

The Drive & Control Company

Rexroth
Bosch Group

Bladder-type accumulator

Type HAB

RE 50171

Edition: 2016-03

Replaces: 50170



- ▶ Component series 6X
- ▶ Nominal volume 1 ... 50 liters
- ▶ Maximum operating pressure 350 bar

CE

Features

- ▶ Hydraulic accumulator according to Pressure Equipment Directive 2014/68/EU
- ▶ Bladder material for different applications
- ▶ Use:
 - Energy storage in intermittent operation systems
 - Energy reserve for emergencies
 - Compensation of leakage loss
 - Impact and vibration absorption
 - Volume compensation in case of pressure and temperature change

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2/20 **HAB** | Bladder-type accumulator

Ordering code

01	02	03	04	05	06	07	08	09	10	11	12	13	14
HAB		-	-	6X	/	0	G	-	2	1	1	1	-

01	Bladder-type accumulator	HAB
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Nominal volume

02	1 liter	1
	2.5 liters	2.5
	4 liters	4
	6 liters	6
	10 liters	10
	20 liters	20
	24 liters	24
	32 liters	32
	50 liters	50

Maximum operating pressure

03	350 bar (1 ... 6 liters)	350
	330 bar (1 ... 50 liters)	330

04	Component series 60 ... 69 (60 ... 69: unchanged installation and connection dimensions)	6X
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Gas filling pressure

05	0 bar	0
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Port size for hydraulic fluid ¹⁾

06		"1"	"2.5"	"4"	"6"	"10"	"20"	"24"	"32"	"50"	
	G3/4	✓	-	-	-	-	-	-	-	-	G05
	G1 1/4	-	✓	✓	✓	-	-	-	-	-	G07
	G2	-	-	-	-	✓	✓	✓	✓	✓	G09

Type of mounting (oil port form)

07	Thread with sealing surface, radial on the inside	G
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Gas port form

08	Gas valve for filling and test device (see page 12)	2
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Bladder material ¹⁾

09	NBR	N
	ECO	E
	FKM	F
	HNBR	H

Tank material ¹⁾

10	Steel	1
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Surface of the tank inside ¹⁾

11	Steel	1
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Surface of the connection side ¹⁾

12	Steel	1
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Certification (acceptance)

13	CE (PED 2014/68/EU)	CE
	Instructions for use	BA

16	Further details in the plain text, e.g. special versions	*
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Order example:
HAB10-330-6X/OG09G-2N111-CE

¹⁾ Other versions upon request.

Function, section

General

Hydraulic accumulators are hydrostatic devices capable of storing a certain amount of energy in order to release it to the hydraulic system when needed.

Fluids only possess low compressibility; however, gases are highly compressible. The working principle of all gas-loaded hydraulic accumulators is based on this difference. The difference between bladder and diaphragm type accumulators lies in the type of separator element. Hydraulic accumulators essentially consist of a fluid section and a gas section with a gastight separator element. The fluid section has a connection to the hydraulic circuit.

If a higher liquid pressure is applied to a specific quantity of pressurized gas, the gas volume decreases as the liquid pressure increases, with the gas pressure increasing with the liquid pressure.

If the pressure of the fluid decreases, the fluid is pushed back into the hydraulic system by the expanding gas until the pressure is balanced again.

Bladder-type accumulator

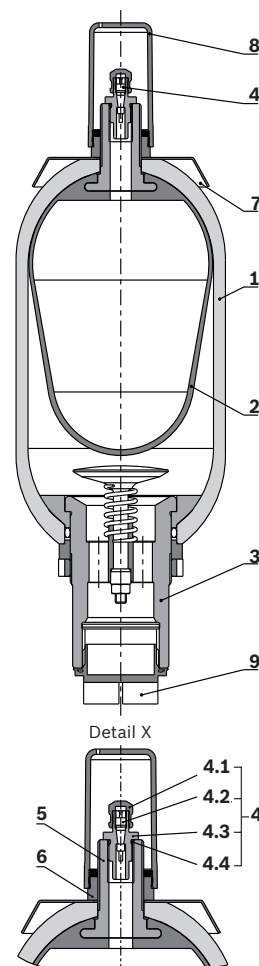
Bladder-type accumulators consist of a seamless cylindrical pressure container (1) made of high-strength steel.

An elastic bladder (2) mounted inside the container separates the accumulator into a gas side and a fluid side. Via the gas valve (4), the bladder is filled with nitrogen up to the intended gas filling pressure p_0 .

The oil valve (3) located inside the oil port of the bladder-type accumulator closes if the pressure on the gas side is higher compared to the fluid side. This prevents the bladder from entering the oil channel and being destroyed. When the minimum operating pressure is reached, a small fluid volume (approx. 10% of the hydraulic accumulator's nominal volume) should remain between the bladder and the oil valve in order to prevent the bladder from hitting the valve during each expansion process.

The gas valve (4) consists of sealing cap (4.1), gas valve insert (4.2), gas prefill valve body (4.3), and O-ring (4.4). These parts can be replaced individually.

The type cap (7) includes the technical data and features of the hydraulic accumulator.



Symbol



- 1 Tank
- 2 Bladder
- 3 Oil valve
- 4 Gas valve
- 5 Gas valve support
- 6 Nut
- 7 Type cap
- 8 Cover cap
- 9 Protective cap of oil valve

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Technical data

(For applications outside these parameters, please consult us!)

General	
Weight	See table on page 10
Design	Bladder-type accumulator
Installation position	Bottom fluid connection socket, others upon request
Type of mounting	With clamping collars and console
Line connection	Screw-in thread

Hydraulic											
Nominal volume	V_{nom}	l	1	2.5	4	6	10	20	24	32	50
Effective gas volume	V_{eff}	l	1.0	2.4	3.7	5.9	9.2	18.1	24.5	33.4	48.7
Maximum flow	q_{max}	l/min	240	450	450	450	900	900	900	900	900
Maximum operating pressure	p_{max}	bar	330	330	330	330	330	330	330	330	330
			350	350	350	350	–	–	–	–	–
Maximum pressure fluctuation range	Δp_{dyn}	bar	200	200	200	200	125	125	125	125	125
Operating pressures and useful volume	See calculation on page 5 ... 8										
Hydraulic fluid	Hydraulic oil according to DIN 51524; other fluids on request!										
Hydraulic fluid temperature range (others upon request)	°C		–15 ... +80 (NBR)								
			–32 ... +80 (ECO)								
			–20 ... +80 (FKM)								
			–30 ... +80 (HNBR)								

Pneumatic	
Charging gas	Nitrogen, cleanliness class 4.0, N ₂ = 99.99 vol. %
Gas filling pressure	p_0 bar 0

Hydraulic fluids	Material
Mineral oils	NBR ¹⁾ ECO ²⁾ HNBR ³⁾
HFC	NBR ¹⁾
HFD	FKM ⁴⁾

¹⁾ Acrylonitrile butadiene rubber

²⁾ Epichlorohydrin rubber

³⁾ Hydrated acrylonitrile butadiene rubber

⁴⁾ Fluorine rubber

Application, mode of operation

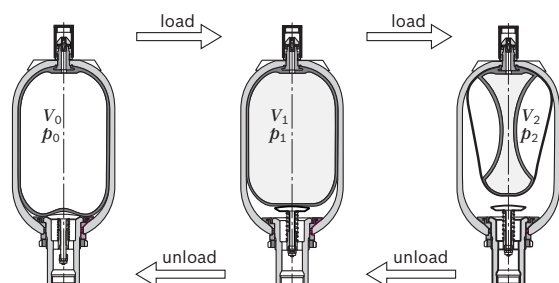
Applications

Various applications exist for hydro-pneumatic accumulators:

- ▶ Energy storage in order to save pump drive power in intermittent operation systems.
- ▶ Energy reserve for emergencies, e.g. upon failure of the hydraulic pump.
- ▶ Compensation of leakage losses.
- ▶ Impact and vibration absorption in case of periodic vibrations.
- ▶ Volume compensation in case of pressure and temperature changes.

Mode of operation

Fluids are almost incompressible and therefore cannot store pressure energy. Hydro-pneumatic Rexroth accumulators use the compressibility of a gas for fluid storage. Exclusively use nitrogen of cleanliness class 4.0!
 $N_2 = 99.99 \text{ vol. \%}$



Calculation

Pressures

The following pressures are of decisive importance for the calculation of an accumulator:

p_0	Gas filling pressure at room temperature and empty fluid chamber
$p_0(t)$	Gas filling pressure at operating temperature
$p_0(t_{max})$	Gas filling pressure at maximum operating temperature
p_1	Minimum operating pressure
p_2	Maximum operating pressure

In order to achieve the best utilization of the accumulator volume possible as well as a long life cycle, compliance with the following values is recommended:

$$p_0(t_{max}) \sim 0.9 \times p_1 \quad (1)$$

The highest hydraulic pressure should not exceed four times the filling pressure, as otherwise too much stress will be put on the elasticity of the bladder, resulting in too great a compression change with strong gas heating:

$$p_2 \leq 4 \times p_0 \quad (2)$$

The life cycle of the accumulator bladder is the higher the smaller the difference between p_1 and p_2 is. However, the operating ratio of the maximum accumulator capacity will also be reduced accordingly.

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Calculation

Oil volume

According to the pressures $p_0 \dots p_2$, the gas volumes $V_0 \dots V_2$ will result.

In this process, V_0 simultaneously is the nominal volume of the accumulator.

The available oil volume ΔV corresponds to the difference of the gas volumes V_1 and V_2 :

$$\Delta V \equiv V_1 - V_2 \quad (3)$$

The gas volume variable within a pressure differential is determined by the following equations:

- For an isothermal state change of gases, i.e. when the change of the gas cushion happens so slowly as to leave sufficient time for a complete thermal exchange between the nitrogen and its environment, therefore keeping the temperature constant, the following applies:

$$p_0 \times V_0 = p_1 \times V_1 = p_2 \times V_2 \quad (4.1)$$

- For an adiabatic state change, i.e. a quick change of the gas cushion accompanied by a temperature change of the nitrogen, the following applies:

$$p_0 \times V_0^\chi = p_1 \times V_1^\chi = p_2 \times V_2^\chi \quad (4.2)$$

χ = ratio of the specific gas heats (adiabatic exponent),
for nitrogen = 1.4

In practice, state changes rather follow adiabatic laws. Often charging is isothermal and discharge is adiabatic. Considering the equations (1) and (2), ΔV is between 50% and 70% of the nominal accumulator volume. The following applies as a guiding principle:

$$V_0 = 1.5 \dots 3 \times \Delta V \quad (5)$$

Calculation diagram

For graphic determination, the formulas (4.1) and (4.2) are converted into diagrams on pages 7 and 8.

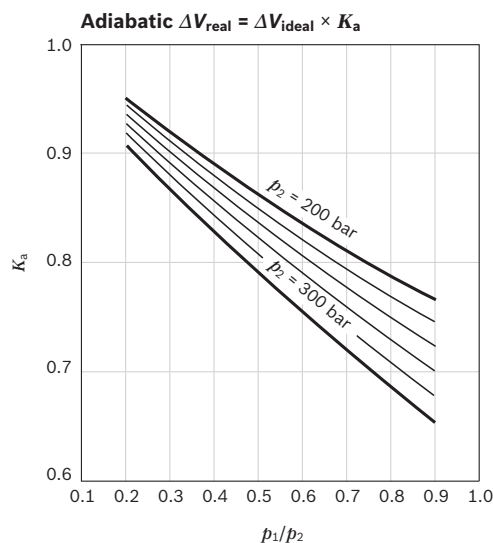
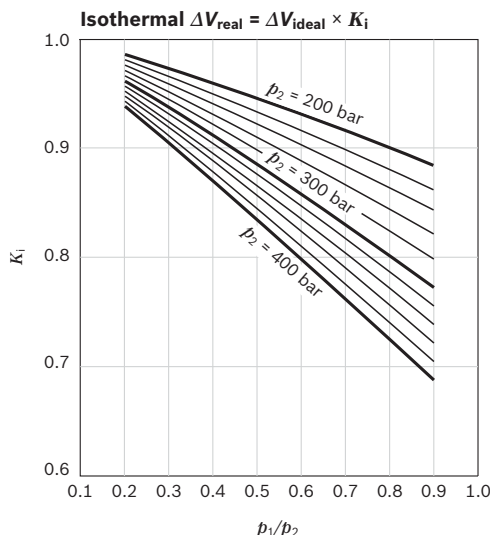
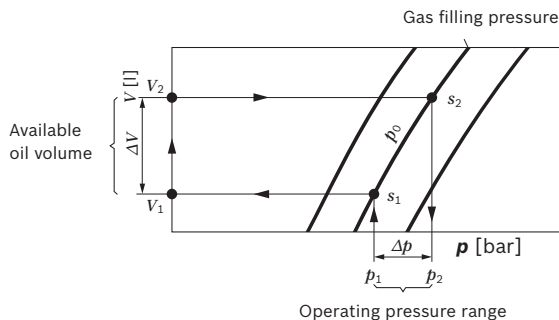
Depending on the task, the available oil volume, the accumulator size or the pressures can be determined.

Correction factor K_i and K_a

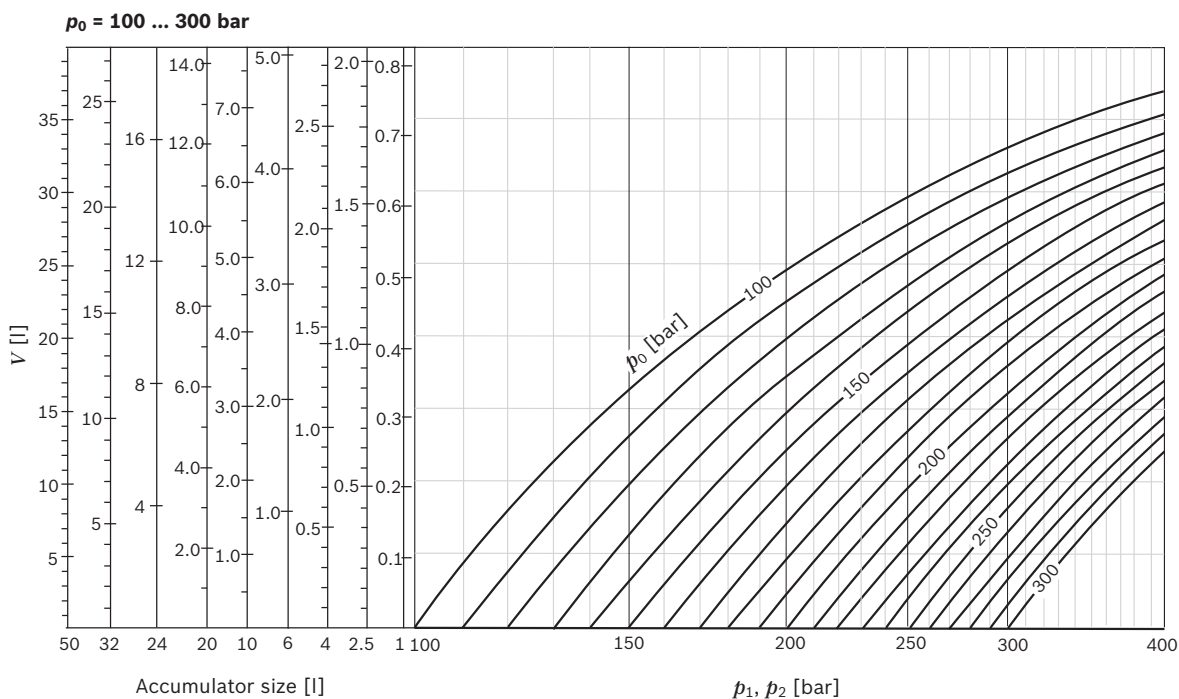
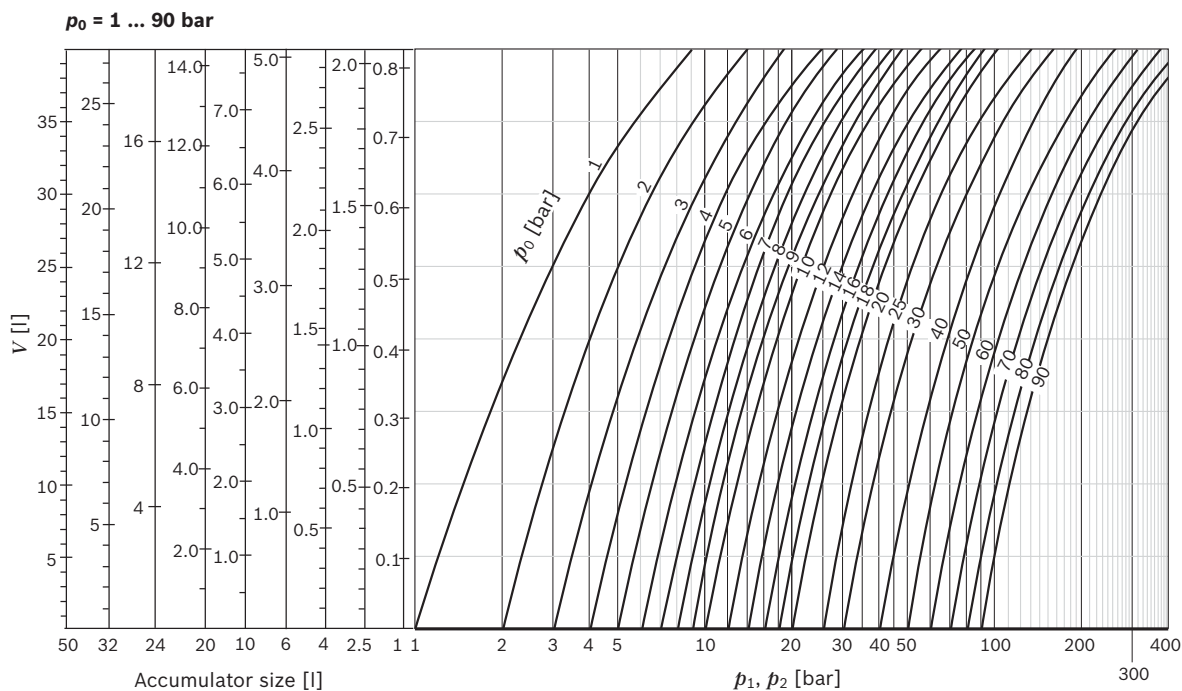
The equations (4.1) and (4.2) apply to ideal gases only. The behavior of real gases, however, will show considerable variation at operating pressures above 200 bar which will have to be accounted for by correction factors. These can be taken from the following diagrams. The correction factors the ideal sampling volume ΔV is to be multiplied with lie within a range of 0.6 ... 1.

Application of calculation diagrams

(see page 7 ... 8)



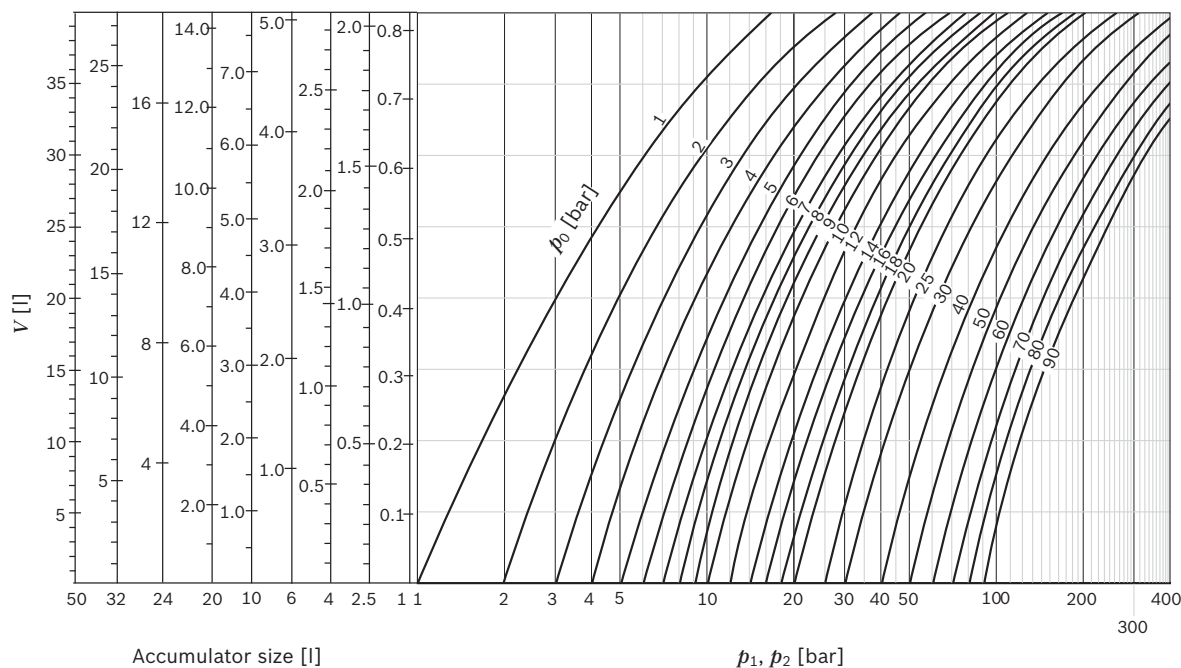
Calculation: isothermal state changes



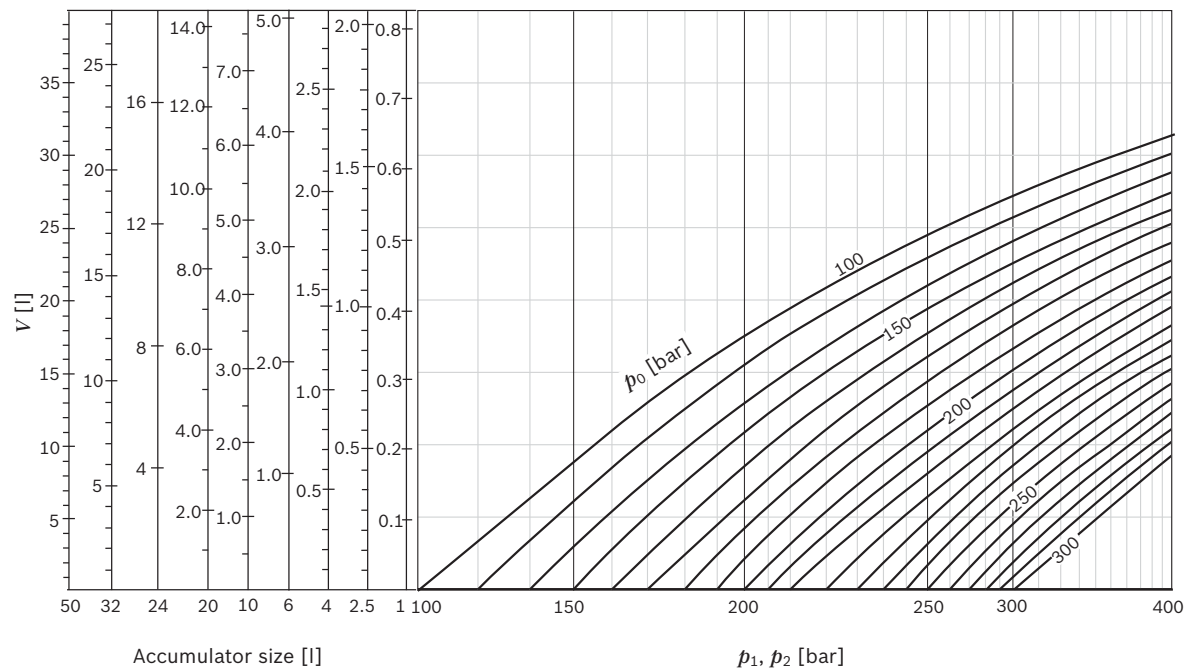
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Calculation: Isothermal state changes

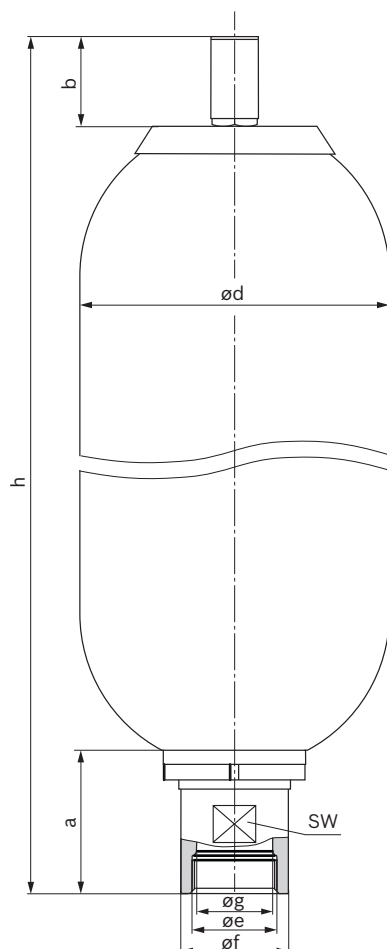
$p_0 = 1 \dots 90 \text{ bar}$



$p_0 = 100 \dots 300 \text{ bar}$



Dimensions (dimensions in mm)



Preferred types HAB-6X

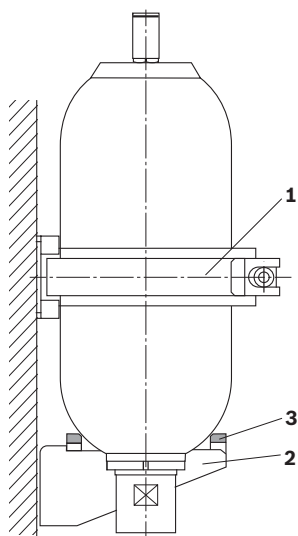
Type	Material no.
HAB1-350-6X/OG05G-2N111-BA	R901435300
HAB2,5-350-6X/OG07G-2N111-CE	R901435301
HAB4-350-6X/OG07G-2N111-CE	R901435302
HAB6-350-6X/OG07G-2N111-CE	R901435303
HAB10-330-6X/OG09G-2N111-CE	R901435304
HAB20-330-6X/OG09G-2N111-CE	R901435305
HAB24-330-6X/OG09G-2N111-CE	R901435306
HAB32-330-6X/OG09G-2N111-CE	R901435307
HAB50-330-6X/OG09G-2N111-CE	R901435308

Nominal volume [l]	Ordering code / type	h	Ød	a	b	Øe	Øf	Øg	SW	Weight [kg]
1	HAB1-330-6X/...G05G... HAB1-350-6X/...G05G...	320.5-354.5	112.5-115.5	65±3	71.5±3	G ³ / ₄ "	52.4	23H7	50	7
2.5	HAB2.5-330-6X/...G07G... HAB2.5-350-6X/...G07G...	520.5-562.5	112.5-115.5	65±3	71.5±3	G1 ¹ / ₄ "	52.4	36H8	50	10
4	HAB4-330-6X/...G07G... HAB4-350-6X/...G07G...	400.5-442.5	166.3-169.7	65±3	71.5±3	G1 ¹ / ₄ "	52.4	36H8	50	16.5
6	HAB6-330-6X/...G07G... HAB6-350-6X/...G07G...	535.5-569.5	166.3-169.7	65±3	71.5±3	G1 ¹ / ₄ "	52.4	36H8	50	20
10	HAB10-330-6X/...G09G...	559-591	216.8-221.2	101.5±3	71.5±3	G2"	76	54H7	70	32
20	HAB20-330-6X/...G09G...	869-901	216.8-221.2	101.5±3	71.5±3	G2"	76	54H7	70	53
24	HAB24-330-6X/...G09G...	1004-1036	216.8-221.2	101.5±3	71.5±3	G2"	76	54H7	70	61
32	HAB32-330-6X/...G09G...	1389-1421	216.8-221.2	101.5±3	71.5±3	G2"	76	54H7	70	85
50	HAB50-330-6X/...G09G...	1904-1936	216.8-221.2	101.5±3	71.5±3	G2"	76	54H7	70	123

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Spare parts and accessories (dimensions in mm)

HAB mounting elements

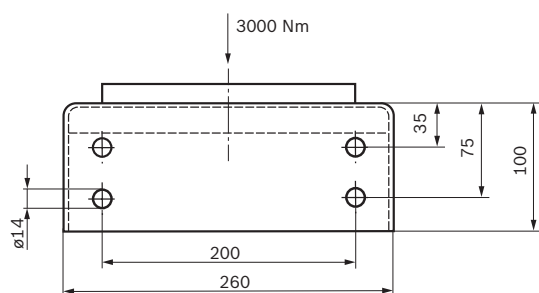


Clamp types	Material number	Accumulator size				
		1	4	20		
		2.5	6	10	24	
					35	50
Clamp 110-120	1531316021	1				
Clamp 160-170	1531316022		2			
Clamp 218-228	1531316026			1	2	
Clamp 224-230	1531316005					2
Console	1531334008			1	1	1
Rubber support ring	1530221042			1	1	1

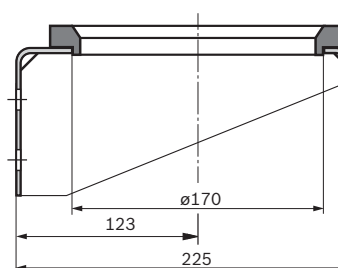
- 1 Clamp
- 2 Console
- 3 Rubber support ring

Console and rubber support ring

Console (material number: 1531334008)



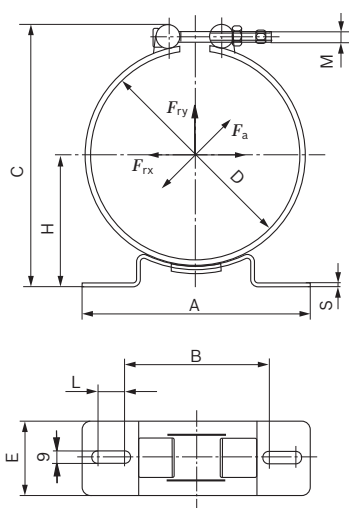
Rubber support ring (material number: 1530221042)



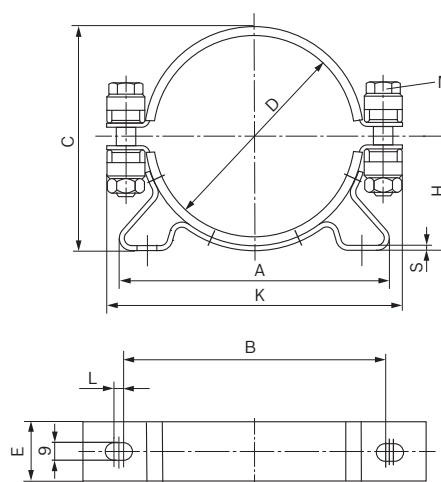
Bladder-type accumulator | **HAB** 11/20

Spare parts and accessories: Mounting clamps
(dimensions in mm)

Type F1



Type F2



Clamp types		Dimensions										
		A	B	C	D	E	H	K	L	M	S	Material number
Clamp 110-120	F1	135	96	150	110-120	50	64-69	–	6	M8	3	1531316021
Clamp 160-170	F1	237	147	200	160-170	50	90-95	–	35	M8	4	1531316022
Clamp 218-228	F1	237	147	258	218-228	50	120-125	–	35	M8	4	1531316026
Clamp 224-230	F2	254	212	244	224-230	30	120-123	295	4	M12	3	1531316005

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Spare parts and accessories: filling and test device (dimensions in mm)

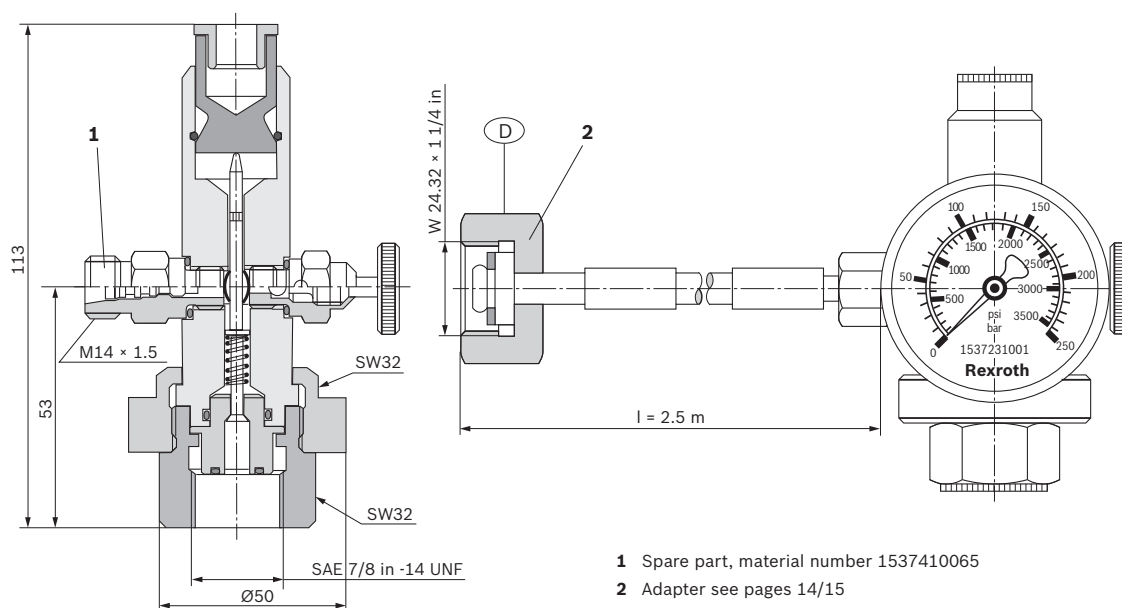


Measurement case	Material number
► for bladder-type accumulator (HAB)	0538103011
– Case (without contents)	R901079781
– Filling and test valve HAB	0538103005
– Pressure gauge 0 to 250 bar	1537231001
– Hose l = 2.5 m with transition socket (D)	1530712005
► for bladder and diaphragm accumulator (HAB/HAD)	0538103014
Components as above plus filling and test valve HAD	0538103006

Supplemental parts (separate order)		Material number
Pressure gauge 0 ... 25 bar		R900033955
Pressure gauge 0 ... 60 bar		1537231002
Pressure gauge 0 ... 400 bar		1537231005
Transition socket	(F)	1533391010
	(GB)	1533391011
	(USA)	1533391012
	(KR)	1533391013
	(J)	1533391014
Hose l = 5 m with transition socket	(RUS)	1533391015
	(D)	1530712006

Dimensions of filling and test valve

1 valve body with check valve, drain valve, pressure gauge connection and gas hose connection.



- 1 Spare part, material number 1537410065
2 Adapter see pages 14/15

Spare parts and accessories: adapter for nitrogen bottle to cap nut
(dimensions in mm)

Material number: 1533391010	Material number: 1533391013	Material number: R900034782
Material number: 1533391011	Material number: R900216133	Material number: R900708208
Material number: 1533391012	Material number: 1533391015	Material number: R901070776

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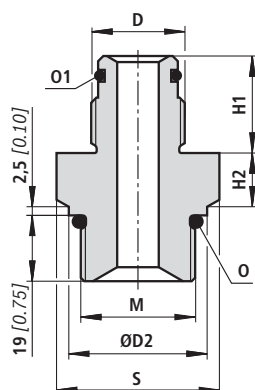
Spare parts and accessories: adapter for nitrogen bottle to cap nut
(dimensions in mm)

Country	Material number								
	1533391010	1533391011	1533391012	1533391013	R900216133	1533391015	R900034782	R900708208	R901070776
Brazil		x							
Bulgaria		x							
China									x
France	x								
Greece		x							
United Kingdom		x							
India		x							
Italy								x	
Japan					x				
Canada			x						
North Korea				x					
South Korea				x					
Malaysia		x							
Mexico	x								
Romania	x								
Russia						x			
Spain		x							
Saudi Arabia	x								
Singapore		x							
Taiwan							x		
Turkey		x							
USA			x						

Other countries upon request

Spare parts and accessories: accumulator adapter for accumulator shut-off blocks type ABZSS
(dimensions in mm [inches])

Please select the matching type according to data sheet 50131.

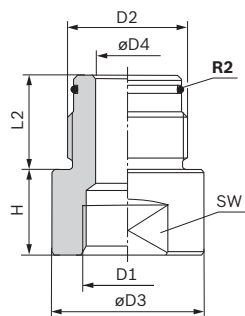


Accumulator shut-off block	Accumulator type	Accumulator DN	Accumulator adapter	D	ØD2
ABZSS 08 ABZSS 10 ABZSS 20	Bladder-type accumulator Data sheet 50171	1.0	S10 ¹⁾ S105 ²⁾	G3/4A	39.9 [1.57] ¹⁾ 35.0 [1.37] ²⁾
		2.5	S12 ¹⁾	G1	
		4.0	S107 ²⁾	1/4A	
		6.0			
		10.0	S13 ¹⁾	G2A	
		20.0 35.0 50.0	S109 ²⁾		
H1	H2	M	O	O1	S
28 [1.10]	15.5 [0.61]	29.7 x 2.8 1); 24 x 2.0 2)		18 x 2.5 [0.71 x 0.10]	SW41 [1.61A/F] ¹⁾ SW36 [1.41A/F] ²⁾
37 [1.46]	16.5 [0.65] ¹⁾ 17.5 [0.68] ²⁾			30x3 [1.18 x 0.12]	SW46 [1.81A/F]
43 [1.69]	20.5 [0.81] ¹⁾ 18.5 [0.73] ²⁾			48 x 3 [1.89 x 0.12]	SW65 [2.55A/F]

Spare parts and accessories: accumulator adapter for accumulator shut-off blocks type ABZSS (dimensions in mm)

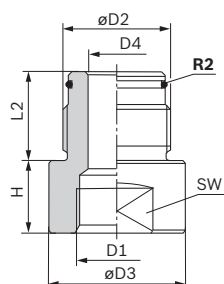
Adapter to metric thread

(HAB...-1X to HAB...-4X and -6X)



Nominal volume [l]	According to ISO 228		According to ISO 228		Dimensions [mm]					Material number adapter	Order number complete with seal ring R2
	D2	M _A [Nm]	D1	M _A [Nm]	H	L2	øD3	øD4	SW		
1	G3/4	180 ⁺¹⁸	M30 × 1.5	180 ⁺¹⁸	32	28	46	12	41	1533345047	R901252863
2.5 ... 6	G1/14	450 ⁺⁴⁵	M40 × 1.5	400 ⁺⁴⁰	43	37	60	20	55	1533345048	R901252864
10 ... 50	G2	500 ⁺⁵⁰	M50 × 1.5	450 ⁺⁴⁵	41	44	78	32	70	1533345049	R901252865

Adapter for reduction of pipe connection



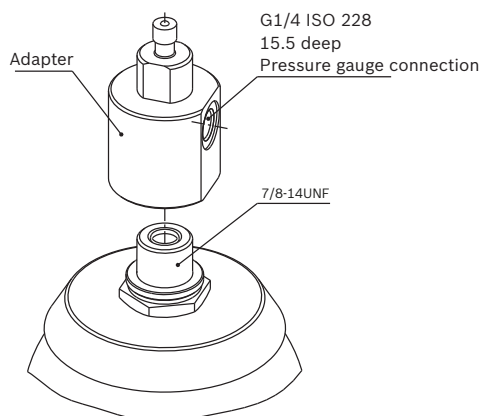
Nominal volume [l]	According to ISO 228		According to ISO 228		Dimensions [mm]					Material number adapter	Order number complete with seal ring R2
	D2	M _A [Nm]	D1	M _A [Nm]	H	L2	øD3	øD4	SW		
1	G3/4	180 ⁺¹⁸	G3/8	70 ⁺⁷	8	28	38	12	32	1533345039	R901252880
2.5 ... 6	G1/14	450 ⁺⁴⁵	G1/2	115 ⁺¹²	8	37	60	24	55	1533345043	R901252884
	G1/14	450 ⁺⁴⁵	G3/4	180 ⁺¹⁸	8	37	60	24	55	1533345040	R901252881
10 ... 50	G2	500 ⁺⁵⁰	G1/2	115 ⁺¹²	20	44	75	30	65	1533345044	R901252885
	G2	500 ⁺⁵⁰	G3/4	180 ⁺¹⁸	20	44	75	30	65	1533345041	R901252882
	G2	500 ⁺⁵⁰	G1	310 ⁺³¹	20	44	75	30	65	1533345045	1533345045
	G2	500 ⁺⁵⁰	G1 1/2	450 ⁺⁴⁵	40	44	75	32	65	1533345042	R901252883

16/20 **HAB** | Bladder-type accumulator

Spare parts and accessories (dimensions in mm)

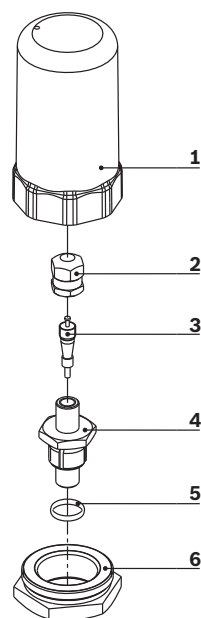
Pressure monitoring

Adapter for pressure gauge, material number 1535400171

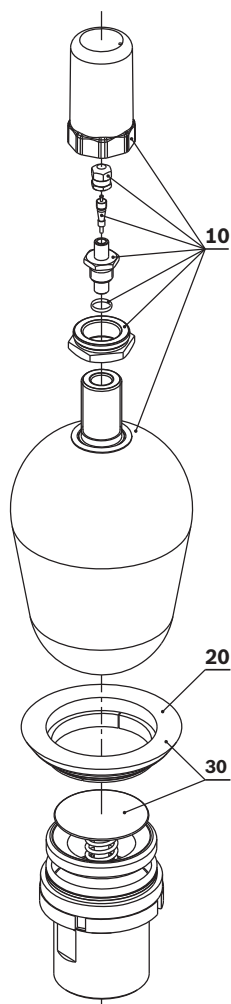


Gas valve

Spare part kit for gas valve	Material number R901438300
Components	Quantity
1 Protective cap	1
2 Sealing cap series 60	1
3 Valve insert series 60	1
4 Gas valve series 60	1
5 O-ring	1
6 Nut	1



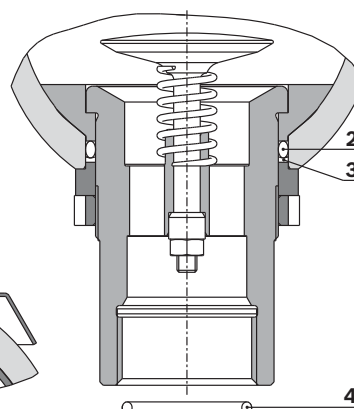
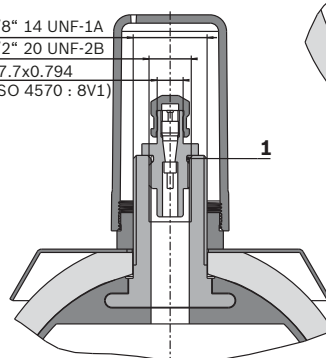
Spare parts (dimensions in mm)



Seal kit (position 1 ... 4)

Accumulator size	Material number NBR, HNBR, ECO	Material number FKM
1L	R901441920	–
2.5 ... 6L	R901441921	–
10 ... 50L	R901441922	R901441923

7/8" 14 UNF-1A
1/2" 20 UNF-2B
Ø7.7x0.794
(ISO 4570 : 8V1)



Accumulator size	10 Spare bladder with gas valve and seal kit				20 Holding ring		30 Oil valve kit consisting of holding ring and oil valve
	Material number				Material number		
	NBR	ECO	FKM	HNBR	NBR, HNBR, ECO	FKM	
1 l	R901437540	–	–	R901438250	R901438280	R901438290	–
2.5 l	R901437541	–	–	R901438251	R901438280	R901438290	–
4 l	R901437542	R901438234	–	R901438252	R901438280	R901438290	R901438270
6 l	R901437543	–	–	R901438253	R901438280	R901438290	R901438270
10 l	R901437544	R901438235	R901438240	R901438254	R901438281	R901438291	R901438271
20 l	R901437545	–	R901438241	R901438255	R901438281	R901438291	R901438271
24 l	R901437546	–	–	R901438256	R901438281	R901438291	R901438271
32 l	R901437547	R901438236	R901438242	R901438257	R901438281	R901438291	R901438271
50 l	R901437548	–	R901438243	R901438258	R901438281	R901438291	R901438271

18/20 **HAB** | Bladder-type accumulator

Important notices

Intended use

Rexroth bladder-type accumulators type HAB..-6X are intended for the set-up of hydraulic drive systems in stationary mechanical engineering and plant construction. In mobile applications or applications in which acceleration forces are applied to the bladder-type accumulator during intended use, its use is permitted only following release by the competent Rexroth product manager. Please contact technical sales for this. Rexroth bladder-type accumulators type HAB..-6X are not intended for private use.

Project planning information

Bladder-type accumulators have to be safely and permanently fastened to the machine or system using mounting elements. The fastening is intended to keep the oil port tension-free. Particularly, no tension forces or static or dynamic inertia forces should be applied to the oil port.

Thermal expansion of the supporting structure and vibrations originating from the environment should be considered in the selection of suitable mounting points.

Safety instructions for hydraulic accumulators

For the hydraulic accumulator type HAB..-6X, observe the operating instructions 50171-B. The machine end-user will have sole responsibility for compliance.

General notices for hydraulic accumulators in hydraulic system can be found in ISO 4413.

Keep all documents included in the delivery in a safe place; they will be required by the expert in recurring tests.

Legal provisions

Hydraulic accumulators are pressure vessels and subject to the application national provisions and/or regulations valid at the place of installation.

In Germany, the Ordinance on Industrial Safety and Health (BetrSichV) applies.

Special regulations are to be observed in shipbuilding, aircraft construction, mining, etc.

Authorized persons

According to Ordinance on Industrial Safety and Health (BetrSichV), only authorized persons may carry out tests. Authorized persons are such persons having obtained the required expert knowledge through professional training, experience and recent professional activity.

Safety equipment



Notice:

Hydraulic accumulators have to be secured against operation outside of the admissible limits according to Pressure Equipment Directive 2014/68/EU.

In order not to exceed the maximum operating pressure, we recommend the use of an accumulator shut-off block type ABZSS according to data sheet 50131.

Further information

Operating instructions valid for HAB1 ... HAB50

Language	Operating instructions	Document number
German	RD50171-B	RA56504062
English	RE50171-B	RA56504064
French	RF50171-B	RA56504063
Spanish	RS50171-B	RA56504059
Italian	RI50171-B	RA56504061
Chinese	RC50171-B	RA56504056
Russian	R-RS50171-B	RA56504054
Norwegian	R-NO50171-B	RA56504058
Polish	R-PL50171-B	RA56504066
Czech	R-CZ50171-B	RA56504065
Romanian	R-RU50171-B	RA56504067
Hungarian	RU50171-B	RA56504057
Portuguese	RP50171-B	RA56504060
Swedish	R-SK50171-B	RA56592909

CE Declarations of Conformity

In German, English, French

Type	Document number
HAB1-330...	–
HAB2,5-330...	RA56313071
HAB4-330...	
HAB6-330...	
HAB1-350...	–
HAB2,5-350...	RA56313069
HAB4-350...	
HAB6-350...	
HAB10-330...	RA56313070
HAB20-330...	
HAB24-330...	
HAB32-330...	
HAB50-330...	

- Accumulator shut-off block
- Selection of filters
- Information on available spare parts