Rexroth
Bosch Group

Bladder-type accumulator

CE

RE 50170/02.12
Replaces: 12.10

Type HAB

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

Table of contents

Features

– Hydraulic accumulator as per Pressure Equipment Directive 97/23/EC
– Bladder material for different applications

Use:

– Energy storage in systems with intermittent operation
– Energy reserve for emergencies
– Compensation of leakage losses
– Shock and vibration absorption
– Volume compensation in case of pressure and temperature changes

Certification:

– CE - label (according to DGRL 97/23EC)
– GOST - label
- ASME - label (according to RA 51350)

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

Ordering code

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

Nominal volume

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

Max. admissible operating pressure

350 bar (1 to 6 liters)	= 350
330 bar (10 to 50 liters)	= 330

Component series

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

Gas filling pressure

2 bar	= 2

Connection size for hydraulic fluid [1]

G 3/4	= G05
G 1 1/4	= G07
G 2	= G09

Mounting type (oil port form)

Thread with sealing surface, radial on the inside	= G

Further details in the plain text
e.g. special versions

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

Surface of the connection side [1]
1 = Steel

Surface of the tank inside [1]
1 = Steel

Tank material [1]
1 = Steel

Bladder material [1]
N = NBR
E = ECO

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

[1] Other variants upon request

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

Standard types see page 11

Operating instructions and declarations of conformity

Operating instructions
applicable to HAB1 to HAB50

Language	Operating instructions Material no.
German	R901200925
English	R901200926
French	R901200927
Spanish	R901200928
Italian	R901200929
Chinese	R901200930
Russian	R901200931
Norwegian	R901200932
Polish	R901278729
Czech	R901278730
Hungarian	R901301675
Romanian	R901289016

Declarations of conformity
Language: German, English, French

Nominal volume	CE - Declaration of conformity	
	Bladder material NBR Material no.	Bladder material ECO Material no.
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 devices that are able to save a certain amount of energy and release it to the hydraulic system, if necessary.

Liquids are only compressible to a very small extent; gases, however, are very compressible. The working principle of all gas-filled hydraulic accumulators is based on that difference.

If a certain pressurized gas quantity is pressurized with a higher liquid pressure, the gas volume decreases with increasing liquid pressure whereas the gas pressure increases with the liquid pressure.

If the liquid pressure decreases, the extending gas presses the liquid back into the hydraulic system until the pressure is equalized again.

Bladder-type accumulators

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

The elastic bladder (2) mounted in the interior divides the accumulator into a gas and a fluid side.

Via the gas valve (4), the bladder is filled with nitrogen to the provided gas filling pressure p_0.

1 Tank
2 Bladder
3 Oil valve
4 Gas valve
5 Gas valve support
6 Nut
7 Type cap
8 Cover cap
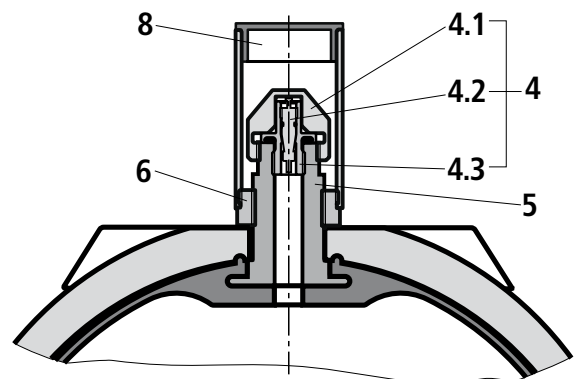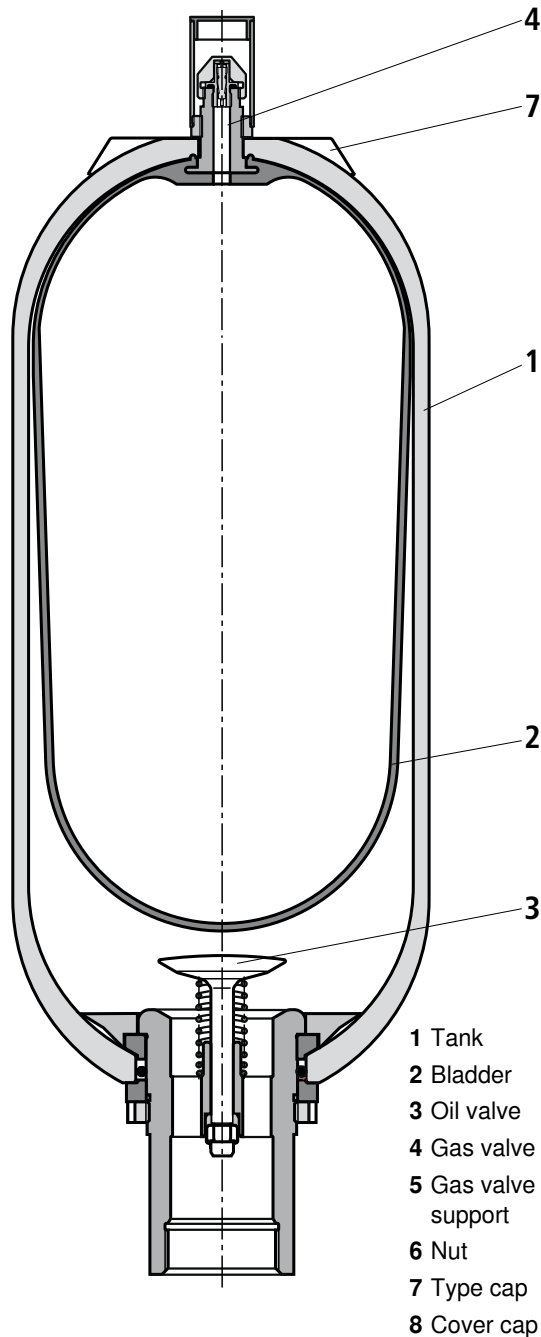
If the fluid is now pressed into the accumulator, the gas in the bladder is compressed and in this way, a pressure increase is achieved. The gas volume decreases and on the fluid side, the fluid can flow into the accumulator. As soon as the pressure on the fluid side decreases under the gas pressure, the accumulator is emptied.

In the bladder-type accumulator oil port, there is the oil valve (3) which closes if the pressure on the gas side exceeds the pressure on the fluid side. In this way, exit of the bladder into the oil channel and destruction of the bladder are avoided.

If the minimum operating pressure is reached, a small fluid volume (approx. 10 % of the hydraulic accumulator nominal volume) is to remain between bladder and oil valve so that the bladder does not hit the valve in every expansion process. The gas valve (4) consists of sealing cap (4.1), gas valve insert (4.2) and gas filling valve body (4.3). These parts can be exchanged individually.

The type cap (7) contains the technical data and features of the hydraulic accumulator.
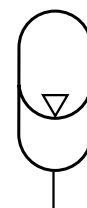
Depending on the design of the separating element, you distinguish between bladder-type and diaphragm-type accumulators. Hydraulic accumulators basically consist of a liquid and a gas part with a gas-tight separating element. The liquid part is connected to the hydraulic circuit.

Symbol

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

general

Weight	kg	See table page 11
Design		Bladder-type accumulator
Installation position		Fluid connection socket at the bottom, others on request
Mounting type		with clamps and console
Ambient temperature range	°C	−15 to +65 [1]
Line connection		Screw-in thread

hydraulic

Nominal volume	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
Max. adm. flow	q_{max}	l/min	240	600	600	600	900	900	900	900
Max. admissible operating pressure	p_{max}	bar	350	350	350	350	330	330	330	330
Max. adm. pressure fluctuation range	Δp_{dyn}	bar	200	200	200	200	200	200	200	200
Operating pressures and useful volumes		See calculation page 5 to 10								
Hydraulic fluid		Hydraulic oil according to DIN 51524; other liquids on request!								
Hydraulic fluid temperature range Others on request	°C	−15 to +80 (NBR) −35 to +80 (ECO)								

pneumatic

Charging gas		Nitrogen, purity class 4.0, N_2 = 99.99 vol. %
Gas filling pressure	p_0 bar	2

Hydraulic fluids that can be used

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 Epichlorhydrin rubber

For other hydraulic fluids and temperatures, please contact us.

Application, mode of operation

Applications

Hydro-pneumatic accumulators offer versatile applications:
– Energy storage for saving pump drive power in systems with intermittent operation.
– Energy reserve for emergencies, e.g. in case of hydraulic pump failure.
– Compensation of leakage losses.
– Shock and vibration absorption in periodic vibrations.
– Volume compensation in case of pressure and temperature changes.

Mode of operation

Liquids are almost incompressible and are therefore not able to store pressure energy. In hydro-pneumatic Rexroth accumulators, the compressibility of a gas is used for the fluid storage. You may **only** use nitrogen of cleanliness class 4.0! N_2 = 99.99 vol. %
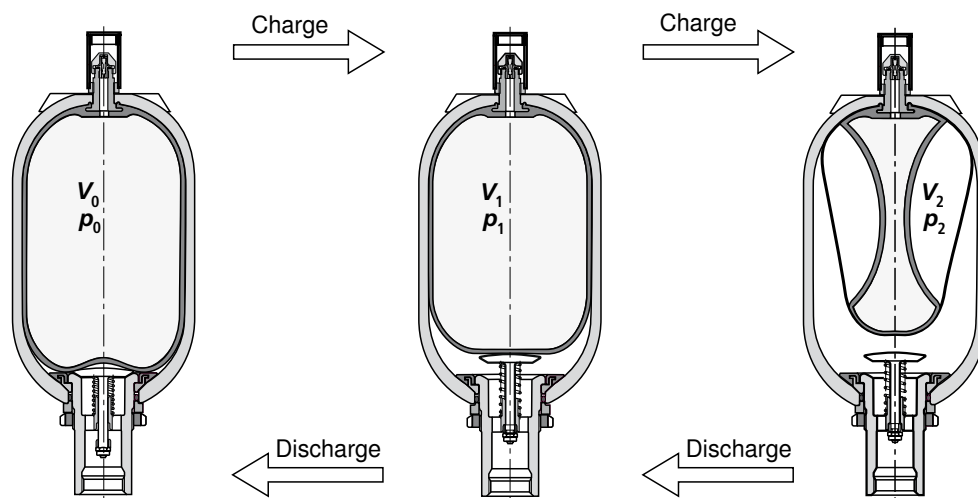
Calculation

Pressures

In the accumulator calculation, the following pressures are of vital importance:

p_0 = Gas filling pressure at room temperature and drained fluid chamber

$p_0(t)$ = Gas filling pressure at operating temperature

$p_0(t_{max})$ = Gas filling pressure at max. 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 long service life, compliance with the following values is recommended:

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

The largest hydraulic pressure is not to exceed four times the filling pressure as otherwise, the bladder elasticity is greatly strained and excessive compression changes with considerable gas heating result:

$$p_2 \leq 4 \cdot p_0 \qquad (2)$$

The accumulator bladder service life is the longer the smaller the difference between p_1 and p_2. This, however, results in the reduction in the corresponding degree of utilization of the maximum storage capacity.

Calculation

Oil volume

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

In this connection, V_0 is also the accumulator's nominal volume.

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

$$\Delta V \le V_1 - V_2 \qquad (3)$$

The gas volume that can be changed within one pressure difference is determined by the following equations:

a) To **isothermal changes of condition** of gases, i.e. if the gas cushion changes so slowly that there is enough time for the complete heat exchange between the nitrogen and its environment and the temperature therefore remains constant, the following applies:

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

b) To **adiabatic changes of condition,** i.e. if the gas cushion changes quickly with the nitrogen temperature changing as well, the following applies:

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

χ = Ratio of the specific heats of the gases (adiabatic exponent), for nitrogen = 1.4

In practice, the changes of condition rather follow adiabatic laws. The charging is often isothermal, the discharge adiabatic.

Considering the equations (1) and (2), V lies at Δ **50 % to 70 % of the nominal accumulator volume**. As reference point, the following applies:

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

Calculation diagram

For the graphical determination, the formulas (4.1) and (4.2) in diagrams on pages 7 to 10 are implemented. 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 equation (4.1) or (4.2) is only true for ideal gases. In the behavior of real gases, considerable deviations result at operating pressures of more than 200 bar, which have to be considered by correction factors. They can be seen from the following diagrams. The correction factors by which the ideal sampling volume ΔV is to be multiplied lie within the range from 0.6 … 1.

Application of the calculation diagrams

(see page 7 to 10)
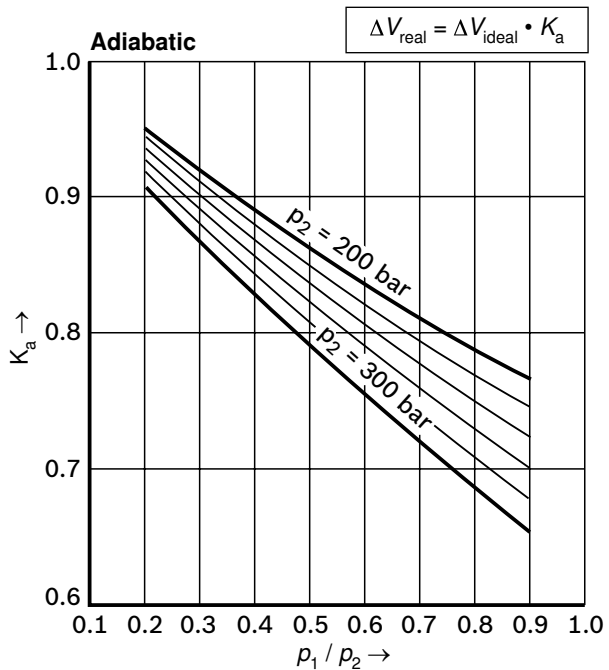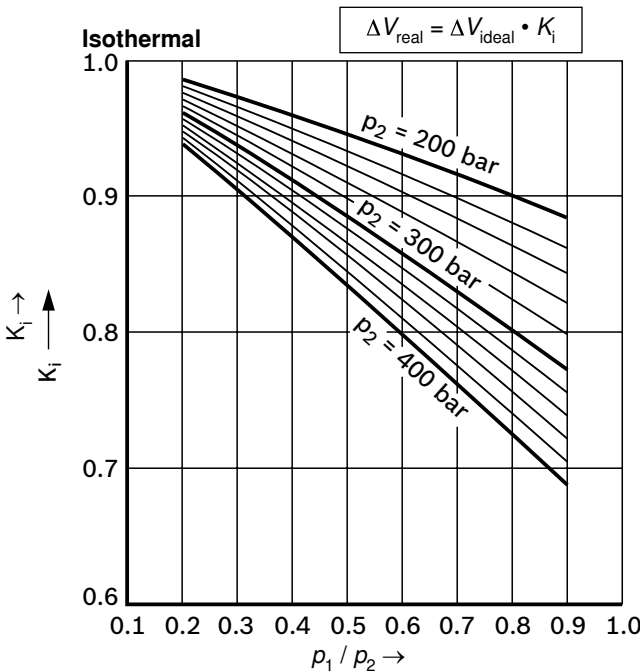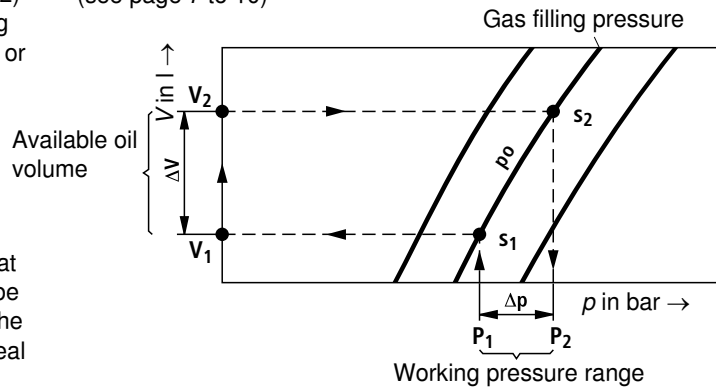
$$\Delta V_{real} = \Delta V_{ideal} \cdot K_i$$

$$\Delta V_{real} = \Delta V_{ideal} \cdot K_a$$

Calculation

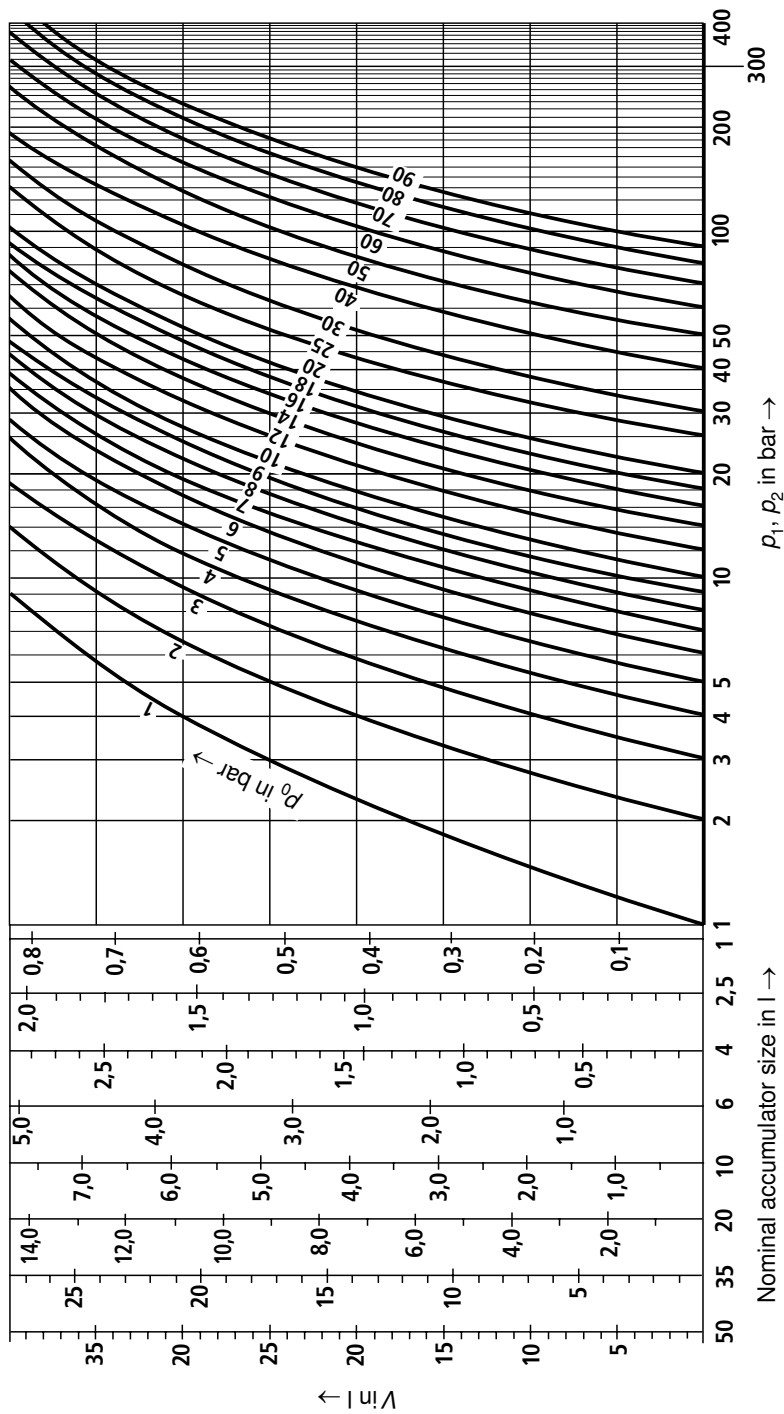**Isothermal changes in condition**

p_0 = 1 to 90 bar

Calculation
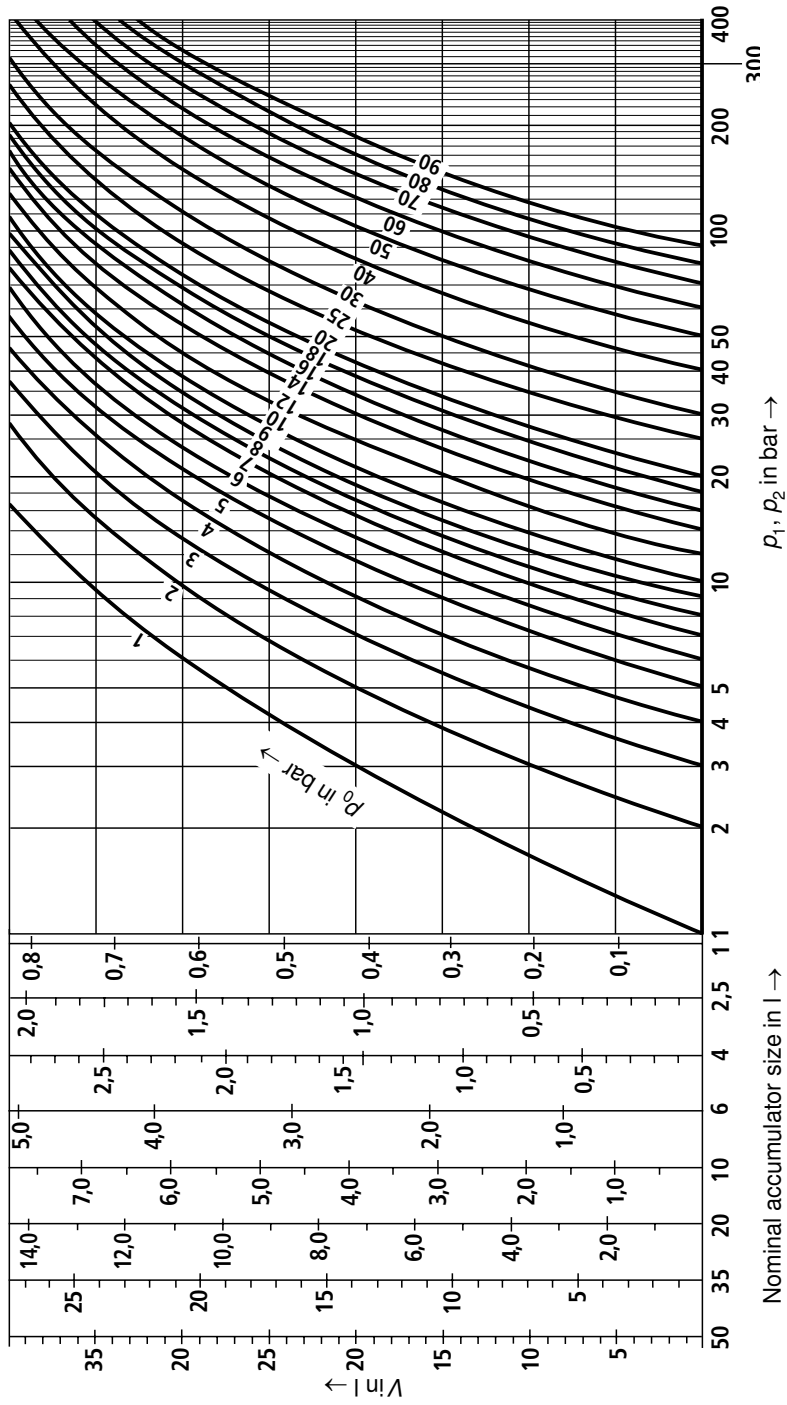
Isothermal changes in condition

p_0 = 100 to 300 bar

Calculation

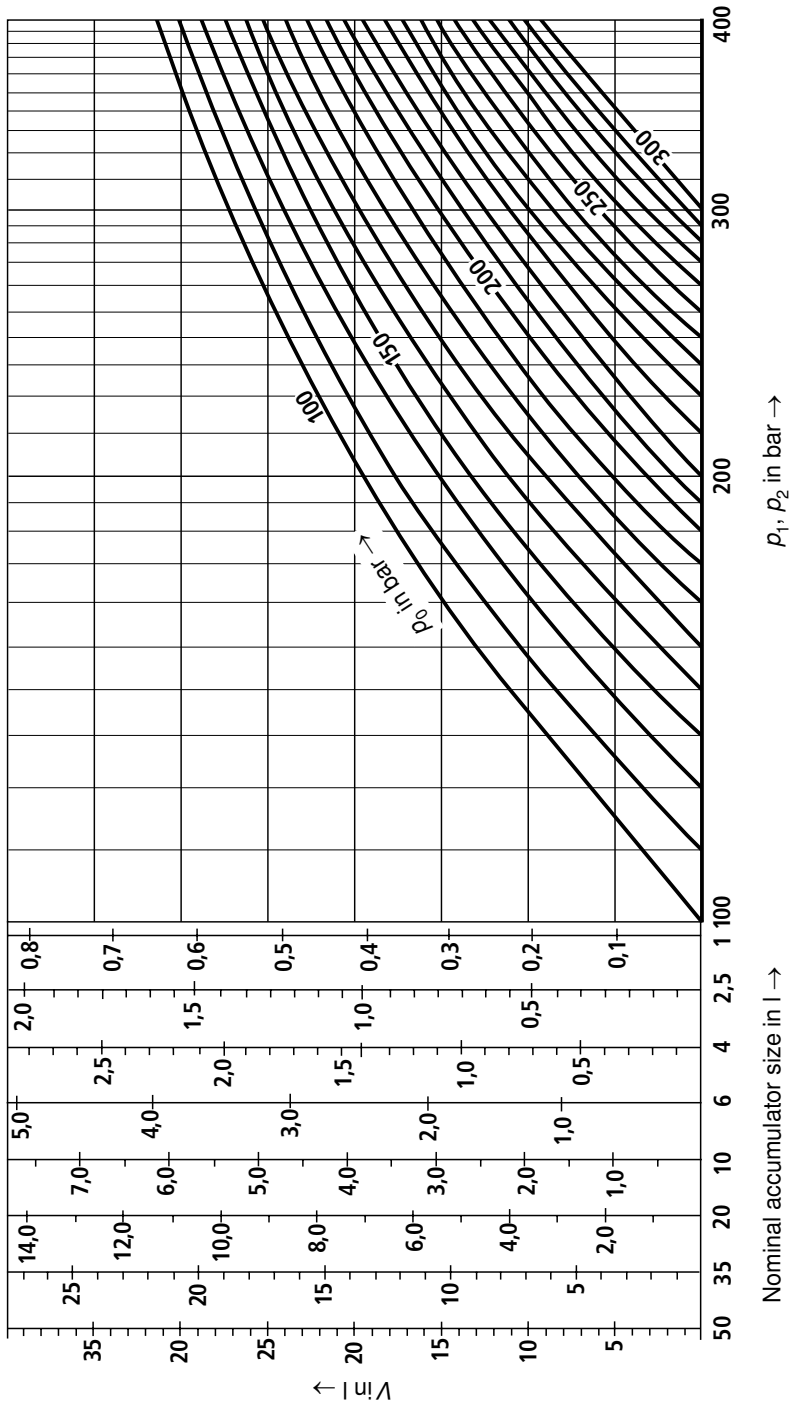**Adiabatic changes in condition**

p_0 = 1 to 90 bar

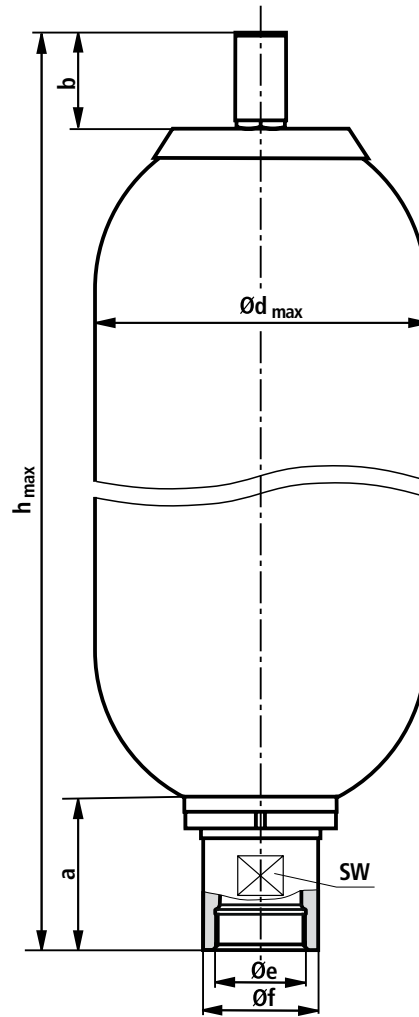# Calculation
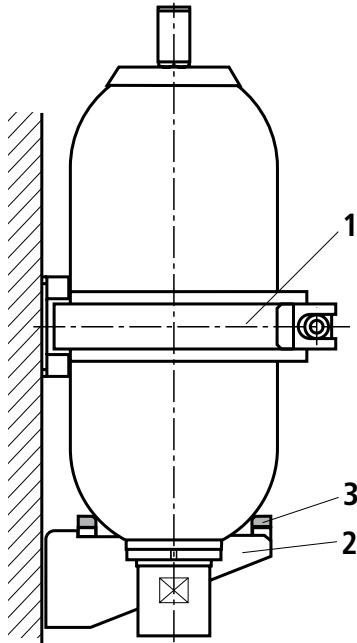
Adiabatic changes in condition

p_0 = 100 to 300 bar

Unit dimensions, standard types (dimensions in mm)

Nominal Volume (liter)	Ordering code / Type	Material no.	h max	Ød max	a	b	Øe	Øf	SW	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-2N111-GOST	R901326058								
2.5	HAB2,5-350-4X/2G07G-2N111-CE	R901195135	554	115.5	69	70	G1 1/4"	53	50	10
	HAB2,5-350-4X/2G07G-2N111-GOST	R901326059								
4	HAB4-350-4X/2G07G-2N111-CE	R901195136	438.5	170.0	67	70	G1 1/4"	53	50	16
	HAB4-350-4X/2G07G-2N111-GOST	R901326060								
6	HAB6-350-4X/2G07G-2N111-CE	R901195139	564.5	170.0	67	70	G1 1/4"	53	50	20
	HAB6-350-4X/2G07G-2N111-GOST	R901326061								
10	HAB10-330-4X/2G09G-2N111-CE	R901195140	590.5	225.5	104	70	G2"	76	70	32
	HAB10-330-4X/2G09G-2N111-GOST	R901326062								
20	HAB20-330-4X/2G09G-2N111-CE	R901195141	900.5	225.5	104	70	G2"	76	70	53
	HAB20-330-4X/2G09G-2N111-GOST	R901326063								
35	HAB35-330-4X/2G09G-2N111-CE	R901195143	1424	225.5	104	70	G2"	76	70	85
	HAB35-330-4X/2G09G-2N111-GOST	R901326064								
50	HAB50-330-4X/2G09G-2N111-CE	R901195145	1940	225.5	104	70	G2"	76	70	123
	HAB50-330-4X/2G09G-2N111-GOST	R901326065								

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 support ring	**1530221042**			1	1	1

1 Clamp
2 Console
3 Rubber support ring

Console and rubber support ring

3000 Nm

35
75
100
Ø14
200
260
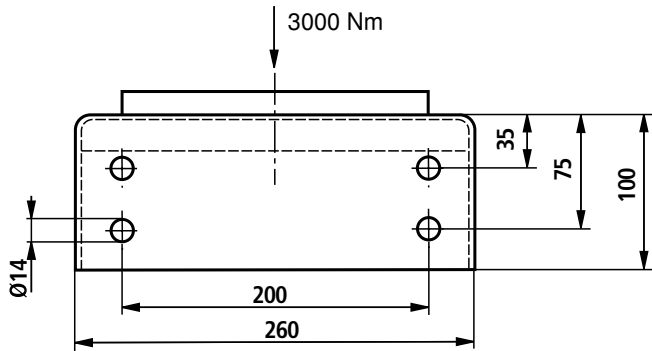
Console
Material no. 1531334008

Ø170
123
225
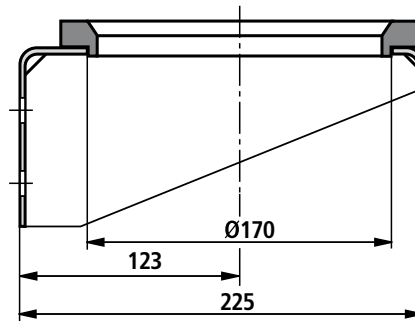
Rubber support ring
Material no. 1530221042

Accessories (dimensions in mm)

Mounting clamps

Type F1
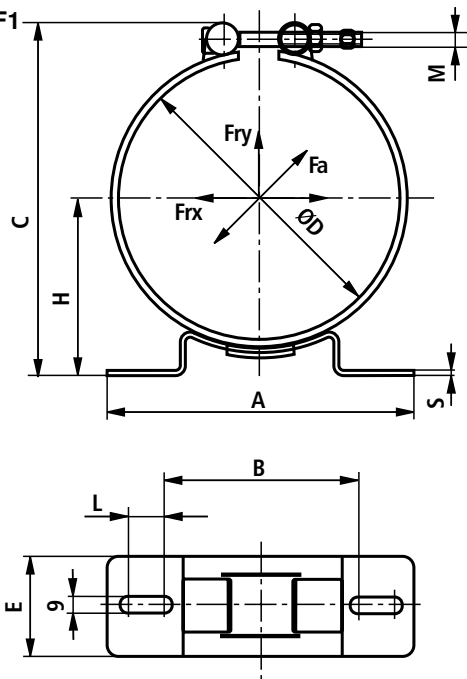
Type F2
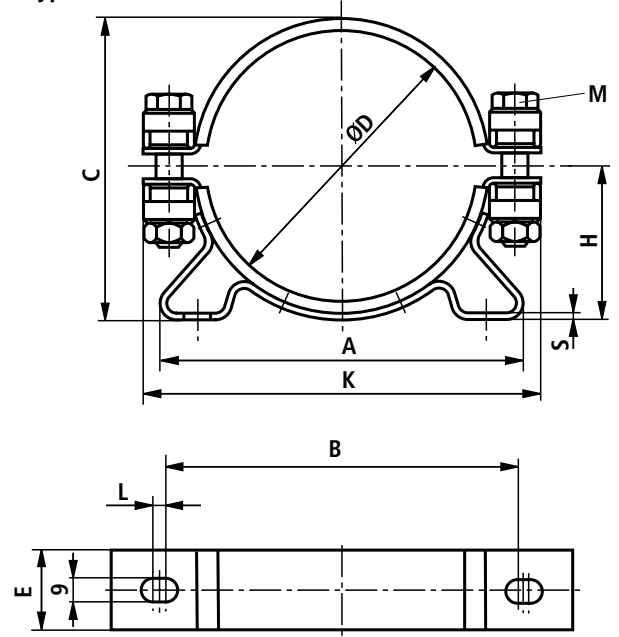
Clamp type		Dimensions										Material no.
		A	B	C	∅D	E	H	K	L	M	S	
Clamp 110-120	F1	135	96	150	110-120	50	64-69	–	6	M8	3	**1531316021**
Clamp 160-170	F1	237	147	200	160-170	50	90-95	–	35	M8	4	**1531316022**
Clamp 218-228	F1	237	147	258	218-228	50	120-125	–	35	M8	4	**1531316026**
Clamp 224-230	F2	254	212	244	224-230	30	120-123	295	4	M12	3	**1531316005**

Accessories (dimensions in mm)

Filling and testing device

Measurement case	Material no.
Measurement case complete (HAB bladder-type accumulator)	**0538103011**
Case (separate)	**R901070141**
Filling and test valve	**0538103005**
Pressure gauge 0 to 250 bar	**1537231001**
Hose l = 2.5 m with transition socket Form ⒟	**1530712005**

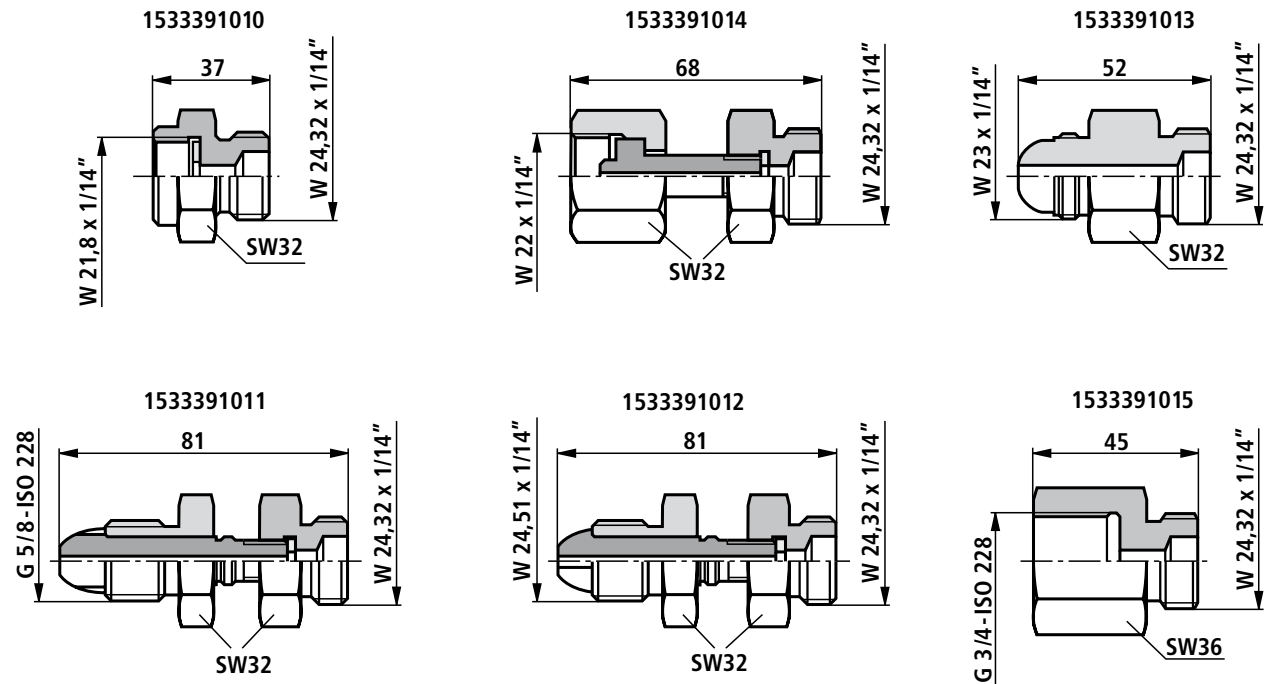| Supplementary parts to be ordered separately	Material no.
Pressure gauge 0 to 25 bar	**R900033955**
Pressure gauge 0 to 60 bar	**1537231002**
Pressure gauge 0 to 400 bar	**1537231005**
Transition socket Form ⒡	**1533391010**
Form ⒢⒝	**1533391011**
Form ⓤⓈⒶ	**1533391012**
Form ⒸⓄⓇ	**1533391013**
Form ⒿⒶⓅ	**1533391014**
Form ⒢ⓤⓈ	**1533391015**
Hose l = 5 m with transition socket Form ⒟	**1530712006**

Dimensions filling and test valve

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

1 M14x1,5

SAE 7/8"-14 UNF

W 24,32 x 1/14"

l = 2,5 m

1 Spare part, material no. **1537410065**
2 Adapter see page 15
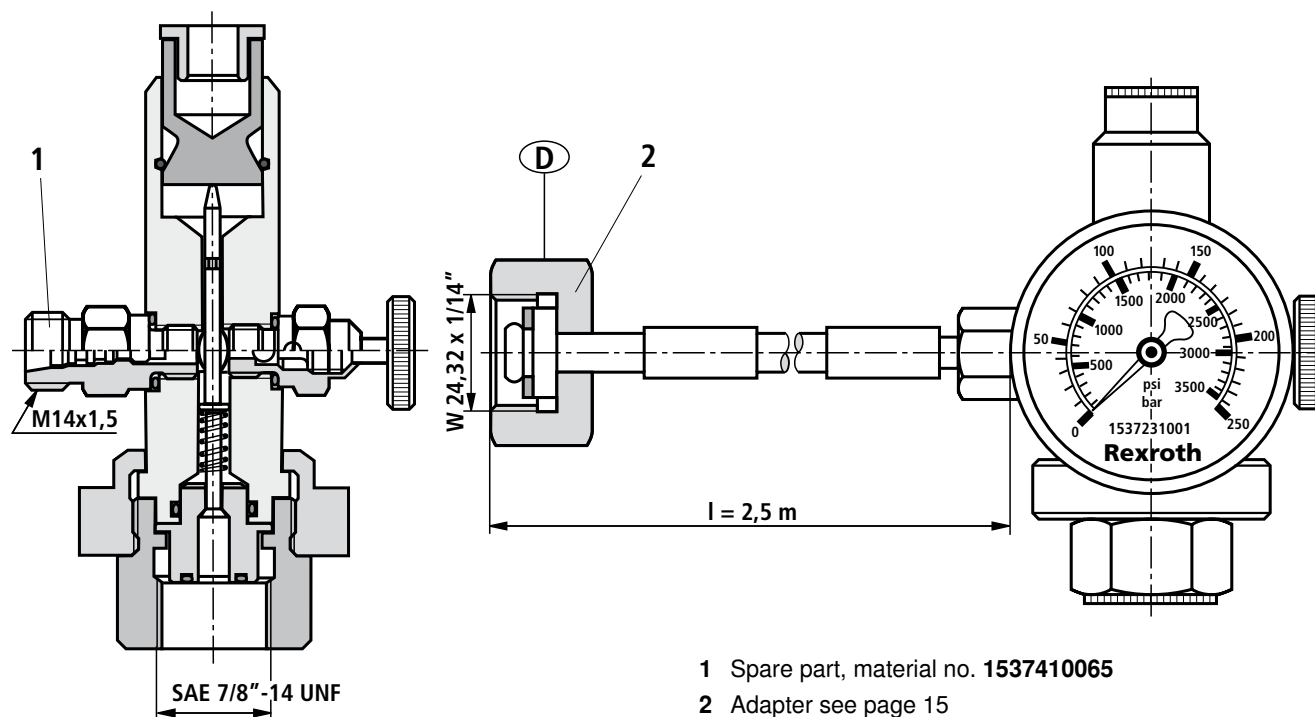
Accessories (dimensions in mm)

Adapter for nitrogen bottle to the cap nut

1533391010

1533391014

1533391013

1533391011

1533391012

1533391015

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

Accessories (dimensions in mm)

Accumulator adapter accumulator shut-off blocks Type ABZSS
Please select the corresponding type according to data sheet 50131

**Connection socket for accumulator shut-off blocks
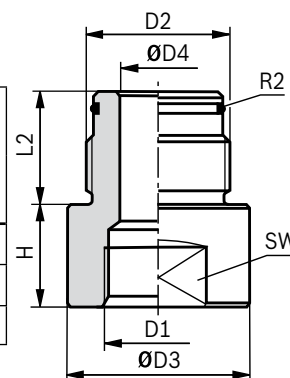size 20/DN20 Type 0532VAW according to data sheet 50128**

Safety block		according to ISO 228		Dimensions in mm						Material no. socket	Order number complete with seal rings R1 and R2
D1	M_A in Nm	D2	M_A in Nm	L	L2	Ø D3	Ø D4	Ø D5	SW		
M33x2	310 $^{+30}$	G3/4	180 $^{+18}$	64	28	53	12	42	46	**1533359038**	**R901252857**
		G1 1/4	450 $^{+45}$	74	37	63	20	55	55	**1533359039**	**R901252859**
		G2	500 $^{+50}$	85	44	90	30	75	80	**1533359040**	**R901252860**
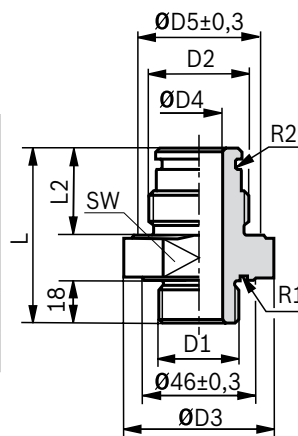
**Transition socket from inch to metric threads
HAB..–1X to HAB..–4X**

Nominal volume liter	according to ISO 228		according to ISO 228		Dimensions in mm					Material no. socket	Order number complete with seal ring R2
	D2	M_A in Nm	D1	M_A in Nm	H	L2	Ø D3	Ø D4	SW		
1	G3/4	180 $^{+18}$	M30x1.5	180 $^{+18}$	32	28	46	12	41	**1533345047**	**R901252863**
2.5 to 6	G1 1/4	450 $^{+45}$	M40x1.5	400 $^{+40}$	43	37	60	20	55	**1533345048**	**R901252864**
10 to 50	G2	500 $^{+50}$	M50x1.5	450 $^{+45}$	41	44	78	32	70	**1533345049**	**R901252865**

**Reducing unit for pipe connection**

Nominal volume liter	according to ISO 228		according to ISO 228		Dimensions in mm					Material no. socket	Order number complete with seal ring R2
	D2	M_A in Nm	D1	M_A in Nm	H	L2	Ø D3	Ø D4	SW		
1	G3/4	180 $^{+18}$	G3/8	70 $^{+7}$	8	28	38	12	32	**1533345039**	**R901252880**
2.5 to 6	G1 1/4	450 $^{+45}$	G1/2	115 $^{+12}$	8	37	60	24	55	**1533345043**	**R901252884**
	G1 1/4	450 $^{+45}$	G3/4	180 $^{+18}$	8	37	60	24	55	**1533345040**	**R901252881**
10 to 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**
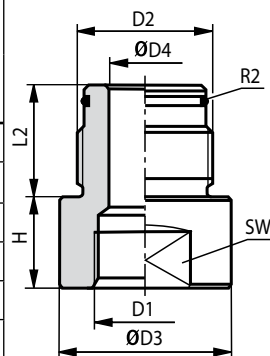
Intended use

Rexroth HAB..-4X bladder-type accumulators are intended for setting up hydraulic drive systems in the stationary machine and plant construction.

In mobile applications or applications in which acceleration forces act on the bladder-type accumulator during the intended use, use is only permitted after the prior release by the competent Bosch Rexroth product manager. Please contact the Technical Sales.

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

They must not be used in explosive environments in accordance with directive 94/9/EC (ATEX).

Safety instructions for hydraulic accumulators

For hydraulic accumulators, the provisions applicable at the place of installation are to be complied with before commissioning as well as during operation.

The operator will have sole responsibility for complying with existing provisions.

General information for hydraulic accumulators in hydraulic systems is provided by DIN EN ISO 4413.

Documents included in the delivery must be kept carefully; they will be required by the expert in recurring tests.

⚠ **Warning**

Don't carry out welding, soldering or any other mechanical work at the accumulator tank!

– Risk of explosion in welding and soldering works!

– Danger of bursting and loss of the operating license in case of mechanical processing!

Don't charge hydraulic accumulators with oxygen or air. Risk of explosion!

Before working at hydraulic systems, depressurize the system and secure it against re-activation.

Improper assembly may cause serious injuries!

The commissioning may only be performed by qualified specialists.

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

☞ **Note!**

All vessel classes are to be secured by means of a pressure relief valve according to directive 97/23/EC.

Safety devices
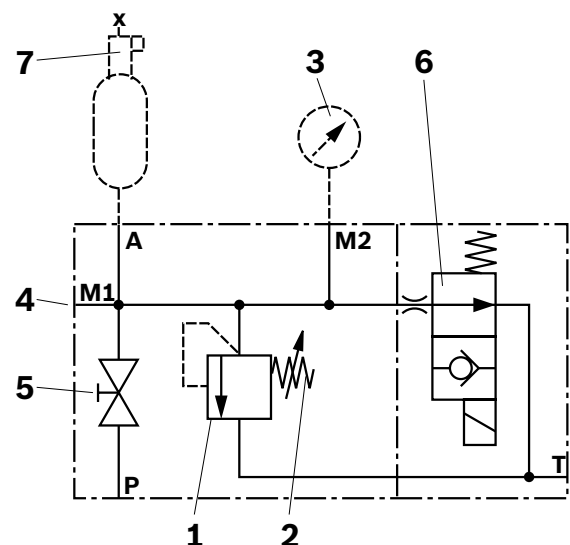
In Germany, the following safety equipment is necessary:

1 Equipment against excessive pressure (type-tested)
2 Discharge device
3 Pressure measurement device
4 Test pressure gauge connection
5 Shut-off device

Option:

6 Electro-magnetically operated discharge device
7 Safety device against excessive temperature

These safety devices are combined in a compact Bosch Rexroth accumulator safety block:

– Type ABZSS according to data sheet 50131
– Type 0532VAW according to data sheet 50128

Notes