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		20
SB35AH- 100 ... 450	35		

1) Q = max. flow rate of pressure fluid
2) Higher pressures on request

1.3. BLADDER MATERIAL

The bladder material must be selected in accordance with the particular operating fluid or operating temperature, see section 2.1.

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 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 section 3. for the particular series (may differ from nominal pressure for foreign test certificates)

2.1.2 **Nominal volume**
see section 3. for the particular series

2.1.3 **Effective gas volume**
see section 3. for the particular series
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 **Operating temperature and operating fluid**
The permitted operating temperature of a bladder accumulator is dependent on the application limits of the metal materials and the bladder. Outside this temperature range, special materials must be used. The operating fluid must also be taken into account.
The following table shows the standard selection of elastomer materials with temperature range and a rough overview of resistant and non-resistant fluids:

Materials		Material code [1]	Temperature range	Overview of the fluids [2]	
				Resistant to	Not resistant to
NBR	Acrylonitrile butadiene rubber	2	-15 °C ... + 80 °C	● Mineral oil (HL, HLP) ● Flame-resistant fluids of the groups HFA, HFB, HFC ● Synthetic ester (HEES) ● Water ● Sea water	● Aromatic hydrocarbons ● Chlorinated hydrocarbons (HFD-S) ● Amines and ketones ● Hydraulic fluids of 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-resistant fluids of the group HFB ● Synthetic ester (HEES) ● Water ● Sea water	● Aromatic hydrocarbons ● Chlorinated hydrocarbons (HFD-S) ● Amines and ketones ● Hydraulic fluids of the group HFD-R ● Flame-resistant fluids of the groups HFA and HFC ● Fuels
IIR	Butyl rubber	4	-50 °C ... +100 °C	● Hydraulic fluids of the group HFD-R ● Flame-resistant fluids of the group HFC ● Water	● Mineral oils and mineral greases ● Synthetic ester (HEES) ● Skydrol and HyJet IV ● Aliphatic, chlorinated and aromatic hydrocarbons ● Fuels
FKM	Fluorine rubber	6	-10 °C ... +150 °C	● Mineral oil (HL, HLP) ● Hydraulic fluids of the group HFD ● Synthetic ester (HEES) ● Fuels ● Aromatic hydrocarbons ● Inorganic acids	● Amines and ketones ● Ammonia ● Skydrol and HyJet IV ● Steam

[1] see section 2.2. Model code, material code, bladder accumulator

[2] others available on request

2.1.7 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.

2.1.8 Limits for gas pre-charge pressure

$p_0 \leq 0.9 \bullet p1$
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 bar*
Type SB35A/AH: $p_{0\,max}$ = 10 bar
Type SB35HB: $p_{0\,max}$ = 10 bar

* in model with perforated disc

2.1.9 Certificate codes

Country	Certificate code (AKZ)
EU member states	U
Australia	F [1]
Belarus	A6
Canada	S1 [1]
China	A9
Hong Kong	A9
Iceland	U
Japan	P
Korea (Republic)	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

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.BA

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

Bladder accumulator [1] [3] [4]
2 = NBR [5]
3 = ECO
4 = IIR
5 = NBR [5]
6 = FKM
7 = other
9 = NBR [5]

Certification code
U = European Pressure Equipment Directive (PED)

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
[5] observe temperature ranges, see section 2.1.

3. LOW PRESSURE ACCUMULATORS

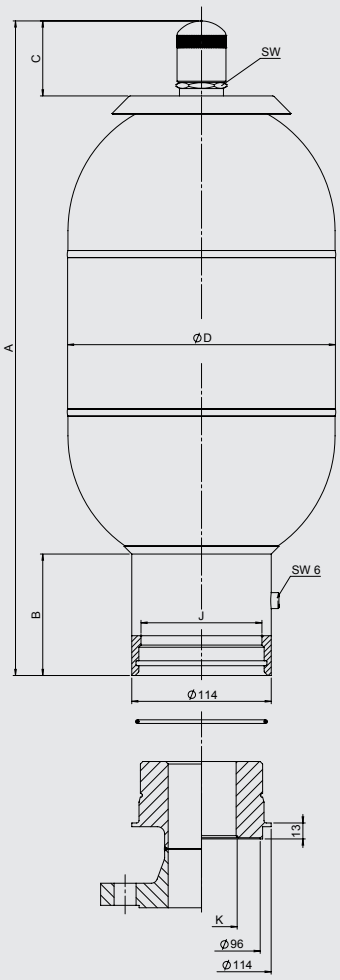
3.1. STANDARD BLADDER ACCUMULATORS SB40-2.5 ... 50

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 section 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



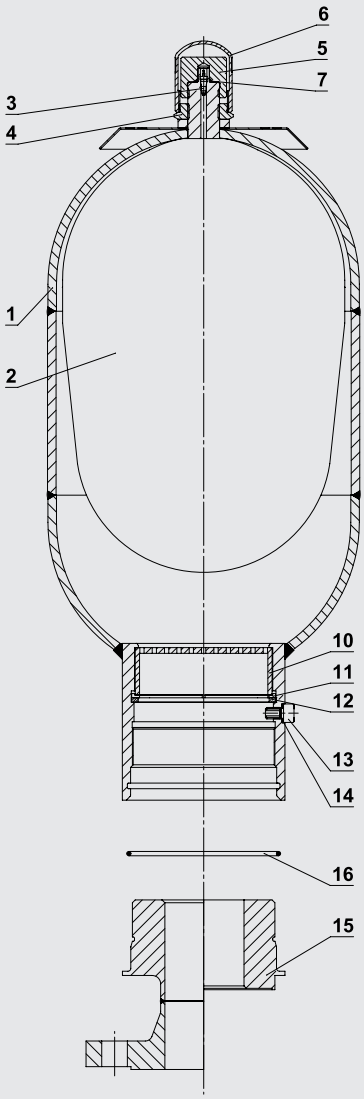
SB40-2.5 ... 50

Permitted operating pressure 40 bar (PED)

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	9.3	14	533	106		219				
20	18	23	843							
32	33.5	38	1363							
50	48.6	52	1875		78				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 assembly [1] consisting of:	
Bladder	2
Gas valve insert*	3
Retaining nut	4
Seal cap	5
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

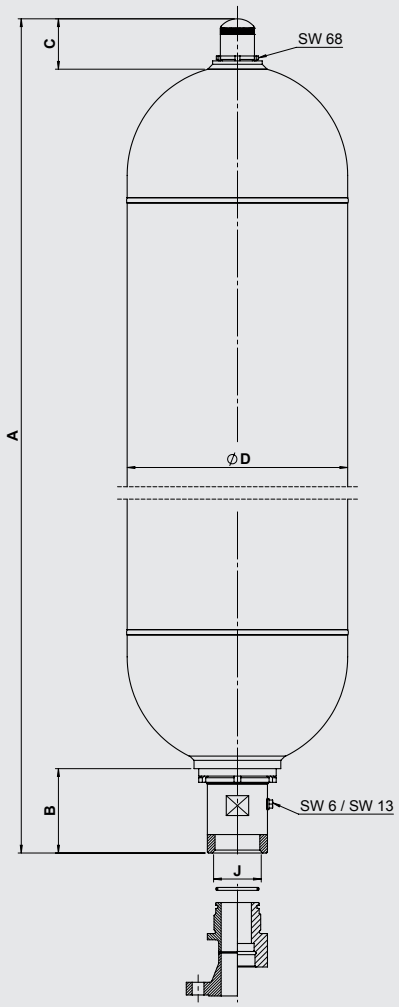
3.2. BLADDER ACCUMULATOR SB40-70 ... 220

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



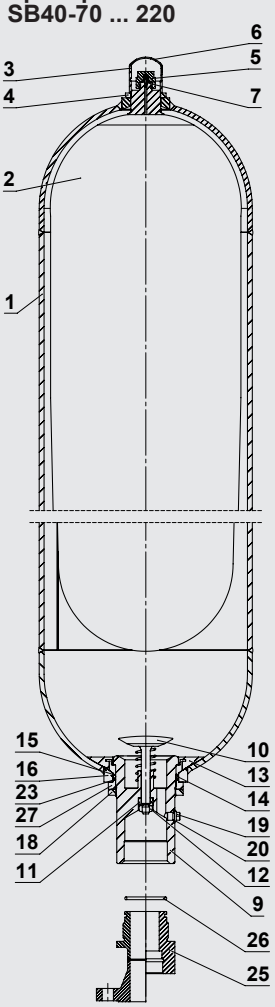
SB40-70 ... 220

Permitted operating pressure 40 bar (PED)

Nominal volume [l]	Eff. gas volume [l]	Weight [kg]	A max. [mm]	B [mm]	C [mm]	Ø D [mm]	J thread ISO 228	SW [mm]	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			406			
220	221	197	2119						

[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
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

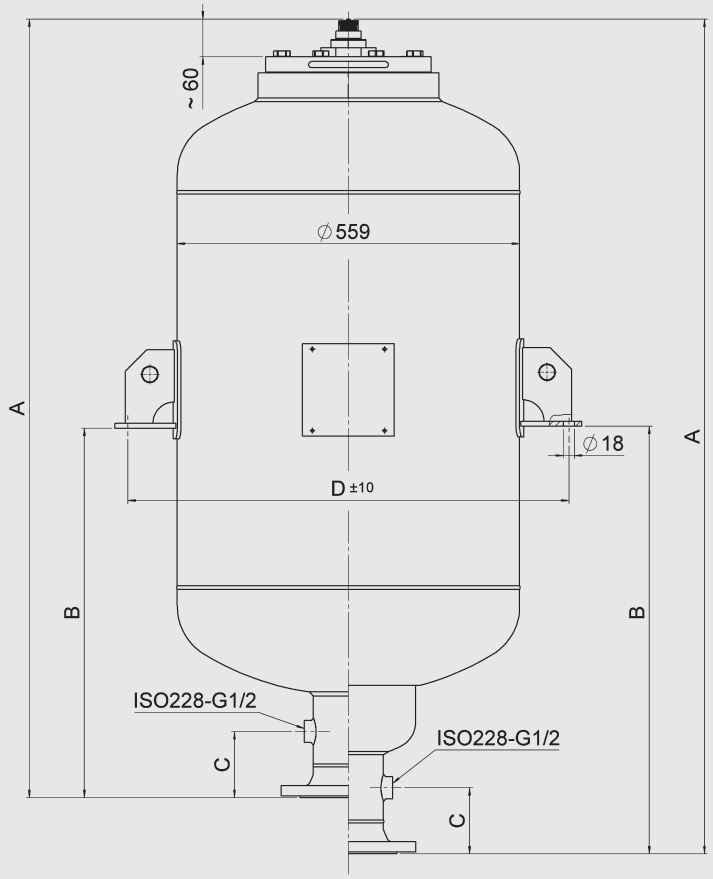
3.3.1 Design

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**



SB16/35A

Permitted operating pressure 16/35 bar (PED)

Nominal volume [l]	Eff. gas volume [l]	Weight [kg] SB16A	Weight [kg] SB35A	A (approx.) [mm] SB16A	A (approx.) [mm] SB35A	B (approx.) [mm] SB16A	B (approx.) [mm] SB35A	C (approx.) [mm] SB16A	C (approx.) [mm] SB35A	D ±10 [mm] SB16A	D ±10 [mm] SB35A
100	108	110	144	854	881	398	418	108	121	720	728
150	151	127	171	1044	1076	493	578				
200	205	149	208	1275	1318	691	699				
300	290	178	261	1644	1701	920	937				
375	376	214	315	2020	2086	1063	1083				
450	455	244	364	2361	2436	1234	1258				

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

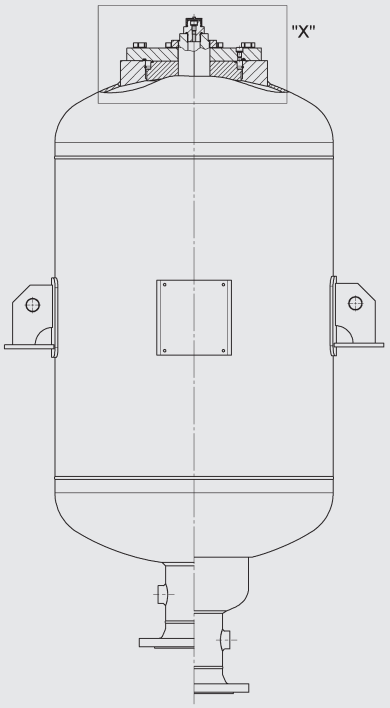
SB16/35AH

Permitted operating pressure 16/35 bar (PED)

Nominal volume [l]	Eff. gas volume [l]	Weight [kg] SB16AH	Weight [kg] SB35AH	A (approx.) [mm] SB16AH	A (approx.) [mm] SB35AH	B (approx.) [mm] SB16AH	B (approx.) [mm] SB35AH	C (approx.) [mm] SB16AH	C (approx.) [mm] SB35AH	DN* SB16AH	DN* SB35AH
100	108	118	153	945	971	488	508	108	121	720	728
150	151	135	180	1135	1166	638	641				
200	205	157	217	1366	1408	754	762				
300	290	186	270	1735	1791	988	1000				
375	376	222	324	2111	2176	1127	1146				
450	455	252	373	2452	2526	1298	1321				

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

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



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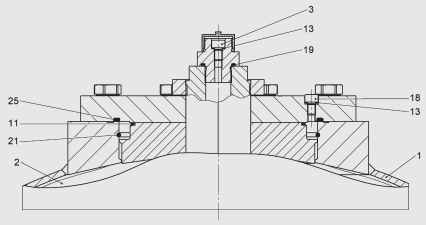


Description	Item
Bladder assembly	2
Gas valve assembly consisting of:	
Screw plug	3
Gas valve body	12
Seal ring	13
O-ring	19
Protection cap	29
Seal kit consisting of:	
O-ring	11
Seal ring	13
Air bleed screw	18
O-ring	19
Retaining ring	21
O-ring	25

Item 1 not available as a spare part.

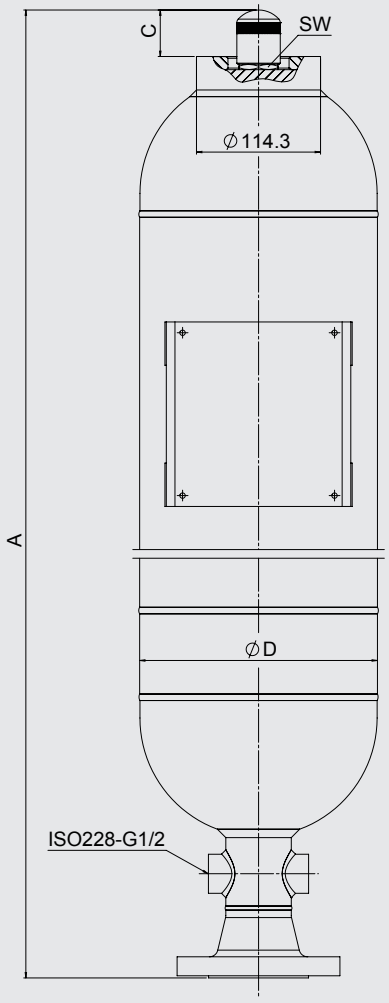
3.4. HIGH FLOW BLADDER ACCUMULATOR SB35HB

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 section 2.1. for bladder materials.

3.4.2 Dimensions SB35HB



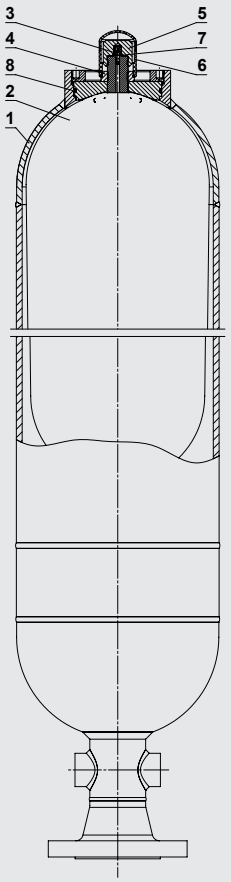
SB35HB

Permitted operating pressure 35 bar (PED)

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		Ø 68 [2)]		

* to EN1092-1/11 / 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 assembly	2
Gas valve insert*	3
Retaining nut	4
Seal cap	5
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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