Bladder accumulators
High pressure

1. DESCRIPTION

1.1. FUNCTION

While fluids are practically incompressible, this does not apply to gases. Hydraulic accumulators use these basic laws of physics to store hydraulic energy. Nitrogen is normally used as the compressible medium.

The various types of hydraulic accumulator are categorised on the basis of the separation element that keeps the gas section separate from the fluid section in the pressure vessel. In the case of a bladder accumulator, the separation element is a closed elastomer bladder.

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

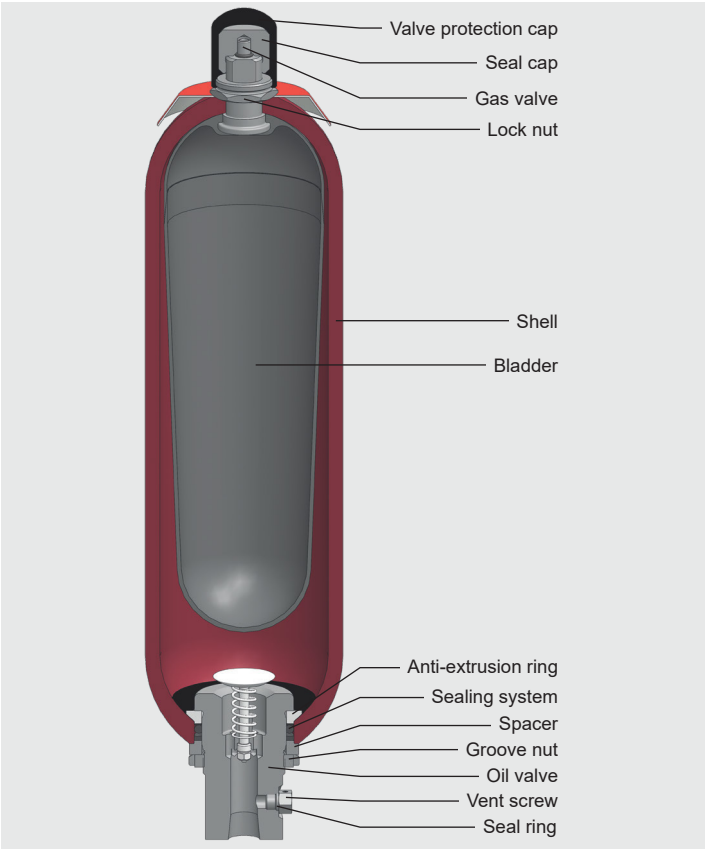
HYDAC bladder accumulators are available in various designs, see catalogue sections:

- Bladder accumulators Standard design
  No. 3.201

- Bladder accumulators Low pressure
  No. 3.202

Bladder accumulators can also be used as dampers, for example - see catalogue section:

- Hydraulic dampers
  No. 3.701



HYDAC high pressure bladder accumulators from the SB690 series consist of the pressure vessel, the flexible bladder with gas valve and the hydraulic connection with check valve.

2. GENERAL INFORMATION

2.1. MATERIALS, CORROSION PROTECTION

2.1.1 Accumulator shell

The pressure vessel is seamless and manufactured from high tensile chrome molybdenum steel.
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 hydraulic accumulator can be supplied with an epoxy resin finish specially designed for offshore applications.

2.1.2 Bladder

The bladder material must be selected in accordance with the particular operating medium or operating temperature, see section 2.1.3.
If discharge conditions are unfavourable (high p_2/p_0 pressure ratio, rapid discharge speed), the gas may cool to below the permitted temperature. This can cause cold cracking. The gas temperature can be calculated using the HYDAC Accumulator Simulation Program **ASP**.

2.1.3 Maximum temperature range of elastomer materials

The permitted working temperature of a bladder accumulator is dependent on the applications limits of the metal materials and the bladder. The operating medium must also be taken into account.

The following table shows the main **elastomer materials with their maximum possible temperature ranges** with examples of operating fluids.

Materials		Material code 1)	Max. possible temperature range 2)	Possible operating fluids, others on request	
				Resistant to	Not resistant to
NBR	Acrylonitrile butadiene rubber	2	-15 °C ... + 80 °C	– Mineral oil (HL, HLP) – Flame-retardant fluids from the groups HFA, HFB, HFC – Synthetic esters (HEES) – Water – Sea water	– Aromatic hydrocarbons – Chlorinated hydrocarbons (HFD-S) – Amines and ketones – Hydraulic fluids from the group HFD-R – Fuels
		5	-50 °C ... + 50 °C		
		9	-30 °C ... + 80 °C		
ECO	Ethylene oxide epichlorohydrin rubber	3	-30 °C ... +120 °C	– Mineral oil (HL, HLP) – Flame-retardant fluids from the HFB group – Synthetic esters (HEES) – Water – Sea water	– Aromatic hydrocarbons – Chlorinated hydrocarbons (HFD-S) – Amines and ketones – Hydraulic fluids from the group HFD-R – Flame-retardant fluids from the groups HFA and HFC – Fuels
IIR	Butyl rubber	4	-50 °C to ... 100 °C	– Hydraulic fluids from the group HFD-R – Flame-retardant fluids from the group HFC – Water	– Mineral oils and mineral greases – Synthetic esters (HEES) – Aliphatic, chlorinated and aromatic hydrocarbons – Fuels
FKM	Fluorine rubber	6	-10 °C ... +150 °C	– Mineral oil (HL, HLP) – Hydraulic fluids from the group HFD – Synthetic esters (HEES) – Fuels – Aromatic hydrocarbons – Inorganic acids	– Amines and ketones – Ammonia – Skydrol and HyJet IV – Steam

1) The material code (MC) is described in more detail in the model code, see section 3.

2) The specified temperature range relates to the particular elastomer material, not to the operating range of the hydraulic accumulator, see section 4.1.1

2.2. 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.
For 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 fluid volume and the maximum permitted flow rate of the operating fluid are reduced.

2.3. TYPE OF INSTALLATION

See catalogue sections:

- Mounting elements for hydraulic accumulators
  No. 3.502
- ACCUSET SB
  No. 3.503

2.4. CHARGING GAS

- Charging gas: Nitrogen
- Specification: min. Class 2.8

If other gases are to be used or if these specifications are deviated from, please contact HYDAC.

2.5. CERTIFICATES

Hydraulic accumulators that are installed outside of Germany are supplied with the relevant test certificate documentation. The country of installation must be stated at the time of ordering. HYDAC pressure vessels can be supplied with almost any approval classification. The permitted operating pressure may differ from the nominal pressure. The following table provides some examples of the code in the model code:

Country	Certificate code (CC)
EU member states	U
Australia	F [1)]
Belarus	A6
Canada	S1 [1)]
China	A9
Great Britain	Y
Hong Kong	A9
Iceland	U
Japan	P
Korea (Republic of)	A11
New Zealand	T
Norway	U
Russia	A6
South Africa	S2
Switzerland	U
Turkey	U
Ukraine	A10
USA	S

[1)] Registration required in the individual territories or provinces.
Others on request

2.6. FURTHER INFORMATION

- Operating instructions for bladder accumulators
  No. 3.201.BA

The operating instructions must be observed!
All work on HYDAC bladder accumulators must only be carried out by suitably trained staff. Incorrect installation or handling can lead to serious accidents.

- Installation and repair instructions bladder accumulators
  No. 3.201.M

For repairs to be performed on hydraulic accumulators, we provide corresponding assembly and repair instructions.

Further information such as accumulator sizing, safety information and extracts from the acceptance specifications can be found in our overview catalogue section:

- HYDAC Accumulator Technology
  No. 3.000

This document and others are available from our Download Center at www.hydac.com.

3. MODEL CODE

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

SB690 – 32 A 1 / 312 U – 690 D 320

Series

Nominal volume [l]

Fluid port
A = standard connection

Gas side connection
1 = standard design (see section 4.1.7)
9 = special design (example: 1/4" BSP)

Material code (MC)
Dependent on operating medium
Standard design = 312 for mineral oils
Others on request

Fluid port*
3 = stainless steel 1)

Accumulator shell
0 = plastic coated (internally)
~~4~~ carbon steel 2 =
chemically nickel-plated (internal coating)
6 = low temperature steel
8 = plastic coated (e.g. Duroplast) internally and externally

Accumulator bladder
2 = NBR 2)
~~3~~ ECO 4 =
IIR
5 = NBR 2)
6 = FKM
7 = other
9 = NBR 2)

Certification code
U = European Pressure Equipment Directive (PED)
For others, see section 2.5.

Permitted operating pressure [bar]

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

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

* Others on request
1) Dependent on type and pressure rating
2) Observe temperature ranges of the accumulator bladder, see section 2.1.3.

4. STANDARD ITEMS

The bladder accumulators and spare parts described below are manufactured in carbon steel (with a stainless steel fluid port) with an NBR accumulator bladder (MC = 312).

The table provides the most important data and dimensions for the following series: SB690

The part numbers provided refer to bladder accumulators in accordance with PED (CC = U).
Designs that differ from the standard types described below can be requested from HYDAC.

4.1. TECHNICAL DATA

4.1.1 Permitted operating temperature

As standard, an SB690 can be operated in the following temperature range:

-10 °C ... +80 °C

Other operating temperatures on request.

4.1.2 Permitted operating pressure

The permitted operating pressure may differ from the nominal pressure in the case of other certifications. The table in section 4.2. shows the permitted operating pressure in accordance with the European Pressure Equipment Directive.

4.1.3 Nominal volume

HYDAC bladder accumulators are available with set nominal volumes, see table in section 4.2.

4.1.4 Effective gas volume

The effective gas volume is based on nominal dimensions. It differs slightly from the nominal volume and must be used when calculating the effective fluid volume, see table in section 4.2.

4.1.5 Effective volume

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

4.1.6 Limits for gas pre-charge pressure

$p_0 \leq 0.9 \bullet p_1$
with a permitted pressure ratio of:
$p_2 : p_0 \leq 4:1$

p_2 = max. operating pressure
p_0 = pre-charge pressure

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

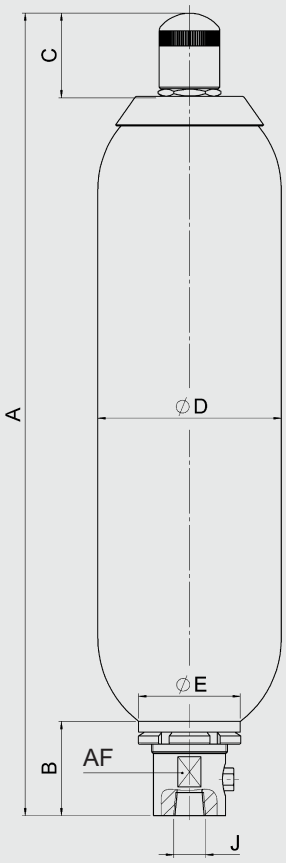
For more information, see catalogue section:

- HYDAC Accumulator Technology
  No. 3.000

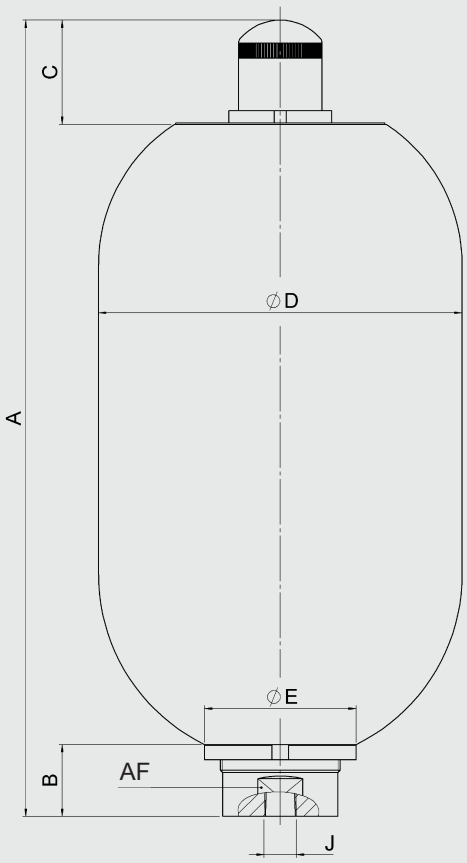
4.1.7 Gas side connection

Volume [l]	Gas valve design
< 10	7/8-14UNF
≥ 10	M50x1.5 / 7/8-14UNF

SB690-1 ... 5

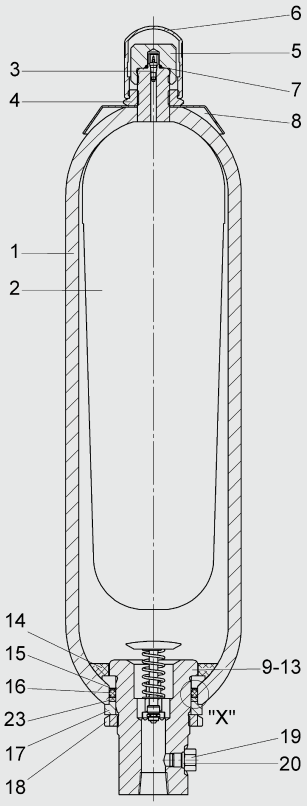


SB690-10 ... 50

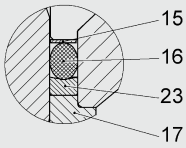


Nominal volume [l]	Series	Perm. operating pressure (PED) [bar]	Part no.	Effective gas volume [l]	A max. [mm]	B [mm]	C [mm]	Ø D max. [mm]	J thread ANSI	Ø E [mm]	AF [mm]	Weight [kg]
1	SB690	690	3444800	1	324	61	58	122	1/2 NPTF	67	45	8.5
2.5			3129516	2.5	531							13.5
5			3129515	4.9	860							23
10			3436744	9	522	43	68	250		100	75	54
20			3436795	17	865							114
32			3436499	33.5	1385							186
50			4291199	49.7	1900							260

SB690-1 ... 5



Detail "X" (2:1)



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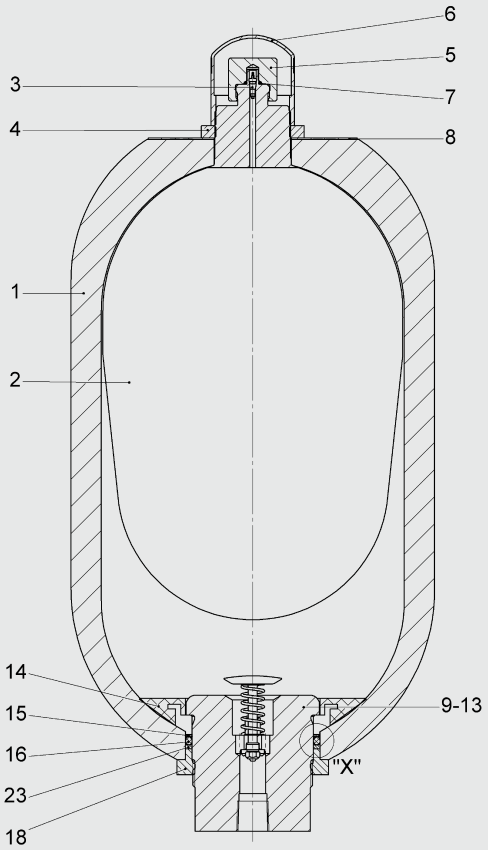

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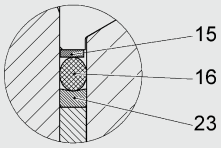

Description	Item
Bladder assembly [1] consisting of:	
Bladder	2
Gas valve insert [2]	3
Lock nut	4
Seal cap	5
Protective cap	6
O-ring	7
Seal kit consisting of:	
O-ring	7
Washer	15
O-ring	16
Vent screw	
Support ring	
Repair kit [1] consisting of:	
Bladder assembly (see above)	
Seal kit (see above)	
Oil valve assembly consisting of:	
Valve	9-13
Anti-extrusion ring [2]	14
Washer	15
O-ring	16
Spacer	17
Groove nut	18
Vent screw	19
Support ring	23

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

[2] Available separately

Accumulator shell (item 1) and company label (item 8) not available as spare part

Vent screw (item 19) for NBR/carbon steel: Seal ring (item 20) included

Nominal volume [l]	Bladder assembly Part no.	Seal kit Part no.	Repair kit Part no.	Oil valve assembly Part no.
1	3010110	3182615	3182617	4291202
2.5	3211568		3201771	
5	3211569		3201772	
10	3120931	4192830	4347598	4030279 [1]
20	3211592		4347600	
32	3211571		4347601	
50	3116598		4347602	

[1] Request versions with spacer (item 17) separately

5. NOTE

The information in this brochure relates to the operating conditions and fields of application described. For applications and/or operating conditions not described, please contact the relevant technical department.

Subject to technical modifications.