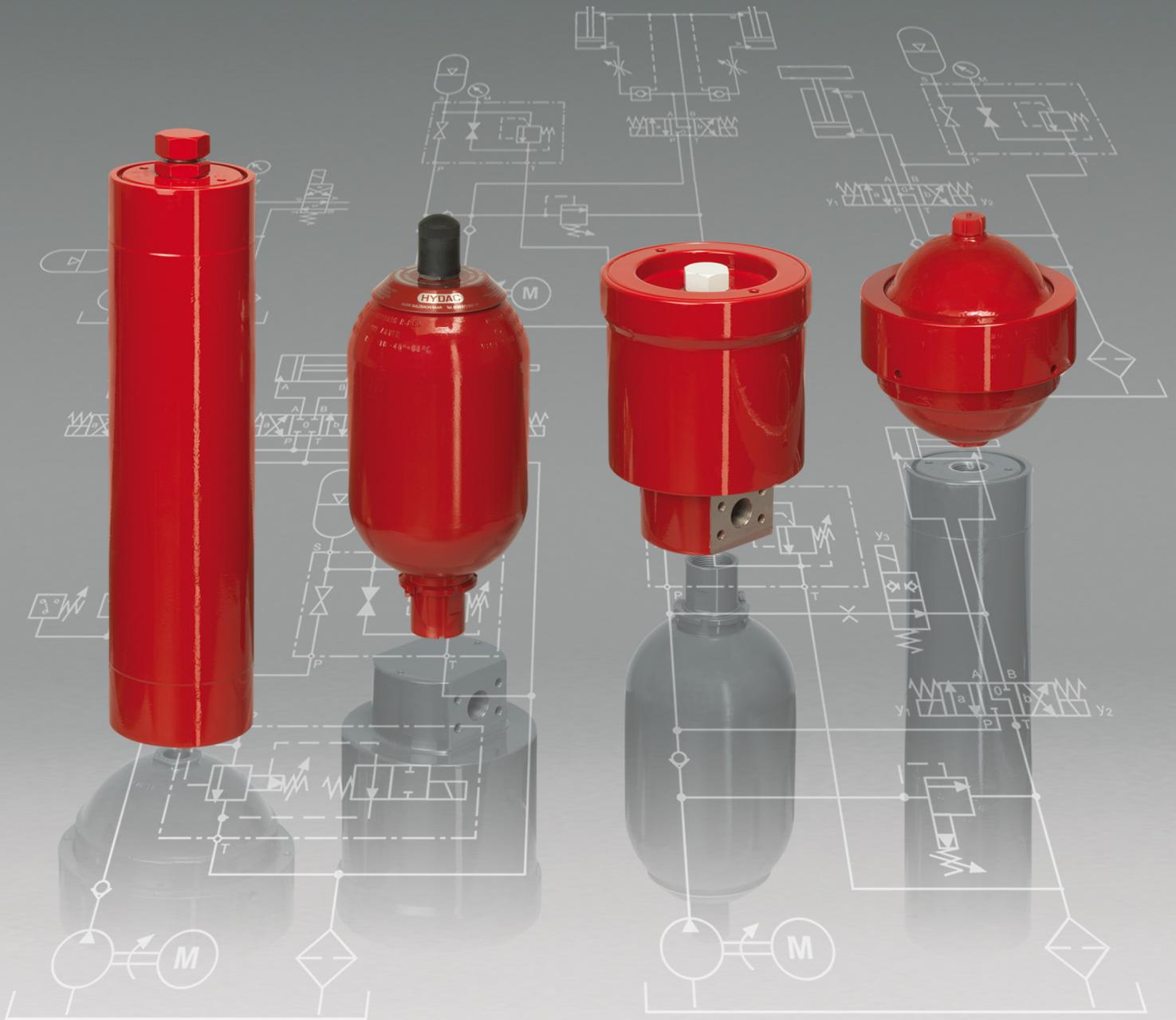


HYDAC

INTERNATIONAL

Accumulator Technology. Product Catalogue.



HYDAC Accumulator Technology. Product Catalogue.

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

HYDAC Accumulator Technology has over 50 years' experience in research & development, design and production of Hydac accumulators.

Bladder, piston, diaphragm and metal bellows accumulators from HYDAC together form an unbeatable range and as components or units, support hydraulic systems in almost all sectors.

The main applications of our accumulators are:

- Energy storage,
- Emergency and safety functions,
- Damping of vibrations, fluctuations, pulsations (pulsation damper), shocks (shock absorber) and noise (silencer),
- Suction flow stabilisation,
- Media separation,
- Volume and leakage oil adjustment,
- Weight equalization,
- Energy recovery.

Using accumulators improves the performance of the whole system and in detail this has the following benefits:

- Improvement in the functions
- Increase in service life
- Reduction in operating and maintenance costs
- Reduction in pulsations and noise

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

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

Basic criteria, such as:

- Design pressure,
- Design temperature,
- Fluid displacement volume,
- Discharge / Charging velocity,
- Fluid,
- Acceptance specifications and also
- Installation options

are important parameters required for sizing the correct accumulator.

In addition the knowledge developed by our accumulator specialists will help to 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.

In taking delivery of a HYDAC hydraulic accumulator therefore, the customer is assured of 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.

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.

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3. SAFETY INFORMATION

Hydraulic accumulators are pressure vessels as defined in the Pressure Equipment Directive 97/23/EC. They are closed vessels which are designed and built to store pressurised fluids. Hydraulic accumulators are charged with nitrogen which is separated from the fluid section by a piston, bladder or diaphragm. Hydraulic accumulators are specifically designed to store and then discharge pressurised fluids.

The regulations for commissioning and operating 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 Manuals for our products.

As regards production and placing on the market, HYDAC has carried out a comprehensive risk assessment.

Similarly the manufacturer of products utilizing hydraulic accumulators must proceed accordingly (see Pressure Equipment Directive 97/23/EC) and the following principles must be adhered to and in this order of priority:

- Removal or reduction of risks, insofar as this is reasonably possible,
- Application of appropriate protective measures against risks which cannot be eliminated;
- If required, training of the users on the residual risks and instructions on appropriate special measures for reducing the risks during installation and/or operation.

For safe handling and operation, the operator must draw up a risk assessment for the installation site, particularly in combination with other components and risks.

The resulting measures must be implemented accordingly.

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

- Excessive pressure and
- Increase in temperature (in the event of fire)

we already have the relevant products available.

On no account may any welding, soldering or mechanical work be carried out on the accumulator shell. 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 pressure and the fluid have been released.

3.1. RISK OF EXCESSIVE PRESSURE

Products:

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

See catalogue section:

- Safety and Shut-off Block SAF/DSV No. 3.551

Gas safety valve and gas safety block for the gas side

Bursting 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 de-energised) in conjunction with temperature monitoring.

See catalogue section:

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

Temperature fuses

See catalogue section:

- Safety Equipment for Hydraulic Accumulators No. 3.552



4. REGULATIONS

4.1. PED

On 29 November 1999 the Directive 97/23/EC (Pressure Equipment Directive) came into force and since 29 May 2002 has been exclusively binding in Europe. This directive applies to the design, manufacture, conformity assessment and placing on the market of pressure equipment and assemblies with a maximum permitted pressure of over 0.5 bar. It guarantees the free movement of goods within the European Community. EU member states must not prohibit, restrict or obstruct the placing on the market and the commissioning of pressure equipment on account of pressure-related hazards, if the equipment complies with the requirements of the pressure equipment directive and has the CE mark, and is subject to a conformity assessment.

Hydraulic accumulators with a capacity of $V \leq 1$ litre, 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 3, Paragraph 3 of the European Pressure Equipment Directive and do not receive the CE mark.

Inspection of the equipment and installation, operational safety and repeat testing 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 health & 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, the different material requirements must be observed. Details of some selected approvals are as follows:

4.2.1 CERTIFICATE CODE = S (ASME)

HYDAC Technology GmbH has had authorization since 1985 to use the Certification Mark "ASME" on pressure vessels which have been manufactured in conformity with the ASME specifications and to market these using the "NB" symbol, in the jurisdiction (area of application) 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 authorized 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. HYDAC is therefore authorized to import welded bladder, piston and diaphragm accumulators, and safety valves, into the Chinese market.

4.2.4 CERTIFICATE CODE = A11 (KGS Code)

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

4.3. CERTIFICATE TABLE

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: Certificate Code).

For those countries not listed, please consult HYDAC. Alternative certificates and variations are also possible. Please consult HYDAC.

European member states	Certificate code (AKZ)
AT Austria	
BE Belgium	
BG Bulgaria	
CY Cyprus	
CZ Czech Republic	
DE Germany	
DK Denmark	
EE Estonia	
ES Spain	
FI Finland	
FR France	
GB Great Britain	
GR Greece	
HU Hungary	U
IE Ireland	
IT Italy	
LT Lithuania	
LU Luxembourg	
LV Latvia	
MT Malta	
NL Netherlands	
PL Poland	
PT Portugal	
RO Romania	
SE Sweden	
SI Slovenia	
SK Slovakia	

Rest of the world	Certificate code (AKZ)
AU Australia	F ¹⁾
BY Belarus	A12
CE Canada	S1 ¹⁾
CH Switzerland	U
CN China	A9
HK Hong Kong	A9
IS Iceland	U
JP Japan	P
KR Korea (Republic)	A11
NO Norway	U
NZ New Zealand	T
RU Russia	A6
TR Turkey	U
UA Ukraine	A10
US USA	S
ZA South Africa	S2

¹⁾ Registration required in the individual territories or provinces
others on request

4.4. TRANSPORT REGULATIONS FOR PRESSURE VESSELS

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

5. PRODUCT OVERVIEW

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

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
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 ... 54 l

Benefits of HYDAC bladder accumulators:

- high discharge velocities,
- no pressure differential between fluid side and gas side,
- compact, low-maintenance,
- high charge and discharge frequencies.

5.2. PISTON ACCUMULATORS



5.2.1 Standard
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 ... 6 l



5.2.3 High pressure
Permitted operating pressure:
up to 1000 bar

Nominal volume:
up to 50 l

Benefits of HYDAC piston accumulators:

- minimal pressure differential between fluid side and gas side,
- large effective volume,
- variable installation position,
- monitoring of the piston position possible using a variety of systems,
- particularly suitable for back-up configurations,
- extreme flow rates,
- no sudden discharge of gas when seals are worn.

5.3. DIAPHRAGM ACCUMULATORS



**5.3.1 Diaphragm accumulators
Weld and screw type**

Permitted operating pressure:
up to 750 bar

Nominal volume:
up to 4 l

Benefits of HYDAC diaphragm accumulators:

- function-optimized and weight-optimized design,
- unlimited choice of installation positions,
- no pressure differential between fluid side and gas side,
- low-maintenance and long service life.

5.4. METAL BELLOWS ACCUMULATORS



5.4.1 Metal bellows accumulator

Please contact us

Benefits of the HYDAC metal bellows accumulator:

- durable
- wear-free
- media resistant over a wide range of temperatures

See also flyer

- "Heavy Diesel Engines - Metal Bellows Accumulators"
No. 10.129.1

5.5. HYDRAULIC DAMPERS



5.5.1 Dampers

Permitted operating pressure:
10 ... 1000 bar

Nominal volume:
0.075 ... 450 l

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 a system,
- reduces noise level in hydraulic systems,
- reduces maintenance and servicing costs and
- extends service life of the system.



5.5.2 SILENCER

Permitted operating pressure:
330 bar

5.6. SPECIAL ACCUMULATORS



5.6.1 Weight reduced hydraulic accumulators

Over 80% reduction in weight compared to equivalent carbon steel accumulators.

The choice ranges from weight-optimized accumulators, e.g. by using aluminium, through to light-weight and ultra light-weight accumulators.

See also flyer

- "Weight-reduced accumulators"
No. 3.305



5.6.2 Spring accumulators

are equipped with a spring.

The energy is produced by the spring force, instead of gas.

Further information on request.

5.7. ACCUMULATOR STATIONS



HYDAC supplies fully assembled piston accumulator stations which are ready for operation, complete with all the necessary valve controls, ball valves and safety equipment

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

5.8. ACCUMULATOR ACCESSORIES



5.8.1 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.



5.8.2 Universal charging and testing unit FPU-1

Charging hose, pressure gauge and pressure reducer for HYDAC and other brands of accumulator, up to 350 bar. (Higher pressures on request)



5.8.3 Safety and shut-off block SAF/DSV

Nominal size:
10 ... 50

Permitted operating pressure:
400 bar
(higher pressures on request)

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



5.8.4 Safety equipment

- Gas safety valve GSV6
- Temperature fuse
- Bursting disc



- Gas safety block as safety equipment for HYDAC accumulator products.

Approval according to Pressure Equipment Directive PED and CE mark.



5.8.5 Supports for hydraulic accumulators

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



5.8.6 ACCUSET SB

Permitted operating pressure:
330 bar

Nominal volume:
1 ... 50 l

Using HYDAC nitrogen bottles provides the following benefits:

- cost-effective increase in the accumulator volume and as a result
- smaller accumulators for the same gas volume.

Benefits of the HYDAC Safety and Shut-off Block:

- minimum of space and maintenance required,
- minimum of pipework (1 SAF replaces up to 10 individual pipe connections, as a rule),
- considerable reduction in installation time,
- can be adapted to different types and also different brands of accumulator, and
- additional valves (pilot-operated check valves, flow control valves, etc).

Benefits 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.

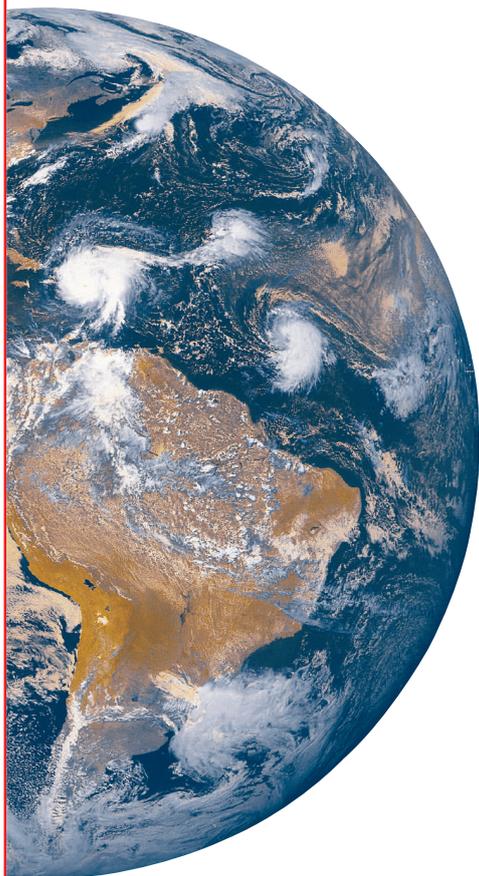
6. INDUSTRIES AND APPLICATIONS

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 oil & gas/offshore as well as more energy efficient systems utilizing accumulators are gaining in importance.

Listed below is a selection of examples with accumulators/dampers which are typical for 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 working machines

Iron and steel industry

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

Plastics machinery

- Accumulator stations for energy storage 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

- 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

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

6.2. MOBILE TECHNOLOGY

Automotive technology

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



Construction Machinery

- 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 and material handling

- 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 pipelines

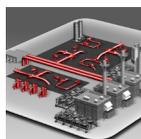


Offshore / Oil & Gas

- 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 the following address:
www.hydac.com.

In addition to Industries, Service and Fluid Engineering, under **Products » Hydraulic Accumulators**, you will find the standard product range and the comprehensive range of accessories from HYDAC TECHNOLOGY GmbH.

Under Downloads you will find this product catalogue in different languages in PDF format as well as other information on HYDAC accumulator products.

You can find the required product via the product search tab and download the relevant CAD model.

The web version of **ASPlight** facilitates quick and simple input, calculation and evaluation of the required accumulator parameters. For further information on **ASPlight** see Section 9.4.

8. SPECIFICATION FORMS

Our aim is to provide optimal customer service both before and after purchasing the accumulator.

The following specification forms are designed to help pre-select the required accumulator/damper or accessories.

You can also download these as a pdf document from the intranet and the HYDAC website (www.hydac.com/Hydraulic accumulators) under the Downloads tab. You can then complete them at your convenience on your PC and send them to your HYDAC contact, e.g. by e-mail.

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

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GENERAL ACCUMULATOR SPECIFICATION FORM (Page 1/2)

(Subject to technical modifications)

Company: _____ Project name: _____
Name, First name: _____ Application: _____
E-mail: _____ Requirement: _____ pieces/year
Telephone no.: _____ as spare part original equipment

Note:

Calculation of the appropriate accumulator is possible using the HYDAC Accumulator Simulation Program ASP.
Download from www.hydac.com.

Type of accumulator Bladder accumulator Piston accumulator Diaphragm accumulator _____

Fluids/medium

Fluid: _____ Viscosity at 20 °C: _____ cSt
Density: _____ kg/m³ Viscosity at operating temperature: _____ cSt

Functioning of the pump

Continuous operation Intermittent operation

Accumulator data

Max. operating pressure: _____ bar
Min. operating pressure: _____ bar
Pre-charge pressure at 20 °C (nitrogen): _____ bar
(See catalogue section: No. 3.000, Sizing)
Ambient temperature: _____ °C
Operating temperature: _____ °C
Complete cycle time: _____ s

Fluid demand time schedule for 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:

Alternatively:

Fluid demand diagram for SEVERAL pumps
and/or consumers (see Page 2)

Additional details on the accumulator

Industry: _____
Country of installation: _____
Design/Certification: _____
Specification: _____
Materials*
Accumulator shell: _____
Fluid connection: _____
Elastomer: _____

Additional information

Installation dimensions: _____ mm
(height x Ø ext.)
Fluid connection: Type: _____
for thread internal _____
 external _____
Standard: _____
Gas connection: _____
Coating/finish: internal _____
 external _____
Spare parts/
Accessories: see www.hydac.com
under Products/Accumulators

* dependent on operating temperature and/or fluid resistance

Remarks: _____

Date: _____ Signature: _____

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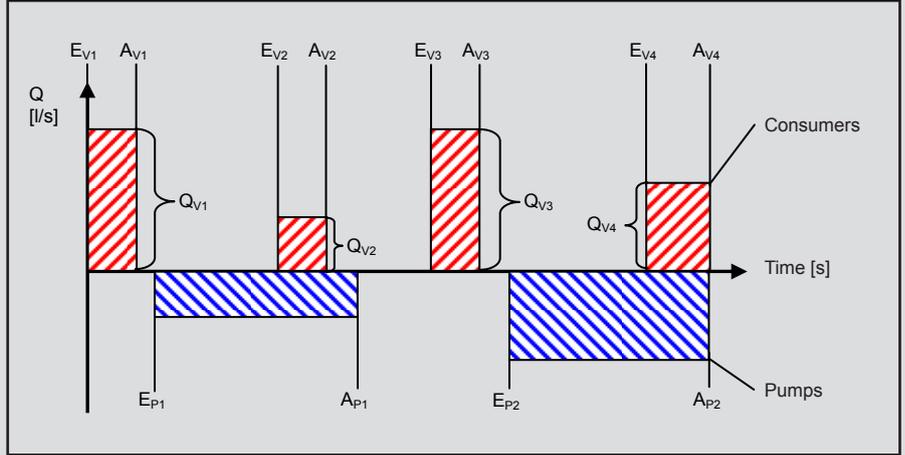
GENERAL ACCUMULATOR SPECIFICATION FORM (Page 2/2)

(Subject to technical modifications)

Fluid demand diagram for several pumps and/or consumers

Designation / Example:

- 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]



Please indicate cycle data below

Number of consumers: _____

Number of pumps: _____

$Q_{v1} =$ _____	$E_{v1} =$ _____	$A_{v1} =$ _____	$Q_{p1} =$ _____	$E_{p1} =$ _____	$A_{p1} =$ _____
$Q_{v2} =$ _____	$E_{v2} =$ _____	$A_{v2} =$ _____	$Q_{p2} =$ _____	$E_{p2} =$ _____	$A_{p2} =$ _____
$Q_{v3} =$ _____	$E_{v3} =$ _____	$A_{v3} =$ _____	$Q_{p3} =$ _____	$E_{p3} =$ _____	$A_{p3} =$ _____
$Q_{v4} =$ _____	$E_{v4} =$ _____	$A_{v4} =$ _____	$Q_{p4} =$ _____	$E_{p4} =$ _____	$A_{p4} =$ _____



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SHOCK ABSORBER SPECIFICATION FORM (Page 1/2)

(Subject to technical modifications)

Company: _____ Project name: _____
Name, First name: _____ Application: _____
E-mail: _____ Requirement: _____ pieces/year
Telephone no.: _____ as spare part original equipment

Note:

The appropriate accumulator can be calculated using the HYDAC Accumulator Simulation Program **ASP**.
Download from www.hydac.com.

Type of accumulator Bladder accumulator Piston accumulator Diaphragm accumulator _____

Cause of the pressure shock

When pump starts When pump switches off
 When check valve flap (valve) closes

Fluids/media

Fluid ¹⁾: _____
Density: _____ kg/m³

Pipeline data for A SINGLE pipe

Length: _____ m
Diameter (internal): _____ mm
Wall thickness: _____ mm
Material of line: _____
Max. permitted pressure in the line: _____ bar
Total closing time of the valve: _____ s
Speed of sound in the system: _____ m/s

Alternatively:

Pipeline data for ADDITIONAL sections of pipe
(see Page 2)

Pump data

Zero head: _____ m
Pressure of the pump at the operating point: _____ bar
Flow rate of the pump at the operating point: _____ l/min

* dependent on operating temperature and/or fluid resistance

¹⁾ please send datasheet

Remarks: _____

Accumulator data

Max. operating pressure: _____ bar
Min. operating pressure: _____ bar
Pre-charge pressure at 20 °C (nitrogen): _____ bar
(See catalogue section: No. 3.000, Sizing)

Ambient temperature: _____ °C
Operating temperature: _____ °C

Fluid connection: Type: _____
for thread internal _____
 external _____

Standard: _____

Gas connection: _____

Coating/finish: internal _____
 external _____

Spare parts/Accessories: see www.hydac.com
under Products/Accumulators

Materials*

Accumulator shell: _____

Fluid connection: _____

Elastomer: _____

Additional information on the accumulator/system:

Available installation space: _____ m
(L x W x H)

Industry: _____

Country of installation: _____

Design/Certification: _____

Specification: _____

Date: _____ Signature: _____

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SHOCK ABSORBER SPECIFICATION FORM (Page 2/2)

(Subject to technical modifications)

Pipeline data for additional sections of pipe

Designation / Example

- H = Zero head of the pump [m]
 D_i = Internal diameter of the pipe [mm]
 T = Closing time of the valve [sec]
 (effectively approx. 30 % of the total closing time)
 L = Length of the pipeline [m]

The diagram shows a horizontal pipeline connecting two tanks. On the left, a tank is connected to a pump. The pump's zero head is labeled 'H'. The pipeline is divided into three sections: L1, L2, and L3. Each section has a different internal diameter, labeled D_{i1}, D_{i2}, and D_{i3} respectively. On the right, the pipeline ends at a valve with a closing time 'T'. The right tank is also connected to the pipeline.

Number of different pipes: 3

L1 = <u>200</u> m	D _{i1} = <u>100</u> mm
L2 = <u>50</u> m	D _{i2} = <u>200</u> mm
L3 = <u>20</u> m	D _{i3} = <u>500</u> mm

Typical values for speed of sound

- Water = 1200 m/s
 Fuel = 1100 m/s

Please complete below with the pipeline data

Number of different pipes: _____

- | | | | |
|--------------|----------------------------|--------------|----------------------------|
| L1 = _____ m | D _{i1} = _____ mm | L5 = _____ m | D _{i5} = _____ mm |
| L2 = _____ m | D _{i2} = _____ mm | L6 = _____ m | D _{i6} = _____ mm |
| L3 = _____ m | D _{i3} = _____ mm | L7 = _____ m | D _{i7} = _____ mm |
| L4 = _____ m | D _{i4} = _____ mm | L8 = _____ m | D _{i8} = _____ mm |

HYDAC Technology GmbH

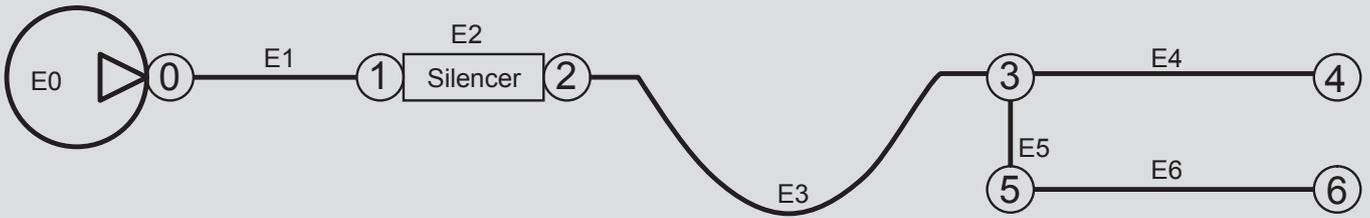
Industriegebiet
 66280 Sulzbach/Saar, Germany
 Tel.: +49 (0) 68 97 / 509 - 01
 Fax: +49 (0) 68 97 / 509 - 464
 Internet: www.hydac.com
 E-Mail: speichertchnik@hydac.com

SILENCER SPECIFICATION FORM

(Subject to technical modifications)

Company: _____ Project name: _____
 Name, First name: _____ Application: _____
 E-mail: _____ Requirement: _____ pieces/year
 Telephone no.: _____ as spare part original equipment

Sizing example:



Pump: **A10VSO71** Design pressure: **210 bar** Silencer inlet: **SAE 1 1/4" 3000 psi**
 Pump rpm: **1500 1/min** No. of pump pistons: **9** Silencer outlet: **SAE 1 1/4" 3000 psi**
 Fluid: **Aral Vitam GF** Fluid density: **890 kg/m³** Design temperature: **50 °C**

Element no.	Length [m]	Ø int. [m]	Ø ext. [m]	Subsequent connection type	Hose type
E1	0.5	0.020	0.030	Straight connection	–
E2	0.4	–	0.200	Straight connection	–
E3	1.5	0.025	0.040	T-junction	4SP (DIN EN 856)
E4	0.6	0.015	0.025	Pressure relief valve	–
E5	0.2	0.015	0.025	Right-angle	–
E6	0.6	0.015	0.025	Shut-off valve	–

Please enter design data here:

Pump: _____ Design pressure: _____ bar Silencer inlet: _____
 Pump rpm: _____ 1/min No. of pump pistons: _____ Silencer outlet: _____
 Fluid: _____ Fluid density: _____ Design temperature: _____ °C

Element no.	Length [m]	Ø int. [m]	Ø ext. [m]	Subsequent connection type	Hose type
E1					
E2					
E3					
E4					
E5					
E6					
E7					
E8					
E9					
E10					
E11					
E12					

Remarks: _____

Date: _____ Signature: _____

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METAL BELLOWS ACCUMULATOR SPECIFICATION FORM FOR HEAVY DIESEL ENGINES

(Subject to technical modifications)

Company: _____ Project name: _____
 Name, First name: _____ Application: _____
 E-mail: _____ Requirement: _____ pieces/year
 Telephone no.: _____ as spare part original equipment

Note:

The appropriate pulsation damper can be calculated using the HYDAC Accumulator Simulation Program ASP.
 Download from www.hydac.com.

Engine data

Manufacturer: _____ max. "spill volume" of the high pressure injection pumps: _____ ccm
 Type: _____ max. flow of the supply line: _____ l/min
 Design: Inline 2-stroke max. flow of the tank line: _____ l/min
 V motor 4-stroke
 Fuel: _____

Operating conditions of the supply line:

	Proportion of operation	min. / max. speed	p_{max}	at	T_{min}	p_{min}	at	T_{max}
Engine start		/ 1/min	_____	bar	_____ °C			
Main operation	_____ %	/ 1/min	_____	bar	_____ °C	_____	bar	_____ °C
Auxiliary operation	_____ %	/ 1/min	_____	bar	_____ °C	_____	bar	_____ °C

Operating conditions of the tank line:

	Proportion of operation	min. / max. speed	p_{max}	at	T_{min}	p_{min}	at	T_{max}
Engine start		/ 1/min	_____	bar	_____ °C			
Main operation	_____ %	/ 1/min	_____	bar	_____ °C	_____	bar	_____ °C
Auxiliary operation	_____ %	/ 1/min	_____	bar	_____ °C	_____	bar	_____ °C

Additional information on the accumulator/system

Available installation space: _____ m (L x W x H)
 Installation vertical: yes no
 If no, specify position: _____
 Material: Carbon steel Stainless steel
 Finish requirement: HYDAC Standard (RAL 7035)

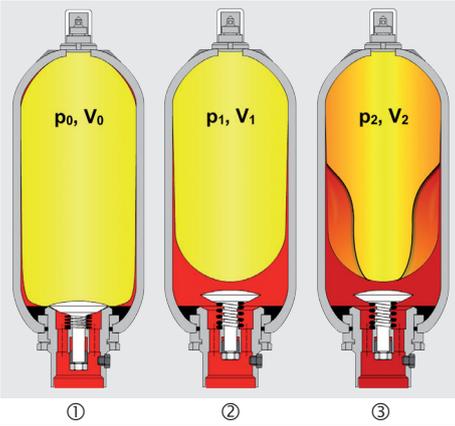
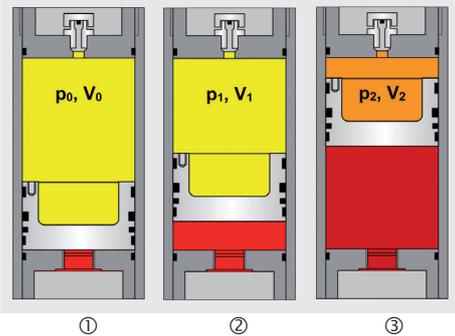
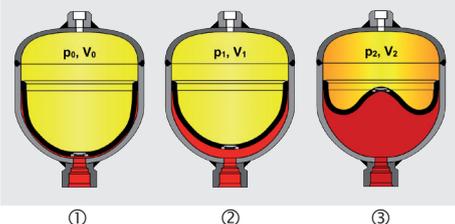
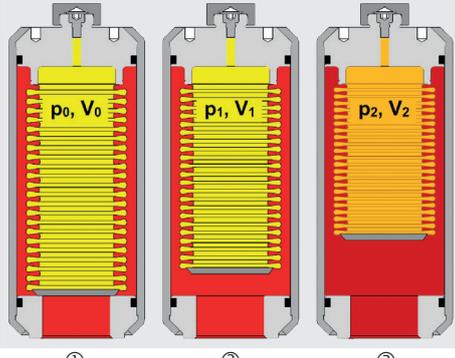
 Gas and fluid connection: see flyer "Heavy Diesel Engines - Metal Bellows Accumulators" No. 10.129.1
 Industry: _____
 Country of installation: _____
 Design/Certification: _____
 or
 Ship's name (IMO): _____
 Ship classification: _____
 Spare parts/Accessories: see www.hydac.com under Products/Accumulators

Remarks: _____

Date: _____ Signature: _____

9. SIZING

9.1. DEFINITION OF VARIABLES FOR SIZING A HYDRAULIC ACCUMULATOR

Function principle	Limits for the gas pre-charge pressure
<p>Bladder accumulator</p> 	$p_0 \leq 0.9 \cdot p_1$ <p>with a permitted pressure ratio of</p> $p_2 : p_0 \leq 4 : 1$ <p>For HYDAC low pressure accumulators, the following must also be taken into account:</p> <p>Type SB40: $p_{0 \max} = 20 \text{ bar}$</p> <p>Type SB35H: $p_{0 \max} = 10 \text{ bar}$</p>
<p>Piston accumulators</p> 	$p_{0, \text{tmin}} \geq 2 \text{ bar (piston type 2)}$ $p_{0, \text{tmin}} \geq 10 \text{ bar (piston type 1)}$ $p_{0, \text{tmin}} \leq p_1 - 5 \text{ bar}$ <p>In extreme cases, during slow charging (isothermal) and rapid discharge (adiabatic) of the effective volume, and after accurate calculation, the gas pre-charge pressure $p_0 \geq p_1$ can be selected.</p> <p>Accumulator supplied uncharged or with 2 bar storage pressure.</p>
<p>Diaphragm accumulator</p> 	<p>a) Permitted pressure ratio: $p_2 : p_0$</p> <p><u>Weld type:</u> The pressure ratio of weld-type diaphragm accumulators is between 4 : 1 and 8 : 1, depending on the design, see catalogue Section Diaphragm Accumulators, No. 3.100, Point 3.1</p> <p><u>Screw type:</u> All sizes: 10 : 1 Other pressure ratios on request</p> <p>b) $p_0 \leq 0.9 \cdot p_1$</p>
<p>Metal bellows accumulators</p> 	<p>a) Metal bellows accumulator with convoluted bellows: The max. permitted or optimal pre-charge pressure of a metal bellows accumulator with convoluted bellows must be determined for each application by providing the particular operating conditions and in consultation with HYDAC (see "Metal Bellows Accumulator Specification Sheet for Heavy Diesel Engines").</p> <p>b) Metal bellows accumulator with diaphragm bellows: $p_0 \leq 0.9 \cdot p_1$ $p_2 : p_0 \geq 20 : 1 \text{ at } t_{\min}$ The required pressure ratio must be indicated when ordering.</p>

- ① The accumulator is pre-charged with nitrogen. The separating element (piston, bladder, diaphragm, corrugated bellows) shuts off the fluid connection.
- ② The minimum operating pressure should be higher than the gas pre-charge pressure. This should prevent the separating element from striking the fluid connection every time fluid is discharged.
- ③ Once the max. operating pressure is reached, the effective volume ΔV 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. SELECTION OF GAS PRE-CHARGE PRESSURE

The selection of the pre-charge pressure defines the accumulator capacity. In order to obtain optimum utilization 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 separating 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.

9.2.2 Limits for gas pre-charge pressure

(see point 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 effect 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. ACCUMULATOR SIZING ON YOUR PC – ASP 5



When calculating the accumulator gas volume, the most important parameters are: pressure, volume and temperature.

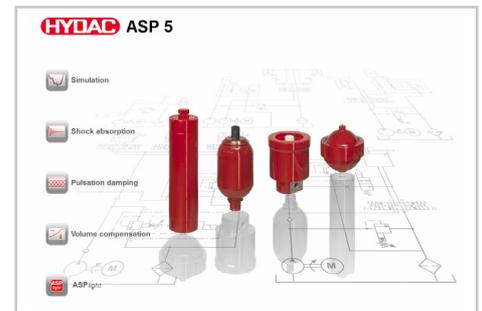
In the past these were used in complicated and unwieldy equations to calculate the required accumulator size. In 1997 by using program routines for real gas behaviours, HYDAC revolutionized the process of calculating and simulating hydraulic accumulators.

The **ASP** - Accumulator Simulation Program was launched. After years of experience, continuous improvement and the inclusion of new functions, **ASP** has developed

into calculation software which enables the user, with great accuracy, to simulate the behaviour of accumulators.

ASP 5 has five elements:

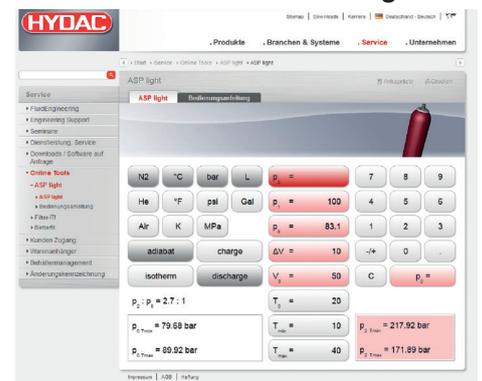
- simulation, with the familiar advantages but in a completely new format and additional visualisations of the most important parameters,
- pressure shock damping, clearly arranged in one program window,
- pulsation damping, including corrected pump factors, also clearly presented in a program window.
- volume compensation and
- integration of the stand-alone, simplified software **ASPlight**.



Printing, export and saving of results has been improved. The current version is clear and convenient to use thanks to visualization of the simulation and the volume, pressure and temperature displays.

9.4. ACCUMULATOR CALCULATION SIMPLIFIED – ASPlight

Das **ASPlight** is an intelligent application which takes into account real gas behaviour. This simplified software from HYDAC Accumulator Technology enables you to calculate all the necessary parameters such as pressure, volume and temperature in different units for gases such as nitrogen or helium. The maximum input for pressure is 2500 bar. Additional information fields help to evaluate the result and to determine the type of accumulator.



ASPlight is aimed at the user who is tasked with determining the essential accumulator parameters within a short time. The software will be a particularly useful tool in your role as sales consultant in the field, by providing quick, straightforward calculations for hydraulic accumulators.

ASPlight is operated via a single window and is language neutral. The design is comparable to a pocket calculator. Simulation curves are not shown.

ASP 5 and **ASPlight** can be found on the Web at hydac.com, and can also be operated via smartphone.

10. NOTE

The information in this brochure relates to the operating conditions and applications described.

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

Subject to technical modifications.

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Bladder Accumulators Low Pressure

1. DESCRIPTION

1.1. FUNCTION

Fluids are practically incompressible and cannot therefore store pressure energy.

The compressibility of a gas is utilised in hydraulic accumulators for storing fluids. HYDAC bladder accumulators are based on this principle, using nitrogen as the compressible medium.

A bladder accumulator consists of a fluid section and a gas section with the bladder acting as the gas-proof screen. The fluid around the bladder is connected to the hydraulic circuit so that the bladder accumulator draws in fluid when the pressure increases and the gas is compressed. When the pressure drops, the compressed gas expands and forces the stored fluid into the circuit.

HYDAC bladder accumulators can be used in a wide variety of applications, some of which are listed below:

- energy storage
- emergency operation
- force equilibrium
- leakage compensation
- volume compensation
- shock absorption
- vehicle suspension
- pulsation damping

See catalogue section:

- Hydraulic Dampers
No. 3.701

1.2. DESIGN

HYDAC low pressure bladder accumulators consist of a welded pressure vessel, a flexible bladder with gas valve and a hydraulic connection with check valve or a perforated disc.

The table shows the different models which are described in greater detail in the pages that follow:

Designation	Perm. pressure [bar] ²⁾	Volume [l]	Q ¹⁾ [l/s]
SB40- 2.5 ... 50	40	2.5 - 50	7
SB40- 70 ... 220		70 - 220	30
SB35HB- 20 ... 50	35	20 - 50	20
SB16A- 100 ... 450	16	100 - 450	15
SB35A- 100 ... 450	35		
SB16AH- 100 ... 450	16		
SB35AH- 100 ... 450	35		20

¹⁾ Q = max. flow rate of pressure fluid

²⁾ Higher pressures on request

1.3. BLADDER MATERIAL

The following elastomers are available as standard:

- NBR (acrylonitrile butadiene rubber, Perbunan),
- IIR (butyl rubber),
- FKM (fluoro rubber, Viton®),
- ECO (ethylene oxide epichlorohydrin rubber).

The material must be selected according to the particular operating fluid and temperature. When choosing the elastomer, allowances must be made for the fact that the gas can cool down to below the permitted elastomer temperature if there are adverse discharge conditions (high pressure ratio p_2/p_0 , high discharging velocity). This can cause cold cracking in the elastomer. The gas temperature can be calculated using the HYDAC Accumulator Simulation Program ASP.

1.4. CORROSION PROTECTION

For operation with chemically aggressive media, the accumulator shell can be supplied with corrosion protection, such as plastic coating on the inside or chemical nickel-plating. If this is insufficient, then stainless steel accumulators must be used.

1.5. INSTALLATION POSITION

HYDAC bladder accumulators can be installed vertically, horizontally and at a slant. When installing vertically or at a slant, the oil valve must be at the bottom. On certain applications listed below, particular positions are preferable:

- Energy storage: vertical,
- Pulsation damping: any position from horizontal to vertical,
- Maintaining constant pressure: any position from horizontal to vertical,
- Pressure surge damping: vertical,
- Volume compensation: vertical.

If the installation position is horizontal or at a slant, the effective fluid volume and the maximum permitted flow rate of the operating fluid are reduced.

Bladder accumulators SB16A / SB35A and SB16AH / SB35AH must only be installed vertically with the gas side uppermost.

1.6. TYPE OF INSTALLATION

For strong vibrations and volumes above 1 litre, we recommend the use of HYDAC accumulator supports or the HYDAC accumulator installation set.

See catalogue sections:

- Supports for Hydraulic Accumulators
No. 3.502
- ACCUSET SB
No. 3.503

2. TECHNICAL SPECIFICATIONS

2.1. EXPLANATORY NOTES

2.1.1 Operating pressure

see tables
Based on nominal pressure for foreign test certificates)

2.1.2 Nominal volume

see tables

2.1.3 Effective gas volume

see tables
Based on nominal dimensions, this differs slightly from the nominal volume and must be used when calculating the effective fluid volume.

2.1.4 Effective fluid volume

Volume of fluid which is available between the operating pressures p_2 and p_1 .

2.1.5 Max. flow rate of the operating fluid

In order to achieve the max. flow rate given in the tables, the accumulator must be installed vertically. It must be noted that a residual fluid volume of approx. 10% of the effective gas volume remains in the accumulator.

The maximum fluid flow rate was determined under specific conditions and is not applicable in all operating conditions.

2.1.6 Fluids

The following sealing and bladder materials are suitable for the fluids listed below.

Material	Fluids
NBR	Mineral oils (HL, HLP, HFA, HFB, HFC), water
ECO	Mineral oil
IIR	Phosphate ester, water
FKM	Chlorinated hydro-carbons, petrol

2.1.7 Permitted operating temperature

The permitted operating temperature of a bladder accumulator is dependent on the application limits of the metal materials and the bladder.

Outside these temperatures, special material combinations must be used. The following table shows the correlation between bladder material and application temperature.

Material	Temperature ranges
NBR20	-15 °C ... +80 °C
NBR21	-50 °C ... +80 °C
NBR22	-30 °C ... +80 °C
ECO	-30 °C ... +120 °C
IIR	-55 °C ... +100 °C
FKM	-10 °C ... +150 °C

2.1.8 Gas charging

Hydraulic accumulators must only be charged with nitrogen.
Never use other gases.

Risk of explosion!

In principle, the accumulator may only be charged with nitrogen class 4.0, filtered to < 3 µm.

If other gases are to be used, please contact HYDAC for advice.

2.1.9 Limits for gas pre-charge pressure

$$p_0 \leq 0.9 \cdot p_1$$

with a permitted pressure ratio of:

$$p_2 : p_0 \leq 4 : 1$$

p_2 = max. operating pressure

p_0 = pre-charge pressure

For HYDAC low pressure accumulators, the following must also be taken into account:

Type SB40: $p_{0 \max} = 20 \text{ bar}^*$

Type SB35A/AH: $p_{0 \max} = 10 \text{ bar}$

Type SB35HB: $p_{0 \max} = 10 \text{ bar}$

* in model with perforated disc

2.1.10 Certificate codes

Country	Certificate code (AKZ)
EU member states	U
AU Australia	F ¹⁾
BY Belarus	A12
CE Canada	S1 ¹⁾
CH Switzerland	U
CN China	A9
HK Hong Kong	A9
IS Iceland	U
JP Japan	P
KR Korea (Republic)	A11
NO Norway	U
NZ New Zealand	T
RU Russia	A6
TR Turkey	U
UA Ukraine	A10
US USA	S
ZA South Africa	S2

¹⁾ Registration required in the individual territories or provinces
others on request

On no account must any welding, soldering or mechanical work be carried out on the accumulator shell. 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 pressure and the fluid have been released.

Please read the Operating Manual! No. 3.201.CE

When replacing seals and/or bladder, please read the Instructions for assembly and repair (No. 3.201.M).

Note:

Application examples, accumulator sizing and extracts from approvals regulations relating to hydraulic accumulators can be found in the following catalogue section:

- HYDAC Accumulator Technology No. 3.000

2.2. MODEL CODE

Not all combinations are possible.

Order example. For further information, please contact HYDAC.

SB40 A - 100 F 7 / 112 U - 40 A

Series _____

Type code _____
no details = standard
H = high flow
N = increased flow, standard oil valve dimensions
A = shock absorber
B = bladder top-repairable
Combinations must be agreed with HYDAC

Nominal volume [l] _____

Fluid connection _____
A = standard connection, thread with internal seal face
F = flange connection
C = valve mounting with screws on underside
E = sealing surfaces on front interface (e.g. on thread M50x1.5 - valve)
G = male thread
S = special connection, to customer specification

Gas side _____
1 = standard model
2 = back-up model
3 = gas valve 7/8-14UNF with M8 female thread
4 = gas valve 7/8-14UNF with gas valve connection 5/8-18UNF
5 = gas valve M50x1.5 in accumulators smaller than 50 l
6 = 7/8-14UNF gas valve
7 = M28x1.5 gas valve
8 = M16x1.5 gas valve (with M14x1.5 bore in gas valve)
9 = special gas valve, to customer specification

Material code _____
dependent on operating medium
standard model = 112 for mineral oils
others on request

Fluid connection _____
1 = carbon steel
2 = high tensile steel
3 = stainless steel ²⁾
6 = low temperature steel

Accumulator shell _____
0 = plastic coated (internally)
1 = carbon steel
2 = chemically nickel-plated (internal coating)
4 = stainless steel ²⁾
6 = low temperature steel

Accumulator bladder ^{1) 3) 4)} _____
2 = NBR20
3 = ECO
4 = IIR (butyl)
5 = NBR21 (low temperature)
6 = FKM
7 = Others
9 = NBR22

Certificate code _____
U = PED 97/23/EC

Permitted operating pressure (bar) _____

Connection _____
Thread, codes for fluid connections: A, C, E, G
A = thread to ISO 228 (BSP)
B = thread to DIN 13 or ISO 965/1 (metric)
C = thread to ANSI B1.1 (UN.-2B seal SAE J 514)
D = thread to ANSI B1.20.1 (NPT)
S = special thread, to customer specification
Flange, codes for fluid connection: F
A = EN 1092-1 welding neck flange
B = flange ASME B16.5
C = SAE flange 3000 psi
D = SAE flange 6000 psi
S = special flange, to customer specification

Required gas pre-charge pressure must be stated separately!

¹⁾ When ordering a spare bladder, please state diameter of the smaller shell port

²⁾ Dependent on type and pressure rating

³⁾ Standard materials, all other materials on request

⁴⁾ Elastomer types not available for all bladder sizes.

3. LOW PRESSURE ACCUMULATORS

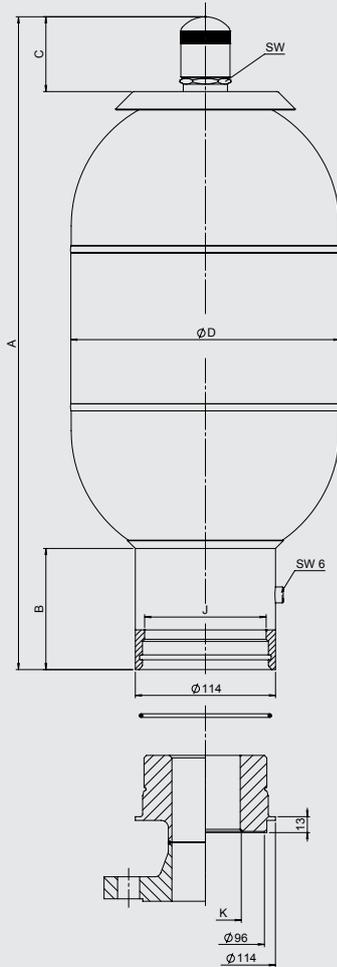
3.1. STANDARD BLADDER ACCUMULATORS SB40-2.5 ... 50

3.1.1 Design

HYDAC standard low pressure accumulators consist of:

- A welded pressure vessel which can be treated with various types of corrosion protection for chemically aggressive fluids, or can be supplied in stainless steel.
- A bladder with gas valve. The bladders are available in the elastomers listed under point 2.1.
- A hydraulic connection with a perforated disc which is held in place with retaining ring.
- In addition, we can offer suitable adapters for connection to the hydraulic system.

3.1.2 Dimensions SB40-2.5 ... 50



SB40-2.5 ... 50

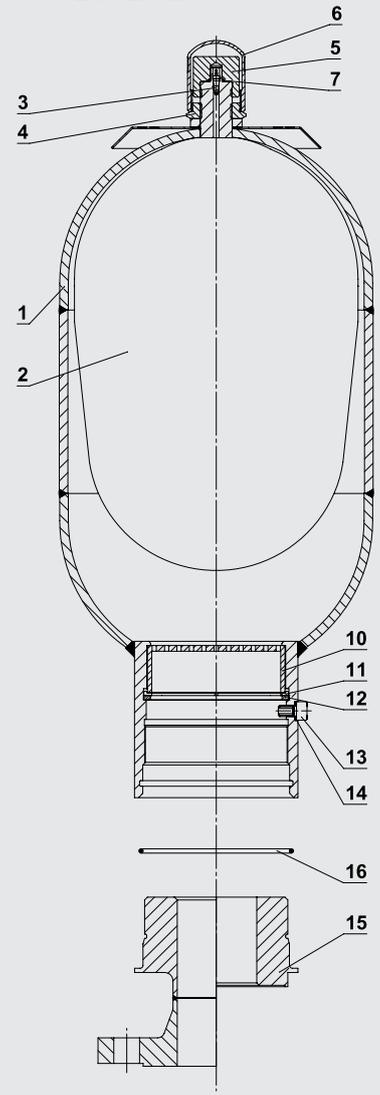
Permitted operating pressure 40 bar (PED 97/23/EC)

Nominal volume [l]	Eff. gas volume [l]	Weight [kg]	A [mm]	B [mm]	C [mm]	Ø D [mm]	J thread ISO DIN 13	K* thread ISO 228	SW [mm]	Q ¹⁾ [l/s]
2.5	2.5	9	541	122	68	108	M100x2	G 2	36	7
5	5	13	891							
10	8.7	14	533							
20	18	23	843							
32	33.5	38	1363							
50	48.6	52	1875	106	78	219	68 ²⁾			

¹⁾ Q = max. flow rate of operating fluid (at approx. 0.5 bar pressure drop via adapter)

²⁾ Use C-spanner

3.1.3 Spare parts SB40-2.5 ... 50



Description	Item
Bladder assembly¹⁾ consisting of:	
Bladder	2
Gas valve insert*	3
Retaining nut	4
Seal cap	5
Valve protection cap	6
O-ring	7
Seal kit consisting of:	
O-ring	7
Bleed screw	13
Seal ring	14
O-ring	15
Repair kit,¹⁾ consisting of:	
Bladder assembly (see above)	
Seal kit (see above)	
Hydraulic connection assembly consisting of:	
Perforated disc	10
Anti-extrusion ring	11
Retaining ring	12
Bleed screw	13
Seal ring	14
O-ring	15

* available separately

¹⁾ When ordering, please state diameter of the smaller shell port).

Item 1 not available as a spare part.

Item 16 available as an accessory, please ask

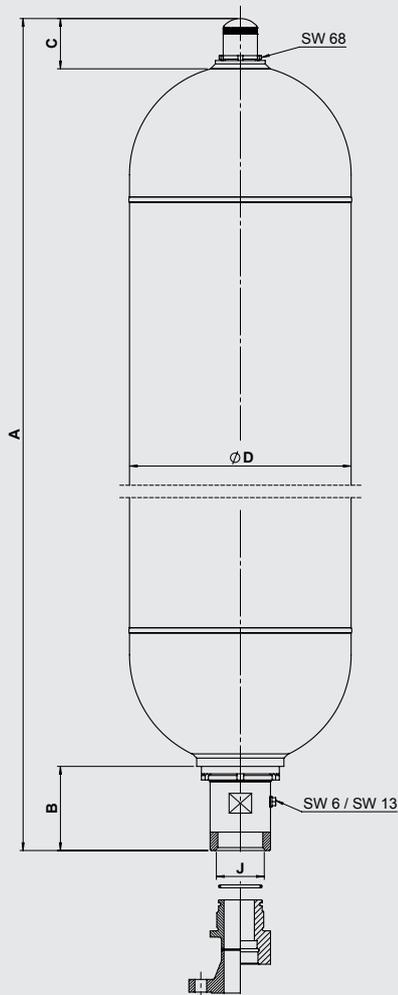
3.2. BLADDER ACCUMULATOR SB40-70 ... 220

3.2.1 Design

HYDAC low pressure accumulators, type SB40-70 ... 220 consist of:

- A welded pressure vessel which is compact and yet suitable for high flow rates and large volumes. The pressure vessel is manufactured in carbon steel or in stainless steel.
- A bladder with gas valve.
- A hydraulic connection with check valve.

3.2.2 Dimensions SB40-70 ... 220



SB40-70 ... 220

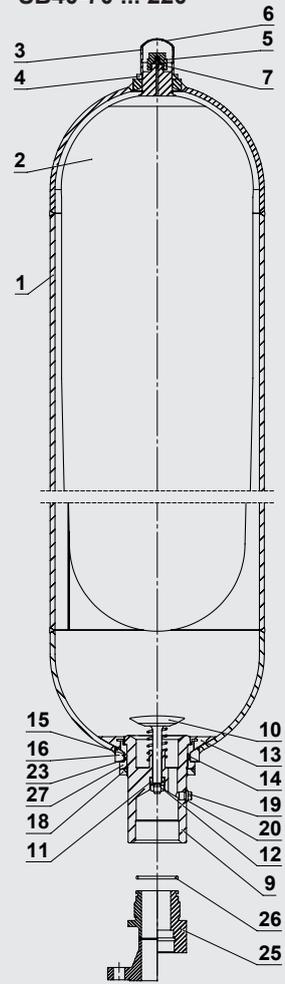
Permitted operating pressure 40 bar (PED 97/23/EC)

Nominal volume [l]	Eff. gas volume [l]	Weight [kg]	A max. [mm]	B [mm]	C [mm]	Ø D [mm]	J Thread ISO 228	SW	Q ¹⁾ [l/s]
70	65	73	898	136	68	356	G 2 1/2	68 ²⁾	30
100	111	99	1423						
130	133	130	1675						
190	192	175	1871						
220	221	197	2119			406			

¹⁾ Q = max. flow rate of operating fluid

²⁾ Use C-spanner

3.2.3 Spare parts SB40-70 ... 220



Description	Item
Bladder assembly ¹⁾ consisting of:	
Bladder	2
Gas valve insert*	3
Retaining nut	4
Seal cap	5
Valve protection cap	6
O-ring	7
Seal kit consisting of:	
O-ring	7
Washer	15
O-ring	16
Bleed screw	19
Support ring	23
O-ring	27
Repair kit, ¹⁾ consisting of:	
Seal kit (see above)	
Bladder assembly (see above)	
Anti-extrusion ring	14
Oil valve assembly consisting of:	
Valve assembly (items 9-13)	9
Anti-extrusion ring	14
Washer	15
O-ring	16
Spacer	17
Lock nut	18
Bleed screw	19
Support ring	23

* available separately

¹⁾ When ordering, please state diameter of the smaller shell port).

Item 1 not available as a spare part.

Item 20 (seal ring) not required for carbon steel accumulators

3.3. LOW PRESSURE ACCUMULATORS SB16/35A AND SB16/35AH

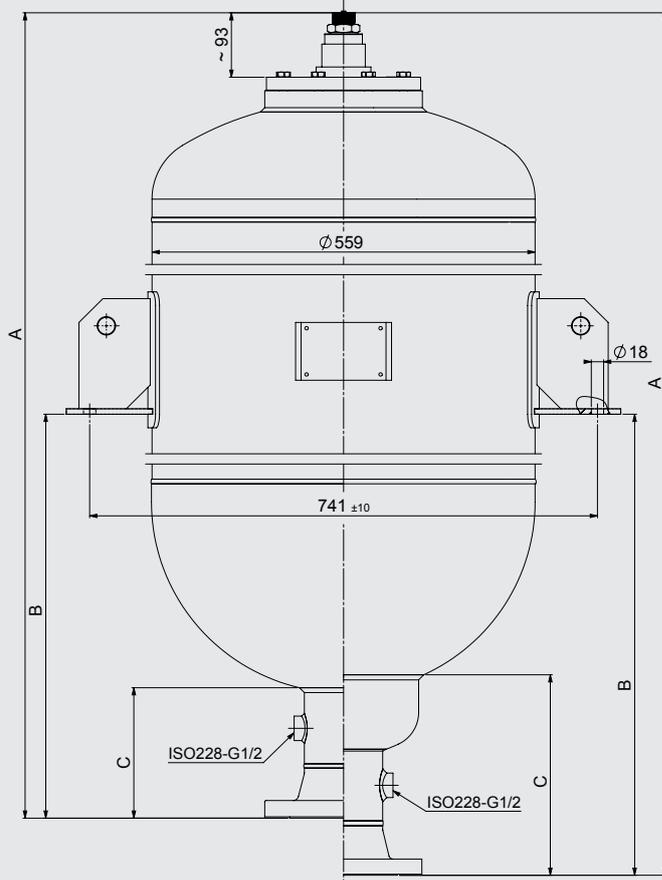
3.3.1 Design

HYDAC low pressure bladder accumulators for large volumes, type SB35A and SB16A are in a weld construction in carbon steel or stainless steel.

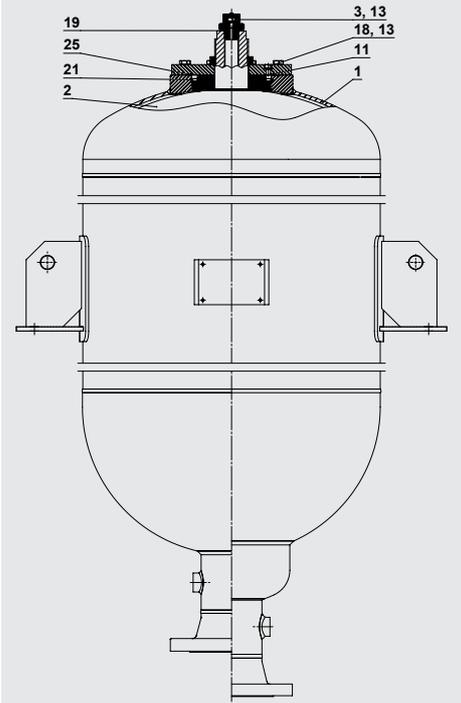
The hydraulic outlet is covered by a perforated disc which prevents the flexible bladder extruding from the shell. The bladder is top-repairable.

3.3.2 Dimensions SB16/35A

SB16/35AH



3.3.3 Spare parts SB16/35A, SB16/35AH



Description	Item
Bladder	2
Lock nut	3
O-ring	11
Seal ring	13
Vent screw	18
O-ring	19
Retaining ring	21
O-ring	25

Item 1 not available as a spare part.

SB16/35A

Permitted operating pressure 16/35 [bar] (PED 97/23/EC)

Nominal volume [l]	Eff. gas volume [l]	Weight [kg]		A (approx.) [mm]		B (approx.) [mm]		C (approx.) [mm]		DN*
		SB16A	SB35A	SB16A	SB35A	SB16A	SB35A	SB16A	SB35A	
100	99	84	144	880	890	400	400	185	198	100
150	143	101	161	1070	1080	500	500			
200	187	122	223	1310	1320	685	685			
300	278	155	288	1710	1720	985	985			
375	392	191	326	2230	2240	1250	1250			
450	480	237	386	2325	2635	1465	1465			

SB16/35AH

Permitted operating pressure 16/35 [bar] (PED 97/23/EC)

Nominal volume [l]	Eff. gas volume [l]	Weight [kg]		A (approx.) [mm]		B (approx.) [mm]		C (approx.) [mm]		DN*
		SB16AH	SB35AH	SB16AH	SB35AH	SB16AH	SB35AH	SB16AH	SB35AH	
100	99	93	153	910	920	450	450	245	254	100
150	143	110	170	1120	1130	560	560			
200	187	131	230	1340	1350	760	760			
300	278	164	297	1755	1765	1040	1040			
375	392	200	335	2285	2295	1330	1330			
450	480	246	395	2670	2680	1530	1530			

* to EN1092-1/11 / PN16 or PN40 others on request

3.4. HIGH FLOW BLADDER ACCUMULATOR SB35HB

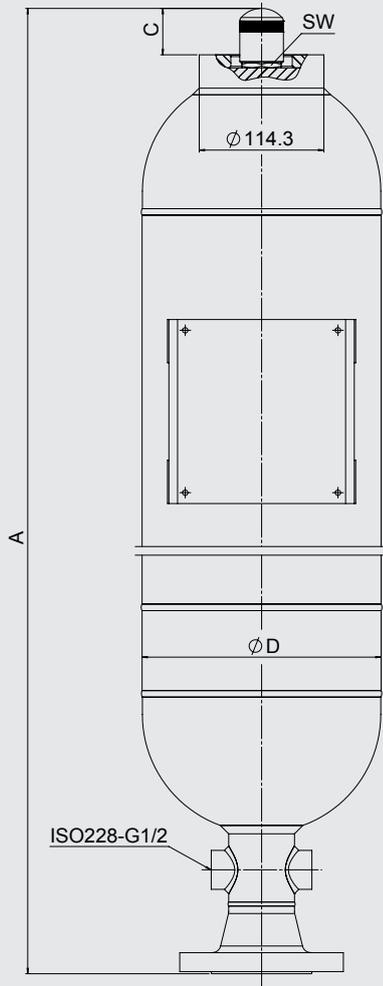
3.4.1 Design

HYDAC high flow bladder accumulators type SB35HB are high performance accumulators for flow rates of up to 20 l/s at 2 bar Δp .

They consist of a pressure vessel in a weld construction and a flexible bladder with gas valve.

The pressure vessel contains a fixed perforated disc, permitting a high flow rate through its large free cross-section. For use with chemically aggressive fluids, the shell can be manufactured in stainless steel. See point 2.1 for bladder materials.

3.4.2 Dimensions SB35HB



SB35HB

Permitted operating pressure 35 bar (PED 97/23/EC)

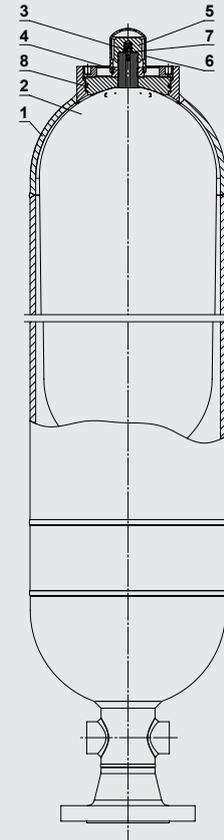
Nominal volume [l]	Eff. gas volume [l]	Weight [kg]	A max. [mm]	C [mm]	Ø D [mm]	SW [mm]	Q ¹⁾ [l/s]	DN*
20	19.8	43	1081	63	219	36	20	50
32	35	56	1591					
50	50	69	2091	78		Ø68 ²⁾		

* to EN 1092-1/11 / PN40, others on request

¹⁾ Q = max. flow rate of operating fluid

²⁾ Lock nut

3.4.3 Spare parts SB35HB



Description	Item
Bladder assembly ¹⁾	
consisting of:	
Bladder	2
Gas valve insert*	3
Retaining nut	4
Seal cap	5
Valve protection cap	6
O-ring	7
Seal kit	
consisting of:	
Gas valve insert*	3
O-ring	7
O-ring	8

Repair kit ¹⁾

consisting of:

Bladder assembly (see above)

Seal kit (see above)

* available separately

¹⁾ When ordering, please state diameter of the smaller shell port.

Item 1 not available as a spare part.

4. NOTE

The information in this brochure relates to the operating conditions and applications described.

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

Subject to technical modifications.

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Bladder Accumulators Standard



1. DESCRIPTION

1.1. FUNCTION

Fluids are practically incompressible and cannot therefore store pressure energy.

The compressibility of a gas is utilised in hydraulic accumulators for storing fluids. HYDAC bladder accumulators are based on this principle, using nitrogen as the compressible medium.

A bladder accumulator consists of a fluid section and a gas section with the bladder acting as the gas-proof screen. The fluid around the bladder is connected to the hydraulic circuit so that the bladder accumulator draws in fluid when the pressure increases and the gas is compressed.

When the pressure drops, the compressed gas expands and forces the stored fluid into the circuit.

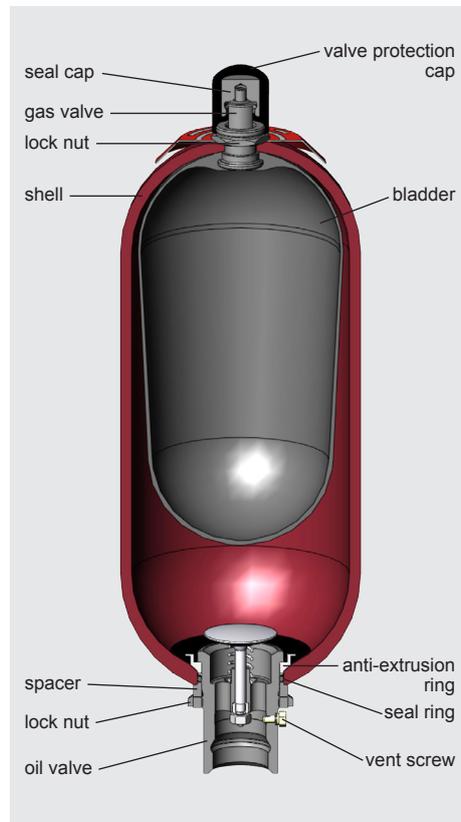
HYDAC bladder accumulators can be used in a wide variety of applications, some of which are listed below:

- energy storage
- emergency operation
- force equilibrium
- leakage compensation
- volume compensation
- shock absorption
- vehicle suspension
- pulsation damping

See Catalogue section:

- Hydraulic Dampers
No. 3.701

1.2. DESIGN



Design

● Standard Bladder Accumulator SB330/400/500/550

HYDAC standard bladder accumulators consist of the pressure vessel, the flexible bladder with gas valve and the hydraulic connection with check valve. The seamless pressure vessel is manufactured from high tensile steel.

● Bladder accumulator SB 330N

The flow optimised design of the standard oil valve enables the maximum possible operating fluid flow rate to increase to 25 l/s on this accumulator type.

● High flow bladder accumulator SB330H

HYDAC high flow bladder accumulators, type SB330H, are high performance accumulators with a flow rate of up to 30 l/s. The fluid connection is enlarged to allow higher flow rates.

1.3. BLADDER MATERIAL

The following elastomers are available as standard:

- NBR (acrylonitrile butadiene rubber, Perbunan),
- IIR (butyl rubber),
- FKM (fluoro rubber, Vitor®),
- ECO (ethylene oxide epichlorohydrin rubber).

The material must be selected according to the particular operating fluid and temperature.

When choosing the elastomer, allowances must be made for the fact that the gas can cool down to below the permitted elastomer temperature if there are adverse discharge conditions (high pressure ratio p_2/p_0 , high discharging velocity). This can cause cold cracking in the elastomer. The gas temperature can be calculated using the HYDAC Accumulator Simulation Program ASP.

1.4. CORROSION PROTECTION

For operation with chemically aggressive media, the accumulator shell can be supplied with corrosion protection, such as chemical nickel-plating. If this is insufficient, then stainless steel accumulators must be used.

1.5. INSTALLATION POSITION

HYDAC bladder accumulators can be installed vertically, horizontally and at a slant. When installing vertically or at a slant, the oil valve must be at the bottom. On certain applications listed below, particular positions are preferable:

- Energy storage: vertical,
- Pulsation damping: any position from horizontal to vertical,
- Maintaining constant pressure: any position from horizontal to vertical,
- Volume compensation: vertical.

If the installation position is horizontal or at a slant, the effective volume and the maximum permitted flow rate of the operating fluid are reduced.

1.6. TYPE OF INSTALLATION

By using an appropriate adapter, HYDAC accumulators, up to size 1 l, can be installed directly inline.

For strong vibrations and volumes above 1 litre, we recommend the use of HYDAC accumulator supports or the HYDAC accumulator installation set.

See catalogue sections:

- Supports for Hydraulic Accumulators No. 3.502
- ACCUSET SB No. 3.503

2. TECHNICAL SPECIFICATIONS

2.1. EXPLANATORY NOTES

2.1.1 Operating pressure
see tables (may differ from nominal pressure for foreign test certificates)

2.1.2 Nominal volume
see tables

2.1.3 Effective gas volume
see tables
Based on nominal dimensions, this differs slightly from the nominal volume and must be used when calculating the effective fluid volume.

2.1.4 Effective fluid volume
Volume of fluid which is available between the operating pressures p_2 and p_1 .

2.1.5 Max. flow rate of the operating fluid

In order to achieve the max. flow rate given in the tables, the accumulator must be installed vertically. It must be noted that a residual fluid volume of approx. 10% of the effective gas volume remains in the accumulator. The maximum fluid flow rate was determined under specific conditions and is not applicable in all operating conditions.

2.1.6 Fluids
The following sealing and bladder materials are suitable for the fluids listed below.

Material	Fluids
NBR	Mineral oils (HL, HLP, HFA, HFB, HFC), water
ECO	Mineral oil
IIR	Phosphate ester, water
FKM	Chlorinated hydrocarbons, petrol

Other fluids on request

2.1.7 Permitted operating temperatures
The permitted operating temperature of a bladder accumulator is dependent on the application limits of the metal materials and the bladder.

Outside these temperatures, special material combinations must be used. The following table shows the correlation between bladder material and application temperature.

Material	Temperature ranges
NBR20	-15 °C ... + 80 °C
NBR21	-50 °C ... + 80 °C
NBR22	-30 °C ... + 80 °C
ECO	-30 °C ... +120 °C
IIR	-55 °C ... +100 °C
FKM	-10 °C ... +150 °C

2.1.8 Gas charging
Hydraulic accumulators must only be charged with nitrogen.

Never use other gases.

Risk of explosion!

In principle, the accumulator may only be charged with nitrogen class 4.0, filtered to < 3 µm.

If other gases are to be used, please contact HYDAC for advice.

2.1.9 Limits for gas pre-charge pressure

$$p_0 \leq 0.9 \cdot p_1$$

with a permitted pressure ratio of:

$$p_2 : p_0 \leq 4 : 1$$

p_2 = max. operating pressure

p_0 = pre-charge pressure

2.1.10 Certificate codes

Country	Certificate code (AKZ)
EU member states	U
AU Australia	F ¹⁾
BY Belarus	A12
CE Canada	S1 ¹⁾
CH Switzerland	U
CN China	A9
HK Hong Kong	A9
IS Iceland	U
JP Japan	P
KR Korea (Republic)	A11
NO Norway	U
NZ New Zealand	T
RU Russia	A6
TR Turkey	U
UA Ukraine	A10
US USA	S
ZA South Africa	S2

¹⁾ = Registration required in the individual territories or provinces.

others on request

On no account must any welding, soldering or mechanical work be carried out on the accumulator shell. 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 pressure and the fluid have been released.

Please read the Operating Manual! No. 3.201.CE

Note:

Application examples, accumulator sizing, instructions and extracts from approvals and transport regulations relating to hydraulic accumulators can be found in the following catalogue section:

- HYDAC Accumulator Technology No. 3.000

2.1.11 Gas side connection Standard

Series	Volume [l]	Gas valve type
SB330 / SB400	< 1	5/8-18UNF
	< 50	7/8-14UNF
	≥ 50	M50x1.5 / 7/8-14UNF

other pressure ranges on request

2.2. MODEL CODE

Not all combinations are possible.

Order example. For further information, please contact HYDAC.

SB330 (H) – 32 A 1 / 112 U – 330 A 050

Series

Type code

no details = standard

H = high flow

N = increased flow, standard oil valve dimensions

A = shock absorber

P = pulsation dampfer³⁾

B = bladder top-repairable

E = bladder with foam filling

D = bladder integrity system

L = lightweight

Combinations must be agreed with HYDAC.

Nominal volume [l]

Fluid connection

A = standard connection, thread with internal seal face

F = flange connection

C = valve mounting with screws on underside

E = sealing surfaces on front interface (e.g. on thread M50x1.5 - valve)

G = male thread

S = special connection, to customer specification

Gas side

1 = standard model (see point 2.1.11)

2 = back-up model⁴⁾

3 = gas valve 7/8-14UNF with M8 female thread

4 = gas valve 7/8-14UNF with gas valve connection 5/8-18UNF

5 = gas valve M50x1.5 in accumulators smaller than 50 l

6 = 7/8-14UNF gas valve

7 = M28x1.5 gas valve

8 = M16x1.5 gas valve (with M14x1.5 bore in gas valve)

9 = special gas valve, to customer specification

Material code

dependent on operating medium

standard model = 112 for mineral oils

others on request

Fluid connection

1 = carbon steel

2 = high tensile steel

3 = stainless steel²⁾

6 = low temperature steel

Accumulator shell

0 = plastic coated (internally)

1 = carbon steel

2 = chemically nickel-plated (internal coating)

4 = stainless steel²⁾

6 = low temperature steel

Accumulator bladder¹⁾

2 = NBR20

3 = ECO

4 = IIR (butyl)

5 = NBR21 (low temperature)

6 = FKM

7 = Others

9 = NBR22

Certificate code

U = PED 97/23/EC

Permitted operating pressure [bar]

Connection, fluid side

Thread, codes for fluid connections: A, C, E, G

A = thread to ISO 228 (BSP)

B = thread to DIN 13 or ISO 965/1 (metric)

C = thread to ANSI B1.1 (UN...-2B seal SAE J 514)

D = thread to ANSI B1.20.1 (NPT)

S = special thread, to customer specification

Flange, codes for fluid connection: F

A = DIN flange

B = flange ANSI B16.5

C = SAE flange 3000 psi

D = SAE flange 6000 psi

S = special flange, to customer specification

Pre-charge pressure p_0 [bar] at 20 °C, must be stated clearly, if required!

¹⁾ When ordering a spare bladder, please state diameter of the smaller shell port

²⁾ Dependent on type and pressure range

³⁾ See catalogue section Hydraulic Dampers, No. 3.701

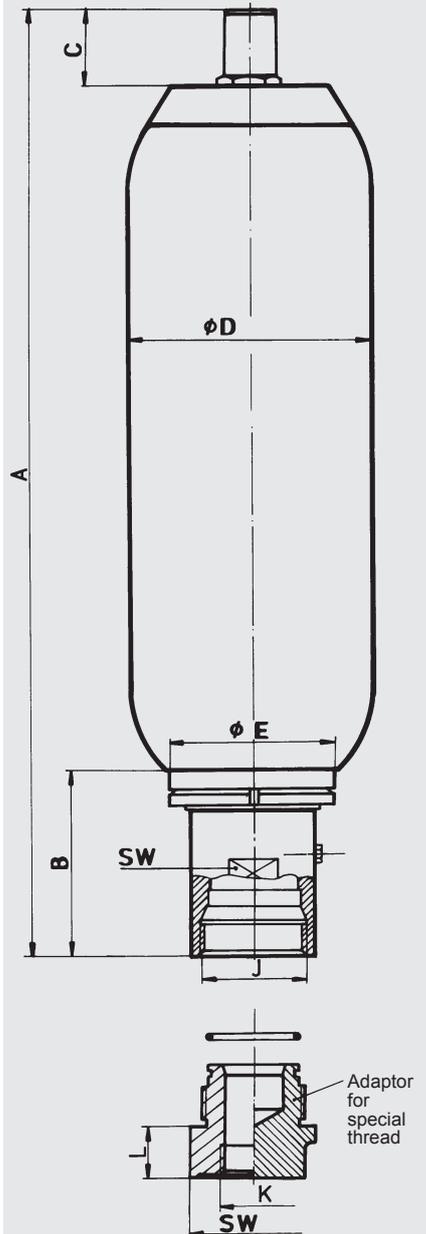
⁴⁾ See catalogue section Hydraulic accumulators with back-up nitrogen bottles, No. 3.553

3. DIMENSIONS AND SPARE PARTS

3.1. DIMENSIONS

Nominal volume	Type of valve, fluid side	Max. operating pressure (PED 97/23/EC)	Eff. gas volume	Weight approx.	A	B	C	Ø D	J	Ø E	SW	Q ¹⁾							
					max.			max.	thread										
[l]		[bar]	[l]	[kg]	[mm]	[mm]	[mm]	[mm]	ISO 228	[mm]	[mm]	[l/s]							
0.5	Standard	400	0.5	2.8	270	57	33.5	95.5	G 3/4	50	32	4							
1		330	1	4.5	302			68					118						
		550		8.5	343								121						
2.5		330	2.4	10	531	63	118	G 1 1/4	67	45	6								
		550	2.5	550	68		121	G 1		45	6								
4		330	3.7	13.5	419	63	58	173	G 1 1/4	50	10								
		400			50					10									
5		550	4.9	23	879	68	121	G 1	45	6									
6		330	5.7	15	531	63	58	173	G 1 1/4	50	10								
10 ²⁾		330	9.3	25	808							63	58	173	G 1 1/4				
10		Standard	330	9.3	31.5	583	103	58	229	G 2	100	70	15						
		N											25						
		H											9	34.5	618	138	G 2 1/2	125	90
	Standard	400											9.3	37.5	579	103	233	G 2	100
13	Standard	330	12	43	696	103	58	229	G 2	100	70	15							
	N											25							
	H											46	730	138	G 2 1/2	125	90	30	
	Standard											400	49	681	103	233	G 2	100	70
20	Standard	330	18.4	50.5	896	103	58	229	G 2	100	70	15							
	N											25							
	H											17.5	53.5	931	138	G 2 1/2	125	90	30
	Standard											400	18.4	63.5	896	103	233	G 2	100
24	Standard	330	23.6	69	1062	103	58	229	G 2	100	70	15							
	N											25							
	H											24	72	1097	138	G 2 1/2	125	90	30
	Standard											400	33.9	104.5	1411	103	58	229	G 2
32	Standard	330	33.9	87	1411	103	58	229	G 2	100	70	15							
	N											25							
	H											32.5	90	1446	138	G 2 1/2	125	90	30
	Standard											400	33.9	104.5	1411	103	58	229	G 2
50	Standard	330	47.5	117.5	1931	103	68	229	G 2	100	70	15							
	N											25							
	H											120.5	1966	138	G 2 1/2	125	90	30	
	Standard											400	142	1931	103	68	229	G 2	100
60	Standard	330	60	182	1206	138	68	356	G 2 1/2	125	90	30							
													80	85	221	1456			
													100	105	255	1706			
													130	133	305	2026			
													160	170	396	2056			
													200	201	485	2356			

Dimensions

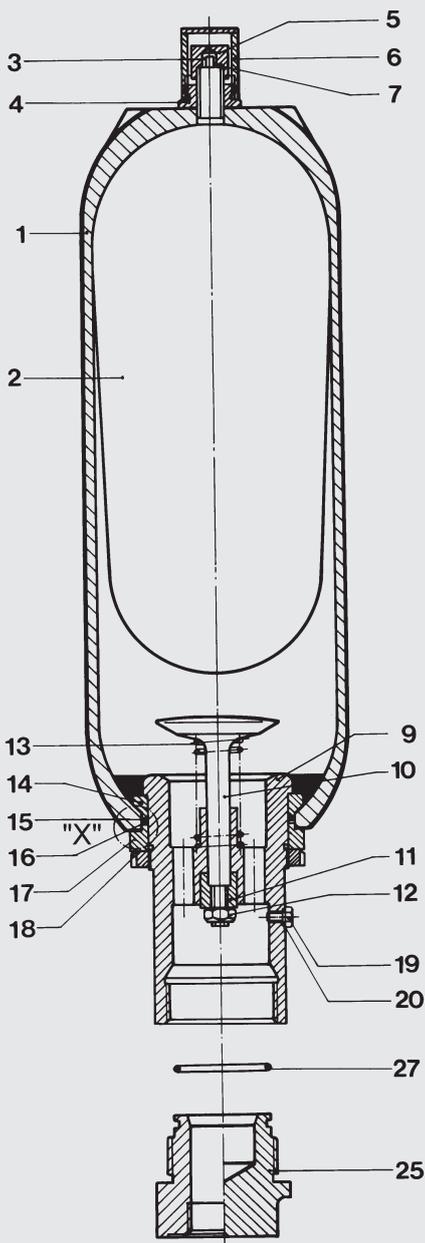


¹⁾ Q = max. flow rate of operating fluid for optimal conditions

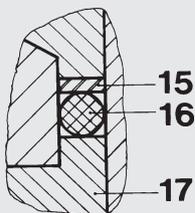
²⁾ slimline version, for confined spaces

3.2. SPARE PARTS

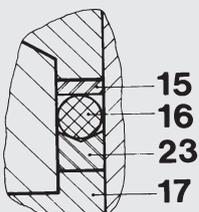
SB330/400/440/500/550
SB330H / SB330N



Detail "X"
SB330/400 – 0.5 ... 6 l



SB330/400/500 – 10 ... 200 l and
SB330H – 10 ... 200 l
SB550 – 1 ... 5 l



Designation	Item
Bladder assembly	
consisting of:	
Bladder	2
Gas valve insert*	3
Lock nut	4
Seal cap	5
Valve protection cap	6
O-ring	7
Seal kit	
consisting of:	
O-ring	7
Washer	15
O-ring	16
Vent screw	19
Back-up ring	23
O-ring	27
Repair kit ¹⁾	
consisting of:	
Bladder assembly (see above)	
Seal kit (see above)	
Anti-extrusion ring	14
Oil valve assembly	
consisting of:	
Valve assembly (items 9-13)	9
Anti-extrusion ring	14
Washer	15
O-ring	16
Spacer	17
Lock nut	18
Bleed screw	19
Back-up ring	23

* available separately

¹⁾ When ordering, please state diameter of the smaller shell port

Item 1 not available as a spare part

Item 19 for NBR/Carbon steel:
seal ring (item 20) included

Adapter (item 25) must be ordered as an accessory,
see Point 4

SB300/400
NBR, carbon steel
Standard gas valve

Volume [l]	Bladder assembly	Seal kit	Repair kit
0.5	365263	353606	2128169 ²⁾
1	237624		2106261
2.5	236171	353609	2106200
4	236046		2106204
5	240917		2106208
6	2112097		2112100
10*	2127255	353621	3117512
10	236088		2106212
13	376249		2106216
20	236089		2106220
24	376253		2106224
32	235335		2106228
50	235290		2106252
60	3364274		3102043 ¹⁾
80	3364312	3117514	
100	3127313	3117515	
130	3201384	3117516	
160	3184769	3117517	
200	3461300	3117558	

* slimline version for confined spaces

¹⁾ only for SB330

²⁾ only for SB400

others on request

When replacing seals and/or bladder, please read the instructions for assembly and repair (No. 3.201.M).

4. ACCESSORIES FOR BLADDER ACCUMULATORS

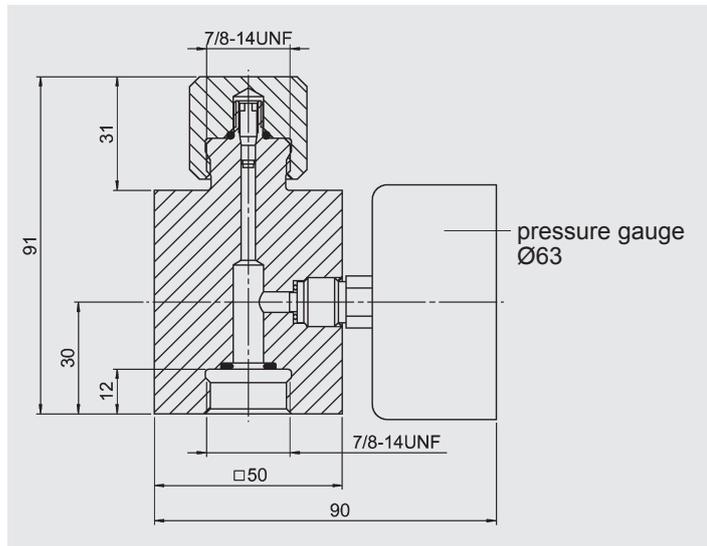
4.1. ADAPTERS (GAS SIDE)

To monitor the accumulator pre-charge pressure, HYDAC offers a selection of gas side adapters.

The adapters shown below are available for standard connections on bladder accumulators and must be specified separately in the order.

4.1.1 Pressure gauge model

Gas side connection on the bladder accumulator for permanent monitoring of the pre-charge pressure

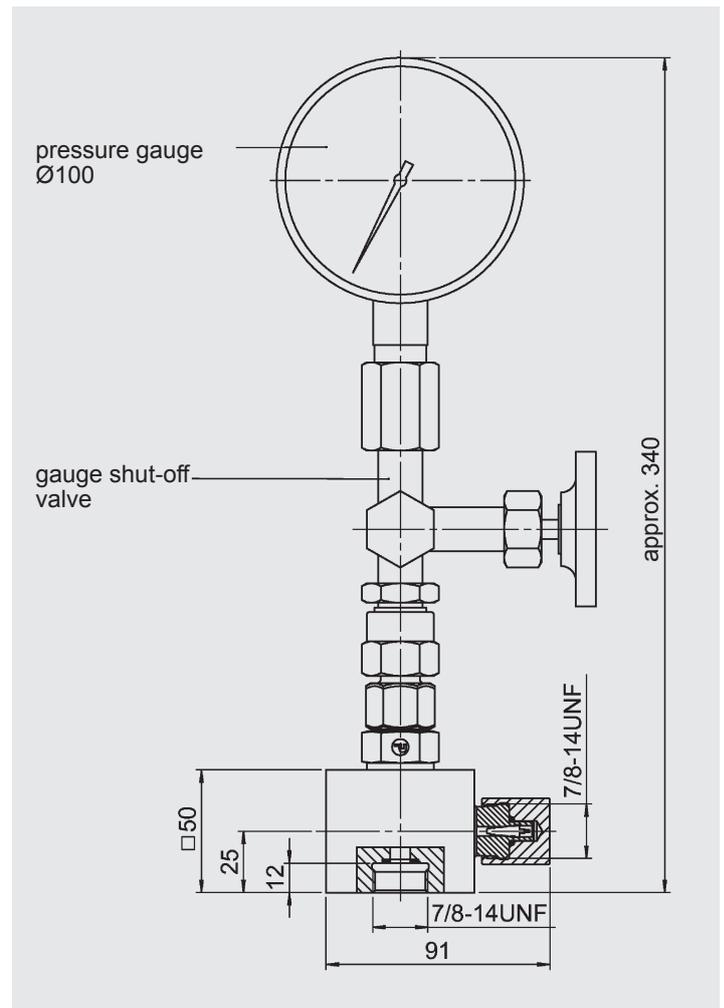


Gauge indication range	Pressure gauge Part no.	Adapter* assembly Part no.
–	–	366621
0 - 10 bar	614420	2108416
0 - 60 bar	606886	3093386
0 - 100 bar	606887	2104778
0 - 160 bar	606888	3032348
0 - 250 bar	606889	2100217
0 - 400 bar	606890	2102117

* $p_{max} = 400$ bar

4.1.2 Pressure gauge model with shut-off valve

Gas side connection on the bladder accumulator for permanent monitoring of the pre-charge pressure with shut-off option.



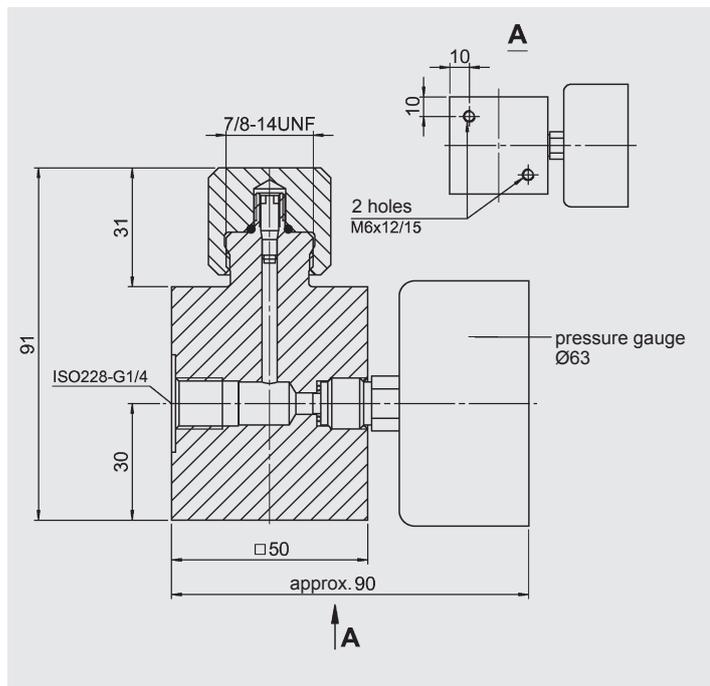
Gauge indication range	Pressure gauge Part no.	Adapter* assembly Part no.
–	–	2103381
0 - 25 bar	617928	3784725
0 - 60 bar	606771	2110059
0 - 100 bar	606772	3139314
0 - 160 bar	606773	3202970
0 - 250 bar	606774	3194154
0 - 400 bar	606775	2103226

* $p_{max} = 400$ bar

4.1.3 Remote monitoring of the pre-charge pressure

To monitor the pre-charge pressure in hydraulic accumulators remotely, gas side adapters with pressure gauge and mounting holes are available.

In order to connect these adapters directly with the hydraulic accumulator using appropriate lines, accumulator adapters are also available for connection at the top (see diagram 1) or for side-connection (see diagram 2).



Gauge indication range	Pressure gauge Part no.	Adapter* assembly Part no.
–	–	3037666
0 - 10 bar	614420	3095818
0 - 60 bar	606886	3095819
0 - 100 bar	606887	3095820
0 - 160 bar	606888	3095821
0 - 250 bar	606889	3095822
0 - 400 bar	606890	3095823

* p_{max} = 400 bar

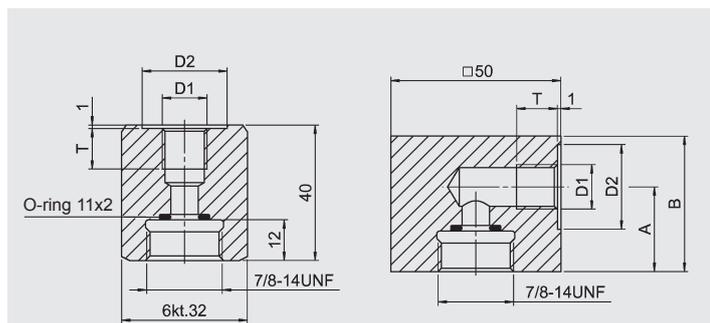


Diagram 1

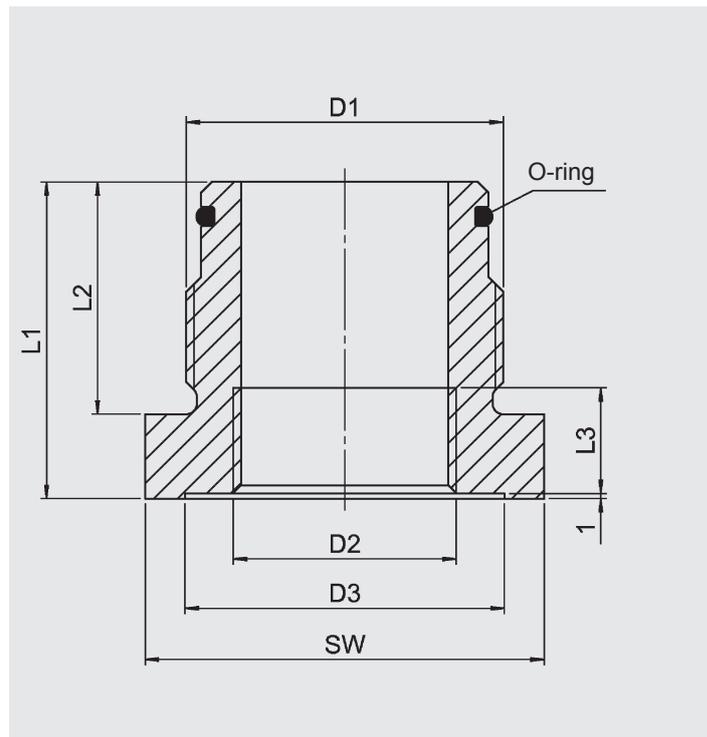
Diagram 2

D1 Threaded connection	D2 [mm]	T	Adapter assembly Part no.	Diag.
ISO228- G 1/4	25	14	2109481	1
			2102042	2
ISO228- G 3/8	28	14	2109483	1
			366607	2
ISO228- G 1/2	34	16	2110636	1
			366608	2

* p_{max} = 400 bar

4.2. ADAPTERS FOR STANDARD BLADDER ACCUMULATORS (FLUID SIDE)

To connect the bladder accumulator to pipe fittings. These are available separately.



D1 Accum. conn.* (ISO228-BSP)	D2 [mm]	D3 [mm]	L1 [mm]	L2 [mm]	L3 [mm]	SW [mm]	O-ring [mm]	Part no. NBR/ Carbon steel
G 3/4	G 3/8	28	55	28	12	32	17x3	2104346
	G 1/2							60
G 1 1/4	G 3/8	28	50	37	12	46	30x3	2116345
	G 1/2							34
	G 3/4	44			16			2104384
	G 1	50			18			2110124
G 2	G 3/4	44	60	44	16	65	48x3	2104849
	G 1 1/4	60			20			2107113
	G 1 1/2	68	80		22			2105905

* others on request

5. NOTE

The information in this brochure relates to the operating conditions and applications described. For applications and operating conditions not described, please contact the relevant technical department. Subject to technical modifications.

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Bladder Accumulators High Pressure

1. DESCRIPTION

1.1. FUNCTION

Fluids are practically incompressible and cannot therefore store pressure energy.

The compressibility of a gas (nitrogen) is utilised in hydraulic accumulators for storing fluids.

HYDAC bladder accumulators are based on this principle.

A bladder accumulator consists of a fluid section and a gas section with the bladder acting as the gas-proof screen.

The fluid around the bladder is connected to the hydraulic circuit so that the bladder accumulator draws in fluid when the pressure increases and the gas is compressed. When the pressure drops, the compressed gas expands and forces the stored fluid into the circuit.

HYDAC bladder accumulators can be used in a wide variety of applications and are also available in different pressure ranges, see catalogue sections:

- Bladder Accumulators Standard No. 3.201
- Bladder Accumulators Low Pressure No. 3.202
- HYDAC Accumulator Technology No. 3.000

1.2. DESIGN

The high pressure bladder accumulator consists of the pressure vessel, the flexible bladder with gas valve and the hydraulic connection with check valve.

1.2.1 Shell material

The seamless pressure vessel is manufactured from high tensile chrome molybdenum steel.

1.2.2 Bladder material

The following elastomers are available as standard:

- NBR (acrylonitrile butadiene rubber, Perbunan),
- IIR (butyl rubber),
- FKM (fluoro rubber, Viton®),
- ECO (ethylene oxide epichlorohydrin rubber).

The material used depends on the particular operating medium and temperature.

When choosing the elastomer, allowances must be made for the fact that the gas can cool down to below the permitted elastomer temperature if there are adverse discharge conditions (high pressure ratio p_2/p_0 , high discharging velocity). This can cause cold cracking in the elastomer. The gas temperature can be calculated using the HYDAC Accumulator Simulation Program ASP.

1.2.3 Corrosion protection

For operation with chemically aggressive media, the accumulator shell can be chemically nickel-plated internally or supplied with a special plastic coating.

For external corrosion protection the accumulator can be supplied with an epoxy resin finish specially for offshore applications.

1.3. INSTALLATION POSITION AND TYPE OF INSTALLATION

Information on secure installation positions and mounting elements can be found in the following catalogue sections:

- Bladder Accumulators Standard No. 3.201
- Supports for Hydraulic Accumulators No. 3.502
- ACCUSET SB No. 3.503

On no account must any welding, soldering or mechanical work be carried out on the accumulator shell. 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 pressure and the fluid have been released.

Please read the Operating Manual! No. 3.201.CE

When replacing seals and/or bladder, please read the Instructions for assembly and repair (No. 3.301.M).

Note:

Application examples, accumulator sizing and extracts from approvals regulations relating to hydraulic accumulators can be found in the following catalogue section:

- HYDAC Accumulator Technology No. 3.000

2. TECHNICAL SPECIFICATIONS

2.1. MODEL CODE

Not all combinations are possible.
Order example. For further information, please contact HYDAC.

SB690 - 32 A 1 / 312 U - 690 D

Series _____

Nominal volume [l] _____

Fluid connection _____
A = standard connection

Gas side connection _____
1 = standard model ¹⁾
9 = special model (example: 1/4" - BSP)

Material code _____

Fluid connection _____
2 = high tensile steel
3 = stainless steel
6 = low temperature steel

Accumulator shell _____
0 = plastic coated (internally)
1 = carbon steel
2 = chemically nickel-plated (internal coating)
6 = low temperature steel
8 = plastic coated (e.g. Duroplast) internally and externally

Accumulator bladder _____
2 = NBR20
3 = ECO
4 = IIR (butyl)
5 = NBR21 (low temperature)
6 = FKM
7 = Others
9 = NBR22

Certificate code _____
U = PED 97/23/EC

Permitted operating pressure (bar) _____

Connection _____
A = Thread to ISO228 (1/2" BSP)
D = Thread to ANSI B1.20.3 (1/2" NPTF)

Required gas pre-charge pressure must be stated separately!

1) Gas valve in SB < 10 l = 7/8 - 14 UNF,
in SB ≥ 10 l = M50x1.5

2.2. EXPLANATORY NOTES

2.2.1 Operating pressure

690 bar (10000 psi)
higher pressures on request

2.2.2 Permitted working temperature and elastomer resistance

NBR20	-15 °C ... +80 °C	Water Water-glycol Mineral oil
NBR21	-50 °C ... +80 °C	
NBR22	-30 °C ... +80 °C	
ECO	-30 °C ... +120 °C	Mineral oil
IIR	-55 °C ... +100 °C	Phosphate ester, water
FKM	-10 °C ... +150 °C	Chlorinated hydrocarbons, petrol

2.2.3 Gas charging

Hydraulic accumulators must only be charged with nitrogen.
Never use other gases.

Risk of explosion!

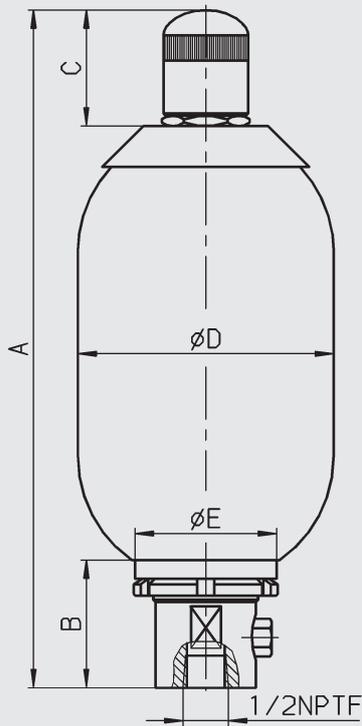
In principle, the accumulator may only be charged with nitrogen class 4.0, filtered to < 3 µm.

If other gases are to be used, please contact HYDAC for advice.

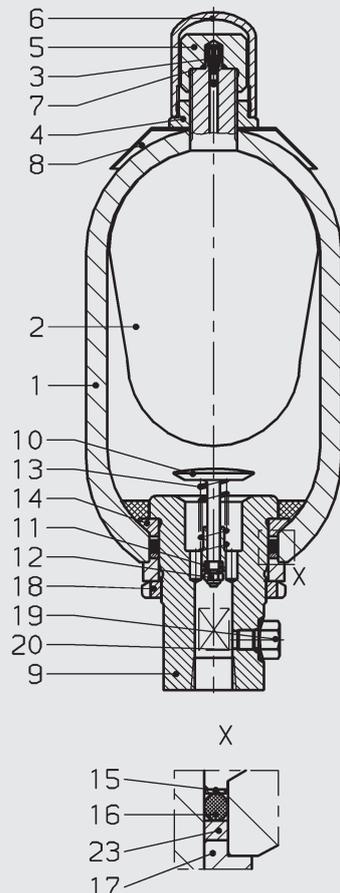
3. DIMENSIONS AND SPARE PARTS

3.1. DRAWINGS

3.1.1 Dimensions



3.1.2 Spare parts



3.2. DIMENSIONS

Nominal volume [l]	Eff. gas volume [l]	Weight: [kg]	A max. [mm]	B [mm]	C [mm]	Ø D max. [mm]	Ø E [mm]	SW [mm]
1	1	8.5	324	61	58	122	67	45
2.5	2.5	13.5	531					
5	4.9	23	860					
13	12	92	700	77	68	250	110	75
20	17	114	865					
32	33.5	186	1385					
54	49.7	260	1900					

3.3. SPARE PARTS

3.3.1 Part numbers NBR

Description	Item
Bladder assembly	
consisting of:	
Bladder	2
Gas valve insert	3
Retaining nut	4
Seal cap	5
Valve protection cap	6
O-ring	7
Seal kit	
consisting of:	
O-ring	7
Washer	15
O-ring	16
Bleed screw	19
Support ring	23
Repair kit	
consisting of:	
Seal kit (see above)	
Bladder assembly (see above)	
Anti-extrusion ring	14
Oil valve assembly	
consisting of:	
Valve assembly (items 9-13)	9
Anti-extrusion ring	14
Washer	15
O-ring	16
Spacer	17
Lock nut	18
Bleed screw	19
Support ring	23

Item 1 not available as a spare part.

Nominal volume [l]	Seal kit Part no.	Bladder assembly Part no.	Repair kit Part no.	Anti-extrusion ring Part no.
1	3182615	3010110	3182617	293262
2.5		3211568	3201771	
5		3211569	3201772	
13	3182616	3211570	3211573	3028455
20		3211592	3211574	
32		3211571	3211585	
54		3116598	3211586	

4. NOTE

The information in this brochure relates to the operating conditions and applications described. For applications and operating conditions not described, please contact the relevant technical department.
Subject to technical modifications.

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Piston Accumulators Standard



1. DESCRIPTION

1.1. FUNCTION

Fluids are practically incompressible and cannot therefore store pressure energy. The compressibility of a gas (nitrogen) is utilised in hydraulic accumulators for storing fluids. HYDAC piston accumulators are based on this principle.

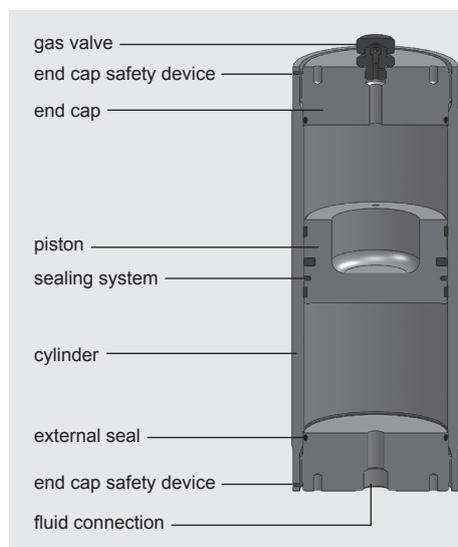
A piston accumulator consists of a fluid section and a gas section with the piston acting as the gas-proof screen.

The gas section is pre-charged with nitrogen.

The fluid section is connected to the hydraulic circuit so that the piston accumulator draws in fluid when the pressure increases and the gas is compressed.

When the pressure drops, the compressed gas expands and forces the stored fluid into the circuit.

1.2. DESIGN



HYDAC piston accumulators consist of:

- A cylinder with very finely machined internal surface.
- End caps on the gas side and the oil side. Sealed with O-rings.
- A floating steel or aluminium piston which can easily be accelerated due to its low weight.
- A sealing system adapted to the particular application.

The piston floats on two guide rings which prevent metal-to-metal contact between the piston and the accumulator wall.

For use with certain aggressive or corrosive fluids, the parts coming into contact with the fluid can be nickel plated for protection, or made entirely from corrosion-resistant material. Suitable materials are also available for low temperature applications.

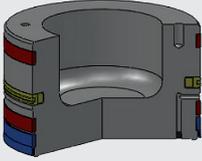
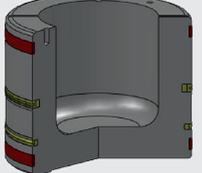
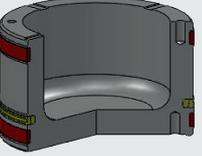
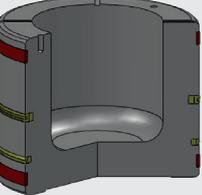
1.3. SEALING SYSTEMS

Precise information about operating conditions is required in order to select the most appropriate sealing system. Important criteria for this selection are, for example:

- Design pressure,
- Effective pressure differential,
- Switching frequency or cycles,
- Temperature fluctuation,
- Operating fluid,
- Cleanliness of fluid (micron rating of filter),
- Maintenance requirements.

The sealing systems differ according to the type of piston used, each of which has its own type and arrangement of seals. The following elastomer sealing materials are available, depending on the operating conditions:

- NBR (acrylonitrile butadiene rubber, Perbunan),
- FKM (fluoro rubber, Viton®),
- PUR (polyurethane).

Piston design type	Application	Degree of contamination in the fluid	Comment
	<p>1</p> <ul style="list-style-type: none"> ● For general accumulator operation without special requirements <p><u>Application limitations:</u> max. piston velocity: 0.5 m/s</p>	<p>Optimized for applications with a high level of contamination</p>	
	<p>2</p> <ul style="list-style-type: none"> ● Low-friction design ● For high piston speeds ● Slow movements without stick-slip effect <p><u>Application limitations:</u> max. piston velocity: 3.5 m/s</p>		
	<p>3</p> <ul style="list-style-type: none"> ● Low-friction design ● Simple-to-fit seals ● Slow movements without stick-slip effect <p><u>Application limitations:</u> max. piston velocity: 0.8 m/s</p>	<p><u>Filtration:</u> NAS 1638 - Class 6 ISO 4406 - Class 17/15/12</p>	<p>1 guide ring for pistons with $\varnothing \leq 150$ mm</p>
	<p>4</p> <ul style="list-style-type: none"> ● Low-friction design with emergency safety features ● Slow movements without stick-slip effect ● Very low oil transfer to the gas side <p><u>Application limitations:</u> max. piston velocity: 5 m/s</p>		<p>2 guide rings for pistons $\varnothing \geq 180$ mm</p>

1.4. INSTALLATION POSITION

HYDAC piston accumulators operate in any position.

Vertical installation is preferable with the gas-side at the top, to prevent contamination from the fluid settling on the piston seals. For accumulators with certain piston position indicators vertical installation is essential (see 1.7.). Piston accumulators with a piston diameter ≥ 355 mm must only be installed vertically.

1.5. ADVANTAGES OF HYDAC PISTON ACCUMULATORS

- complete range to over 3300 litres nominal volume,
- high ratios possible between pre-charge pressure and max. working pressure,
- economic solution using back-up gas bottles for low pressure differentials,
- high flow rates possible; limitation: max. piston velocity,
- power savings,
- high level of efficiency of the hydraulic installation,
- gas-tight and leakage free,
- no sudden discharge when seals are worn,
- requires little space,
- monitoring of the volume across the entire piston stroke or electrical limit switch.

Further advantages of using the low-friction sealing system:

- minimum friction,
- also suitable for low pressure differentials,
- no start-up friction,
- no stick-slip,
- low noise, no vibration,
- high piston velocity up to 5 m/s for piston type 4,
- improved accumulator efficiency,
- good life expectancy of seals because of low wear,
- suitable for large temperature fluctuations,
- low maintenance requirement.

1.6. TECHNICAL REQUIREMENTS

HYDAC piston accumulators are suitable for high flow rates. With the largest piston accumulator diameter made to date of 800 mm, a flow rate of 1000 l/s can be achieved at a piston velocity of 2 m/s.

1.6.1 Effect of sealing friction

The permitted piston velocity depends on the sealing friction.

Higher piston velocities are possible where there is less sealing friction.

HYDAC piston accumulators of piston design type 2 allow velocities of up to 3.5 m/s.

1.6.2 Permitted velocities

Gas velocity

The flow velocities in the gas connection and pipe system should be limited to 30 m/s when using piston accumulators of the back-up type. Gas velocities of over 50 m/s should be avoided at all costs.

Oil velocity

In order to limit the pressure losses when the operating fluid is displaced, the flow velocity should not exceed 10 m/s in the adapter cross-section.

1.6.3 Function tests and fatigue tests

Function tests and fatigue tests are carried out to ensure continuous improvement of our piston accumulators.

By subjecting the accumulators to endurance tests under realistic as well as extreme working conditions, important data can be obtained about the long-term behaviour of the components. In the case of piston accumulators, important information on gas density and the life expectancy of seals is gained from such tests.

Vital data for use in accumulator sizing is gained by altering the working pressure and switching cycles.

1.6.4 Fluids

The following sealing materials are suitable for the fluids listed below:

NBR, resistant to:

- mineral oils (HL and HLP)
- fire-resistant fluids from the groups HFA, HFB and HFC
- water and seawater up to approx. 100 °C

NBR, not resistant to:

- aromatic hydrocarbons
- chlorinated hydrocarbons
- amines and ketones
- hydraulic fluids of type HFD

FPM, resistant to:

- mineral oils (HL and HLP)
- hydraulic fluids of type HFD
- fuels as well as aromatic and chlorinated hydrocarbons
- inorganic acids (but not all, please contact our technical department)

FPM, not resistant to:

- amines and ketones
- (anhydrous) ammonia
- organic acids such as formic acid and acetic acid

PUR, resistant to:

- mineral oils (HL and HLP)
- fire-resistant fluids from the HFA group

PUR, not resistant to:

- water and water-glycol mixtures
- alkalis
- acids

1.6.5 Temperature ranges of the seals

Material abbrev.	HYDAC code	Temp. range long-term
NBR	2	-20 °C ... +80 °C
FPM	6	-15 °C ... +160 °C
PUR	8	-30 °C ... +80 °C

For temperatures outside these ranges, please contact our technical department for more information. There are also special grades available depending on the application.

1.6.6 Gas charging

Hydraulic accumulators must only be charged with nitrogen. Never use other gases.

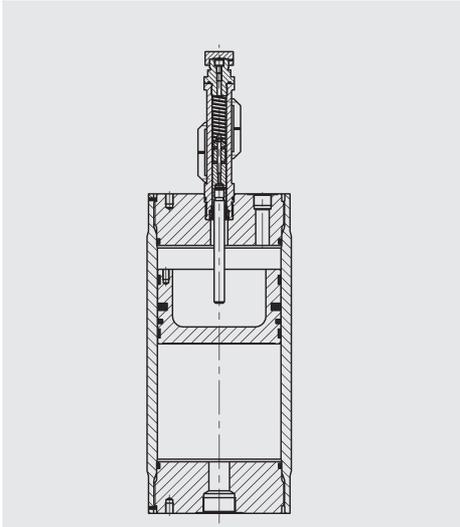
Risk of explosion!

In principle, the accumulator may only be charged with nitrogen class 4.0, filtered to $< 3 \mu\text{m}$.

If other gases are to be used, please contact HYDAC for advice.

1.7. PISTON POSITION INDICATORS

1.7.1 Electrical limit switch



The electrical limit switch usually monitors the max. charged condition of the piston accumulator.

It can, however, also permit control functions of the attached hydraulics to be carried out over a certain stroke length.

The limit switch consists of the switching rod with a permanent solenoid which is not attached to the piston and can only achieve a limited stroke, and an anti-magnetic housing and two or more switches.

These switches can be normally closed or normally open or bistable. An N/C or N/O and a bistable switch cannot be fitted simultaneously to a limit switch. Our standard limit switch is fitted with a N/C and a N/O switch.

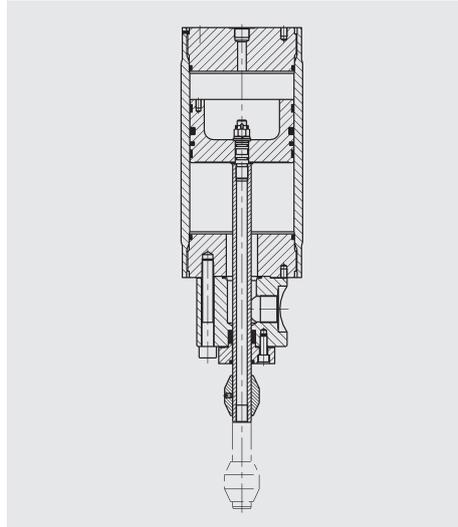
On another model, switching is carried out by inductive proximity switches.

The switch is reset by a spring or the force of gravity. Vertical mounting is preferable, due to the friction and possible wear and tear in the rod guide.

For limit switches with a stroke of > 200 mm, vertical mounting with the gas side at the top is essential.

The maximum piston velocity must not exceed 0.5 m/s over the stroke range of the limit switch.

1.7.2 Protruding piston rod



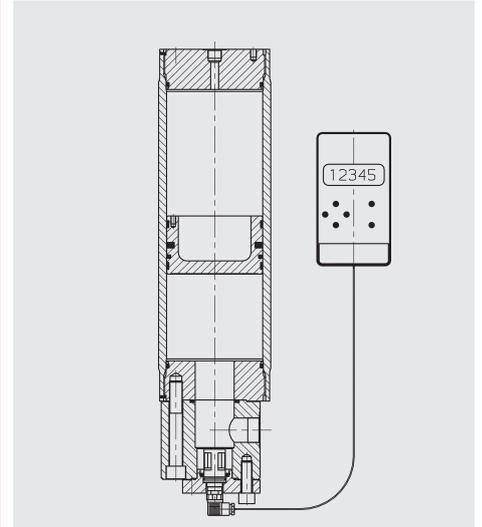
The protruding piston rod permits the position of the piston to be monitored over the whole stroke. It consists of the piston rod, which is fixed to the piston and sealed in, and what is known as the trip cam which actuates the limit switches.

The position of the piston can be monitored at any point using the trip cam. This facility is used mainly to switch the pump on and off.

Normally the piston rod protrudes from the accumulator on the fluid side to avoid possible points of leakage on the gas side. On the protruding piston rod version, the hydraulic connection will be on the side if the size of the end cap does not permit otherwise.

The protruding piston rod functions in any mounting position. There must however be sufficient space available for the piston to move in and out. The maximum piston velocity should not exceed 0.5 m/s.

1.7.3 Ultrasonic distance measurement



The piston position is determined by ultrasonic measurement.

It is only possible to take the measurements from the fluid side because a continuous sound carrier medium is required for ultrasound. In order to eliminate false readings, the fluid must be as free of air bubbles as possible. The piston should be mounted so that no air can collect under the sensor.

The measurement data is evaluated by a microprocessor and is converted into a continuous measurement signal. It is possible to pick up interim measurement results to switch system parts e.g. turn the pump on and off.

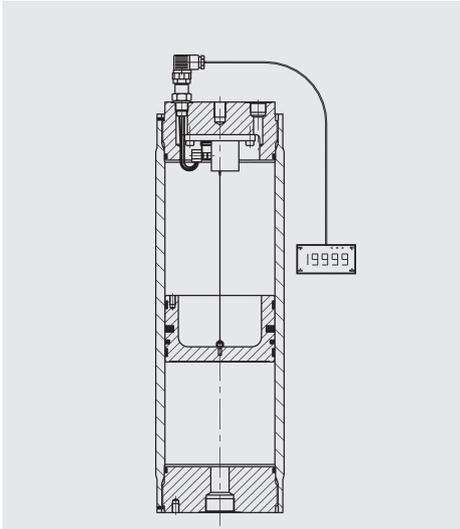
The most important features of the system are:

- Protection class
IP 65 according to DIN 40050
- LCD display
- Outputs
 - 5 floating relay change-over switches (with 125 V, 1A rating), of which 1 is error output, and 4 are user-adjustable switching thresholds between 0 and 100 %
 - 4 - 20 mA

The maximum pressure for the sensor must not exceed 350 bar.

- Measuring frequency: 15 Hz
- Signal: no control signal
- Max. measuring section: 5 m

1.7.4 Cable tension measurement system



Using the cable tension measurement system, the position of the piston can be determined by means of a cable which is fixed to the piston.

The cable is attached to a wheel which is tensioned by a spring. This wheel alters an electrical resistance via an attached rotary potentiometer during the piston movement. This resistance is converted by a transducer into an electrical signal so that it can be processed directly by a PLC system. The signal is supplied through the end cap via a pressure-tight cable gland. Alternatively various digital display units and transmitters can be connected.

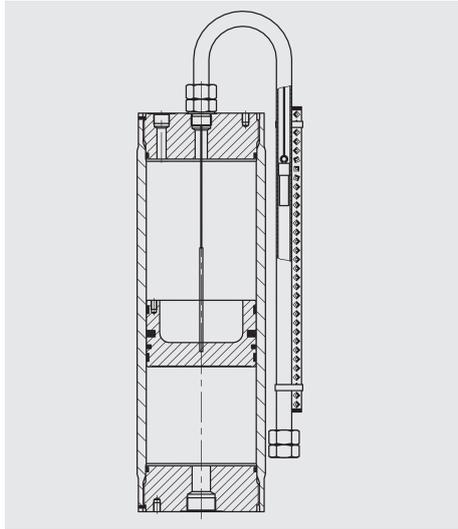
- Digital display unit:
Supply voltage 230 V AC
(or 24 V DC)
4-channel limit comparator
4 optical coupler outputs
2 relay contact outputs
1 RS 232 interface
(optionally with analogue output
4 - 20 mA)
- Transmitter:
Supply voltage 24 V DC
Analog output 4 - 20 mA

The maximum pressure must not exceed 350 bar. The piston acceleration is limited to certain values according to measurement system forces, approx. 7 ... 30 g, and is limited to a max. velocity of 0.5 m/s. The measurement system is not suitable for rapid fluctuations in volume.

For such loads, please contact the technical department at our Head Office or your local HYDAC agent. The preferred installation position is with the gas side at the top.

The cable tension measurement system can only be fitted to the gas-side of the piston accumulator.

1.7.5 Magnetic flap indication



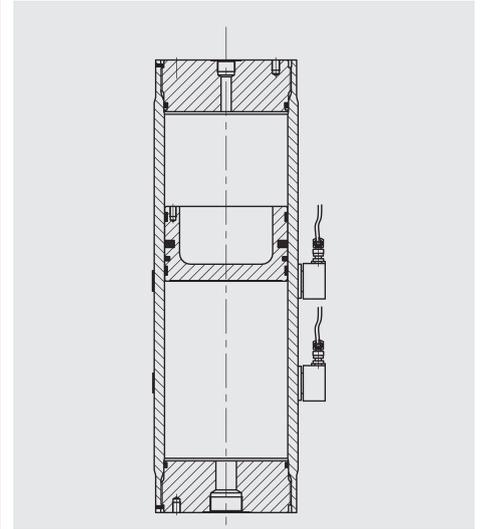
With magnetic flap indication, the position of a piston can be determined by the colour indicated by a set of magnetic flaps which are visible externally.

A non-magnetic tube installed externally on the piston accumulator contains a cable, one end of which is fastened to the gas side of the piston, and the other end is attached to a magnet. Movement in the cable causes red and white magnetic flaps to turn over.

As the piston moves, the change in colour of the flaps indicates the piston's position. When the piston moves in the direction of the gas side, the indicator moves towards the oil-side. In addition, reed switches can be fitted to switch system parts or measurement scales can be fitted to the tube.

The maximum piston velocity must not exceed 0.5 m/s. No more than 5 cycles per day on average should be carried out. Piston accumulators with magnetic flap indication must only be installed vertically, gas-side at the top.

1.7.6 Piston position switch



With the piston position switch it is possible to detect the piston position in a piston accumulator using ultrasound.

The indicator can be retrofitted using a clamp. No other modification is required. It is possible to fit without disrupting the operation.

The piston position switch detects the change-over from oil to piston at which point the signal is switched off. This is the case if the piston is in the sound path or has passed it.

There are three different versions available:

- Standard version for hydraulic fluid with a viscosity of 100 cSt.
- Special version for hydraulic fluid with a viscosity of 500 cSt.
- Special version for use in explosion protected areas.

Supply voltage
18 ... 30 V DC
Switching output:
NPN (or PNP)

2. TECHNICAL SPECIFICATIONS

2.1. EXPLANATORY NOTES

2.1.1 **Nominal volume [l]**
see table at Point 3.1.

2.1.2 **Eff. gas volume V_p [l]**
These differ slightly from the nominal volume and form the basis of the calculations of the effective fluid volume.

See Point 3.1.1.

2.1.3 **Effective fluid volume ΔV [l]**

The volume (on the fluid side) between the working pressure p_2 and p_1 .

2.1.4 **Permitted operating temperature (fluid)**

-10 °C ... +80 °C

263 K ... 353 K

Standard material, others on request

2.1.5 **Certificate codes**

Country	Certificate code (AKZ)
EU member states	U
AU Australia	F ¹⁾
BY Belarus	A12
CE Canada	S1 ¹⁾
CH Switzerland	U
CN China	A9
HK Hong Kong	A9
IS Iceland	U
JP Japan	P
KR Korea (Republic)	A11
NO Norway	U
NZ New Zealand	T
RU Russia	A6
TR Turkey	U
UA Ukraine	A10
US USA	S
ZA South Africa	S2

¹⁾ Registration required in the individual territories or provinces

other fluids on request

2.2. MODEL CODE

Not all combinations are possible.

Order example. For further information, please contact HYDAC.

SK350 - 20 / 2212 U - 350 AAG - VA - 18 A - 1 - 050

Series _____

Nominal volume [l] _____

Material and piston code _____

Piston design type (see Point 1.3.) _____

Piston material

- 1 = aluminium
- 2 = carbon steel
- 3 = stainless steel

Material of cylinder and end caps

- 1 = carbon steel
- 2 = carbon steel coated
- 3 = stainless steel
- 6 = carbon steel (low temperature)

Material of seals including piston seals

- 2 = NBR / PTFE compound
- 5 = TT-NBR / PTFE compound (low temperature)
- 6 = FPM / PTFE compound
- 8 = NBR / PUR (polyurethane)
- 9 = special qualities

Certificate code

- U = PED 97/23/EC

Permitted operating pressure [bar] _____

Fluid connection

- Type of connection (see Table 1)
- Standard or specification of the type of connection (see Table 2 + 3)
- Size of connection (see Table 4 + 5)

Gas side connection or gas valve

- Type of connection (see Table 1)
- Standard or specification of the type of connection (see Table 2 + 3)
- (no letter required with connection type V)
- Size of connection (see Table 4; 5 + 6)

Piston diameter

04 = 40 mm	20 = 200 mm
05 = 50 mm	25 = 250 mm
06 = 60 mm	31 = 310 mm
08 = 80 mm	35 = 355 mm
10 = 100 mm	49 = 490 mm
12 = 125 mm	54 = 540 mm
15 = 150 mm	61 = 610 mm
18 = 180 mm	

Supplementary equipment*

- A = electrical limit switch – 35 mm stroke
- B = electrical limit switch – 200 mm stroke
- C = electrical limit switch – 500 mm stroke
- K = protruding piston rod
- M = magnetic flap indication
- S = cable tension measurement system
- U = ultrasonic measurement system
- E.. = special switch fixed or adjustable
- P = magnetic piston
- UP.. = piston position switch
(e.g. UP2 = 2 position switches, UPEX = ATEX version)
- W = linear distance sensor

Safety equipment*

- 1 = burst disc (please give nominal pressure and temperature)
- 2 = gas safety valve
- 3 = temperature fuse

Pre-charge pressure p_0 [bar] at 20 °C* _____

*if required, please state at time of ordering!

Table 1, Connection type

Code letter	Description
A	Threaded connection (female)
B	Threaded connection (male)
F	Flange connection
H	Protruding flange
K, S	Combination connection / Special connection
V	Gas valve type

Table 2, Threaded connection: standard or specification

Code letter	Description
A	Thread to ISO 228 (BSP)
B	Thread to DIN 13 or ISO 965/1 (metric)
C	Thread to ANSI B1.1 (UN...-2B, seal SAE J 514)
D	Thread to ANSI B1.20.3 (NPTF)

Table 3, Flange connection: standard or specification

Code letter	Description
A	Flanges to DIN standards (pressure range + standard)
B	Flanges to ANSI B 16.5
C	SAE flange 3000 psi
D	SAE flange 6000 psi
E	High pressure block flange (Bosch-Rexroth) PN320
F	High pressure block flange (AVIT, HAVIT)

Table 4, Threaded model connection sizes

Type Tab.2	Code, size										
	A	B	C	D	E	F	G	H	J	K	L
A	G 1/8	G 1/4	G 3/8	G 1/2	G 3/4	G 1	G1 1/4	G1 1/2	G2	G2 1/2	G3
B	M10x1	M12x1.5	M14x1.5	M16x1.5	M18x1.5	M22x1.5	M27x2	M33x2	M42x2	M48x2	M60x2
C	5/16- 24UNF	3/8- 24UNF	7/16- 20UNF	1/2- 20UNF	9/16- 18UNF	3/4- 16UNF	7/8- 14UNF	1 1/16- 12UNF	1 3/16- 12UNF	1 5/16- 12UNF	1 5/8- 12UNF
D	1/16- NPTF	1/8- NPTF	1/4- NPTF	3/8- NPTF	1/2- NPTF	3/4- NPTF	1-11 1/2 NPTF	1 1/4-11 1/2 NPTF	11/2-11 1/2 NPTF	2-11 1/2 NPTF	2 1/2 - NPTF

Table 5, Flange model connection sizes

Type Tab.3	Code, size										
	A	B	C	D	E	F	G	H	J	K	L
A	DN15	DN25	DN40	DN50	DN65	DN80	DN100	DN125	DN150	DN200	–
B	1/2" - 1500 psi	1" - 1500 psi	1 1/2" - 1500 psi	2" - 1500 psi	2 1/2" - 1500 psi	3" - 1500 psi	1/2" - 2500 psi	1" - 2500 psi	1 1/2" - 2500 psi	2" - 2500 psi	2 1/2" - 2500 psi
C	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	3 1/2"	4"	5"
D							–	–	–	–	–
E	DN32	DN40	DN50	DN65	DN80	DN100	DN125	DN150	–	DN25	–
F											

Table 6, Gas valve models

Code letter	Description
A	Gas valve G3/4 male, with M28x1.5/M8
B	Gas valve end connection M28x1.5/M8
C	Gas valve 1/2"-20 UNF, male, with M16x2 (ISO 10945)
D	Gas valve M14x1.5 male with external M16x1.5 (Minimes)
E	Gas valve G3/4 male with 7/8-14 UNF-VG8
F	Gas valve end connection M42x1.5/M12

Note:

Application examples, accumulator sizing and extracts from approvals regulations relating to hydraulic accumulators can be found in the following catalogue section:

- HYDAC Accumulator Technology
No. 3.000

3. DIMENSIONS

3.1. PISTON ACCUMULATORS

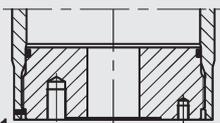
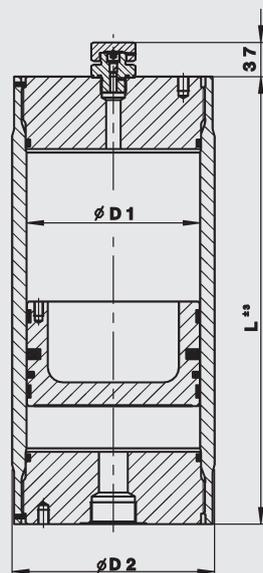
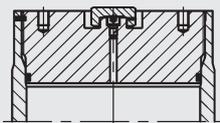


Diagram 1

Nom. volume V min. - max.	Series	Country code U = PED 97/23/EC						Weight ²⁾ min. - max. [kg]
		Permitt. operating pressure [bar]	$\varnothing D1$ [mm]	$\varnothing D2$ [mm]	Length calculation ¹⁾ $L = a + (b \times V)$			
					a [mm]	b [mm/l]		
0.2 – 5	SK350	350	60	80	126	353.7	6 – 35	
0.5 – 10	SK350	350	80	100	157	198.9	11 – 48	
0.5 – 15	SK350	350	100	125	184	127.3	19 – 85	
1 – 50	SK350	350	125	160	185	81.5	32 – 280	
2.5 – 70	SK210	210	150	180	210	56.6	45 – 280	
	SK350	350			234		49 – 283	
2.5 – 100	SK210	210	180	210	262	39.3	70 – 346	
	SK350	350					220	79 – 458
2.5 – 125	SK210	210	200	235	290	31.8	86 – 452	
	SK350	350						
10 – 200	SK210	210	250	286	408	20.4	170 – 631	
	SK350	350		300			200 – 860	
25 – 400	SK350	350	310	350	462	13.2	390 – 1110	
25 – 400	SK210	210	355	404	534	10.1	468 – 1338	
	SK350	350		434			590 – 2048	
200 – 650	SK210	210	490	580	700	5.3	1760 – 3180	
	SK350	350						

¹⁾ The lengths calculated are usually rounded up or down in 5 mm increments

²⁾ Intermediate weights can be calculated approximately depending on the length/diameter required

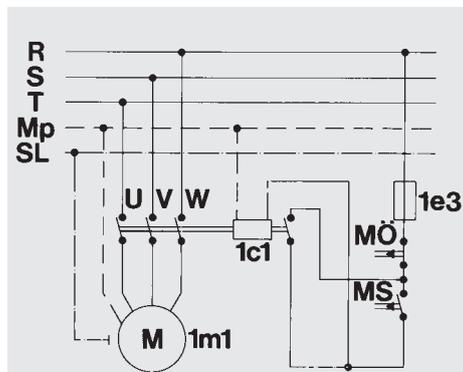
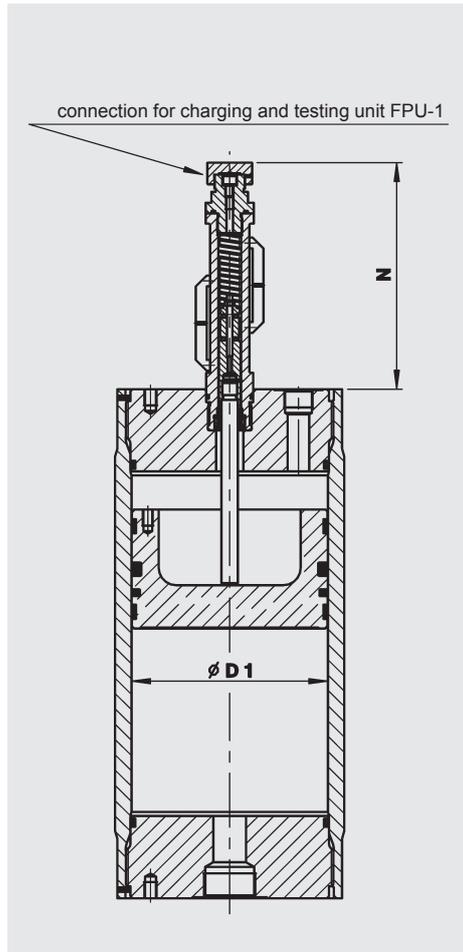
Other pressures, volumes, approvals etc possible on request.

3.1.1 Effective gas volume V_0

The gas volume V is larger than the nominal volume given in the tables in Point 3.1. by the amount shown below.

Piston $\varnothing D1$ [mm]	Piston design type			
	1	2	3	4
	Δ [l]			
60	–	0.040	–	0.040
80	–	0.044	0.081	0.044
100	0.062	0.062	0.270	0.062
125	–	0.169	0.546	0.169
150	–	0.653	0.824	0.653
180	1.213	1.213	1.286	1.213
200	–	0.999	1.601	0.999
250	3.034	3.034	2.617	3.034
310	–	6.221	–	6.221
355	4.514	4.514	–	4.514
490	–	12.705	–	12.705

3.2. PISTON ACCUMULATOR WITH ELECTRICAL LIMIT SWITCH



- 1m1 = Motor
- 1c1 = Motor contactor
- 1e3 = Control cut-out
- Mö = Solenoid switch - N/C
- Ms = Solenoid switch - N/O

Nominal volume ²⁾	Series	Country code U								
		Ø D1	Gas side connection ³⁾	Fluid side connection ⁴⁾	N			Additional weight		
[l]		[mm]	ISO228		A	B	C	A	B	C
					[mm]	[mm]	[mm]	[kg]	[kg]	[kg]
0.2	SK350	60 ¹⁾								
0.5										
1										
0.5	SK350	80 ¹⁾								
1										
2										
2.5	SK350	100	G 3/4 lateral	G 1				2.55	4.85	7.15
5										
7.5										
2	SK350	125						2.55	4.85	7.15
5										
15										
6	SK350	150	G 3/4					2.60	4.90	7.20
20										
40										
10	SK210	180	G 1	G 1 1/2						
	SK350									
20	SK210									
	SK350									
50	SK210									
	SK350									
20	SK350	200	G 1					2.65	4.95	7.25
40										
100										
50	SK210				209	439	679			
	SK350									
80	SK210									
	SK350	250	G 1 1/4	G 2						
120	SK210									
	SK350									
120	SK350	310	G 1 1/4					2.90	5.20	7.50
150										
200										
130	SK210	355	G 1 1/2	NW50						
	SK350									
180	SK210									
	SK350									
250	SK210									
	SK350									
200	SK350	490	G 2					3.00	5.30	7.60
400										
600										

¹⁾ Electrical limit switch is not possible for these piston sizes.

²⁾ Volume details are examples, for others see Point 3.1.

³⁾ Standard connection for back-up type, others on request

⁴⁾ others on request
for further information, see Point 1.7.

Table 7, Supplementary seal

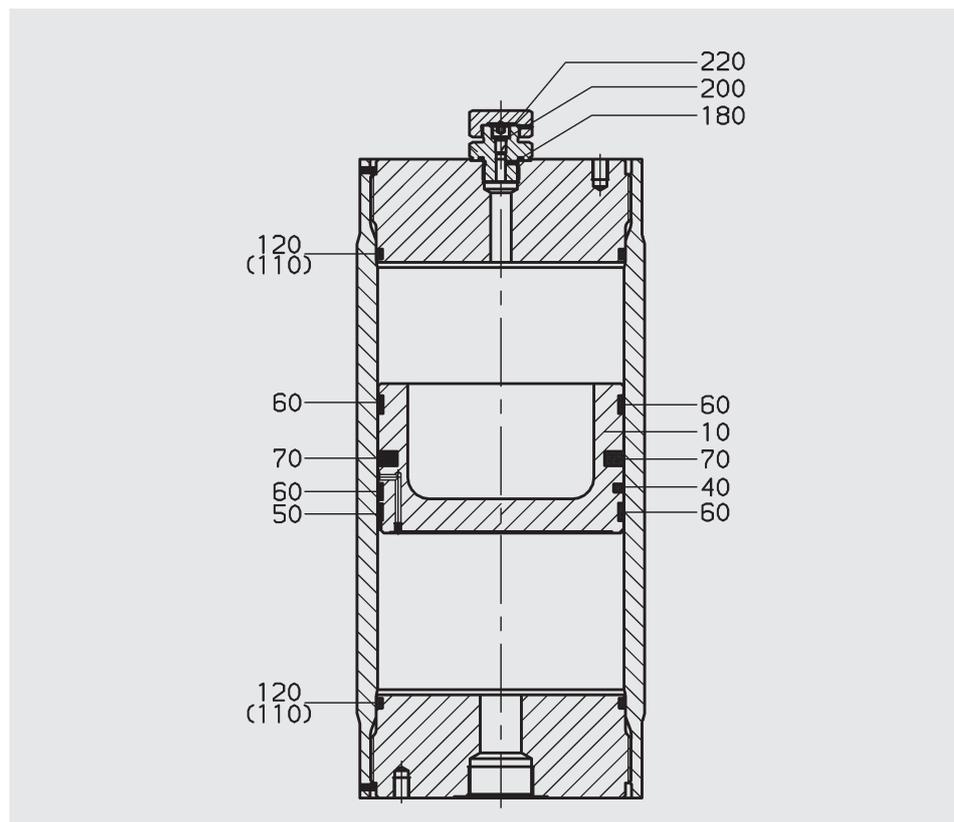
Piston Ø [mm]	Type	NBR	FKM
		Part no.	Part no.
All diam.	1	601078	601109
	2		
	3		
	4		

Note:

When ordering spare parts for the piston accumulator with electrical limit switch, the supplementary seal must be ordered in addition to the seal kit (Point 4).

4. SPARE PARTS

4.1. PISTON ACCUMULATORS



Piston assembly (Table 8)

Piston Ø [mm]	Piston	NBR Part no.	FPM Part no.	PUR Part no.
60	1	–	–	–
	2	3183495	–	–
	3	–	–	3009372
80	1	–	–	–
	2	3183496	3183497	–
	3	–	–	2119931
100	1	3128922	3128926	–
	2	3175476	3183117	–
	3	–	–	2115547
125	1	–	–	–
	2	3016232	3016253	–
	3	–	–	3016150
150	1	–	–	–
	2	3016228	3016229	–
	3	–	–	3016231
180	1	3141888	3182493	–
	2	2118451	2112535	–
	3	–	–	3046277
200	1	–	–	–
	2	3110811	3016215	–
	3	–	–	3016218
250	1	3128924	3128938	–
	2	353980	353981	–
	3	–	–	3016171
310	1	–	–	–
	2	3016195	3016197	–
	3	–	–	–
355	1	3128925	3128939	–
	2	356382	354079	–
	3	–	–	–
490	1	–	–	–
	2	3128989	3128990	–
	3	–	–	–

Seal kit, complete (Table 9)

Piston Ø [mm]	Piston	NBR Part no.	FPM Part no.	PUR Part no.
60	1	–	–	–
	2	3090507	–	–
	3	–	–	3016210
80	1	–	–	–
	2	3041573	3015745	–
	3	–	–	3013230
100	1	3128940	3128944	–
	2	363268	363269	–
	3	–	–	2123414
125	1	–	–	–
	2	3116665	3016234	–
	3	–	–	2128104
150	1	–	–	–
	2	3016235	3016237	–
	3	–	–	3007546
180	1	3128941	3128945	–
	2	363270	363271	–
	3	–	–	2123415
200	1	–	–	–
	2	3110810	3016242	–
	3	–	–	3113127
250	1	3128942	3128946	–
	2	363266	363267	–
	3	–	–	3016213
310	1	–	–	–
	2	3016200	3016201	–
	3	–	–	–
355	1	3128943	3128947	–
	2	363272	363273	–
	3	–	–	–
490	1	–	–	–
	2	3104100	3128991	–
	3	–	–	–

4.1.1 Piston type 1

Description	Qty.	Item
Piston assembly ¹⁾ consisting of:		
Piston	1	10
Seal ring	1	50
Guide ring	2	60
Centre seal	1	70
Seal kit, complete consisting of:		
Seal ring	2	40
Centre seal	1	70
(Support ring)	(2)	(110)
O-ring	2	120
O-ring	1	180
Seal ring	1	200
O-ring	1	220

4.1.2 Piston type 2

Description	Qty.	Item
Piston assembly ¹⁾ consisting of:		
Piston	1	10
Seal ring	1	40
Guide ring	2	60
Centre seal	1	70
Seal kit, complete consisting of:		
Seal ring	1	40
Guide ring	2	60
Centre seal	1	70
(Support ring)	(2)	(110)
O-ring	2	120
O-ring	1	180
Seal ring	1	200
O-ring	1	220

4.1.3 Piston type 3

Description	Qty.	Item
Piston assembly consisting of:		
Piston	1	10
Seal ring	1	70
Guide ring	1	60
Seal kit, complete consisting of:		
Seal ring	1	70
Guide ring	1	60
(Support ring)	(2)	(110)
O-ring	2	120
O-ring	1	180
Seal ring	1	200
O-ring	1	220

¹⁾ Item. 120, 180, 200 und 220 are supplied loose.
Pressure resistant parts cannot be supplied as spares.

Spare parts for piston type 4 are available on request.

4.2. ASSEMBLY INSTRUCTIONS

Before assembling or disassembling a piston accumulator or piston accumulator station, the system must always be depressurised.

The gas and fluid side must be depressurised and the gas valve unscrewed or opened before the accumulator is disassembled. Before the end caps are removed, ensure that the piston is moving freely. This may be achieved by using a rod. Only authorised persons should repair piston accumulators where the piston is jammed.

Piston accumulators with internal diameters up to 250 mm are fitted with a securing pin. This pin is to prevent the end cap being removed incorrectly. It must be taken out before removing the end cap. There may be a danger to life due to stray components.

All work must only be carried out by suitably trained staff.

On no account must any welding, soldering or mechanical work be carried out on the accumulator shell.

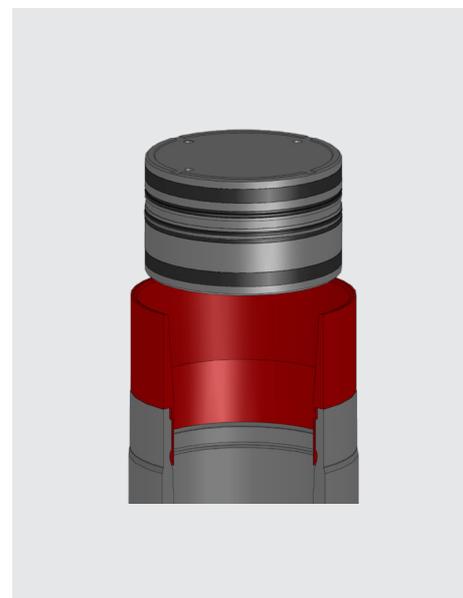
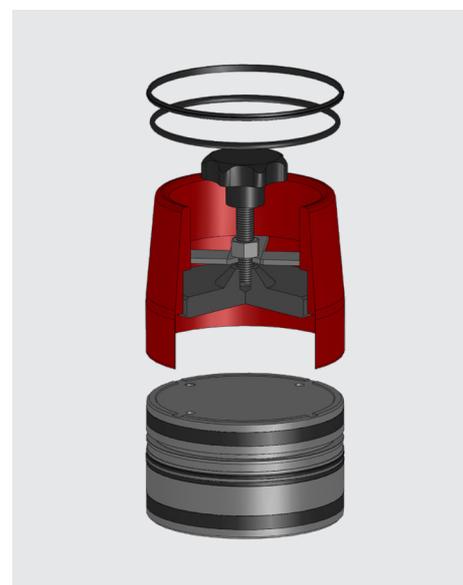
Please read the Operating Manual! No. 3.301.CE

Assembly sleeves for piston accumulators (Table 11)

Piston Ø [mm]	to fit the seals Type 1+2
60	297430
80	244991
100	352198
125	370734
150	2124157
180	3713269
200	3644938
250	3715658
310	3721000
355	3728790
490	3114220

Piston Ø [mm]	to install the piston
60	2120188
80	359614
100	290056 (M105x2) 2117672 (M110x3)
125	2128223
150	2124161 (SK210) 3680195 (SK350)
180	290049 (M186x3) 3028679 (M190x4)
200	3600690
250	3026807
310	3027403
355	3389677
490	3440695

When replacing seals and/or pistons, please read the Instructions for assembly and repair (No. 3.301.M).



5. NOTE

The information in this brochure relates to the operating conditions and applications described.

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

Subject to technical modifications.

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Piston Accumulators

Series SK280

1. DESCRIPTION

1.1. FUNCTION

Fluids are practically incompressible and cannot therefore store pressure energy.

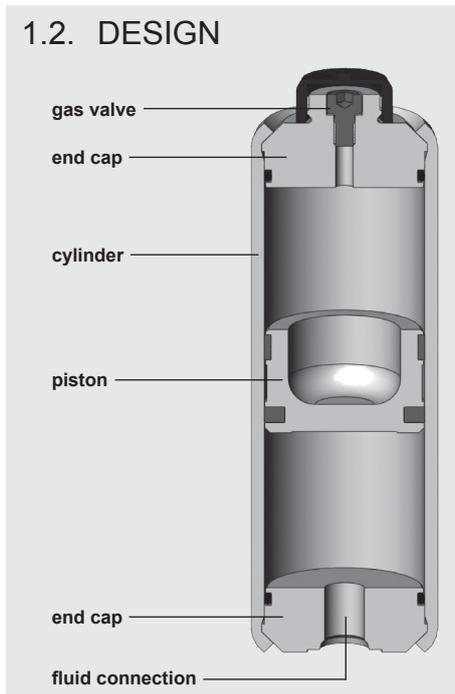
The compressibility of a gas (nitrogen) is utilised in hydraulic accumulators for storing fluids. HYDAC piston accumulators are based on this principle.

A piston accumulator consists of a fluid section and a gas section with the piston acting as the gas-proof screen. The gas section is pre-charged with nitrogen.

The fluid section is connected to the hydraulic circuit so that the piston accumulator draws in fluid when the pressure increases and the gas is compressed.

When the pressure drops, the compressed gas expands and forces the stored fluid into the circuit.

1.2. DESIGN



HYDAC piston accumulators consist of:

- a cylinder with very finely machined internal surface;
- end caps on the gas side and the oil side, sealed with O-rings;
- a floating steel or aluminium piston.
- a sealing system adapted to the particular application. The piston floats on two guide rings which prevent metal-to-metal contact between the piston and the accumulator wall. Suitable materials are also available for low temperature applications.

1.3. TYPE OF INSTALLATION

HYDAC can provide suitable accumulator clamps for the piston accumulator series SK280. The table at Point 3 lists the appropriate clamps for each individual diameter. In order to prevent deformation of the cylinder, we recommend that the accumulators are mounted using two clamps, one at each end cap.

1.4. ADVANTAGES OF THE SK280

- Optimized production process, saving on material and manufacturing costs
- Reduced-weight series
- Reduced installation space
- Standard gas valve M28x1.5 integrated into end cap (non-refillable version possible)
- Endurance tested (function and fatigue tests)

1.5. DESIGN PRESSURE

- Standard 280 bar
 - Manufactured and tested to PED 97/23/EC
- higher pressures on request

1.6. SEALING SYSTEM

- Piston type 3: NBR/PUR
 - Temperature range: -30 °C ... +80 °C
- others on request

1.7. COMMISSIONING

Please read the Operating Manual!

- Piston accumulators No. 3.301.CE

For further information, please turn to the section:

- Piston Accumulators Standard No. 3.301

2. TECHNICAL SPECIFICATIONS

2.1. MODEL CODE

Not all combinations are possible.

Order example. For further information, please contact HYDAC.

SK280 - 1 / 3218 U - 280 AAD - VB - 05 - 030

Series _____

Nominal volume [l] _____

Material and piston code _____ ●●●●

Piston design type _____
(see Point 1.6.)

Material: piston _____
2 = carbon steel

Material: cylinder and end caps _____
1 = carbon steel

Material: seals including piston seals _____
8 = NBR/PUR (polyurethane)

Certificate code _____
U = PED 97/23/EC

Permitted operating pressure [bar] _____

Fluid connection _____
AAD = Threaded connection to ISO 228
Size G 1/2

AAE = Threaded connection to ISO 228
Size G 3/4

AAF = Threaded connection to ISO 228
Size G 1

ACE = Threaded connection to SAE J 514
Size 9/16-18 UNF, SAE #6

ACF = Threaded connection to SAE J 514
Size 3/4-16 UNF, SAE #8

ACH = Threaded connection to SAE J 514
Size 1 1/16-12 UN, SAE #12

ACH = Threaded connection to SAE J 514
Size 1 5/16-12 UN, SAE #16

Gas side connection or gas valve _____
VB = Gas valve type M28x1.5/M8 integrated into gas side end cap
000 = Non-refillable version (see drawing, Point 3.1.) on request

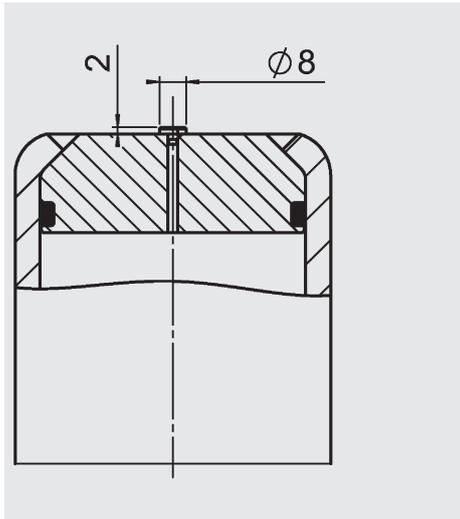
Piston diameter _____
05 = 50 mm

Pre-charge pressure p_0 [bar] at 20 °C, must be stated clearly, if required! _____

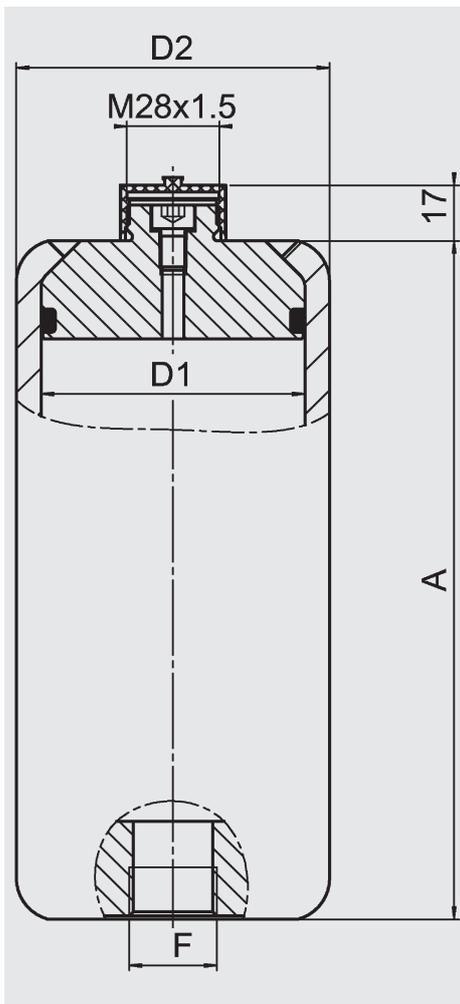
other sizes and versions on request

3. DIMENSIONS

3.1. TYPE -000- (non refillable)



3.2. TYPE -VB- (refillable)



Nominal volume [l]	Permitt. oper. pressure [bar]	D1 [mm]	D2 [mm]	A ±3 [mm]	F to ISO 228	F to SAE J 514	Weight [kg]	Mounting clamps ¹⁾		
0.16	280	50	60	160	G 1/2	9/16-18UNF	2	3018442 HRGKSM 0 R 58-61/62 ST		
0.32				240			2.5			
0.5				335			3.1			
0.75				451			4			
1				590			4.8			
0.32	280	60	75	205		G 3/4	3/4-16UNF	4	444912 HRGKSM 0 R 73-76/76 ST	
0.5				265				4.7		
0.75				355				5.8		
1				445				6.9		
1.5				620				9.1		
2				800				11.4		
2.5				975				13.6		
0.5				280				80		95
0.75	260	7.2								
1	310	8								
1.5	410	9.5								
2	510	11.5								
2.5	605	13								
3	705	14.5								
3.5	805	16								
4	905	17.5								
0.75	280	100	120		235	G 1	1 5/16-12UN		11.7	
1				265	12.5					
1.5				330	14.3					
2				395	16					
3				520	19.5					
4				650	23					
5				775	26.3					
6				900	30					

¹⁾ Clamps must be mounted near the end caps in order to prevent deformation of the cylinder; for further information see following catalogue section:

- Supports for Hydraulic Accumulators
No. 3.502

4. NOTE

The information in this brochure relates to the operating conditions and applications described. For applications and operating conditions not described, please contact the relevant technical department. Subject to technical modifications.

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Piston Accumulators High Pressure

1. DESCRIPTION

1.1. FUNCTION

Fluids are practically incompressible and cannot therefore store pressure energy.

The compressibility of a gas is utilised in hydraulic accumulators for storing fluids.

HYDAC piston accumulators are based on this principle, using nitrogen as the compressible medium.

A piston accumulator consists of a fluid section and a gas section with the piston acting as the gas-proof screen. The gas section is pre-charged with nitrogen. The fluid section is connected to the hydraulic circuit so that the piston accumulator draws in fluid when the pressure increases and the gas is compressed.

When the pressure drops, the compressed gas expands and forces the stored fluid into the circuit.

HYDAC piston accumulators can be used in a wide variety of applications and are also available in different pressure ranges, see also catalogue sections:

- Piston Accumulators
Standard
No. 3.301
- Piston Accumulators
Series SK280
No. 3.303

1.2. DESIGN

The high pressure piston accumulator consists of:

- a cylinder with very finely machined internal surface,
- end caps on the gas side and the oil side,
- O-ring seals,
- floating metal piston,
- high pressure sealing system.

The piston floats on guide rings which prevent metal-to-metal contact between the piston and the accumulator wall.

For use with aggressive or corrosive fluids, the parts coming into contact with the fluid can be made of corrosion-resistant material. Suitable materials are also available for low temperature applications.

1.3. SEALING SYSTEMS

Precise information about the intended operating conditions is required in order to select the most appropriate sealing system for the application. Important criteria for this selection are, for example:

- Design pressure,
- Actual pressure differential,
- Switching frequency or cycles,
- Piston velocity,
- Operating temperature,
- Operating fluid,
- Cleanliness of fluid (micron rating of filter),
- Maintenance requirements.

On high pressure piston accumulators, a modified version of piston Type 2 is used, developed for applications up to 1000 bar. Hydraulic accumulators must only be operated using hydraulic fluids which are filtered to the following cleanliness class:

- NAS 1638 Class 6 or
- ISO 4406 Class 17/15/12.

1.4. INSTALLATION POSITION AND TYPE OF INSTALLATION

HYDAC piston accumulators operate in any position. Vertical installation with the gas-side uppermost is preferable, to prevent contamination from the fluid settling on the piston seals.

Information on secure installation and mounting elements can be found in the following catalogue sections:

- Piston Accumulators
Standard
No. 3.301
- Supports for Hydraulic Accumulators
No. 3.502

**Please read the Operating Manual!
No. 3.301.CE**

**When replacing seals and/or piston,
please read the Instructions for
assembly and repair (No. 3.302.M).**

2. TECHNICAL SPECIFICATIONS

2.1. OPERATING PRESSURE

Three pressure ranges are possible:
690 bar / 800 bar / 1000 bar

2.2. OPERATING TEMPERATURE

-20 °C ... +50 °C
others on request

2.3. FLUID AND TEMPERATURE RESISTANCE OF THE SEALS

NBR/PTFE	-20 ... +80 °C	Mineral oil
NBR/PTFE ¹⁾		Water / Ethylene glycol
FKM/PTFE	-10 ... +80 °C	Mineral oil, petroleum ²⁾

¹⁾ PTFE modified for water applications

²⁾ other compatible fluids on request

For temperatures outside these ranges, or for different fluids, please contact us. There are also special grades available depending on the application.

2.4. GAS CHARGING

Hydraulic accumulators must only be charged with nitrogen.
Never use other gases.

Risk of explosion!

In principle, the accumulator may only be charged with nitrogen class 4.0, filtered to < 3 µm.

If other gases are to be used, please contact HYDAC for advice.

2.5. MODEL CODE

Not all combinations are possible.

Order example. For further information, please contact HYDAC.

SK690 - 1 / 2212 U - 690 ADE - VB - 08 UP2 - 1 - 300

Series

Nominal volume [l]

Material and piston code

Piston type 2 (High pressure)

Piston material

2 = carbon steel

3 = stainless steel

Material of cylinder and end caps

1 = carbon steel

3 = stainless steel

Material of seals including piston seals

2 = NBR / PTFE

6 = FKM / PTFE

Certification code

U = PED 97/23/EC

Permitted operating pressure [bar]

Fluid connection

Type of connection (see Table 1)

Standard or specification of the type of connection (see Table 2)

Size of connection (see Table 3)

Gas side connection or gas valve

Type of connection (see Table 1)

Standard or specification of the type of connection (see Table 2+3)

Size of connection (see Table 4+5)

Piston diameter

08 = 80 mm

12 = 125 mm

15 = 150 mm

18 = 180 mm

Supplementary equipment*

M = magnetic flap indication ¹⁾

UP.. = piston position switch

(e.g. UP2 = 2 position switches, UPEX = ATEX version)

Safety equipment*

1 = bursting disc (please give nominal pressure and temperature)

Pre-charge pressure p₀ [bar] at 20 °C*

* if required, please state at time of ordering!

¹⁾ not possible for all series and sizes.

Table 1, Connection type

Code letter	Description
A	Threaded connection (female)
K, S	Combination connection / Special connection
V	Gas valve type

Table 2, Threaded connection: standard or specification

Code letter	Description
A	Thread to ISO 228 (BSP)
B	Thread to DIN 13 or ISO 965/1 (metric)
C	Thread to ANSI B1.1 (UN...-2B, seal SAE J 514)
D	Thread to ANSI B1.20.3 (NPTF)
S	Special version

Table 3, Threaded model connection sizes

Type Table 2	Code letter, size						
	A	B	C	D	E	F	G
A	G 1/8	G 3/4	G 3/8	G 1/2	G 3/4	G 1	G 1 1/4
B	M10x1	M12x1.5	M14x1.5	M16x1.5	M18x1.5	M22x1.5	M27x2
C	5/16-24 UNF	3/8-24 UNF	7/16-20 UNF	1/2-20 UNF	9/16-18 UNF	3/4-16 UNF	7/8-14 UNF
D	1/16-27 NPTF	1/8-27 NPTF	1/4-18 NPTF	3/8-18 NPTF	1/2-14 NPTF	3/4-14 NPTF	1-11 1/2 NPTF

Table 4, Autoclave connection sizes (preferred connection)

	Code letter, size						
	KCQ	KCR	KCT	KUR	KUY	KWB	KWP
1st connection	13/16-16UNF (9MF)	13/16-16UNF (9MF)	9/16-18UNF (6MF)	9/16-18UNF (6MF)	1 3/8-12UNF (16MF)	9/16-18UNF (6MF)	3/4-16UNF (6HF)
2nd connection	13/16-16UNF (9MF)	-	-	9/16-18UNF (6MF)	-	G 3/4-ISO228	-

other connections on request

Table 5, Gas valve models

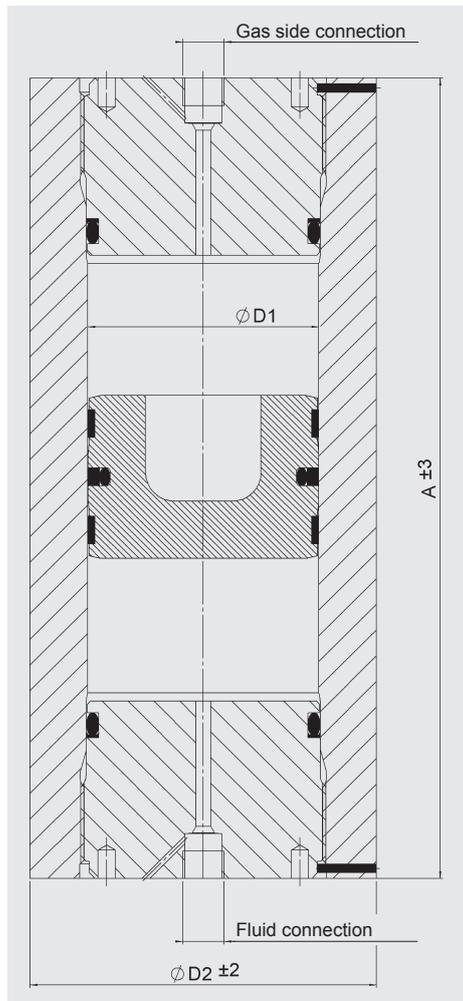
Code letter	Description
B	Gas valve end connection M28x1.5/M8 (max. pre-charge pressure 350 bar using FPU-1, 600 bar with FPK 600)
F	Gas valve end connection M42x1.5 (max. pre-charge pressure 800 bar with FPH 800)
M	Gas valve, male, for Autoclave 9/16-18UNF (6MP) (no limit for pre-charge pressure)

Note:

Application examples, accumulator sizing and extracts from approvals regulations on hydraulic accumulators can be found in the following catalogue section:

- HYDAC Accumulator Technology
No. 3.000

3. DIMENSIONS



3.1. SERIES: SK690

max. permitted operating pressure: up to 690 bar

Volume [l]	Ø D1 [mm]	Ø D2*		A [mm]	Weight*	
		Carbon steel [mm]	Stainless steel [mm]		Carbon steel [kg]	Stainless steel [kg]
1	80	107	110	380	18	20
10				2170	74.2	83
5	125	160	160	620	57.5	57.5
20				1845	132.9	132.9
10	150	190	200	820	92.5	118.2
30				1950	193.2	240
20	180	246	220	1075	243	163
50				2250	447	279

* according to PED 97/23/EC, others on request

3.2. SERIES: SK800

max. permitted operating pressure: 800 bar

Volume [l]	Ø D1 [mm]	Ø D2*		A [mm]	Weight*	
		Carbon steel [mm]	Stainless steel [mm]		Carbon steel [kg]	Stainless steel [kg]
1	80	107	110	380	20	20
10				2170	83	83
5	125	162	160	620	60	56
20				1845	140.2	132.9
10	150	185	200	820	97.6	120.8
30				1950	179.3	242.7
20	180	246	226	1075	243	180
50				2250	443	316

* according to PED 97/23/EC, others on request

3.3. SERIES: SK1000

max. permitted operating pressure: 1000 bar

Volume [l]	Ø D1 [mm]	Ø D2*		A [mm]	Weight*	
		Carbon steel [mm]	Stainless steel [mm]		Carbon steel [kg]	Stainless steel [kg]
1	80	120	119	380	25.4	24.9
10				2170	113.7	110.5
5	125	172	164	620	71.2	60.8
20				1845	176.6	146
10	150	200	200	855	130	130
30				1990	253	253
20	180	246	255	1100	267.2	298.3
50				2275	471.4	534.6

* according to PED 97/23/EC, others on request

4. NOTE

The information in this brochure relates to the operating conditions and applications described.

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

Subject to technical modifications.

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Diaphragm Accumulators



1. DESCRIPTION

1.1. FUNCTION

Fluids are practically incompressible and cannot therefore store pressure energy.

The compressibility of a gas is utilised in hydraulic accumulators for storing fluids. HYDAC diaphragm accumulators are based on this principle, using nitrogen as the compressible medium.

Diaphragm accumulators consist of a fluid section and a gas section with the diaphragm acting as a gas-proof screen.

The fluid section is connected to the hydraulic circuit so that the diaphragm accumulator draws in fluid when the pressure increases and the gas is compressed. When the pressure drops, the compressed gas expands and forces the stored fluid into the circuit.

Set into the base of the diaphragm is a valve poppet. This shuts off the hydraulic outlet when the accumulator is completely empty and thus prevents damage to the diaphragm.

Note:

HYDAC diaphragm accumulators when fitted with a HYDAC Safety and Shut-off Block comply with the regulations of the Pressure Equipment Directive PED 97/23/EC and the German regulations on health & safety at work (Betr.Sich.V.).

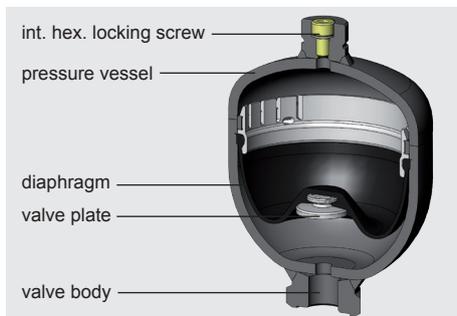
See catalogue section:

- Safety and Shut-off Block SAF/DSV No. 3.551

1.2. DESIGN

HYDAC diaphragm accumulators are available in two versions.

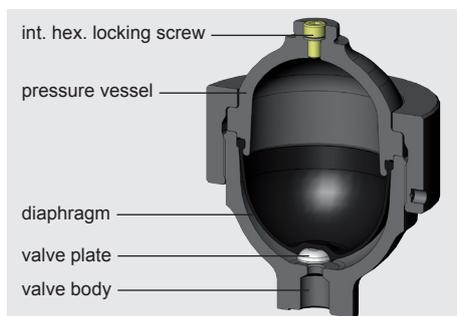
1.2.1 Weld type



This consists of:

- Welded pressure vessel, rechargeable on the gas side or, alternatively, completely sealed. Fluid connection available in various types.
- Flexible diaphragm to separate the fluid and gas sections.
- Valve poppet set into the base of the diaphragm.

1.2.2 Screw type



This consists of:

- Forged upper section with gas charging connection.
- Forged lower section with fluid connection.
- Exchangeable flexible diaphragm to separate the gas and fluid.
- Vulcanized valve poppet set into the base of the diaphragm.
- Lock nut to hold the upper and lower sections of the accumulator together.

1.2.3 Diaphragm materials

The diaphragms are available in the following materials:

- NBR (acrylonitrile butadiene rubber, Perbunan),
- IIR (butyl rubber),
- PTFE (polytetrafluoroethylene),
- FKM (fluoro rubber, Viton®),
- ECO (ethylene oxide epichlorohydrin rubber).

The material must be selected according to the particular operating fluid and temperature.

When choosing the elastomer, allowances must be made for the fact that the gas can cool down to below the permitted elastomer temperature if there are adverse discharge conditions (high pressure ratio p_2/p_0 , high discharging velocity). This can cause cold cracking in the elastomer. The gas temperature can be calculated using the HYDAC Accumulator Simulation Program ASP.

1.2.4 Corrosion protection

For use with chemically aggressive fluids the accumulator can be supplied with corrosion protection, such as plastic coating or a galvanic or chemical surface protection. If this is insufficient, then almost all types can be supplied in stainless steel.

1.3. INSTALLATION POSITION

Optional. However, if there is a risk of contamination collecting, a vertical position is preferable (fluid connection at the bottom).

1.4. TYPE OF INSTALLATION

Accumulators up to 2 l can be screwed directly inline.

Where strong vibrations are expected, the accumulator must be secured to prevent it working loose. For weld type accumulators we recommend HYDAC support clamps.

For screw type accumulators with lock nut, a suitable support console can be ordered.

For additional male thread on the hydraulic connection for screwing into mounting holes - see table 3.1.

See catalogue section:

- Supports for Hydraulic Accumulators No. 3.502

1.5. GENERAL

1.5.1 Permitted operating pressure

see tables 3.1. and 3.2.

The permitted operating pressure can differ from the nominal pressure for foreign test certificates.

1.5.2 Nominal volume

see tables 3.1. and 3.2.

1.5.3 Effective gas volume

Corresponds to the nominal volume of the diaphragm accumulator.

1.5.4 Effective fluid volume

Volume of fluid which is available between the operating pressures p_2 and p_1 .

1.5.5 Fluids

Mineral oils, hydraulic oils. Other fluids on request.

1.5.6 Gas charging

All accumulators are supplied with a protective pre-charge. Higher gas pre-charge pressures are available on request (gas charging screw or sealed gas connection).

Hydraulic accumulators must only be charged with nitrogen.

Never use other gases.

RISK OF EXPLOSION!

In principle, the accumulator may only be charged with nitrogen class 4.0, filtered to $< 3 \mu\text{m}$.

If other gases are to be used, please contact HYDAC for advice.

1.5.7 Limits for gas pre-charge pressure

$$p_0 \leq 0.9 \cdot p_1$$

For diaphragm accumulators with PTFE diaphragms, the following applies:

$$p_{0\text{max}} \leq 200 \text{ bar}$$

For further information, see catalogue section:

- HYDAC Accumulator Technology No. 3.000

1.5.8 Permitted operating temperature

$-10 \text{ }^\circ\text{C} \dots +80 \text{ }^\circ\text{C}$

for material code 112.

Others on request.

1.5.9 Permitted pressure ratio

Ratio of maximum operating pressure p_2 to gas pre-charge pressure p_0 .

1.5.10 Max. flow rate of the operating fluid

In order to achieve the max. flow rate given in the tables, a residual fluid volume of approx. 10% of the effective gas volume must remain in the accumulator.

The maximum fluid flow rate was determined under specific typical conditions and is not applicable in all operating conditions.

1.5.11 Certificate codes

Hydraulic accumulators which are installed in countries outside Germany are supplied with the test certificates required in that country. The user country must be stated at the time of ordering.

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

Please note that the permitted operating pressure can differ from the nominal pressure.

The following table contains a few examples of the codes used in the model code for different countries of installation.

Country	Certificate code (AKZ)
EU member states	U
AU Australia	F ¹⁾
BY Belarus	A12
CE Canada	S1 ¹⁾
CH Switzerland	U
CN China	A9
HK Hong Kong	A9
IS Iceland	U
JP Japan	P
KR Korea (Republic)	A11
NO Norway	U
NZ New Zealand	T
RU Russia	A6
TR Turkey	U
UA Ukraine	A10
US USA	S
ZA South Africa	S2

¹⁾ Registration required in the individual territories or provinces

others on request

On no account must any welding, soldering or mechanical work be carried out on the accumulator shell. 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 pressure and the fluid have been released.

**Please read the Operating Manual!
No. 3.100.CE**

Note:

Application examples, accumulator sizing and extracts from approvals regulations on hydraulic accumulators can be found in the catalogue section:

- HYDAC Accumulator Technology No. 3.000

2. TECHNICAL SPECIFICATIONS

2.1. MODEL CODE

Not all combinations are possible.
Order example. For further information, please contact HYDAC.

SBO210 - 2 E1 / 112 U - 210 AK 050

Series _____

Nominal volume [l] _____

Type _____

Weld type:

- E1 = rechargeable M28x1.5
- E2 = sealed gas connection,
with gas pre-charge as requested ³⁾
- E3 = rechargeable,
gas valve M16x1.5 / M14x1.5

Screw type

- A6 = rechargeable M28x1.5,
exchangeable diaphragm
- A3 = gas valve M16x1.5 / M14x1.5,
exchangeable diaphragm

Material code _____

dependent on operating medium
standard model = 112 for mineral oils

Fluid connection _____

- 1 = carbon steel
- 3 = stainless steel 1.4571
- 4 = carbon steel with protective coating ¹⁾
- 6 = low temperature steel
- 7 = other materials

Accumulator shell _____

- 0 = plastic coated
- 1 = carbon steel
- 2 = carbon steel with protective coating ^{1) 2)}
- 4 = stainless steel 1.4571
- 6 = low temperature steel
- 7 = other materials

Diaphragm _____

- 2 = NBR20 (acrylonitrile butadiene)
- 3 = ECO (ethylene oxide epichlorohydrin)
- 4 = IIR (butyl)
- 5 = NBR21 (low temperature)
- 6 = FKM (fluoro rubber)
- 7 = other materials (e.g. PTFE, EPDM...)

Certificate code _____

- U = PED 97/23/EC
For other countries see table

Permitted operating pressure [bar] _____

Fluid connection form _____

Standard connection = AK or AB

e.g. Form AK = G 3/4
for SBO210-2 see Point 3.

Pre-charge pressure p_0 [bar] at 20 °C, must be stated clearly, if required! ³⁾ _____

¹⁾ only for screw type

²⁾ only parts in contact with the medium

³⁾ only for type E1 or E2, for scheduled orders

3. TECHNICAL SPECIFICATIONS

3.1. WELD TYPE

– non-exchangeable diaphragm –

3.1.1 Drawings

Diag.	Type	Gas side connection			Fluid side connection*	
		E1	E2	E3	AK	AB
1						
2			—			
3			on request			
4			—			

* = alternative fluid connections on request

3.1.2 Dimensions

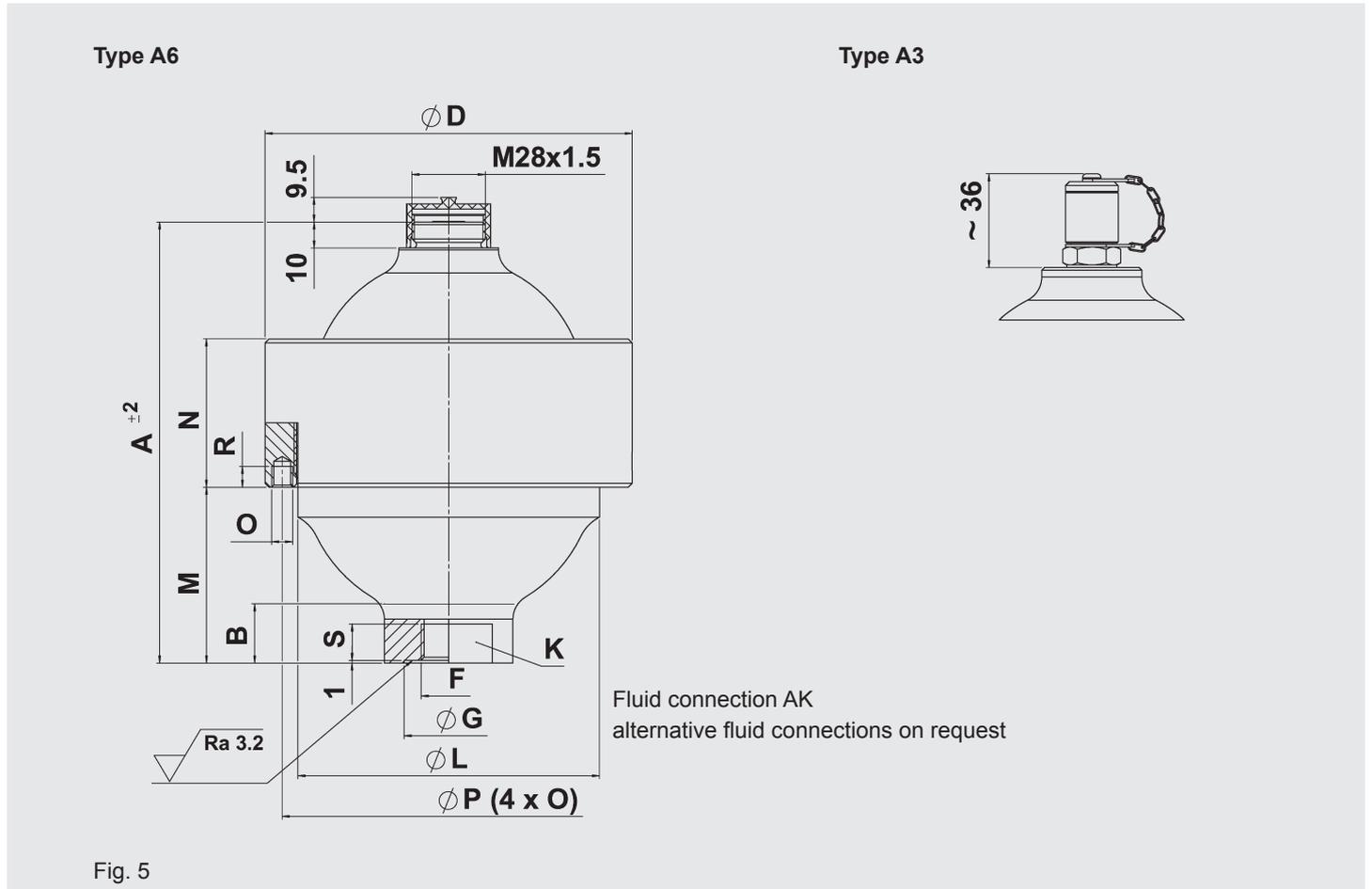
Nom. vol. ¹⁾	Perm. press. ratio	Series	Certificate code U		R	ØD	Weight	Q ²⁾	Standard fluid connection											Diag.
			Permitt. oper. pressure [bar]						Form AK					Form AB						
			Carbon steel	Stainless steel					F ISO 228	ØG [mm]	L [mm]	B 1 [mm]	hex. SW	F ISO 228	H DIN 13	L [mm]	B 2 [mm]	hex. SW		
0.075	8 : 1	250	250	–	91	64	0.7	38	G 1/2	–	14	21	30	not available					1	
0.16	8 : 1	210	210	180	103	74	0.8	38	G 1/2	–	14	21	30	not available					1	
		300	300	–	108	78	1.1													
0.32	8 : 1	210	210	160	116	93	1.3	95	G 1/2	–	14	21	30	not available					1	
		300	300	–	120	96	1.8													
0.5	8 : 1	160	160	–	130	102	1.3	95	G 1/2	–	14	21	30	G 1/2	M33x1.5	14	37	41	1	
		210	210	–	133	105	1.7													
0.6	8 : 1	330	330	–	151	115	3.3	95	G 1/2	34	14	21	41	G 1/2	M33x1.5	14	37	41	1	
		350	350	–	130	121	3.5													
0.7	8 : 1	100	100	–	151	106	1.8	95	G 1/2	34	14	21	41	G 1/2	M33x1.5	14	37	41	1	
0.75	8 : 1	140	140	–	142	116	1.8	95	G 1/2	34	14	21	41	G 1/2	M33x1.5	14	37	41	1	
		210	210	140	147	121	2.8													
		250	250	–	152	126	3.6													
		330	330	–	140	126	4													
1	8 : 1	200	200	–	159	136	3.6	95	G 1/2	34	14	21	41	G 1/2	M33x1.5	14	37	41	1	
		250	250	–	192	126	4.4													
		330	330	–	169	–	4.8													
1.4	8 : 1	140	140	–	173	145	3.9	95	G 1/2	34	14	21	41	G 1/2	M33x1.5	14	37	41	1	
		210	210	–	178	150	5.4													
		250	250	–	185	153	5.9													
		330	330	–	172	155	7.6													
2	8 : 1	100	100	100	190	160	4	150	G 3/4	44	16	28	46	G 3/4	M45x1.5	16	33	46	1	
		210	210	–	198	167	6.6													
	4 : 1	250	250	–	232	153	7.4													
	8 : 1	330	330	–	181	172	9.2													
2.8	4 : 1	210	210	–	250	167	8.2	150	G 3/4	44	16	28	46	G 3/4	M45x1.5	16	33	46	2	
		250	250	–	250	170	7.8													
	6 : 1	330	330	–	237	172	11													
		–	–	–	231	–	–													
3.5	4 : 1	250	210	–	306	170	11.2	150	G 3/4	44	16	28	46	G 3/4	M45x1.5	16	33	46	2	
		330	330	–	274	172	13.8													
4	4 : 1	50	–	50	294	158	5	150	G 3/4	44	16	44	46	G 3/4	M45x1.5	16	33	46	2	
		250	–	180	306	170	11.2													

¹⁾ others on request

²⁾ max. flow rate of operating fluid

3.2. SCREW TYPE – exchangeable diaphragm –

3.2.1 Drawings



3.2.2 Dimensions

Nom. vol. ¹⁾ [l]	Perm. press. ratio $p_2 : p_0$	Series	Certificate code U		Weight [kg]	A [mm]	B [mm]	$\varnothing D$ [mm]	$\varnothing L$ [mm]	M [mm]	N [mm]	O [mm]	$\varnothing P$ [mm]	R [mm]	Q ²⁾ [l/min]	Standard fluid connection				Diag.
			Permitt. oper. pressure [bar]													Form AK				
			Carbon steel	Stainless steel												F ISO 228	S [mm]	$\varnothing G$ [mm]	K SW	
0.1	10 : 1	500	500	–	1.9	110	30	95	–	53	35	–	–	–	95	G 1/2	14	–	36	5
0.25	10 : 1	500	500	–	3.9	129	20	115	92	56	56	–	–	–	95	G 1/2	14	–	36	
			–	350	4.9			125												
0.6	10 : 1	450	450	250	5.7	170	19	140	115	68	57	–	–	–	95	G 1/2	14	34	41	
1.3	10 : 1	400	400	–	11.2	212	28	199	160	97	65	M8	180	10	150	G 3/4	16	44	50	
2	10 : 1	250	250	180	11.4	227	17	201	168	101	64	M8	188	10	150	G 3/4	16	44	50	
2.8	10 : 1	400	400	–	22	257	30	252	207	106	80	M8	230	10	150	G 3/4	16	44	50	
4	10 : 1	400	400	–	34	284	30	287	236	127.5	90	M8	265	10	150	G 3/4	16	44	50	

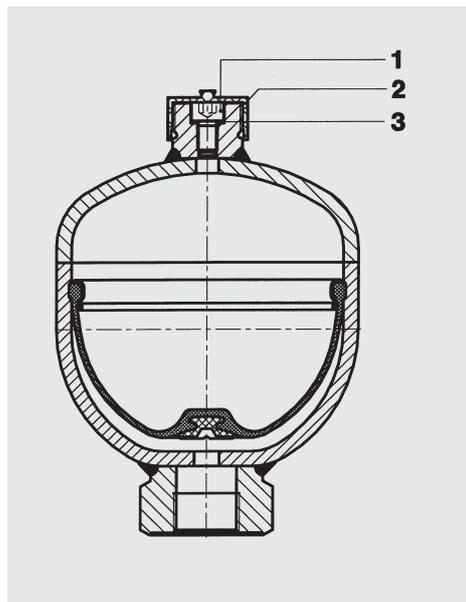
¹⁾ others on request

²⁾ max. flow rate of operating fluid

4. SPARE PARTS

4.1. WELD TYPE

– non-exchangeable diaphragm –



Description	Quantity	Item
-------------	----------	------

Spare parts set for gas side consisting of:

Int. hex. locking screw	20	1
Protective cap	20	2
Seal ring	20	3

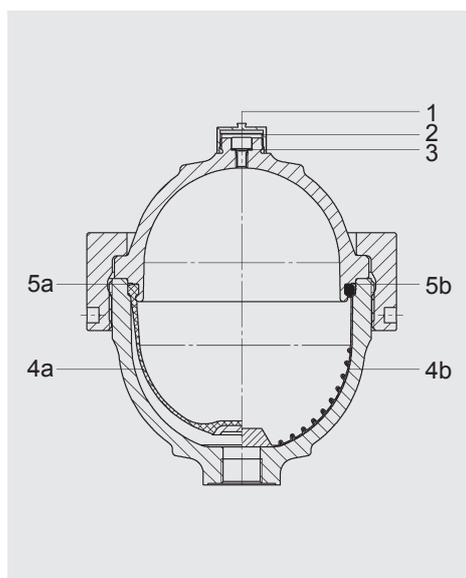
Nominal volume [l]	Part no.				
	NBR	ECO	FKM	IIR	PTFE

Spare parts set for gas side

0.075 - 4	3262845	-	-	-	-
-----------	---------	---	---	---	---

4.2. SCREW TYPE

– exchangeable diaphragm –



Description	Quantity	Item
-------------	----------	------

Spare parts set for gas side consisting of:

Int. hex. locking screw	20	1
Protective cap	20	2
Seal ring	20	3

Spare parts kit for elastomer diaphragm consisting of:

Int. hex. locking screw	1	1
Seal ring	1	3
Elastomer diaphragm	1	4a
Back-up ring	1	5a

Spare parts kit for PTFE diaphragm consisting of:

Int. hex. locking screw	1	1
Seal ring	1	3
PTFE diaphragm	1	4b
O-ring	1	5b

Nominal volume [l]	Part no.				
	NBR	ECO	FKM	IIR	PTFE

Spare parts set for gas side

0.1 - 4	3262845	-	-	-	-
---------	---------	---	---	---	---

Spare parts kit

0.1	3042668	3182526	-	-	-
0.25	3042709	3042712	3042714	3042713	3504798
0.6	3042710	3042715	3042717	3042716	3550388
1.3	3042681	3042682	3042684	-	3446897
2	3042711	3042719	3042721	3042720	3464205
2.8	3042700	3042701	3042704	3042702	-
4	3042705	3042706	3042708	3042707	-

4. NOTE

The information in this brochure relates to the operating conditions and applications described. For applications and operating conditions not described, please contact the relevant technical department. Subject to technical modifications.

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When replacing seals and/or diaphragms, please read the Instructions for assembly and repair (No. 3.100.M).

Metal Bellows Accumulators for Heavy Diesel Engines



1. DESCRIPTION

In the fuel injection system of heavy-duty diesel engines (e.g. marine engines and engines for power plants / two and four-stroke), pressure fluctuations are generated during the injection process by the high pressure pumps.

In most heavy-duty diesel engines each cylinder has its own injection pump. During the phases of fuel extraction from the supply line, compression and injection as well as the release of unused fuel into the return line, cyclic pressure pulsations may result.

Example:

$$\frac{600 [\text{rpm}] \times 8 [\text{cylinders}]}{60 [\text{s}] \times 2 [4\text{-stroke}]} = 40 [\text{Hz}]$$

The supply line and the return line are at a lower pressure than that required for fuel injection and in such dual-pipe systems the above-mentioned pressure fluctuations can cause problems, depending on the size of the pressure variations. It is for this reason that superimposed pressure fluctuations from 0 to approx. 13 bar can occur in a 4.5 bar return line (see the graph at Point 2). In other systems pressure peaks of over 50 bar have been measured.

This fluctuating pressure with its unacceptable pressure peaks not only creates an additional stress on the pipe system but also an additional load for all integrated fittings and equipment. Valves, filters, measurement and monitoring devices, e.g. viscosity meters, ... can be seriously impaired, damaged, sometimes even irreparably.

Until now a standard method for reducing or eliminating the pulsations has been to use hydraulic accumulators with nitrogen as the damping element and an elastomer diaphragm or bladder as the separating element between the gas and the fuel. The best damping results may be obtained by installing one damper in the supply line and one in the return line close to the engine. However, standard diaphragm and bladder accumulators have two main limitations:

Problems with elastomer resistance to fuels and high temperatures.

Fuels other than diesel oil, such as bio-oils or heavy fuel oil require higher injection temperatures. These can reach 160 °C. Even FKM (Viton®) used for the diaphragm or bladder has compatibility problems under such extreme conditions.

Gas loss through the elastomer

The accumulator gradually loses gas through the elastomer and the higher the temperature the higher the gas loss. If it is not possible to recharge the accumulator regularly, its function will deteriorate and the diaphragm or bladder will split.

These last two disadvantages can only be prevented by a relatively high investment in monitoring and maintenance. Depending on the type of fuel and its operating temperature, it can be necessary to replace the elastomer part after specific intervals.

HYDAC set itself the task of developing a pulsation damper without the problems outlined and which above all would also avoid the problems generated by other solutions (e.g. piston accumulators, spring-type accumulators, accumulators with elastic damping elements inside). These solutions have problems either with friction and abrasion or fuel leakage. One of the prime targets was to relieve the system operator of the burden of excessive monitoring and maintenance.

The recently developed solution from HYDAC is the Metal Bellows Accumulator. Instead of a bladder or diaphragm, a metal bellows is used as the flexible separating element between fluid and gas. This bellows is resistant to all conventional fuels over a very wide temperature range. Heavy fuel oil at temperatures of up to 160°C is no problem for these dampers. The metal bellows is welded to the other components and is therefore completely gas-tight. It is able to move up and down inside the accumulator without any friction or abrasion and it can operate for a very long time (years) with just one adjustment. Monitoring and maintenance for this type of damper is therefore reduced to a minimum.

A diverting block is built into the fuel side of the damper which forces the fuel directly into the accumulator, thereby increasing the damping efficiency considerably. If two dampers are fitted to the fuel system (in both supply and return line), no pressure fluctuations can leave the engine before passing through one of the metal bellows dampers.

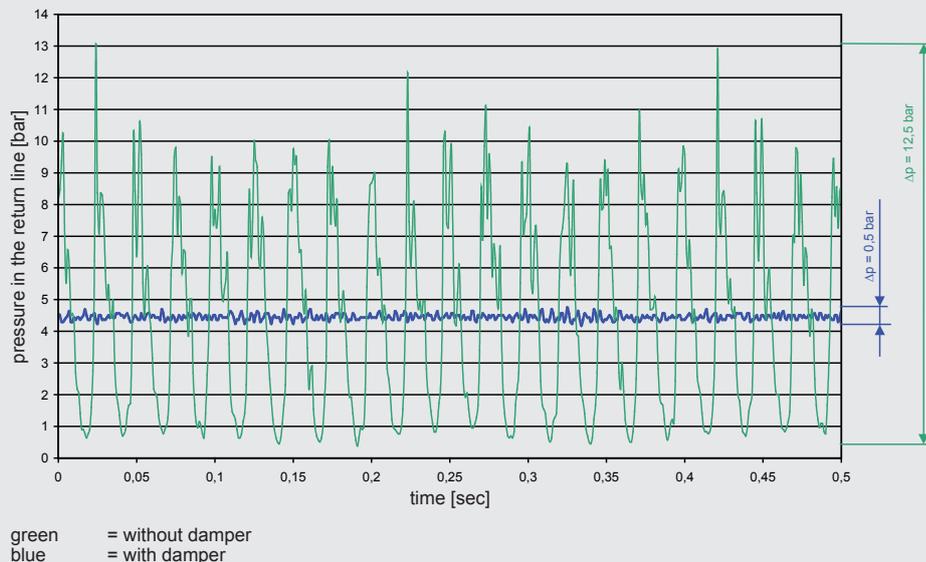
With this metal bellows accumulator, HYDAC has developed a competitively-priced damper which is unrivalled in terms of maintenance. The purchase costs will be recouped within a short time and as a result of reduced maintenance, the availability of the entire system is increased.

For further benefits, see below:

1.1. BENEFITS OF THE SM50P-...

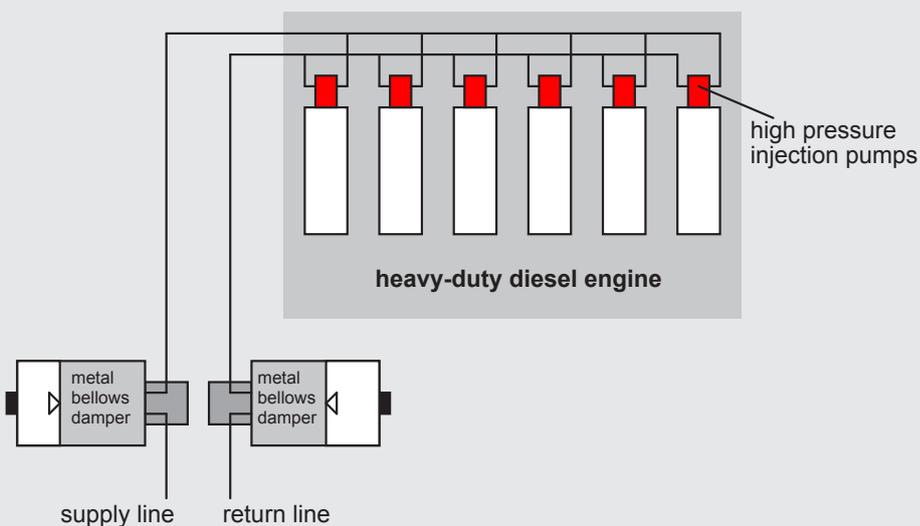
- Maintenance-free
 - extremely gas-tight
 - frictionless parts (non-wearing)
- Fluid resistant across whole temperature range
- Cost-effective: "fit and forget"

2. PRESSURE GRAPH



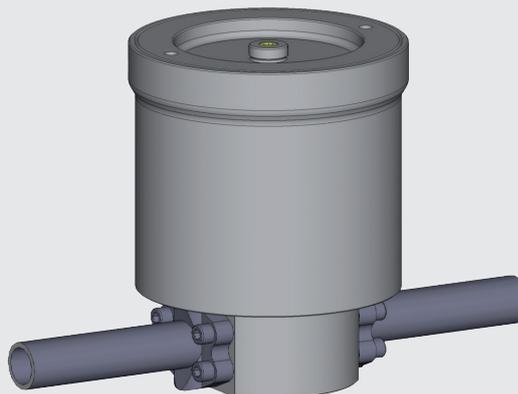
3. INSTALLATION OF THE SM50P-...

3.1. DIAGRAM



3.2. MODEL

3-D standard model, e.g. for inline installation.



Special connections on request

4. TECHNICAL SPECIFICATIONS

4.1. TECHNICAL DATA

Operating pressure:

3 ... 12 bar (others on request)

Max. pre-charge pressure:

4 bar (at max. operating temperature)

Design temperature range:

-10 °C ... +160 °C

Operating fluids:

Diesel and heavy fuel oil, biofuels

Total volume:

3.8 litres

Effective gas volume:

0.5 litre (nitrogen)

Gas-side fluid pre-charge:

0.6 litre (ethylene glycol)

Fluctuating volumes:

max. 0.04 litres (others on request)

Material:

Carbon steel (primed externally)

Design and Approval:

PED / ABS / DNV / GL /

LR / BV / AS1210 / ...

Fluid connection:

SAE 1 1/4" - 3000 psi

SAE 2" - 3000 psi

SAE 3" - 3000 psi

Gas connection:

M28x1.5 for Universal Charging and

Testing Unit FPU-1

Part No.: 3398235

Mounting position:

Vertical (gas connection at top),
others on request

Weight:

22 ... 33 kg depending on the connection
size

4.2. MODEL CODE

Not all combinations are possible.

Order example. For further information, please contact HYDAC.

SM50 P - 0.5 W E 1/ 116 U - 50 AAJ - 2.5

Series

Type code

— = accumulator without diverting block*

L = light-weight accumulator*

P = damper with diverting block

Capacity [l]

Version

W = corrugated bellows

M = diaphragm bellows*

Type of shell

A = screw type

E = weld type*

G = formed type*

Type of gas-side connection

1 = gas pressure adjustable (M28x1.5)

2 = gas pressure pre-set, non-adjustable gas locking screw*

3 = gas pressure adjustable (M16x1.5)

Material code

Fluid connection

1 = carbon steel

2 = carbon steel with corrosion protection

3 = stainless steel

Accumulator shell

1 = carbon steel

2 = carbon steel with corrosion protection

4 = stainless steel

Seal material

0 = no seal

2 = NBR*

5 = low temperature NBR*

6 = FKM

Certificate code

U = PED

For others, see catalogue section

Hydac Accumulator Technology, No. 3.000

Permitted operating pressure [bar]

Fluid connection

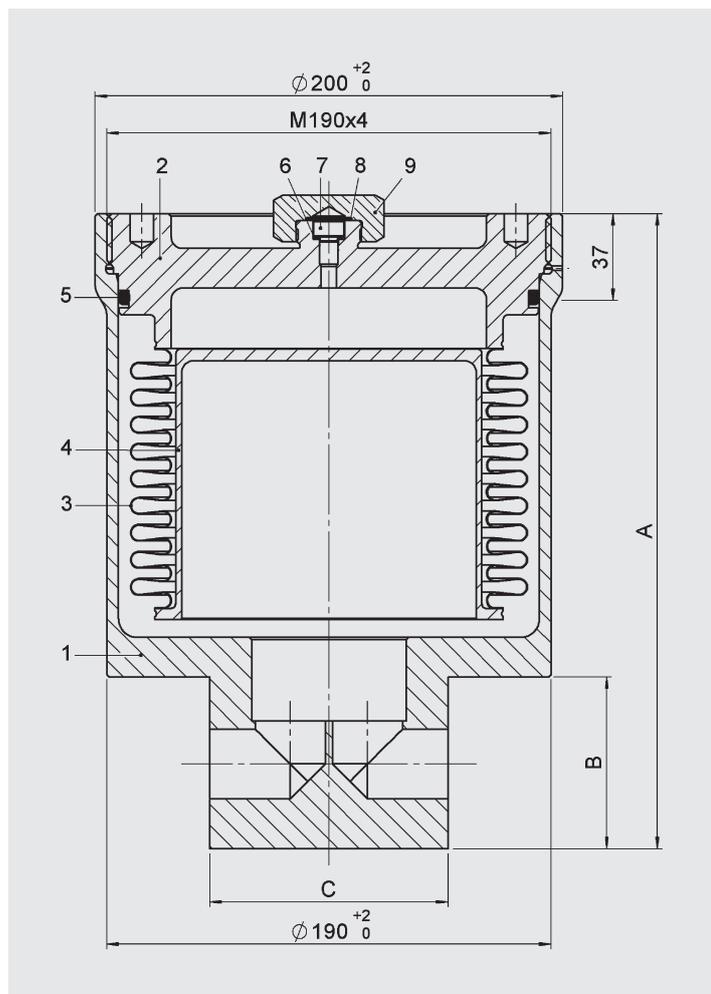
See tables in catalogue section 3.301, Piston Accumulators

Pre-charge pressure p_0 [bar] at 20 °C,

must be stated clearly, if required!

* currently only on request

4.3. DIMENSIONS



Item	Description
1	Accumulator lower section
2	Accumulator cover plate
3	Metal bellows
4	Bowl
5	O-ring
6	Seal ring
7	Adjustable locking screw
8	O-ring
9	Protective cap

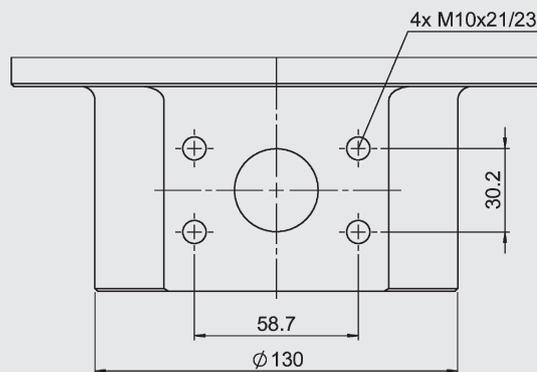
4.4. ACCUMULATOR CONNECTION

	Dimension [mm]		
	SAE 1 1/4" (FCD)*	SAE 2" (FCF)	SAE 3" (FCH)
A	274	294	333
B	74	94	134
C	102	120	133

* FCD = formerly AD

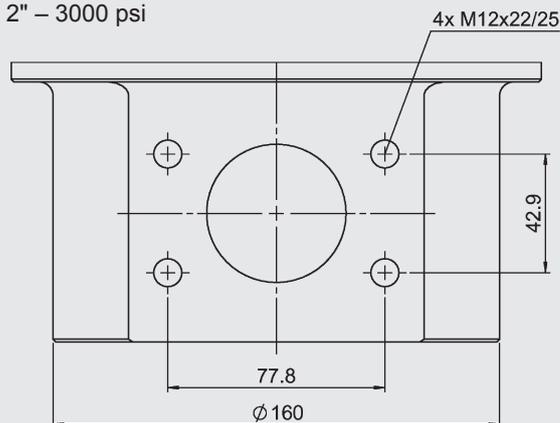
SM50P-3.8A6/116...FCD

SAE 1 1/4" – 3000 psi



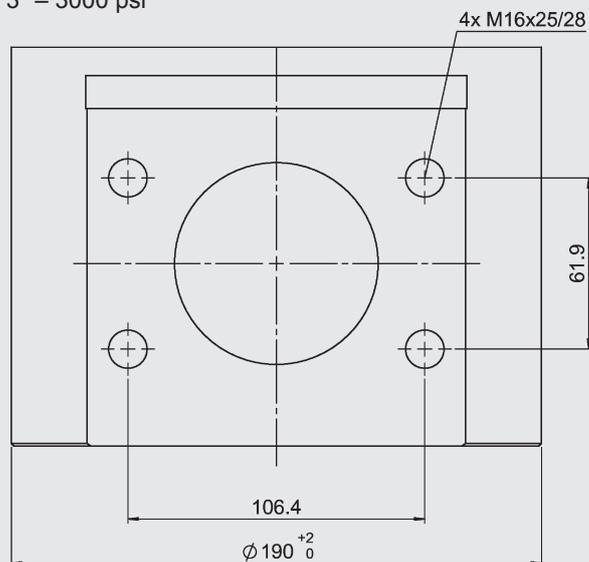
SM50P-3.8A6/116...FCF

SAE 2" – 3000 psi



SM50P-3.8A6/116...FCH

SAE 3" – 3000 psi

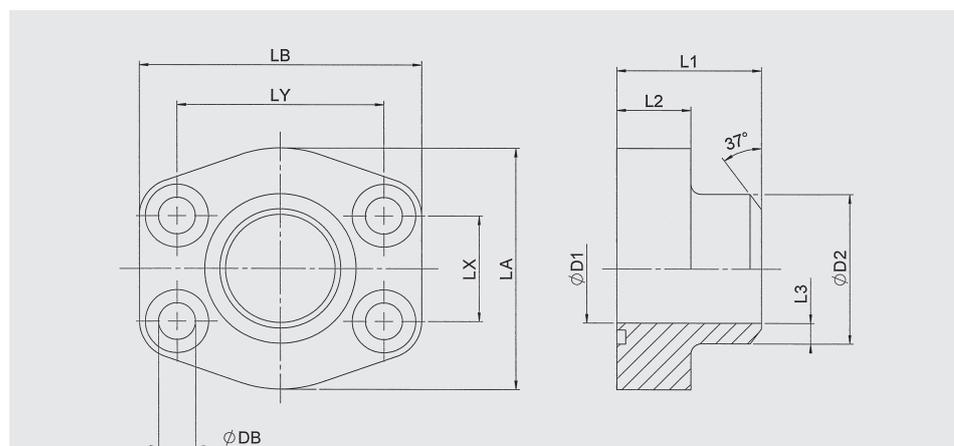


4.5. FLOW RATES / TEMPERATURE DEPENDENCY

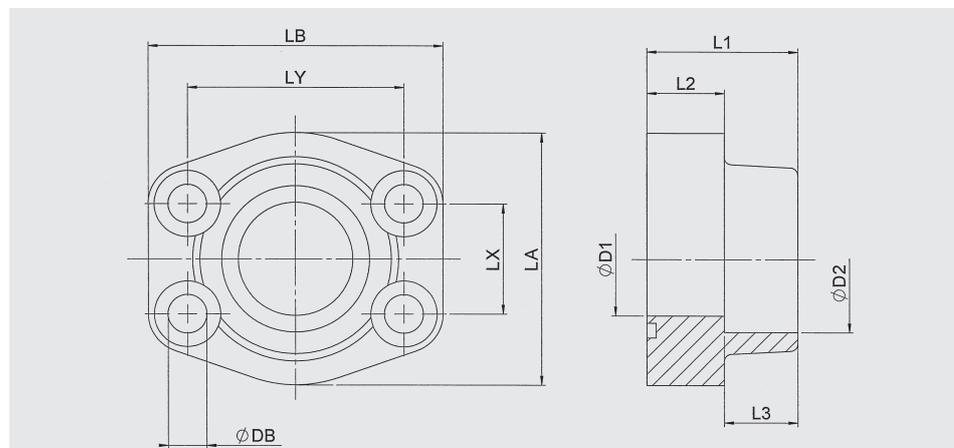
Series SM50P-...	Bore	Max. flow rate	Weight	A	Ext. diam.
Flange SAE [inch] - 3000 psi	[mm]	Q_{max} [m ³ /h]	[kg]	[mm]	D_a [mm]
1 1/4 ...FCD	30	< 8	22	274	200
2 ...FCF	50	8 - 21	25	294	
3 ...FCH	73	> 21	33	333	

4.6. BUTT WELD AND SOCKET WELD FLANGES

Pressure: 3000 psi
Seal: FKM (Viton®)



Series SAE [inch]	D1 [mm]	D2 [mm]	L1 [mm]	L2 [mm]	L3 [mm]	LA [mm]	LB [mm]	LX [mm]	LY [mm]	DB [mm]	Screws
1 1/4 Butt weld flange	31	42.8	41	21	3	< 74	≅ 80	30.2	58.7	10.5	M10x40
2 Butt weld flange	50	61	45	25	5.5	< 94	≅ 103	42.9	77.8	13.5	M12x45
3 Butt weld flange	73	89	50	27	8	< 134	≅ 135	61.9	106.4	17	M16x50



Series SAE [inch]	D1 [mm]	D2 [mm]	L1 [mm]	L2 [mm]	L3 [mm]	LA [mm]	LB [mm]	LX [mm]	LY [mm]	DB [mm]	Screws
1 1/4 Socket weld flange	31	42.8	41	21	20	< 74	≅ 80	30.2	58.7	10.5	M10x40
2 Socket weld flange	50	61	45	25	24	< 94	≅ 103	42.9	77.8	13.5	M12x45
3 Socket weld flange	73	90.5	50	27	28	< 134	≅ 135	61.9	106.4	17	M16x50

5. NOTE

The information in this brochure relates to the operating conditions and applications described.

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

Subject to technical modifications.

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Hydraulic Dampers



1. HYDRAULIC DAMPERS

1.1. DESCRIPTION

1.1.1 Function

The pressure fluctuations occurring in hydraulic systems can be cyclical or one-off problems due to:

- flow rate fluctuations from displacement pumps
- actuation of shut-off and control valves with short opening and closing times
- switching on and off of pumps
- sudden linking of spaces with different pressure levels.

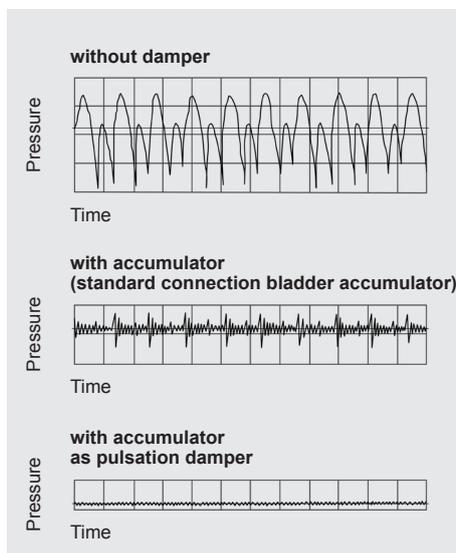
HYDAC hydraulic dampers are particularly suitable for damping such pressure fluctuations.

Selecting the most suitable hydraulic damper for each system ensures that

- vibrations caused by pipes, valves, couplings etc are minimised and subsequent pipe and valve damage is prevented
- measuring instruments are protected and their performance is no longer impaired
- the noise level in hydraulic systems is reduced
- the performance of machine tools is improved
- interconnection of several pumps in one line is possible
- a pump rpm and feed pressure increase is possible
- the maintenance and servicing costs can be reduced
- the service life of the system is increased.

1.2. APPLICATION

1.2.1 Pulsation damping TYPE SB...P / SBO...P



General

The HYDAC pulsation damper

- prevents pipe breaks caused by material fatigue, pipe oscillations and irregular flow rates,
- protects valves, control devices and other instruments,
- improves noise level damping.

Applications

The pulsation damper is particularly suitable for hydraulic systems, displacement pumps of all types, sensitive measurement and control instruments and manifolds in process circuits in the chemical industry.

Operation

The pulsation damper generally has two fluid connections and can therefore be fitted directly inline.

The flow is diverted in the fluid valve so that it is directed straight at the bladder or diaphragm. This causes direct contact of the flow with the bladder or diaphragm which, in an almost inertialess operation, balances the flow rate fluctuations via the gas volume.

It particularly compensates for higher frequency pressure oscillations. The pre-charge pressure is adjusted to individual operating conditions

Design

The HYDAC pulsation damper consists of:

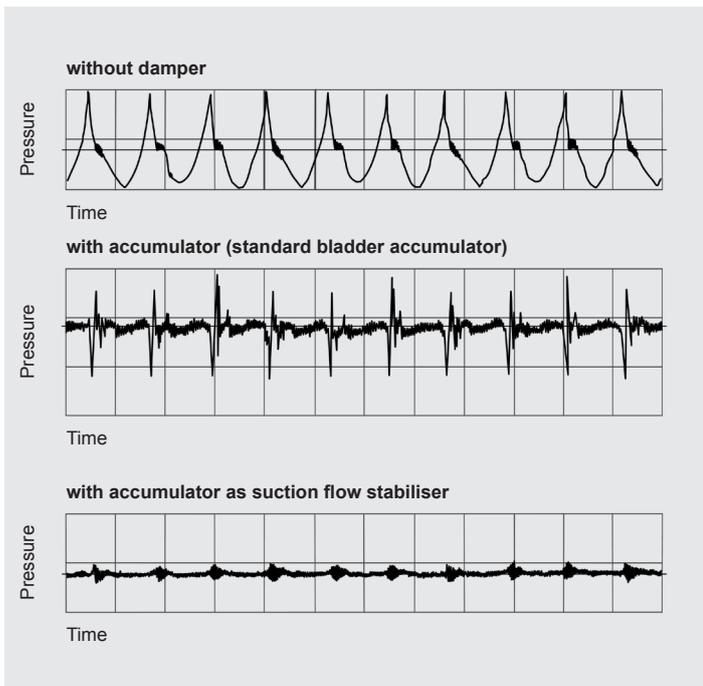
- the welded or forged pressure vessel in carbon steel; available with internal coating or in stainless steel for chemically aggressive fluids.
- the special fluid valve with inline connection, which guides the flow into the vessel (threaded or flange connection).
- the bladder or diaphragm in various elastomers as shown under 1.4.1.

Installation

As close as possible to the pulsation source. Mounting position preferably vertical (gas valve pointing upwards).

Preferred and alternative installation positions are shown in schematic form in Point 1.3.

1.2.2 Suction flow stabiliser Type SB...S



General

The HYDAC suction flow stabiliser

- improves the NPSH value of the system;
- prevents cavitation of the pump;
- prevents pipe oscillations.

Applications

Main application areas are piston and diaphragm pumps in public utility plants, reactor construction and the chemical industry.

Operation

Trouble-free pump operation is only possible if no cavitation occurs in the pump suction and pipe oscillations are prevented.

A relatively high fluid volume in the suction flow stabiliser in relation to the displacement volume of the pump reduces the acceleration effects of the fluid column in the suction line. Also an air separation is achieved due to the extremely low flow rate in the suction flow stabiliser and the deflection on a baffle. By adjusting the charging pressure of the bladder to the operating conditions, the best possible pulsation damping is achieved.

Design

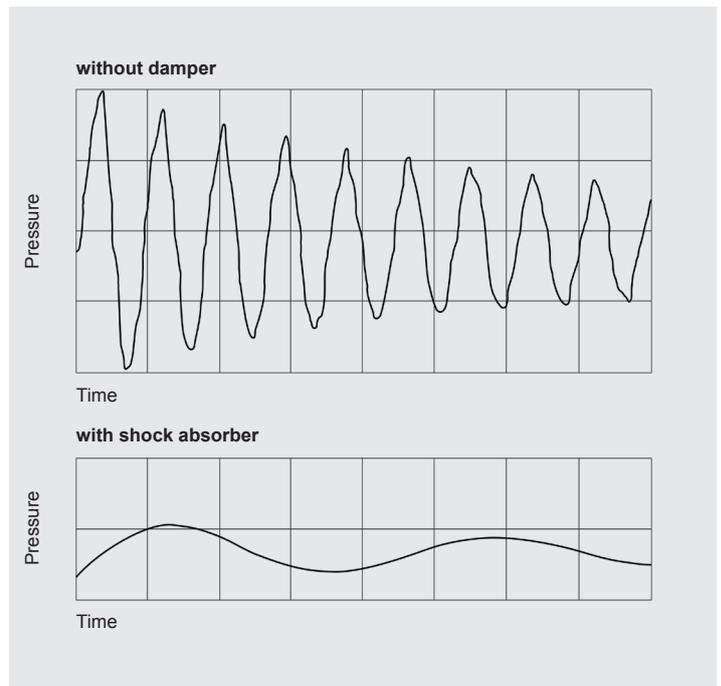
The HYDAC suction flow stabiliser consists of a welded vessel in steel or stainless steel.

Inlet and outlet are on opposite sides and are separated by a baffle. The upper part houses the encapsulated bladder. In addition, there is a vent screw in the cover plate and a drainage facility on the bottom.

Installation

As close as possible to the suction inlet of the pump. Mounting position vertical (gas valve uppermost).

1.2.3 Shock absorber Type SB...A



General

The HYDAC shock absorber

- reduces pressure shocks;
- protects pipelines and valves from being destroyed.

Applications

The accumulators are particularly suitable for use in pipelines with quick-acting valves or flaps and whilst pumps are being switched on and off.

They are also suitable for energy storage in low pressure applications.

Operation

Sudden changes in pipeline flow, such as those caused by pump failure or the closing or opening of valves, can cause pressures which are many times higher than the normal values.

The shock absorber prevents this by converting potential into kinetic energy and vice versa. This prevents pressure shocks and protects pipelines, valves, control instruments and other devices from destruction.

Design

The HYDAC shock absorber consists of:

- the welded pressure vessel in carbon steel with or without corrosion protection or in stainless steel.
- the connection including perforated disc which prevents the flexible bladder from extruding from the vessel, and the flange.
- the bladder in various compounds as shown under point 1.4.1 with built-in gas valve, which is used for charging pressure p_0 and for possible monitoring activities.

Special version

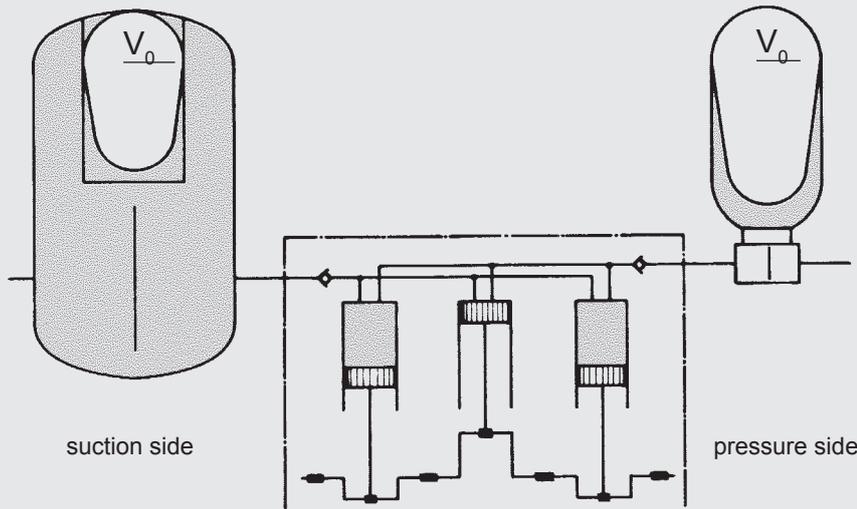
Shock absorbers can also be in the form of diaphragm or piston accumulators. Available on request.

Installation

As close as possible to the source of the erratic condition. Mounting position vertical (gas valve pointing upwards).

1.3. SIZING

1.3.1 Pulsation damper and suction flow stabiliser



On the suction and pressure side of piston pumps almost identical conditions occur regarding irregularity of the flow rate. Therefore the same formulae for determining the effective gas volume are used for calculating the damper size. That in the end two totally different damper types are used is due to the different acceleration and pressure ratios on the two sides.

Not only is the gas volume V_0 a decisive factor but also the connection size of the pump has to be taken into account when selecting the pulsation damper.

In order to avoid additional variations in cross-section which represent reflection points for vibrations, and also to keep pressure drop to a reasonable level, the connection cross-section of the damper must be the same as the pipeline.

The gas volume V_0 of the damper is determined with the aid of the formula for adiabatic changes of state.

By giving the residual pulsation or the gas volume, the damper size can be calculated with the aid of the HYDAC software **ASP** (Accumulator Simulation Program). The results can then be printed out or the data files can be stored in ASP format.

The ASP-program is available free of charge via our website www.hydac.com or via e-mail to speichertechnik@hydac.com.

Designations:

ΔV = fluctuating fluid volume [l]

$$\Delta V = m \cdot q$$

q = stroke volume [l]

$$q = \frac{\pi \cdot d_k^2}{4} \cdot h_k$$

d_k = piston diameter [dm]

h_k = piston stroke [dm]

m = amplitude factor

$$m = \frac{\Delta V}{q}$$

z = no. of compressions / effective cylinders per revolution

x = residual pulsation [\pm %]

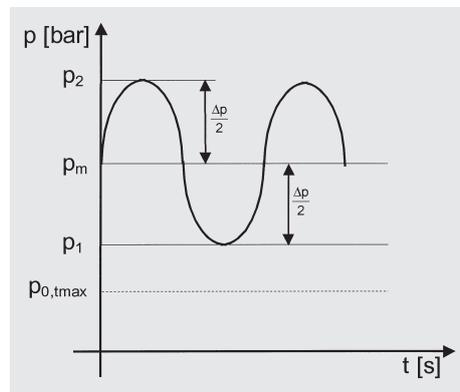
κ = isentropic exponent

Φ = pressure ratio of pre-charge pressure to operating pressure [0.6 ... 0.9]

$$\Phi = \frac{p_0}{p_m}$$

Δp = height of pressure fluctuations

$$\Delta p = p_2 - p_1 \text{ [bar]}$$



Formulae:

$$V_0 = \frac{\Delta V}{\left[\frac{\Phi}{1 - \frac{x}{100}} \right]^{\frac{1}{\kappa}} - \left[\frac{\Phi}{1 + \frac{x}{100}} \right]^{\frac{1}{\kappa}}}$$

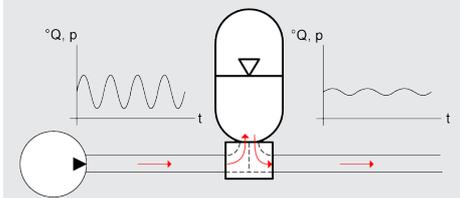
$$\Delta V = m \cdot q$$

$$x [\pm \text{ %}] = \left| \frac{p_1 - p_m}{p_m} \cdot 100 \right|$$

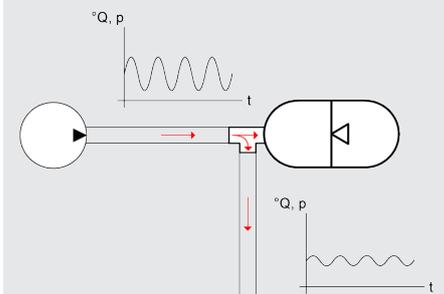
$$= \left| \frac{p_2 - p_m}{p_m} \cdot 100 \right|$$

Schematic of installation options:

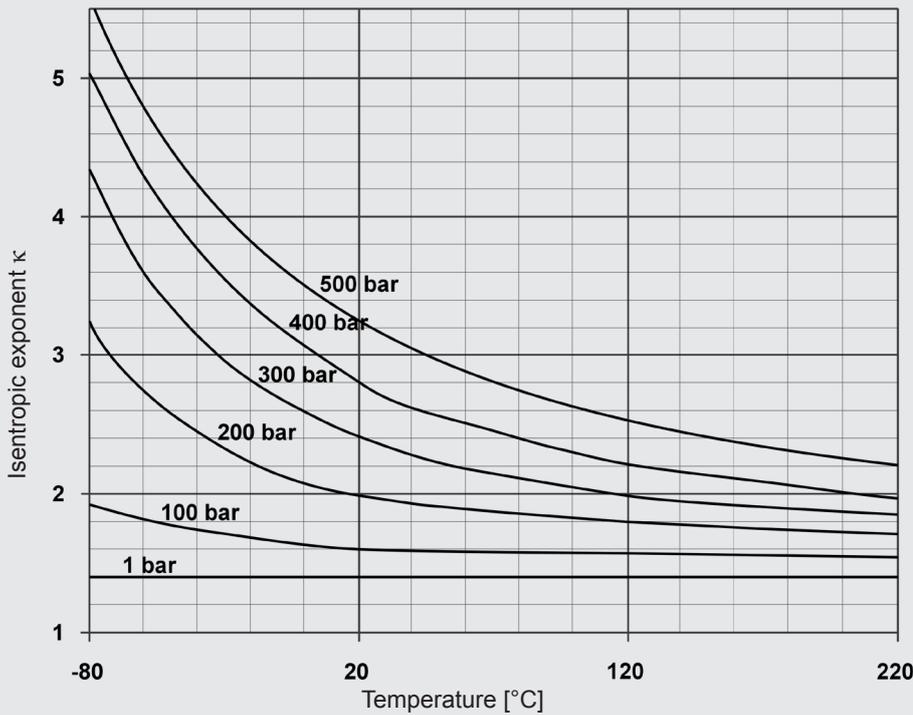
Preferred installation configuration with maximum damping effect



Alternative installation configuration using standard accumulator with a T-piece with reduced damping effect



Isentropic exponent κ dependent on pressure and temperature:



Amplitude factor (m) for piston pump:

z	μ- Wert	
	single acting	double acting
1	0.550	0.250
2	0.210	0.120
3	0.035	0.018
4	0.042	0.010
5	0.010	0.006
6	0.018	0.001
7	0.005	
8	0.010	
9	0.001	

others on request

Calculation example

Given parameters:

Single-acting 3-piston pump
 Piston diameter: 70 mm
 Piston stroke: 100 mm
 Motor speed: 370 min⁻¹
 Output: 427 l/min
 Operating temperature: 20 °C
 Operating pressure
 - Outlet: 200 bar
 - Inlet: 4 bar

Required:

- Suction flow stabiliser for a residual pulsation of ± 2.5%
- Pulsation damper for a residual pulsation of ± 0.5%

Solution:

- Determining the required suction flow stabiliser

$$V_0 = \frac{\Delta V}{\left[\frac{\Phi}{1 - \frac{x}{100}} \right]^{\frac{1}{\kappa}} - \left[\frac{\Phi}{1 + \frac{x}{100}} \right]^{\frac{1}{\kappa}}}$$

$$V_0 = \frac{0.035 \cdot \pi \cdot 0.7^2 \cdot 1.0}{4 \cdot \left[\frac{0.6}{1 - \frac{2.5}{100}} \right]^{\frac{1}{1.4}} - \left[\frac{0.6}{1 + \frac{2.5}{100}} \right]^{\frac{1}{1.4}}}$$

$V_0 = 0.54 \text{ l}$

Selected: SB16S-12 with 1 litre gas volume

- Determining the required pulsation damper

$$V_0 = \frac{\Delta V}{\left[\frac{\Phi}{1 - \frac{x}{100}} \right]^{\frac{1}{\kappa}} - \left[\frac{\Phi}{1 + \frac{x}{100}} \right]^{\frac{1}{\kappa}}}$$

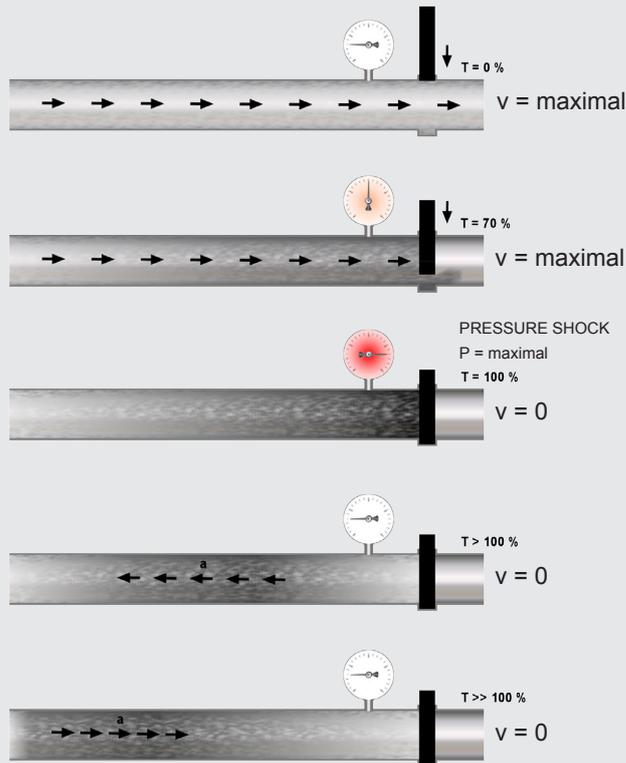
$$V_0 = \frac{0.035 \cdot \pi \cdot 0.7^2 \cdot 1.0}{4 \cdot \left[\frac{0.7}{1 - \frac{0.5}{100}} \right]^{\frac{1}{2.0}} - \left[\frac{0.7}{1 + \frac{0.5}{100}} \right]^{\frac{1}{2.0}}}$$

$V_0 = 3.2 \text{ l}$

Selected: SB330P-4

1.3.2 Shock absorber

Pressure shock produced when a valve is closed without a hydraulic accumulator



Simplified pressure shock calculation for the closing of a valve.

Estimate of Joukowsky's max. occurring pressure shock

- $\Delta p [\text{N/m}^2] = \rho \cdot a \cdot \Delta v$
- $\rho [\text{kg/m}^3]$ = fluid density
- Δv = change of fluid velocity
- $v [\text{m/s}]$ = fluid velocity before the change in its condition
- $v_1 [\text{m/s}]$ = fluid velocity after the change in its condition
- $a [\text{m/s}]$ = propagation velocity of pressure wave
- $a [\text{m/s}] = \frac{1}{\sqrt{\rho \cdot \left[\frac{1}{K} + \frac{D}{E \cdot e} \right]}}$
- $K [\text{N/m}^2]$ = compression modulus of the fluid
- $E [\text{N/m}^2]$ = modulus of elasticity of pipeline
- $D [\text{mm}]$ = internal diameter of pipeline
- $e [\text{mm}]$ = wall thickness of the pipeline

The pressure wave runs to the other end of the pipeline and will reach the valve again after time t (reflection time), whereby:

- $t [\text{s}] = \frac{2 \cdot L}{a}$
- $L [\text{m}]$ = length of the pipeline
- $T [\text{s}]$ = effective operating time (closing) of the valve
- If $T < t$ then:
 $p_{\text{max}} = p_1 + \Delta p$
- If $T > t$ then:
 $p_{\text{max}} = p_1 + \rho \cdot a \cdot \Delta v \cdot \frac{t}{T}$

Determining the required damper size

The accumulator must absorb the kinetic energy of the fluid by converting it into potential energy within the pre-determined pressure range. The change of state of the gas is adiabatic in this case.

$$V_0 = \frac{m \cdot v^2 \cdot 0.4}{2 \cdot p_1 \cdot \left[\left(\frac{p_2}{p_1} \right)^{\frac{1}{\kappa}} - 1 \right] \cdot 10^2} \cdot \left(\frac{p_1}{p_0} \right)^{\frac{1}{\kappa}}$$

- $m [\text{kg}]$ = weight of the fluid in the pipeline
- $v [\text{m/s}]$ = change in velocity of the fluid
- $p_1 [\text{bar}]$ = zero head of the pump
- $p_2 [\text{bar}]$ = permitted operating pressure
- $p_0 [\text{bar}]$ = pre-charge pressure

A special calculation program to analyse the pressure curve is available for sizing during pump failure or start-up and for manifolds.

Calculation example

Rapid closing of a shut-off valve in a re-fuelling line

Given parameters:

Length of the pipe line L:

2000 m

NW of pipeline D:

250 mm

Wall thickness of pipeline e:

6.3 mm

Material of pipeline:

Steel

Flow rate Q:

432 m³/h = 0.12 m³/s

Density of medium ρ:

980 kg/m³

Zero feed height of pump p₁:

6 bar

Min. operating pressure p_{min}:

4 bar

Effective closing time of the valve T:

1.5 s (approx. 20% of total closing time)

Operating temperature:

20 °C

Compression modulus of the fluid K:

1.62 × 10⁹ N/m²

Elasticity modulus (steel) E:

2.04 × 10¹¹ N/m²

Required:

Size of the required shock absorber, when the max. pressure (p₂) must not exceed 10 bar.

Solution:

Determination of reflection time:

$$a = \frac{1}{\sqrt{\rho \cdot \left[\frac{1}{K} + \frac{D}{E \cdot e} \right]}}$$

$$a = \frac{1}{\sqrt{980 \cdot \left[\frac{1}{1.62 \cdot 10^9} + \frac{250}{2.04 \cdot 10^{11} \cdot 6.3} \right]}}$$

$$a = 1120 \text{ m/s}$$

$$t = \frac{2 \cdot L}{a} = \frac{2 \cdot 2000}{1120} = 3.575 \text{ s}^*$$

* since T < t the max. pressure surge occurs and the formula as shown in Point 1.3.2. must be used.

$$v = \frac{Q}{A}$$

$$v = \frac{0.12}{0.25^2 \cdot \frac{\pi}{4}} = 2.45 \text{ m/s}$$

$$\Delta p = \rho \cdot a \cdot \Delta v$$

$$\Delta p = 980 \cdot 1120 \cdot (2.45 - 0) \cdot 10^{-5} = 26.89 \text{ bar}$$

$$p_{\max} = p_1 + \Delta p$$

$$p_{\max} = 6 + 26.89 = 32.89 \text{ bar}$$

Determining the required gas volume:

$$p_0 \leq 0.9 \cdot p_{\min}$$

$$p_0 \leq 0.9 \cdot 5 = 4.5 \text{ bar}$$

$$V_0 = \frac{m \cdot v^2 \cdot 0.4}{2 \cdot p_1 \cdot \left[\left(\frac{p_2}{p_1} \right)^{1 - \frac{1}{k}} - 1 \right] \cdot 10^2} \cdot \left(\frac{p_1}{p_0} \right)^{\frac{1}{k}}$$

$$\text{with } m = V \cdot \rho = \frac{\pi}{4} \cdot D^2 \cdot L \cdot \rho$$

$$V_0 = \frac{\frac{\pi}{4} \cdot 0.25^2 \cdot 2000 \cdot 980 \cdot 2.45^2 \cdot 0.4}{2 \cdot 7 \cdot \left[\left(\frac{11}{7} \right)^{1 - \frac{1}{1.4}} - 1 \right] \cdot 10^2} \cdot \left(\frac{7}{4.5} \right)^{\frac{1}{1.4}}$$

$$V_0 = 1641 \text{ l}$$

Selected:

4 x shock absorbers
SB35AH-450

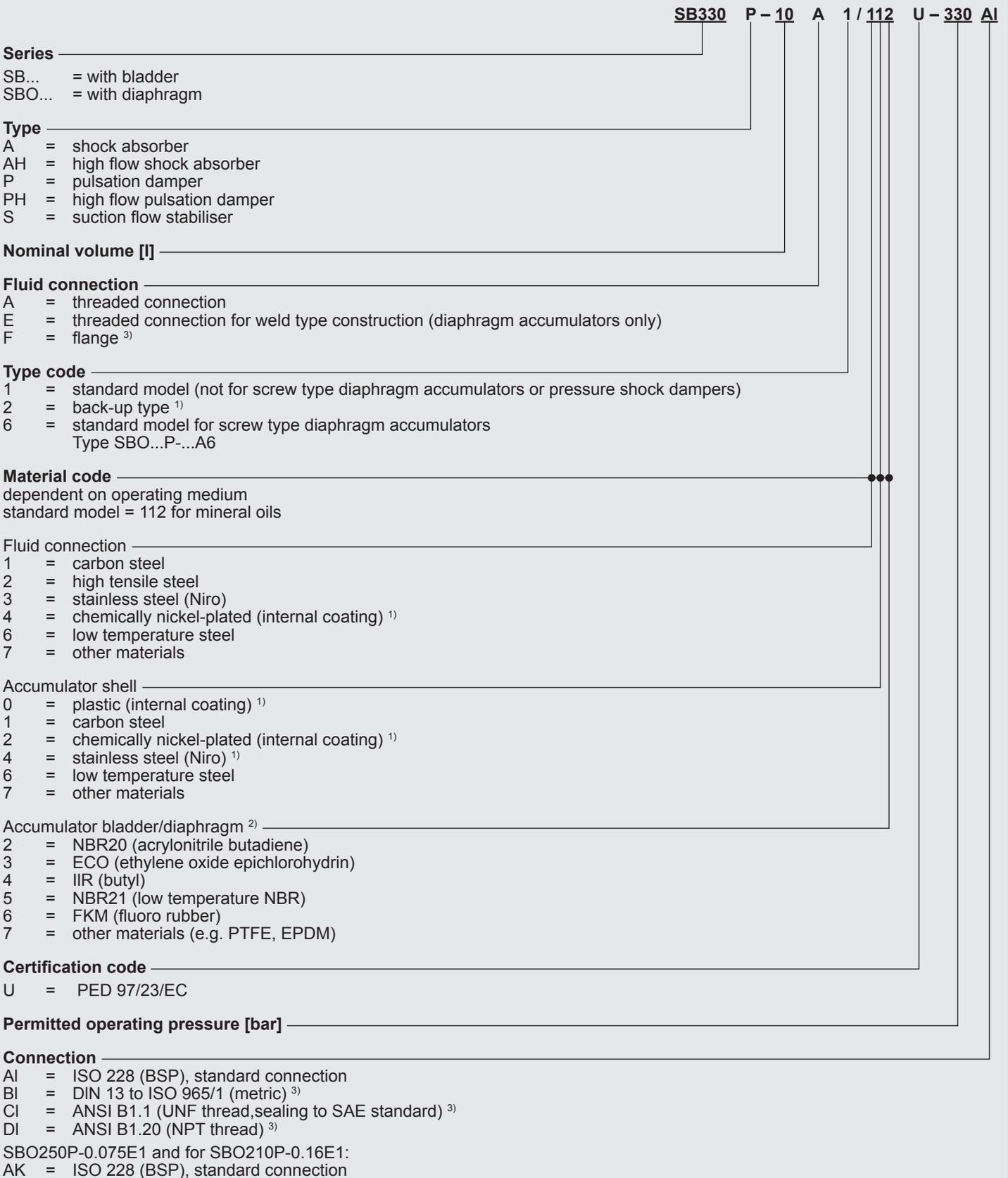
1.4. TECHNICAL SPECIFICATIONS

1.4.1 MODEL CODE

Pulsation damper, suction flow stabiliser, shock absorber

Not all combinations are possible.

Order example. For further information, please contact HYDAC.



¹⁾ Not available for all models

²⁾ When ordering a spare bladder, please state diameter of the smaller shell port

³⁾ Please give full details when ordering

1.4.2 General

Operating pressure

See tables (may differ from nominal pressure for foreign test certificates).

Nominal volume

see tables

Effective gas volume

See tables, based on nominal dimensions. This differs slightly from the nominal volume and must be used when calculating the effective fluid volume.

For diaphragm accumulators, the effective gas volume corresponds to the nominal volume.

Effective fluid volume

Volume of fluid which is available between the operating pressures p_2 and p_1 .

Fluids

Mineral oils, hydraulic oils, non-flam fluids, water, emulsions, fuels.
Other fluids on request.

Gas charge

Hydraulic accumulators must only be charged with nitrogen.
Never use other gases.

Risk of explosion!

In principle, the accumulator may only be charged with nitrogen class 4.0, filtered to $< 3 \mu\text{m}$.

If other gases are to be used, please contact HYDAC for advice.

When supplied, the accumulator is only pre-charged for storage purposes. Higher pre-charge pressures are possible by arrangement.

Permitted operating temperature

$-10 \text{ }^\circ\text{C} \dots +80 \text{ }^\circ\text{C}$
for material code 112.

Others on request

Permitted pressure ratio

Ratio of maximum operating pressure p_2 to gas pre-charge pressure p_0 .

See catalogue section:

- HYDAC Accumulator Technology
No. 3.000

General safety instructions

On no account must any welding, soldering or mechanical work be carried out on the accumulator shell.

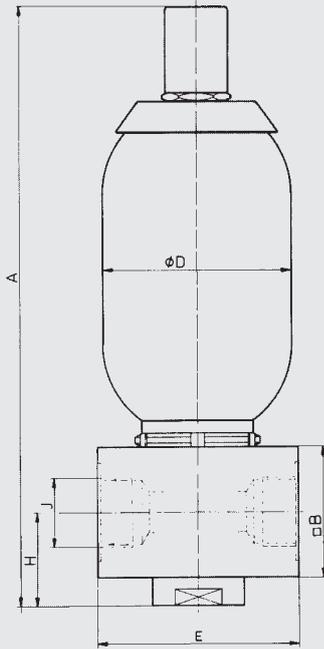
After the hydraulic line has been connected it must be completely vented. Work on systems with hydraulic dampers (repairs, connecting pressure gauges etc) must only be carried out once the pressure and the fluid have been released.

Please read the Operating Manuals!

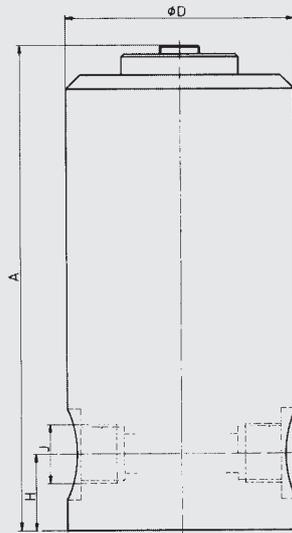
- Bladder Accumulators
No. 3.201.CE
- Diaphragm Accumulators
No. 3.100.CE
- Piston accumulators
No. 3.301.CE

1.4.3 Pulsation damper

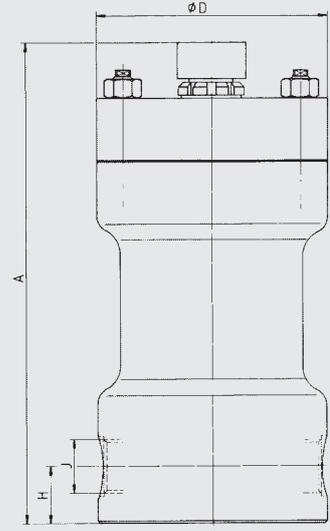
SB330/550P(PH)-...



SB800P-...



SB1000P-...



Dimensions SB

Nominal volume [l]	Max. operating pressure* [bar]	Eff. gas volume [l]	Weight [kg]	A [mm]	□ B [mm]	Ø D [mm]	E [mm]	H [mm]	J ²⁾ Thread ISO 228	Series
1	330	1	11	365	80	118	120	57	G 1 1/4	SB330P
	550		13	384	70	121		53		SB550P
1.5	800 ³⁾	1.3	36	346	-	160	-	55	1)	SB800P
	1000 ³⁾		94	414	-	215	-	49		SB1000P
2.5	330	2.4	16	570	80	118	120	57	G 1 1/4	SB330P
	550	2.5	20	589	70	121		53		SB550P
4	330	3.7	18	455	80	171	150	57	G 1 1/2	SB330P
			26	491	100			85		SB330PH
5	550	4.9	26	917	70	121	120	53	G 1 1/4	SB550P
6	330	5.7	20	559	80	171		150		57
			28	593	100		85		SB330PH	
10	330	9.3	40	620	130x140	171	150	100	SAE 2" - 6000 psi	SB330PH
			50	652				100		85
13	330	12	48	712	100	171	150	85	G 1 1/2	SB330P
20		18.4	70	920				100		85
	24	330	23.6	82	986	100	171	150	100	SAE 2" - 6000 psi
80				952	130x140				85	
32	330	33.9	100	1445	130x140	171	150	85	G 1 1/2	SB330P
			110	1475				100		100

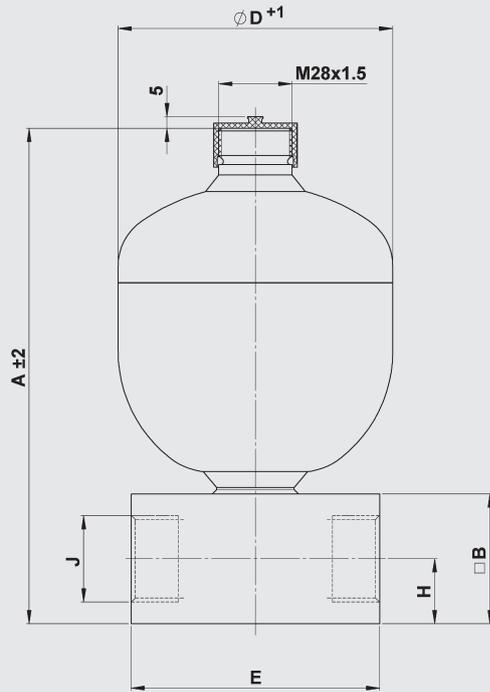
* Certification to PED 97/23/EC

¹⁾ M56x4, high pressure connection DN 16, others on request

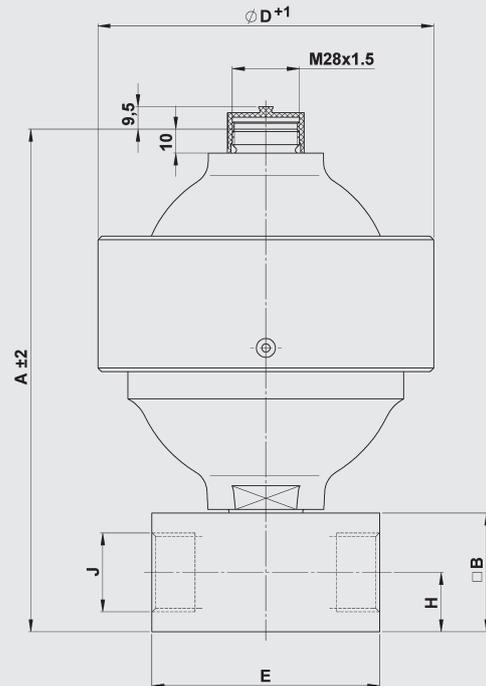
²⁾ Standard connection code = Al, others on request

³⁾ Special model, on request

SBO...P...E



SBO...P...A6



Dimensions SBO

Nominal volume [l]	Max. operating pressure*		Weight [kg]	A [mm]	□ B [mm]	Ø D [mm]	E [mm]	H [mm]	J thread ISO 228	Series and connection type ¹⁾
	Carbon steel [bar]	St. steel (NIRO) [bar]								
0.075	250	–	0.9	131	–	64	41 hex.	13	G 1/4	SBO250P-...E1...AK
0.16	210	180	1	143	–	74				SBO210P-...E1...AK
0.32		160	2.6	175	50	93	80	25	G 1/2	SBO210P-...E1...AI
0.5	–	3	192	105						
0.6	330	–	5.6	222	60	115	105	30	G 1	SBO330P-...E1...AI
0.75	210	140	5.1	217		121				SBO210P-...E1...AI
1	200	–	6	231		136				SBO200P-...E1...AI
1.4	140	–	6.2	244		145				SBO140P-...E1...AI
	210	–	7.7	250		150				SBO210P-...E1...AI
	250	–	8.2	255		153				SBO250P-...E1...AI
2	100	100	6.3	261		160				SBO100P-...E1...AI
	210	–	8.9	267		167				SBO210P-...E1...AI
3.5	250	–	13.5	377		170				SBO250P-...E1...AI
4	–	50	7.9	368		158				SBO50P-...E1...AI
		250	13.5	377	170	SBO250P-...E1...AI				
0.25	500	350	5.2 (6.3)	162	50	115 (125)	80	25	G 1/2	SBO500P-...A6...AI
0.6	450	250	8.9 (9.1)	202	60	140 (142)	95	30	G 1	SBO450P-...A6...AI
1.3	400	–	13.8	267		199	SBO400P-...A6...AI			
2	250	180	15.6	285		201	SBO250P-...A6...AI			
2.8	400	–	24.6	308		252	SBO400P-...A6...AI			
4		–	36.6	325		287				

weld-type

thread-type

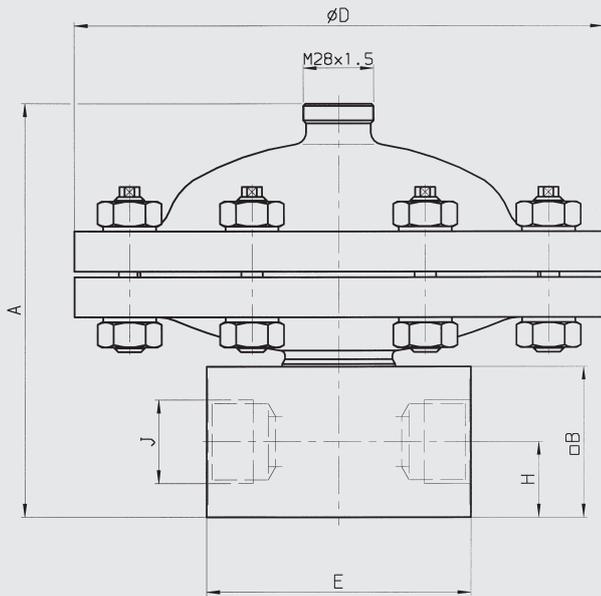
* Certification to PED 97/23/EC

¹⁾ Standard connection code = AK or AI, others on request

() Brackets indicate different dimensions for stainless steel version (NIRO)

Pulsation dampers for aggressive media

SBO...P...A6/347...(PTFE)



Pulsation damper in stainless steel with PTFE coated diaphragm and PTFE or FFKM seals.
Also available without connection block.

Certification to PED 97/23/EC

Permitted operating temperature:
-15 °C ... +80 °C

Permitted pressure ratio $p_2 : p_0 = 2 : 1$

Nominal volume [l]	Max. operating pressure [bar]	Weight [kg]	A [mm]	□ B [mm]	Ø D [mm]	E [mm]	H [mm]	J ¹⁾ Thread
0.2	40	11	140	60	210	105	30	G 1
	250	27	197		230			
0.5	40	12	165		210			
	250	26	200		230			

¹⁾ Standard connection code = A1, others on request

SBO...(P)...A4/777... (PVDF/PTFE)

Diagram 1

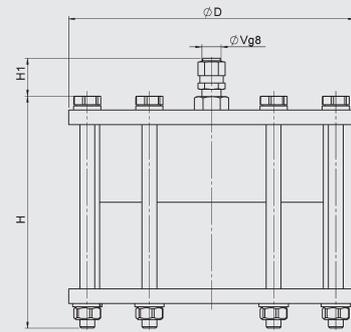
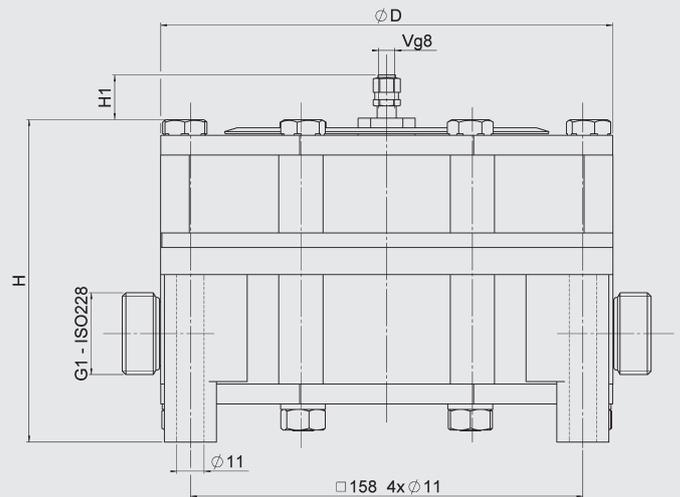


Diagram 2



Pulsation damper in PVDF with PTFE-coated diaphragm.

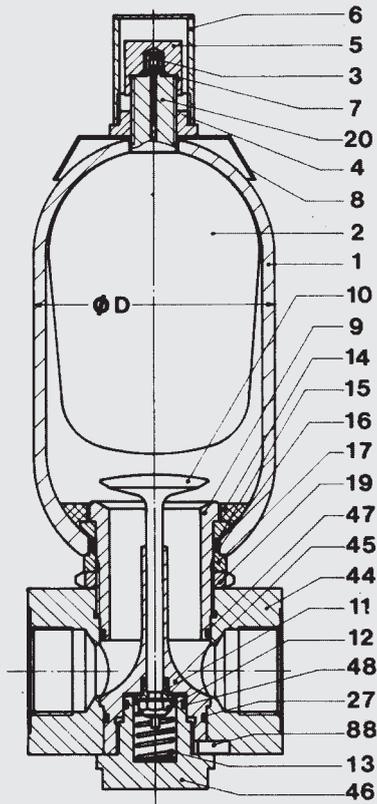
Permitted operating temperature:
-10 °C ... +65 °C

Permitted pressure ratio $p_2 : p_0 = 2 : 1$

Nominal volume [l]	Max. operating pressure [bar]	Weight [kg]	Ø D [mm]	H [mm]	H [mm]	Diag.
0.08	10	1.5	115	94	15	1
0.2	10	5.7	182	128	20	2
	16	6.4		130	18	
	25			168	20	
0.5	10	6		170	19	
	16	6.8				
	25					

Spare parts

SB...P



Description	Item
Bladder assembly*	
consisting of:	
Bladder	2
Gas valve insert	3
Retaining nut	4
Cap nut	5
Valve protection cap	6
O-ring	7
Seal kit*	
consisting of:	
O-ring	7
Washer	15
O-ring	16
Support ring	23
O-ring	27
O-ring	47
O-ring	48
Anti-extrusion ring*	14
Gas valve insert*	3

* recommended spares

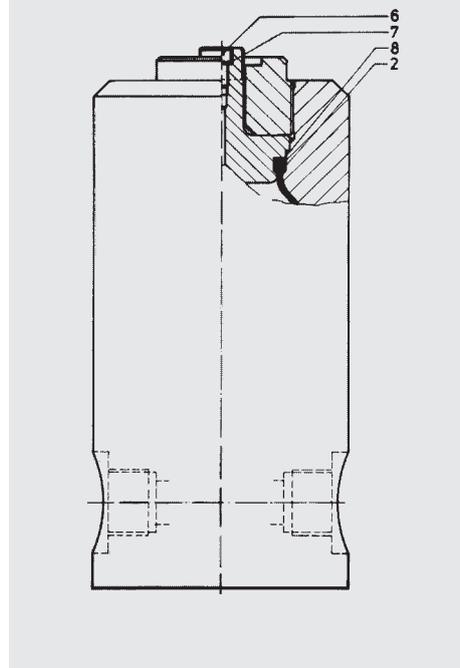
Description	Item
Connection assembly	
consisting of:	
Oil valve body	9
Valve poppet	10
Damping sleeve	11
Lock nut	12
Spring	13
Anti-extrusion ring	14
Washer	15
O-ring	16
Spacer	17
Lock nut	19
Support ring (only for 330 bar)	23
O-ring	27
Connector	44
Guide piece	45
Cap	46
O-ring	47
O-ring	48
Locking key	88

O-ring dimensions (mm)

Series	Nominal volumes	Item 7	Item 16	Item 27	Item 47	Item 48
SB330P	1- 6 l	7.5x2	55x3.5 ¹⁾	42.2x3 ¹⁾	46x3 ¹⁾	24.2x3 ¹⁾
SB550P	1- 5 l	7.5x2	50.17x5.33 ¹⁾	37.82x1.78 ¹⁾	40.94x2.62 ¹⁾	23.52x1.78 ¹⁾
SB330P/PH	10-32 l/4+6 l	7.5x2	80x5 ¹⁾	57.2x3 ¹⁾	67.2x3 ¹⁾	37.2x3 ¹⁾
SB330PH	10-32 l	7.5x2	100x5 ¹⁾	64.5x3 ¹⁾	84.5x3 ¹⁾	44.2x3 ¹⁾

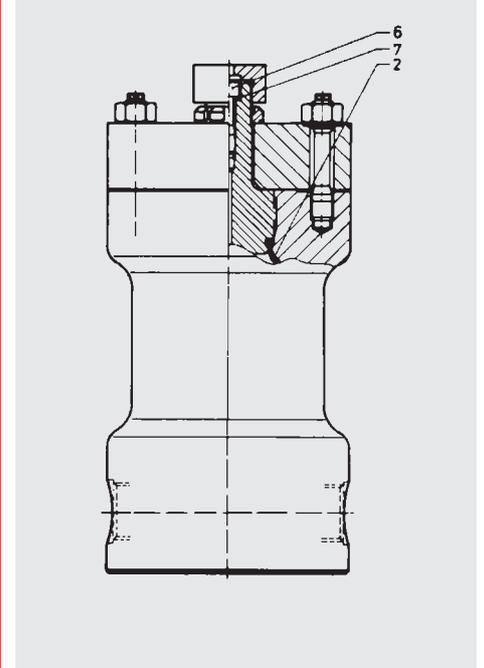
¹⁾ For code 663 and 665 different dimensions

SB800P



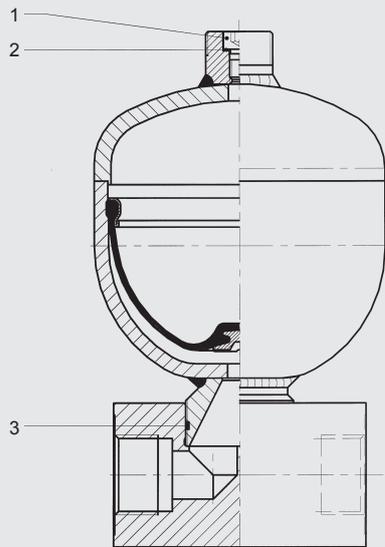
Description	Item
Bladder	2
Charging screw	6
Seal ring U 9.3x13.3x1	7
Support ring	8

SB1000P



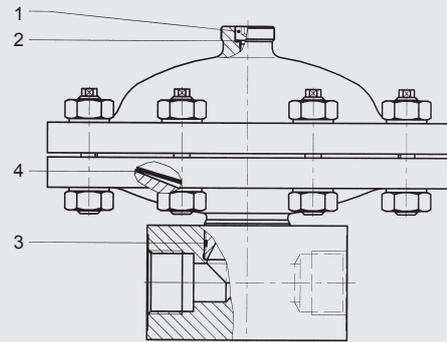
Description	Item
Bladder	2
Charging screw	6
Seal ring	7

SBO...P...E



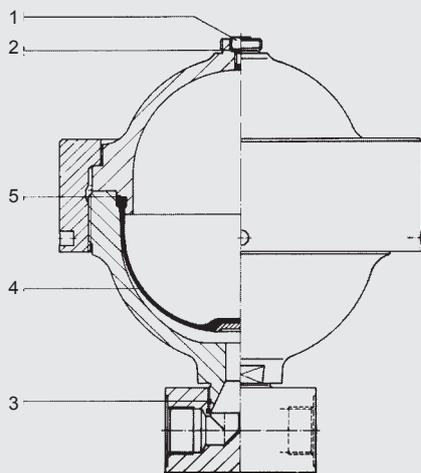
Description	Item
Charging screw	1
Seal ring	2
Seal ring	3

SBO...P-...A6/347...(PTFE)



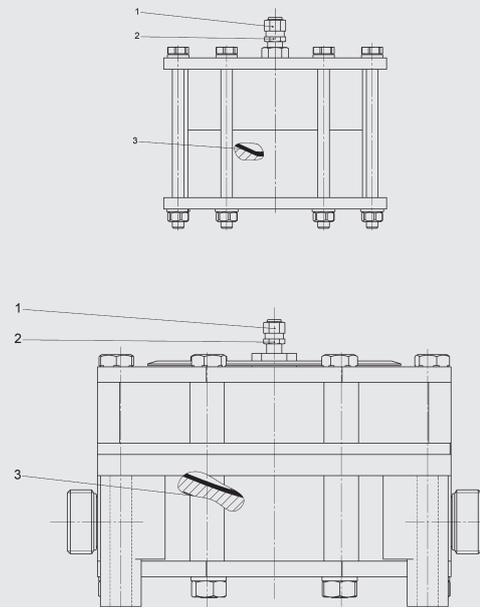
Description	Item
Charging screw	1
Seal ring	2
Seal ring	3
Diaphragm	4

SBO...P...A6



Description	Item
Charging screw	1
Seal ring	2
Seal ring	3
Diaphragm	4
Support ring	5

SBO...(P)-...A4/777... (PVDF/PTFE)

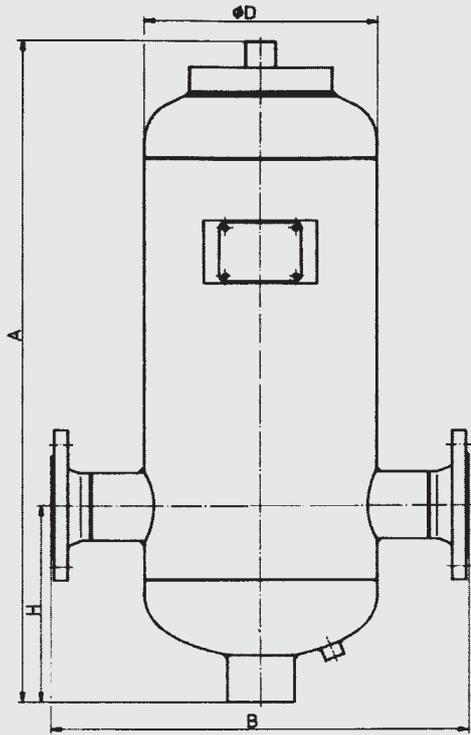


Description	Item
Gas valve complete	1
Gas valve insert brass / stainless steel	2
Diaphragm	3

Relevant operating manual is available on request.

1.4.4 Suction flow stabiliser

SB16S



Dimensions

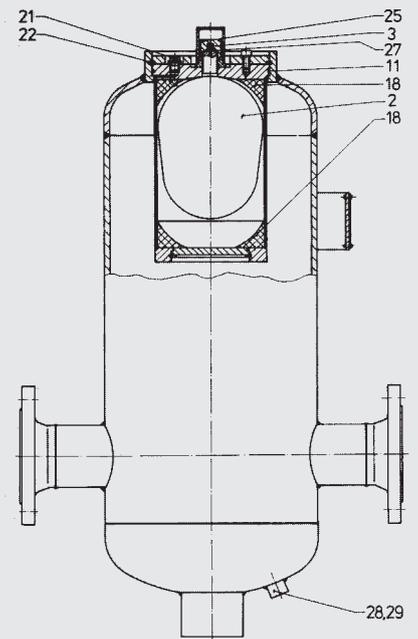
SB 16 S - permitted working pressure 16 bar; certified to PED 97/23/EC

Nominal volume [l]	Fluid volume [l]	Eff. gas volume [l]	Weight [kg]	A [mm]	B [mm]	Ø D [mm]	H [mm]	DN*
12	12	1	40	580	425	219	220	65
25	25	2.5	60	1025				
40	40	4	85	890	540	300	250	80
100	100	10	140	1150	650	406	350	100
400	400	35	380	2050	870	559	400	125

Further pressure ranges 25 bar, 40 bar; others on request.
Other fluid volumes on request.

* to EN1092-1/11 /B1/PN16

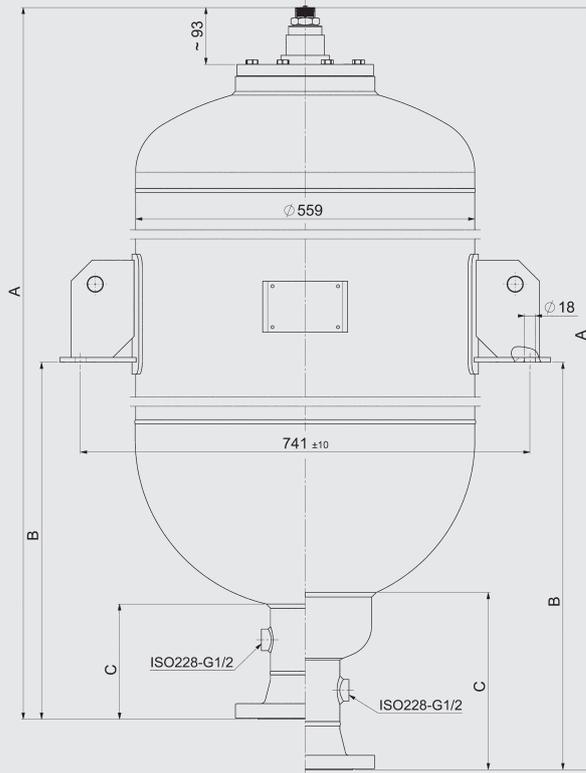
Spare parts



Description	Item
Bladder	2
Gas valve insert	3
O-ring	11
Insertion ring, 2x	18
Lock nut	21
Retaining ring	22
Cap nut	25
O-ring	27
Seal ring	28
Lock nut	29

1.4.5 Shock absorber

SB16/35A, SB16/35AH



Dimensions

SB16/35 A - permitted operating pressure 16/35 bar (PED 97/23/EC)

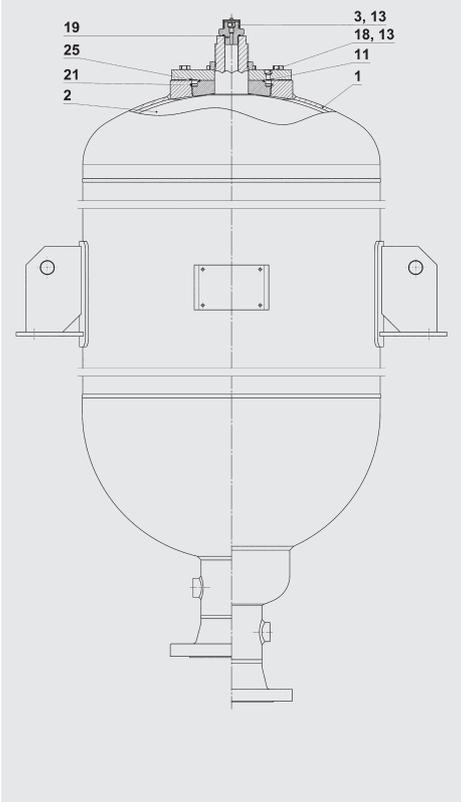
Nominal volumes [l]	Eff. gas volume [l]	Weight [kg]		A max. [mm]		B max. [mm]		C max. [mm]		DN*
		SB16A	SB35A	SB16A	SB35A	SB16A	SB35A	SB16A	SB35A	
100	99	84	144	880	890	400	400	185	198	100
150	143	101	161	1070	1080	500	500			
200	187	122	223	1310	1320	685	685			
300	278	155	288	1710	1720	985	985			
375	392	191	326	2230	2240	1250	1250			
450	480	237	386	2625	2635	1465	1465			

SB16/35 AH - permitted operating pressure 16/35 bar (PED 97/23/EC)

Nominal volumes [l]	Eff. gas volume [l]	Weight [kg]		A max. [mm]		B max. [mm]		C max. [mm]		DN*
		SB16AH	SB35AH	SB16AH	SB35AH	SB16AH	SB35AH	SB16AH	SB35AH	
100	99	93	153	910	920	450	450	245	254	100
150	143	110	170	1120	1130	560	560			
200	187	131	230	1340	1350	760	760			
300	278	164	297	1755	1765	1040	1040			
375	392	200	335	2285	2295	1330	1330			
450	480	246	395	2670	2680	1530	1530			

* to EN1092-1/11 /B1/PN16 or PN40
others on request

Spare parts

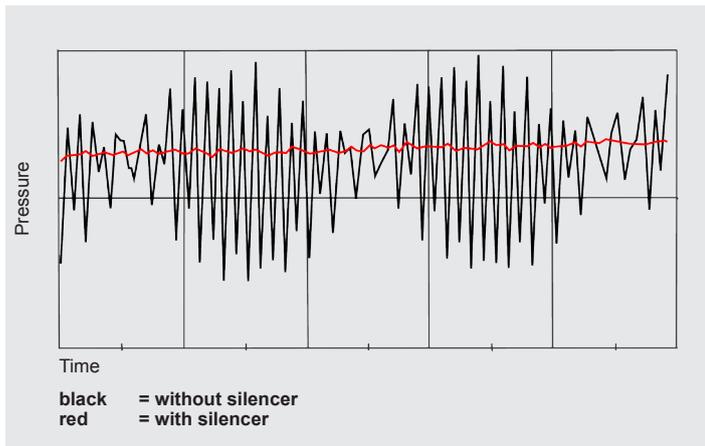


Description	Item
Bladder	2
Lock nut	3
O-ring	11
Seal ring	13
Vent screw	18
O-ring	19
Retaining ring	21
O-ring	25

2. SILENCER

2.1. APPLICATION

2.1.1 Silencer for fluid noise damping Type SD...



General

All displacement pumps, such as axial and radial piston pumps, vane, gear or screw pumps produce volume and pressure fluctuations which are exhibited as vibrations and noises. Noises are not only generated and transmitted by the pump. They are also the result of mechanical vibrations and vibrations caused by the fluid pulsations, which are amplified when transmitted to larger surfaces. Insulation, the use of flexible hoses and silencer covers can provide only partial solutions to the problem as they do not prevent transmission to other areas.

Applications

Vehicles, machine tools, plastics machinery, aeroplanes, ships, hydraulic power stations and other systems with a large "surface" are all applications where the noise level can be reduced.

Operation

The HYDAC fluid SILENCER is based on the principle of an expansion chamber with interference line.

By reflecting the oscillations within the silencer the majority of the oscillations are dampened across a wide frequency spectrum.

Design

The HYDAC SILENCER consists of a welded or forged external housing, an internal tube and two pipe connections on opposite sides.

The SILENCER has no moving parts and no gas charge and is therefore absolutely maintenance free.

The HYDAC SILENCER can be used for mineral oils, phosphate ester and water glycol. A stainless steel model is available for other fluids.

Special model

SILENCERS can also be in the form of diaphragm or piston accumulators. Available on request.

Installation

It is recommended that one connection side is joined via a flexible hose in order to reduce the transmission of mechanical vibrations.

The installation position of the damper is optional, but the flow direction must be taken into account.

**Please read the Operating Manual!
No. 3.701.CE**

2.2. SIZING

2.2.1 Silencer

The sizing calculation of the HYDAC SILENCER is designed to result in a small unit with the best possible damping. The starting point for the selection table is to determine the level of transmission damping D from 20 dB upwards.

$$D = 20 \cdot \log \frac{\Delta p_o}{\Delta p_m}$$

Δp_o = height of pressure fluctuations without silencer

Δp_m = height of pressure fluctuations with silencer

When selecting the damper the following has to be taken into account:

- 1) the size of the silencer body
- 2) the fundamental frequency f of the pump.

$$f = i \cdot n / 60 \text{ in Hz}$$

i = number of displacement elements

n = motor speed in min^{-1}

2.2.2 Calculation example

Given parameters:

Axial piston pump with 9 pistons

Motor speed: 1500 min^{-1}

Connection: G1 corresponds to $D_1 = 19 \text{ mm}$

Flow rate: 300 l/min

Operating medium: mineral oil

Max. operating pressure: 210 bar

Solution:

Fundamental frequency f

$$f = i \cdot n / 60 \text{ in Hz}$$

$$= 9 \cdot 1500/60$$

$$= 225 \text{ Hz}$$

By calculating the fundamental frequency and using the system data (e.g. pipe length, ball valves, pressure, temperature, etc.) we can determine the correct size of silencer for you.

Use the specification sheet to provide the required data quickly and conveniently on the PC and send it to us.

See www.hydac.com or catalogue section

- HYDAC Accumulator Technology
No. 3.000

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SILENCER SPECIFICATION FORM
(Subject to technical modifications)

Company: _____ Project name: _____
Name, first name: _____ Application: _____
E-mail: _____ Requirement: _____ price/year
Telephone no.: _____ as □ spare part □ original equipment

Sizing diagram:

Pump: A15VSD07H Design pressure: 210 bar Silencer inlet: SAE 1 1/4" 3000 psi
Pump rpm: 1500 No. of pump pistons: 9 Silencer outlet: SAE 1 1/4" 3000 psi
Fluid: Fluid density: 850 kg/m³ Design temperature: 50 °C

Element no.	Length [m]	Ø int. [in]	Ø ext. [in]	Subsequent connection type	Hose type
E1	0.5	0.620	0.500	Straight connection	—
E2	0.4	—	0.500	Straight connection	—
E3	1.5	0.625	0.545	Function	ESP (DIN EN 856)
E4	0.6	0.615	0.525	Pressure relief valve	—
E5	0.2	0.615	0.525	Right angle	—
E6	0.6	0.615	0.525	Right-off valve	—

Please enter design data here:
Pump: _____ Design pressure: _____ bar Silencer inlet: _____
Pump rpm: _____ No. of pump pistons: _____ Silencer outlet: _____
Fluid: _____ Fluid density: _____ kg/m³ Design temperature: _____ °C

Element no.	Length [m]	Ø int. [in]	Ø ext. [in]	Subsequent connection type	Hose type
E1					
E2					
E3					
E4					
E5					
E6					
E7					
E8					
E9					
E10					
E11					
E12					

Remarks: _____
Date: _____ Signature: _____

16 | HYDAC

2.3. TECHNICAL SPECIFICATIONS

2.3.1 Model code for SD

Not all combinations are possible.

Order example. For further information, please contact HYDAC.

SD330 M - 4.2 / 212 U - 330 AD/AD

Series _____

Type code _____
no details = for SD 330
B = bladder accumulator base body*
K = piston accumulator base body*
M = diaphragm accumulator base body*

Nominal volume [l] _____

Material code _____

Damper _____
0 = without pipe
1 = damper for frequencies > 500 Hz
2 = narrow band damper - DR
3 = broadband damper - DR

Housing material _____
1 = carbon steel
2 = carbon steel with protective coating*

Seal material _____
2 = NBR (acrylonitrile butadiene)
6 = FPM (fluoro rubber)

Certificate code _____
U = PED 97/23/EC

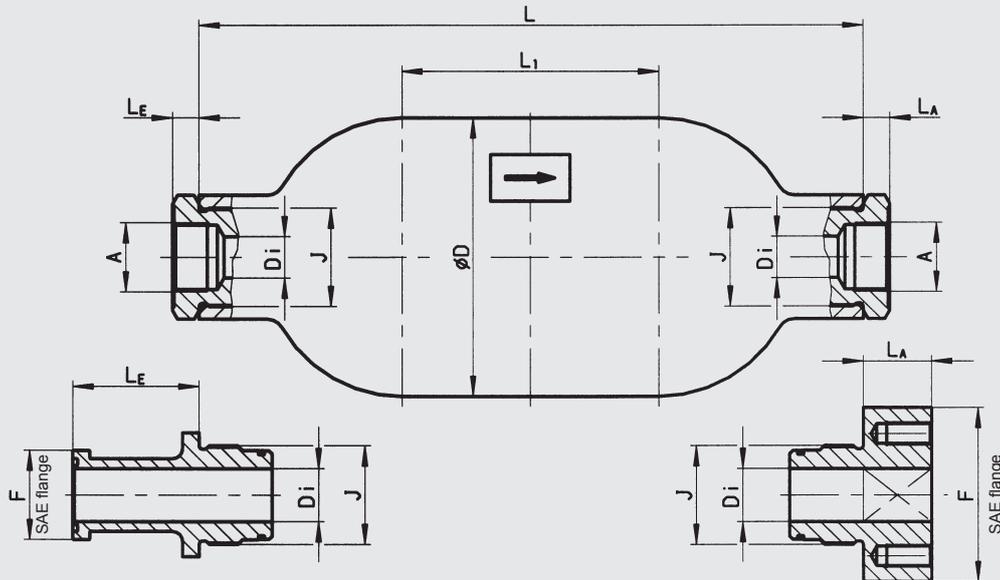
Permitted operating pressure [bar] _____

Inlet connector / Outlet connector _____
see Table 2.3.3

* only on request

2.3.2 Dimensions

SD330



Nominal volume [l]	L [mm]	L1 [mm]	Ø D [mm]	J ISO 228	Weight [kg]
1.3	250	–	114	G 1	6.5
1.8	355	155		G 1 1/4	5.5
4.2	346	–	168	G 1 1/2	12.5
4.7	420	155		G 2"	11.4

2.3.3 Silencer connections

a) Threaded connection to ISO 228

Nominal volume [l]	Fluid connection A													
	AB G 3/8 Di = 15 mm		AC G 1/2 Di = 13 mm		AD G 3/4 Di = 16 mm		AE G 1 Di = 19 mm		AF G 1 1/4 Di = 25 mm		AG G 1 1/2 Di = 32 mm		GG G 1 1/2 Di = J	
	LE [mm]	LA [mm]	LE [mm]	LA [mm]	LE [mm]	LA [mm]	LE [mm]	LA [mm]	LE [mm]	LA [mm]	LE [mm]	LA [mm]	LE [mm]	LA [mm]
1.3	17	17	–	–	–	–	–	–	–	–	–	–	–	–
1.8	–	–	13	13	13	13	30	30	33	33	–	–	–	–
4.2	–	–	–	–	–	–	–	–	–	–	–	–	–	Without adapter
4.7	–	–	–	–	16	16	16	16	26	26	36	36	36	36

b) Flange connection SAE J518 (Code 62 - 6000 psi)

Nominal volume [l]	Fluid connection F											
	FG SAE 1/2" Di = 13 mm		FH SAE 3/4" Di = 19 mm		FI SAE 1" Di = 25 mm		FK SAE 1 1/4" Di = 32 mm		FL SAE 1 1/2" Di = 38 mm		FM SAE 2" Di = 50 mm	
	LE [mm]	LA [mm]	LE [mm]	LA [mm]	LE [mm]	LA [mm]	LE [mm]	LA [mm]	LE [mm]	LA [mm]	LE [mm]	LA [mm]
1.3	–	–	–	–	–	–	–	–	–	–	–	–
1.8	53	31	59	36	65	36	–	–	–	–	–	–
4.2	–	–	–	–	–	–	–	–	0	33	–	–
4.7	–	–	105	36	120	36	76	28	76	28	–	*

- not available

* on request

3. NOTE

The information in this brochure relates to the operating conditions and applications described.

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

Subject to technical modifications.

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Internet: www.hydac.com

E-Mail: speichertechnik@hydac.com

Accumulator Stations



1. GENERAL

HYDAC supplies fully assembled piston accumulator stations which are ready for operation, complete with all the necessary valve controls, ball valves and safety equipment

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

The HYDAC system approach creates a HYDAC system of, for example, bladder or piston accumulator stations, by integrating individual HYDAC components.

An accumulator station can be composed of

- piston accumulators with nitrogen bottles,
- bladder accumulators with nitrogen bottles or
- nitrogen bottles alone.

The modular construction of the accumulator stations enables HYDAC to incorporate all customer requirements. HYDAC can calculate the required accumulator volume using the accumulator sizing program, taking the customer's own operating data into account:

- **ASP – Accumulator Simulation Program.**

Please read the relevant operating manual for the individual HYDAC components!

2. MODEL CODE

(also order example)

SS 350 K - 4 x 250 / 12 x 320 (U)

Type of accumulator _____

SS = accumulator station

Max. operating pressure [bar] _____

Series _____

K = piston accumulator
B = bladder accumulator
N = nitrogen bottles

Number of accumulators _____

Nominal volume [l] of the accumulators _____

Number of nitrogen bottles _____

Nominal volume [l] of the nitrogen bottles _____

Certification code _____

Piston accumulators and nitrogen bottles are connected up via a manifold block or pipework

3. EXAMPLES OF ACCUMULATOR STATIONS

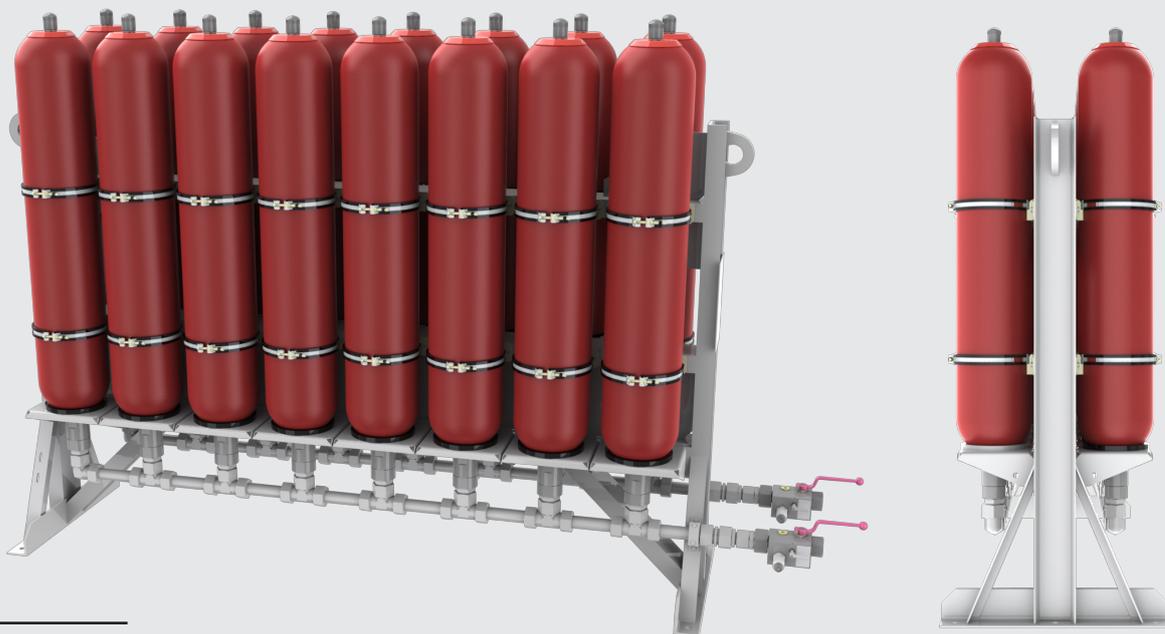
3.1. BLADDER ACCUMULATOR STATIONS

EXAMPLE: SS330B-16x32(U)

Technical specifications:

16 bladder accumulators, each with a volume of 32 l

Max. operating pressure: 330 bar



Dimensions

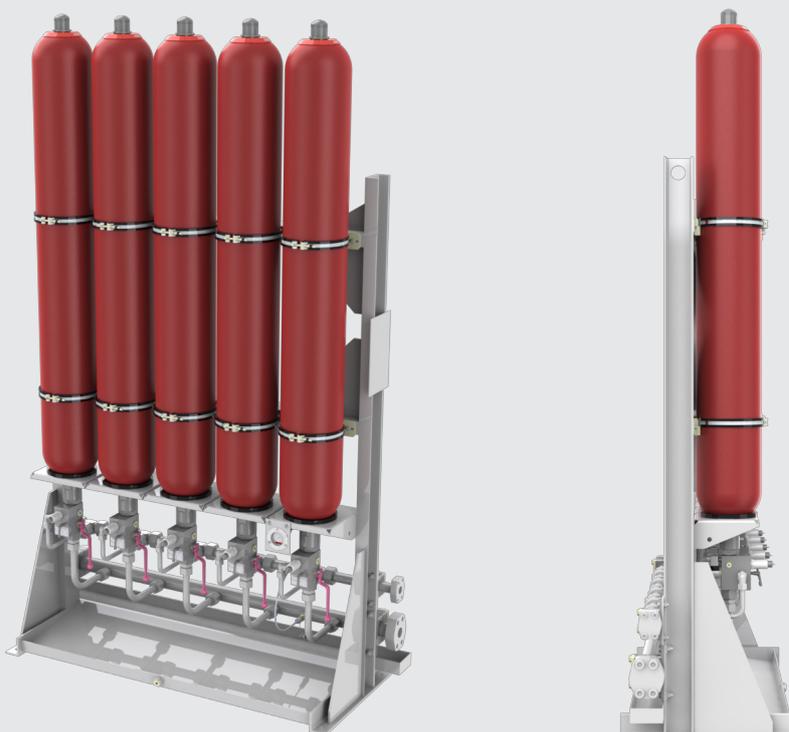
Length [mm]	Width [mm]	Height [mm]
2780	660	1950

EXAMPLE: SS330B-5x50(U)

Technical specifications:

5 bladder accumulators, each with a volume of 50 l

Max. operating pressure: 330 bar



Dimensions

Length [mm]	Width [mm]	Height [mm]
1640	600	2750

3.2. PISTON ACCUMULATOR STATIONS

EXAMPLE: SS350K-1x110/8x50(U)

Technical specifications:

1 piston accumulator, volume 110 l

8 N₂ bottles, each with a volume of 50 l

Max. operating pressure: 350 bar



Dimensions

Length [mm]	Width [mm]	Height [mm]
1540	900	3300

EXAMPLE: SS220K-1x120/1x75(U)

Technical specifications:

1 piston accumulator, volume 120 l

1 N₂ bottle, volume 75 l

Max. operating pressure: 220 bar



Dimensions

Length [mm]	Width [mm]	Height [mm]
520	800	3500

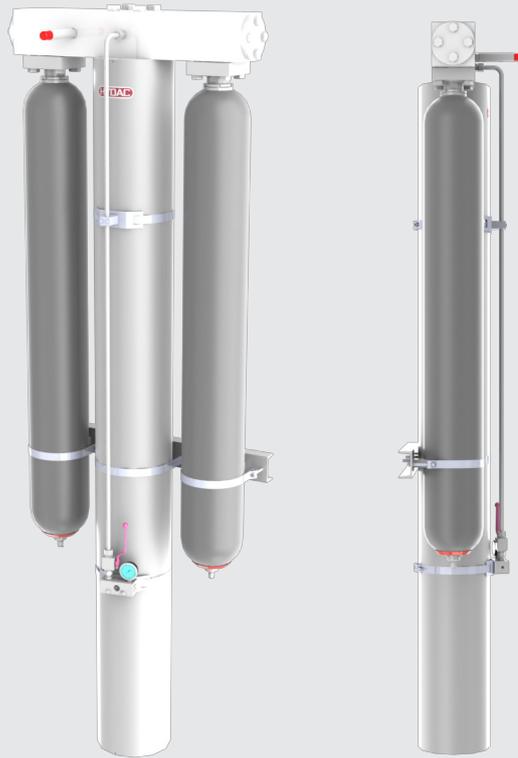
EXAMPLE: SS210K-1x110/2x50(U)

Technical specifications:

1 piston accumulator, volume 110 l

2 N₂ bottles, each with a volume of 50 l

Max. operating pressure: 210 bar



Dimensions

Length [mm]	Width [mm]	Height [mm]
950	475	2840

Example: SS350K-1x200/2x100(A9)

Technical specifications:

1 piston accumulator, volume 200 l

2 N₂ bottles, each with a volume of 110 l

Max. operating pressure: 350 bar



Dimensions

Length [mm]	Width [mm]	Height [mm]
1250	550	2900

3.3. NITROGEN BOTTLES

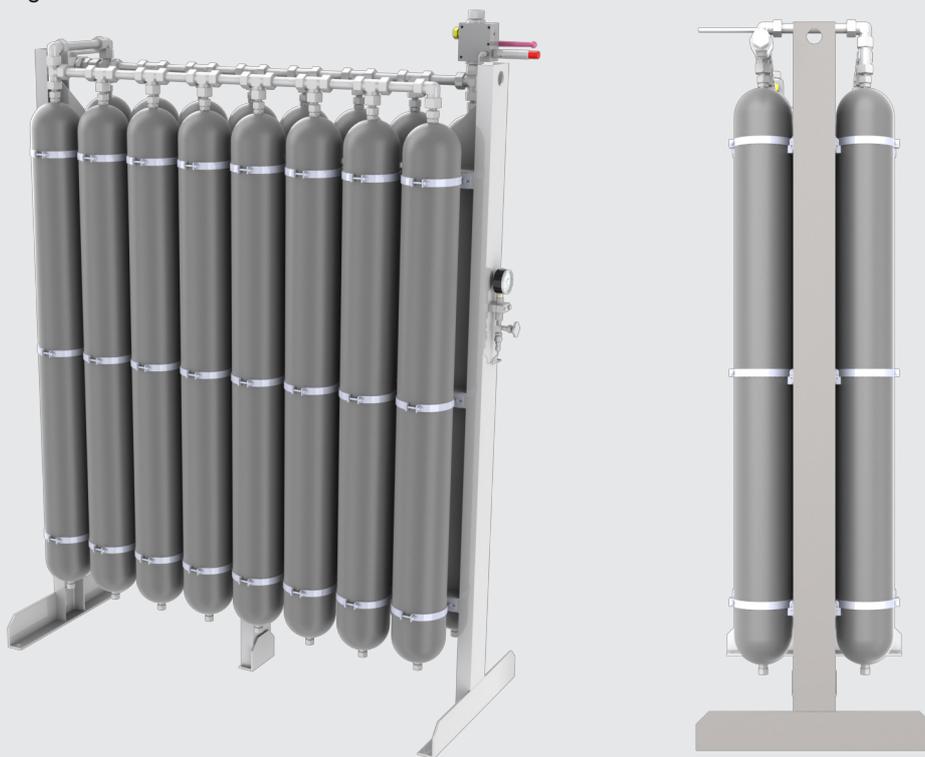
Nitrogen bottles in modular construction:
up to 24 bottles can be assembled in this version on a frame. For a larger number,
a special model can be supplied.

See catalogue section:

- Hydraulic accumulators with back-up nitrogen bottles
No. 3.553

Example: SS350N-16x75(U)

Technical specifications:
16 N₂ bottles, each with a volume of 75 l
Max. operating pressure: 350 bar



Dimensions

Length [mm]	Width [mm]	Height [mm]
2440	900	3000

4. NOTE

The information in this brochure relates to the operating conditions and applications described.

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

Subject to technical modifications.

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Hydraulic Accumulators with Back-Up Nitrogen Bottles

1. GENERAL

To complete the accumulator range, HYDAC provides a variety of useful accessory products. They guarantee correct installation and optimum functioning of HYDAC hydraulic accumulators. These include, amongst others, 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. This means that smaller accumulators can be used for the same gas volume and costs can be reduced. To assist selection the Simulation Program ASP can be downloaded from www.hydac.com.

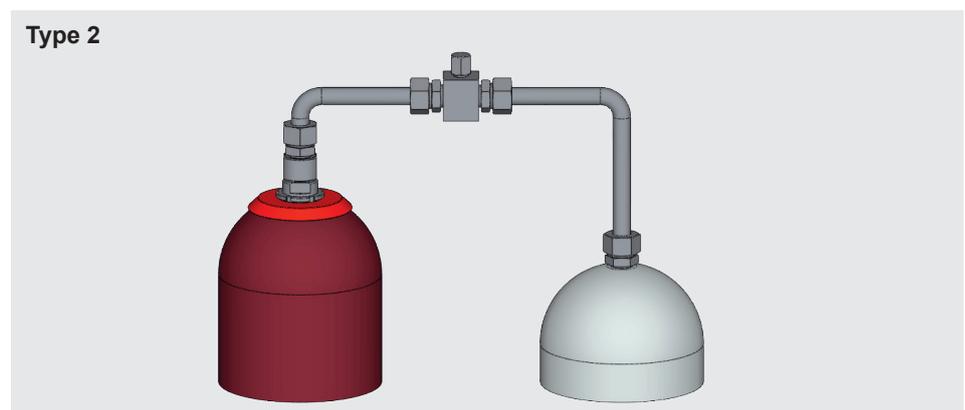
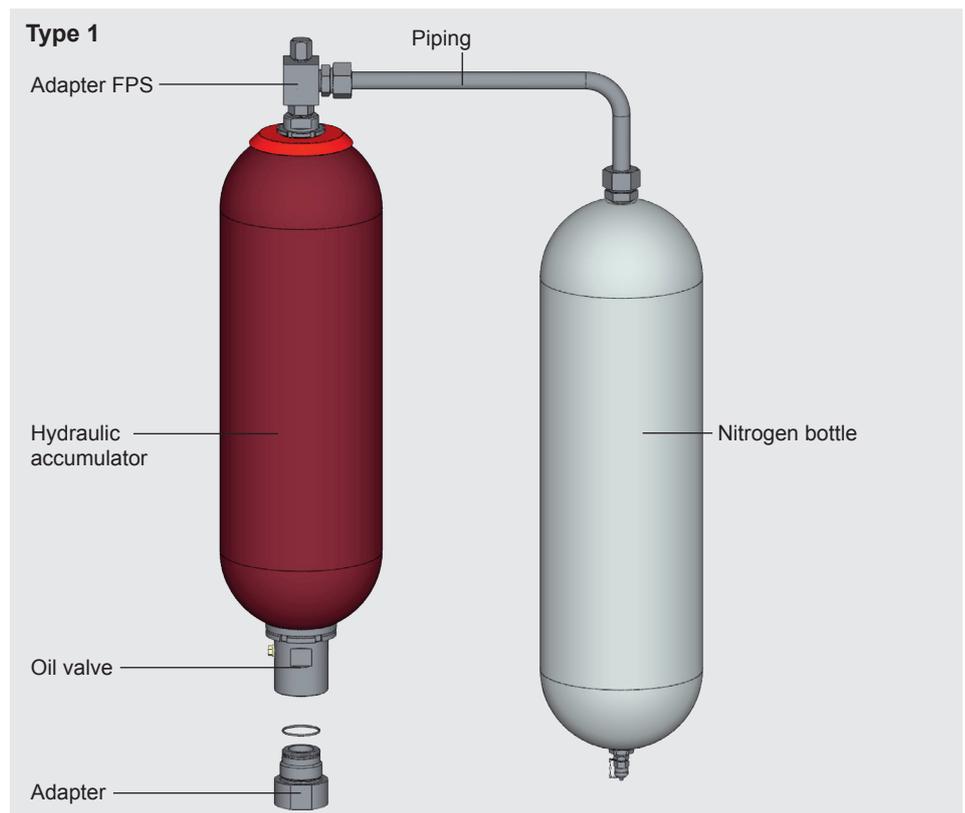
For further information, please turn to the sections:

- Bladder Accumulators
Standard
No. 3.201
- Piston Accumulators
Standard
No. 3.301

2. BACK-UP VERSIONS

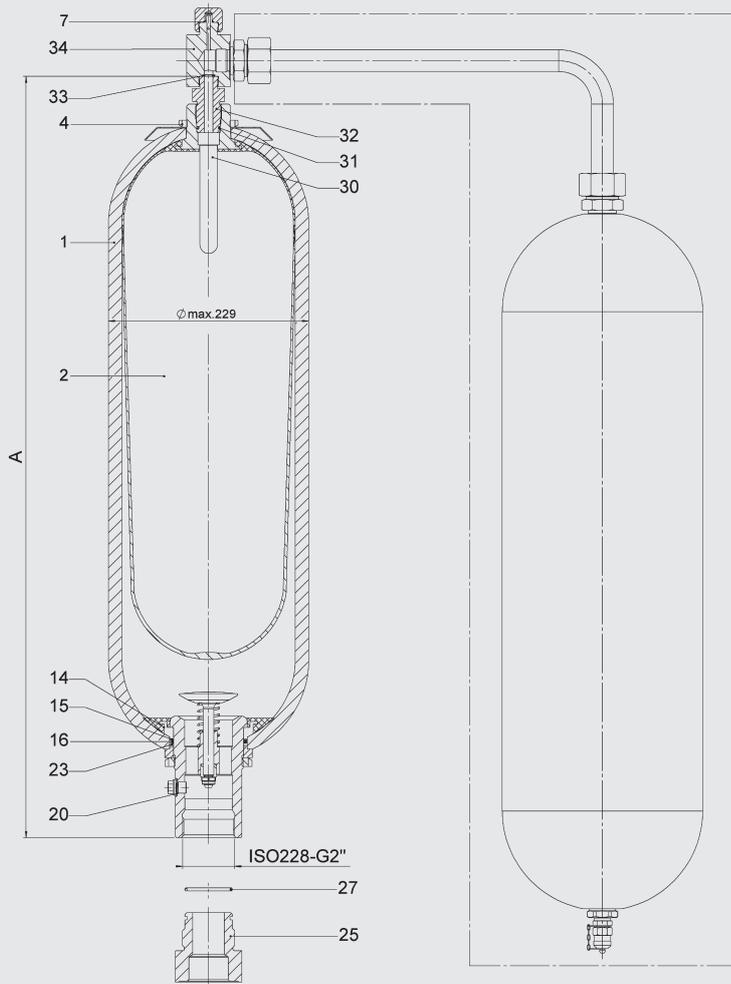
2.1. SET-UP USING THE EXAMPLE OF A BLADDER ACCUMULATOR

Based on bladder accumulator models 20 ... 50 l, the gas-side of these transfer accumulators is designed especially for connecting to nitrogen bottles. A diffuser rod prevents damage to the bladder when the accumulator is charged. This design can also be used for the separation of fluids (taking into account the volume ratios which apply to bladder accumulators).

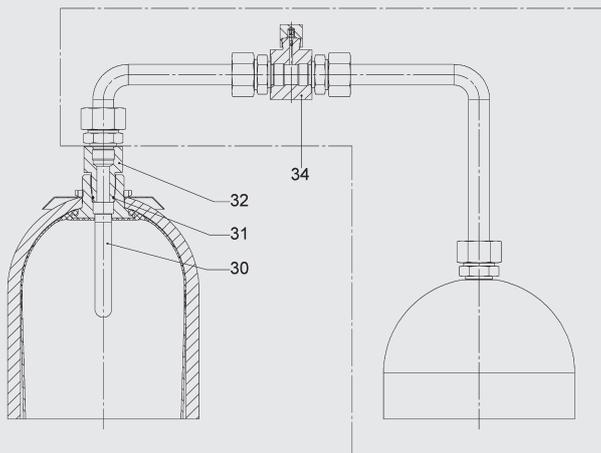


2.2. DIMENSIONS

Type 1



Type 2



Nominal volume [l]	Effective gas volume [l]	Weight [kg]	A max. [mm]
20	17.5	53.5	905
24	24	72	1070
32	32.5	89	1420
50	47.5	119.5	1930

others on request

2.3. SPARE PARTS

NBR, carbon steel, standard gas valve

Nominal volume of accum. [l]	Seal kit Part no.	Repair kit	
		Type 1 Part no.	Type 2 Part no.
20	353621	3119500	3897464
24		3119502	3897463
32		3119498	3897462
50		3119499	3897461

Description	Item
Bladder assembly	
consisting of:	
Bladder	2
Lock nut	4
Diffuser rod	30
O-ring 22x2.5 ¹⁾	31
Adapter for Type 1/2	32
Seal kit	
consisting of:	
O-ring 7.5x2 ¹⁾	7
Washer	15
O-ring 80x5 ¹⁾	16
Seal ring	20
Back-up ring	23
O-ring 48x3 ¹⁾	27
Repair kit	
consisting of:	
Bladder assembly (see above)	
Seal kit (see above)	
O-ring 11x2 ¹⁾	33
Anti-extrusion ring	14
Adapter FPS for Type 1/2 ²⁾	34

Recommended spare parts

¹⁾ For code 663 and 665 different dimensions

²⁾ see Point 4.

Item 1 not available as a spare part.

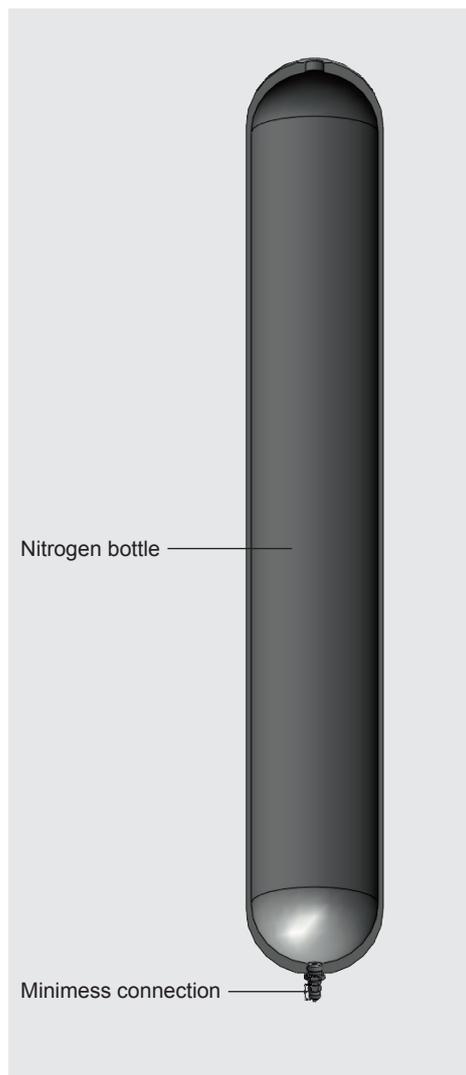
Item 25 must be ordered separately, see Bladder Accumulator Standard, No. 3.201 (Point 4.2)

Item 32 Type 1 is standard.

For other spare parts, see Point 3.

3. NITROGEN BOTTLES

3.1. DESCRIPTION AND CONSTRUCTION



HYDAC nitrogen bottles are used to take in and store nitrogen. HYDAC offers a wide selection of bottle types, such as forged vessels and bladder shells or piston cylinders.

3.2. ADVANTAGES

The use of HYDAC nitrogen bottles provides the following benefits:

- Cost-effective increase of the accumulator volume and as a result
- smaller accumulators for the same gas volume.

3.3. TECHNICAL DATA

3.3.1 Model code (also order example)

SN360 - 50 AA / 010 U - 360 D D

Series _____

Code letter _____
 No details = standard
 B = bladder accumulator shell ¹⁾
 K = piston accumulator cylinder ²⁾
 M = diaphragm accumulator half-sections ³⁾

Nominal volume [l] _____

Connection type _____

Connection type on connection side* _____
 A = ISO 228 (BSP)
 B = DIN 13 to ISO 965/1 (metric)
 C = ANSI B1.1 (UNF seal SAE)
 D = ANSI B2.1
 F = flange

Drain side (condensate)* _____
 A = ISO 228 (BSP)
 B = DIN 13 to ISO 965/1 (metric)
 C = ANSI B1.1 (UNF seal SAE)
 D = ANSI B2.1
 F = flange
 1 = sealed with blanking plug
 2 = with condensate drain, hex. socket cap screw
 3 = with condensate drain valve
 4 = with Minimes valve

Material code _____

Material (connection) _____
 0 = no installed parts
 1 = carbon steel
 3 = stainless steel
 4 = carbon steel with protective coating
 6 = low temperature steel

Housing material _____
 1 = carbon steel
 2 = carbon steel with protective coating
 4 = stainless steel
 6 = low temperature steel

Seal material (elastomer) _____
 0 = no elastomer used
 2 = NBR (Perbunan)
 4 = IIR (Butyl)
 5 = TT-NBR
 6 = FKM (fluoro rubber)

Certificate code _____
 U = PED 97/23/EC ⁴⁾

Permitted operating pressure [bar] _____

Size for connection side (see Table 3.3.2) _____

Size for drain side (see Table 3.3.2) _____
 0 = for type 1-4

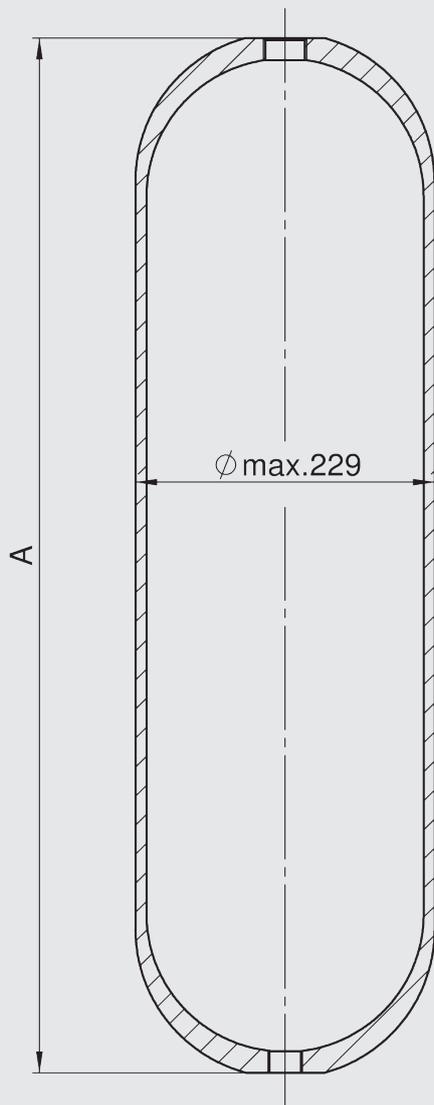
¹⁾ see catalogue section: Bladder Accumulators Standard, No. 3.201
²⁾ see catalogue section: Piston Accumulators Standard, No. 3.301
³⁾ see catalogue section: Diaphragm Accumulators, No. 3.100
⁴⁾ see catalogue section: HYDAC Accumulator Technology, No. 3.000, Point 3.

3.3.2 Connections*

Type	A BSP ISO228	B metric DIN13 ISO965/1	C SAE ANSI B1.1	D NPT ANSI B2.1	F Flange connection
Size					
A	G 1/4"	M12x1.5	7/16"-20UNF	1/4"	1/2" 3000 psi Code 61
B	G 3/8"	M18x1.5	9/16"-18UNF	3/8"	3/4"
C	G 1/2"	M22x1.5	3/4"-16UNF	1/2"	1"
D	G 3/4"	M27x2	1 1/16"-12UN	3/4"	1 1/4"
E	G 1"	M33x2	1 5/16"-12UN	1"	1 1/2"
F	G 1 1/4"	M42x2	1 5/8"-12UN	1 1/4"	2"
G	G 1 1/2"	M48x2	1 7/8"-12UN	1 1/2"	1 1/2" 6000 psi Code 62
H	G 2"	M14x1.5	2 1/2"-12UN	2"	3/4"
I	G 1 3/4"	M8			
K		M16x1.5			1 1/4"
L			7/8"-14UNF	5/8"	1 1/2"
M					2"
S	Special version				

* not all combinations are possible, others on request

3.3.3 Dimensions of standard bottle



Designation	Vol. [l]	Connections to ISO 228	Weight [kg]	A max. [mm]	Part no.
SN360-50AA/010U-360DD	50	G 3/4 G 3/4	87	1615	3176324
SN360-50AA/010U-360DG	50	G 3/4 G 1 1/2	87	1615	3418347
SN500-50AA/010U-500DD	50	G 3/4 G 3/4	112	1745	3107549
SN600-50AA/010S-345DD	50	G 3/4 G 3/4	128	1750	3528730
SN360-75AA/010U-360DE	75	G 3/4 G 1	133	2305	3233527
SN360-75AA/010U-360DG	75	G 3/4 G 1 1/2	133	2305	3561595

others on request

4. ACCESSORIES

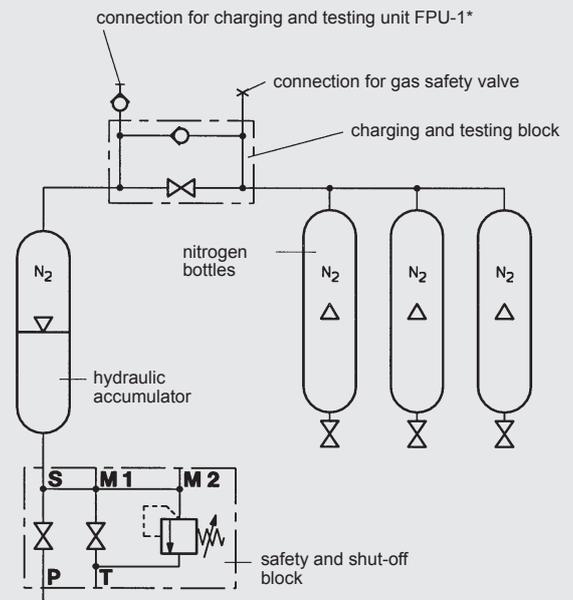
4.1. CHARGING AND TESTING BLOCK F + P

4.1.1 Description

The HYDAC charging and testing block F+P is used to charge and test back-up type hydraulic accumulators. It has connections for the charging and testing unit FPU-1 and for pressure gauges. As a safety function, a gas safety valve GSV6 (see catalogue section given below) can be fitted. In addition, it allows the back-up nitrogen bottles to be shut off from the hydraulic accumulator.

- Safety Equipment for Hydraulic Accumulators No. 3.552

4.1.2 Hydraulic circuit with charging and testing block



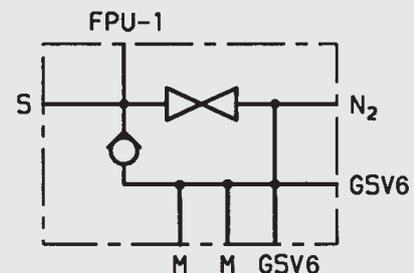
* for further information, see catalogue section:

- Universal Charging and Testing Unit FPU-1 No. 3.501

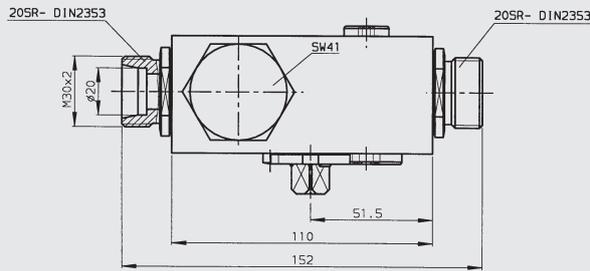
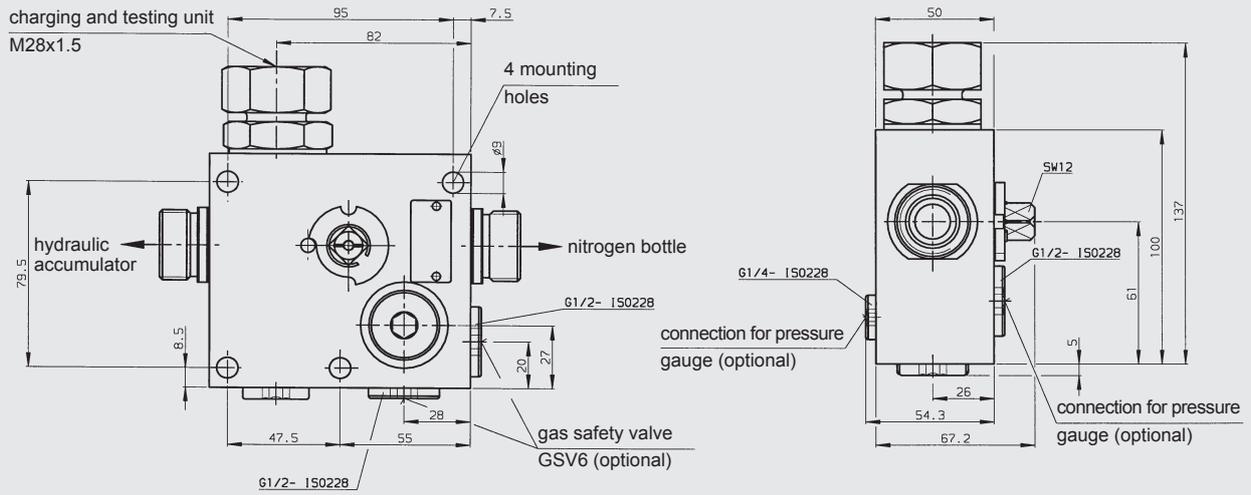
4.1.3 Preferred models / Spare parts

Designation	Max. operating pressure [bar]	Weight [kg]	Part no.	Seal kit ¹⁾
F+P-16-20SR-6112-02X	400	4.3	850233	2115776
F+P-32-38SR-6112-02X	350	14	552193	2112088

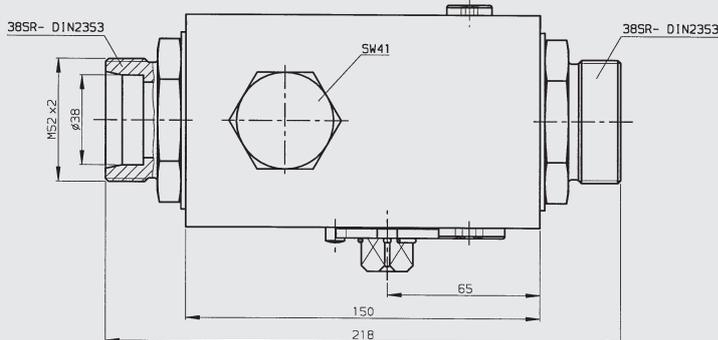
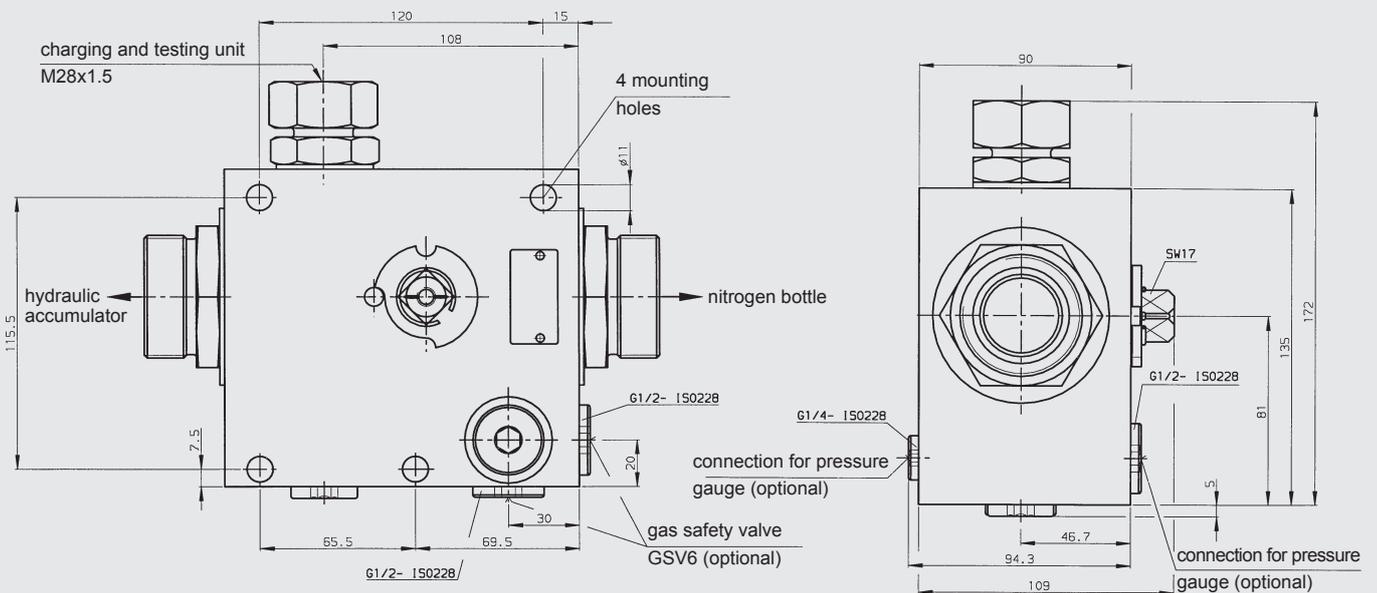
¹⁾ recommended spare parts



4.1.4 Technical specifications/dimensions
Charging and testing block DN 16

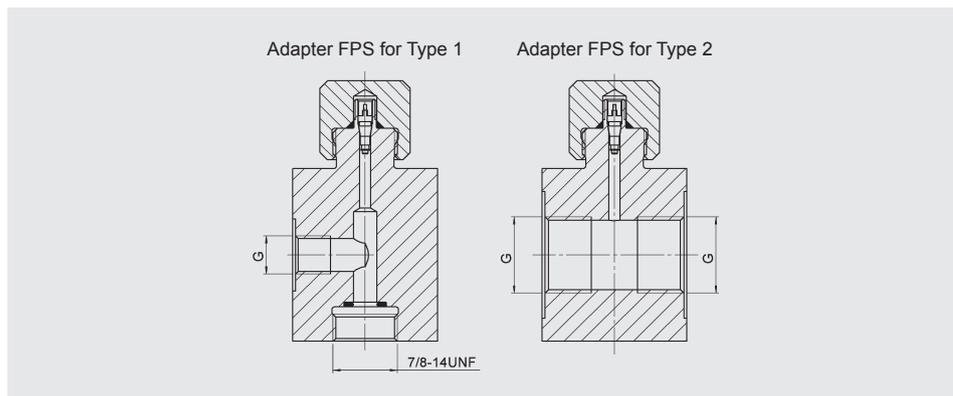


Charging and testing block DN 32



4.2. FPS ADAPTER

The HYDAC FPS adapter is used to charge back-up type hydraulic accumulators. For this it has a connection for the Charging and Testing Unit FPU-1.

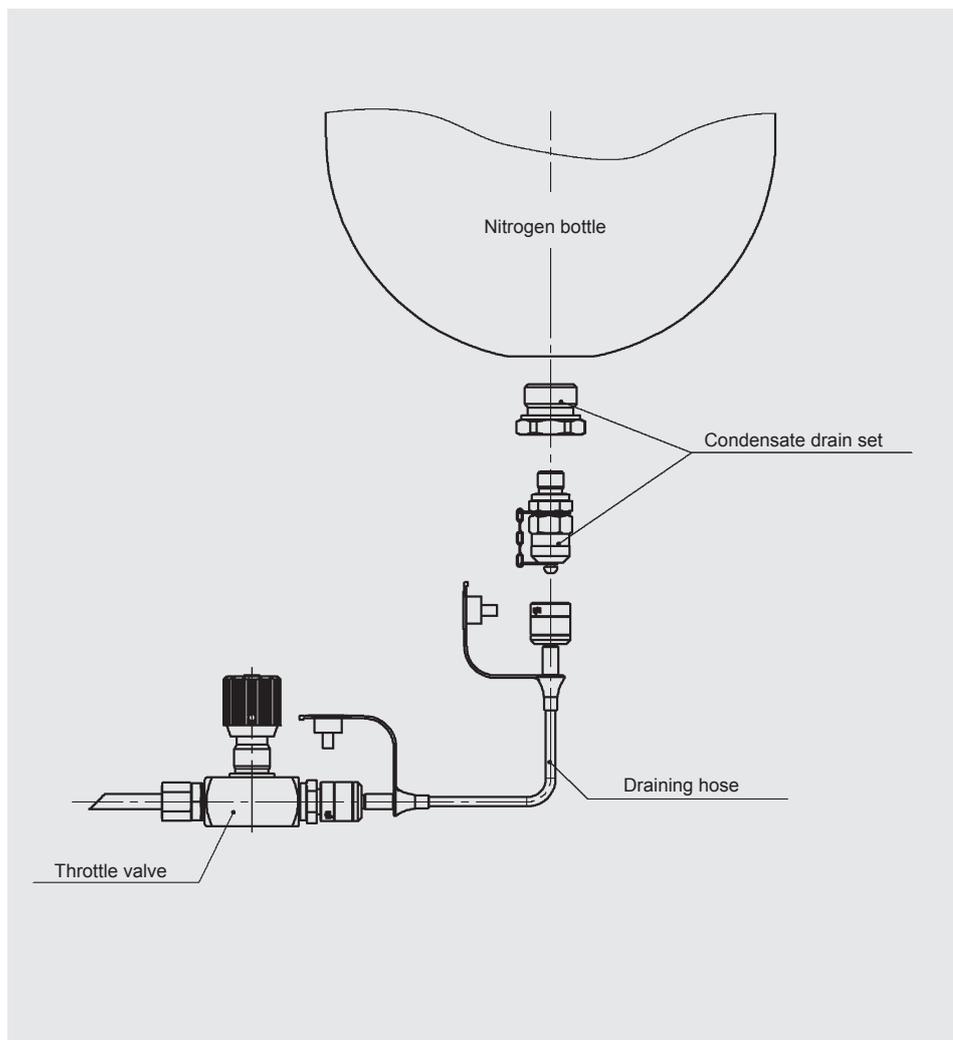


Description	G	Part no.	Type
Adapter FPS 7/8-14UNF	ISO228	363226	1
Adapter FPS	G 3/4	243218	2

4.3. CONDENSATE DRAIN SET

The condensate drain set consists of a throttle valve and a suitable condensate draining hose.

It is used to drain any condensate from the nitrogen bottle, in a controlled way.



Description	Length [m]	Part no.
Condensate drain G 3/4 – Minimes M16x1.5	–	3219496
Condensate drain set	0.4	3472820
	1	3472823
	1.6	3472824

4.3. NITROGEN CHARGING UNIT



HYDAC nitrogen charging units facilitate fast and cost-effective charging or testing of the required pre-charge pressures in bladder, diaphragm and piston accumulators. They guarantee optimum use of standard nitrogen bottles up to a residual pressure of 20 bar and a maximum accumulator charging pressure of 350 bar. Portable, mobile and stationary types of N₂-Server are available.

For further information and technical specifications, see catalogue section:

- Nitrogen charging units N₂-Server No. 2.201

5. NOTE

The information in this brochure relates to the operating conditions and applications described. For applications and operating conditions not described, please contact the relevant technical department. Subject to technical modifications.

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Universal Charging and Testing Unit FPU-1 for Bladder, Piston and Diaphragm Accumulators



1. DESCRIPTION

1.1. FUNCTION

The HYDAC charging and testing unit FPU-1 is used to charge accumulators with nitrogen or to check or to change the existing pre-charge pressure in accumulators.

For this purpose the charging and testing unit is screwed onto the gas valve of the hydraulic accumulator and connected via a hose to a commercial nitrogen bottle. If the nitrogen pressure is only to be checked or reduced, the charging hose does not need to be connected. The unit has a screw-type fitting with a built-in gauge, check valve and a spindle for opening the accumulator gas valve to control the pressure.

HYDAC piston and diaphragm accumulators can be charged and checked without the need for adapters. Bladder accumulators, however, require an A3 adapter.

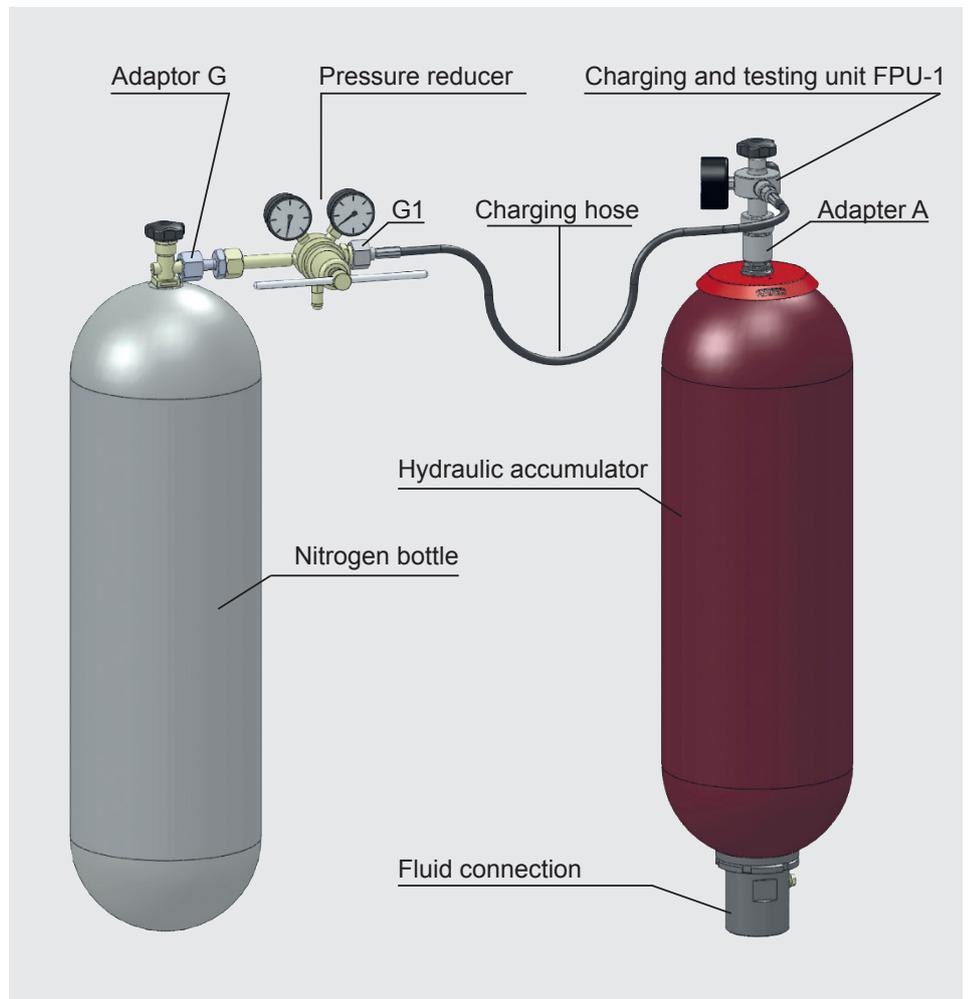
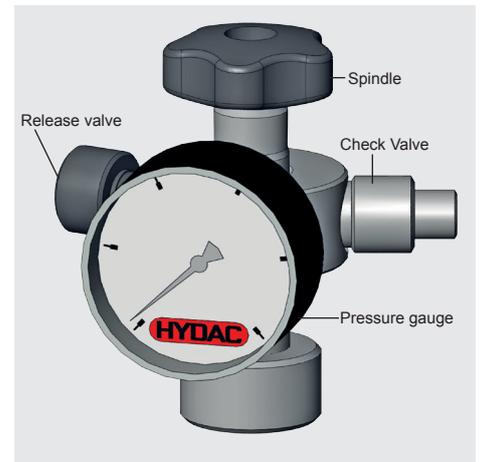
Information on how to check the pre-charge pressure, on testing intervals and other instructions relating to operation can be found in the Operating Manual.

**Please read the Operating Manual!
No. 3.501.CE**

1.2. DESIGN

The HYDAC charging and testing unit for bladder, piston and diaphragm accumulators consists of:

- Valve body
- Spindle
- Check valve
- Release valve
- Pressure gauge
- Charging hose
- A3 adapter for bladder accumulators



The photo top left shows one possible order option, including accessories.

2. TECHNICAL SPECIFICATIONS

2.1. MODEL CODE

(also order example)

FPU-1 - 250 F 2.5 G2 A1 K

Universal charging and testing unit

$p_{max} = 350 \text{ bar}$

Gauge indication range

0 - 10 bar	0 - 145 psi	10
0 - 25 bar	0 - 363 psi	25
0 - 100 bar	0 - 1450 psi	100
0 - 250 bar	0 - 3625 psi	250
0 - 400 bar	0 - 5800 psi	400

Charging hose

F = for 200 bar nitrogen bottle with connection W24.32x1/14 (DIN 477, Part 1)

FM = for 300 bar nitrogen bottle with connection M30x1.5 (DIN 477, Part 5 up to April 2002)

FW = for 300 bar nitrogen bottle with connection W30x2 (DIN 477, Part 5 from April 2002)

Length of charging hose

2.5 = 2.5 m

4.0 = 4 m

special lengths on request

Adapter G for nitrogen bottles

see table, Point 3.4.

Adapter A

A3 = 7/8-14UNF, supplied as standard for others, see table at Point 3.3.

Protective case

Accessories - please give full details when ordering (see Point 4.)

2.2. STANDARD TYPES

Models without protective case

Designation	Part no.
FPU-1-010F2.5A3	2114486
FPU-1-010F4A3	2115056
FPU-1-025F2.5A3	2114481
FPU-1-025F4A3	2116876
FPU-1-100F2.5A3	2114310
FPU-1-100F4A3	2115657
FPU-1-250F2.5A3	2114306
FPU-1-250F4A3	2114311
FPU-1-400F2.5A3	2115646
FPU-1-400F4A3	2119673

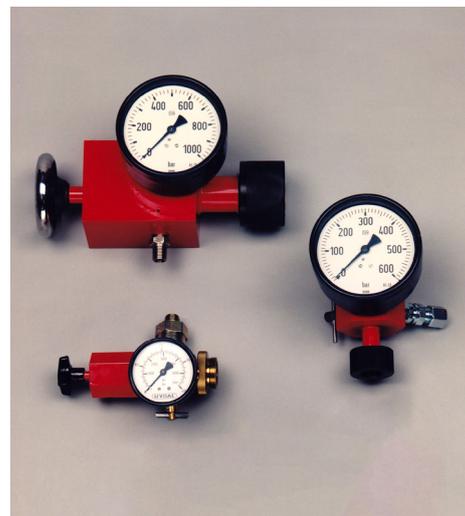
Models with protective case

Designation	Part no.
FPU-1-010F2.5A3K	2115365
FPU-1-010F4A3K	3013690
FPU-1-025F2.5A3K	2114305
FPU-1-025F4A3K	2116738
FPU-1-100F2.5A3K	2115314
FPU-1-100F4A3K	2114842
FPU-1-250F2.5A3K	2114302
FPU-1-250F4A3K	2114303
FPU-1-400F2.5A3K	2114307
FPU-1-400F4A3K	2114304

Models with protective case and adapter G

Designation	Part no.
FPU-1-250F2.5G2A3K	2114309
FPU-1-250F2.5G3A3K	2114308
FPU-1-250F2.5G4A3K	2103046
FPU-1-250F2.5G5A3K	2117038
FPU-1-250F2.5G6A3K	2115420
FPU-1-250F2.5G7A3K	2120010
FPU-1-250F2.5G8A3K	2115216
FPU-1-250F2.5G9A3K	2115833
FPU-1-250F2.5G10A3K	2115403
FPU-1-250F2.5G11A3K	3104265
FPU-1-250F2.5G12A3K	3738731
FPU-1-250F2.5G13A3K	3820014

2.3. SPECIAL MODELS

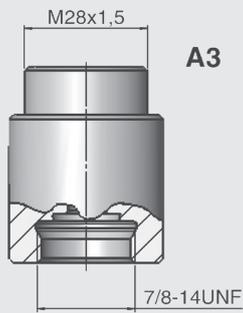
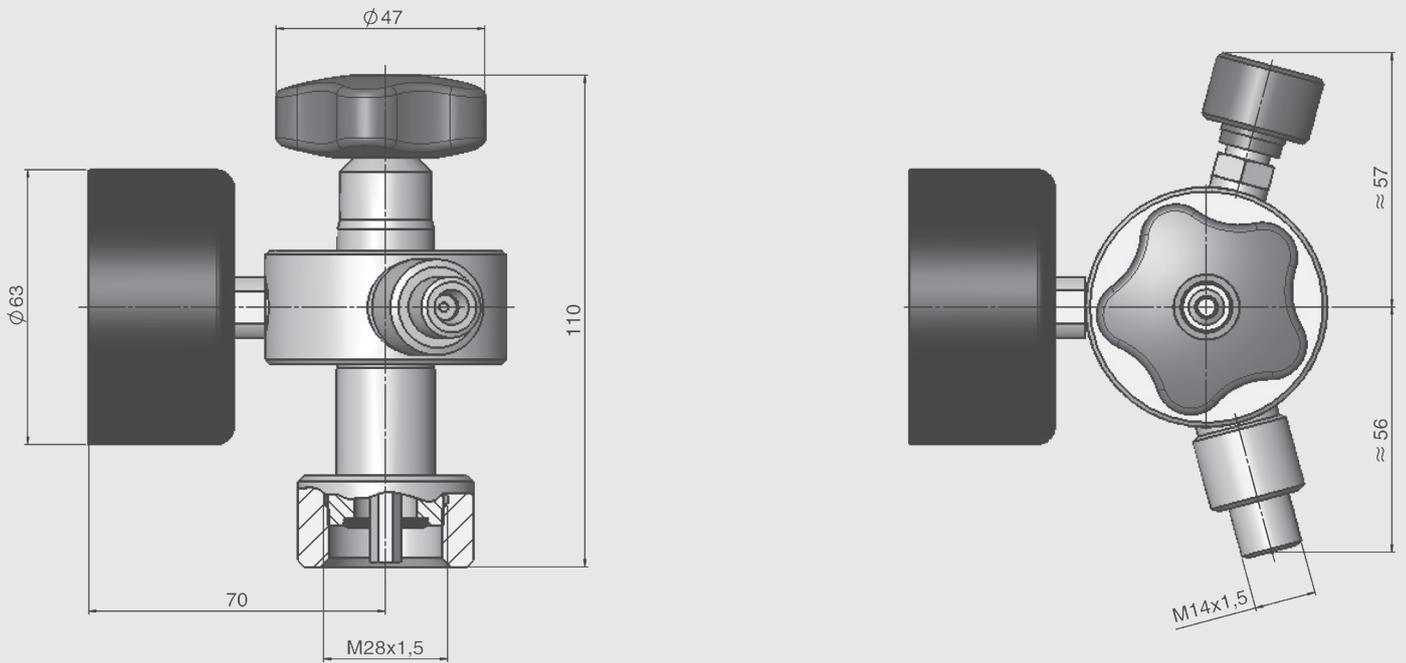


For higher pressures, the following special models are available:

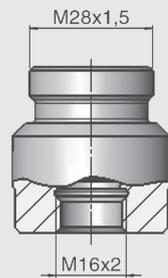
- FPS 600 for bladder accumulators up to 600 bar max. pre-charge pressure.
- FPK 600 for piston, diaphragm and SB800-1.5 accumulators up to 600 bar max. pre-charge pressure.
- FPH 800 for high pressure bladder accumulators up to 800 bar max. pre-charge pressure.

3. DIMENSIONS

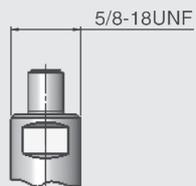
3.1. GAS-SIDE CONNECTION OF THE CHARGING AND TESTING UNIT FPU-1 USING ADAPTERS FOR HYDAC ACCUMULATORS



A11



D4 Adapter



7/8-18UNF

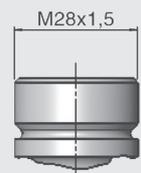


**Bladder accumulators
330-0.5 / 400-0.5**

**Bladder accumulators
 $\geq 1l$**



**Gas valve
to ISO 10945**



**Piston and
diaphragm
accumulators**

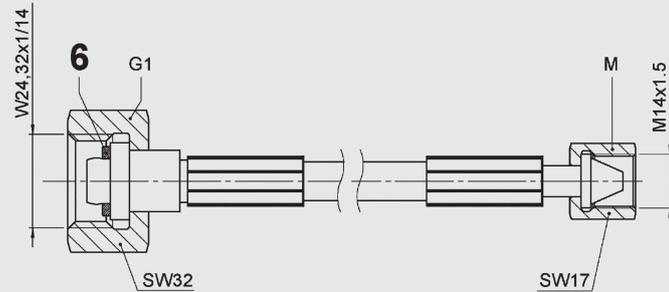
3.2. CHARGING HOSES

Charging hoses are designed for the particular maximum permitted operating pressure marked on them and 10,000 charging processes.
(HYDAC charging hoses comply with DIN EN ISO 4413 and DIN EN 853 to 857)

3.2.1 Charging hose for nitrogen bottles up to 200 bar

Charging hose **F**

Connection to DIN 477, Part 1

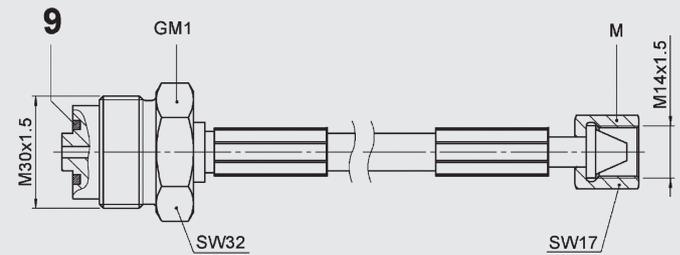


Type	Length [m]	Part no.
Charging hose F	2.5	236514
	4	236515
	10	373405
	15	2115552
	20	2109765
	28	2109574

3.2.2 Charging hose for nitrogen bottles up to 300 bar

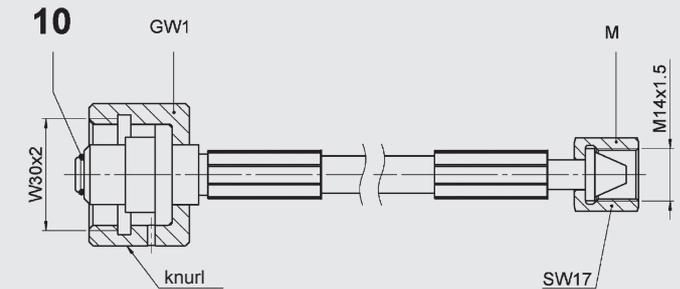
Charging hose **FM**

Connection to DIN 477, Part 5 up to April 2002



Charging hose **FW**

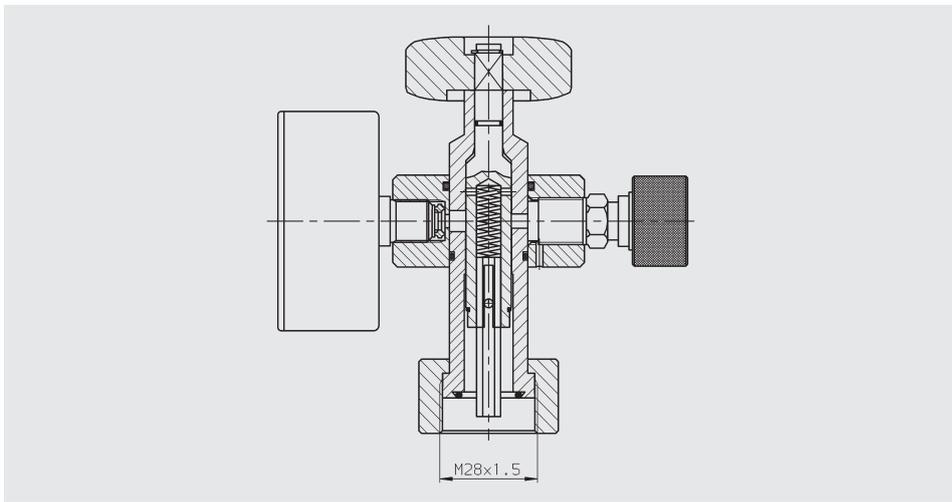
Connection to DIN 477, Part 5 from April 2002



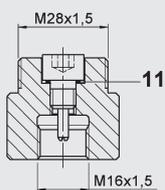
Type	Length [m]	Part no.
Charging hose FM	2.5	3019417
	4	3019418
Charging hose FW	2.5	3019419
	4	3019420

3.3. ADAPTERS A1 TO A12

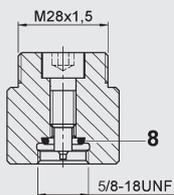
The universality of the FPU-1 is guaranteed because as well as HYDAC piston and diaphragm accumulators, bladder accumulators can also be charged and tested using the A3 adapter. Additional adapters can be used to charge and test other brands of accumulator.



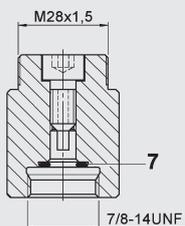
A1 (Part no. 361619)



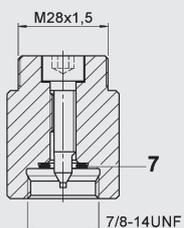
A2 (Part no. 361605)



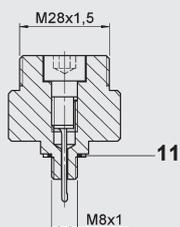
A3 (Part no. 291533)



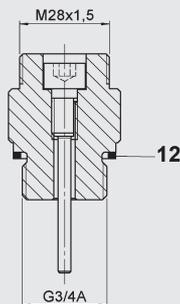
A4 (Part no. 291536)



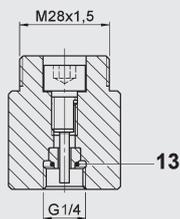
A5 (Part no. 291531)



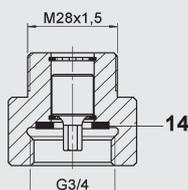
A6 (Part no. 2108819)



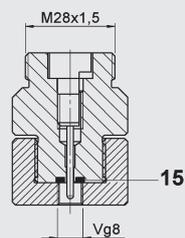
A7 (Part no. 2110629)



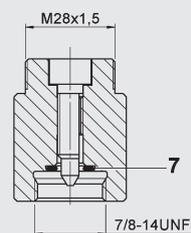
A8 (Part no. 2124524)



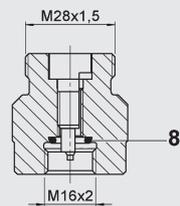
A9 (Part no. 2128638)



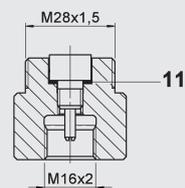
A10 (Part no. 2128849)



A11 (Part no. 3018210)

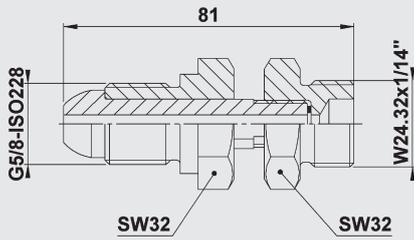


A12 (Part no. 3203185)

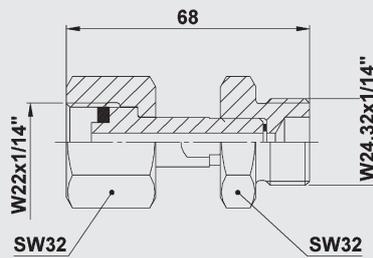


3.4. ADAPTERS G2 TO G12

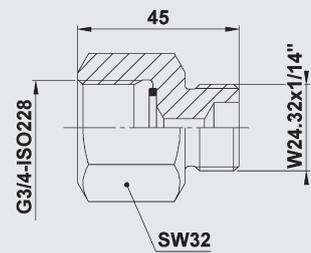
G 2 (Part no. 236376)



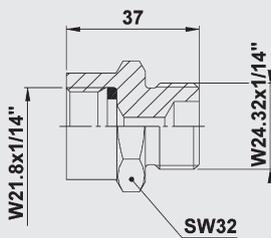
G 6 (Part no. 2103423)



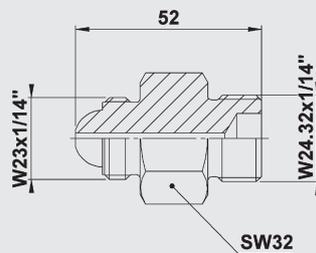
G 10 (Part no. 2103427)



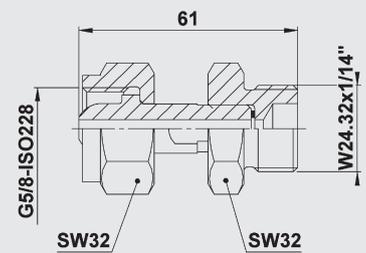
G 3 (Part no. 2103421)



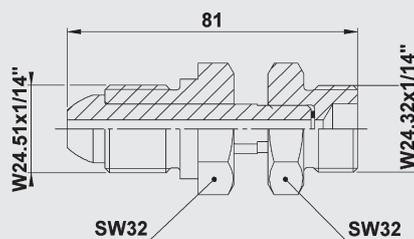
G 7 (Part no. 236377)



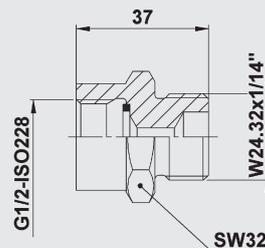
G 11 (Part no. 3018678)



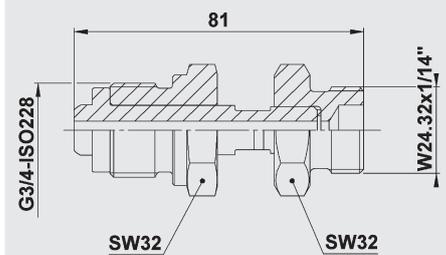
G 4 (Part no. 236374)



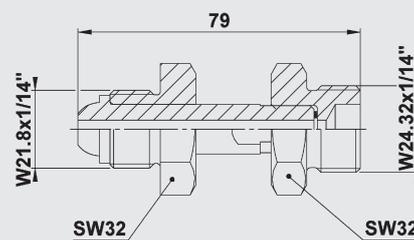
G 8 (Part no. 2103425)



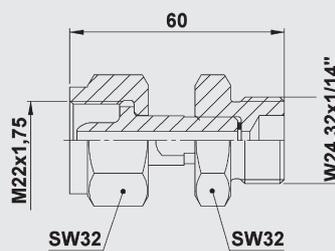
G 12 (Part no. 3195556)



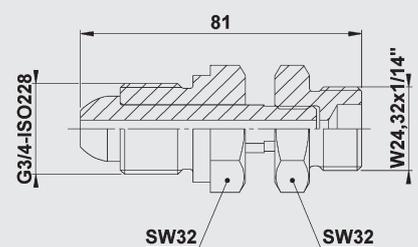
G 5 (Part no. 236373)



G 9 (Part no. 241168)



G 13 (Part no. 3787884)



3.4.1 Schedule of countries

G adapters for nitrogen bottles from different countries.

Country	Type / Part no.												
	G1 ¹⁾	G2 236376	G3 2103421	G4 236374	G5 236373	G6 2103423	G7 236377	G8 2103425	G9 241168	G10 2103427	G11 3018678	G12 3195556	G13 3787884
Africa ³⁾													
Albania													•
Algeria			•										
Argentina		•											
Australia												•	
Austria	•												
Bahamas		•											
Bahrain			•										
Bangladesh		•											
Barbados		•											
Belgium	•												
Bolivia								•					
Brazil				•									
Bulgaria			•										
Burma		•											
Canada				•									
Chile								•					
China											•		
Colombia								•					
Costa Rica		•											
Cyprus		•											
Czech Republic	•												
Denmark	•												
Djibouti			•										
Dominican Republic								•					
Ecuador								•					
Egypt			•										
Ethiopia		•											
Fiji		•											
Finland	•												
France			•										
Gabon			•										
Gambia		•											
Germany	•												
Ghana		•											
Great Britain		•											
Greece		•											
Guatemala								•					
Guinea			•										
Guyana								•					
Honduras								•					
Hong Kong		•											
Hungary			•										
India		•											
Indonesia		•											
Iran			•										
Iraq			•										
Ireland		•											
Israel			•										
Italy					•								
Ivory Coast			•										
Jamaica		•											
Japan						•							
Jordan			•										
Kenya		•											
Korea							•						
Kuwait			•										
Lebanon			•										
Libya			•										
Malawi		•											
Malaysia		•											
Malta		•											
Mauritius			•										
Mexico			•										
Morocco			•										
Netherlands	•												
New Zealand		•											
Nigeria			•										
Norway	•												
Oman			•										
Pakistan		•											
Paraguay								•					
Peru								•					
Philippines		•											
Poland	•												
Portugal		•											
Puerto Rico				•									
Qatar			•										
Romania			•										
Russia										•			
Saudi Arabia			•										
Singapore		•											
Spain		•											
Sri Lanka		•											
Sudan		•											
Surinam		•											
Swaziland		•											
Sweden	•												
Switzerland	•												
Syria			•										
Taiwan									•				
Tanzania		•											
Thailand		•											
Trinidad/Tobago										•			
Tunisia			•										
Turkey		•											
Ukraine										•			
United Arab Emirates			•										
Uruguay								•					
USA				•									
Venezuela										•			
Vietnam		•											
Yugoslavia ²⁾										•			
Zambia		•											

¹⁾ = already fitted to hose

²⁾ = Bosnia, Herzegovina, Croatia, Macedonia, Slovenia

³⁾ = Angola, Botswana, Lesotho, Mozambique, Namibia, Somalia, South Africa, Zimbabwe

4. ACCESSORIES

4.1. PROTECTIVE CASE

For storing the charging and testing unit and adapters.

Different types of case are available, depending on customer requirement.

FPU-1, standard model, without case: approx. 1.4 kg

FPU-1, standard model, with case: approx. 3 kg

4.2. GAS SAFETY VALVE

Provides protection by reducing the pressure in a controlled way if pressure exceeds the permitted level unexpectedly, see catalogue section:

- Safety Equipment for Hydraulic Accumulators No. 3.552

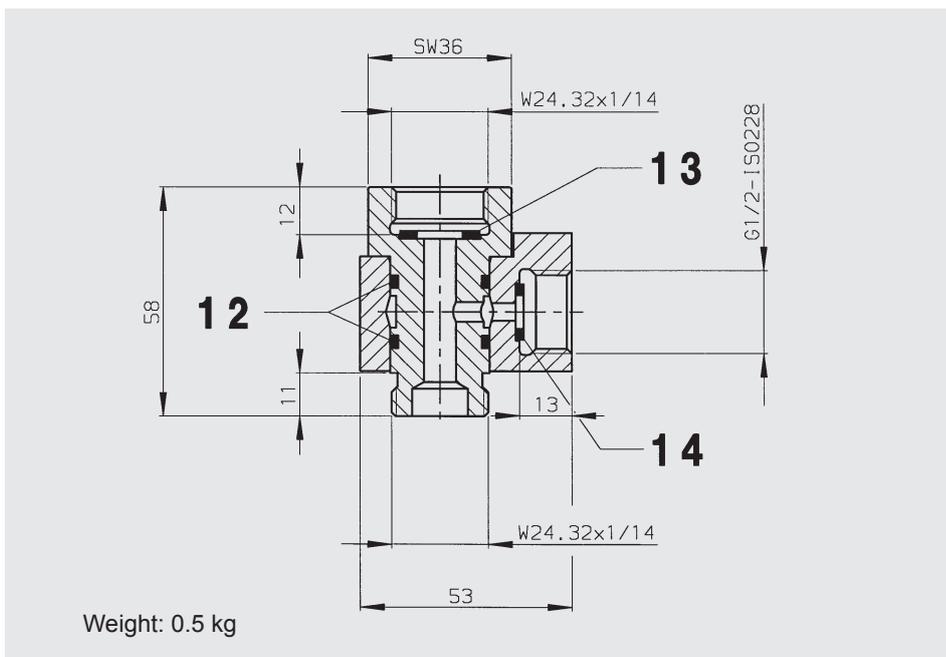
4.3. ADAPTER D4

For screw connector D on bladder accumulators < 1 l (see Point 3.)

D4 = 5/8-18UNF (Part no. 366374)

4.4. INTERMEDIATE PIECE GSV6-10-CE

Intermediate piece for installing the gas safety valve GSV 6 between the 200 bar nitrogen bottle and the Charging and Testing Unit FPU-1.



Description	Quantity	Item	Part no.
Intermediate piece GSV6-10-CE	-	-	242558
Seal kit for intermediate piece	-	-	2117287
consisting of:			
O-ring 20x2.5x2	2	12	-
Seal ring 20x11.5x2	1	13	-
Seal ring 14x8.5x2	1	14	-

4.5. PRESSURE REDUCER

For adjusting the required pre-charge pressure between the nitrogen bottle and the accumulator.

4.5.1 Pressure reducer for 200 bar nitrogen bottles

Inlet: connection W24.32x1/14-DIN477, Part 1

Outlet: male thread W24.32x1/14-DIN477, Part 1

Bottle pressure [bar]	Pressure after reducer [bar]	Part no.
200	20	635409
	100	635411
	200	635412

4.5.2 Pressure reducer for 300 bar nitrogen bottles

Inlet: connection W30x2-DIN477, Part 5

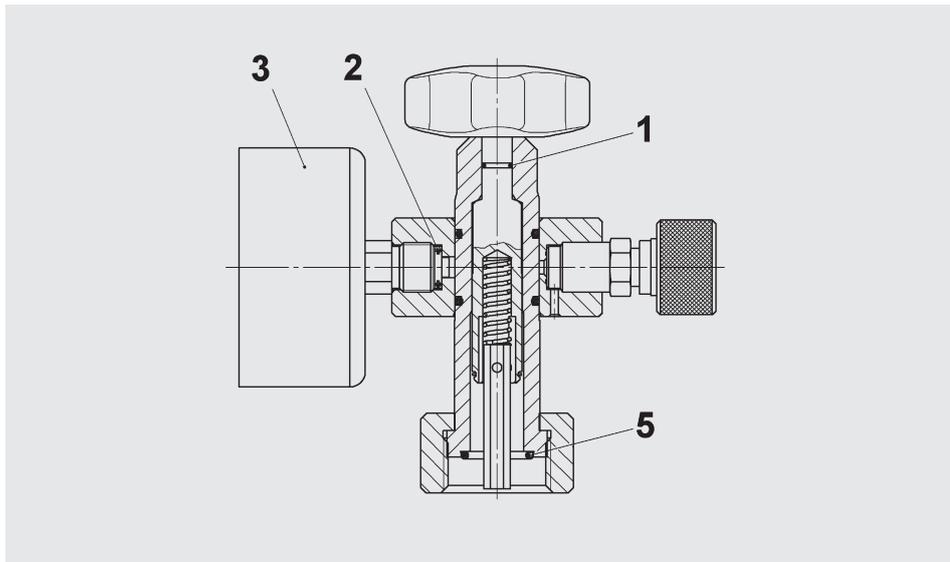
Outlet: male thread W24.32x1/14-DIN477, Part 5

Bottle pressure [bar]	Pressure after reducer [bar]	Part no.
300	20	6004020
	100	6004021
	200	6004022
	270*	6004023

* for pressures after reducer > 200 bar, the outlet has a male thread W30x2-DIN 477, Part 5

5. SPARE PARTS, ADAPTERS AND TOOLS

5.1. SPARE PARTS FOR FPU-1



Description	Quantity	Item	Part no.
Seal kit for FPU-1	1	-	2117669
consisting of:			
O-ring 6x1	1	1	-
Seal ring	1	2	-
O-ring 15x2	1	5	-
Seal ring	1	6	-
O-ring 11x2	1	7	-
O-ring 9x2	1	8	-
O-ring 11x2.5	1	9	-
O-ring 5.7x1.9	1	10	-
Pressure gauge			
0 - 10 bar			635139
0 - 25 bar			635140
0 - 100 bar	1	3	635141
0 - 250 bar			635142
0 - 400 bar			635143

5.2. ADAPTERS

Description	Quantity	Item	Part no.
Seal kit for adapters A1-12	1	-	3269153
consisting of:			
O-ring 11x2	3	7	-
O-ring 9x2	2	8	-
Seal ring 9.3x13.3x1	1	11	-
Seal ring 27x32x2	1	12	-
O-ring 6x1.2	1	13	-
O-ring 19x2	1	14	-
Seal ring for adapter A9	1	15	-
Seal ring 6x13x2	1	50*	-

* only suitable for adapters A7 up to May 2006

5.3. TOOLS

Description	Part no.
Wrench 14x15	1011065
Allen key SW6	1005164
Torque wrench	3136470
Valve tool for gas valve	616886

6. NOTE

The information in this brochure relates to the operating conditions and applications described.

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

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 E-Mail: speichertechnik@hydac.com

Safety and Shut-off Block SAF/DSV



1. DESCRIPTION

1.1. GENERAL

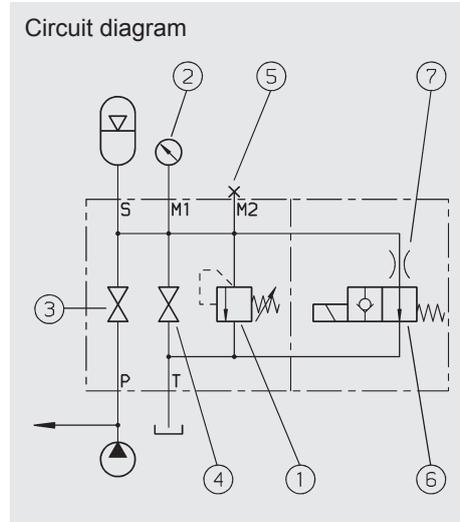
The HYDAC safety and shut-off block is used to shut off and discharge hydraulic accumulators.

It complies with the relevant safety standards in accordance with DIN ISO 4413 and the German Health & Safety at Work regulations, BetrSichV.

The Hydac pressure relief valve DB12 is used on the SAF series. This is a direct-operated pressure relief valve in poppet valve construction with excellent opening and closing properties. This version of the DB12 complies with the requirements of the Pressure Equipment Directive 97/23/EC with CE marking and is supplied with a declaration of conformity and an operating manual.

**Please read the Operating Manual!
No. 5.169.B**

1.1.1 Key to the circuit diagram



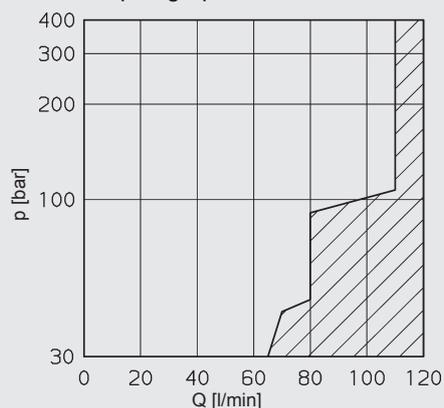
- ① Safety valve to prevent excessive pressure to PED 97/23/EC
 - ② Pressure gauge
 - ③ Shut-off valve
 - ④ Pressure release valve
 - ⑤ Connection for test gauge
- These devices are combined in a compact HYDAC safety and shut-off block. The following devices are also available:
- ⑥ Solenoid-operated pressure release valve
 - ⑦ Throttle

1.1.2 Product benefits

The compact combination of components considerably simplifies the connection of an accumulator or consumer to the hydraulic system and provides the following benefits:

- Minimum of space and maintenance and installation required. As all the individual units are combined in one block, considerably fewer pipe fittings are necessary for installation.
- Considerable reduction in installation time.
- All types of connections for various accumulator designs and manufacturers are available - imperial and metric connections as well as manifold mounted and weld nipple.
- Additional valves such as pilot-operated check valves, flow control valves and combined flow control and check valves can be fitted to the system connection P.

DB12-CE p-Q graph, see ① above



This valve cannot be set to values in the shaded area

1.2. DESIGN

The SAF safety and shut-off block consists of a valve block, an integrated HYDAC pressure relief valve, a main shut-off valve and a manually operated pressure release valve, and the necessary gauge connections are provided in addition to the tank connection.

In addition an optional solenoid-operated 2-way directional valve allows automatic discharge of the accumulator or consumer and therefore of the hydraulic system in an emergency or for shut-down.

1.3. PORTS

The safety and shut-off block has the following ports:

- S – Accumulator port
- P – Inline port connects SAF to the system (pump)
- T – Tank port
The connection to the tank must be piped separately. This will ensure that when the pressure relief valve DB12 opens, flow can drain unpressurised to tank.
- M1 – Test gauge port
G 1/2-ISO 228
(G 1/4 at SAF 10)
- M2 – Gauge connection
G 1/4-ISO 228

1.4. SPECIFICATIONS

1.4.1 Operating fluids

Mineral oil to DIN 51524
Part 1 and Part 2
(other fluids on request)

Viscosity range

min. 10 mm²/s
max. 380 mm²/s

Filtration

Max. permitted contamination level of the operating fluid to ISO 4406 Class 21/19/16 or SAE AS 4059 Class 11.

We therefore recommend a filter with a minimum retention rate of $\beta_{20} \geq 100$.

The fitting of filters and regular replacement of the filters guarantees correct operation, reduces wear and tear and extends the service life.

1.4.2 Permitted operating temperature

-10 °C ... +80 °C
(ambient temperature on E version limited to -10 °C ... +60 °C)

1.4.3 Max. operating pressure

400 bar

1.4.4 Model with solenoid-operated pressure release

Type

Solenoid-operated by means of pressure-tight, oil-immersed, single-stroke solenoids in accordance with VDE 0580. Actuating solenoid with male connector to DIN 43650, standard for general industrial applications, available for 24 V DC and 230 V AC.

Type of current

DC solenoid

When connected to AC voltage, the necessary DC voltage is produced by means of a bridge rectifier connector.

VOLTAGE TOLERANCE:

± 15 % of the nominal voltage

Nominal current

Dependent on the nominal voltage
24 V DC 0.80 A
230 V AC 0.11 A

Power consumption

$p_{20} = 18 \text{ W}$

DUTY: Continuous

Switching time

Depending on symbol, pressure across the individual ports and flow rate:

WSM06020Y:

on: 50 ms,

off: 35 ms

WSM06020Y:

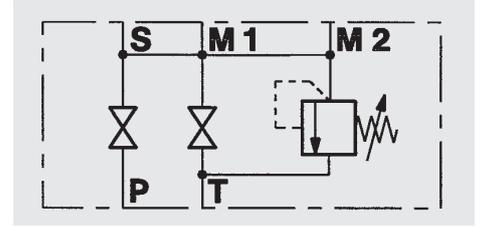
on: 35 ms,

off: 50 ms

1.5. STANDARD TYPES

1.5.1 Model with manually operated pressure release valve

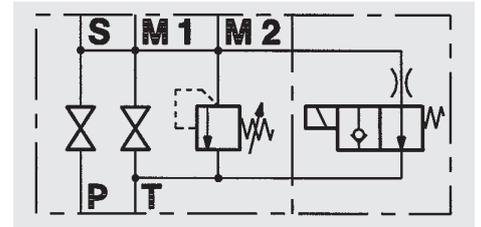
The basic model Safety and Shut-off Block has a manually operated pressure release valve, code "M", and a direct-acting pressure relief valve.



Sizes: SAF10M
SAF20M
SAF32M

1.5.2 Model with solenoid-operated pressure release

The E version of the safety and shut-off block has a solenoid-operated 2-way directional valve for automatic pressure release of the accumulator and the hydraulic system in an emergency or for shut-down.



Sizes: SAF10E
SAF20E
SAF32E

1.6. Δp -Q GRAPHS FOR SAF

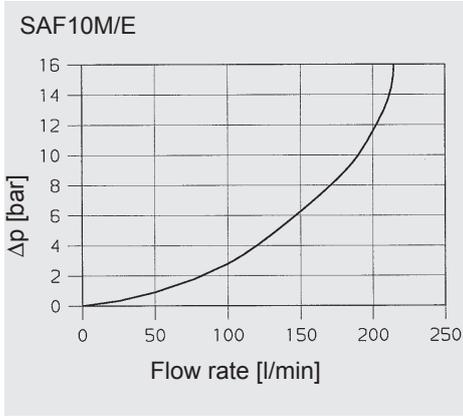
Measured at:

$v = 32 \text{ mm}^2/\text{s}$

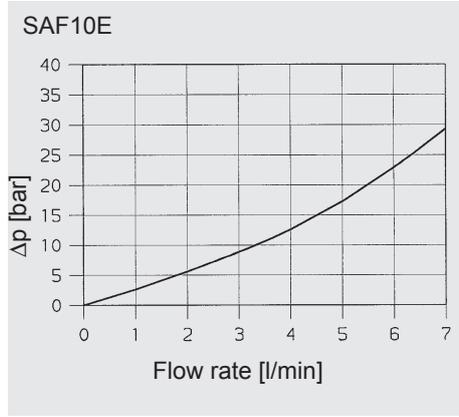
$t_{\text{oil}} = 40 \text{ }^\circ\text{C}$

Operating pressure = 400 bar
with DB12 pressure relief valve

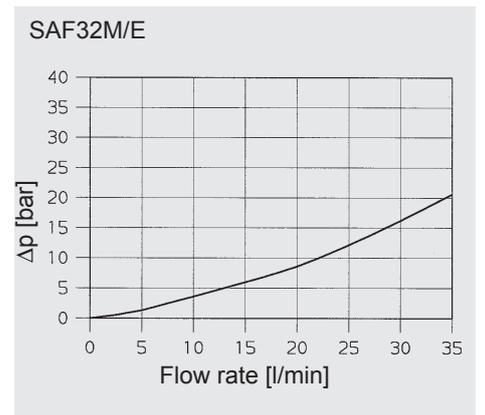
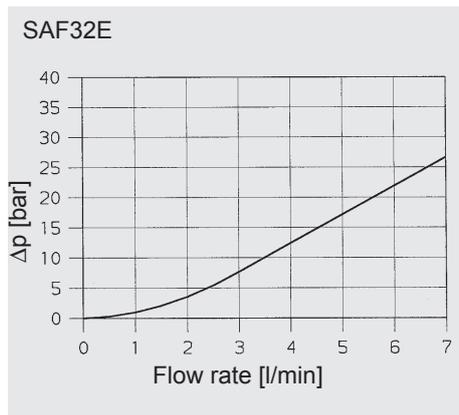
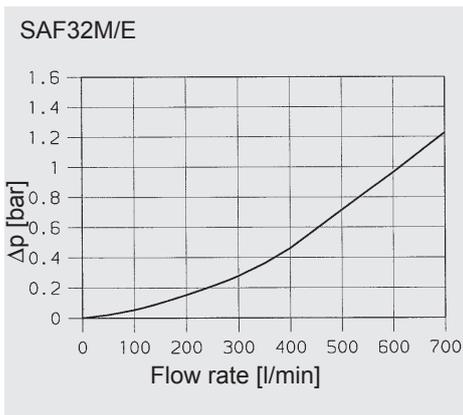
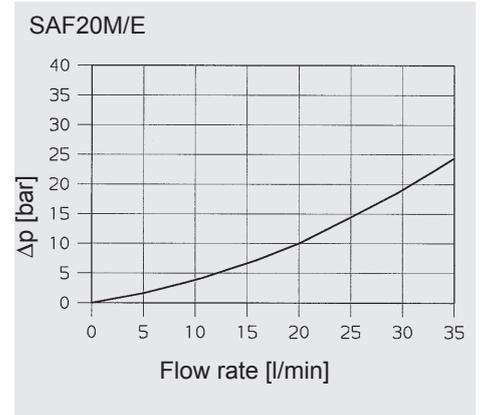
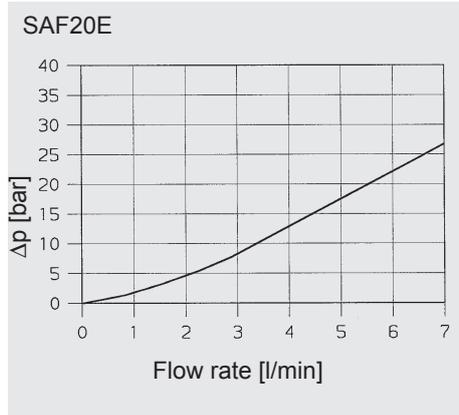
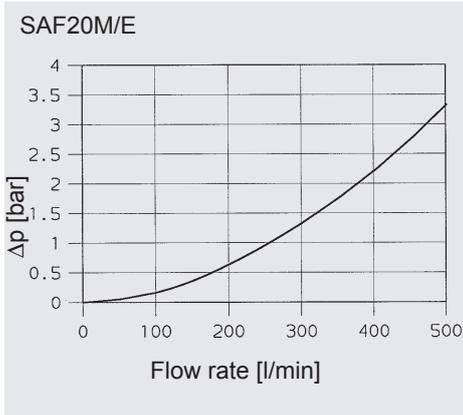
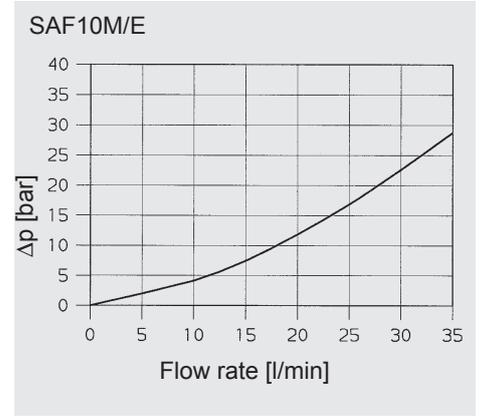
1.6.1 Flow from the pump to the accumulator



1.6.2 Flow from the accumulator via the solenoid-operated release valve to the tank



1.6.3 Flow from the accumulator via release valve to the tank



2. MODEL CODE FOR SAF

(also order example)

SAF 20 E 1 2 Y 1 T 210 A - S 13 - LPI

Safety and shut off block

Series SAF

Size of main shut-off valve

- 10 = DN10
- 20 = DN20
- 32 = DN32
- 32-3 = DN32 with 3 pressure relief valves NG12
- 50 = DN50

Type of discharge

- M = manual discharge
- E = solenoid-operated and manual discharge

Block material

- 1 = carbon steel
- other materials ¹⁾

Material of seals (elastomer)

- 2 = NBR (Perbunan)
- 5 = EPDM
- 6 = FKM (Viton®)
- 7 = others

Type of directional poppet valve

- Y = open when de-energised (2/2 directional valve WSM06020Y)
- Z = closed when de-energised (2/2 directional valve WSM06020Z, only up to 350 bar)

Type of voltage - directional poppet valve

- 1 = 24 VDC
- 2 = 115 VAC
- 3 = 230 VAC
- 6 = 120 VAC
- 7 = others

Pressure relief valve

- T... = pressure-set and lead-sealed by TÜV
- N... = pressure-set without TÜV ¹⁾

Pressure setting

e.g. 210 bar

Threaded connection to

- A = ISO 228 (BSP)
- B = DIN 13, to ISO 965/1 (metric) ¹⁾
- C = ANSI B1.1 (UNF, O-ring seal to SAE) ¹⁾

Adapter

to accumulator (see Point 7.)
e.g. S13 = ISO 228 - G 2A

Additional equipment (see Point 5.4.)

- L = lockable main shut-off valve (for use with locking device)
- LPI = model L with additional position monitoring (inductive proximity switch)
- LPM = model L with additional position monitoring (mechanical limit switch with roller lever)
- LS = lockable release valve

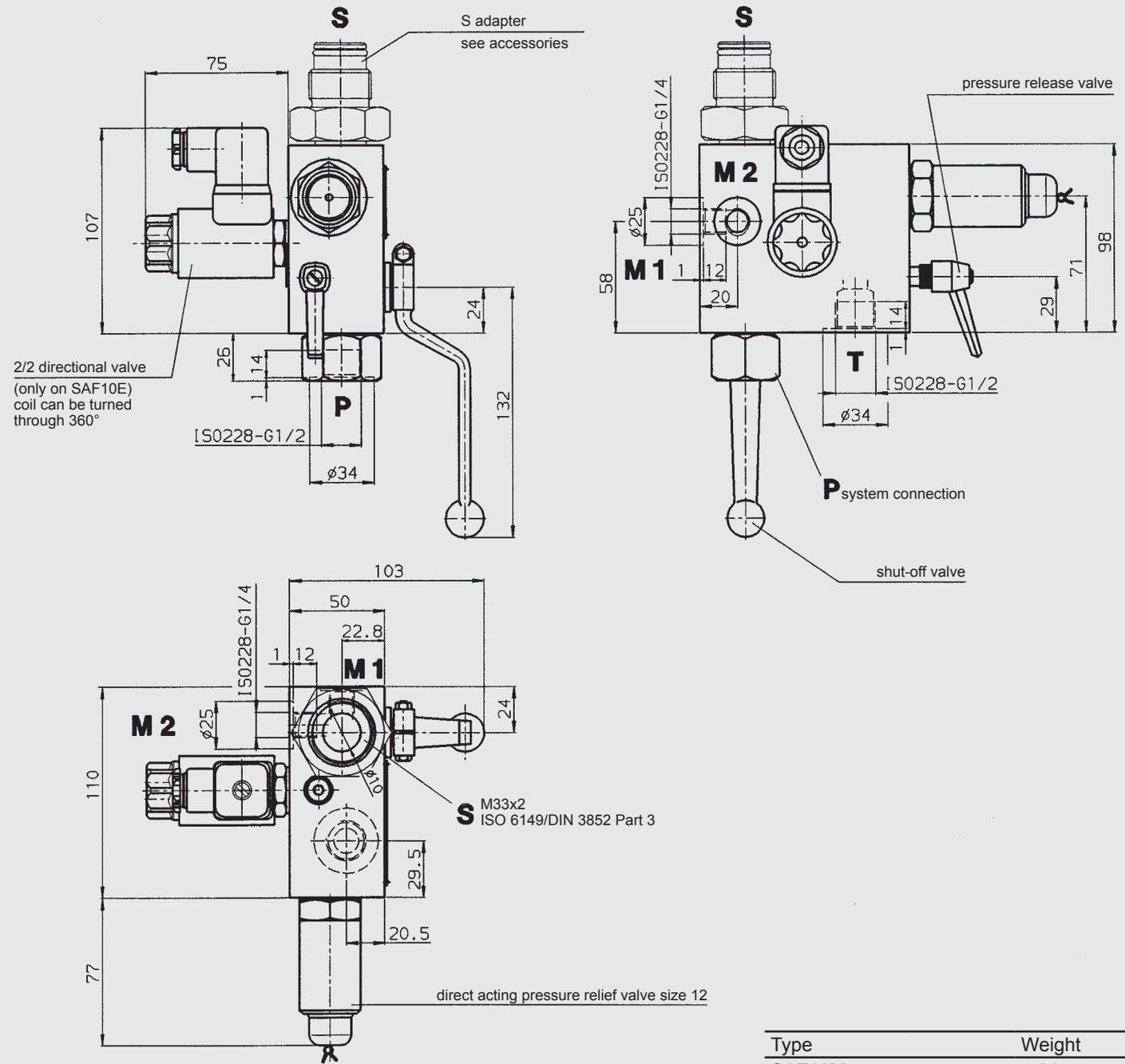
Accessories

(Please give full details when ordering: see Point 7. Accessories)

¹⁾ on request

3. DIMENSIONS

3.1. SAF10 SAFETY AND SHUT-OFF BLOCK SIZE 10

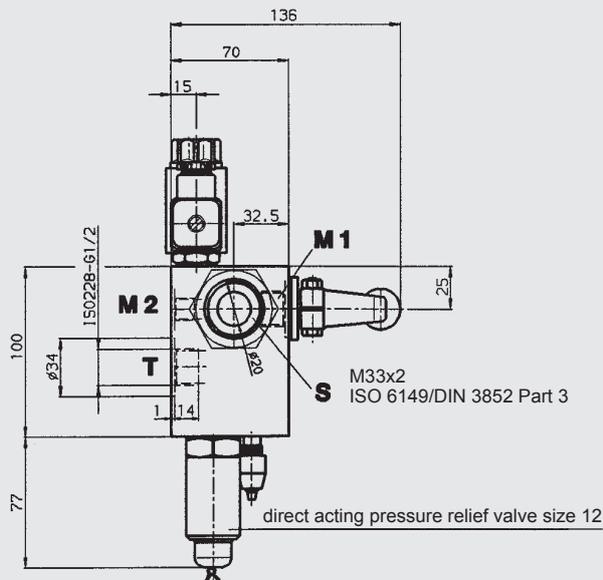
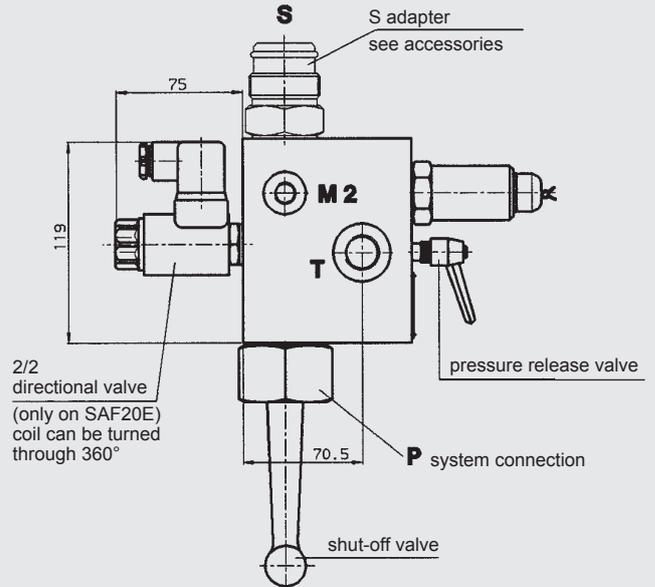
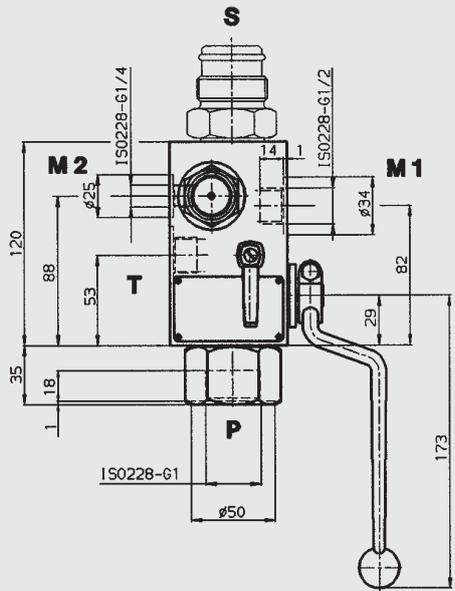


SAF10 Standard types

Type	Part no.	Type	Part no.
SAF10M12T400A	2121582	SAF10E12Y1T400A	2125858
SAF10M12T350A	2122208	SAF10E12Y1T350A	2122210
SAF10M12T330A	2121236*	SAF10E12Y1T330A	2122211*
SAF10M12T315A	2121121	SAF10E12Y1T315A	2122212
SAF10M12T300A	2121354	SAF10E12Y1T300A	2122213
SAF10M12T250A	2121353	SAF10E12Y1T250A	2122214
SAF10M12T210A	2121346	SAF10E12Y1T210A	2121662
SAF10M12T200A	2121351	SAF10E12Y1T200A	2122215
SAF10M12T150A	2121345	SAF10E12Y1T150A	2122216
SAF10M12T100A	2121344	SAF10E12Y1T100A	2122041
SAF10M12T070A	2121350	SAF10E12Y1T070A	2122217
SAF10M12T050A	2122207	SAF10E12Y1T050A	2122218
SAF10M12T035A	2121349	SAF10E12Y1T035A	2122219

* Preferred models

3.2. SAF20 SAFETY AND SHUT-OFF BLOCK SIZE 20



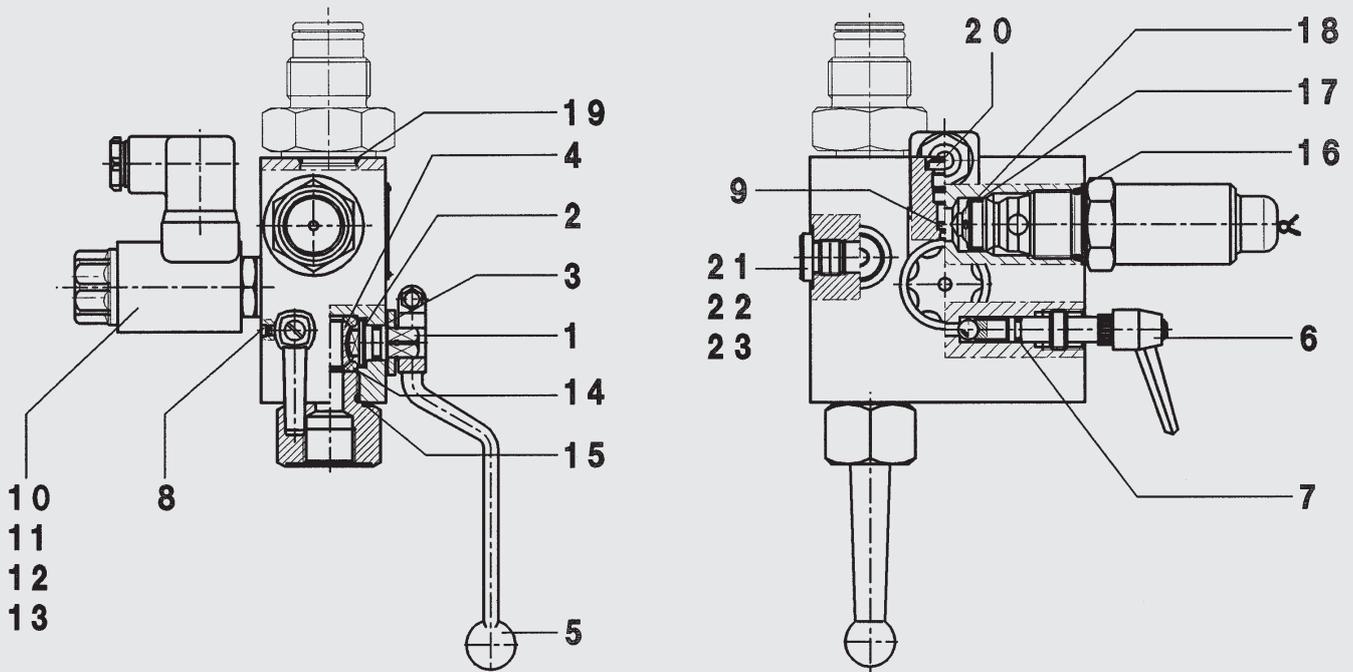
Type	Weight
SAF20M...	6.8 kg
SAF20E...	7.2 kg

SAF20 Standard types

Type	Part no.	Type	Part no.
SAF20M12T400A	2120317	SAF20E12Y1T400A	2121022
SAF20M12T350A	2120434	SAF20E12Y1T350A	2121979
SAF20M12T330A	2120323*	SAF20E12Y1T330A	2120394*
SAF20M12T315A	2120324	SAF20E12Y1T315A	2120833
SAF20M12T300A	2120332	SAF20E12Y1T300A	2120836
SAF20M12T250A	2120432	SAF20E12Y1T250A	2120851
SAF20M12T210A	2120319	SAF20E12Y1T210A	2120320
SAF20M12T200A	2120325	SAF20E12Y1T200A	2120835
SAF20M12T150A	2120330	SAF20E12Y1T150A	2120832
SAF20M12T100A	2120401	SAF20E12Y1T100A	2120369
SAF20M12T070A	2120326	SAF20E12Y1T070A	2120849
SAF20M12T050A	2122172	SAF20E12Y1T050A	2121000
SAF20M12T035A	2120281	SAF20E12Y1T035A	2122220

* Preferred models

4. SPARE PARTS

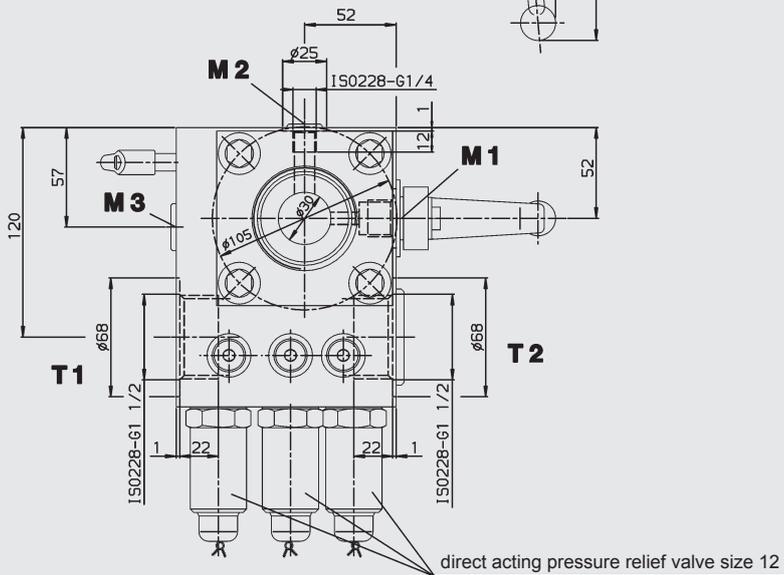
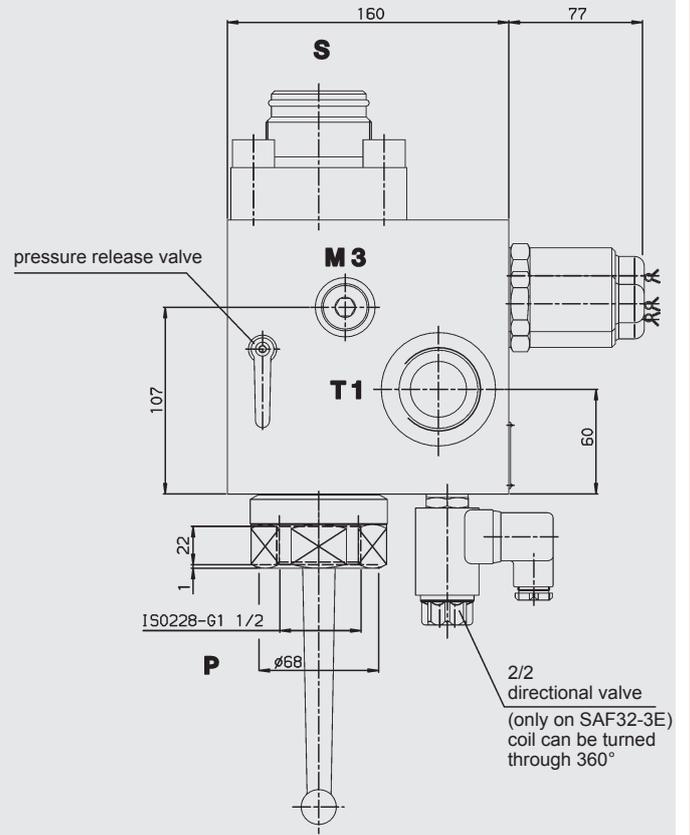
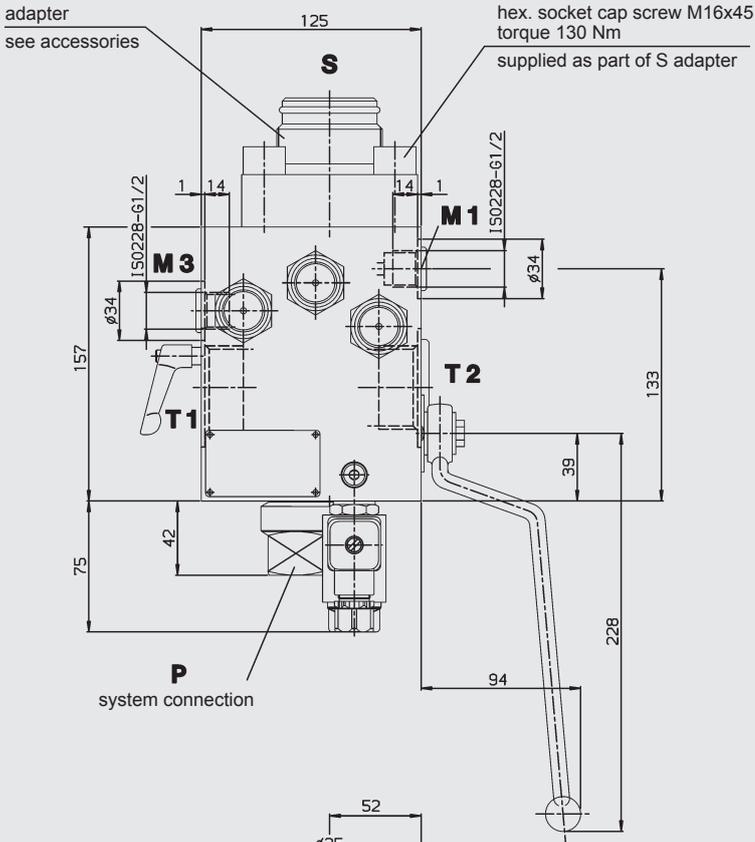


Type of safety and shut-off block	SAF10M, SAF10E	SAF20M, SAF20E	SAF32M, SAF32E
Description	Item	Dimensions or Part no.	
Repair kit consisting of:	2122238 (NBR) 2122240 (FPM)	2122242 (NBR) 2122244 (FPM)	2122246 (NBR) 2122248 (FPM)
Spindle	1		
Disc	2		
O-ring	3	10x2	15x2.5
Ball	4		
Switching handle	5		
Spindle	6		
O-ring	7	6x2	
Threaded pin	8	M4x6	M4x10
Orifice	9	Ø1.5 mm (Q _{max} - 25.5 l/min)	
O-ring	11	17x2	
Back-up ring	12	11.7x15x1	
O-ring	13	11x2	
Sealing cup	14		
O-ring	15	21x2	34x2.5
O-ring	16	23.47x2.62	
Back-up ring	17	18.3x21.5x1	
O-ring	18	18x2	
O-ring	19	29.7x2.8	29.7x2.8
Blanking plug	20	G 1/8	G 1/8
	21	G 1/4	G 1/4
	22	-	G 3/8
	23	-	G 1/2
2/2 directional valve assembly (only for E-version)	10	WSM06020Y - open when de-energised 3153871 (350 bar); 3156869 (400 bar) WSM06020Z - closed when de-energised 3153874 (350 bar); 3156873 (400 bar)	
Blanking plug assembly (converts "E" version to "M" version)		277645	
Seal kit consisting of: Items 3, 7, 8, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23		2121699 (NBR) 2121701 (FPM)	2121703 (NBR) 2121705 (FPM)
Spindle repair kit consisting of: Items 6, 7, 8		2115648 (NBR) 2115649 (FPM)	

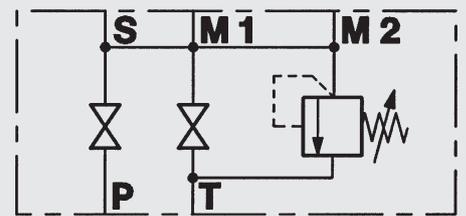
5. SPECIAL MODELS

5.1. TYPE SAF32-3M(E)

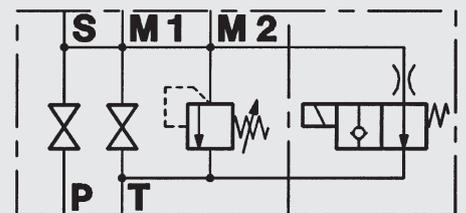
with 3 direct acting pressure relief valves size 12
(max. operating pressure 400 bar)



SAF32-3M



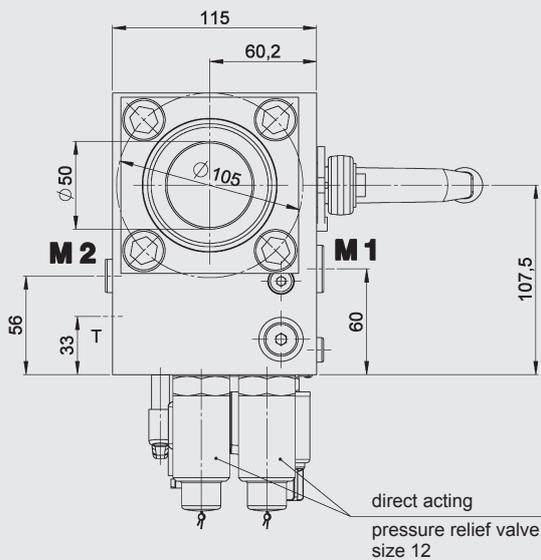
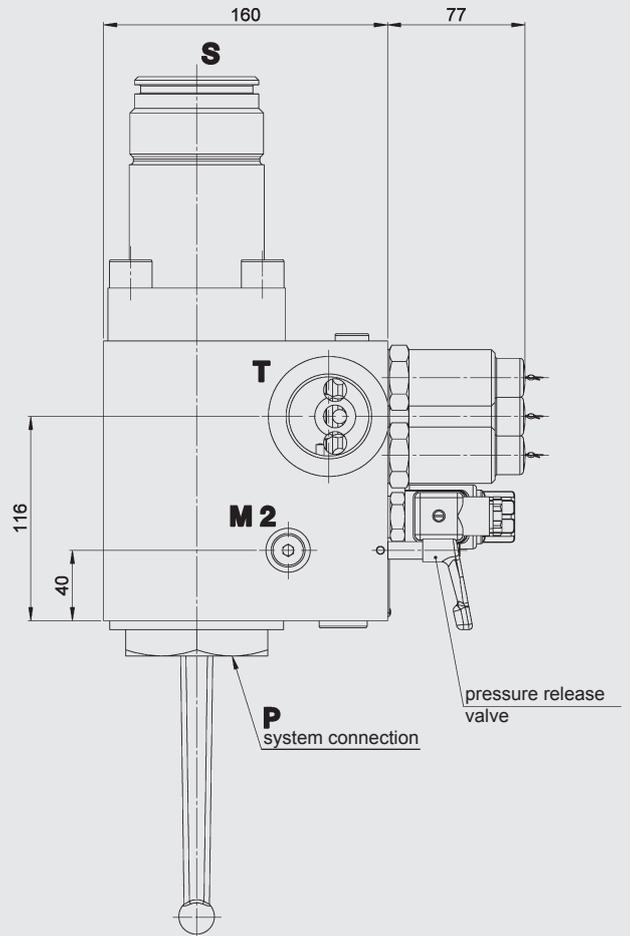
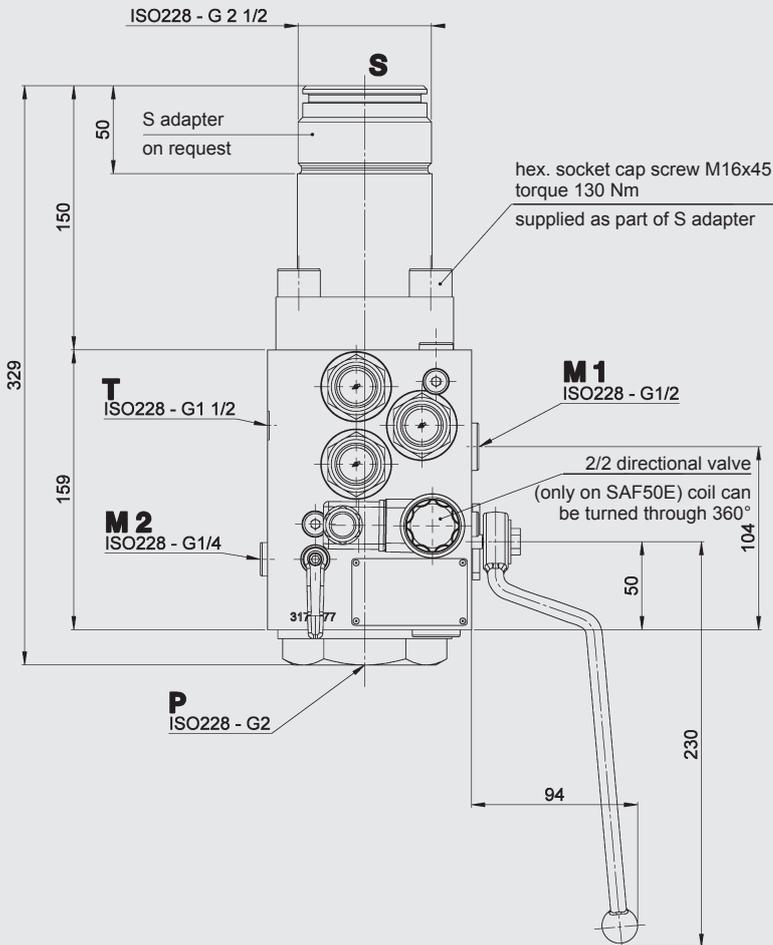
SAF32-3E



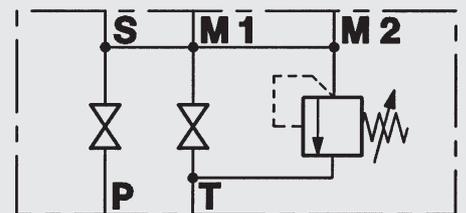
Type	Weight
SAF32-3M...	24 kg
SAF32-3E...	25 kg

5.2. TYPE SAF50M(E)

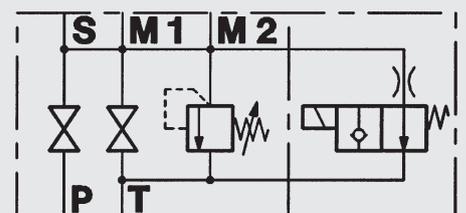
for large flows
with 3 direct acting pressure relief valves size 12
(max. operating pressure 400 bar)



SAF50M



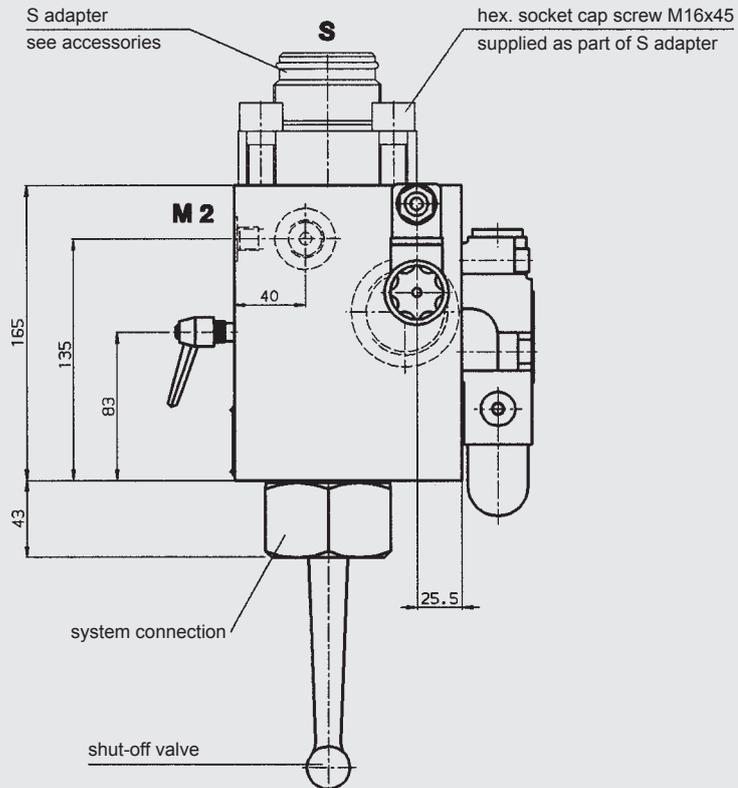
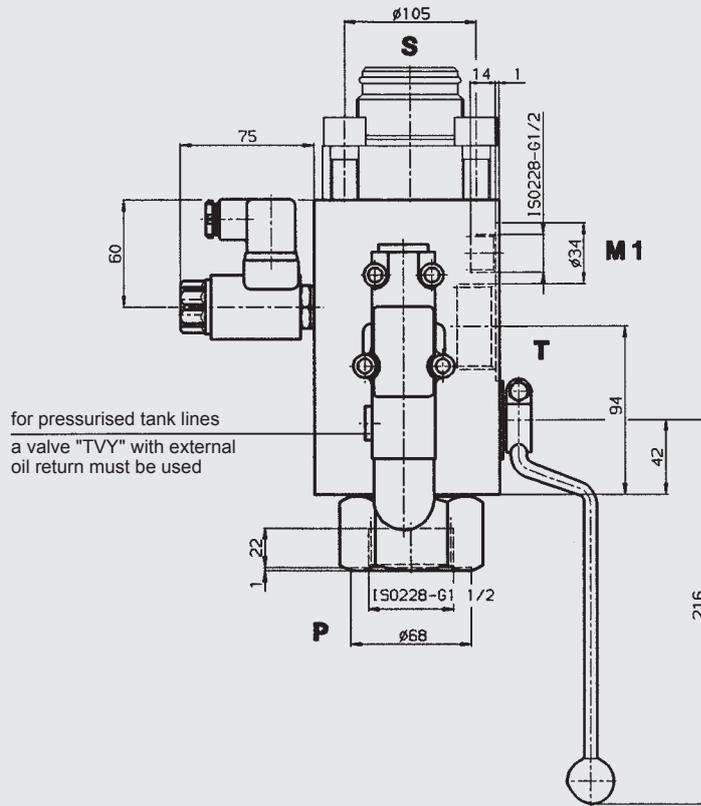
SAF50E

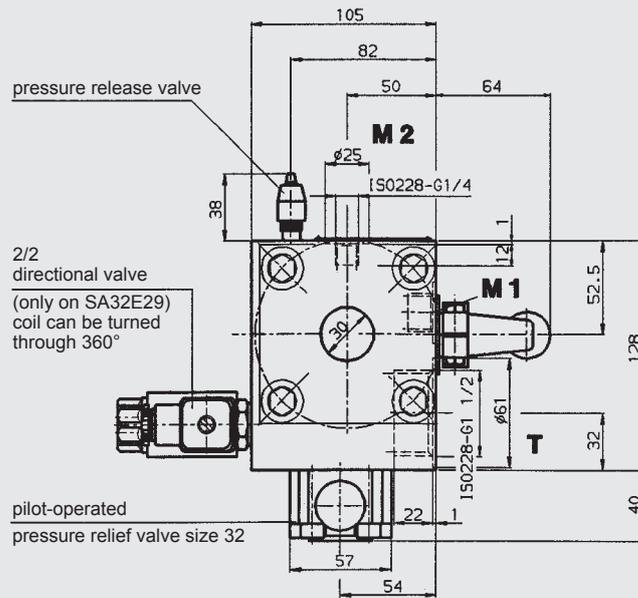


Type	Weight
SAF50M...	25 kg
SAF50E...	26 kg

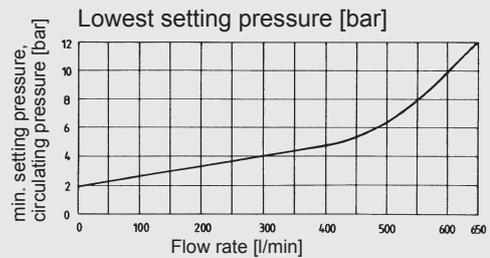
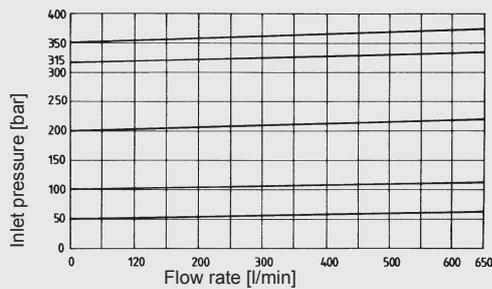
5.3. TYPE SA32M(E)29

with pilot-operated pressure relief valve ($Q_{max} = 600 \text{ l/min}$)
 (max. operating pressure 330 bar)

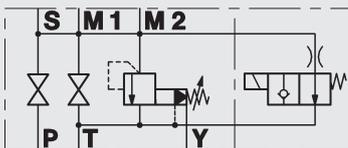




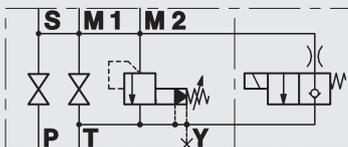
Pilot-operated pressure relief valve size 32



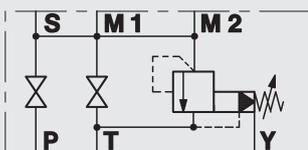
SA32E29TVY



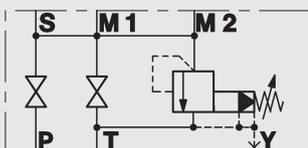
SA32E29TV



SA32M29TVY



SA32M29TV



The safety and shut-off block SA32M(E)29 is equipped with a pilot-operated pressure relief valve size 32 for high flow rates up to 600 l/min.

The E version of the safety and shut-off block has a solenoid-operated 2-way directional valve for automatic pressure release of the accumulator and the hydraulic system in an emergency or for shut-down.

For unpressurized tank lines, valve type "TV" must be used (with internal oil return to tank).

For pressurized tank lines, valve type "TVY" is recommended (with external oil return to tank).

Two different models of the 2-way directional valve are available:

- WSM06020Y (open when de-energised)
- WSM06020Z (closed when de-energised)

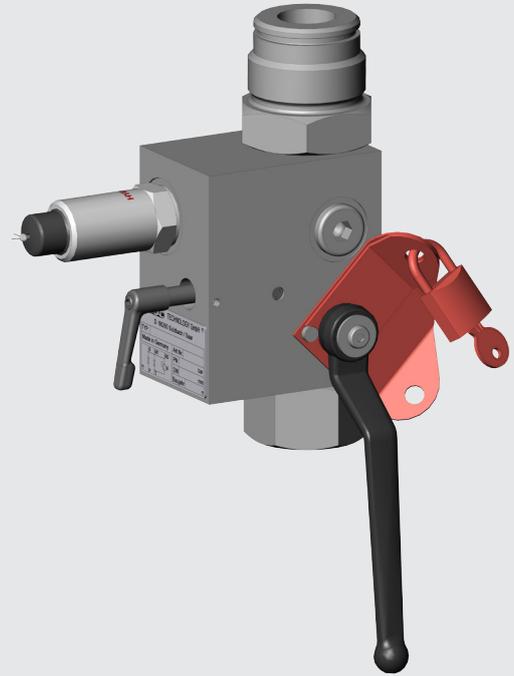
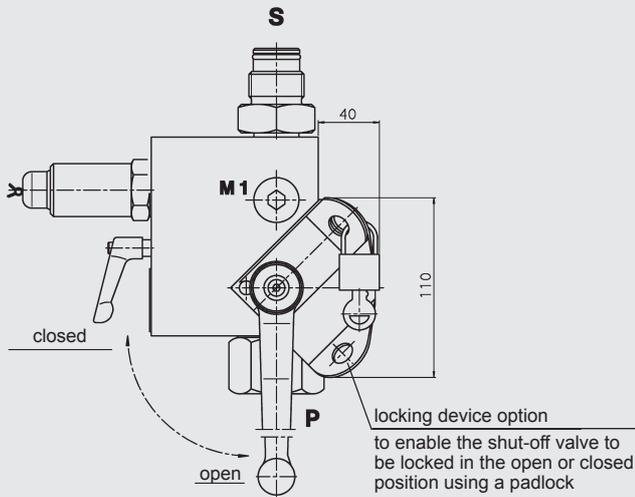
Type	Weight
SA32M29...	22.5 kg
SA32E29...	23.5 kg

5.4. SAFETY AND SHUT-OFF BLOCK WITH ADDITIONAL EQUIPMENT

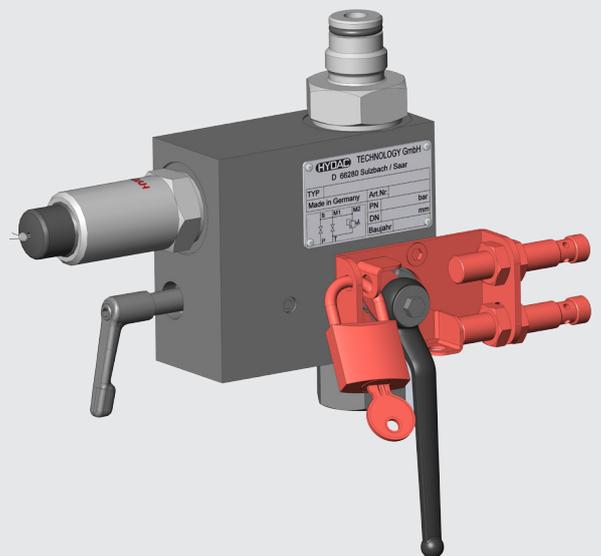
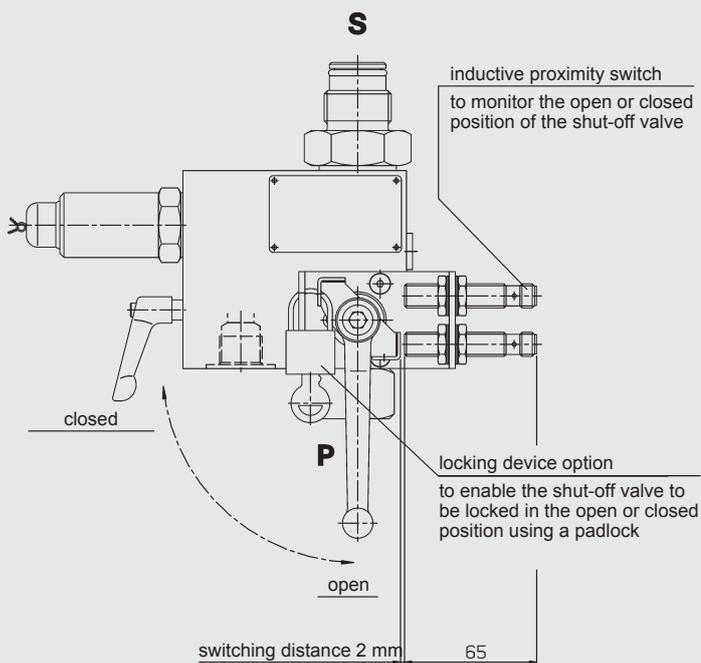
Safety and shut-off blocks can be supplied with different options for locking the shut-off valve in position (see Point 2 Type code for SAF) and to lock the release valve (see Point 7. Accessories).

The following overview shows the individual models:

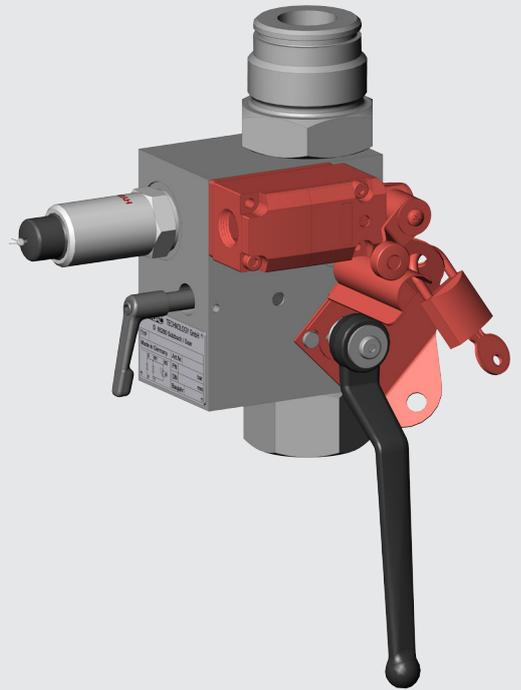
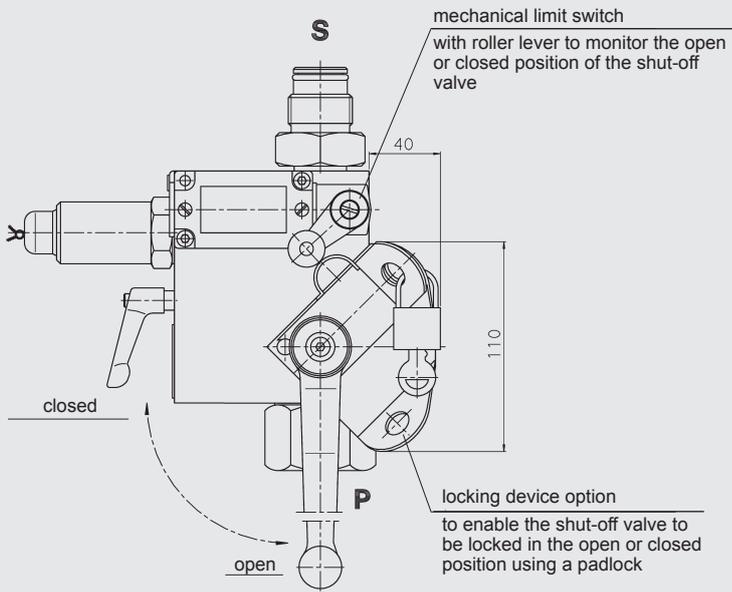
Additional equipment L



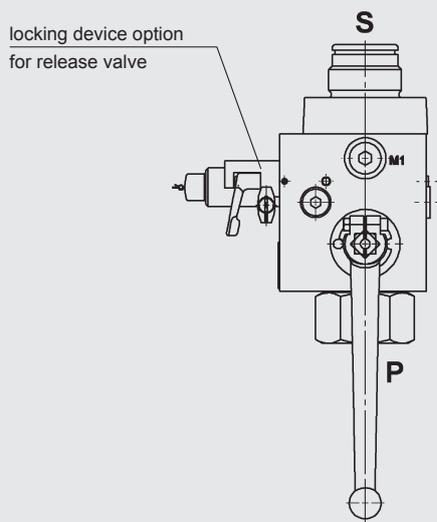
Additional equipment LPI



Additional equipment LPM



Additional equipment LS



5.5. SAFETY AND SHUT-OFF BLOCK FOR FRONT PANEL MOUNTING

The safety and shut-off block consists of a valve block, a built-in pressure relief valve, a main shut-off valve and a manually operated pressure release valve.

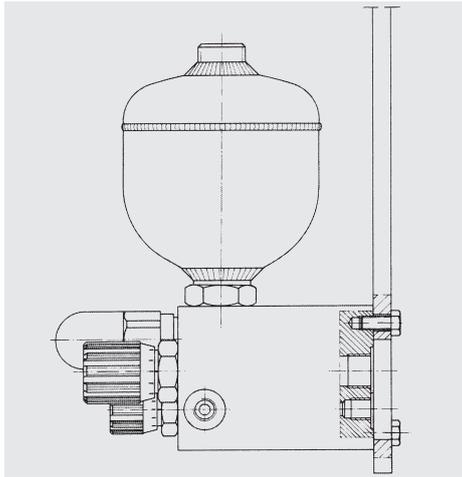
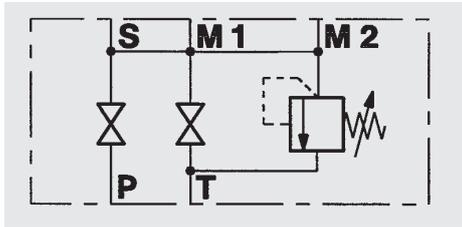
This block is mounted on a front panel with 3 M8 screws. Ports "P" and "T" are located on the mounting side.

Advantages:

The compact design means that the block occupies a minimum of space and ensures minimum maintenance.

Specifications

Type:	SA6M10T...
Size:	DN10
Max. operating pressure:	350 bar
Direct acting pressure relief valve	NG6



5.6. SAFETY AND SHUT-OFF BLOCK WITH 2-WAY CARTRIDGE VALVE (LOGIC ELEMENT)

This safety and shut-off block consists of a valve block, an integrated pressure relief valve and a solenoid-operated 2-way cartridge valve which replaces the main shut-off valve.

Advantages:

In addition to its compact construction, this model is capable of rapid switching to control the oil flow.

5.6.1 Function when using 4/2 directional valve

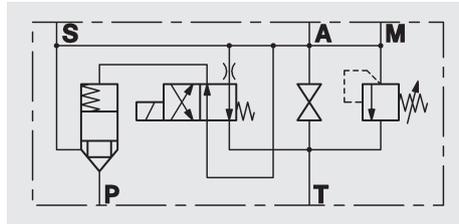
When the 4/2 directional valve is in the switching position shown (open when de-energised), the spring chamber of the logic element is pressurised via the accumulator pressure; the path from P to S is blocked and the hydraulic accumulator is automatically shut off from the system. By connecting the accumulator via the slip-in orifice in the pilot valve to the tank, it will slowly discharge.

When the 4/2 directional poppet valve is in the discharge position (energised) the spring chamber of the logic element is discharged, the path from P to S is open and the accumulator is charged.

Technical specifications:

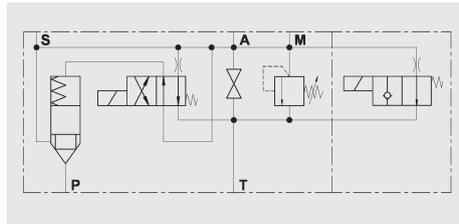
Type	Size	Max. operating pressure	Pressure relief valve ¹⁾
SA20A50T...	DN20	400 bar	NG12 (2)
SA32A50T...	DN30	400 bar	NG12 (3)
SA40A50T...	DN40	400 bar	NG12 (3)

¹⁾ number of pressure relief valves



Type	Size	Max. operating pressure	Pressure relief valve ¹⁾
SA20E50T...	DN20	400 bar	NG12 (2)
SA32E50T...	DN30	400 bar	NG12 (3)
SA40E50T...	DN40	400 bar	NG12 (3)

¹⁾ number of pressure relief valves



5.6.2 Function when using 3/2 directional poppet valve

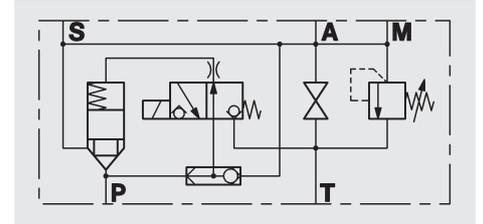
When the 3/2 directional poppet valve is in the switching position shown (open when de-energised), the spring chamber of the logic element is pressurised via the system pressure; the path from P to S is blocked and the accumulator is shut off from the system. When the 3/2 directional poppet valve is in the discharge position (energised) the spring chamber of the logic element is discharged, the path from P to S is open and the accumulator is charged.

If the pump breaks down or if it is switched off, the 3/2 directional poppet valve reverts to the "open when de-energised" position; the accumulator pressure shuts off the logic element via the shuttle change-over valve and shuts off the accumulator from the system.

Technical specifications:

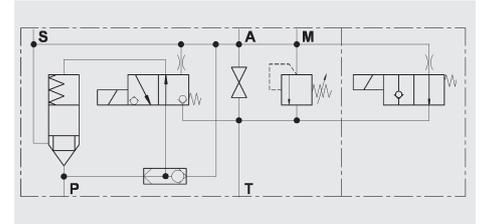
Type	Size	Max. operating pressure	Pressure relief valve ¹⁾
SA20A51T...	DN20	400 bar	NG12 (2)
SA32A51T...	DN30	400 bar	NG12 (3)
SA40A51T...	DN40	400 bar	NG12 (3)

¹⁾ number of pressure relief valves



Type	Size	Max. operating pressure	Pressure relief valve ¹⁾
SA20E51T...	DN20	400 bar	NG12 (2)
SA32E51T...	DN30	400 bar	NG12 (3)
SA40E51T...	DN40	400 bar	NG12 (3)

¹⁾ number of pressure relief valves



6. DESCRIPTION OF DSV10

6.1. GENERAL

DSV10 as a "Low Cost Alternative" to SAF10

The three-way safety block DSV10 is used to isolate and discharge hydraulic accumulators and consumers. It complies with relevant safety standards in accordance with DIN EN 4413 and the German Health & Safety at Work regulations, BetrSichV.

The HYDAC pressure relief valve DB12 is used with the DSV series. This is a direct-operated pressure relief valve in poppet valve construction with excellent opening and closing characteristics.

This version of the DB12 complies with the requirements of the Pressure Equipment Directive 97/23/EC with CE marking. There are four different models:

- DSV10M, manual discharge, standard L-ball
- DSV10M-T-ball, manual discharge, t-ball
- DSV10EY, manual/solenoid-operated discharge, open when de-energised
- DSV10EZ, manual/solenoid-operated discharge, closed when de-energised

The essential difference compared to the SAF10 lies in the shut-off and discharge function of the DSV10. On request we can supply other models to cover almost all applications, e.g. for aggressive media.

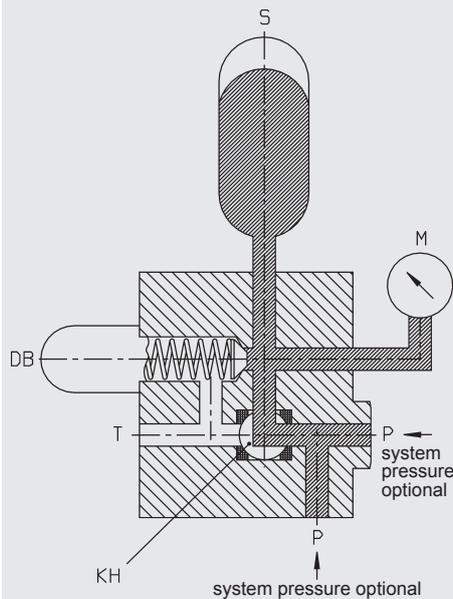
On request we can supply test certificates to EN 10204 and quality test certificates to DIN 55350, Part 18.

6.2. DESIGN

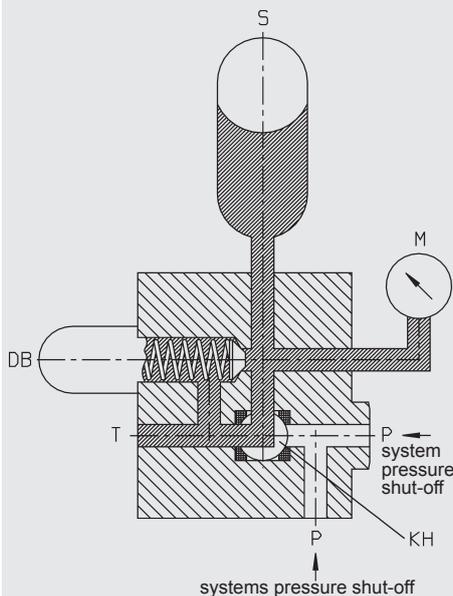
The DSV three-way safety block consists of a valve block with an integrated pressure relief valve and the shut-off valve. It has ports for the pump, pressure gauge, tank and accumulator.

In addition, an optional solenoid-operated 2-way directional valve allows automatic discharge of the accumulator or consumer.

Accumulator operation



Shutting off the system pressure and simultaneously discharging of the accumulator



- P - pump connection
- S - accumulator
- KH - change-over ball valve
- DV - pressure relief valve
- M - pressure gauge
- T - tank connection

The DSV10 can be used as a cost-effective alternative to the SAF10. Unlike the SAF10, the DSV10 shuts off when discharging simultaneously to the tank.

6.3. PORTS

The DSV has the following ports:

- S - Accumulator port (M33x2 DIN 3852 part 3)
- P - Inline port (G 3/8 and G 1/2)
- T - Tank port (G 1/4)
- M - Pressure gauge port (G 1/4)

6.4. FUNCTION

When the accumulator is in operation the change-over ball valve connects the pump port with the accumulator. At the same time the accumulator is monitored for pressure via the built-in pressure relief valve.

By switching over the ball valve, the pump port is shut off leakage-free on the inlet side and the accumulator is discharged simultaneously to the tank.

During switching all three ports (P, S and T) are momentarily interconnected (negative switching overlap). If a solenoid-operated 2/2 directional poppet valve is installed, automatic discharge is possible (e.g. in the event of a power failure or shut-down).

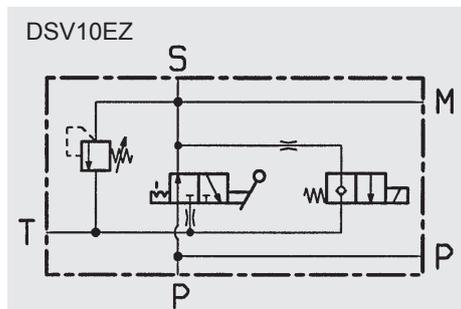
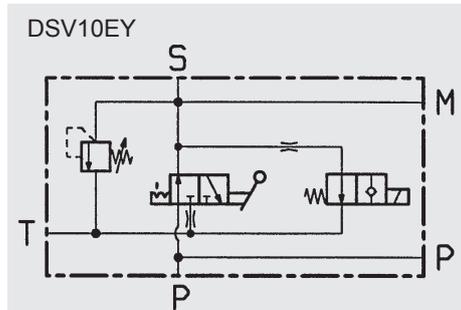
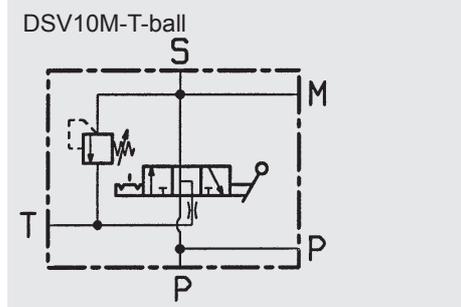
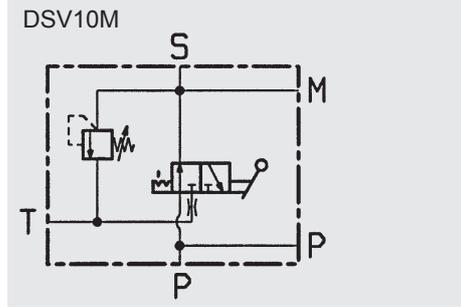
6.5. NOTES

Ball valves are not designed to be used as flow control valves; therefore they should always be either fully open or fully closed to avoid damaging the sealing cups.

To ensure correct functioning, pressure and temperature specifications must be observed.

6.6. SPECIFICATIONS

6.6.1 Symbols



6.6.2 Type of construction

Ball valve isolating device

Pressure relief valve is a direct-acting poppet seat valve

Poppet valve is pilot-operated

6.6.3 Materials

Housing and blanking plug in steel, surface protection: phosphate-plated. Ball in steel, hard-chromed

Pressure relief valve and poppet valve in high tensile steel, closing element in hardened and ground steel, wear-resistant, surface protection: phosphate-plated
Ball seal in high quality synthetic material (POM) Soft seals in Perbunan (NBR)
Cranked handle SW09 in red anodised aluminium.

6.6.4 Mounting position optional

6.6.5 Operating fluids

Mineral oil to DIN 51524 Part 1 and Part 2 (other fluids on request)

Viscosity range

min. 10 mm²/s
max. 380 mm²/s

Filtration:

Max. permitted contamination of the operating fluid to ISO 4406 Class 21/19/16 or SAE AS 4059 Class 11.

We therefore recommend a filter with a minimum retention rate of $\beta_{20} \geq 100$. The fitting of filters and the regular replacement of filter elements guarantees correct operation, reduces wear and tear and increases the service life.

6.6.6 Permitted operating temperature

-10 °C ... +80 °C

(ambient temperature for E version limited to -10 °C ... +60 °C)

6.6.7 Maximum operating pressure

350 bar

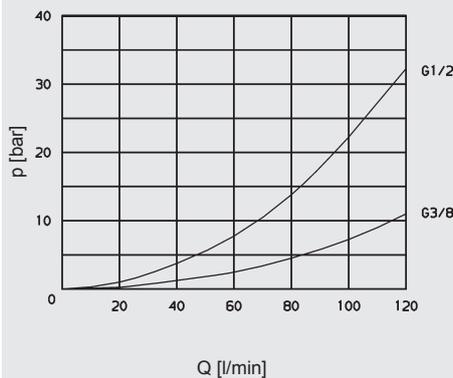
6.6.8 Δp - Q graph

measured at

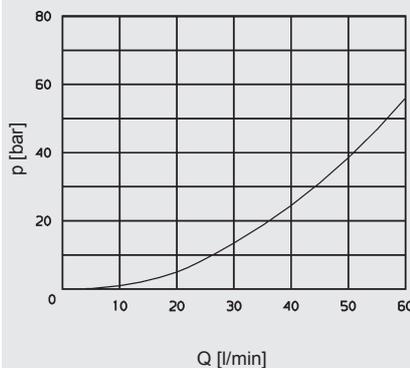
$t_{oil} = 50$ °C

$v = 30$ mm²/s

Flow rate from P to S



Flow rate from S to T



6.6.9 Model with solenoid-operated pressure release

Type

Solenoid-operated by means of pressure-tight, oil-immersed, single-stroke solenoids in accordance with VDE 0580. Actuating solenoid with male connector to DIN 43650, standard for general industrial applications, available for 24 V DC and 230 V AC.

Type of current

DC solenoid

When connected to AC voltage, the necessary DC voltage is produced by means of a bridge rectifier connector.

Voltage tolerance

± 15 % of the nominal voltage

Nominal current

dependent on the nominal voltage

24 V DC 0.80 A

230 V AC 0.11 A

Power consumption

$p_{20} = 18$ W

Duty

Continuous

Switching time

Depending on symbol, pressure across the individual ports and flow rate

WSM06020Y:

on: 50 ms,

off: 35 ms

WSM06020Y:

on: 35 ms,

off: 50 ms

6.7. SPARE PARTS

please see brochure:

- 3-way safety block DSV No. 5.251

6.8. MODEL CODE FOR DSV10

(also order example)

DSV 10 M - 4 . 1 / 1 / X / T ... - G 24 - Z4 ...

3-way safety block

Nominal size

10

Discharge

M = manual discharge

E = solenoid-operated and manual discharge

For manual/solenoid-operated discharge, also indicate

Y = open when de-energised

Z = closed when de-energised

Type of pressure relief valve

4 = DB12

With/without fitted pressure relief valve

1 = with pressure relief valve

0 = without pressure relief valve

Accumulator connection

1 = M33x2

Series

(determined by manufacturer)

Setting of pressure relief valve

T = pressure-set and lead-sealed by TÜV

V = adjustable using tool

F = preset by manufacturer

x = no details (for model without relief valve cartridge)

Pressure setting

... = pressure setting

... = pressure range

xxx = no details (for model without relief valve cartridge)

Pressure setting range

DB12 – 150 bar

DB12 – 250 bar

DB12 – 350 bar

Type of voltage for solenoid

G = DC voltage

W = AC voltage

Nominal voltage for solenoid

24 = 24 Volt for type G voltage (DC)

230 = 230 Volt for type W voltage (AC)

Type of connection for solenoid

Z4 = connector to DIN 43650 - AF2 - PG11

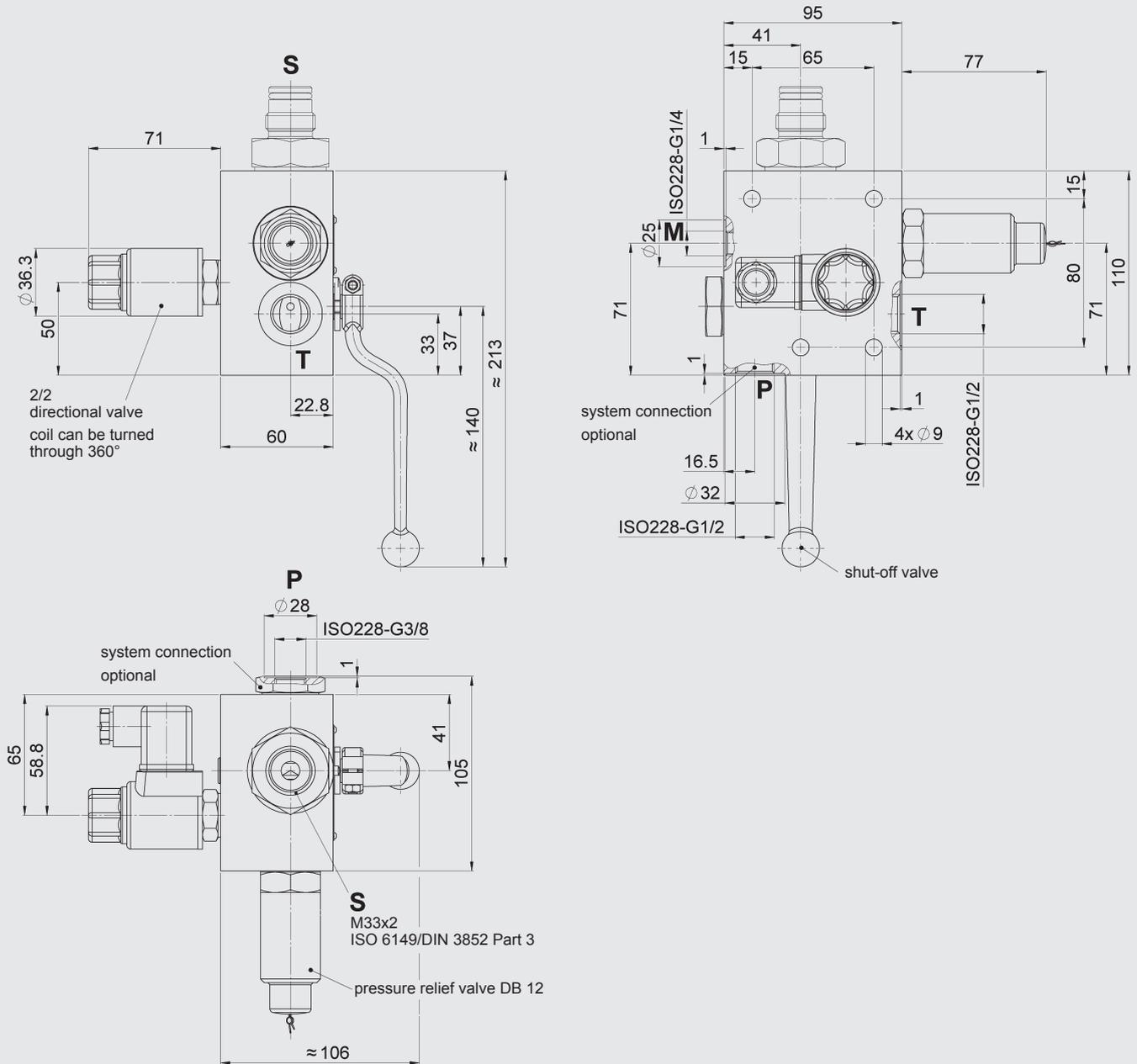
Supplementary details

T-Ball = ball bore (180° switch)

FKM (Viton®) = O-ring seal

6.9. DIMENSIONS

DSV10 3-way safety block



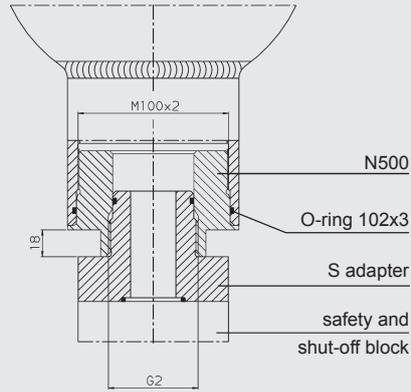
Type	Weight
DSV10M	3.5 kg
DSV10E...	3.9 kg

SAF10 Standard types

Type	Part no.	Type	Part no.
DSV-10-M-4.0/1/X/XXXX	555999	DSV-10-EY-4.0/1/X/XXXX-G24-Z4	557367
DSV-10-M-4.1/1/X/T035	555968	DSV-10-EY-4.1/1/X/T035-G24-Z4	555980
DSV-10-M-4.1/1/X/T035	555969	DSV-10-EY-4.1/1/X/T050-G24-Z4	555981
DSV-10-M-4.1/1/X/T070	555970	DSV-10-EY-4.1/1/X/T070-G24-Z4	555982
DSV-10-M-4.1/1/X/T100	555971	DSV-10-EY-4.1/1/X/T100-G24-Z4	555983
DSV-10-M-4.1/1/X/T150	555972	DSV-10-EY-4.1/1/X/T150-G24-Z4	555984
DSV-10-M-4.1/1/X/T200	555973	DSV-10-EY-4.1/1/X/T200-G24-Z4	555985
DSV-10-M-4.1/1/X/T210	555974	DSV-10-EY-4.1/1/X/T210-G24-Z4	555986
DSV-10-M-4.1/1/X/T250	555975	DSV-10-EY-4.1/1/X/T250-G24-Z4	555987
DSV-10-M-4.1/1/X/T300	555976	DSV-10-EY-4.1/1/X/T300-G24-Z4	555988
DSV-10-M-4.1/1/X/T315	555977	DSV-10-EY-4.1/1/X/T315-G24-Z4	555989
DSV-10-M-4.1/1/X/T330	555978	DSV-10-EY-4.1/1/X/T330-G24-Z4	555990
DSV-10-M-4.1/1/X/T350	555979	DSV-10-EY-4.1/1/X/T350-G24-Z4	555991

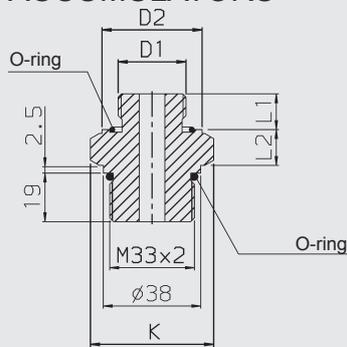
7. ACCESSORIES

7.1. ADAPTERS FOR LOW PRESSURE BLADDER ACCUMULATORS



Type	Accumulator type	Volume [l]	Adapter	Part no. ¹⁾ NBR/Carbon steel	Corresponding S adapter	Part no. ¹⁾ NBR/Carbon steel
SAF10/20 and DSV10	SB35	2.5 ... 50	N500	367229	S 13	369481
SAF32					S 309	366715

7.2. ADAPTERS FOR DIAPHRAGM ACCUMULATORS



Type	Accumulator type	Volume [l]	D1 Thread	Part no. ¹⁾ NBR/Carbon steel	Adapter	K SW	L1 [mm]	L2 [mm]	D2 [mm]	O-ring
SAF10/20 DSV10	SBO...E-	0.075 ... 1.4	G 1/2 A	369485	S 30	41	14	17.5	33	22x3
	SBO...A6-	0.1 ... 210-1.3								
	SBO...E-	2.0 ... 3.5	G 3/4 A	369486	S 31		16		40	28x3
	SBO...A6-	1.3 ... 4								

¹⁾ others on request

7.3. ADAPTERS FOR PISTON ACCUMULATORS

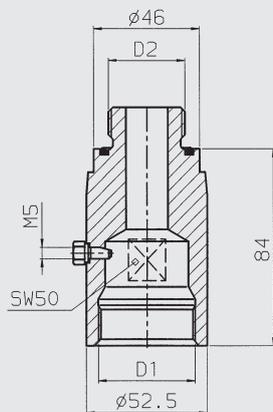


Diagram 1

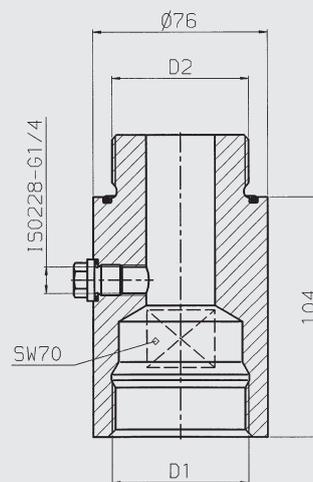
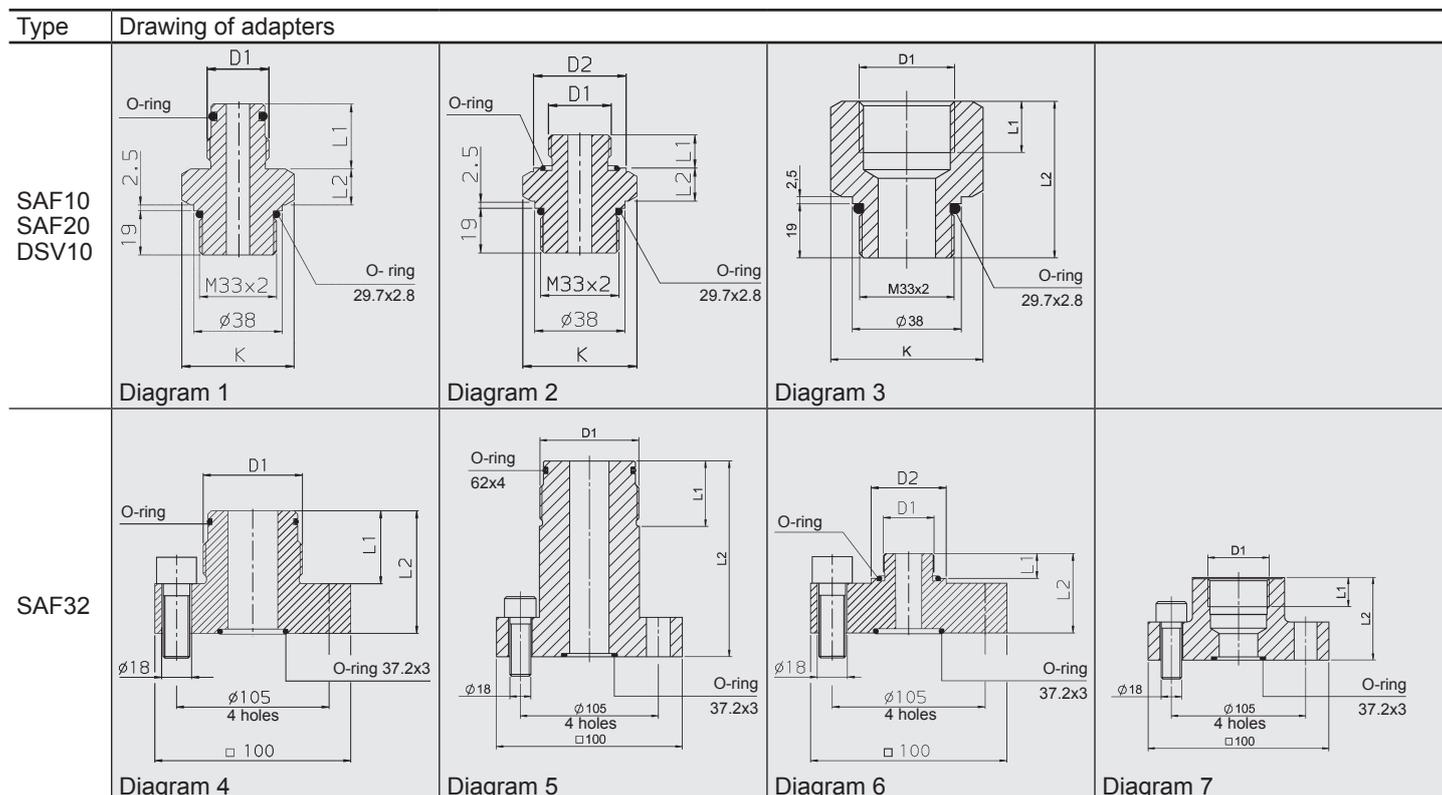


Diagram 2

Type	Accumulator type	Volume [l]	Adapter	Part no. ¹⁾ NBR/Carbon steel	Diag.	D1 [mm]	D2 [mm]	O-ring	Corresponding S adapter	Part no. ¹⁾ NBR/Carbon steel
SAF10/20 DSV10	SK210/350 -	2.5 ... 7.5	K 406	374929	1	G 1 1/4	G 1	35x3	S 12	369480
	SK210/350 -	10 ... 45	K 408	374931						
SAF32	SK210/350 -	50 ... 120	K 409	374933	2	G 2	G 2	62x3	S 309	366715

¹⁾ others on request

7.4. ADAPTERS FOR STANDARD BLADDER ACCUMULATOR



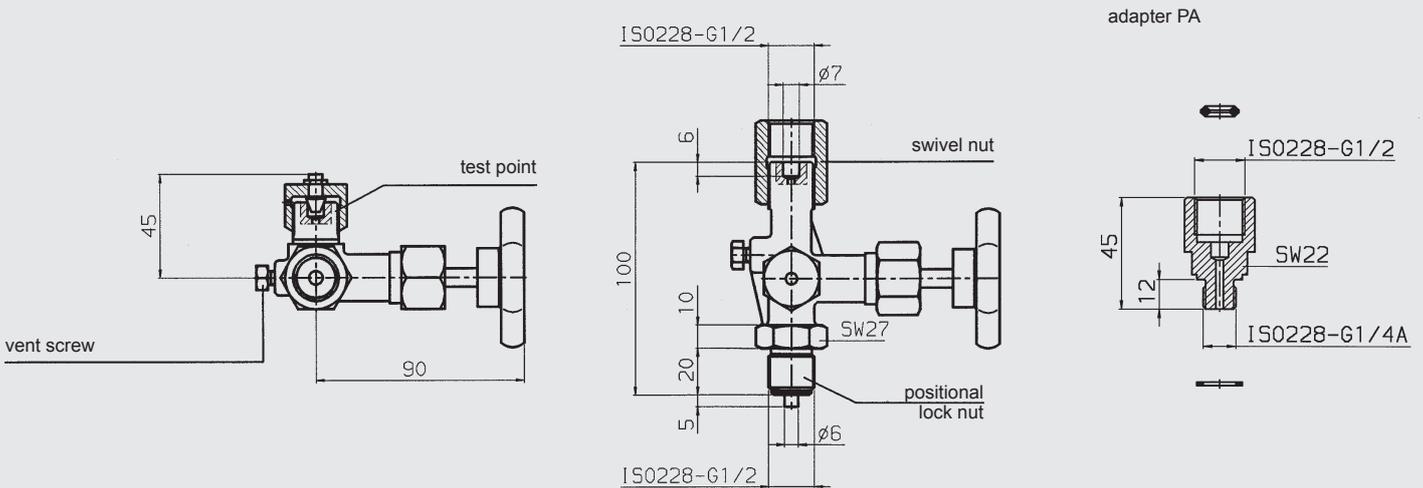
Type	Accumulator type	Volume [l]	D1 Thread	Adapter	Part no. ²⁾ NBR/Carbon steel	K SW [mm]	L1 [mm]	L2 [mm]	D2 [mm]	O-ring [mm]	Diag.	
SAF10 SAF20 DSV10	SB330/400-	0.6 ... 1	G 3/4A	S 10	369479*	41	28	16	—	17x3	1	
	SB550/690-	1 ... 5	G 1A	S 11	372750	46	34	—	22x3			
	SB330/400-	2.5 ... 6	G 1 1/4A	S 12	369480*		37	17	—	30x3		
	SB330/400/ 550/600-	10 ... 50	G 2A	S 13	369481*	65	44	21	—	48x3	2	
	Connection with metric fine thread	—	—	M30x1.5	S 20	369482	20	15	18	40		32x2
		—	—	M40x1.5	S 21	369483		55	21	54		43x3
	SB330/400-	2.5 ... 50	G 3/4	S 367861	369489	41	18	50	—	—	3	
G 1			S 379766	369490	46	20	55	—	—			
G 1 1/4			S 379767	369498	65	22	60	—	—			
SAF32	SB330/400-	0.6 ... 1	G 3/4A	S 305 ¹⁾	366723	—	28	58	—	17x3	4	
	SB550/690-	1 ... 5	G 1A	S 306 ¹⁾	2102855	—	34	64	—	22x3		
	SB330/400-	2.5 ... 6	G 1 1/4A	S 307 ¹⁾	366724	—	37	67	—	30x3		
	SB330/400/600-	10 ... 50	G 2A	S 309 ¹⁾	366715*	—	44	74	—	48x3	5	
	SB550-	10 ... 50		S 308 ¹⁾	376813	—	115	—	—			
	SB330H-	10 ... 50	G 2 1/2A	S 365922	377283	—	50	150	—	62x4	6	
	Connection with metric fine thread	—	M30x1.5	S 330 ¹⁾	366735	—	15	47	45	32x2		
		—	M40x1.5	S 340 ¹⁾	366736	—	20	51	60	43x3		
	SB330/400-	10 ... 50	M50x1.5	S 350 ¹⁾	366737	—	75	53x3	—	—		
			G 1	S 365637	2106583	—	20	60	—	—	7	
G 1 1/4			S 369658	2106578	—	22	—	—	—			
			G 1 1/2	S 237838	2103869	—	24	65	—	—		

* Preferred models

¹⁾ Adapter supplied with 4 off hex. socket cap screws M16x45 (part no. 6032726) Torque 130 Nm

²⁾ others on request

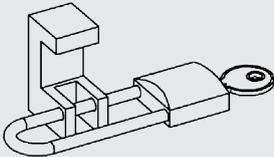
7.5. GAUGE ISOLATOR VALVE



Part no.	Description	consisting of:
611903	Shut-off valve AG DIN 16271	Release valve Swivel nut Positional lock nut Test point
370754	Adaptor PA G1/4A-G1/2	

7.6. SPINDLE SAFETY MECHANISM

Safety mechanism on the release valve on the SAF block to prevent adjustment.
For attachment on SAF, see Point 5.4. Safety and Shut-Off Block with supplementary equipment, type LS.



Part no.	Description	consisting of:
3580490	Spindle safety mechanism SAF	- Spindle safety mechanism SAF - Padlock

7.7. ACCUMULATOR CHARGING VALVE



HYDAC accumulator charging valves control, within an adjustable switching range, the charging of the accumulator. By combining the charging valve with an accumulator, pumps and motors on hydraulic plants with fluctuating flow requirements can be sized smaller. This saves costs and energy - thus preventing unnecessary heat development.

For further information and technical specifications, see catalogue section:

- DLHSD DLHSR Accumulator charging valve
No. 5.190.1

8. NOTE

The information in this brochure relates to the operating conditions and applications described.

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

Subject to technical modifications.

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Safety Equipment for Hydraulic Accumulators



1. DESCRIPTION

1.1. GENERAL

Hydraulic accumulators are pressure vessels, as defined by PED 97/23/EC, and as such their manufacture is subject to the statutory pressure equipment regulations.

For safety in the workplace, system manufacturers and operators must draw up risk assessments for the particular site. These must take into account possible risks at the installation site, particularly in combination with external factors.

Fundamental risks affecting hydraulic accumulators are:

- Excessive pressure and
- Temperature increase (e.g. in the event of an external fire).

HYDAC provides the appropriate safety equipment to protect accumulators from the maximum permitted operating pressure PS of a hydraulic accumulator on the gas and fluid side; see also catalogue section:

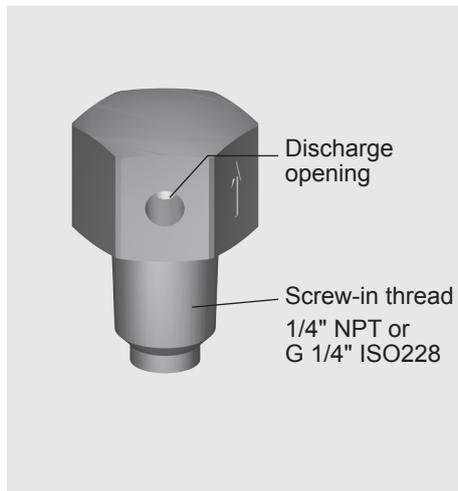
- HYDAC Accumulator Technology No. 3.000

When selecting safety equipment, consideration must be given to the material (elastomers and housing material) as regards material compatibility in the application.

2. PROTECTION ON THE GAS SIDE

2.1. BURSTING DISC

2.1.1 Design



2.1.2 Function

If the pressure exceeds the permitted level, the bursting disc shatters, permanently opening the port. This reduces the gas pressure by discharging the nitrogen completely.

Bursting discs are designed for different burst pressures and are supplied with a certificate of conformity.

Bursting discs are made either entirely of stainless steel, or from an alloy based on stainless steel and nickel.

2.1.3 Standard types

Description	Burst pressure ± 10 % at 50 °C	Part no.
Bursting disc plug 1/4" NPT	210 bar	3156148
	250 bar	3156150
	300 bar	3156151
	330 bar	3341280*
	350 bar	3156152
Bursting disc plug G 1/4" ISO228	210 bar	3516441
	330 bar	3560189
	400 bar	3358418

* Preferred models
others on request

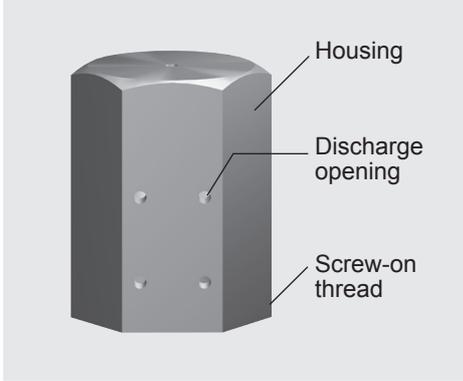
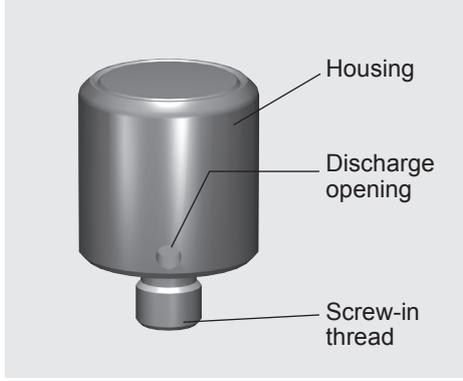
2.2. TEMPERATURE FUSE

HYDAC offers two different kinds of temperature fuse. In addition to the temperature fuse in carbon steel and stainless steel, which is suitable for bladder accumulators, HYDAC also offers a temperature fuse of the type GMP6, which is approved according to PED 97/23/EC. It is made of stainless steel and has a CE mark.

2.2.1 Function

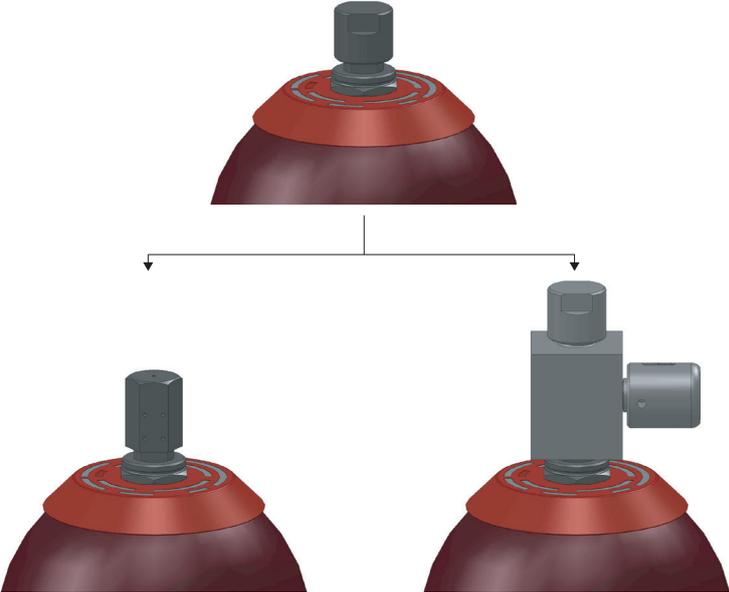
Temperature fuses are "devices with a safety function" and are used to release the gas pressure by discharging the nitrogen completely when a rise in temperature reaches unacceptable levels (e.g. in the case of fire).

2.2.2 Design/Technical data

Type	Temperature fuse	Temperature fuse GMP6										
Design												
Permitted operating pressure	≤ 450 bar	50 ... 420 bar										
Temperature range	-10 °C ... +80 °C	-40 °C ... +120 °C										
Melting point	between +160 °C and +170 °C	between +160 °C and +170 °C										
Standard types	<table border="1"> <tr> <td>363501*</td> <td>Temperature fuse 7/8-14UNF</td> </tr> <tr> <td>3094166*</td> <td>Temperature fuse 7/8-14UNF with crane hook</td> </tr> </table>	363501*	Temperature fuse 7/8-14UNF	3094166*	Temperature fuse 7/8-14UNF with crane hook	<table border="1"> <tr> <td>3517438</td> <td>GMP6-10-CE1637...</td> </tr> <tr> <td>3521196</td> <td>GMP6-10-CE1637... with adapter for bladder accumulators.</td> </tr> <tr> <td>3584817</td> <td>GMP6-10-CE1637... with adapters for piston and diaphragm accumulators</td> </tr> </table>	3517438	GMP6-10-CE1637...	3521196	GMP6-10-CE1637... with adapter for bladder accumulators.	3584817	GMP6-10-CE1637... with adapters for piston and diaphragm accumulators
363501*	Temperature fuse 7/8-14UNF											
3094166*	Temperature fuse 7/8-14UNF with crane hook											
3517438	GMP6-10-CE1637...											
3521196	GMP6-10-CE1637... with adapter for bladder accumulators.											
3584817	GMP6-10-CE1637... with adapters for piston and diaphragm accumulators											

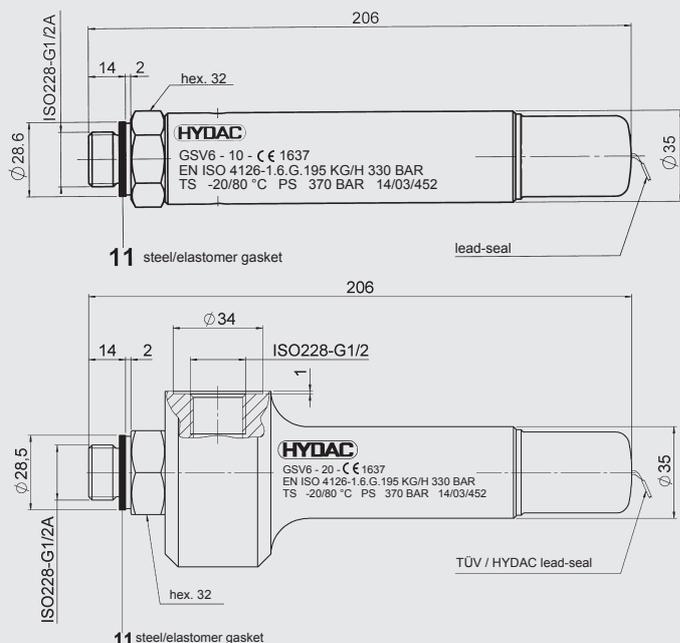
* Preferred models

2.2.3 Installation instructions

Design	Temperature fuse	Temperature fuse GMP6
The instruction manual must be followed! ● GSV/GMP No. 3.504.CE	Simple to retrofit (using the example of a bladder accumulator) by replacing the sealing cap with the temperature fuse.	Simple to retrofit (using the example of a bladder accumulator) by replacing the sealing cap with the temperature fuse GMP6 with adapter.
Bladder accumulator without temperature fuse		
Temperature fuse or temperature fuse GMP6 and adapter		

2.3. GAS SAFETY VALVE

2.3.1 Assembly and dimensions



2.3.2 Function

The gas safety valve provides protection by reducing the pressure in a controlled way if pressure exceeds the permitted level unexpectedly. It is pre-set on the pressure side and lead-sealed by the authorised representative. It is also supplied with a certificate of conformity and a type approval.

2.3.3 Model code

(also order example)

GSV6 - 10 - CE1637.ENISO4126-1.6.G. 195. 330

Gas safety valve

Series

10 = Standard with 2 discharge openings size 6 mm
20 = 1 discharge opening G 1/2 ISO228

Component code

Flow rate Q [kg/h]

(see table, Point 2.3.6)

Pressure setting p [bar]

(see table, Point 2.3.6)

2.3.4 Technical specifications

Design

PED 97/23/EC, EN ISO4126-1, EN 13445-6, others on request

Module category

IV to PED 97/23/EC
Module B + D (EC type test)
Module G (EC type examination) on request

Nominal size

6 mm

Material

Stainless steel, closing element with flexible seat seal

Medium

Nitrogen (N₂)

Operating pressure range

30 ... 370 bar

Temperature range:

-20 °C ... +80 °C

Others on request

Weight

1.1 kg

2.3.5 Installing the gas safety valve GSV

The self-centring gasket means that this valve can be installed simply and securely in any position.

Please read the Operating Manual!

- GSV/GMP
No. 3.504.CE

2.3.6 Preferred models

Selection of the pressure setting is based on the maximum operating pressure of the hydraulic accumulator, according to the application.

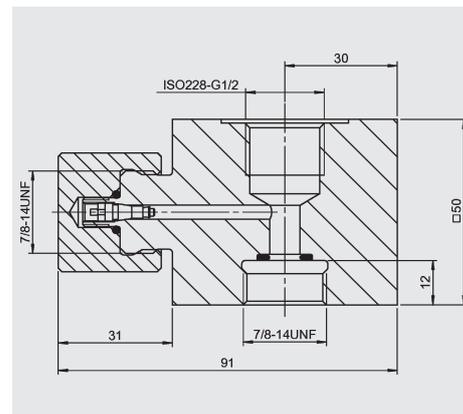
Q [kg/h]	p [bar] ± 10 %	Part no. ¹⁾
15	30	3123965
20	40	3123966
28	50	3123967
35	60	3124028
40	70	3124029
45	80	3124030
50	90	3124031
58	100	3124032
65	110	3124033
70	120	3124034
75	130	3124035
83	140	3124036
88	150	3124037
95	160	3124038
100	170	3124039
105	180	3124040
110	190	3124041
118	200	3124042
125	210	3124043
130	220	3124044
135	230	3124045
140	240	3124046
148	250	3124047
155	260	3124048
160	270	3124049
165	280	3124050
170	290	3124051
178	300	3124052
185	310	3124053
190	320	3124054
195	330	3124055
200	340	3124056
205	350	3124057

¹⁾ others on request

> 350 bar = additional price required for EC type examination, please ask

2.3.7 Adapter for gas safety valve GSV6

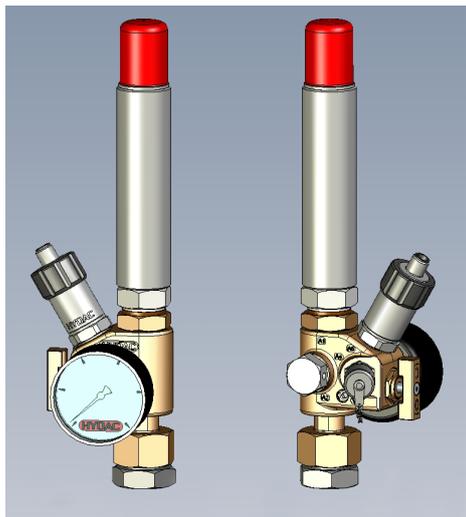
To protect standard and low pressure bladder accumulators, the adapter shown below must be ordered with the gas safety valve GSV6:



Description	Part no.
Adapter assembly	2103381

2.4. GAS SAFETY BLOCK

2.4.1 Design



Gas safety block GSB450 consists of a brass block (other materials on request) with integrated vent valve and shut-off valve and ports for:

- Pressure gauge
- Gas safety valve (GSV6)
- Gas charging valve (e.g. Minimess)
- Pressure transmitter or pressure switch
- Bursting disc or temperature fuse

The gas safety valve connection is designed as a check valve. Therefore the valve can be changed, even if the system is pressurized.

2.4.2 Function

The GSB450 is an adapter block, which is mounted on an accumulator on the gas side and which can be fitted with various pressure devices, charging equipment, safety valves and other safety components.

2.4.3 Advantages

- Compact design
- Flexible connection options
- Variable indication options: bar, MPa or psi, analogue or digital (optional)
- Pressure gauge can be oriented according to customer requirement
- Accumulator can be charged with nitrogen, directly via Minimess valve
- Pre-charge pressure can be checked without FPU-1

2.4.4 Model code (also order example)

GSB450 - 1 - 1 - 5 - 1 - 1 - 350

Series _____

Material _____

- 1 = standard
(brass and add-on parts in carbon steel)
- 2 = stainless steel
(brass and add-on parts in stainless steel)
- 3 = stainless steel
(on request)

Accumulator connection _____

- 1 = Connection for SK/SBO
- 2 = Connection for SB 7/8-14UNF
- 3 = Connection for SB 5/8-18UNF
- 8 = Connection for threaded pipe fitting DKS18
- 9 = Special connection

Monitoring options _____

- 0 = without
- 1 = 0 - 25 bar
- 2 = 0 - 100 bar
- 3 = 0 - 160 bar
- 4 = 0 - 250 bar
- 5 = 0 - 400 bar
- 9 = Special pressure gauge

Gas charging connection _____

- 0 = without
- 1 = Minimess valve M16x2
- 2 = Minimess valve M16x1.5
- 3 = Minimess valve M10x1.5 (see Point 2.4.9)
- 9 = Special connection

Safety equipment _____

- 0 = None
- 1 = GSV
- 2 = Bursting disc
- 3 = Temperature fuse

Pressure range of the safety equipment _____

2.4.5 Technical data

Medium

Nitrogen (N₂)

Permitted operating temperature

-20 °C ... +80 °C

Max. operating pressure

400 bar / 5800 psi

Accumulator connection

Bladder accumulator:
7/8-14UNF with adapter

For bladder accumulators, the appropriate adapter is supplied. All other connections are sealed with blanking plugs.

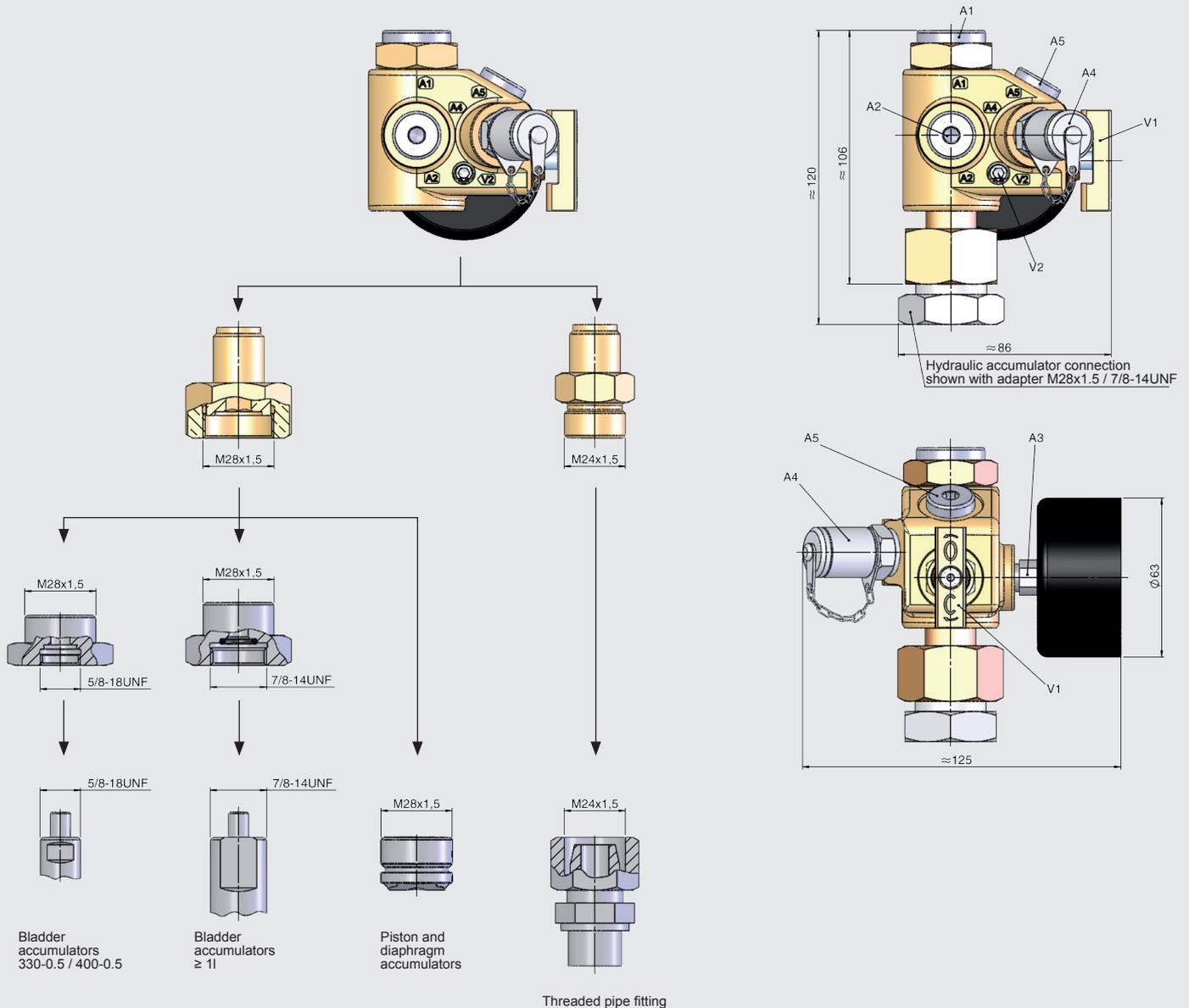
Piston and diaphragm accumulators:
M28x1.5

For piston and diaphragm accumulators the connection is a lock-nut with M28x1.5 thread as standard.

Weight

- Standard model for SB
1.6 kg
- Standard model for SBO and SK
1.5 kg

2.4.6 Dimensions and models



Basic version

In the basic version, the GSB450 is supplied with shut-off valve, vent valve, pressure gauge (0 - 400 bar, Ø 63 mm) and gas charging connection in Minimesse screw coupling series 1620 (M16x2).

The shut-off valve (V1) must always be closed following the charging and testing procedure to protect the pressure gauge (A3), Minimesse valve (A4) and pressure switch/pressure transmitter (A5) from long-term pressure load.

If a pressure switch/pressure transmitter is screwed into the A5 connection, the shut-off valve (V1) must be open. For this we recommend gas charging connection model 3 (see Point 2.4.4).

The pressure chamber must be vented at the vent valve (V2).

Options

The GSB450 can be supplied with the following options*:

- Pressure gauge with different display ranges (Ø 63 mm - at no additional charge) and different displays: bar, MPa or psi; analogue or digital
- Pressure gauges of various accuracy classes and glycerin-filled pressure gauges
- Minimesse gas charging valve series 1615 (M16x1.5) in stainless steel version
- Version for lower and higher temperatures
- Version where all steel parts are stainless steel (A4)
- Gas safety valve GSV6
- Safety devices (bursting disc, temperature fuse)
- Pressure transmitter (e.g. HDA)
- Pressure switch (e.g. EDS)

* on request and must be ordered separately and at additional cost

2.4.7 Standard types

Designation	Part no.
GSB450-1-1-1-1-0	3534710
GSB450-1-1-2-1-0	3534711
GSB450-1-1-3-1-0	3534712
GSB450-1-1-4-1-0	3528946
GSB450-1-1-5-1-0	3426882
GSB450-1-2-1-1-0	3534713
GSB450-1-2-2-1-0	3534714
GSB450-1-2-3-1-0	3484861
GSB450-1-2-4-1-0	3433824
GSB450-1-2-5-1-0	3426905

2.4.8 Installation of gas safety block GSB Please read the Operating Manual!

- GSB
No. 3.505.CE

2.4.9 Accessories

Block connections

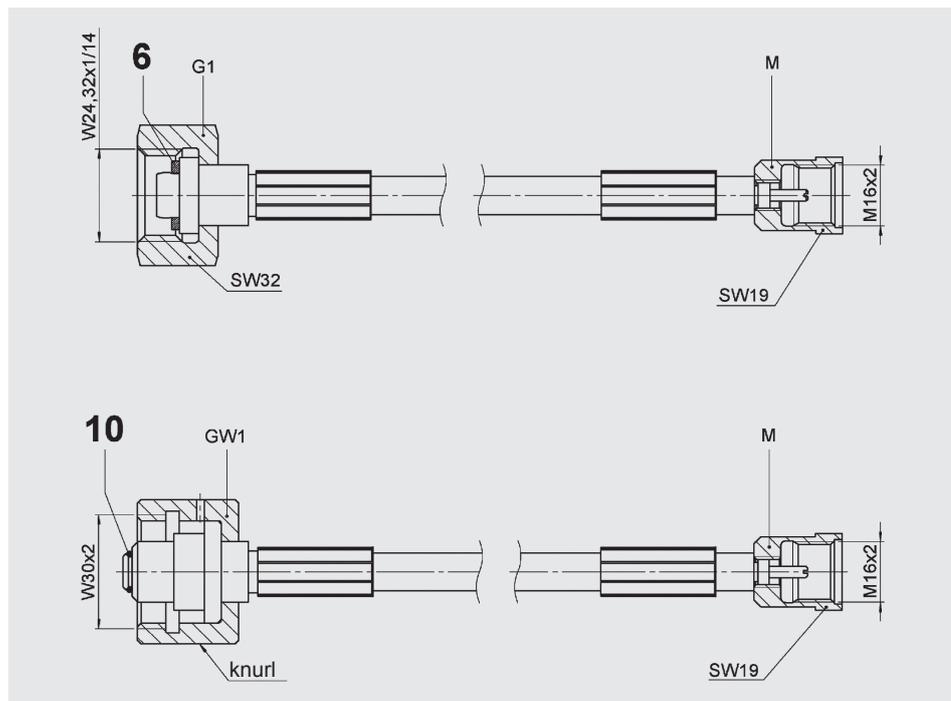
Ports	Size	Description	Options available as accessories
A1	G1/2-ISO228	GSV6 connection, incl. pilot-operated check valve	Blanking plug
A2	G1/4-ISO228	Connection for charging and safety devices	Charging connection for remote charging, Bursting disc, Temperature fuse
A3		Connection for pressure gauge	Pressure gauge in various models and various different indication ranges (0 - 400 bar, 0 - 5714 psi)
A4		Gas charging connection	Minimess M16x2; M16x1.5
A5		General connections	Pressure transmitter e.g. HYDAC HDA, EDS

Valves

Type	Description
V1	Shut-off valve
V2	Vent valve (int. hex. SW4)

Connecting hoses

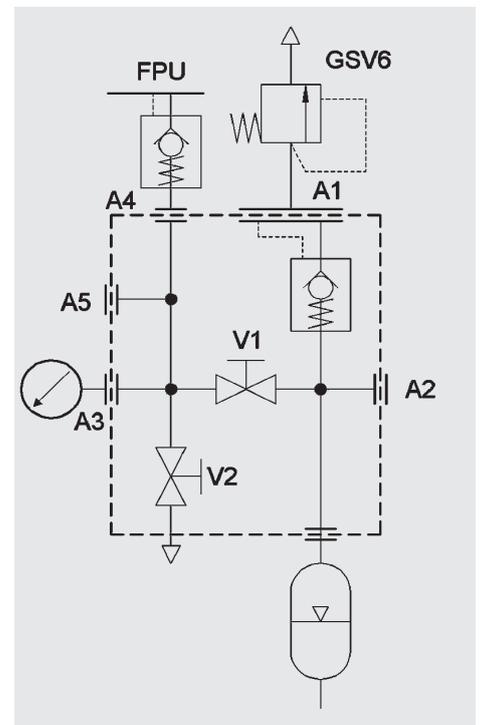
Connecting hoses are designed for the particular maximum permitted operating pressure marked on them and 10,000 charging processes. (HYDAC charging hoses comply with DIN EN ISO 4413 and DIN EN 853 to 857)



Gas connection of nitrogen bottles	Minimess connection	Length [m]	Part no.
W30x2	M16x2	2.5	3434454
		4	3434457
W24.32x1/14	M16x2	2.5	3434424
		4	3434451
		10	3526858

Suitable adapters for foreign nitrogen bottles can be found in the following catalogue section:

- Universal Charging and Testing Unit FPU-1



3. PROTECTION ON THE FLUID SIDE

3.1. GENERAL

The fluid side must be protected against pressures which exceed the permitted operating pressures by installing approved and appropriate safety valves.

HYDAC offers pressure relief valves (DB12) which have a pressure setting of up to 400 bar (set by HYDAC). The valve carries the CE mark and is built into Safety and Shut-off Blocks in the series DSV10 and SAF in nominal sizes DN10 and DN50 and is lead-sealed.

Further information is available from the following catalogue section:

- Safety and Shut-off Block SAF/DSV No. 3.551



4. NOTE

The information in this brochure relates to the operating conditions and applications described.

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

Subject to technical modifications.

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Supports for Hydraulic Accumulators



1. DESCRIPTION

1.1. GENERAL

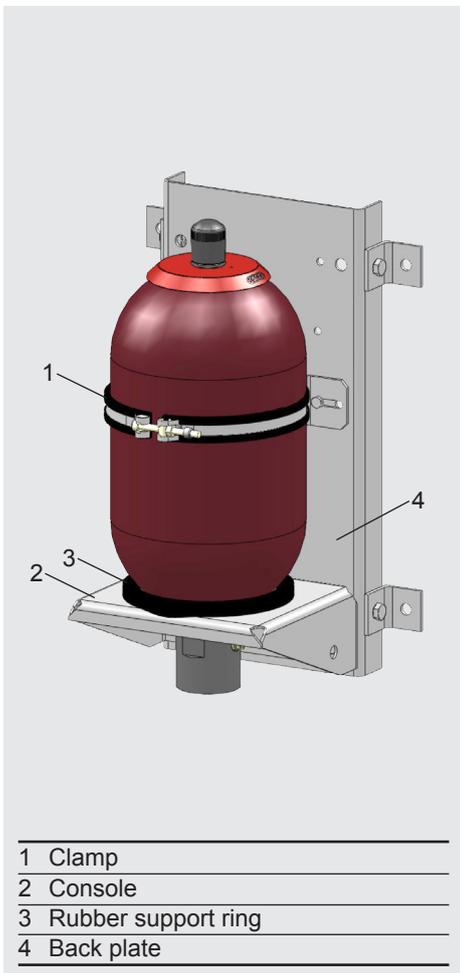
HYDAC supports are used to install all types of hydraulic accumulator safely and simply, irrespective of the installation position and location. Clamps, consoles and complete accumulator sets are available.

1.2. APPLICATION

The supports are designed for static use. For dynamic stresses, specially designed clamps are available on request.

2. SELECTION TABLES FOR SUPPORTS

2.1. BLADDER ACCUMULATORS

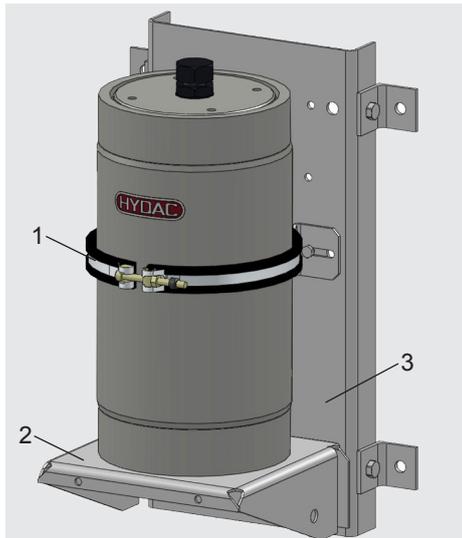


- 1 Clamp
- 2 Console
- 3 Rubber support ring
- 4 Back plate

Designation	Nominal volume [l]																							
	SB330					SB400			SB550		SB500 / SB600		SB35		SB40		SB35H		SB35HB		SN			
	1	2.5+5	4+6	10-24	32-50	60-80	100-130	160-200	0.5	4	10-20	32-50	1	2.5-5	10-20	32-50	2.5-5	10-20	20	32-50	20	32-50	150	
Clamps*																								
HyRac 89-92 ST									1															
HyRac 106-114/115 H3 ST																	2		2					
HyRac 110-118/124 H10 ST	1	2																						
HyRac 121-129/133 H8 ST													1	2										
HyRac 167-175/178 H5 ST		1							1															
HyRac 202-210/214 H8 ST																1	2			1	2			
HyRac 216-224/226 H5 ST																			1	2		1	2	
HyRac 223-230/231 H3 ST				1	2																			2
HyRac 225-234/234 H3 ST										1	2													
HSS 242																	1	2						
HRGKSM 4 R 352-363/360 ST					2	3																		
HRRBS 17 B1L 406 PP ST M ZN B145 H525								3																
Consoles																								
KBK 167 / G		1							1															
KBK 222 / G			1	1						1	1				1	1			1	1				1
KBK 360 / G					1	1																		
KHF 210 / G																					1	1	1	1
Accumulator set																								
SEB	1	1	1	1					1	1	1													
SEBL					1	1																		
SEH														1	1	1								
SEM																			1	1	1			
SEHB																							1	1

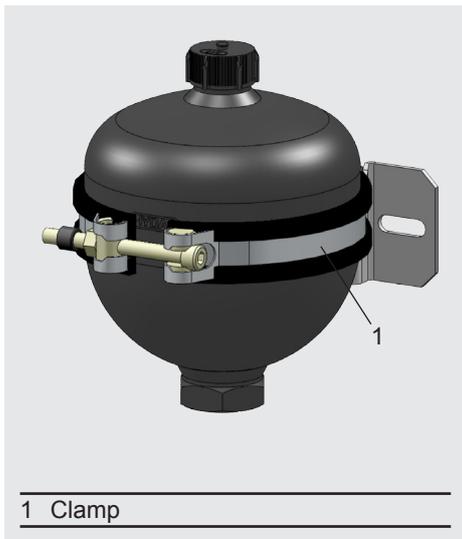
* The number of clamps can vary depending on the requirements and on the length of the accumulator. These are recommendations.

2.2. PISTON ACCUMULATORS



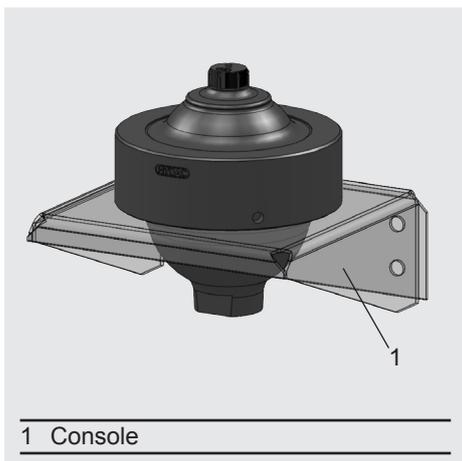
- 1 Clamp
- 2 Console
- 3 Back plate

2.3. DIAPHRAGM ACCUMULATORS (WELD TYPE)



- 1 Clamp

2.4. DIAPHRAGM ACCUMULATORS (SCREW TYPE)



- 1 Console

Designation	Piston diameter [mm]												
	50	60	80	100	150	180	250	> 250					
	Accumulator external diameter [mm]												
	60	75	95	100	120	125	180	210	220	286	300	> 300	
Clamps SK280*													
HRGKSM 0 R 58-61/62 ST	●												on request
HRGKSM 0 R 73-76/76 ST		●											
HRGKSM 0 R 92-95/96 ST			●										
HRGKSM 1 R 119-127/124 ST					●								
Clamps SK Standard *													
HyRac 96-100/100 ST				●									on request
HyRac 121-129/133 H8 ST					●								
HyRac 176-185/187 H5 ST							●						
HyRac 209-217/223 H10 ST								●					
HyRac 216-224/226 H5 ST									●				
HSS 286										●			
HSS 310											●		
Consoles													
KBK 126						1							on request
KBK 219								1	1				
KBK 310										1	1		

* Selecting the correct clamp depends on the external diameter of the accumulator. Depending on the application and length of the accumulator, we recommend that several clamps are used. Clamps must be mounted near the end caps in order to prevent deformation of the cylinder.

Type of accumulator	Clamps
SBO250-0.075E	HyRac 62-65 ST
SBO210-0.16E	HyRac 73-76 ST
SBO210-0.32E	HyRac 92-95/96 ST
SBO210-0.5E	HyRac 100-105/106 H3 ST
SBO100-0.7E	HyRac 106-114/115 H3 ST
SBO330-0.6E	HyRac 110-118/124 H10 ST
SBO330-0.7E	
SBO210-0.75E	HyRac 121-129/133 H8 ST
SBO330-0.75E	
SBO200-1E	HyRac 133-142/142 H3 ST
SBO140-1.4E	HyRac 143-151/151 H3 ST
SBO210-1.4E	
SBO330-1.4E	HyRac 152-159/160 H3 ST
SBO100-2E	HyRac 160-167/169 H5 ST
SBO210-2E	HyRac 167-175/178 H5 ST
SBO210-2.8E	
SBO250-3.5E	
SBO330-2E	
SBO330-2.8E	
SBO330-3.5E	

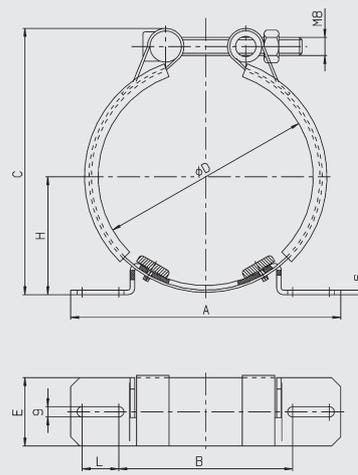
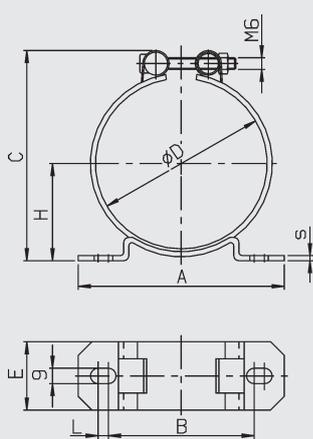
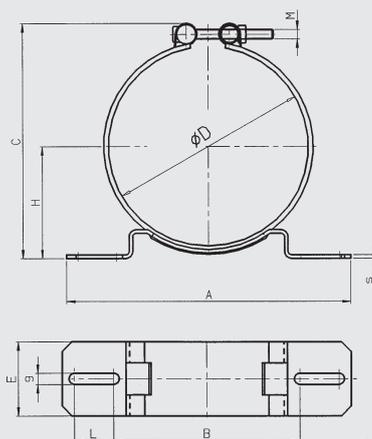
Type of accumulator	Console
SBO210-1.3A6	KMS 200
SBO400-1.3A6	KMS 210
SBO100-2.0A6	KMS 220
SBO250-2.0A6	
SBO210-2.8A6	KMS 250
SBO400-2.8A6	KMS 280
SBO210-4.0A6	KMS 300
SBO400-4.0A6	KMS 310

3. CLAMPS

HRGKSM

HyRac ($\text{ØD} \leq 100 \text{ mm}$)

HyRac ($\text{ØD} \geq 100 \text{ mm}$)



Fastening, Foot
Clamping band
Insert

zinc-plated
stainless steel
LDPE

Fastening, Foot
Clamping band
Insert

zinc-plated
stainless steel
PE

Fastening, Foot
Clamping band
Insert

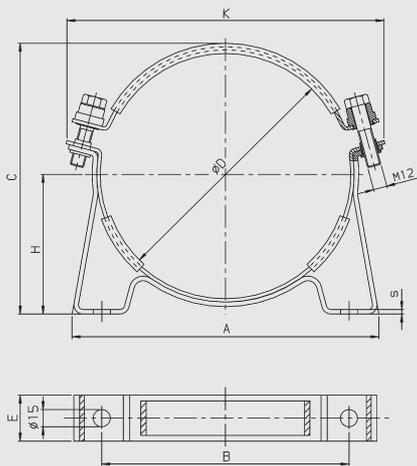
zinc-plated
stainless steel
PE, NBR

Designation	Part no.	A [mm]	B [mm]	C max [mm]	ØD (from - to) [mm]	H (from - to) [mm]	E [mm]	L [mm]	s [mm]	K max. [mm]	Weight [kg]
HRGKSM 0 R 58-61/62 ST	3018442	120	85	83	58 - 61	37.3 - 38.8	40	6	3	-	0.16
HRGKSM 0 R 70-73/73 ST	3018444			93	70 - 73	42 - 43.5					0.21
HRGKSM 1 R 119-127/124 ST	444505			158	100	154					119 - 127
HRGKSM 4 R 352-363/360 ST	444795	400	322	398	352 - 363	187.7 - 193.2	60	28	4	-	1.4
HyRac 62-65 ST	445037	120	85	85	62 - 65	38 - 39.5	40	8	3	-	0.16
HyRac 73-76 ST	445038			96	73 - 76	43.5 - 45					0.16
HyRac 89-92 ST	445039			112	89 - 92	51 - 52.5					0.17
HyRac 92-95/96 ST	445040			115	92 - 95	52.5 - 54					0.17
HyRac 96-100/100 ST	445041			120	96 - 100	54.5 - 56.5					0.17
HyRac 100-105/106 H3 ST	444904	156	100	135	100 - 105	59 - 62	60	18	3	-	0.40
HyRac 106-114/115 H3 ST	444905			143	106 - 114	62.5 - 66					0.41
HyRac 110-118/124 H10 ST	445042			156	110 - 118	72.5 - 77					0.42
HyRac 121-129/133 H8 ST	444906			165	121 - 129	75.5 - 80					0.43
HyRac 133-142/142 H3 ST	444907			174	133 - 142	76.5 - 82.5					0.44
HyRac 143-151/151 H3 ST	444908			182	143 - 151	83 - 86.5					0.45
HyRac 152-159/160 H3 ST	444909			191	152 - 159	87 - 91					0.46
HyRac 160-167/169 H5 ST	444910			197	160 - 167	89 - 93					0.70
HyRac 167-175/178 H5 ST	445043	207	167 - 175	92.5 - 96.5	0.72						
HyRac 176-185/187 H5 ST	445044	241	176 - 185	97 - 102.5	0.75						
HyRac 202-210/214 H8 ST	445045	236	152	245	202 - 210	116 - 120	60	32	4	-	0.76
HyRac 209-217/223 H10 ST	445046			255	209 - 217	122.5 - 126.5					0.77
HyRac 216-224/226 H5 ST	445047			256	216 - 224	120 - 124					0.77
HyRac 223-230/231 H3 ST	445048			259	223 - 230	120.5 - 123.5					0.78
HyRac 225-234/234 H3 ST	445049			265	225 - 234	123 - 127.5					0.79

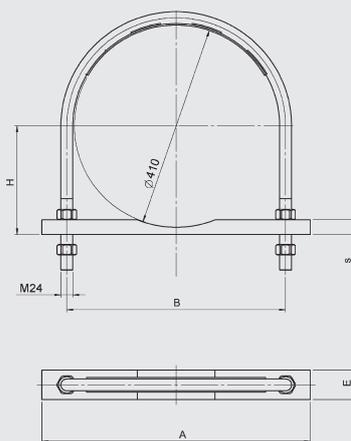
Model/order code (example):

HyRac 167-175/178 H5 ST 445043

HSS



HRRBS



Clamp zinc-plated
 Insert NBR

Clamp zinc-plated
 Insert NBR

Designation	Part no.	A [mm]	B [mm]	C max [mm]	ØD (from - to) [mm]	H (from - to) [mm]	E [mm]	L [mm]	s [mm]	K max. [mm]	Weight [kg]
HSS 222/229	235224	270	216	244	226	123	40	Ø15	4	295	1.7
HSS 242	362712	268	216	265	242	136				305	1.7
HSS 286	237395	332	280	314	286	163				355	2.1
HSS 310	237389	332	280	333	310	170				380	2.1
HSS 360	355592	427	365	383	360	195				424	2.5
HRRBS 17 B1L 406 PP ST M ZN B145 H525	3434519	540	440	450	410	220	60	-	30	-	6.15

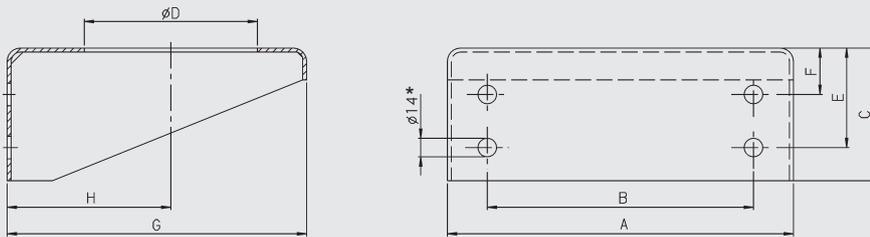
Model/order code (example):

HSS 222/229	235224
-------------	--------

4. CONSOLES

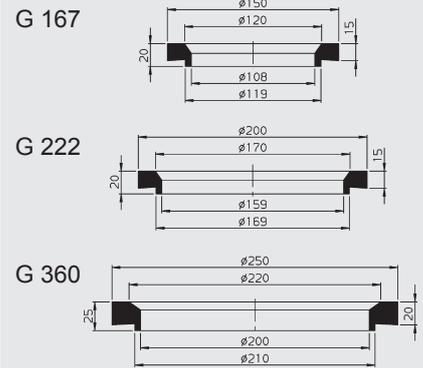
4.1. CONSOLE KBK FOR BLADDER AND PISTON ACCUMULATOR

Console KBK



* Ø22 on KBK 310 and KBK 360

Rubber support ring G



Type	Mat.	Part no.	A [mm]	B [mm]	C [mm]	ØD [mm]	E [mm]	F [mm]	G [mm]	H [mm]	Weight [kg]
126	STZN	290530	175	100	60	65	36	—	150	77	1.1
167		238526	260	200	100	120	75	35	225	92	2.5
219		238042	270	180		135	80	40	250	123	6.5
222		3002160	260	200	170	75	35	225	123	2.4	
310		238043	330	220	200	190	140	60	340	170	18.3
360		357959	390	270	240	211	180		390	195	20.1

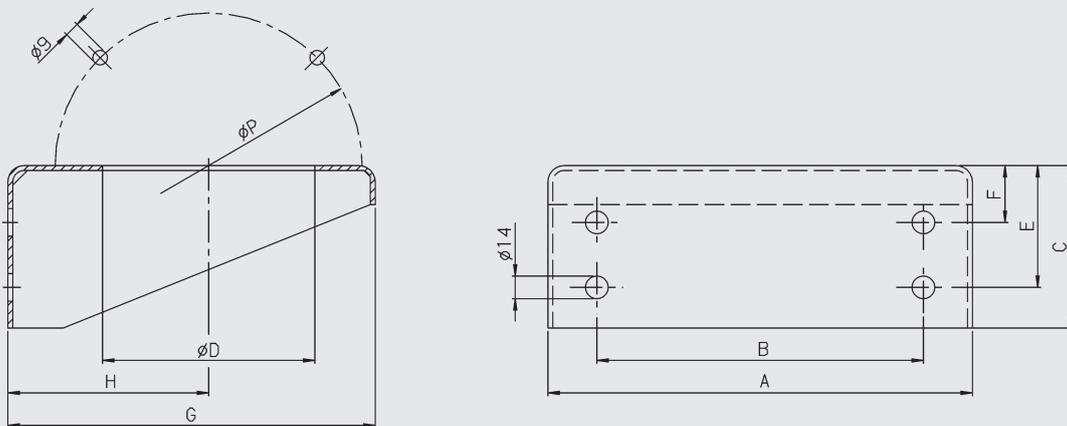
Type	Material	Part no.
—	NBR	—
167		236997
—		—
222		236996
—		—
360		355966

Model/order code (example):

KBK 167 STZN 238526

G 167 NBR 236997

4.2. KMS CONSOLES FOR DIAPHRAGM ACCUMULATOR (SCREW TYPE)



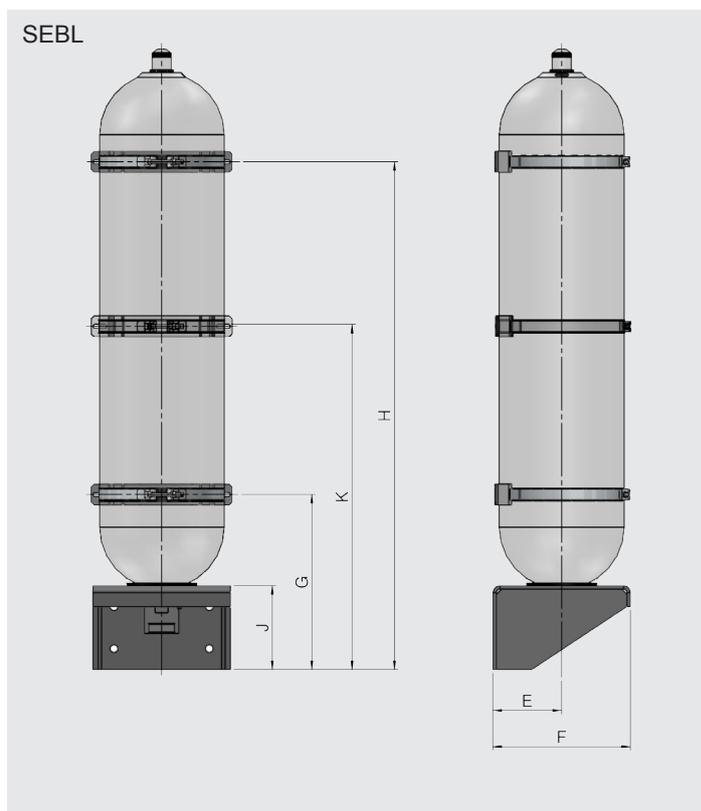
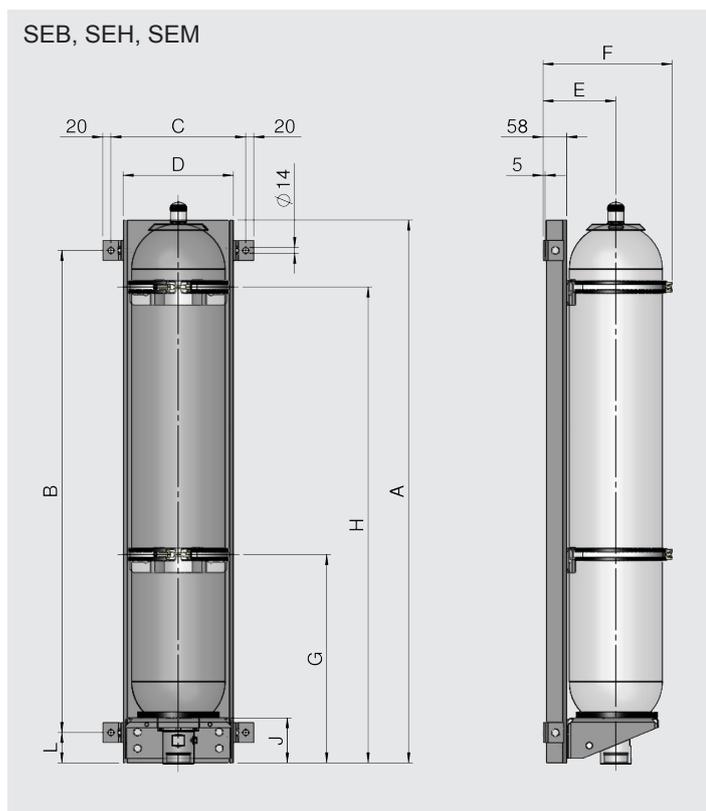
The screw type diaphragm accumulator has threaded bores M8 in the lock nut for fixing to the KMS console.

Type	Mat.	Part no.	A [mm]	B [mm]	C [mm]	ØD [mm]	ØP [mm]	E [mm]	F [mm]	G [mm]	H [mm]	ØI [mm]	Weight [kg]
200	STZN	359931	270	180	100	148	160	80	40	250	123	14	6.5
210		358989	260	200		170	180	75	35	225			2.4
220		359922				170	188						
250		359924	330	220	200	192	204	140	60	340	170	22	18.3
280		359925				215	230						
300		359926				220	235						
310		359927				245	265						
320		359928	290	305									

Model/order code (example):

KMS 200 STZN 359931

5. ACCUMULATOR SET FOR BLADDER ACCUMULATORS

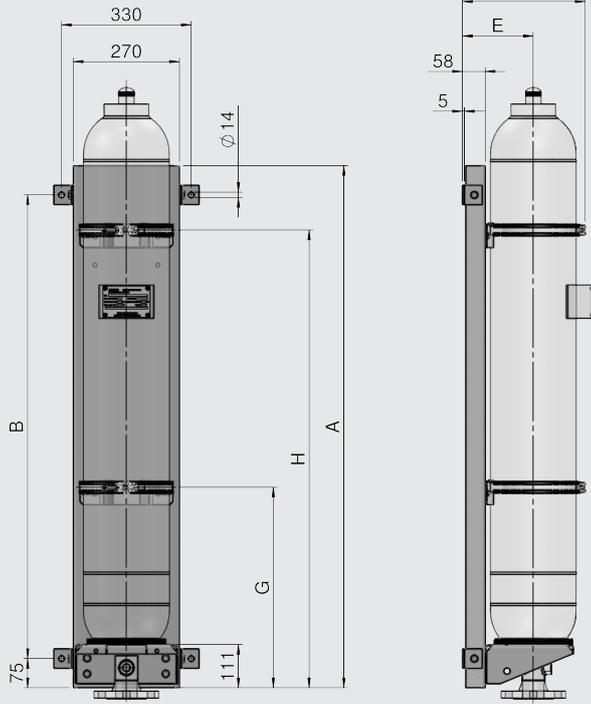


Accumulator set	Part no.	Vol. [l]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H [mm]	K [mm]	L [mm]	J [mm]
SEB for SB330/440, SEBL for SB330													
SEB 2.5	290787	2.5	460	310	198	138	133	214	220	410		75	–
SEB 4	238403	4	410	320			152	265		270		45	95
SEB 6	2115851	6								415			
SEB 10	238407	10	570	420	330	270				330		75	111
SEB 20	240598	20					180	317		500			
SEB 32	238409	32	1340	1190						1160			
SEB 50	240599	50							500				
SEBL 60-80	3605561	60								930			
		80					195	390		1200			240
SEBL 100-130	372132	100								1450	950		
		130								1750	1100		
SEH for SB500/550/600													
SEH 2.5	2105194	2.5	460	310	198	138	133.5	223	220	410			–
SEH 5	2105195	5	750	600						650			
SEH 10	378952	10								330		75	
SEH 20	298181	20	570	420	330	270	194	323		500			111
SEH 32	298182	32	1340	1190									
SEH 50	298183	50							500	1160			
SEM for SB40													
SEM 2.5	3007402	2.5	460	310	198	138	121.5	201	220	410			–
SEM 5	3007423	5	750	600						650			
SEM 10	3007424	10								330		75	
SEM 20	3007425	20	570	420	330	270	172	310		500			111
SEM 32	3007426	32	1340	1190									
SEM 50	3007427	50							500	1160			

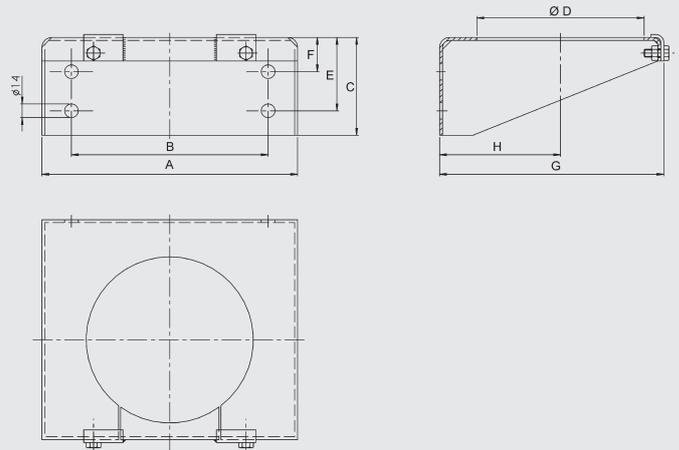
This accumulator set SEB is also available with a SAF and SB330 as a compact unit (ACCUSET SB330).
See catalogue section:

- ACCUSET SB
No. 3.503

SEHB



KHF 210



	Mat.	Part no.	Vol.	A	B	C	ØD	E	F	G	H	L	J	Weight
			[l]	[mm]	[kg]									
Accumulator set SEHB for SB35HB														
SEHB 20		3007431	20	570	420						500			
SEHB 32		3007432	32					172	310	500	1160	75	111	
SEHB 50		3007433	50	1340	1190									
Console KHF														
KHF 210	STZN	239965		260	200	100	170	75	35	230	123			2.5

Model/order code (example):

SEB 10 238407

The accumulator sets SEHF/SEHB are supplied with console KHF 210 / G which can be opened at the front for easier installation of the bladder accumulator.

6. NOTE

The information in this brochure relates to the operating conditions and applications described.
 For applications and operating conditions not described, please contact the relevant technical department.
 Subject to technical modifications.

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ACCUSET SB



1. DESCRIPTION

The HYDAC accumulator unit ACCUSET SB consists of a bladder accumulator SB, a safety and shut-off block SAF and the appropriate accumulator set SEB. The parts are designed for optimum compatibility and provide a compact, ready-to-install unit.

This space-saving combination simplifies the connection of the accumulator to the hydraulic system, reduces maintenance costs and considerably reduces installation costs.

Advantages:

- Simple and secure mounting of the accumulator at the installation site
- Connection of the accumulator with a hydraulic system via a safety and shut-off block
- Protects the accumulator from excessive pressure
- Discharge of the accumulator to the tank via a pressure release valve
- Separation of the accumulator from the system
- Two additional hydraulic connections on the shut-off block for accessories (e.g. pressure gauge).

1.1. STANDARD BLADDER ACCUMULATOR SB330

With a nominal volume of 1 ... 50 litres.

Special accumulators available on request.

See catalogue section:

- Bladder Accumulators Standard No. 3.201

Please read the Operating Manual! No. 3.201.CE

1.2. SAFETY AND SHUT OFF BLOCK SAF

In nominal sizes 10, 20 and 32, with manual or solenoid-operated/manual discharge and with the direct-operated pressure relief valve DB12 with CE marking, in accordance with the regulations of DIN EN 14359 "Accumulators for hydraulic applications" and the European Pressure Equipment Directive PED 97/23/EC.

See catalogue section:

- Safety and Shut-off Block SAF/DSV No. 3.551

1.3. ACCUMULATOR SET SEB

For mounting the bladder accumulator with clamps, back plate, console and rubber support ring.

See catalogue section:

- Supports for Hydraulic Accumulators No. 3.502

2. TECHNICAL SPECIFICATIONS

Design:

Pressure Equipment Directive PED 97/23/EC ¹⁾

Permitted operating pressure: 330 bar ¹⁾

Permitted temperature range: -10 ... +80 °C (NBR) ¹⁾

Temperatures exceeding this range (e.g. in the event of an external fire) can result in the accumulator bursting. To prevent this, HYDAC can provide additional temperature fuses and bursting discs.

Operating medium:

Hydraulic fluids of types HL, HLP, HFA, HFB, HFC (NBR)

Pressure limit:

DB12 set to 330 bar ¹⁾

Release valve:

Operating voltage 24 V DC ¹⁾

Fluid connection P:

see table at point 5.

Surface:

Accumulator primed, SAF block phosphate-plated, accumulator set zinc-plated.

See catalogue section:

- HYDAC Accumulator Technology No. 3.000
- Charging and Testing Unit FPU-1 No. 3.501

¹⁾ others on request

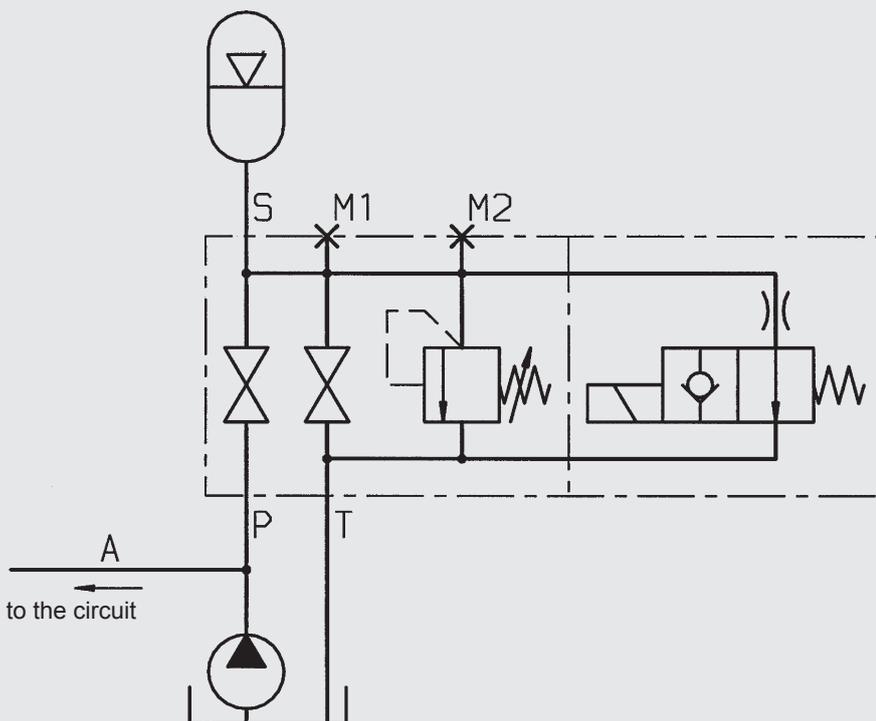
3. MODEL CODE

Not all combinations are possible.
Order example. For further information, please contact HYDAC.

ACCUSET SB 330 - 10 A 1 / 1 1 2 U - 10 Y 1 - 330

- Type of accumulator _____
SB = bladder accumulator
- Accumulator series _____
- Nominal volume [l] _____
- Fluid connection _____
A = standard connection
- Gas valve _____
1 = standard model
- Material of fluid connection / block _____
1 = carbon steel
2 = stainless steel
- Shell material _____
1 = carbon steel
- Accumulator bladder/seal material _____
2 = NBR / NBR
3 = ECO / NBR
4 = IIR / EPDM
6 = FKM / FKM
- Certification code _____
- SAF block series _____
- Type of directional poppet valve _____
M = manual discharge
Y = solenoid-operated and manual discharge (open when de-energised)
Z = solenoid-operated and manual discharge (closed when de-energised)
- Type of voltage - directional poppet valve _____
1 = 24 V DC (only on Y or Z model)
- Permitted operating pressure/
cracking pressure of the pressure relief valve [bar] _____

Circuit diagram

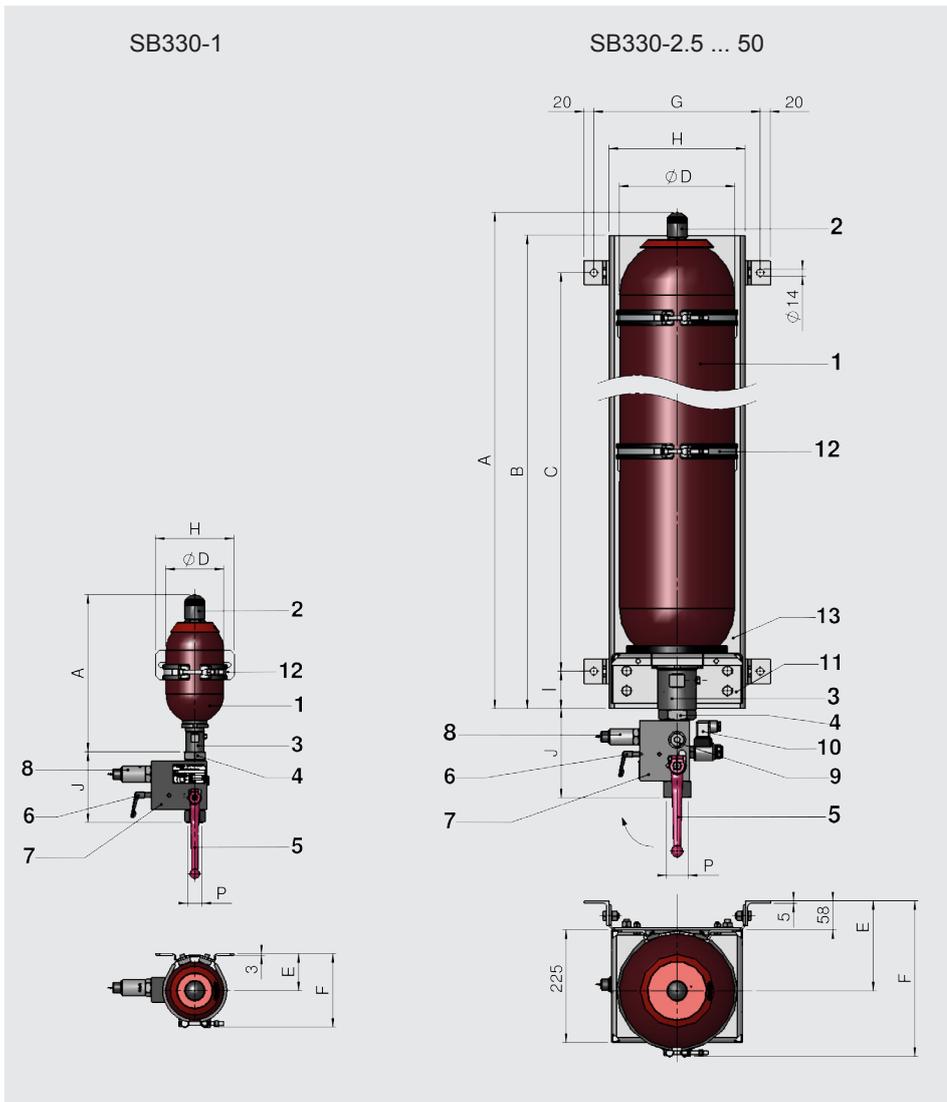


4. PREFERRED MODELS

Designation	Part no.	SB330-1A1/112U-330A	SB330-2.5A1/112U-330A	SB330-4A1/112U-330A	SB330-6A1/112U-330A	SB330-10A1/112U-330A	SB330-13A1/112U-330A	SB330-20A1/112U-330A	SB330-24A1/112U-330A	SB330-32A1/112U-330A	SB330-50A1/112U-330A	SAF10M12T330A	SAF10E12Y1T330A	SAF20M12T330A	SAF20E12Y1T330A	SAF32M12T330A	SAF32E12Y1T330A
ACCUSET SB330-1A1/112U-10M-330	3033471	●										●					
ACCUSET SB330-1A1/112U-10Y1-330	3033472	●											●				
ACCUSET SB330-2.5A1/112U-10M-330	3033473		●									●					
ACCUSET SB330-2.5A1/112U-10Y1-330	3033474		●										●				
ACCUSET SB330-4A1/112U-10M-330	3033475			●								●					
ACCUSET SB330-4A1/112U-10Y1-330	3033476			●									●				
ACCUSET SB330-6A1/112U-10M-330	3033477				●							●					
ACCUSET SB330-6A1/112U-10Y1-330	3033478				●								●				
ACCUSET SB330-10A1/112U-10M-330	3033479					●						●					
ACCUSET SB330-10A1/112U-10Y1-330	3033480					●							●				
ACCUSET SB330-13A1/112U-10M-330	3033481						●					●					
ACCUSET SB330-13A1/112U-10Y1-330	3033482						●						●				
ACCUSET SB330-13A1/112U-20M-330	3033483						●							●			
ACCUSET SB330-13A1/112U-20Y1-330	3033484						●								●		
ACCUSET SB330-20A1/112U-20M-330	3033485							●						●			
ACCUSET SB330-20A1/112U-20Y1-330	3033486							●							●		
ACCUSET SB330-24A1/112U-20M-330	3033487								●					●			
ACCUSET SB330-24A1/112U-20Y1-330	3033488								●						●		
ACCUSET SB330-32A1/112U-20M-330	3033489									●				●			
ACCUSET SB330-32A1/112U-20Y1-330	3033490									●					●		
ACCUSET SB330-32A1/112U-32M-330	3033491										●					●	
ACCUSET SB330-32A1/112U-32Y1-330	3033492											●					●
ACCUSET SB330-50A1/112U-20M-330	3033493										●			●			
ACCUSET SB330-50A1/112U-20Y1-330	3033494										●				●		
ACCUSET SB330-50A1/112U-32M-330	3033495											●				●	
ACCUSET SB330-50A1/112U-32Y1-330	3033496												●				●

Other combinations and models available on request.

5. DIMENSIONS



Bladder accumulator	A _{max} [mm]	B [mm]	C [mm]	ØD [mm]	E [mm]	F [mm]	G [mm]	H [mm]	I [mm]
SB330-1 ¹⁾	302	–	–	118	74	147	–	156	–
SB330-2.5 ²⁾	571	460	310		133	214	198	138	75
SB330-4	440	415	320	173	152	253	330	270	75
SB330-6	560	570	420						
SB330-10	568			1340	1190	229	180	317	
SB330-13	686								
SB330-20	896								
SB330-24	1062								
SB330-32	1411								
SB330-50	1931								

¹⁾ without back plate and console, with one HyRac clamp 110-118/124 H10 ST

²⁾ without console, with back plate and two HyRac clamps 110-110/124 H10 ST

SAF series	Nominal size SB330 [l]	P ISO 228	Connection for pressure gauge Pos. 9	J [mm]
SAF10	1	G 1/2	2 x G 1/4	142
	2.5			104
	4			113
	6			102
	> 10			147
SAF20	2.5	G 1	G 1/4, G 1/2	135
	4			142
	6			132
	> 10			178
SAF32	> 10	G 1 1/2		203

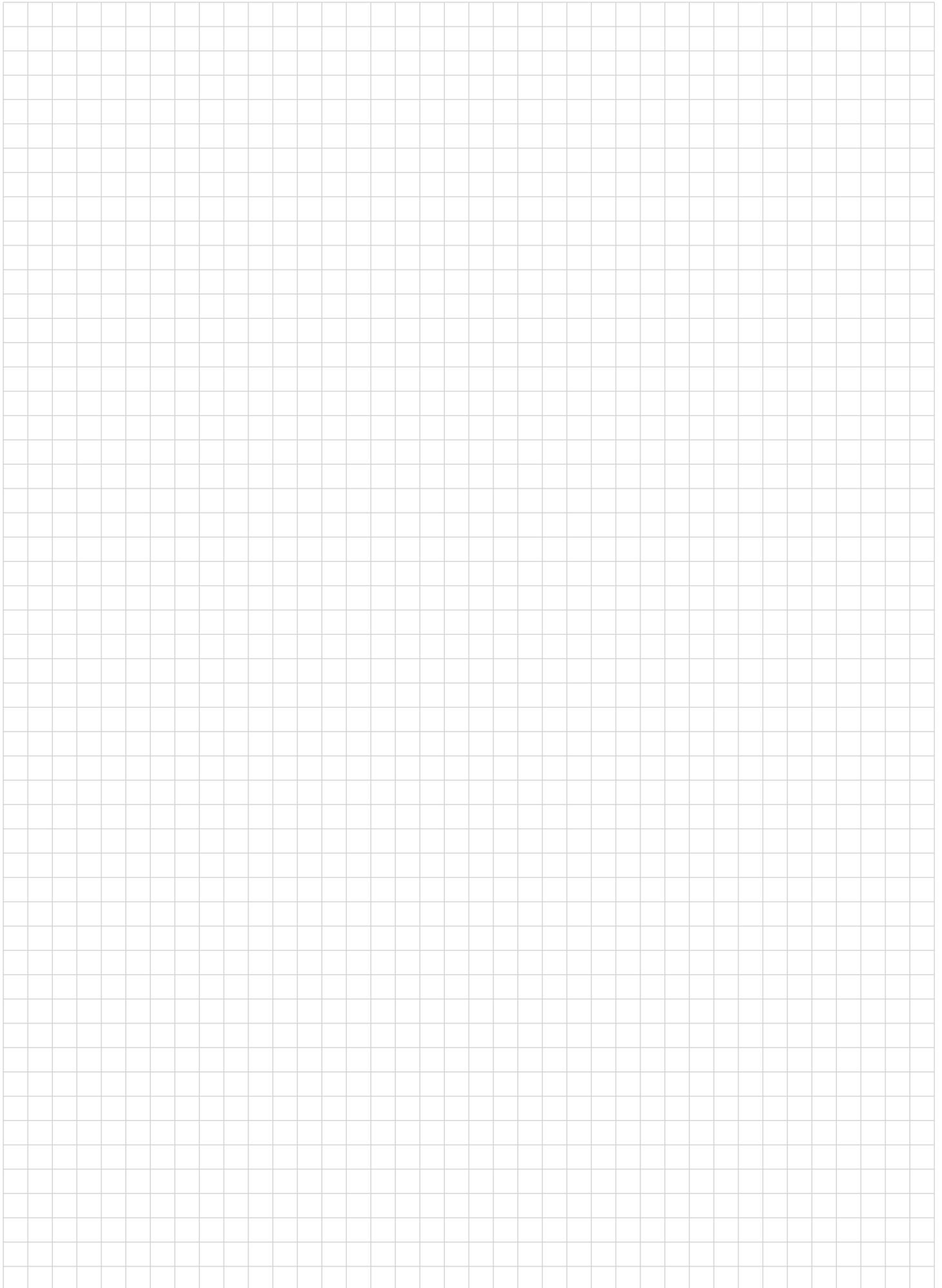
Description	Item
Accumulator shell	1
Gas valve	2
Oil valve	3
Adapter S	4
Switching handle	5
Release spindle	6
SAF safety block	7
Pressure relief valve	8
Connection for pressure gauge	9
Release valve	10
Console	11
HyRac clamp	12
Back plate	13

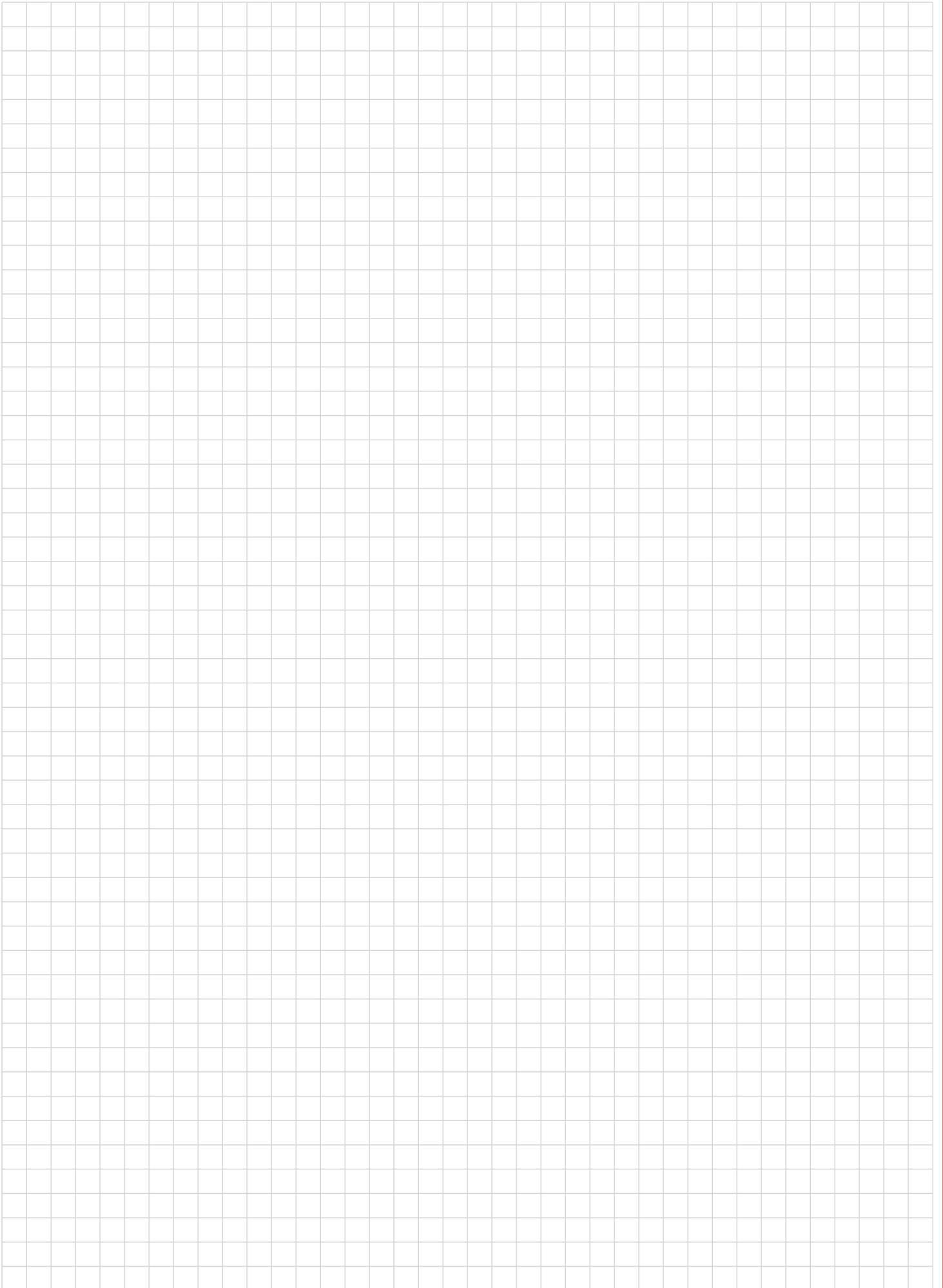
6. NOTE

The information in this brochure relates to the operating conditions and applications described.

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

Subject to technical modifications.





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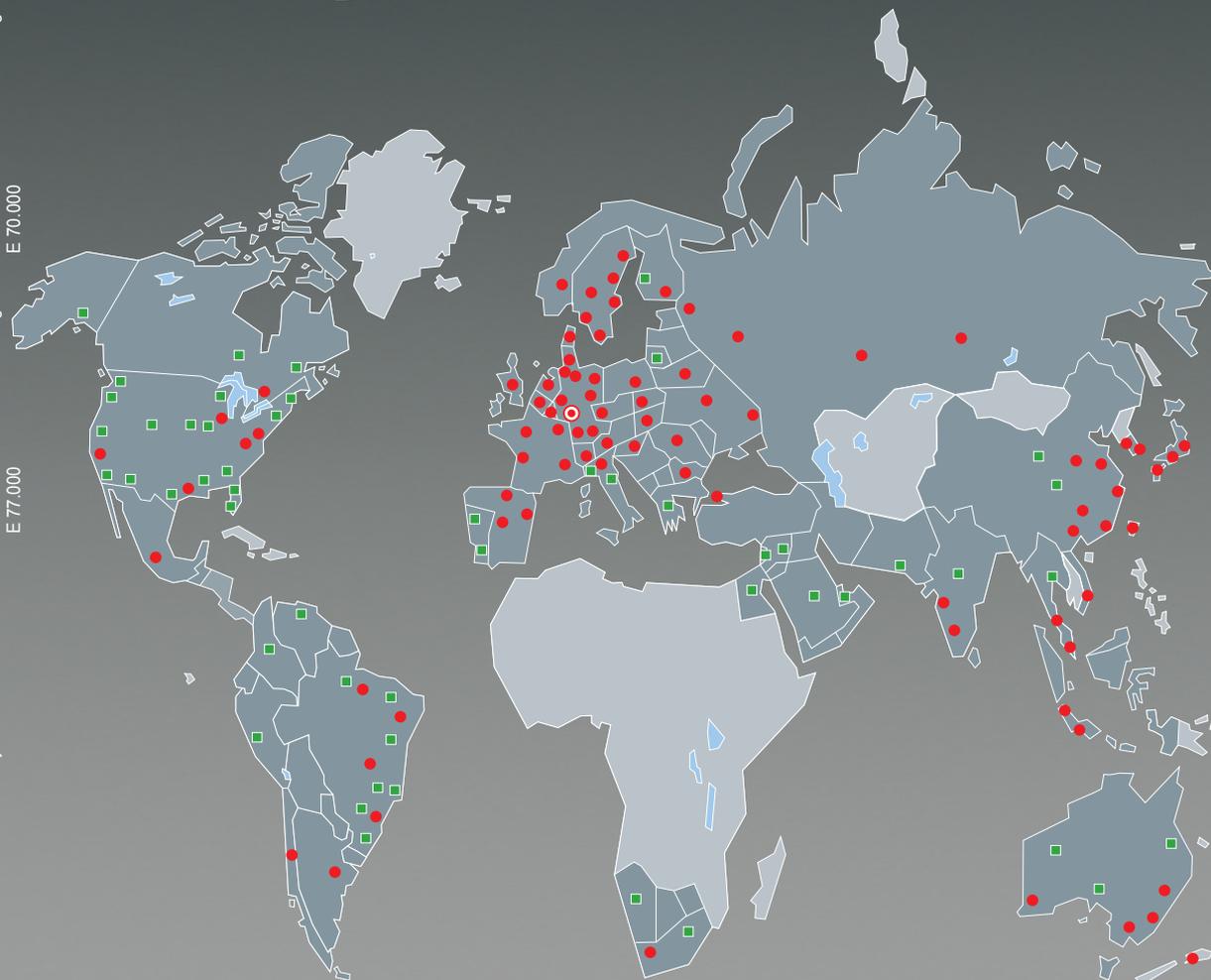


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