Rexroth
Bosch Group

Bladder-type accumulator

CE

RE 50170/01.09 1/18
Replaces: 05.2008

Type HAB

Component series 4X
Nominal capacity 1 to 50 liters
Maximum operating pressure 350 bar

Table of contents

Information on available spare parts:
www.boschrexroth.com/spc

Features

- Hydraulic accumulator according to Pressure Equipment Directive 97/23/EC
- Bladder material for different applications

Use:

- Energy storing in systems with intermittent operation
- Energy reserve for emergencies
- Compensation for leakage losses
- Impact and vibration damping
- Compensation of flow in the case of changes in pressure and temperature

Note
Pressure Equipment Directive 97/23/EC of the European Parliament and of the Council of May 29, 1997 on the approximation of the laws of the Member States has been in force since November 29, 1999. With effect from May 29, 2002 hydraulic accumulators may exclusively placed on the market in accordance with this Directive.

Ordering code

HAB | – | – | **4X** / | **2** | | **G** – | **2** | | **1** | **1** | **1** – | – | *

Nominal capacity
1 liter = **1**
2.5 liters = **2,5**
4 liters = **4**
6 liters = **6**
10 liters = **10**
20 liters = **20**
35 liters = **35**
50 liters = **50**

Permissible max. operating pressure
350 bar (1 to 6 liters) = **350**
330 bar (10 to 50 liters) = **330**

Component series
Component series 40 to 49 (unchanged installation and connection dimensions) = **4X**

Gas charge pressure
2 bar = **2**

Port size for hydraulic fluid [1)]
G 3/4 = **G05**
G 1 1/4 = **G07**
G 2 = **G09**

Type of mounting (oil connection form)
Thread with internally radial sealing face = **G**

Gas port form
2 = Gas valve for filling and test device (see page 14)

Bladder material[1)]
N = NBR
E = ECO

Vessel material[1)]
1 = Steel

Surface inside vessel[1)]
1 = Steel

Surface of connection side [1)]
1 = Steel

Certification (acceptance)
CE = Acceptance according to 97/23/EC
BA = Instructions for use

Further details in clear text e.g. special versions

Order example:
HAB10-330-4X/2G09G-2N111-CE

[1)] Further variants on request

For standard types, see page 11

Operating instructions and declarations of conformity

Operating instructions
available for HAB1 bis HAB50

Language	Operating instructions Material number
German	**R901200925**
English	**R901200926**
French	**R901200927**
Spanish	**R901200928**
Italian	**R901200929**
Chinese	**R901200930**
Russian	**R901200931**
Norwegian	**R901200932**

Declarations of conformity
Sprache: german, english, french

Nominal capacity	Declarations of conformity	
	Bladder material NBR Material number	Bladder material ECO Material number
1 l	–	–
2,5 l	**R901200940**	**R901200942**
4 l		
6 l		
10 l	**R901200941**	**R901200943**
20 l		
35 l		
50 l		

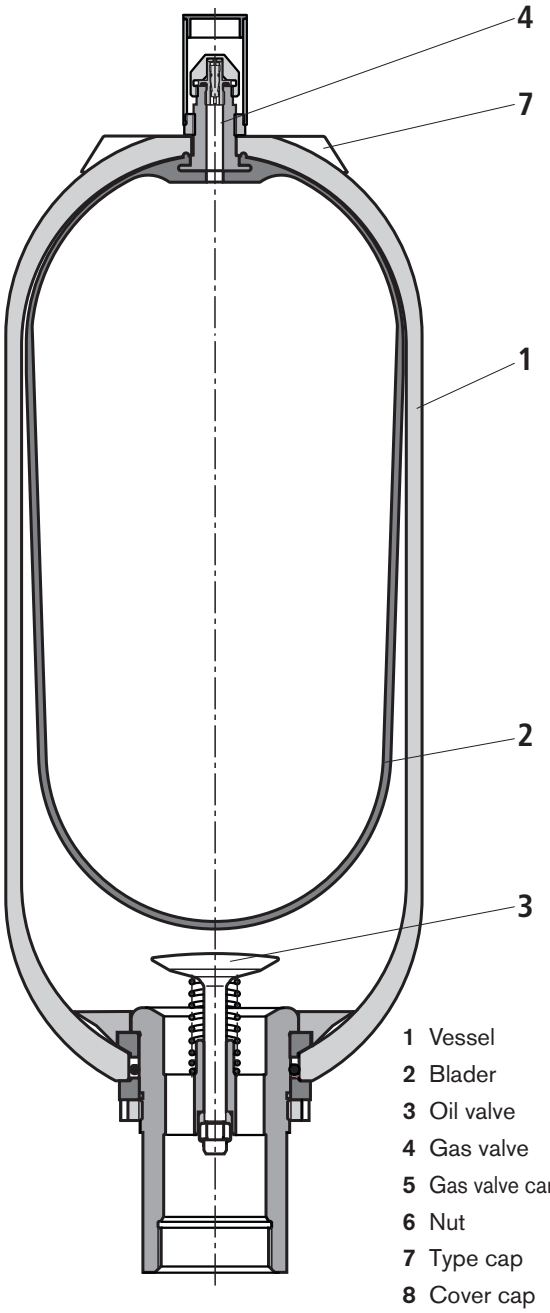
Function, section, symbol

General

Hydraulic accumulators are hydrostatic units, which can store a certain amount of energy and make it available to the hydraulic system when required.

Fluids are hardly compressible, whereas gases feature high compressibility. The operating principle of all gas-loaded hydraulic accumulators is based on this difference.

Depending on the design of the separating element, we distinguish between bladder-type and diaphragm accumulators. Hydraulic accumulators basically consist of a fluid and a gas section with a gas-tight separating element. The fluid section is connected to the hydraulic circuit.



1 Vessel
2 Blader
3 Oil valve
4 Gas valve
5 Gas valve carrier
6 Nut
7 Type cap
8 Cover cap

When a certain amount of pressurized gas is pressurized to a higher fluid pressure, the gas volume decreases as the fluid pressure rises.

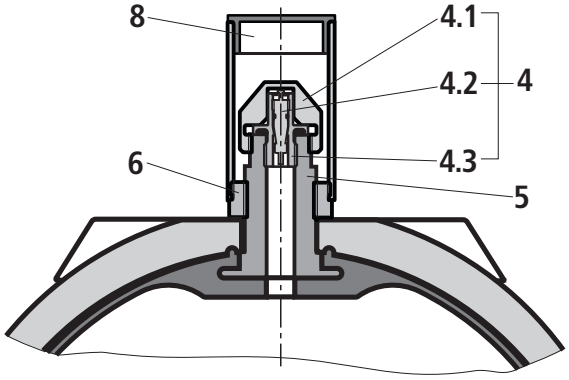
When the fluid pressure falls, the fluid is pressed back into the hydraulic system through expansion of the gas until the pressure is again balanced.

Bladder-type accumulators

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

The accumulator is subdivided into a gas and a fluid side by an elastic bladder (2) mounted in the interior of the vessel. The bladder is charged with nitrogen to the specified gas charge pressure p_0 by means of gas valve (4).

When the fluid is pressed into the accumulator, the gas in the bladder is compressed and hence the pressure increased. The gas volume reduces and on the fluid side, the fluid can flow



into the accumulator. As soon as the pressure on the fluid side falls below the gas pressure, the accumulator is emptied.

Oil valve (3) is provided in the oil port of the bladder-type accumulator and closes when the pressure on the gas side is higher than on the fluid side. This prevents draining of the bladder into the oil channel and thus the bladder from being destroyed.

When the minimum operating pressure is reached, a small oil volume is to be maintained between the bladder and the fluid volume (approx. 10 % of the nominal capacity of the hydraulic accumulator), in order that the bladder does not hit the valve during every expansion process.

Gas valve (4) consists of sealing cap (4.1), gas valve insert (4.2) and gas charging valve body (4.3). These parts can be replaced separately.

Type cap (7) shows the technical data and features of the hydraulic accumulator.

Symbol

Technical data (for applications outside these parameters, please consult us!)

General

Weight	kg	See table on page 11
Design		Bladder-type accumulator
Installation position		Preferably with fluid connection pointing downwards or horizontal
Type of mounting		With clamps and console
Ambient temperature range	°C	–15 to +65 [1)]
Pipe connection		Female thread

Hydraulic

Nominal capacity	V_{nom}	l	1	2.5	4	6	10	20	35	50
Effective gas volume	V_{eff}	l	1.0	2.4	3.7	5.9	9.2	18.1	33.4	48.7
Permissible max. flow	q_{max}	l/min	240	600	600	600	900	900	900	900
Permissible max. operating pressure	p_{max}	bar	350	350	350	350	330	330	330	330
Permissible max. pressure fluctuation width	Δp_{dyn}	bar	200	200	200	200	200	200	200	200
Operating pressures and useful volume			See Calculation on pages 5 to 10							
Hydraulic fluid			Hydraulic oil to DIN 51524; other fluids on request!							
Hydraulic fluid temperature range Others on request		°C	–15 to +80 (NBR) –35 to +80 (ECO)							

Pneumatic

Charge gas			nitrogen, purity degree 4.0, N_2 = 99,99 Vol.-%
Gas charge pressure	p_0	bar	2

Usable hydraulic fluids

Temperature range

Hydraulic fluids	Temperature range	Material
Mineral oils	–15 to +80 °C –35 to +80 °C	NBR ECO
HFC	–10 to +60 °C	NBR

NBR Acrylonitrile butadiene rubber (Perbunan)
ECO Epichlorohydrin rubber

In the case of other hydraulic fluids or temperatures, please consult us.

Application, operating principle

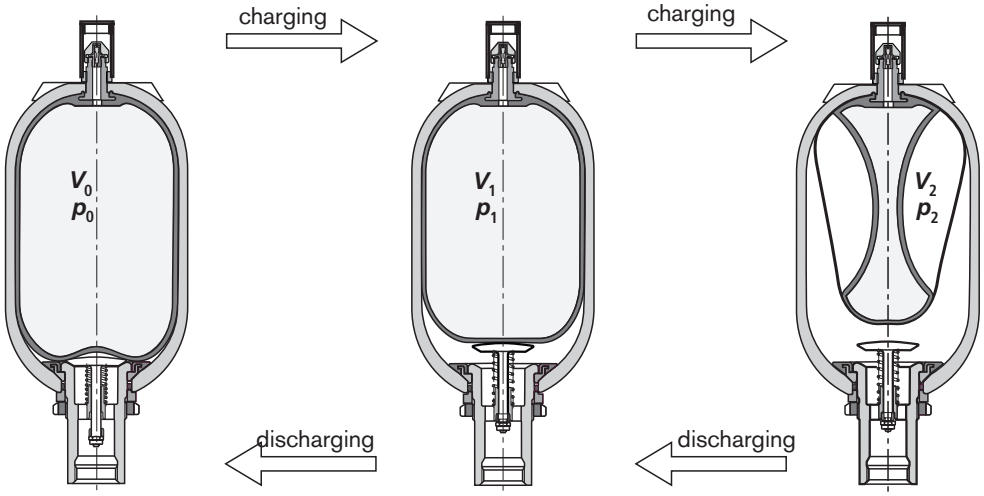
Applications

Hydro-pneumatic accumulators can be used in a wide variety of applications:

- Storage of energy for saving pump drive power in systems with intermittent operation.
- Energy reserve for emergencies, e.g. in the event of a failure of the hydraulic pump.
- Compensation of leakage losses.
- Damping of impacts and vibration in the case of periodic vibration.
- Compensation of volume in the case of changes in pressure and temperature.

Operating principle

Fluids are almost incompressible and can therefore not store pressure energy. Hydro-pneumatic Rexroth accumulators utilize the compressibility of a gas for storing a fluid. Only nitrogen of purity degree 4.0 may be used!
N_2 = 99.99 percent by volume



Calculation

Pressures

For the calculation of an accumulator, the following pressures are of decisive significance:

p_0 = gas charge pressure at room temperature and drained fluid chamber
$p_0(t)$ = gas charge pressure at operating temperature
$p_0(t_{max})$ = gas charge pressure at max. operating temperature
p_1 = minimum operating pressure
p_2 = maximum operating pressure
p_m = medium operating pressure

To achieve the best possible utilization of the accumulator capacity and a long service life, it is recommended that the following values be adhered to:

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

The highest hydraulic pressure should not exceed the quadruple of the precharge pressure; otherwise, the elasticity of the bladder is overstressed and excessive variations in the compression result in strong heating up of the gas:

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

The smaller the difference between p_1 and p_2 the longer is the service life of the accumulator bladder. However, this also reduces the degree of utilization of the corresponding maximum accumulator capacity.

Calculation

Oil volume

Pressures p_0 … p_2 determine gas volumes V_0 … V_2.

Here, V_0 is also the nominal capacity of the accumulator.

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

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

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

a) In the case of **isothermal changes of state** of gases, that is, when the gas buffer changes so slowly that enough time is available for a complete heat exchange between the nitrogen and its surroundings and the temperature therefore remains constant, the following is valid:

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

b) In the case of an **adiabatic change of state,** that is, with a rapid change of the gas buffer, in which the temperature of the nitrogen changes as well, the following is valid:

$$p_0 \cdot V^{\chi}_0 = p_1 \cdot V^{\chi}_1 = p_2 \cdot V^{\chi}_2 \quad (4.2)$$

χ = ratio of the specific heat of gases (adiabatic exponent), for nitrogen = 1.4

In practice, changes in state rather follow adiabatic laws. Charging is often isothermal, discharging adiabatic.

Taking account of equations (1) and (2), ΔV is 50 % to 70 % of the nominal accumulator capacity. The following can be applied as a rule of thumb:

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

Calculation diagram

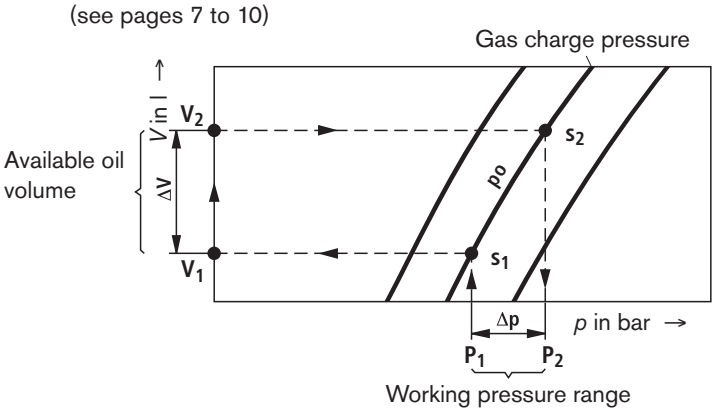
To allow a determination on the basis of a graphic representation, the formulas (4.1) and (4.2) were translated into diagrams on pages 7 to 10. Depending on the task at hand, the available oil volume, the accumulator size or the pressures can be established.

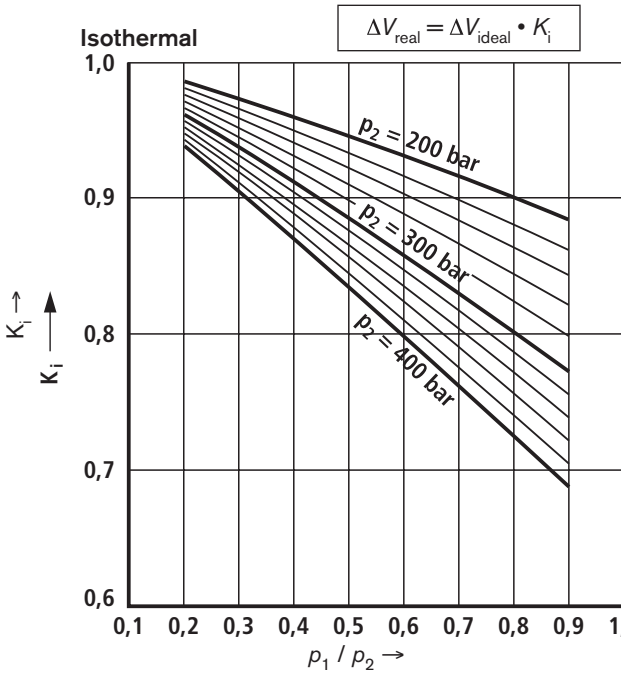
Correction factors K_i and K_a

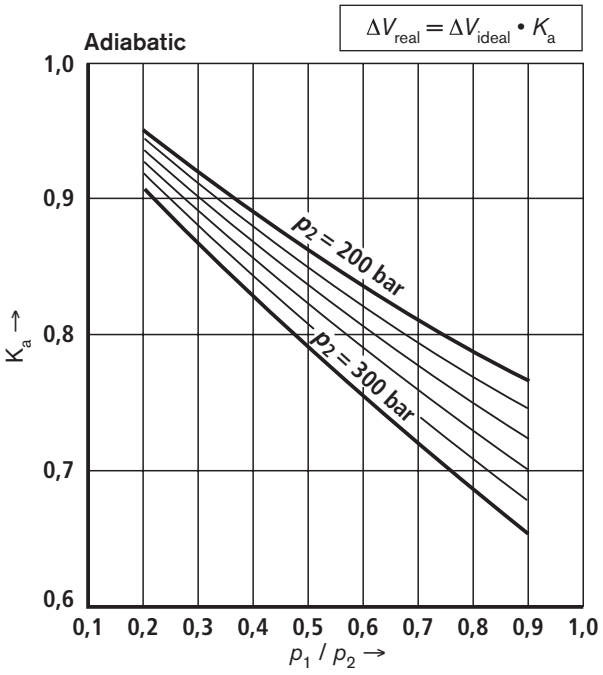
Equations (4.1) and (4.2) are only valid for ideal gases. In the characteristics of real gases, significant deviations can be observed at operating pressures above 200 bar, which must be taken into account by applying correction factors. These are shown on the following diagrams. The correction factors which are to be multiplied by the ideal withdrawal volume ΔV are within the range of 0.6 … 1.

Application of the calculation diagrams

(see pages 7 to 10)



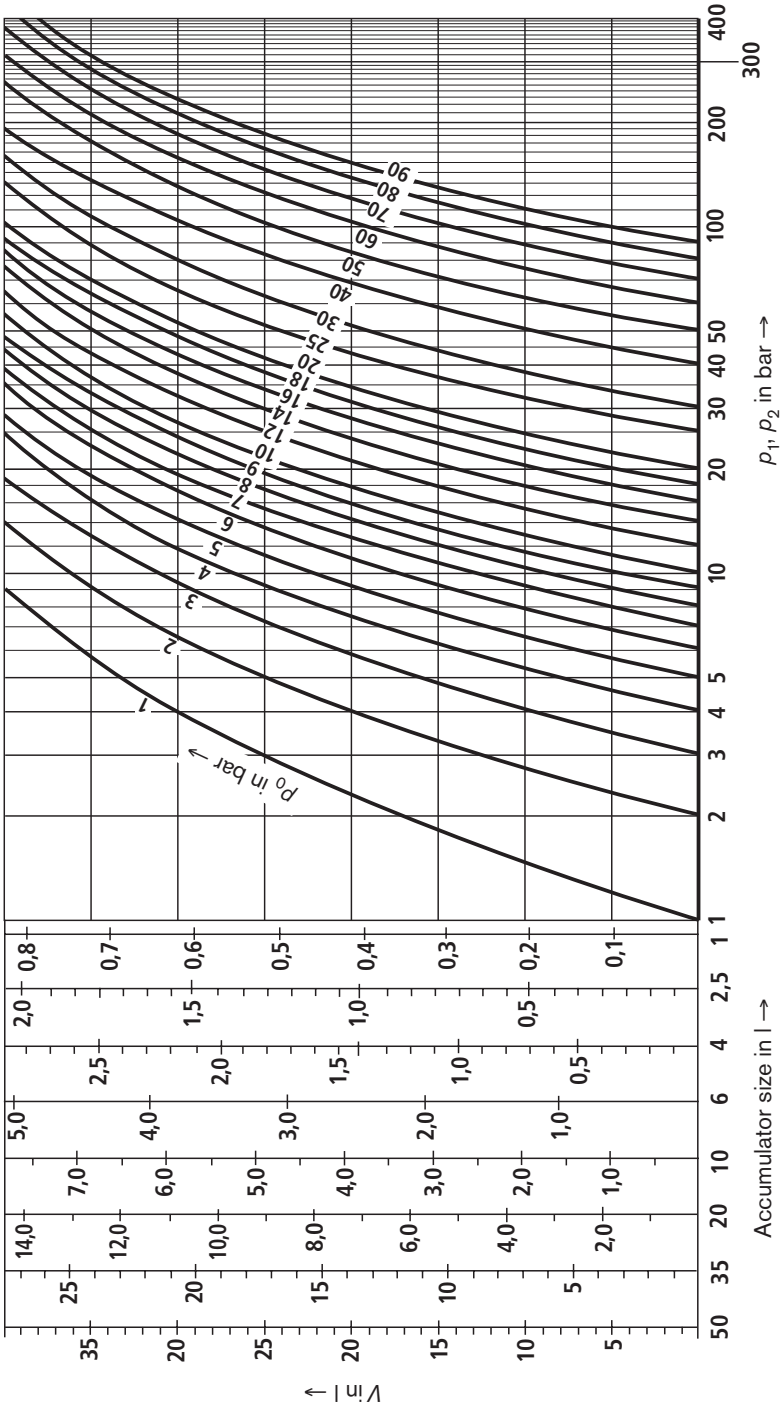




Calculation

Isothermal changes of state

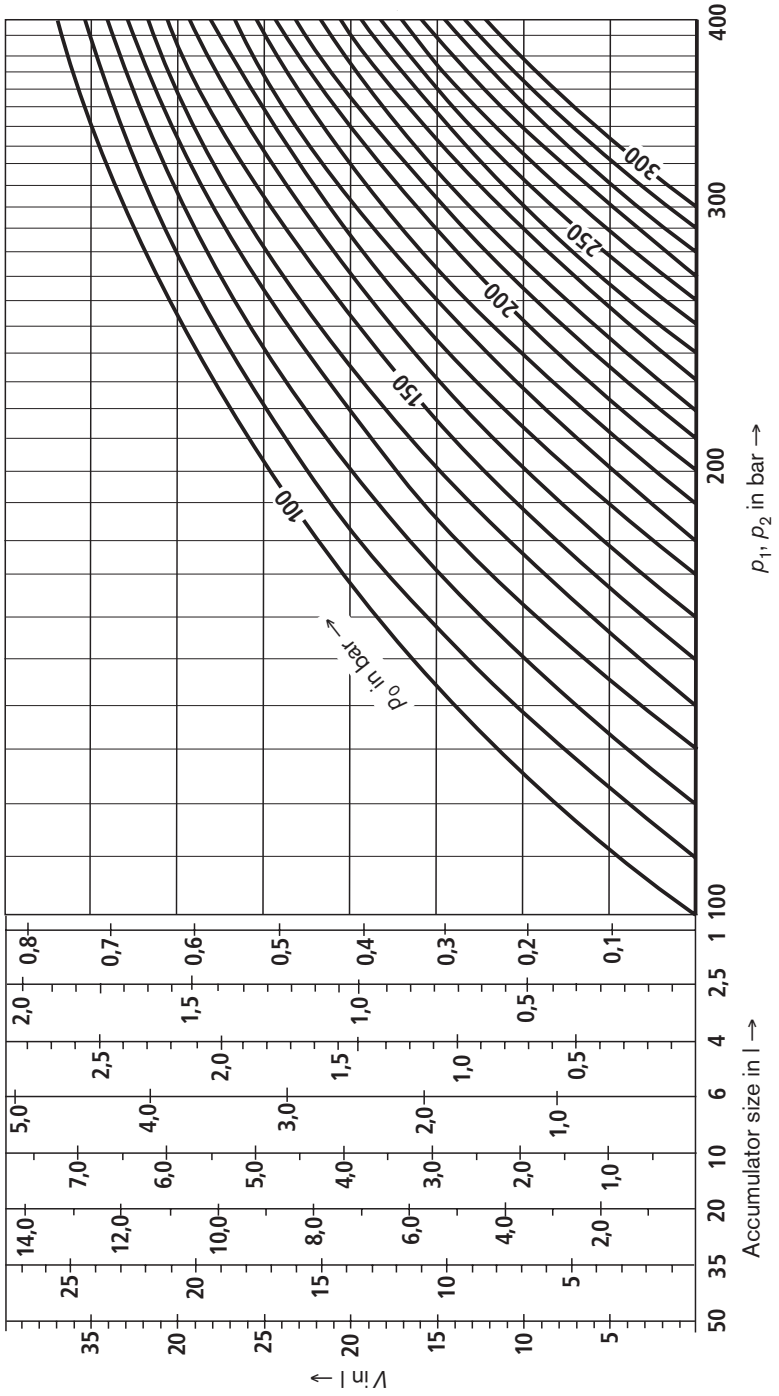
p_0 = 1 to 90 bar



Calculation

Isothermal changes of state

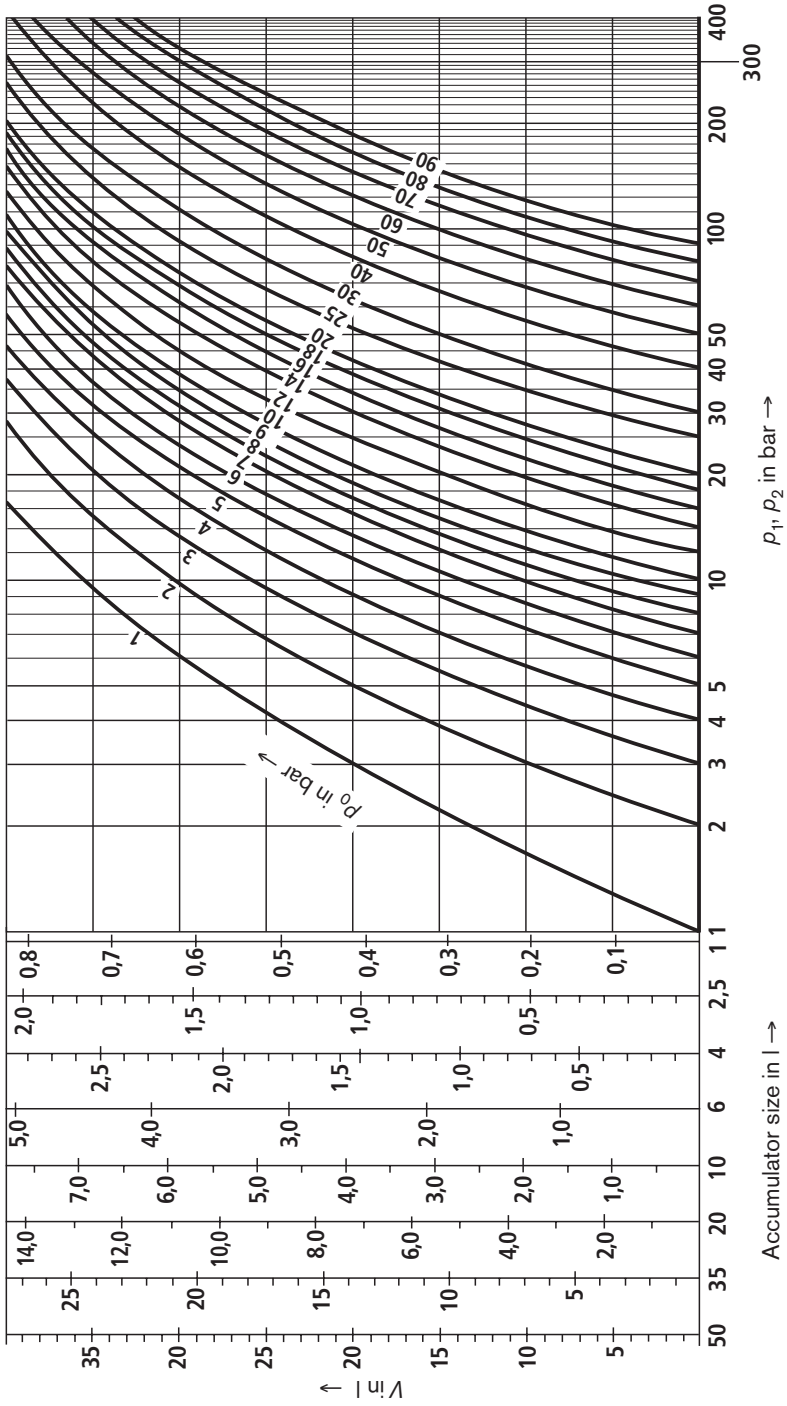
p_0 = 100 to 300 bar



Calculation

Adiabatic changes of state

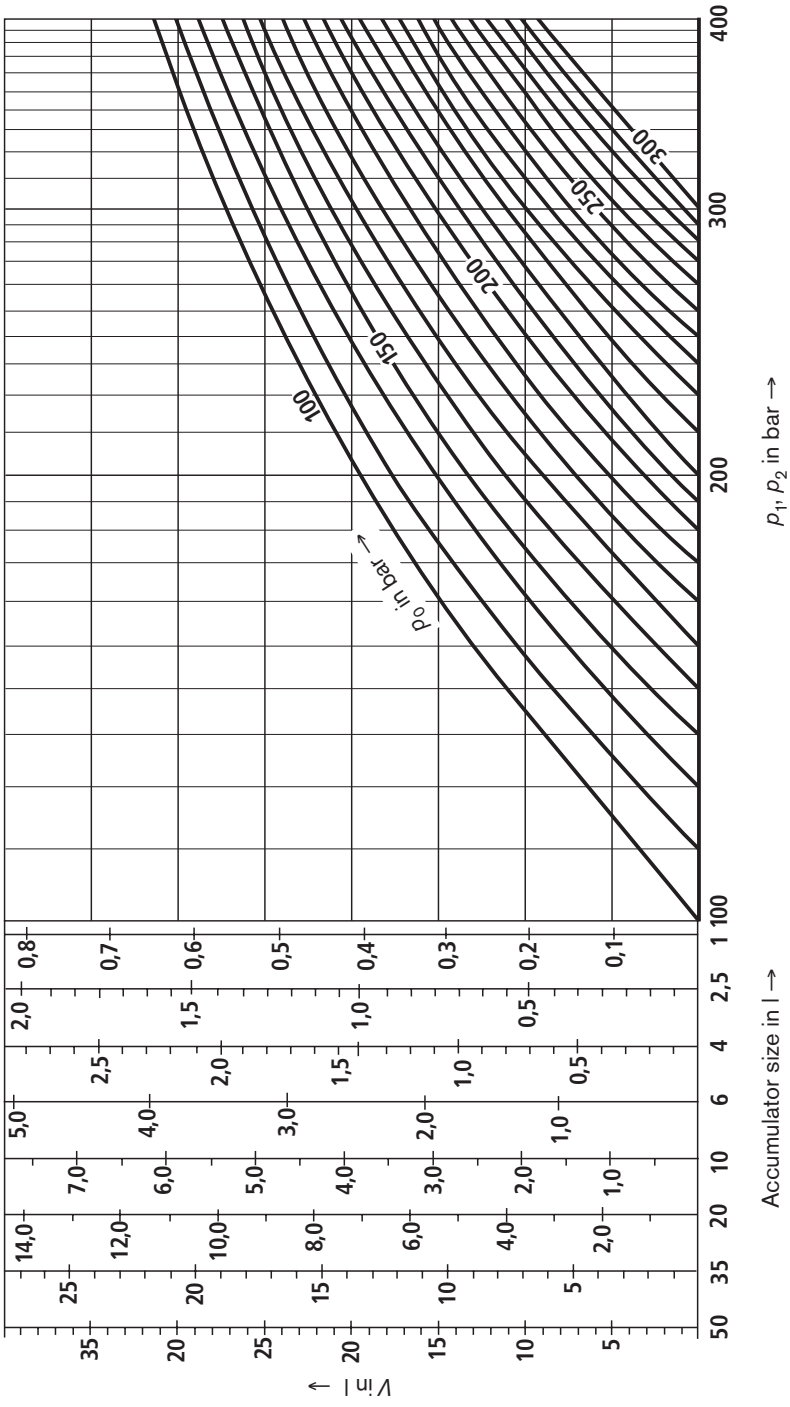
p_0 = 1 to 90 bar



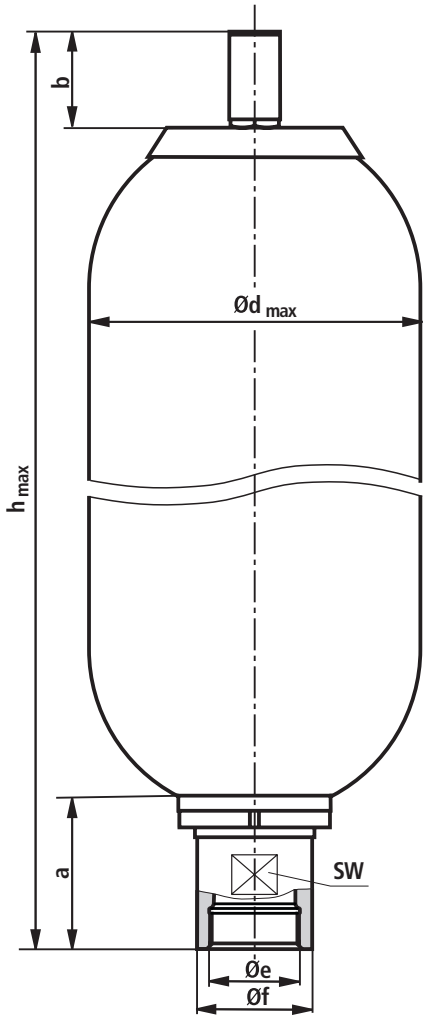
Calculation

Adiabatic changes of state

p_0 = 100 to 300 bar



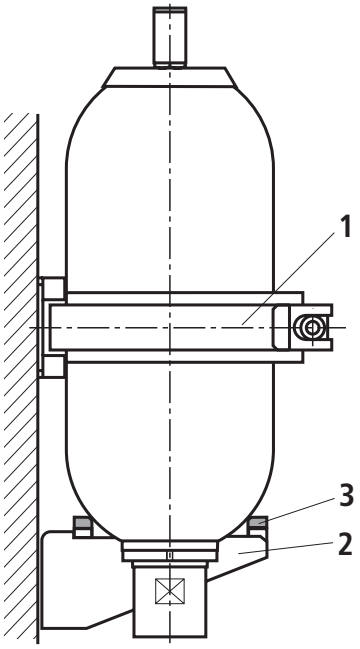
Unit dimensions, standard types (dimensions in mm)



Nominal capacity in liters	Ordering code / type	Material no.	h max	Ød max	a	b	Øe	Øf	A/F	Weight kg
1	HAB1-350-4X/2G05G-2N111-BA	**R901195131**	333,5	115,5	56	70	G3/4"	36	32	5
	HAB1-350-4X/2G05G-2E111-BA	**R901195132**								
2,5	HAB2,5-350-4X/2G07G-2N111-CE	**R901195133**	554	115,5	69	70	G1 1/4"	53	50	10
	HAB2,5-350-4X/2G07G-2E111-CE	**R901195134**								
4	HAB4-350-4X/2G07G-2N111-CE	**R901195135**	438,5	170	67	70	G1 1/4"	53	50	16
	HAB4-350-4X/2G07G-2E111-CE	**R901195136**								
6	HAB6-350-4X/2G07G-2N111-CE	**R901195137**	564,5	170	67	70	G1 1/4"	53	50	20
	HAB6-350-4X/2G07G-2E111-CE	**R901195138**								
10	HAB10-330-4X/2G09G-2N111-CE	**R901195139**	590,5	225,5	104	70	G2"	76	70	32
	HAB10-330-4X/2G09G-2E111-CE	**R901195140**								
20	HAB20-330-4X/2G09G-2N111-CE	**R901195141**	900,5	225,5	104	70	G2"	76	70	53
	HAB20-330-4X/2G09G-2E111-CE	**R901195142**								
35	HAB35-330-4X/2G09G-2N111-CE	**R901195143**	1424	225,5	104	70	G2"	76	70	85
	HAB35-330-4X/2G09G-2E111-CE	**R901195144**								
50	HAB50-330-4X/2G09G-2N111-CE	**R901195145**	1940	225,5	104	70	G2"	76	70	123
	HAB50-330-4X/2G09G-2E111-CE	**R901195146**								

Accessories (dimensions in mm)

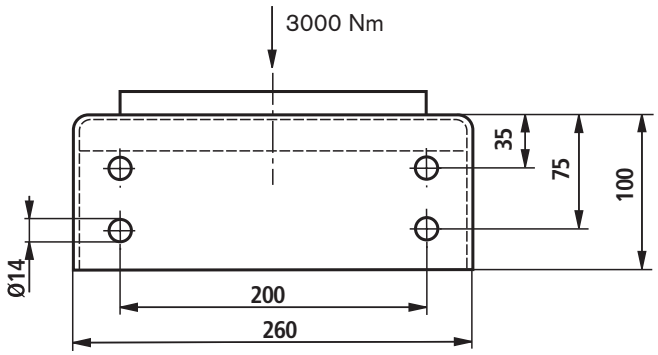
HAB mounting elements



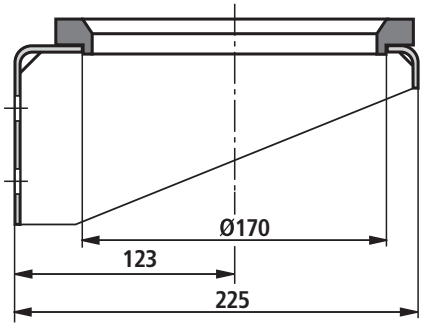
Clamp type	Material no.	Accumulator size				
		1	4		20	
		2.5	6	10	35	50
Clamp 110-120	**1531316021**	1				
Clamp 160-170	**1531316022**		2			
Clamp 218-228	**1531316026**			1	2	
Clamp 224-230	**1531316005**					2
Console	**1531334008**			1	1	1
Rubber back-up ring	**1530221042**			1	1	1

1 Clamp
2 Console
3 Rubber back-up ring

Console and rubber back-up ring



Console
Material no. 1531334008

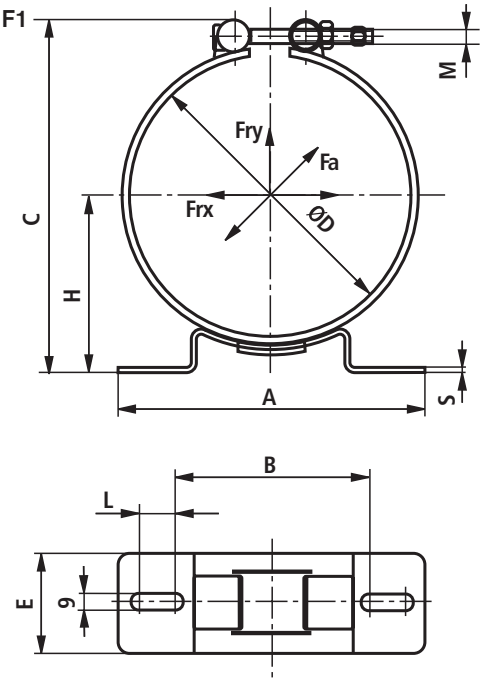


Rubber back-up ring
Material no. 1530221042

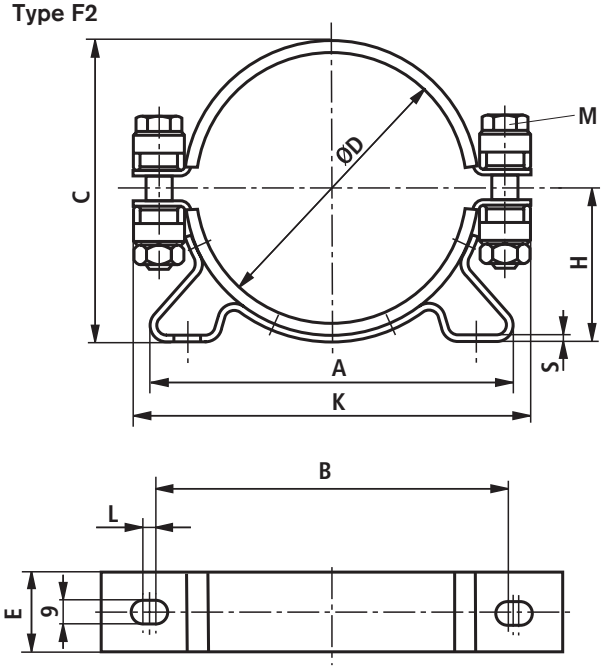
Accessories (dimensions in mm)

Mounting clamps

Type F1



Type F2



Clamp type		Dimensions										Material no.
		A	B	C	ØD	E	H	K	L	M	S	
Clamp 110-120	F1	135	96	150	110-120	50	64-69	–	10	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	13	M12	3	**1531316005**

Accessories (dimensions in mm)

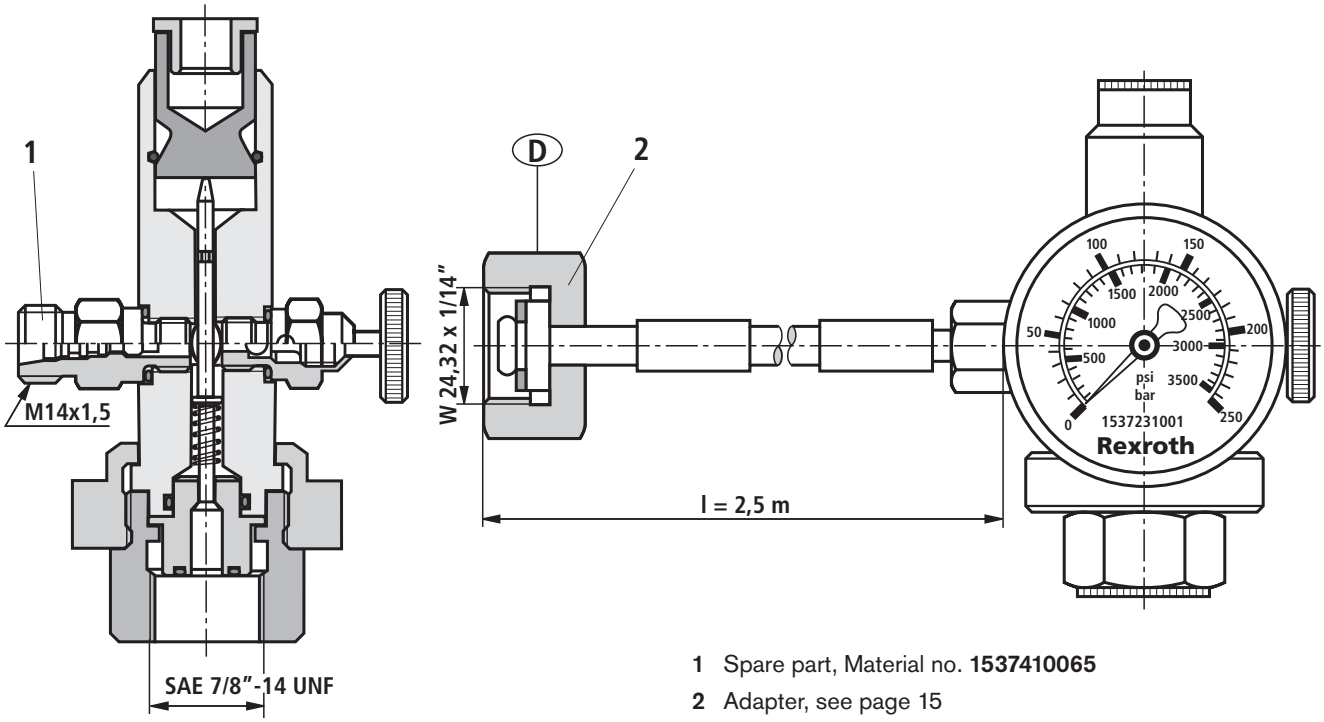
Charging and test device

Test case	Material no.
Test case, complete (bladder-type accumulator HAB)	**0538103011**
Case (separately)	**R901070141**
Charging and test valve	**0538103005**
Pressure gauge 0 to 250 bar	**1537231001**
Hose l = 2.5 m with adapter connection form (D)	**1530712005**

Supplementary parts to be ordered separately	Material no.
Pressure gauge 0 to 25 bar	**R900033955**
Pressure gauge 0 to 60 bar	**1537231002**
Pressure gauge 0 to 400 bar	**1537231005**
Adapter connection Form (F)	**1533391010**
Form (GB)	**1533391011**
Form (USA)	**1533391012**
Form (KOR)	**1533391013**
Form (JAP)	**1533391014**
Form (GUS)	**1533391015**
Hose l = 5 m with adapter connection form (D)	**1530712006**

Dimensions or charging and test valve

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



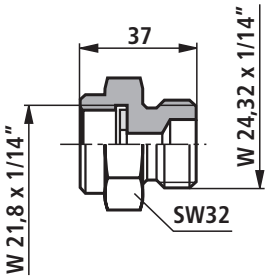
1 Spare part, Material no. **1537410065**

2 Adapter, see page 15

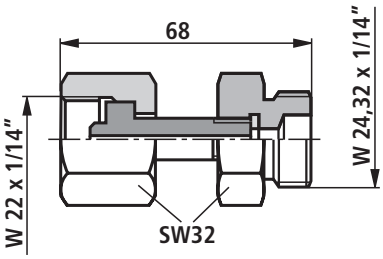
Accessories (dimensions in mm)

Adapter for nitrogen bottle to cap nut

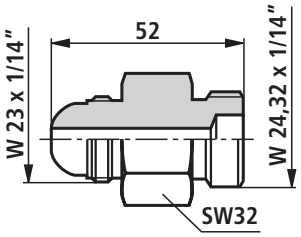
1533391010



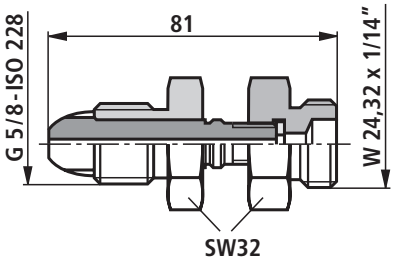
1533391014



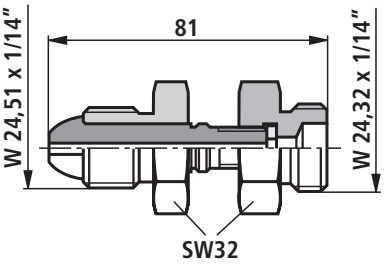
1533391013



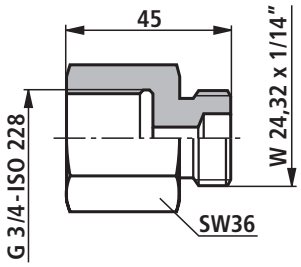
1533391011



1533391012



1533391015

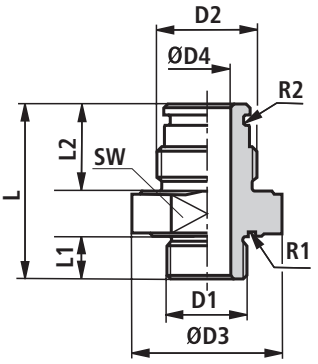


Country	1533391011	1533391010	1533391012	1533391014	1533391013	1533391015
Brazil	x					
Bulgaria	x					
Canada			x			
France		x				
Great Britain	x					
Greece	x					
India	x					
Japan				x		
Korea North					x	
Korea South					x	
Malaysia	x					
Romania		x				
Russia						x
Saudi Arabia		x				
Singapore	x					
Spain	x					
Turkey	x					
USA			x			
Other countries on request						

Accessories (dimensions in mm)

Connection adapter for safety blocks NG20
Connection A (accumulator)

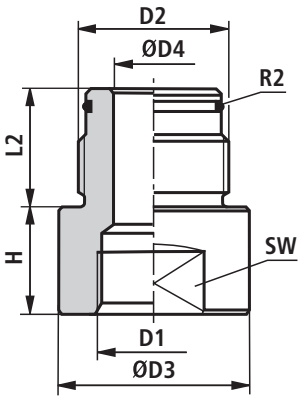
Safety block		to ISO 228		Dimensions in mm						
D1	M_T in Nm	D2	M_T in Nm	L	L1	L2	Ø D3	Ø D4	A/F	**Material no.**
M33x2	310 $^{+30}$	G3/4	180 $^{+18}$	64	18	28	53	12	46	**1533359038**
		G1 1/4	450 $^{+45}$	74	18	37	63	20	55	**1533359039**
		G2	500 $^{+50}$	85	18	44	90	30	80	**1533359040**



Adapter from imperial to metric thread
HAB..–1X ti HAB..–4X

The associated seal rings (R2) are included in the scope of supply.
The seal rings for axial sealing (reducing piece for pipe connection) are included in the scope of supply.

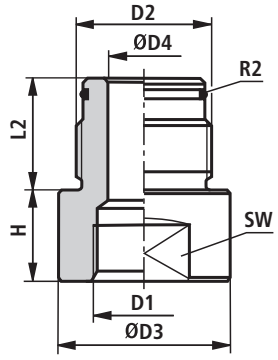
Nominal capacity in liters	to ISO 228		to ISO 228		Dimensions in mm					
	D2	M_T in Nm	D1	M_T in Nm	H	L2	Ø D3	Ø D4	A/F	**Material no.**
1	G3/4	180 $^{+18}$	M30x1.5	180 $^{+18}$	32	28	46	12	41	**1533345047**
2.5 to 6	G1 1/4	450 $^{+45}$	M40x1.5	400 $^{+40}$	43	37	60	20	55	**1533345048**
10 to 50	G2	500 $^{+50}$	M50x1.5	450 $^{+45}$	41	44	78	32	70	**1533345049**



Reducing piece for pipe connection

The associated seal rings (R2) are included in the scope of supply.

Nominal capacity in liters	to ISO 228		to ISO 228		Dimensions in mm					
	D2	M_T in Nm	D1	M_T in Nm	H	L2	Ø D3	Ø D4	A/F	**Material no.**
1	G3/4	180 $^{+18}$	G3/8	70 $^{+7}$	8	28	38	12	32	**1533345039**
2.5 to 6	G1 1/4	450 $^{+45}$	G1/2	115 $^{+12}$	8	37	60	24	55	**1533345043**
	G1 1/4	450 $^{+45}$	G3/4	180 $^{+18}$	8	37	60	24	55	**1533345040**
10 to 50	G2	500 $^{+50}$	G1/2	115 $^{+12}$	20	44	75	30	65	**1533345044**
	G2	500 $^{+50}$	G3/4	180 $^{+18}$	20	44	75	30	65	**1533345041**
	G2	500 $^{+50}$	G1	310 $^{+31}$	20	44	75	30	65	**1533345045**
	G2	500 $^{+50}$	G1 1/2	450 $^{+45}$	40	44	75	32	65	**1533345042**



Intended use

Rexroth bladder type accumulators HAB..-4X are intended for the setup of hydraulic drive systems in the field of stationary machine-building and plant construction.
In mobile applications or applications, in which acceleration forces act on the bladder-type accumulator during operation according to the intended purpose, the use is subject to approval by the responsible Bosch Rexroth product manager. Please contact the technical sales organization.

Rexroth HAB..-4X bladder-type accumulators are not intended for private use.

They must not be used in potentially explosive atmospheres in accordance with Directive 94/9/EC (ATEX).

Safety notes on hydraulic accumulators

Before commissioning and during operation of hydraulic accumulators, observe the regulations valid at the place of installation.

The operator is solely responsible for observing applicable regulations.

General notes on hydraulic accumulators in hydraulic systems can be found in EN 982.

Documents included in the scope of supply must be properly kept; they are required by the surveyor for recurring inspections.

⚠ Warning

Never carry out any welding, soldering or mechanical work on the accumulator vessel!

– Risk of explosion during welding and soldering!
– Risk of bursting and loss of the operating permission in the case of mechanical working!

Never charge hydraulic accumulators with oxygen or air. Risk of explosion!

Before carrying out any work on hydraulic systems, depressurize the system and secure it against restarting!

Improper mounting can lead to severe accidents!

Commissioning must exclusively by carried out by qualified personnel.

Legal stipulations

Hydraulic accumulators are pressure vessels and are subject to the national regulations and ordinances valid at the place of installation.

In Germany, the Health and Safety at Work Regulations (BetrSichV) must be complied with.

Special rules must be observed in the fields of shipbuilding, aircraft construction, mining, etc.

☞ Note!

All vessel categories must be protected by means of a pressure relief valve in accordance with Directive 97/23/EC.

Safety equipment

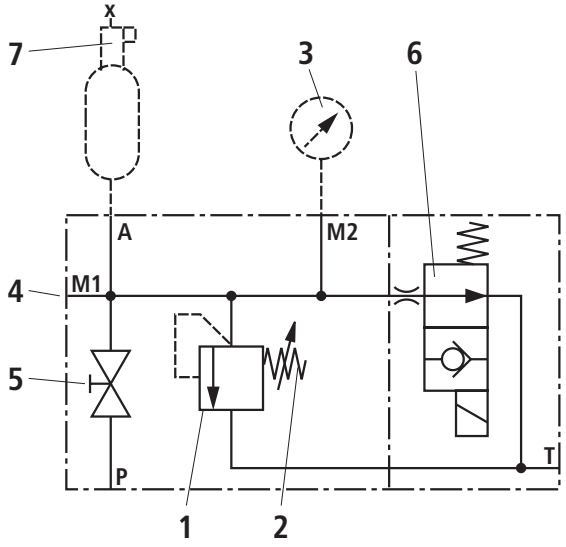
In Germany, the following safety equipment is required:

1 Features against excessive pressure (type-tested)
2 Unloading feature
3 Pressure measuring instrument
4 Test pressure gauge connection
5 Shut-off feature

Option:

6 Electromagnetically operated unloading device
7 Safety device against excessive temperatures

These safety devices are combined in a compact Bosch Rexroth safety and shut-off block (see RE 50128).



Notes

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