











## Calculation

### Oil volume

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

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

The available oil volume  $\Delta V$  corresponds to the difference of the gas volumes  $V_1$  and  $V_2$ :

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

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:

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

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

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

$\chi$  = 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  **$\Delta 50\%$  to  $70\%$  of the nominal accumulator volume**. As reference point, the following applies:

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

### Calculation diagram

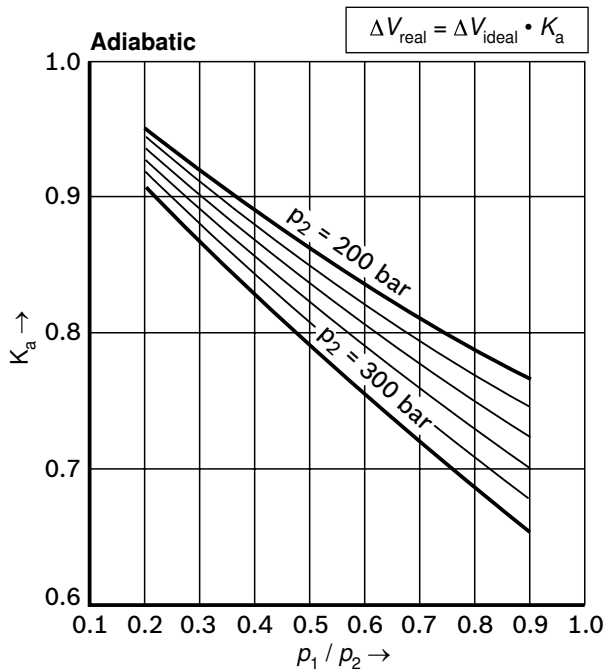
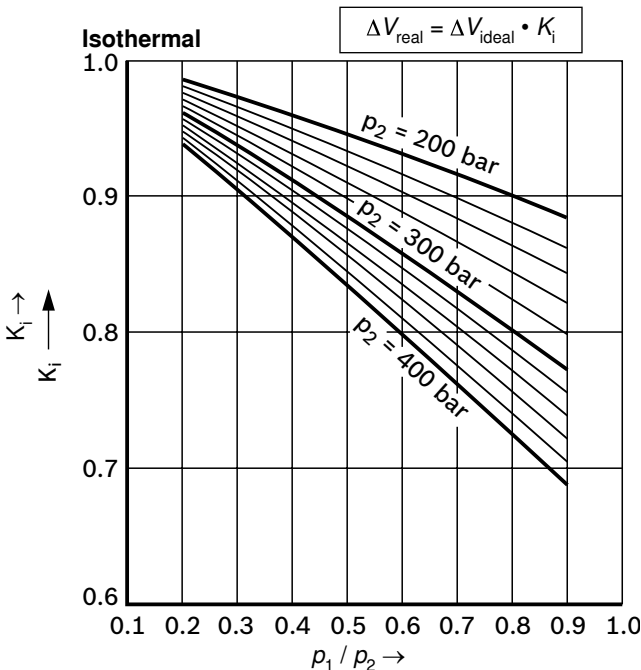
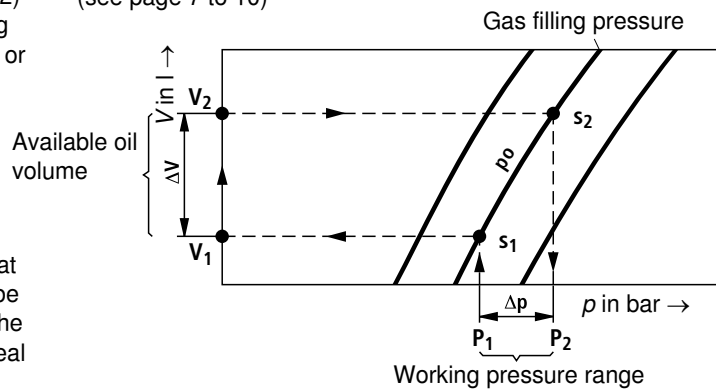
For the graphical determination, the formulas (4.1) and (4.2) in diagrams on pages 7 to 10 are implemented. Depending on the task, the available oil volume, the accumulator size or the pressures can be determined.

### 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  $\Delta V$  is to be multiplied lie within the range from 0.6 ... 1.

### Application of the calculation diagrams

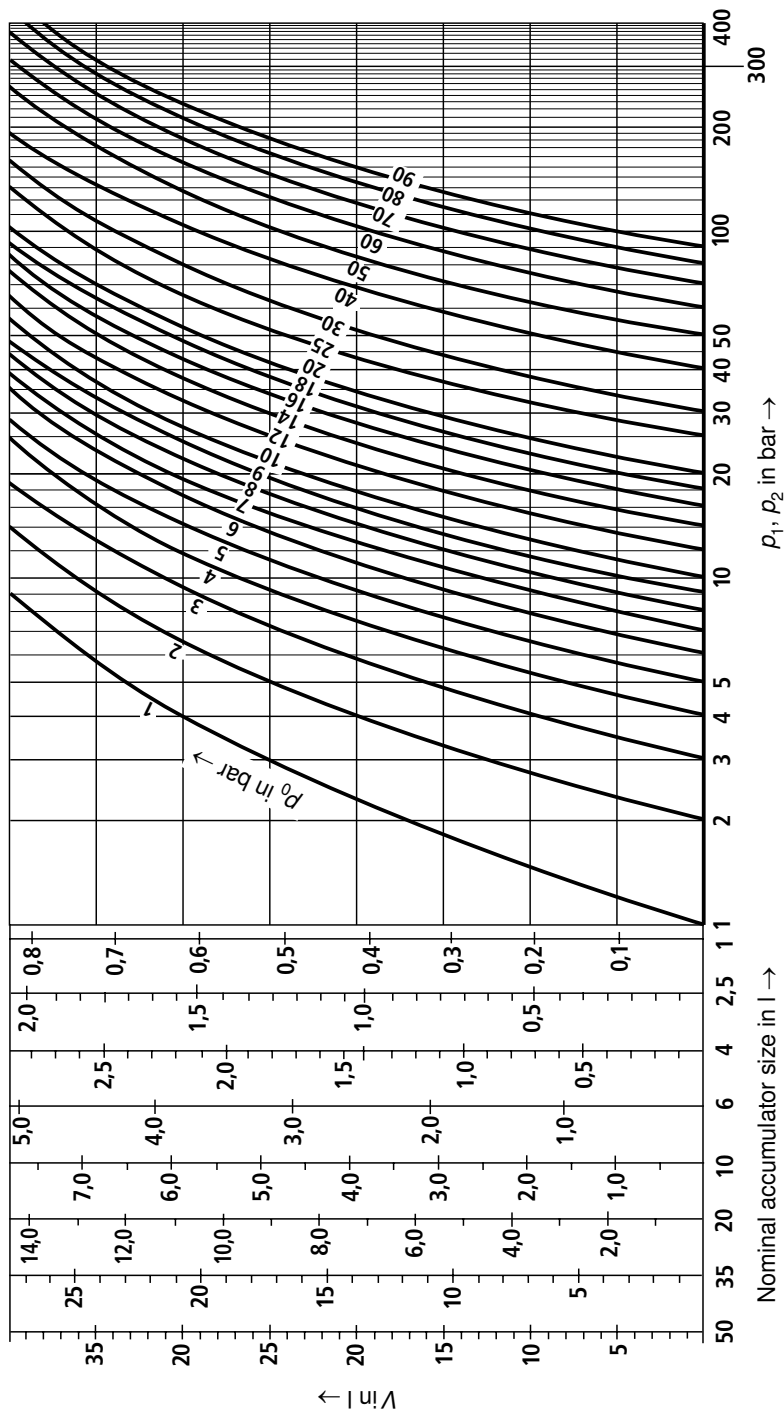
(see page 7 to 10)



### Calculation

Isothermal changes in condition

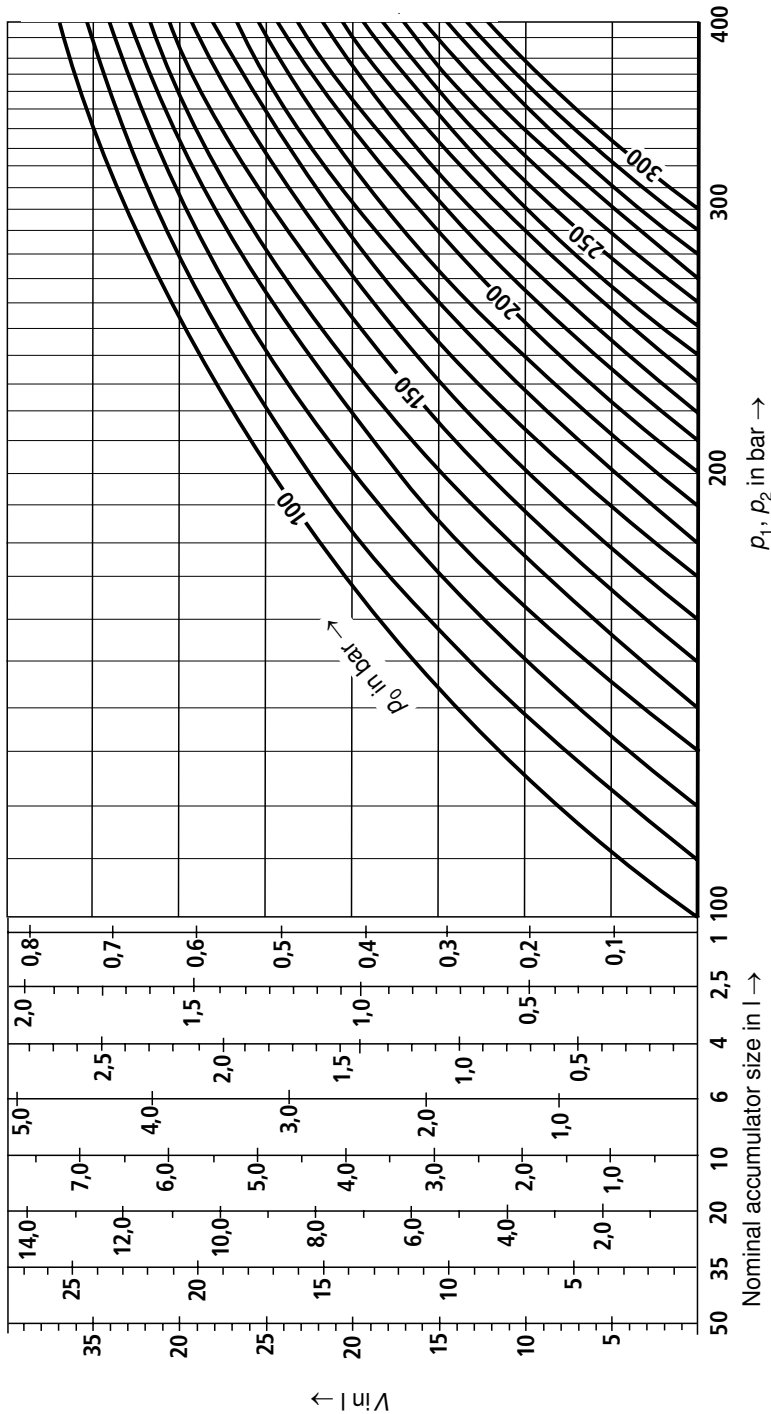
$p_0 = 1$  to 90 bar



### Calculation

#### Isothermal changes in condition

$p_0 = 100$  to  $300$  bar

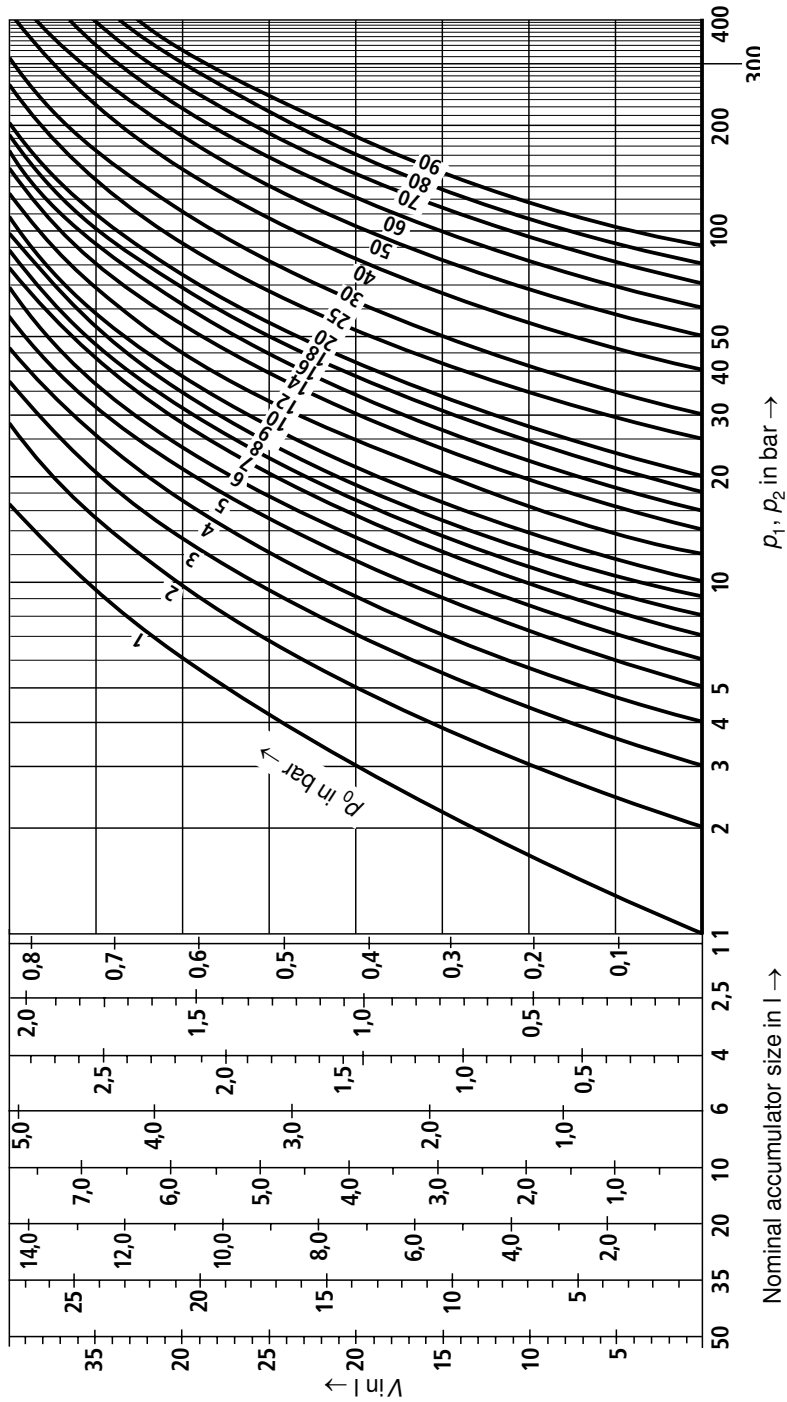




### Calculation

Adiabatic changes in condition

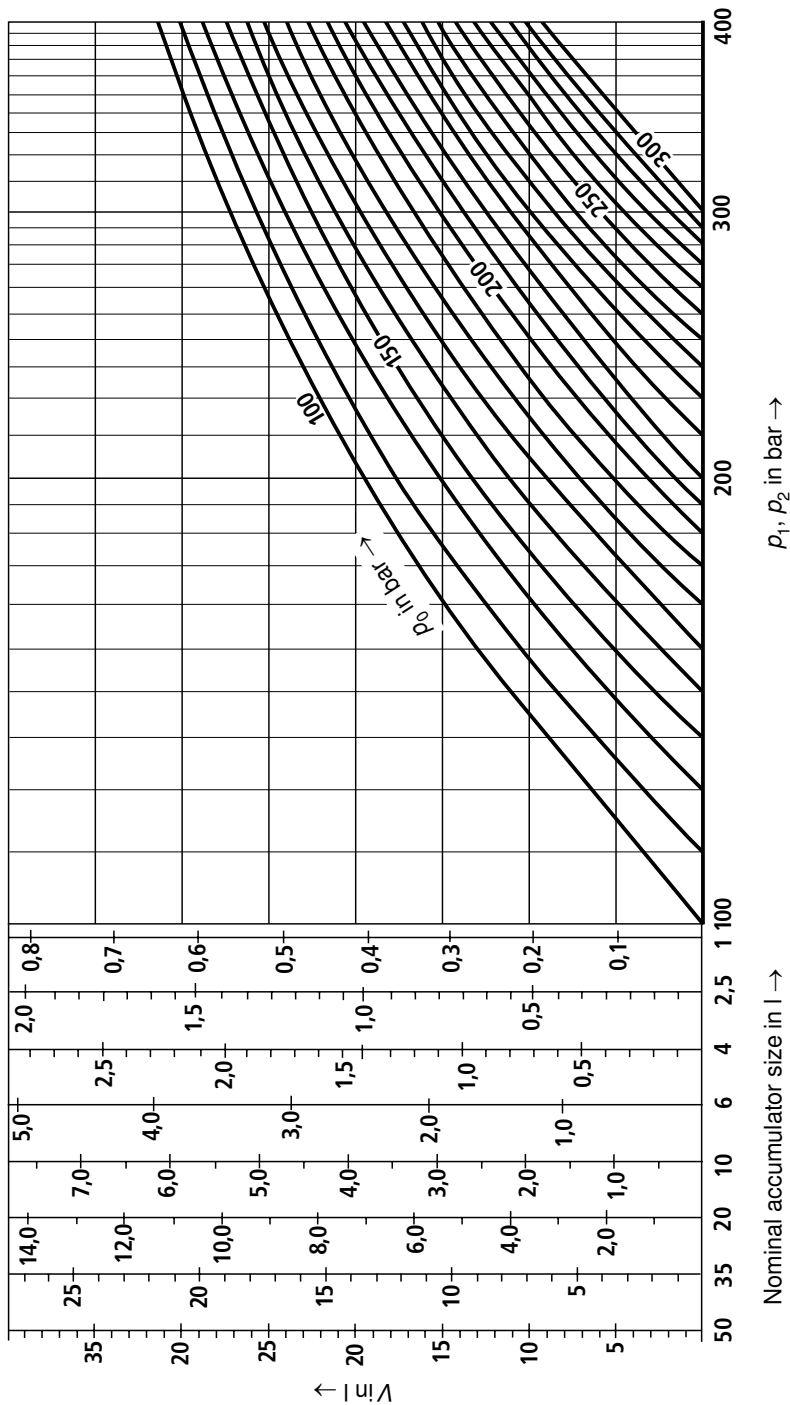
$p_0 = 1$  to 90 bar



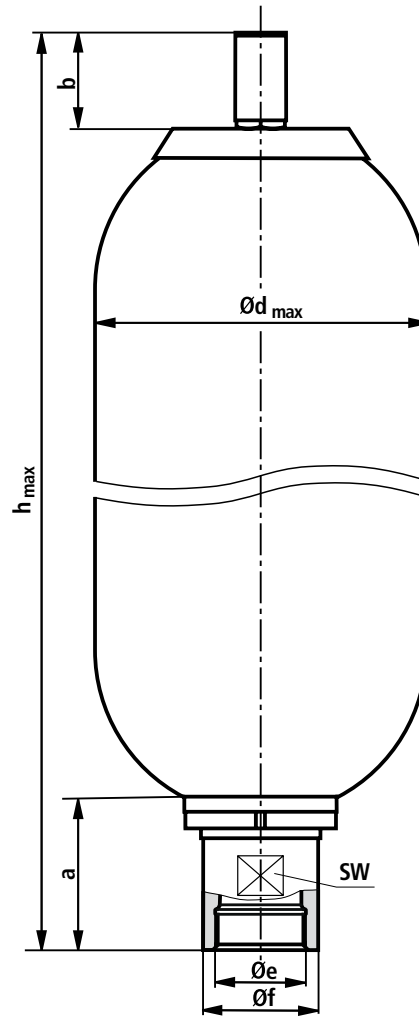
## Calculation

### Adiabatic changes in condition

$p_0 = 100$  to  $300$  bar



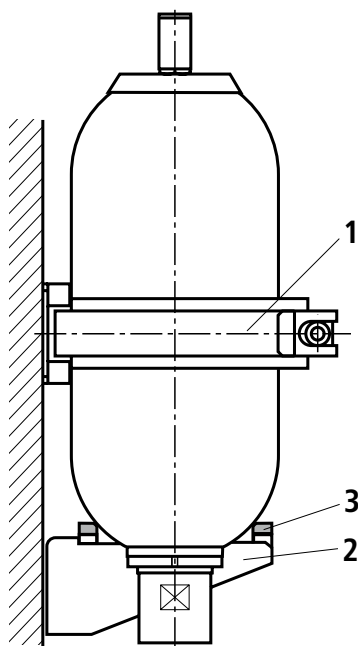
## Unit dimensions, standard types (dimensions in mm)



Nominal Volume (liter)	Ordering code / Type	Material no.	$h_{max}$	$\varnothing d_{max}$	$a$	$b$	$\varnothing e$	$\varnothing f$	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)

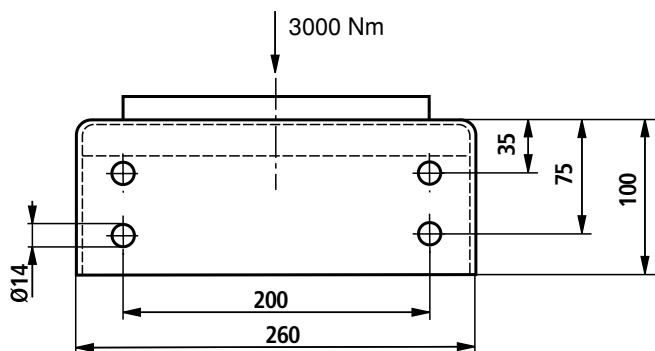
### HAB mounting elements



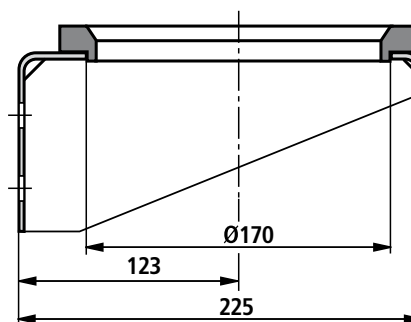
- 1 Clamp
- 2 Console
- 3 Rubber support ring

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

### Console and rubber support ring



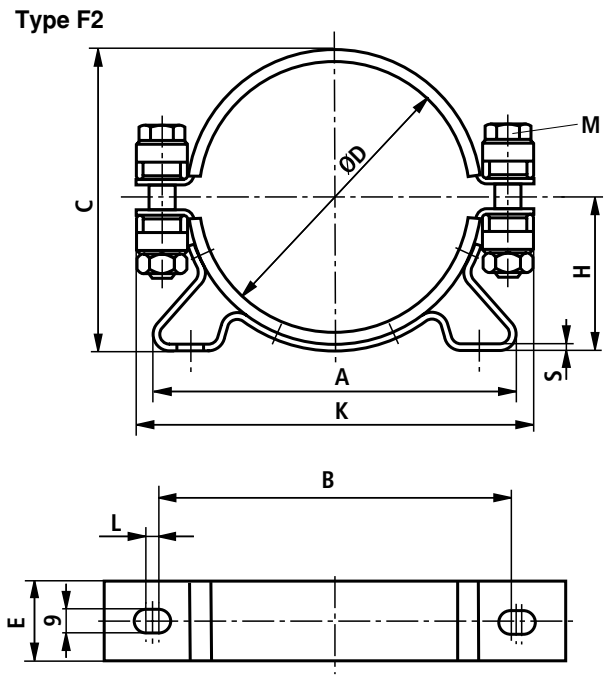
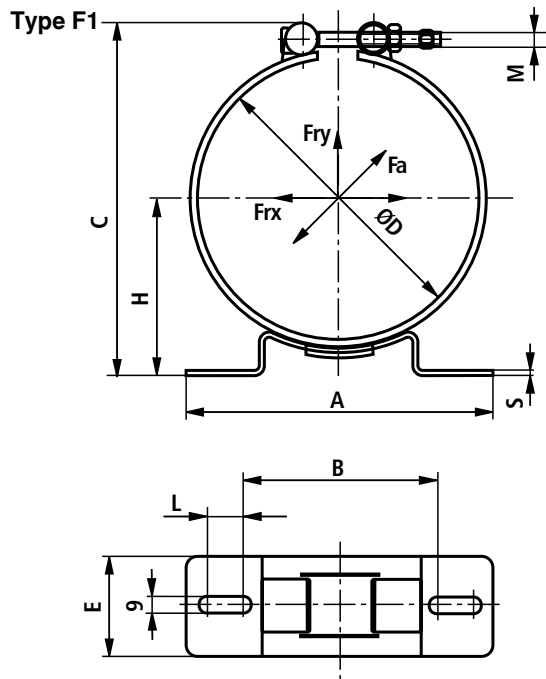
**Console**  
Material no. 1531334008



**Rubber support ring**  
Material no. 1530221042

**Accessories** (dimensions in mm)

**Mounting clamps**



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	-	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

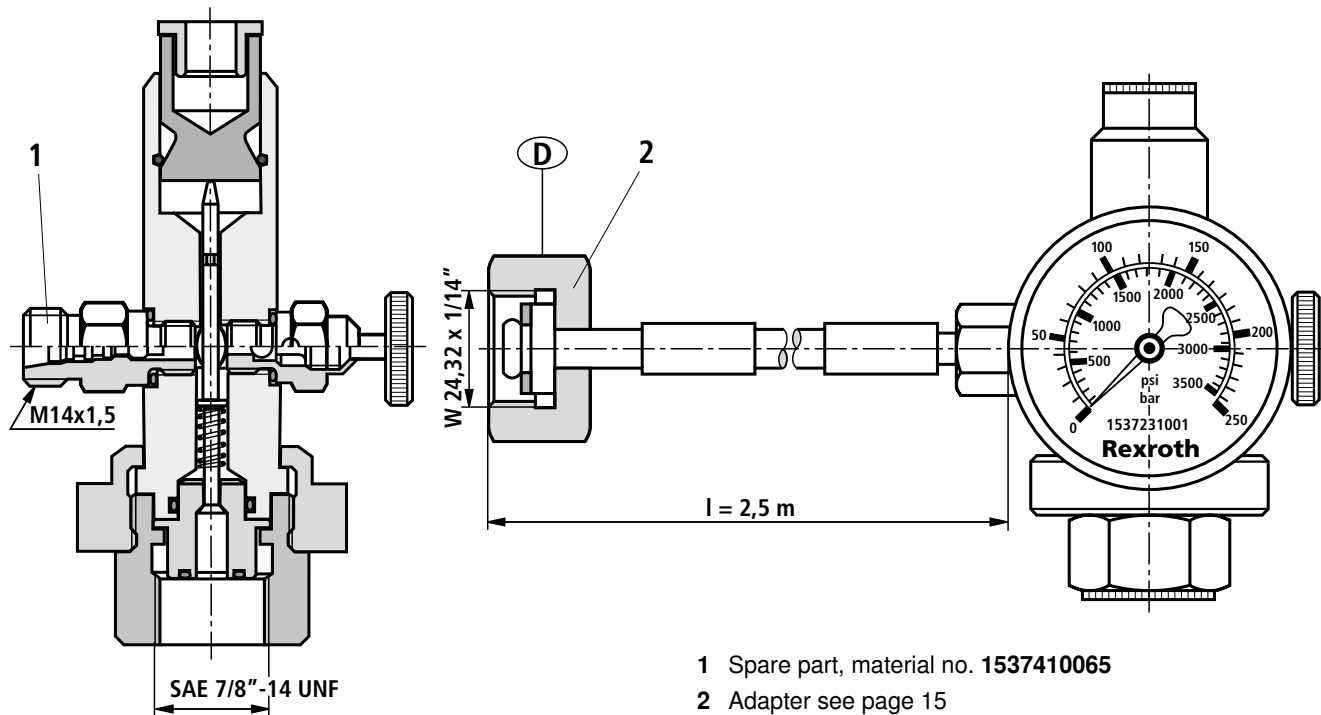


Supplementary parts to be ordered separately	Material no.
Pressure gauge 0 to 25 bar	R900033955
Pressure gauge 0 to 60 bar	1537231002
Pressure gauge 0 to 400 bar	1537231005
Transition socket Form (F)	1533391010
Form (GB)	1533391011
Form (USA)	1533391012
Form (COR)	1533391013
Form (JAP)	1533391014
Form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

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 (D)	1530712005

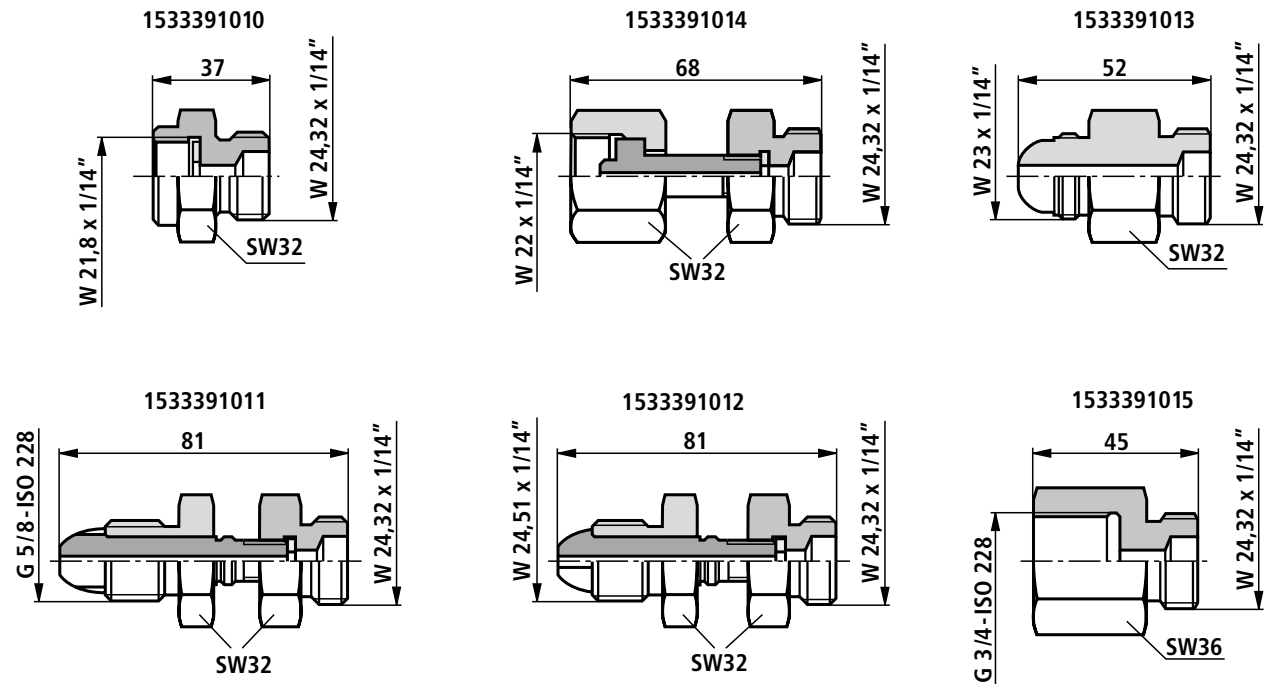
### Dimensions filling and test valve

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



### Accessories (dimensions in mm)

#### Adapter for nitrogen bottle to the cap nut



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						

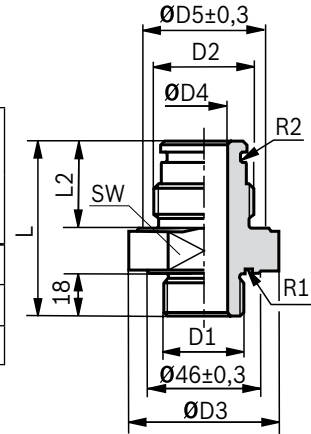
## Accessories (dimensions in mm)

### 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

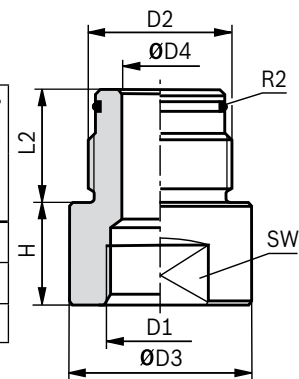
Safety block		according to ISO 228		Dimensions in mm						Material no. socket	Order number complete with seal rings R1 and R2
D1	M <sub>A</sub> in Nm	D2	M <sub>A</sub> in Nm	L	L2	∅ D3	∅ D4	∅ D5	SW		
<b>M33x2</b>	310 <sup>+30</sup>	G3/4	180 <sup>+18</sup>	64	28	53	12	42	46	<b>1533359038</b>	<b>R901252857</b>
		G1 1/4	450 <sup>+45</sup>	74	37	63	20	55	55	<b>1533359039</b>	<b>R901252859</b>
		G2	500 <sup>+50</sup>	85	44	90	30	75	80	<b>1533359040</b>	<b>R901252860</b>



### Transition socket from inch to metric threads

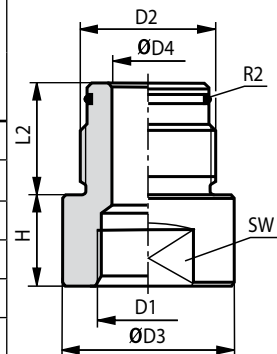
HAB...-1X to HAB...-4X

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 <sub>A</sub> in Nm	D1	M <sub>A</sub> in Nm	H	L2	∅ D3	∅ D4	SW		
<b>1</b>	G3/4	180 <sup>+18</sup>	M30x1.5	180 <sup>+18</sup>	32	28	46	12	41	<b>1533345047</b>	<b>R901252863</b>
<b>2.5 to 6</b>	G1 1/4	450 <sup>+45</sup>	M40x1.5	400 <sup>+40</sup>	43	37	60	20	55	<b>1533345048</b>	<b>R901252864</b>
<b>10 to 50</b>	G2	500 <sup>+50</sup>	M50x1.5	450 <sup>+45</sup>	41	44	78	32	70	<b>1533345049</b>	<b>R901252865</b>



### 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 <sub>A</sub> in Nm	D1	M <sub>A</sub> in Nm	H	L2	∅ D3	∅ D4	SW		
<b>1</b>	G3/4	180 <sup>+18</sup>	G3/8	70 <sup>+7</sup>	8	28	38	12	32	<b>1533345039</b>	<b>R901252880</b>
<b>2.5 to 6</b>	G1 1/4	450 <sup>+45</sup>	G1/2	115 <sup>+12</sup>	8	37	60	24	55	<b>1533345043</b>	<b>R901252884</b>
	G1 1/4	450 <sup>+45</sup>	G3/4	180 <sup>+18</sup>	8	37	60	24	55	<b>1533345040</b>	<b>R901252881</b>
<b>10 to 50</b>	G2	500 <sup>+50</sup>	G1/2	115 <sup>+12</sup>	20	44	75	30	65	<b>1533345044</b>	<b>R901252885</b>
	G2	500 <sup>+50</sup>	G3/4	180 <sup>+18</sup>	20	44	75	30	65	<b>1533345041</b>	<b>R901252882</b>
	G2	500 <sup>+50</sup>	G1	310 <sup>+31</sup>	20	44	75	30	65	<b>1533345045</b>	<b>1533345045</b>
	G2	500 <sup>+50</sup>	G1 1/2	450 <sup>+45</sup>	40	44	75	32	65	<b>1533345042</b>	<b>R901252883</b>





## 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:

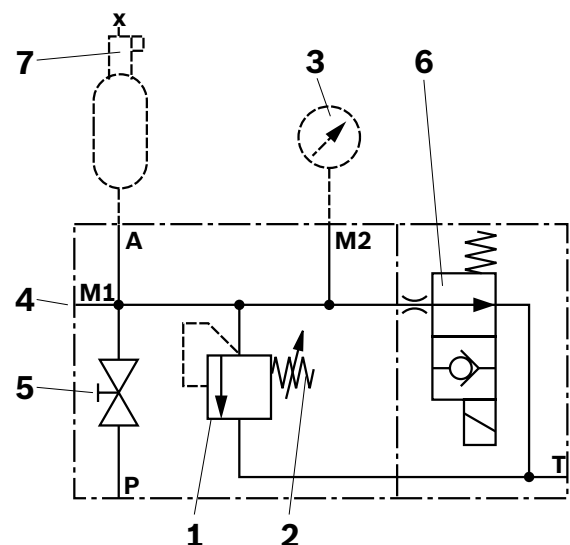
- 1 Equipment against excessive pressure (type-tested)
- 2 Discharge device
- 3 Pressure measurement device
- 4 Test pressure gauge connection
- 5 Shut-off device

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

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