

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 hydro-pneumatic accumulators for storing fluids. HYDAC diaphragm accumulators are based on this principle, using nitrogen as the compressible medium.

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

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

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

At 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:

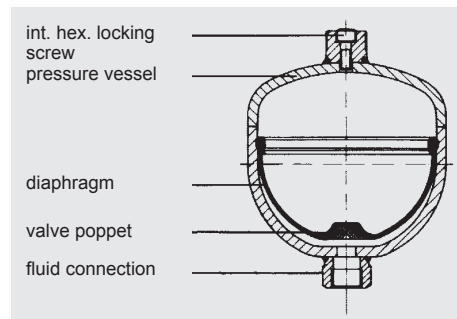
When fitted with a HYDAC Safety & Shut-off Block HYDAC diaphragm accumulators comply with the regulations of the Pressure Equipment Directive PED 97/23/EC and the German industrial safety regulations BetrSichV.

Please refer to brochure:
Safety & Shut-Off Block SAF/DSV
no. 3.551

1.2. CONSTRUCTION

HYDAC diaphragm accumulators are available in two versions.

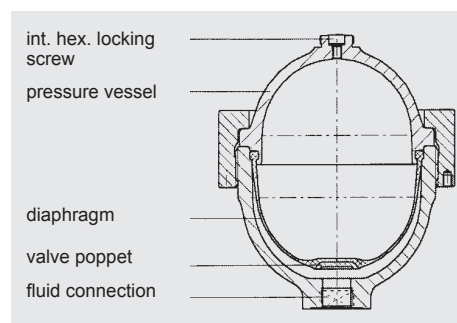
1.2.1 Weld type



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 elastomers:

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

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

When selecting the elastomer, allowances must be made for the fact that the gas can cool down to below the permissible elastomer temperature if there are adverse discharge conditions (high pressure ratio p_2/p_0 , rapid discharge speed). This can cause cold cracking in the elastomer. The gas temperature can be calculated using the HYDAC Accumulator Simulation Programm 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 stainless steel accumulators are available in nearly all types.

The options detailed in points 1.2.3. and 1.2.4. allow these accumulators to be used with mineral oils, non-flam fluids and numerous chemically aggressive fluids.

1.3. MOUNTING POSITION

Optional; however, if there is a risk of contamination collecting, a vertical position is preferable, with the fluid connection at the bottom.

1.4. TYPE OF MOUNTING

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 found in our brochure "Supports for Hydraulic Accumulators" no. 3.502.
- Additional male threads on the hydraulic connection are available for screwing into mounting holes - see point 3.1.
- Please see brochure section:
- Supports for hydraulic accumulators, no. 3502

1.5. GENERAL

1.5.1 Operating pressure

See tables 3.1. and 3.2.

In some countries the permissible operating pressure can differ from the nominal pressure.

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 volume

Volume of fluid 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

Use only nitrogen when charging diaphragm accumulators, never oxygen (**risk of explosion**).

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).

1.5.7 Permissible operating temperature

-10 °C ... +80 °C

263 K ... 353 K

for material code 112.

Others on request.

1.5.8 Permissible pressure ratio

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

1.5.9 Max. flow rate of the pressure fluid

It is necessary to ensure that a residual fluid volume of approx. 10% of the effective gas volume remains in the accumulator if the max. flow rate given in the tables is to be achieved.

1.5.10 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.

The permissible operating pressure can differ from the nominal pressure.

The following table contains the codes used in the model code for different countries:

Australia	F ¹⁾
Brazil	U ³⁾
Canada	S1 ²⁾
China	A9
CIS	A6
EU member states	U
Hungary	U ³⁾
India	U ³⁾
Japan	P
New Zealand	T
Poland	U
Romania	U ³⁾
Slovakia	U
South Africa	U ³⁾
Switzerland	U ³⁾
USA	S

others on request

¹⁾ = approval required in the individual territories

²⁾ = approval required in the individual provinces

³⁾ = alternative certificates possible

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 accumulators (repairs, connecting pressure gauges etc) must only be carried out once the pressure and fluid have been released.

**Please read Instruction Manual!
No. 3.100.CE**

Note:

Application examples, accumulator sizing and extracts from approvals regulations on hydraulic accumulators can be found in the accumulator overview brochure no. 3.000

2. TECHNICAL SPECIFICATIONS

2.1. MODEL CODE (also order example)

SBO210 - 2 E1 / 112 U - 210 AK 050

Series _____

Nominal volume (litres) _____

Type ²⁾ _____

E1 = weld type, standard model, rechargeable (M28x1.5)

E2 = weld type, sealed gas connection
with gas pre-charge as requested ⁴⁾

E3 = weld type, gas valve M16x1.5,
rechargeable

A6 = screw type (exchangeable diaphragm),
standard model,
rechargeable (M28x1.5)

A3 = screw type (exchangeable diaphragm),
gas valve M16x1.5,
rechargeable

Material code ²⁾ _____

depending on operating medium

112 = standard for mineral oil

Fluid connection _____

1 = carbon steel

3 = stainless steel 1.4571 (316)

4 = carbon steel with surface protection ¹⁾

6 = low temperature steel

Accumulator shell _____

0 = plastic coated

1 = carbon steel

2 = carbon steel with surface protection ^{1) 3)}

4 = stainless steel 1.4571 (316)

6 = low temperature steel

Accumulator diaphragm _____

2 = NBR 20 (acrylonitrile butadiene)

3 = ECO (ethylene oxide epichlorohydrin)

4 = IIR (butyl)

5 = NBR 21 (low temperature NBR)

6 = FKM (fluoro rubber)

7 = others (on request)

Certificate code ²⁾ _____

U = PED 97/23/EC

(for other countries see table 2.2.10)

Permissible operating pressure (bar) _____

Fluid connection ²⁾ form _____

Standard connection = AK or AB

e.g. Form AK = G ³/₄

for SBO 210-2 according to table on page 5

Please state gas pre-charge pressure p_0 at 20 °C ⁴⁾ _____

1) only for screw type

2) not all combinations are possible

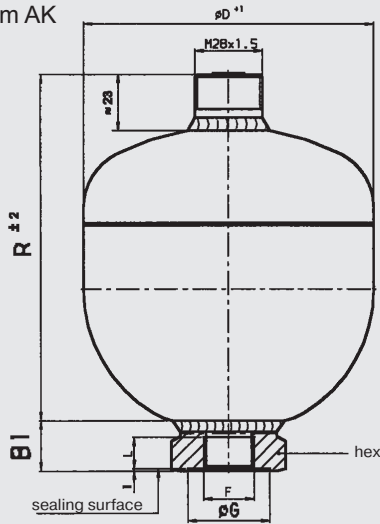
3) only parts in contact with the medium

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

3. DIMENSIONS

3.1. WELD TYPE ACCUMULATORS – non-exchangeable diaphragm –

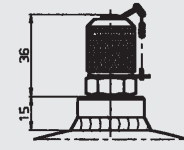
Type E1
Form AK



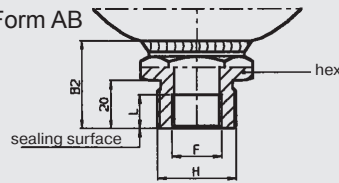
Type E2



Type E3

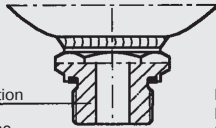


Form AB

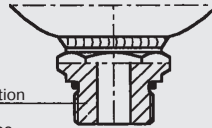


Alternative fluid connection on request

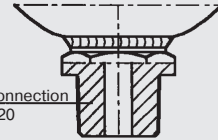
Examples:



Male threaded connection
DIN 3852 Form E
Metric thread or ISO 228



Male threaded connection
DIN 3852 Form F
Metric thread or ISO 228



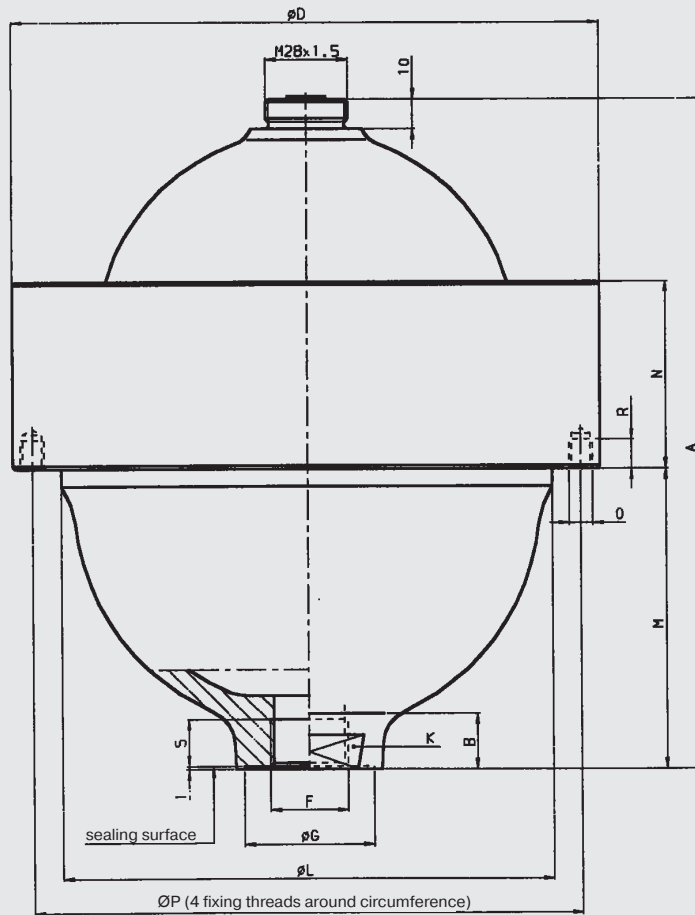
Male threaded connection
NPT to ANSI B1.20

Nominal volume ¹⁾ [l]	Permissible pressure ratio p2 : p0	Series	User country U		R [mm]	Ø D [mm]	Weight [kg]	Q ²⁾ [l/min]	Standard fluid connection										
			perm. working pressure [bar]	carbon steel					stainless steel	Form AK			Form AB						
										F ISO 228	Ø G [mm]	L [mm]	B1 [mm]	hex. SW	F ISO 228	H DIN 13	L [mm]	B2 [mm]	hex. SW
0.075	8 : 1	250	250	–	91	64	0.7	38	G 1/2	–	14	21	30	not available					
0.16		210	210	180	103	74	0.8												
		300	300	–	108	78	1.1												
0.32		210	210	160	116	93	1.3												
		300	300	–	120	96	1.8												
0.5		160	160	–	130	102	1.3												
		210	210	–	133	105	1.7												
0.6		330	330	–	151	115	3.3												
0.7		100	100	–	151	106	1.8												
0.75		8 : 1	140	140	–	142	116										1.8	95	G 1/2
	210		210	140	147	121	2.8	15	42										
	330		330	–	140	126	4.0	14	36										
1	4 : 1	200	200	–	159	136	3.6	126	34	21	26	41	G 1/2	M33x1.5	14	36	41		
		330	330	–	169	–	4.8								15	42			
1.4	8 : 1	140	140	–	173	145	3.9	150	G 3/4	44	16	21	46	G 3/4	M45x1.5	14	36	46	
		210	210	–	178	150	5.4									15	42		
		250	250	–	185	153	5.9									14	36		
2	8 : 1	330	330	–	172	155	7.6	150	G 3/4	44	16	28	46	G 3/4	M45x1.5	14	36	46	
		100	100	100	190	160	4.0									15	42		
		210	210	–	198	167	6.6									16	33		
2.8	4 : 1	4 : 1	250	250	–	232	153	7.4	150	G 3/4	44	16	28	46	G 3/4	M45x1.5	14	36	46
		8 : 1	330	330	–	181	172	9.2									15	42	
		210	210	–	250	167	8.2	16									33		
3.5	4 : 1	250	250	–	250	170	7.8	150	G 3/4	44	16	28	46	G 3/4	M45x1.5	14	36	46	
		330	330	–	237	172	11.0									15	42		
		250	210	–	306	170	11.2									16	33		
4	4 : 1	330	330	–	274	172	13.8	150	G 3/4	44	16	28	46	G 3/4	M45x1.5	14	36	46	
		50	–	50	294	158	5.0									15	42		
		250	–	180	306	170	11.2									16	33		

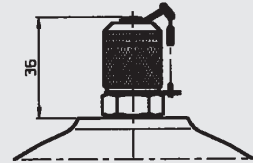
1) others on request, 2) max. flow rate

3.2. THREAD TYPE – exchangeable diaphragm –

Type A6 (Standard)



Type A3



Nominal volume ¹⁾ [l]	Permissible pressure ratio $p_2 : p_0$	Series	User country U		Weight [kg]	A [mm]	B [mm]	ØD [mm]	ØL [mm]	M [mm]	N [mm]	O	ØP [mm]	R [mm]	Q ²⁾ [l/min]	Standard fluid connection											
			Per. working pressure (bar)													Form AK											
			Carbon steel	Stainless steel												F ISO 228	S [mm]	ØG [mm]	K SW								
0.1	10 : 1	500	500	–	1.9	110	30	95	–	53	35	–	–	–	95	G 1/2	14	–	32								
0.25			–	350	4.9	129	20	115	92	56	60								36								
		750	750	750	9.0	136	11	153	114	57.5	63								27	41							
0.6		450	450	250	5.7	170	19	140	115	68	57								M8	180	10	150	G 3/4	16	44	50	
1.3		400	400	–	11.2	212	28	199	160	97	65															188	50
2		250	250	180	11.4	227	17	201	168	101	64															230	50
2.8		400	400	–	22.0	257	30	252	207	106	80															265	50
4		–	–	34.0	284	287		236	127,5	90																	

¹⁾ others on request

²⁾ max. flow rate

4. NOTE

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

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