Bladder accumulators
Low 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 High pressure
  No. 3.203

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

- Hydraulic dampers
  No. 3.701

1.2. DESIGN

- **SB40-2.5...50 litres**
  HYDAC low pressure accumulators of the series SB40-2.5 ... 50 consist of a welded pressure vessel, the accumulator bladder with gas valve and the hydraulic connection with a perforated disc (check valve on request). In addition, we can offer suitable adapters for connection to the hydraulic system.
- **SB35HB**
  HYDAC high flow bladder accumulators in the series SB35HB are high performance accumulators with flow rates of up to 20 l/s at 2 bar Δp. They consist of a welded pressure vessel and an accumulator bladder with gas valve. The pressure vessel contains a fixed perforated disc which permits a high flow rate through its large free cross section. In addition, we can offer suitable adapters for connection to the hydraulic system.
- **SB40-70 ... 220 litres**
  HYDAC low pressure accumulators in the series SB40-70 ... 220 consist of a welded pressure vessel, an accumulator bladder with gas valve and a hydraulic connection with a check valve. In addition, we can offer suitable adapters for connection to the hydraulic system.
- **SB16/35A AND SB16/35AH**
  HYDAC low pressure bladder accumulators for large volumes have a welded design. The pressure vessel is fabricated in carbon steel or in stainless steel. The hydraulic outlet is covered by a perforated disc which prevents the flexible bladder from extruding from the shell. The bladder is top-removable.

2. GENERAL INFORMATION

2.1. MATERIALS, CORROSION PROTECTION

2.1.1 Accumulator shell

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 hydraulic accumulators must be used.

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 ... +100 °C	– Hydraulic fluids from the group HFD-R – Flame-retardant fluids from the group HFC – Water	– Mineral oils and 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
- 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.

2.3. TYPE OF INSTALLATION

For strong vibrations and volumes above 1 litre, we recommend HYDAC mounting elements – see catalogue section:

- 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 and maintenance instructions for low pressure bladder accumulators are available on request.

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.

SB16 A – 150 F 7 / 112 U – 40 A

Series

Type code
No details = standard
H = high flow
~~N~~ flow-optimised oil valve A(H) =
shock absorber (high flow)
B = bladder top-repairable
DA = bladder integrity system, industry version (others on request)
Combinations must be agreed with HYDAC.

Nominal volume [l]

Fluid port
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 = external thread
S = special connection, to customer specification

Gas-side connection
~~1~~ standard design 2
= back-up version
~~3~~ gas valve 7/8-14UNF with M8 internal thread 4
= gas valve 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 (MC)
Dependent on operating medium
Standard design = 112 or 342 for mineral oils
Others on request

Fluid port
1 = carbon steel
2 = high tensile steel
3 = stainless steel [2)]
6 = low-temperature steel

Accumulator shell
0 = plastic (inner coating)
1 = carbon steel
2 = chem. nickel-plated (inner coating)
4 = stainless steel [2)]
6 = low temperature steel

Accumulator bladder [1) 3)]
~~2~~ NBR [4)] 3
= ECO
~~4~~ IIR 5 =
NBR [4)]
6 = FKM
7 = other
9 = NBR [4)]

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

Permitted operating pressure [bar]

Connection, fluid side
Thread, codes for fluid port: A, C, E, G
A = thread to ISO228 (BSP)
B = thread to DIN13 or ISO965/1 (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 port: F
A = flange EN 1092-1
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) Elastomer types not available for all bladder sizes
4) Observe temperature ranges, see section 2.1.

4. STANDARD ITEMS

The bladder accumulators and spare parts described below are manufactured in carbon steel and stainless steel with an NBR accumulator bladder (MC = 112/342).

The tables provide the most important data and dimensions for the series depicted.

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, the products listed in the tables may 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 tables 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 Maximum 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 ensured 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.

4.1.7 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

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

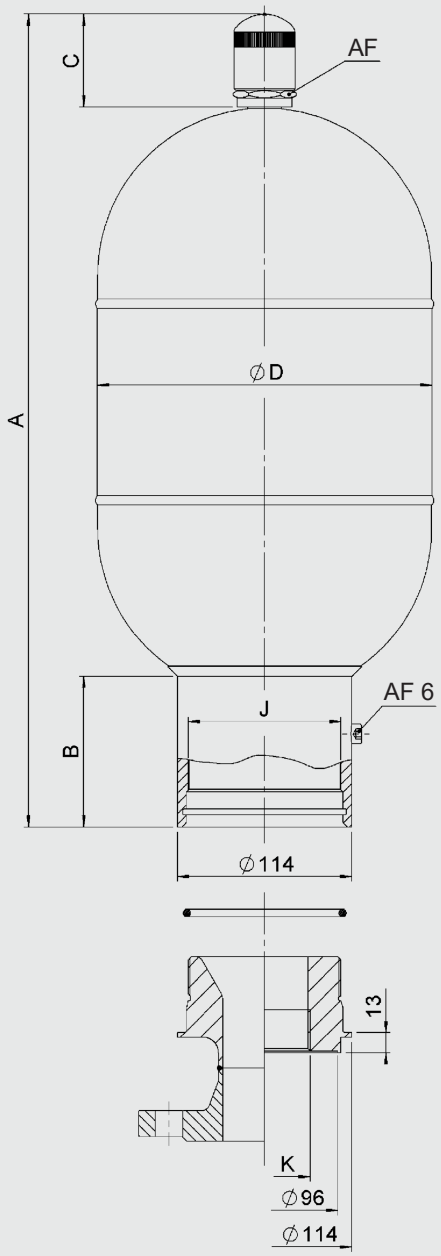
Type SB40: $p_{0\,max}$ = 20 bar (in model with perforated disc)
Type SB16/35A/AH: $p_{0\,max}$ = 10 bar
Type SB35HB: $p_{0\,max}$ = 10 bar

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

4.2.1 Series SB40-2.5 ... 50

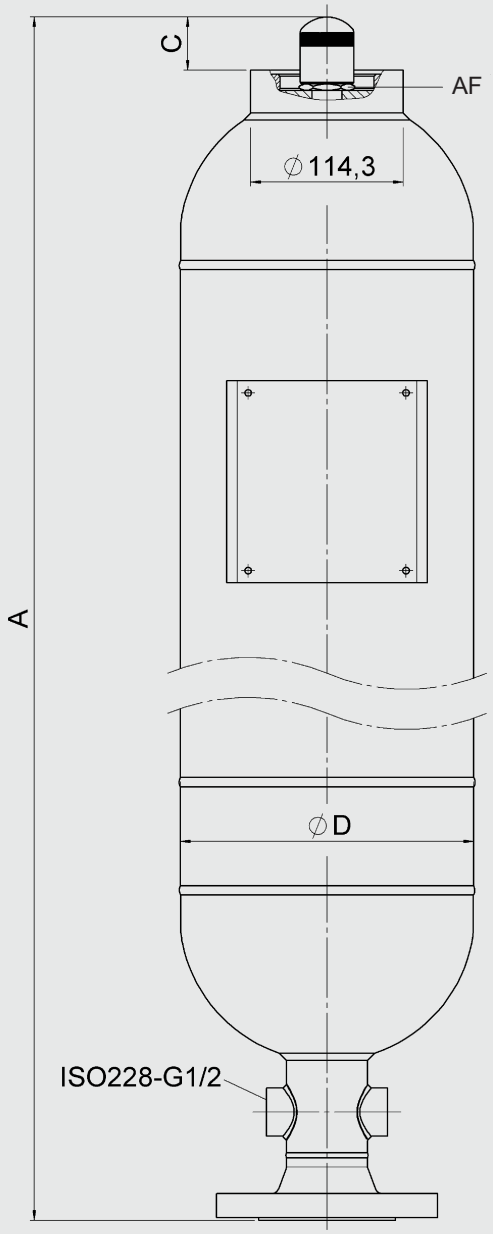


Nominal volume	Perm. operating pressure (PED)	Part no.		Eff. gas volume	A	B	C	Ø D	J thread	K thread	AF	$Q_{max\ 1)}$	Weight
		Carbon steel, NBR	Stainless steel, NBR										
[l]	[bar]			[l]	[mm]	[mm]	[mm]	[mm]	ISO DIN 13	ISO 228	[mm]	[l/s]	[kg]
2.5	40	3114684	3130528	2.5	541	122	68	108	M100x2	G 2	36	7	9
5		3113791	3118722	5	891								13
10		3111110	3125662	9.3	533	843		219					14
20		3125719	3130529	18	106								23
32		3130487	3130530	33.5	1363								38
50		3119445	3130531	48.6	1875		78				68 2)		52

1) Approx. 0.5 bar pressure drop via connection

2) Use C-spanner

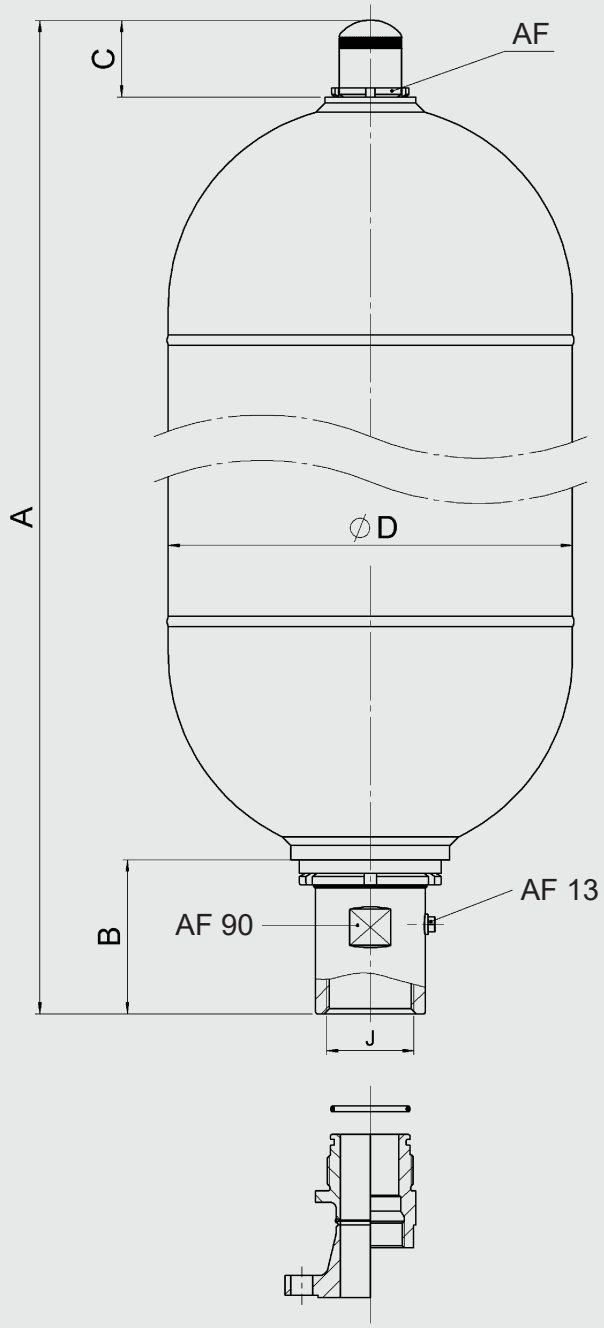
4.2.2 SB35HB



Nominal volume [l]	Perm. operating pressure (PED) [bar]	Part no. Carbon steel, NBR	Part no. Stainless steel, NBR	Eff. gas volume [l]	A max. [mm]	C [mm]	Ø D [mm]	AF [mm]	Q_{max} [l/s]	DN 1)	Weight [kg]
20	35	3130682	3130683	19.8	1081	63	219	36	20	50	43
32		3130684	3130685	35	1591						56
50		3130686	3130687	50	2091	78		Ø 68 2)			69

1) To EN 1092-1/11 / PN40, others on request
2) Groove nut

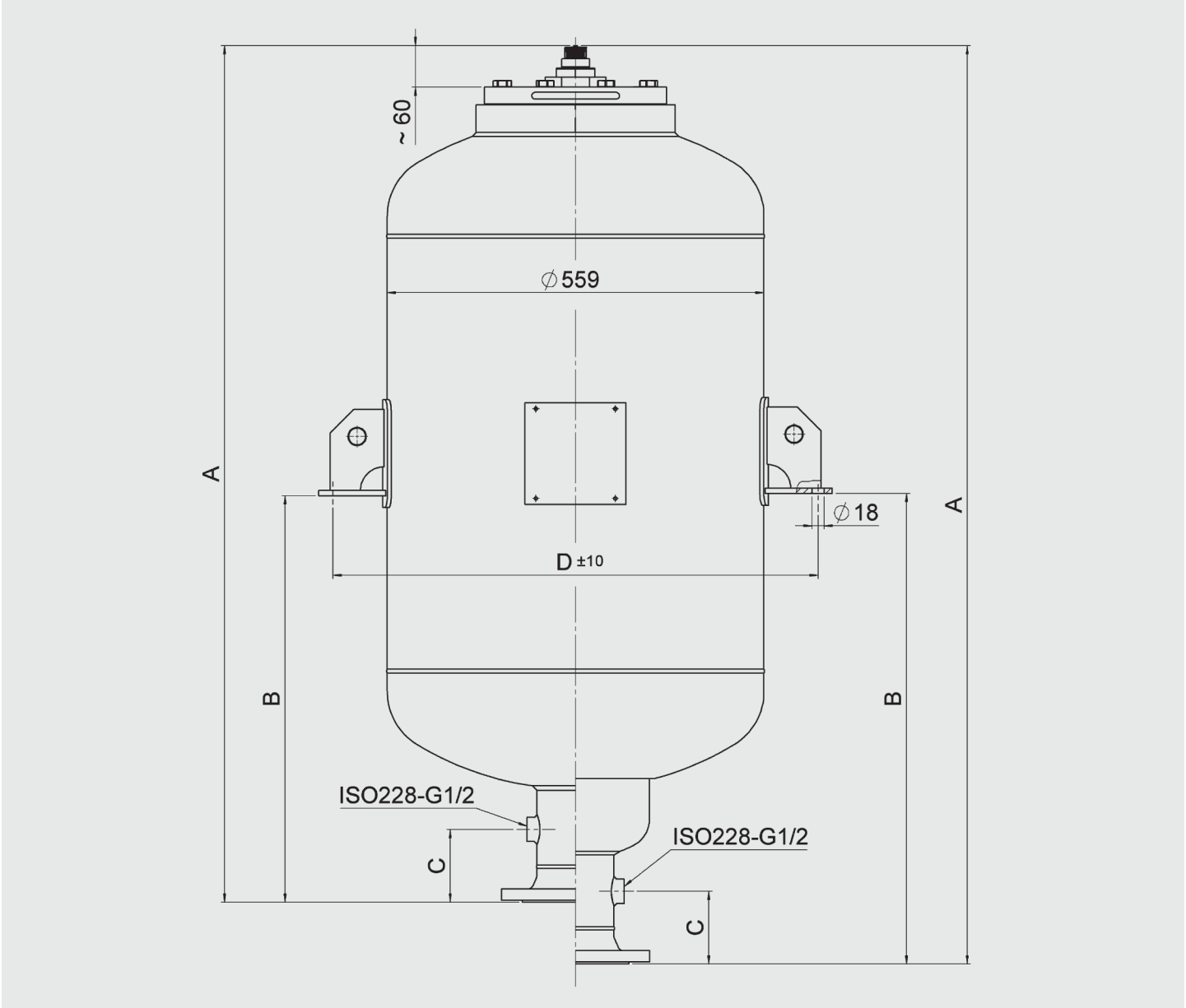
4.2.3 SB40-70 ... 220



Nominal volume [l]	Perm. operating pressure (PED) [bar]	Part no. Carbon steel, NBR	Part no. Stainless steel, NBR	Eff. gas volume [l]	A max. [mm]	B [mm]	C [mm]	Ø D [mm]	J thread ISO 228	AF [mm]	Q_{max} [l/s]	Weight [kg]
70	40	2127513	2127533			136	69	356	G 2 1/2	68 1)	30	73
100		2127514	2127534	111	1655							99
130		2127515	2127535	133	1905							130
190		3182579	3182581	192	2101			406				175
220		3182582	3182583	221	2348							197

1) Use C-spanner

4.2.4 SB16/35A, SB16/35AH

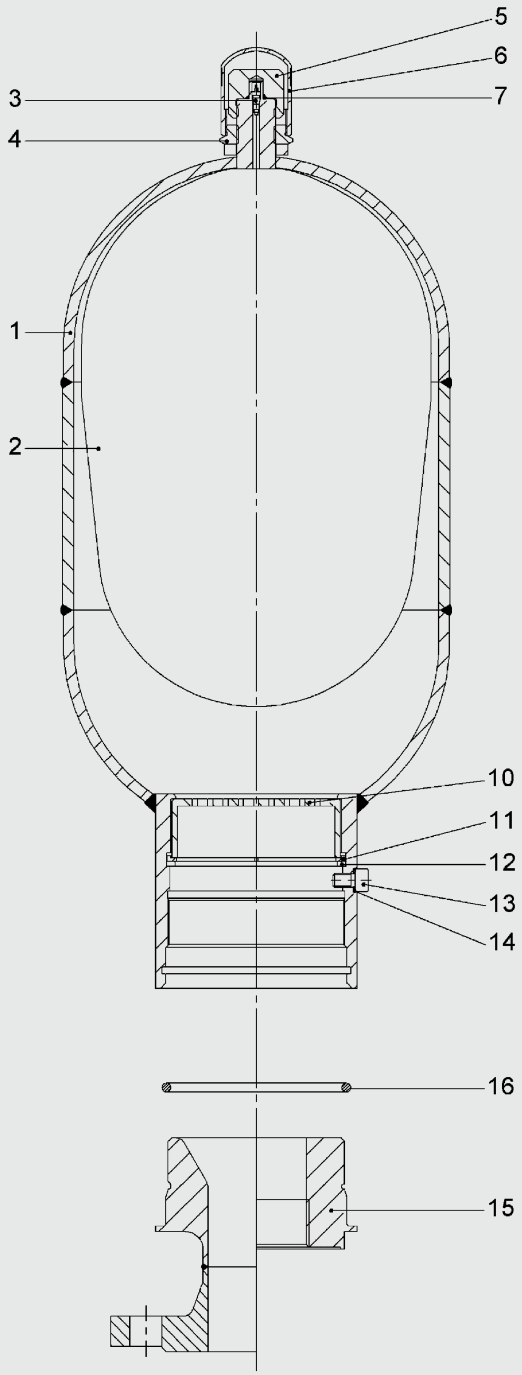


Series	Nominal volume [l]	Perm. operating pressure (PED) [bar]	Part no. Carbon steel, NBR	Part no. Stainless steel, NBR	Eff. gas volume [l]	A B (approx.) (approx.) [mm]	(approx.) [mm]	C [mm]	D ±10 [mm]	Weight [kg]
	150		4108288	4108241	149	1044	493			127
	200		4108290	4093557	203	1275	691			149
SB16A	300	16	4108291	4108242	288	1644	920	108	720	178
	375		4108292	4108243	374	2020	1063			214
	450		4108294	4108244	453	2361	1234			244
	150		4108339	4108306	149	1076	578			171
	200		4108341	4108307	203	1318	699			208
SB35A	300	35	4108342	4108308	288	1701	937	121	728	261
	375		4108355	4108312	374	2086	1083			315
	450		4108357	4108314	453	2436	1258			364
	150		4108720	4108702	149	1135	638			135
	200		4108721	4108703	203	1366	754			157
SB16AH	300	16	4108724	4108715 288 988	108 374	1735			720	186
	375		4108725	4108717		2111	1127			222
	450		4108726	4108718	453	2452	1298			252
	150		4108773	4108729	149	1166	641			180
	200		4108775	4108730	203	1408	762			217
SB35AH	300	35	4108774	4108734	288	1791	1000	121	728	270
	375		4108776	4108758	374	2176	1146			324
	450		4108778	4108762	453	2526	1321			373

Flange to EN1092-1/11 / DN100 / PN16 or PN40, others on request

4.3. SPARE PARTS

4.3.1 SB40-2.5 ... 50



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
Vent screw	13
Seal ring	14
O-ring	16
Hydraulic connection assembly consisting of:	
Hydraulic connector	10
Anti-extrusion ring	11
Retaining ring	12
Vent screw	13
Seal ring	14

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

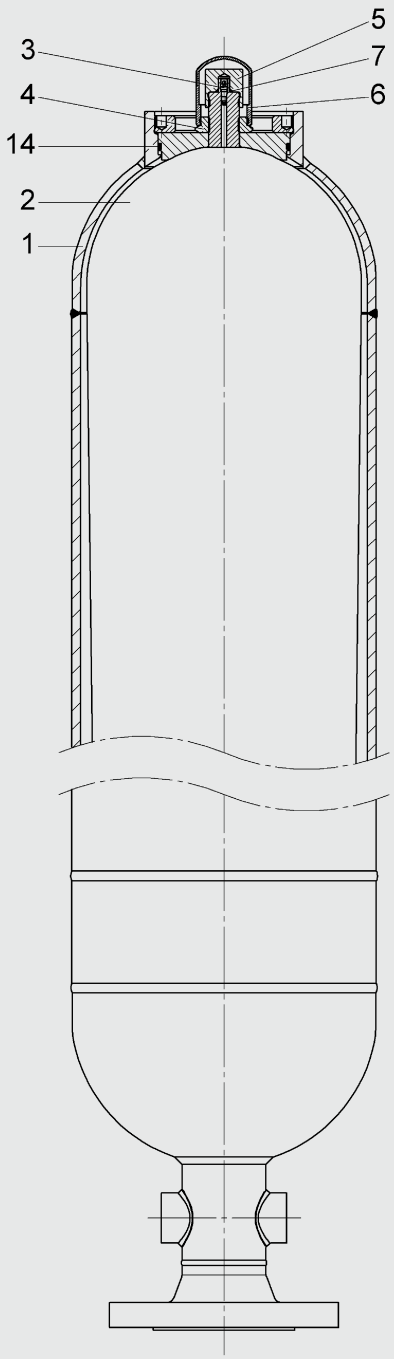
[2] Available separately

Accumulator shell (item 1) not available as spare part Adapter (item 15) incl. O-ring (item 16) available as accessory, please ask

Carbon steel, NBR				
Nominal volume [l]	Bladder assembly	Seal kit	Hydraulic connector assembly	Gas valve insert
2.5	236171	3951615	2106751	632865
5	240917			
10	236088			
20	236089			
32	235335			
50	235290			

Stainless steel, NBR				
Nominal volume [l]	Bladder assembly	Seal kit	Hydraulic connector assembly	Gas valve insert
2.5	356019	4102701	2115039	632865
5	2123155			
10	356022			
20	4611049			
32	3259250			
50	356025			

4.3.2 SB35HB



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:	
Gas valve insert [2]	3
O-ring	7
O-ring	14

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

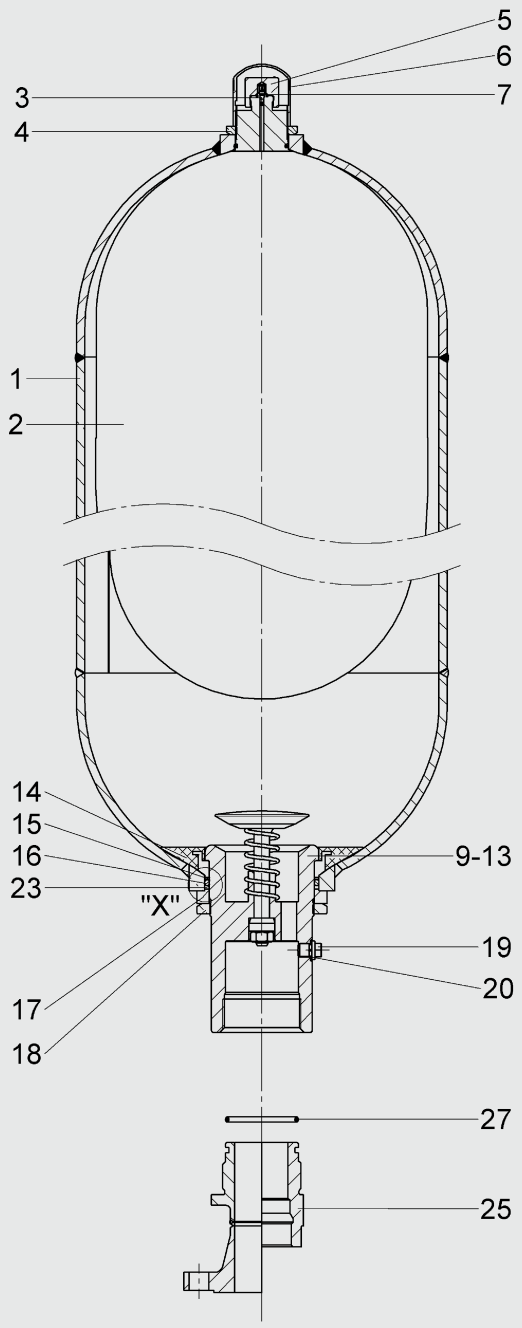
[2] Available separately

Accumulator shell (item 1) not available as spare part

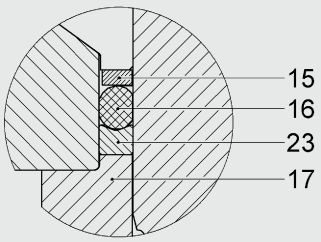
Carbon steel, NBR			
Nominal volume [l]	Bladder assembly	Seal kit	Gas valve insert
20	236089	2125204	2125204
32	235335		
50	376257		

Stainless steel, NBR			
Nominal volume [l]	Bladder assembly	Seal kit	Gas valve insert
20	4611049	2125204	632865
32	3259250		
50	4747510		

4.3.3 SB40-70 ... 220



Detail "X"



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	19
Support ring	23
O-ring	27
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) not available as spare part

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

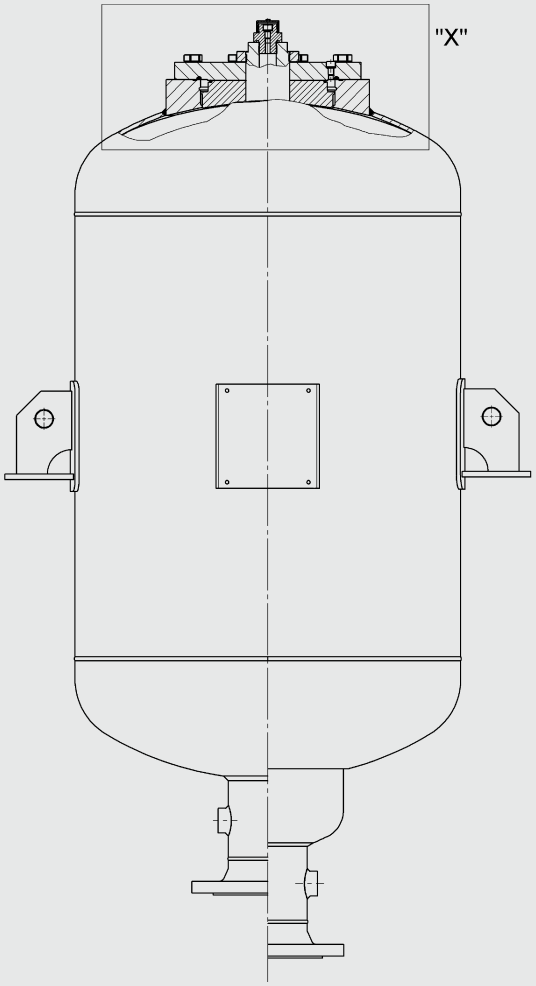
Adapter (item 25) incl. O-ring (item 27) available as accessory, please ask

Carbon steel, NBR					
Nominal volume [l]	Bladder assembly	Seal kit	Oil valve assembly	Anti-extrusion ring	Gas valve insert
70	3364274	4126907	3273734	3102326	632865
100	3127313				
130	4583554				
190	3640698				
220	3461300				

Stainless steel, NBR					
Nominal volume [l]	Bladder assembly	Seal kit	Oil valve assembly	Anti-extrusion ring	Gas valve insert
70	3143382	3102124	3891165	3099934	632865
100	3176772				
130	3143388				
190	3143389				
220	3143390				

4.3.4 SB16/35A, SB16/35AH

The following spare parts relate exclusively to hydraulic accumulators from the construction year 2016 and later. For low-pressure bladder accumulators SB16/35A and SB16/35AH with construction year < 2016, spare parts are available on request.



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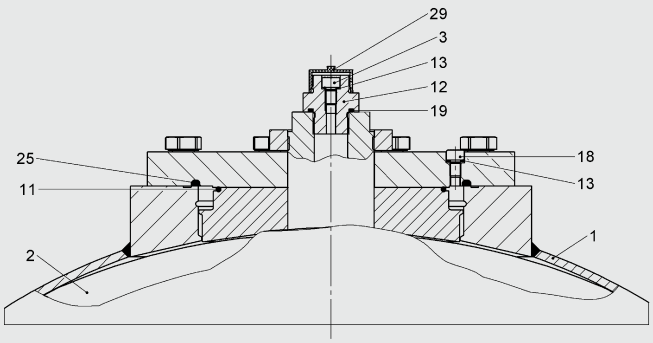

Description	Item
Bladder	2
Gas valve assembly consisting of:	
Locking screw	3
Gas valve body	12
Seal ring	13
O-ring	19
Protective cap	29
Seal kit consisting of:	
O-ring	11
Seal ring	13
Vent screw	18
O-ring	19
O-ring	25

Accumulator shell (item 1) not available as spare part

Nominal volume [l]	Bladder	Seal kit	
		Carbon steel, NBR	Stainless steel, NBR
150	4241264	4241465	4197141
200	4241263		
300	4113771		
375	4113731		
450	4241435		

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.