

1. HYDAC ACCUMULATOR TECHNOLOGY FLUID TECHNOLOGY EFFICIENCY THROUGH ENERGY MANAGEMENT.

HYDAC Accumulator Technology can reflect on over 45 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 and also
- Energy recovery.

Using accumulators improves the performance of the whole system and specifically 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
- Mounting 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 both before and after sale of an experienced workforce.

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3. SAFETY INSTRUCTIONS

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 pressurized 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 pressurized 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 exclusively 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 with 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 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.

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. PRESSURE EQUIPMENT DIRECTIVE REGULATIONS

On 29 November 1999 the Directive 97/23/EC (Pressure Equipment Directive) came into force and has been operative since 29 May 2002. 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 and 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 industrial safety regulations.

4.1. OVERSEAS

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

The country of installation must be stated at the time of ordering.

HYDAC pressure vessels can be supplied with virtually any test certificate. In some of these the permitted operating pressure can differ from the nominal pressure.

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

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

4.2. CERTIFICATE CODE = S (U STAMP)

HYDAC Technology GmbH has had authorization since 1985 to use the Code Symbol "U STAMP" 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".



4.3. 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.

4.4. 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 bladder, piston and diaphragm accumulators, and safety valves, into the Chinese market.

Country	AKZ (Certificate code)
AUS Australia	F ¹⁾
BDS Barbados	U ³⁾
BM Bermuda	U ³⁾
BOL Bolivia	U ³⁾
BR Brazil	U ³⁾
BS Bahamas	E
BY Belarus	A12
CDN Canada	S1 ²⁾
CH Switzerland	U
CR Costa Rica	E ³⁾
CZ Czech Republic	U
DZ Algeria	U ³⁾
EC Ecuador	U ³⁾
ET Egypt	U
H Hungary	U ³⁾
HK Hong Kong	A9
IL Israel	U ³⁾
IND India	U ³⁾
IR Iran	U
IRQ Iraq	U ³⁾
IS Iceland	U ³⁾
J Japan	P
JOR Jordan	U ³⁾
KWT Kuwait	U ³⁾
LAR Libya	U ³⁾
MAL Malaysia	U ³⁾
MEX Mexico	U ³⁾
N Norway	U ³⁾
NZ New Zealand	T
PAK Pakistan	U ³⁾
PE Peru	U ³⁾
PL Poland	U
PR Puerto Rico	E ³⁾
RA Argentina	U ³⁾
RC Taiwan	U ³⁾
RC China	A9
RCH Chile	U ³⁾
RI Indonesia	U ³⁾
RL Lebanon	U ³⁾
RO Romania	U
ROK Korea (Republic)	U ³⁾
RP Philippines	U ³⁾
RUS Russia	A6
SA Saudi Arabia	U ³⁾
SGP Singapore	U
SK Slovakia	U
SUD Sudan	U ³⁾
SYR Syria	U
TT Thailand	U ³⁾
TN Tunisia	U ³⁾
TR Turkey	U
USA United States	S
WAN Nigeria	U ³⁾
YU Yugoslavia (Serbia/Montenegro)	U
ZA South Africa	U ³⁾

¹⁾ approval required in the individual territories

²⁾ approval required in the individual provinces

³⁾ alternative certificates possible

5. PRODUCT OVERVIEW

5.1. BLADDER ACCUMULATORS



5.1.1 Standard

Nominal volumes:
0.5 ... 200 l

Max. operating pressure:
330 ... 550 bar



5.1.2 Low pressure

Nominal volumes:
2.5 ... 450 l

Max. operating pressure:
up to 40 bar



5.1.3 High pressure

Nominal volumes:
1 ... 54 l

Max. operating pressure:
5.0 ... 1000 bar

Benefits of HYDAC bladder accumulators:

- High discharge speeds,
- No differential pressure between fluid and gas sides,
- Compact, maintenance-free,
- High charging and discharge frequencies.

5.2. PISTON ACCUMULATORS



5.2.1 Standard

Nominal volumes:
0.2 ... 1200 l

Max. operating pressure:
210 ... 350 bar
(higher pressures on request)



5.2.2 Series SK280

Nominal volumes:
0.16 ... 5 l

Max. operating pressure:
280 bar

Benefits of HYDAC piston accumulators:

- Minimal pressure differential between the fluid and gas sides,
- Large usable volume,
- Variable mounting position,
- Monitoring of the piston position possible using various systems,
- Particularly suitable for back-up configurations,
- High flow rates possible,
- No sudden discharge of gas when seals are worn.

5.3. DIAPHRAGM ACCUMULATORS



5.3.1 Diaphragm accumulators Weld type

Nominal volumes:
0.075 ... 4 l

Max. operating pressure:
50 ... 330 bar

Screw type

Nominal volumes:
0.1 ... 4 l

Max. operating pressure:
210 ... 750 bar

Benefits of HYDAC diaphragm accumulators:

- Design optimized for function and weight,
- Choice of mounting positions,
- No differential pressure between fluid and gas sides,
- Low-maintenance and long service life.

5.4. METAL BELLOWS ACCUMULATORS



5.4.1 Metal bellows accumulator for heavy diesel engines

Nominal volume:
3.8 l

Max. operating pressure:
50 bar

Series: SM50P-...

Other models on request

Benefits of the HYDAC metal bellows accumulator:

- Gas-tight
- Maintenance-free
- Media resistance over a wide range of temperatures

5.5. HYDRAULIC DAMPERS



5.5.1 Dampers

Nominal volumes:
0.075 ... 450 l

Max. operating pressure:
10 ... 1000 bar

Benefits of the HYDAC hydraulic damper:

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



5.5.2 SILENCER

Max. operating pressure:
330 bar

5.6. SPECIAL ACCUMULATORS



5.6.1 Low weight hydraulic accumulators

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



5.6.2 Spring accumulators

are fitted with a spring. The energy is produced from 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 model 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 makes of accumulator, up to 300 bar.



5.8.3 Safety and shut-off block SAF/DSV

Nominal sizes:
10 ... 50

Max. operating pressure:
400 bar (DSV 350 bar)

Pressure relief valve:
Nominal size DN 12



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.



5.8.5 ACCUSET SB

Nominal volumes:
1 ... 50 l

Max. operating pressure:
330 bar

Using HYDAC nitrogen bottles provides
the following benefits:

- Cost-effective expansion of 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
- Minimum of installation required (1 SAF generally replaces up to 10 individual pipe fittings),
- Considerable reduction in installation time,
- Can be adapted to different types and also different makes of accumulator, and
- Additional valves (pilot-operated check valves, flow control valves, etc).

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.

Listed below is a selection of examples which are typical for these industries:



6.1. INDUSTRIAL HYDRAULICS

Machine tools

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

Plastics technology

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

Die casting machines

- Energy storage for injection process
- Volume compensation using diaphragm accumulators

Steel industry

- Energy storage in rolling mills
- Blast furnace hydraulics

Power plants

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

Paper industry

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

Wind energy

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



6.2. MOBILE TECHNOLOGY

Agricultural and forestry machines

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

Construction machinery

- Accumulators in braking systems
- Chassis damping
- Bucket damping

Cranes and commercial vehicles

- Accumulators for boom damping on mobile cranes
- Accumulators in steering systems of HGVs
- Accumulators in hydraulic switching systems

Rail vehicles

- Temperature and leakage oil adjustment
- Chassis controls
- Level control
- Pump noise damping

Automotive

- Automatic and manual transmission
- Automatic clutch systems
- Engine management systems
- Pump noise damping



6.3. PROCESS TECHNOLOGY

Chemical industry

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

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

Loading stations / Refineries

- Shock absorption for valve closing
- Pulsation damping on pipelines

7. WEBSITE

Please visit us at the following address:

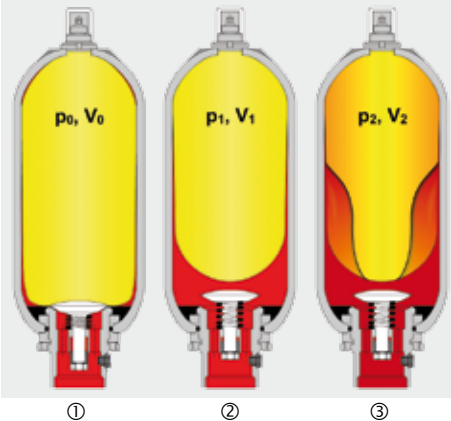
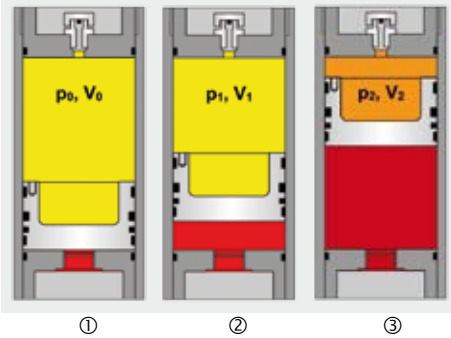
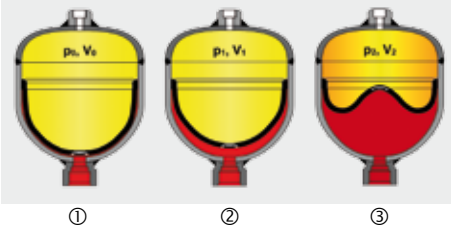
www.hydac.com.

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

8. SIZING

8.1. DEFINITION OF VARIABLES FOR SIZING A HYDRAULIC ACCUMULATOR

Function principle	Accumulator cycle	Limits for the gas pre-charge pressure
Bladder accumulator  ① ② ③	① The accumulator is pre-charged with nitrogen. The separating element (piston, bladder, diaphragm) 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 = Gas 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 = Gas pre-charge temperature t_{min} = Min. operating temperature t_{max} = Max. operating temperature	$p_0 \leq 0.9 \cdot p_1$ with a permitted pressure ratio of $p_2 : p_0 \leq 4 : 1$ For HYDAC low pressure accumulators, the following must also be taken into account: Type SB40: $p_{0,max} = 20 \text{ bar}$ Type SB35H: $p_{0,max} = 10 \text{ bar}$
Piston accumulator  ① ② ③		$p_{0,tmin} \geq 2 \text{ bar}$ (piston type 2) $p_{0,tmin} \geq 10 \text{ bar}$ (piston type 1) $p_{0,tmin} \leq p_1 - 5 \text{ bar}$ 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. Accumulator supplied uncharged or with 2 bar storage pressure.
Diaphragm accumulator:  ① ② ③		a) Permitted pressure ratio: $p_2 : p_0$ Weld type: 2.8 l and 3.5 l: 4 : 1 other sizes: 8 : 1 Screw type: All sizes: 10 : 1 Other pressure ratios on request b) $p_0 \leq 0.9 \cdot p_1$

8.2. SELECTION OF GAS PRE-CHARGE PRESSURE

The selection of the gas pre-charge pressure defines the accumulator capacity. In order to obtain optimum utilization of the accumulator volume the following gas pre-charge pressures are recommended:

8.2.1 Recommended values for energy storage:

$$p_{0,tmax} = 0.9 \cdot p_1$$

for shock absorption:

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

(p_m = average operating pressure for free flow)

for pulsation damping:

$$p_{0,tmax} = 0.6 \cdot p_m$$

(p_m = average operating pressure)

or

$$p_{0,tmax} = 0.8 \cdot p_1$$

(for several operating pressures)

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

Since the volume of the gas increases as the temperature increases, the gas pre-charge pressure must be determined at the maximum operating temperature using the recommended values.

8.2.2 Limits for gas pre-charge pressure:

(see right-hand column of table)

8.2.3 Temperature effect

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

$$p_{0,tcharge} = p_{0,tmax} \cdot \frac{t_{charge} + 273}{t_{max} + 273}$$

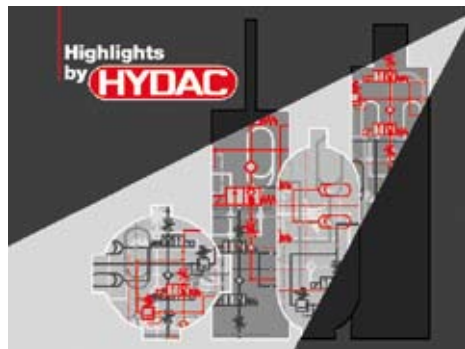
$$t_0 = t_{charge} \text{ (gas charging temperature in } ^\circ\text{C)}$$

To take the temperature effect into account when sizing accumulators, the pre-charge pressure p_0 at min. temperature t_0 should be selected as follows:

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

8.3. ACCUMULATOR SIZING ON YOUR PC

ASP - ACCUMULATOR SIMULATION PROGRAM



Do you want to size an accumulator for your hydraulic system and need to find out the required gas volume? What does the accumulator's behaviour in the system actually look like?

The relevant formulae are unwieldy and in any case are only partially applicable.

The solution: HYDAC **ASP** - Accumulator Simulation Program:

- Accumulator sizing on your PC with Windows interface for bladder, piston and diaphragm accumulators and systems using back-up nitrogen bottles and taking into account isentropic, isothermal and polytropic changes in condition.
- Calculation of accumulator systems with the possibility of inputting accumulators, consumers and pumps with their particular switch-on and switch-off times.
- Simulation of pressure, temperature and volume over the given cycle time. Real gas equations are used for this and the accumulator type and its heat exchange behaviour is taken into account in the calculation.
- Sizing of pulsation dampers.
- Calculation of the gas volume and the residual pulsation of gas-filled pulsation dampers.
- Sizing of shock absorbers, calculation of the required gas volume for "Joukowsky shock".
Complex pipe systems are possible on request.
- Display of the gas compression and the degree of efficiency

Example Petrol tanker filling station



When loading fuels into vehicles, ships or barrels, the flow is suddenly interrupted when the valve closes.

This deceleration of mass results in a pressure shock which is also called a "Joukowsky pressure shock". By using a hydraulic accumulator, the pressure shock can be reduced to a tolerable level.

Given parameters:

- Temperature: 20 °C
Fluid: PETROL (Super leaded)
(Density: 0.760 kg/dm³)
- Pipe length from pump to valve: 900 m
- Pipe cross-section: Internal diameter = 107.1 mm
(DN100 = 114.3 external, wall thickness = 3.6 mm)
- Zero head of the pump: 147.5 m, equivalent to 11 bar
- Pump pressure at operating point: 10 bar (pre-charge pressure p_0 = 9 bar)
- Max. permitted pressure of the pipe: 12 bar
- Flow rate: 500 l/min
- Closing time of the shut-off valve: 1s (0.33 s effectively)
- Pipe material: Steel $E = 2.1 \times 10^5$ N/mm²

Required:

- Maximum Joukowsky pressure shock in bar
- Maximum flow velocity in the pipe in m/s
- Required accumulator gas volume in L

Solution:

- Maximum Joukowsky pressure shock: 18.867 bar
- Maximum flow velocity: 0.925 m/s
- Required accumulator gas volume: 41.795 l

9. 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.

HYDAC Technology GmbH

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General ACCUMULATOR Specification Form (Page 1/2)

(subject to technical modifications)

Company: _____ Location: _____
Project name: _____ Originator: _____
E-Mail: _____ Telephone no.: _____
Application: _____ Requirement: _____ pieces/year

Note:

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

Accumulator type ☐ 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

(Please see Product Catalogue No. 30.000, section on Sizing)

Ambient temperature: _____ °C

Operating temperature: _____ °C

Complete cycle time: _____ sec

Fluid demand diagram for one pump
and one consumer:

Accumulator discharge rate: _____ l/min

Accumulator discharge time: _____ sec

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 Øext.)

Fluid connection: Type: _____

(for thread ☐ internal _____

☐ external _____)

Standard: _____

Gas connection: _____

Colour/Finish: _____

Corrosion protection: ☐ internal ☐ external

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

* dependent on operating temperature and/or fluid resistance

Comments: _____

Date: _____ Name: _____

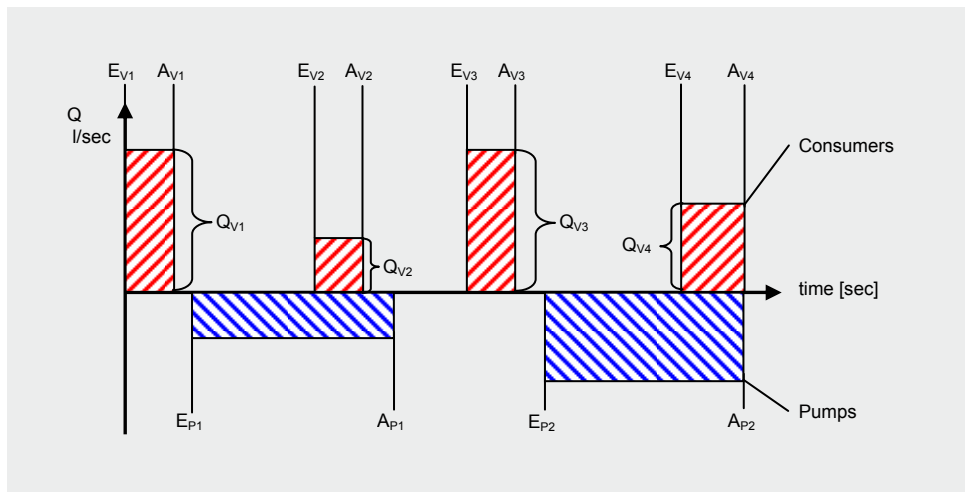
General ACCUMULATOR Specification Form (Page 2/2)

(subject to technical modifications)

Fluid demand diagram for several pumps and/or consumers:

Designation / Example:

Q_v = Consumer flow rate (l/sec)
 E_v = Switch-on time of consumer (sec)
 A_v = Switch-off time of consumer (sec)
 E_p = Switch-on time of pump (sec)
 A_p = Switch-off time of pump (sec)



Please indicate cycle data below:

Number of consumers: _____

Q_{v1} = _____ E_{v1} = _____ A_{v1} = _____
 Q_{v2} = _____ E_{v2} = _____ A_{v2} = _____
 Q_{v3} = _____ E_{v3} = _____ A_{v3} = _____
 Q_{v4} = _____ E_{v4} = _____ A_{v4} = _____

Number of pumps: _____

Q_{p1} = _____ E_{p1} = _____ A_{p1} = _____
 Q_{p2} = _____ E_{p2} = _____ A_{p2} = _____
 Q_{p3} = _____ E_{p3} = _____ A_{p3} = _____
 Q_{p4} = _____ E_{p4} = _____ A_{p4} = _____



PULSATION DAMPER SPECIFICATION FORM

(subject to technical modifications)

Company: _____ Location: _____
Project name: _____ Originator: _____
E-mail: _____ Telephone no.: _____
Application: _____ Requirement: _____ pieces/year

Note:

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

Fluids/Medium:

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

Pump and system data:

Oper. press./pump pressure: _____ bar
Flow rate: _____ l/min
Rpm: _____ 1/min
No. of displacements: ☐ single ☐ double acting
Pump factor: _____ optional (if available)
Stroke volume: _____ 1dm³

→ for piston pumps: $V_H = \frac{d^2 \times \pi}{4} \times H \times 10^6$

d = Ø piston: _____ mm

H = stroke length: _____ mm

→ for diaphragm pumps: see manufacturer's specifications

Accumulator data:

Pre-charge pressure ¹⁾: _____ bar
Operating temperature: _____ °C
Design temperature: _____ °C
Application: ☐ pressure side ☐ suction side
Residual pulsation: _____ %
Result: _____ l gas volume ²⁾

Additional information on the accumulator:

Country of installation: _____
Certification: _____
Materials
Accumulator shell: _____
Fluid connection: _____
Elastomer: _____
Design pressure: _____ bar

¹⁾ See Product Catalogue, No. 30.000, Section 8. Sizing

²⁾ Normally pre-charged with nitrogen (N₂)

Comments: _____

Date: _____ Name: _____

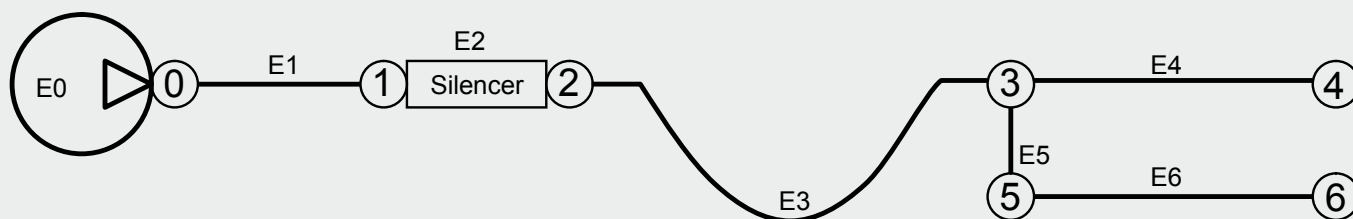
SILENCER SPECIFICATION FORM

(subject to technical modifications)

Company: _____
Project name: _____
E-mail: _____
Application: _____

Location: _____
Originator: _____
Telephone no.: _____
Requirement: _____ pieces/year

Sizing example:



Pump: **A10VSO71**
Pump rpm: **1500 1/min**
Fluid: **Aral Vitam GF**

Design pressure: **210 bar**
No. of pump pistons: **9**
Density of the fluid: **890 kg/m³**

Connection SD in: **SAE 1 1/4" 3000 PSI**
Connection SD out: **SAE 1 1/4" 3000 PSI**
Design temperature: **50 °C**

Element no.	Length [m]	Ø int. [m]	Ø ext. [m]	Following connection type	Hose type
E1	0.5	0.020	0.030	Straight connection	–
E2	0.4	–	0.20	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	–

Design data:

Pump: _____
Pump rpm: _____ 1/min
Fluid: _____

Design pressure: _____ bar
No. of pump pistons: _____
Density of the fluid: _____

Connection SD in: _____
Connection SD out: _____
Design temperature: _____ °C

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

Comments:

Date: _____ Name: _____