HARLEX

Bladder-type accumulator HAB

- Component series 4X
- Nominal volume 1 to 50 li ers
- Maximum operating pressure 350 bar

Features

- Hydraulic accumulator as per Pressure Equipment Directive 97/23/EC
- Bladder material for differentapplication
- Use:
  - Energy storage for systems with intermittent operation
  - Energy reserve for emergencies
  - Compensation for leakage
  - Shock and vibration damping
  - Volume compensation for pressure and temperature changes
- Certifi cations
  - CE label (as per Pressure Equipment Directive 97/23/EC)
  - CE + GOST label
  - ASME label (as per data sheet)

Ordering code

01	02	03	04	05	06	07	08	09	10	11	12	13	14
HAB		–		–	4x	/	2		G	–	2		1	1	1	–		

Type

01	Bladder-type accumulator	HAB

Nominal volume

02	1 liters	1
	2.5 liters	2,5
	4 liters	4
	6 liters	6
	10 liters	10
	20 liters	20
	35 liters	35
	50 liters	50

Maximum permissible operating pressure

03	350 bar (1 to 6 liters)	350
	330 bar (10 to 50 liters)	330

Series

04	Series 40 to 49 (unchanged installation and connection dimensions)	4X

Gas filling pressure

05	< 2 bar	2

Port size for hydraulic fluid[1)]

		1	2,5	4	6	10	20	35	50	
06	G3/4	●	–	–	–	–	–	–	–	G05
	G1 1/4	–	●	●	●	–	–	–	–	G07
	G2	–	–	–	–	●	●	●	●	G09

Type of mounting (oil connection form)

07	Thread with inner radial sealing surface	G

Gas connection form

08	Gas valve for charging and testing device (see page 13)	2

Bladder material[1)]

09	NBR	N
	ECO	E

Container material[1)]

10	Steel	1

Surface of container inner[1)]

11	Steel	1

Surface of port side[1)]

12	Steel	1

Certification (acceptance)

13	Acceptance according to 97/23/EC	CE
	Instructions for use	BA
	Acceptance in accordance with Gosudarstwenny Standard	GOST

14	State other details in plain language, e.g. special versions	

Ordering example

HAB10-330-4X/2G09G-2N111-CE

– = not available, ● = available

1) Other variants on request.

Instruction manuals and declarations of conformity

CE declarations of conformity

In the languages German, English, French

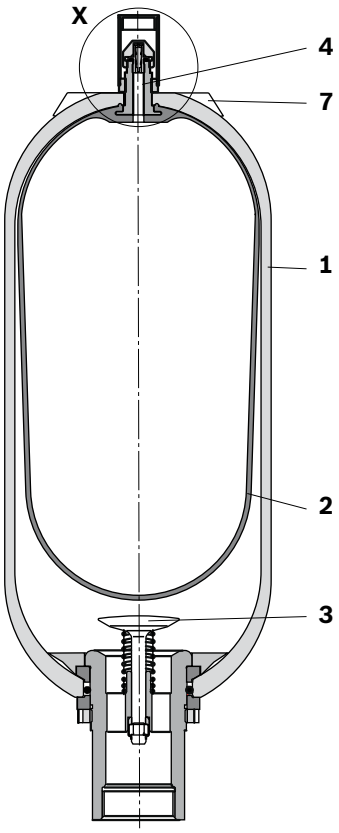
Nominal volume [l]
1
2,5
4
6
10
20
35
50

CE + GOST declarations of conformity

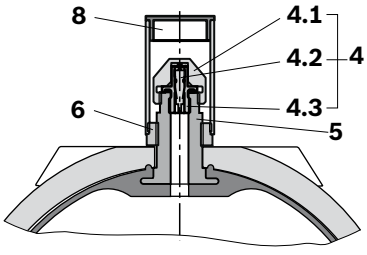
In the languages German, English, Russian

Nominal volume [l]
1
2,5
4
6
10
20
35
50

Functional description



Detail X



1 Reservoir
2 Bladder
3 Oil valve
4 Gas valve
5 Gas valve support
6 Nut
7 Type cap
8 Cover cap

General

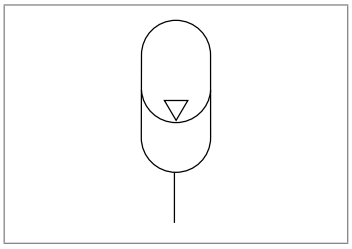
Hydraulic accumulators are hydrostatic devices which are used to store a certain amount of energy, which they dispense as necessary to the hydraulic system.
Fluids are only compressible to a small extent, while gases are highly compressible. This differenceisthebasisforthe operating principle of all gas-charged hydraulic accumulators.
Depending on the design of the separating element, a distinction is made between bladder-type and diaphragm-type accumulators". Hydraulic accumulators essentially consist of a fluidsectionandagassectionwithagas-proof separator element. The flu id section is connected to the hydraulic circuit.

If a certain volume of pressurized gas is charged with a higher fluid pressure, the gas volume will reduce as fluid pressure increases; the gas pressure increases with the fluid pressure.
If the fluid pressure drops, the gas will expand, pressing the fluid back into the hydraulic system until the pressure is equalized again.

Bladder-type accumulator

Bladder-type accumulators consist of a seamless cylindrical pressure reservoir (**1**) made of high-strength steel.
Inside the container is an elastic bladder (**2**) which divides the accumulator into a gas section and a fluid section.
The bladder is filled with nitrogen via the gas valve (4). to the specified gas pressure p_0.
The oil valve (**3**) is located in the oil port of the bladder-type accumulator. It closes when the pressure is higher on the gas side than on the fluid side. This prevents the bladder from exiting into the oil duct, which would destroy the bladder.
When the minimum operating pressure is reached, there should be a small volume of fluid between the bladder and the oil valve (approx. 10% of the nominal volume of the hydraulic accumulator). This prevents the bladder from coming into contact with the valve every time it expands.
The gas valve (**4**) consists of a sealing cap (**4.1**), gas valve insert (**4.2**) and gas charging valve body (**4.3**). These parts can be exchanged individually.
The type cap (**7**) contains the technical data and features of the hydraulic accumulator.

Symbol



Technical data

General										
Weight			See table on page 10							
Design			Bladder-type accumulator							
Installation position			Fluid connection socket at bottom, others on request							
Mounting style			With clamps and console							
Ambient temperature range			–15 °C to +65 °C							
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
Maximum permissible flow	q_{max}	l/min	240	600	600	600	900	900	900	900
Maximum permissible operating pressure	p_{max}	bar	350	350	350	350	330	330	330	330
Maximum permissible pressure fluctuation range	Δp_{dyn}	bar	200	200	200	200	200	200	200	200
Operating pressure and effective volume			See calculation on pages 6 to 9							
Hydraulic fluid			Hydraulic fluid according to DIN 51524; other fluids on request!							
Hydraulic fluids temperature range (others on request)			–15 °C to +80 °C (NBR) –35 °C to +80 °C (ECO)							
Pneumatic										
Filling gas			Nitrogen, cleanliness level 4.0, N_2 = 99.99% by volume							
Gas filling pressure	p_0		< 2 bar							

Hydraulic fluids	Temperature range	Material
Mineral oils	–15 °C to +80 °C	NBR[1)]
	–35 °C to +80 °C	ECO[2)]
HFC	–10 °C to +60 °C	NBR[1)]

Please consult us with respect to other hydraulic fluids and temperatures.

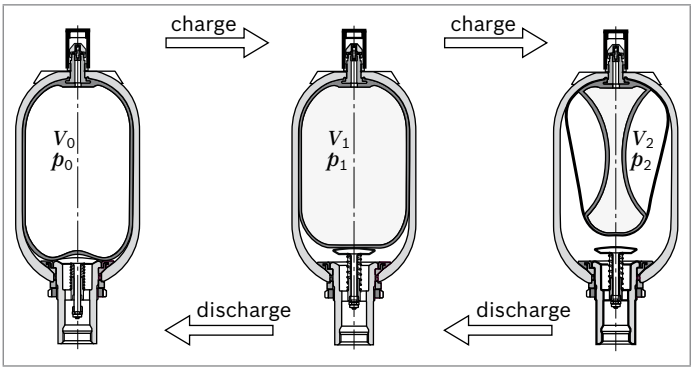
1) Acrylonitrile butadiene rubber (Perbunan)
2) Epichlorhydrin rubber

Application, mode of operation

Applications

Hydro-pneumatic accumulators have many different possible applications:

- Energy storage to eliminate the need for pump drive power on systems with intermittent operation.
- Energy reserve for emergencies, e.g. if the hydraulic pump fails.
- Compensation for leakage.
- Shock and vibration damping for periodic vibrations.
- Volume compensation for pressure and temperature changes.



Mode of operation

Fluids are practically incompressible and are therefore unable to store pressure energy. hydro-pneumatic accumulators use the compressibility of a gas for fluid storage. Only nitrogen of cleanliness level 4.0 may be used!
N_2 = 99.99 % by volume

Calculation

Pressures

The following pressures are key factors in calculating an accumulator:

p_0	Gas filling pressure at room temperature and empty fluid space
$p_0\ (t)$	Gas charge pressure at operating temperature
$p_0\ (t_{max})$	Gas charge pressure at max. operating temperature
p_1	Minimum positive operating pressure
p_2	Maximum positive operating pressure

The following values are recommended to achieve optimum utilization of the accumulator volume and a long service life:

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

The top hydraulic pressure should not exceed four times the filling pressure as otherwise bladder elasticity is overstressed, leading to excessive compression changes and strong gas heating:

- $p_2 \leqq 4 \times p_0$ **(2)**

The service life of the accumulator bladder increases as the difference between p_1 and p_2 decreases. Correspondingly the degree of utilization of the maximum storage capacity is however also reduced.

Oil volumes

The pressures p_0 to p_2 result in the gas volumes V_0 to V_2. Here, V_0 is at also the nominal volume of the accumulator. The available oil volume ΔV is equal to the difference in gas volume V_1 and V_2:

▶ $\Delta V \leqq V_1 - V_2$ (**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

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

b) In the case of adiabatic transformation, i.e. a rapid change in the gas cushion entailing a change in the temperature of the nitrogen, the following applies:

▶ $p_0 \times V^{\chi}_0 = p_1 \times V^{\chi}_1 = p_2 \times V^{\chi}_2$ (**4.2**)

χ = Ratio of the specific heat of the gas (adiabatic exponent), in the case of nitrogen = 1.4

In practice, transformation tends to follow adiabatic rules. Charging is frequently isothermal, discharging adiabatic. Taking into account the equations (**1**) and (**2**) ΔV is 50 % to 70 % of the accumulator nominal volume. As reference:

▶ V_0 = 1.5 bis 3 × ΔV (**5**)

Calculation diagram

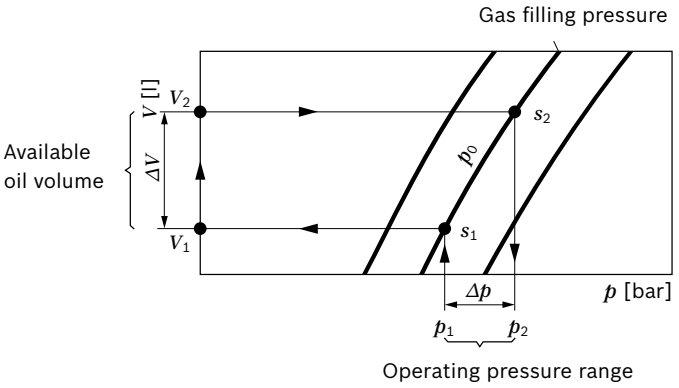
For the purpose of graphic determination, the formulas (**4.1**) and (**4.2**) are implemented in the diagrams on pages 8 to 9. Depending on the purpose, the available oil volume, accumulator size or pressures can be ascertained.

Correction factor K_i and K_a

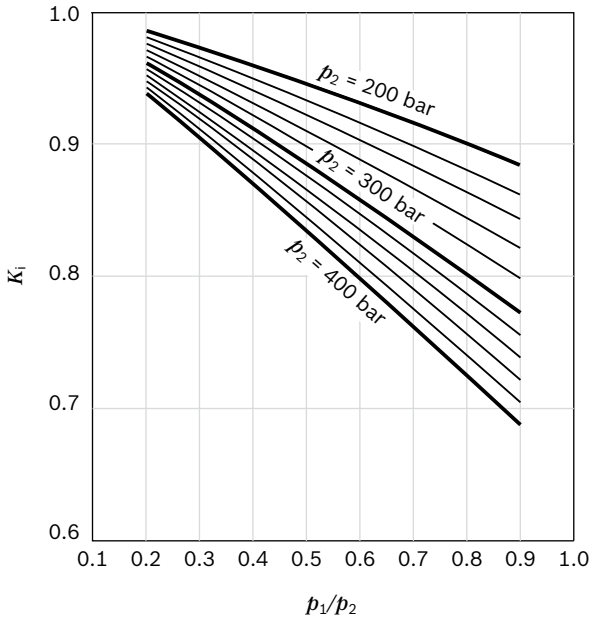
Equations (**4.1**) and (**4.2**) only apply for ideal gases. In the behavior of real gases, however, considerable deviations occur at operating pressures over 200 bar that must be taken into account by correction factors. These can be found in the following diagrams. The correction factors by which the ideal discharge volume ΔV should be multiplied are in a range from 0.6 to 1.

Application of calculation diagrams

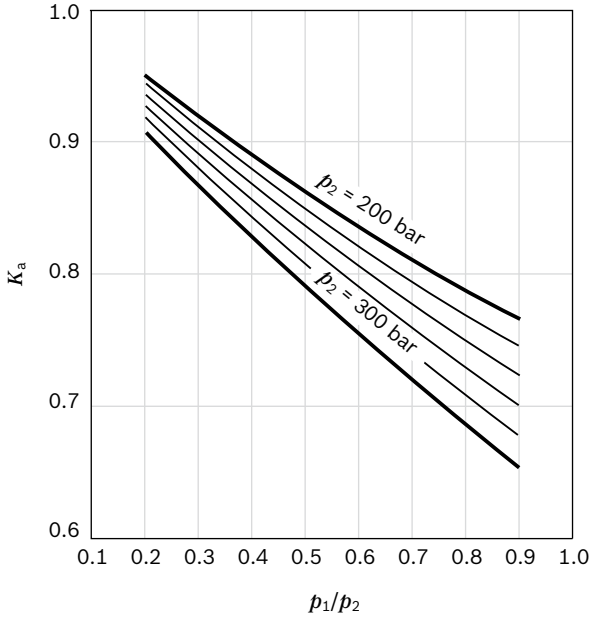
(see pages 8 to 9)



▼ **Isothermal** $\Delta V_{real} = \Delta V_{ideal} \times K_i$

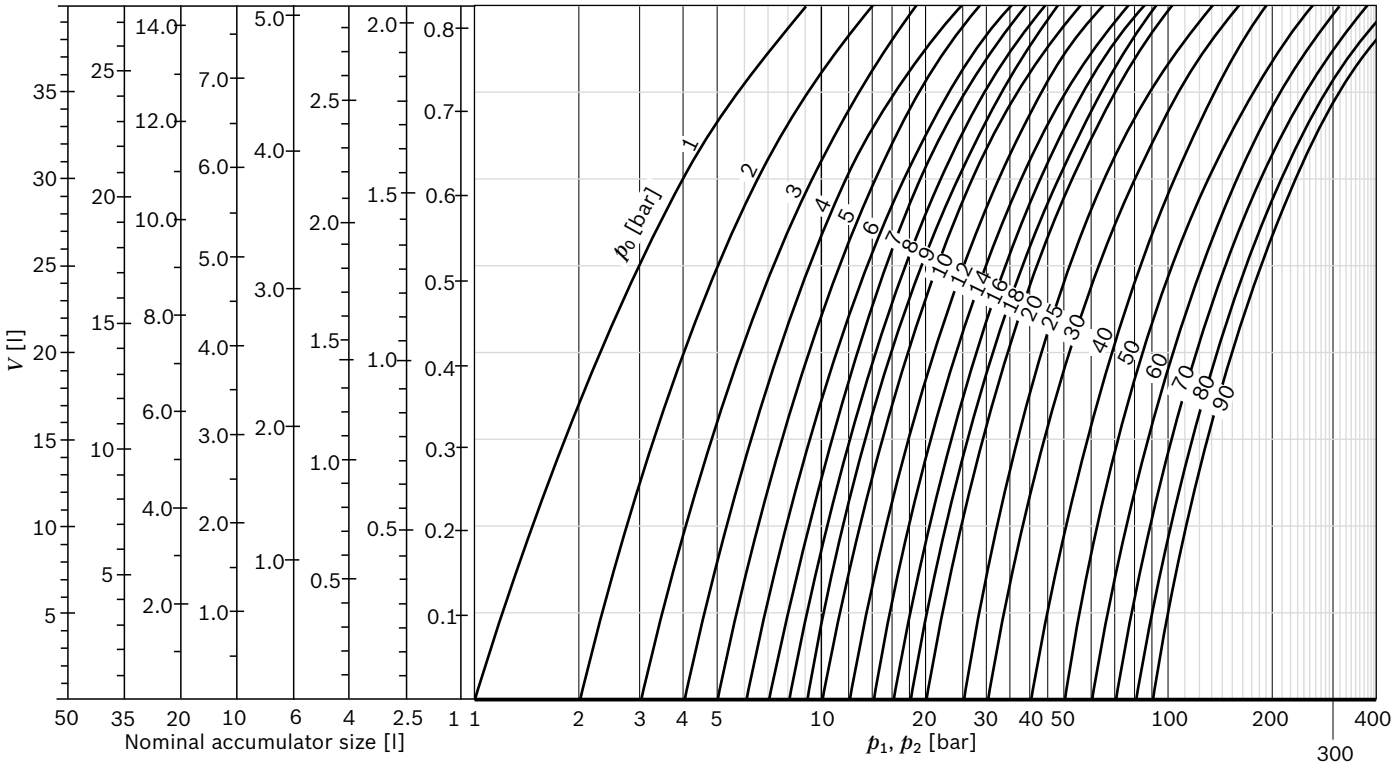


▼ **Adiabatic** $\Delta V_{real} = \Delta V_{ideal} \times K_a$

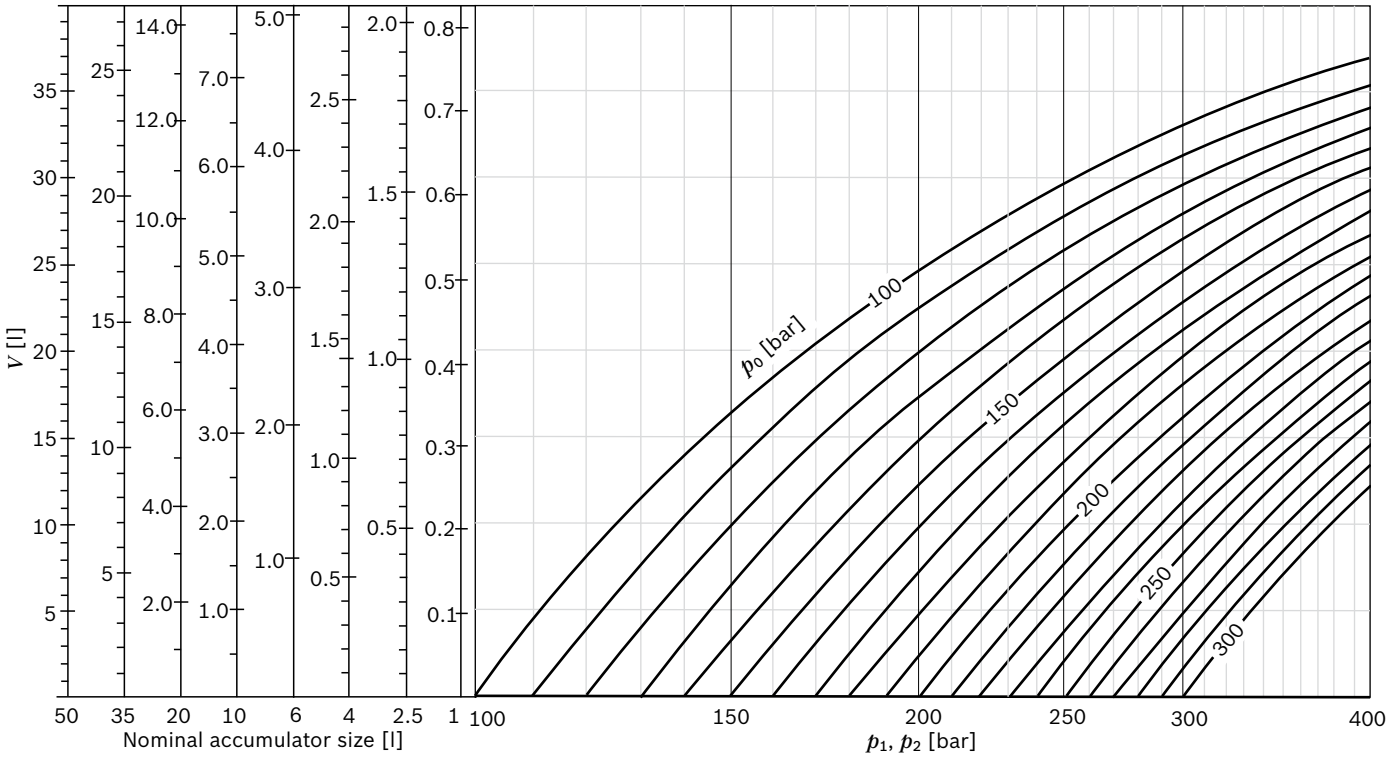


Isothermal state changes

▼ p_0 = 1 to 90 bar

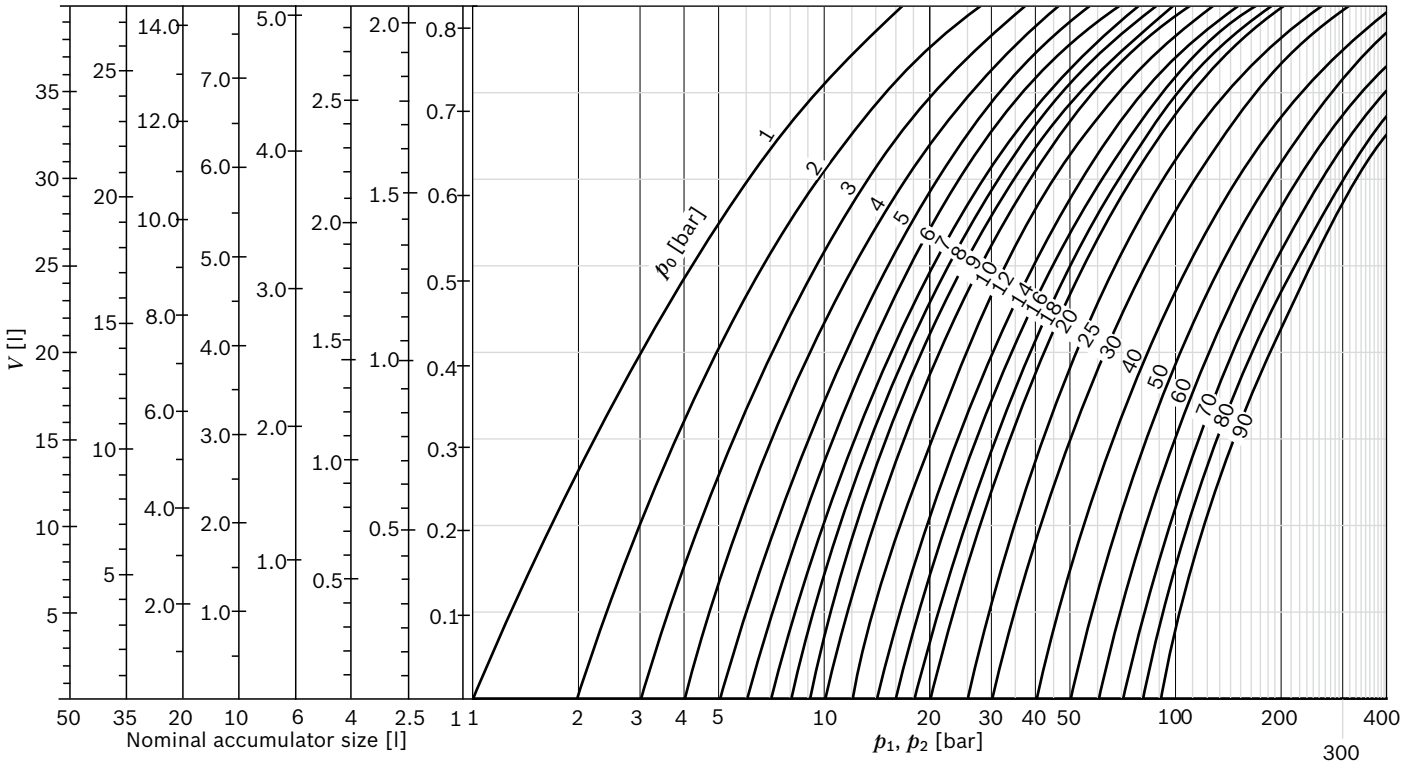


▼ p_0 = 100 to 300 bar

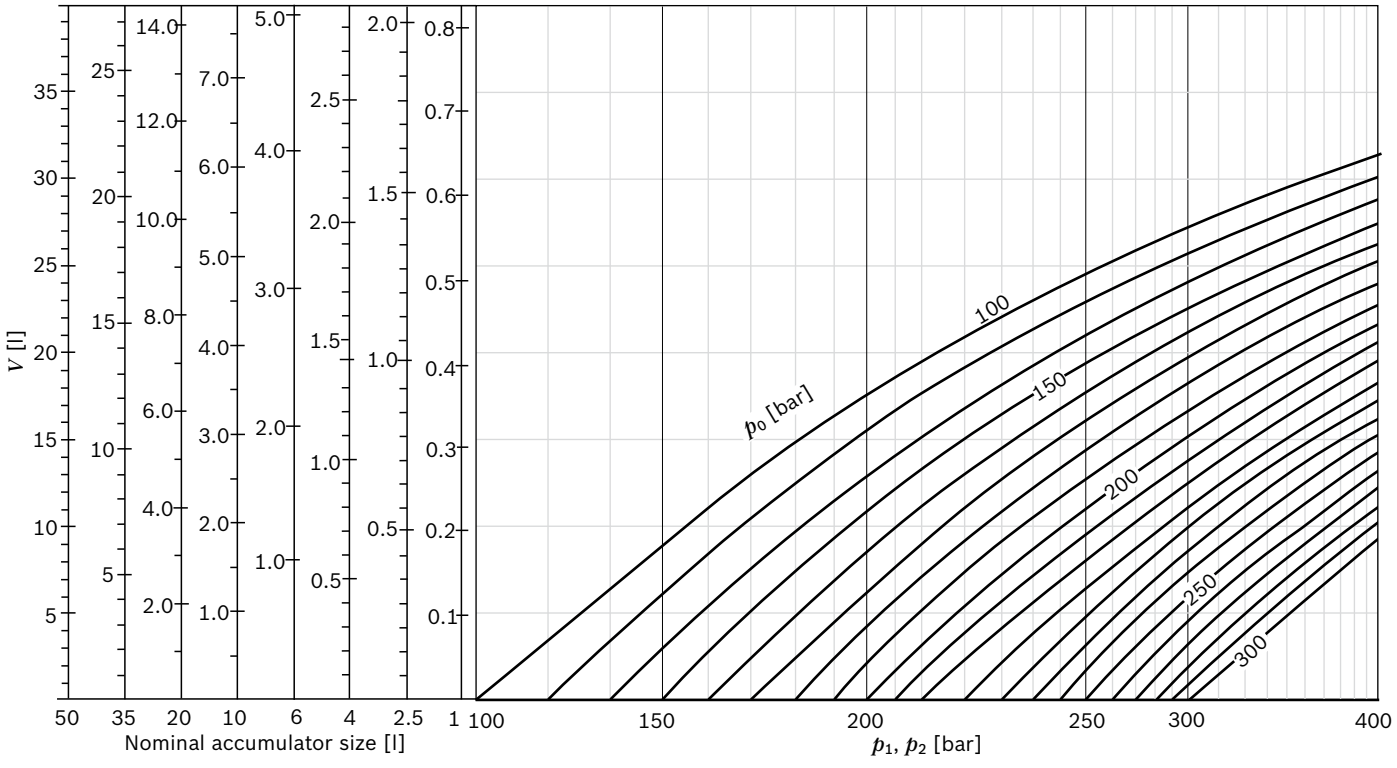


Adiabatic state changes

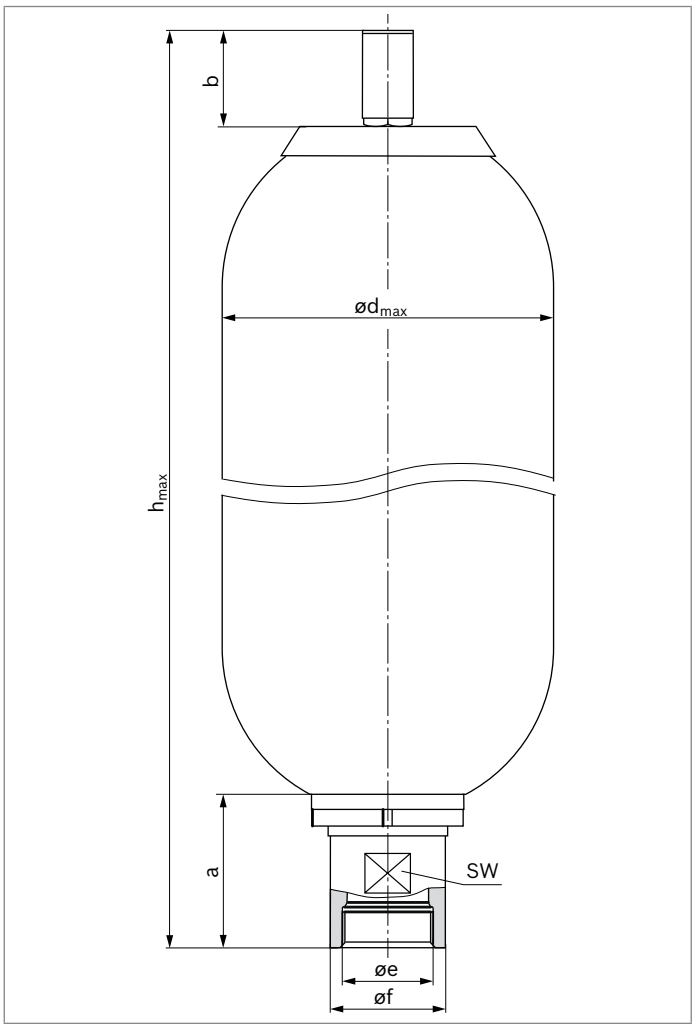
▼ p_0 = 1 to 90 bar



▼ p_0 = 100 to 300 bar



Dimensions

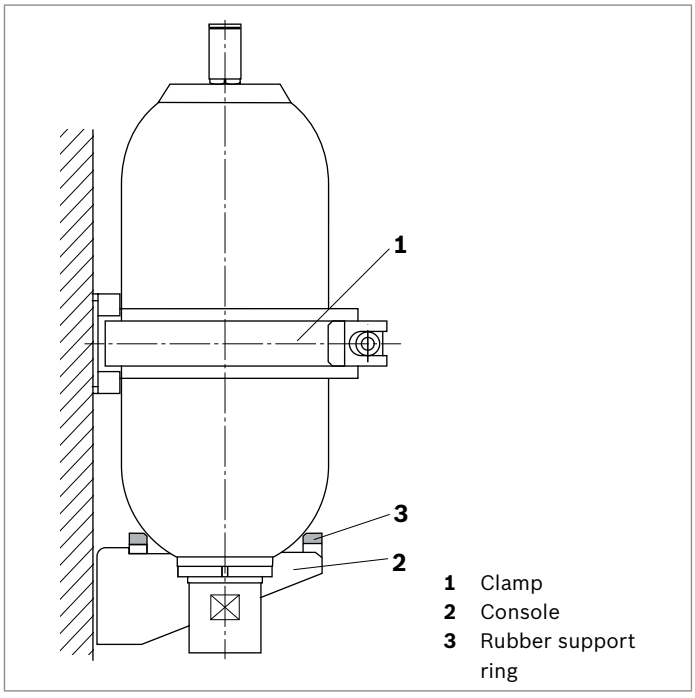


Dimensions [mm]

Nominal volume [l]	Order data / type	h_{max}	ød_{max}	a	b	øe	øf	SW	Weight [kg]
1	HAB1-350-4X/2G05G-2N111-BA	333.5	115.5	56	70	G3/4"	36	32	5
	HAB1-350-4X/2G05G-2N111-GOST								
2,5	HAB2.5-350-4X/2G07G-2N111-CE	554	115.5	69	70	G1/14"	53	50	10
	HAB2.5-350-4X/2G07G-2N111-GOST								
4	HAB4-350-4X/2G07G-2N111-CE	438.5	170	67	70	G1/14"	53	50	16
	HAB4-350-4X/2G07G-2E111-CE								
	HAB4-350-4X/2G07G-2N111-GOST								
6	HAB6-350-4X/2G07G-2N111-CE	564.5	170	67	70	G1/14"	53	50	20
	HAB6-350-4X/2G07G-2N111-GOST								
10	HAB10-330-4X/2G09G-2N111-CE	590.5	225.5	104	70	G2"	76	70	32
	HAB10-330-4X/2G09G-2E111-CE								
	HAB10-330-4X/2G09G-2N111-GOST								
20	HAB20-330-4X/2G09G-2N111-CE	900.5	225.5	104	70	G2"	76	70	53
	HAB20-330-4X/2G09G-2N111-GOST								
35	HAB35-330-4X/2G09G-2N111-CE	1424	225.5	104	70	G2"	76	70	85
	HAB35-330-4X/2G09G-2N111-GOST								
50	HAB50-330-4X/2G09G-2N111-CE	1940	225.5	104	70	G2"	76	70	123
	HAB50-330-4X/2G09G-2N111-GOST								

Spare parts and accessories

HAB mounting elements

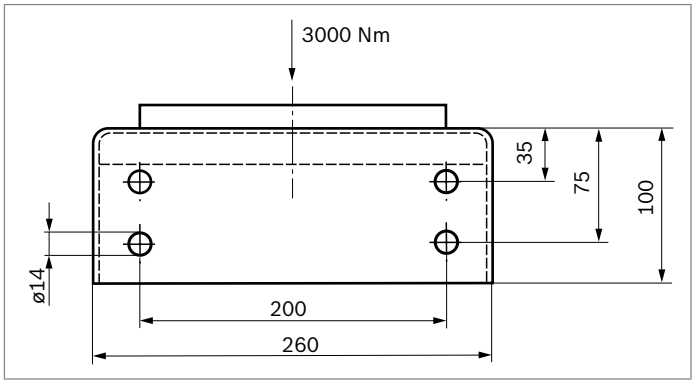


1 Clamp
2 Console
3 Rubber support ring

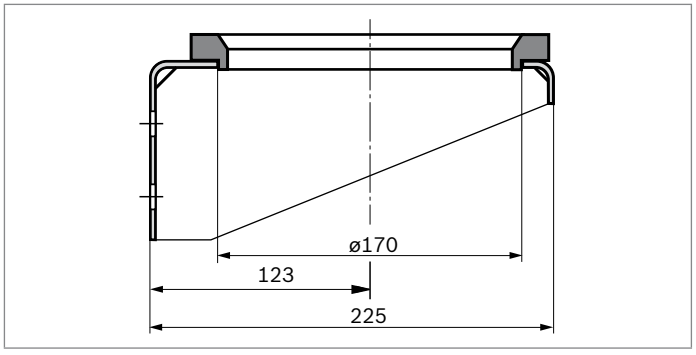
Clamp type	Nominal accumulator size				
	1	4		20	
	2,5	6	10	35	50
Clamp 110-120	1				
Clamp 160-170		2			
Clamp 218-228			1	2	
Clamp 224-230					2
Console			1	1	1
Rubber support ring			1	1	1

Console and rubber support ring

▼ **Console**

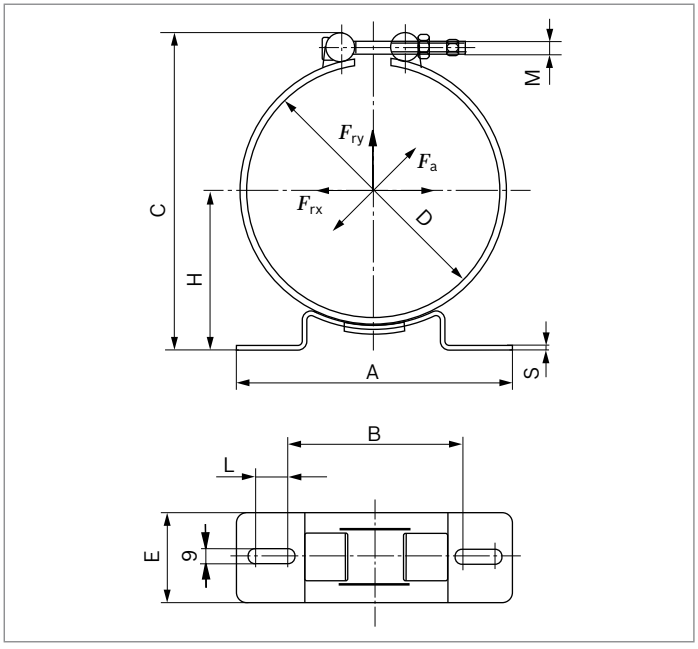


▼ **Rubber support ring**

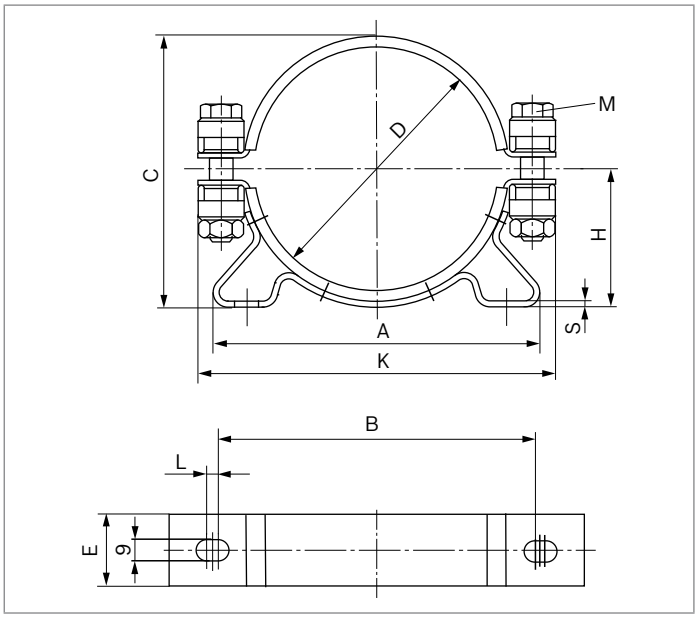


Securing clamps

▼ Type F1



▼ Type F2



Clamp type		Dimensions									
		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
Clamp 160-170	F1	237	147	200	160-170	50	90-95	–	35	M8	4
Clamp 218-228	F1	237	147	258	218-228	50	120-125	–	35	M8	4
Clamp 224-230	F2	254	212	244	224-230	30	120-123	295	4	M12	3

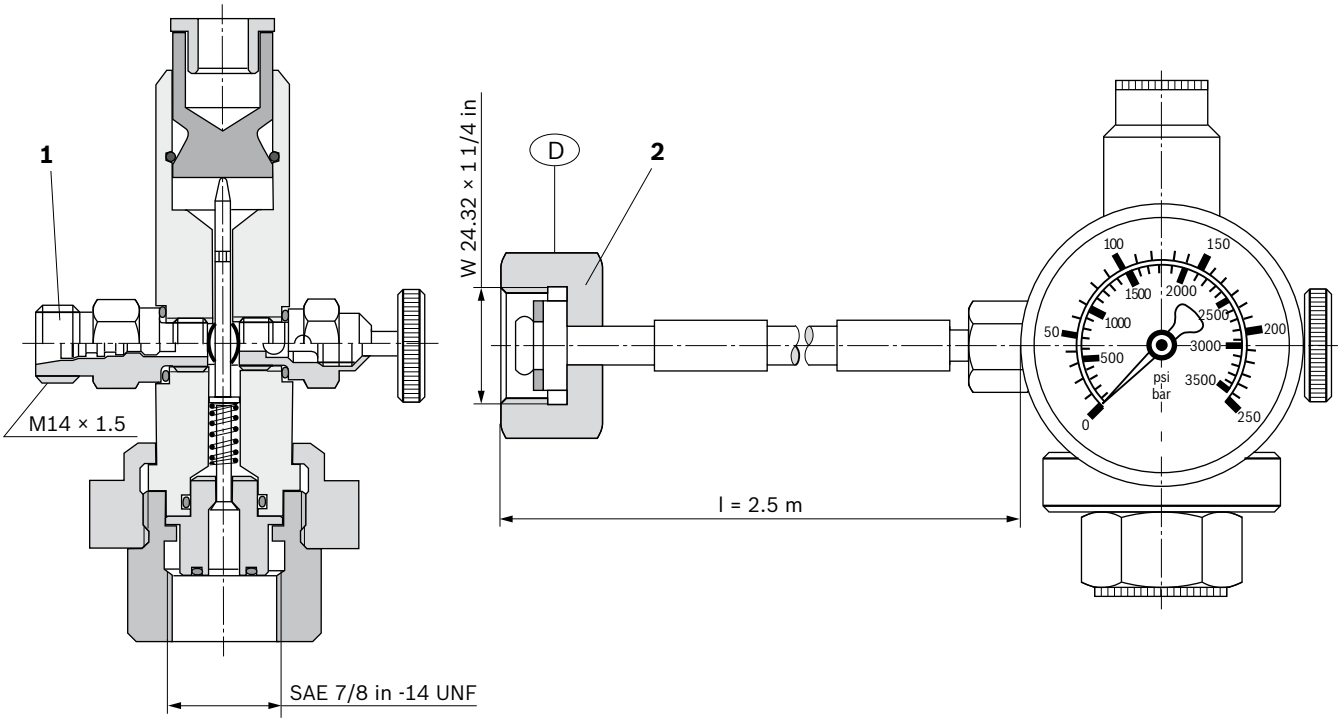
Filling and testing device

Measurement set	
Measurement set, complete (for bladder-type accumulator HAB)	
Consists of	
Case (without contents)	
Filling and testing valve	
Pressure gauge (0 to 250 bar)	
Hose l = 2.5 m with connection fittings	D

Additional parts to be ordered separately	
Pressure gauge (0 to 25 bar)	
Pressure gauge (0 to 60 bar)	
Pressure gauge (0 to 400 bar)	
Connection fittings	F
	GB
	USA
	KR
	J
	RUS
Hose l = 5 m with connection fittings	D

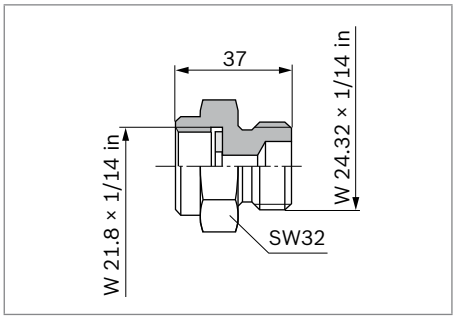
Dimensions of filling and testing valve

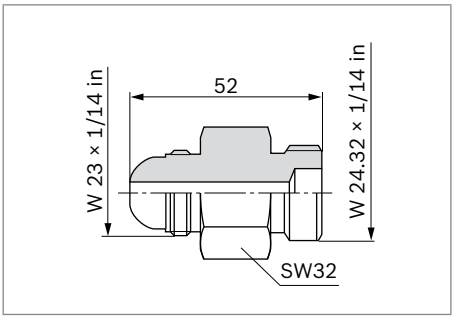
1 Valve body with check valve, release valve, pressure gauge port and gas hose port.

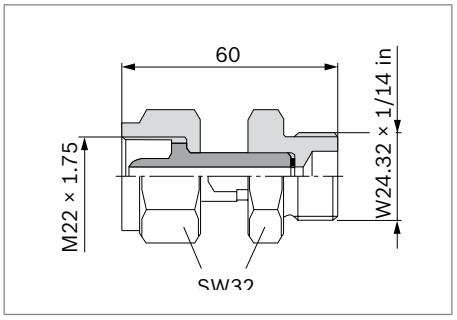


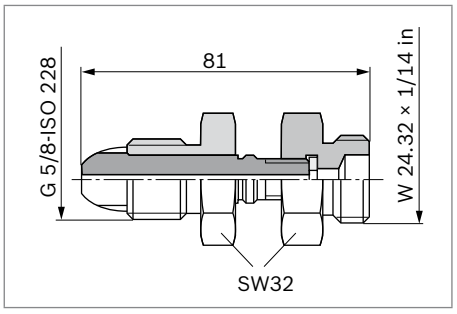
1 Spare part
2 Adapter, see pages 14/15

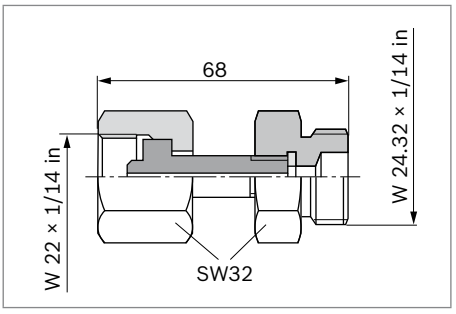
Adapter for nitrogen bottle to union nut

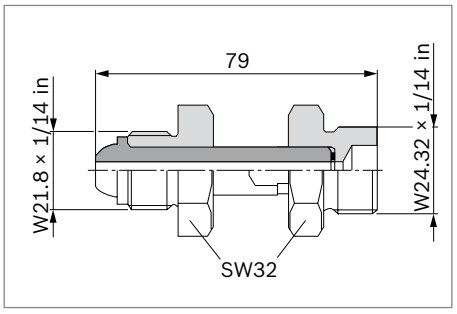


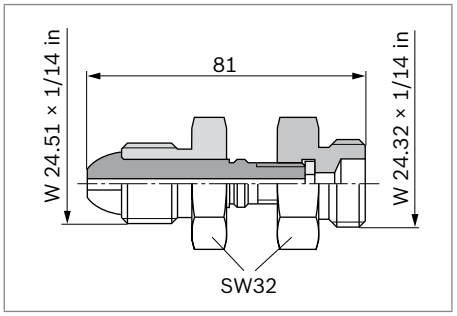


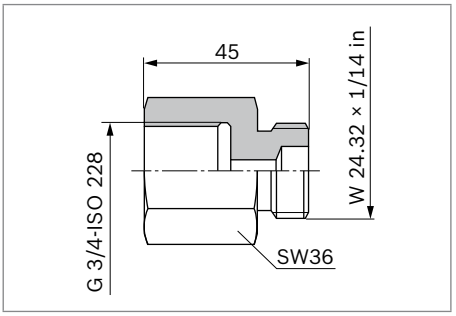


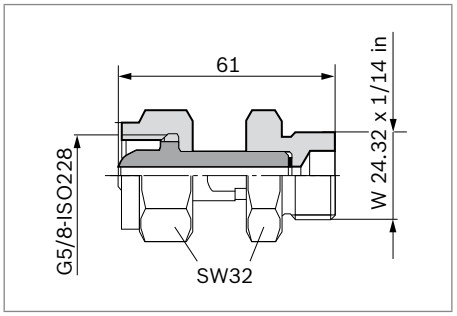












Dimensions [mm]

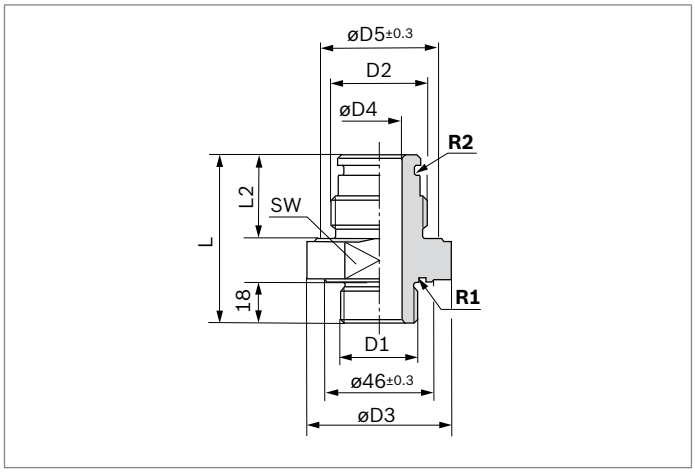
Country									
Brazil		x							
Bulgaria		x							
China									x
France	x								
Greece		x							
United Kingdom		x							
India		x							
Italy								x	
Japan					x				
Canada			x						
North Korea				x					
South Korea				x					
Malaysia		x							
Mexico	x								
Romania	x								
Russia						x			
Spain		x							
Saudi Arabia	x								
Singapore		x							
Taiwan							x		
Turkey		x							
USA			x						

Other countries on request

Accumulator adapter for accumulator shut-offblockstypeABZSS

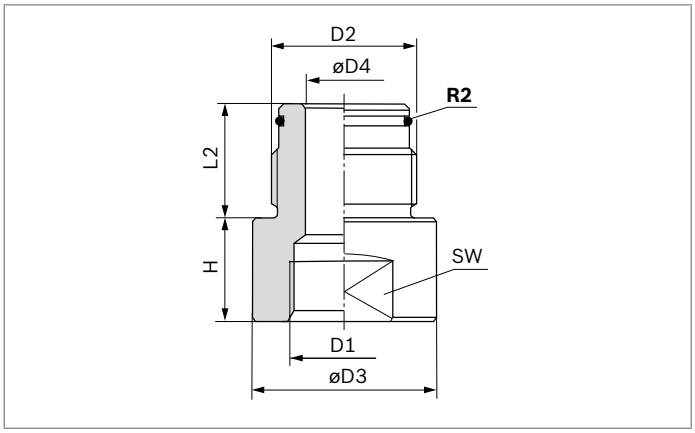
Please select the type required in accordance with data sheet.

▼ **Connection fi tting for accumulator shut-off blocks NG20/DN20 type 0532VAW in accordance with data sheet**



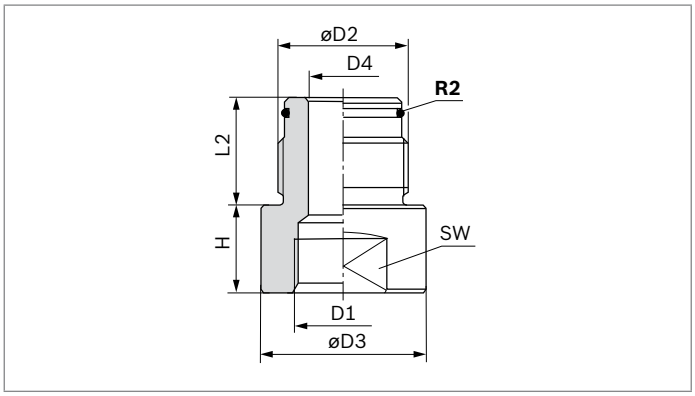
Safety block		acc. to ISO 228		Dimensions [mm]					
D1	M_A [Nm]	D2	M_A [Nm]	L	L2	øD3	øD4	øD5	SW
M33 × 2	310^{+30}	G3/4	180^{+18}	64	28	53	12	42	46
		G1/14	450^{+45}	74	37	63	20	55	55
		G2	500^{+50}	85	44	90	30	75	80

▼ **Connection fitting, inch to metric thread**
HAB..-1X to HAB..-4X



Nominal volume [l]	acc. to ISO 228		acc. to ISO 228		Dimensions [mm]				
	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
2,5 to 6	G1/14	450^{+45}	M40 × 1.5	400^{+40}	43	37	60	20	55
10 to 50	G2	500^{+50}	M50 × 1.5	450^{+45}	41	44	78	32	70

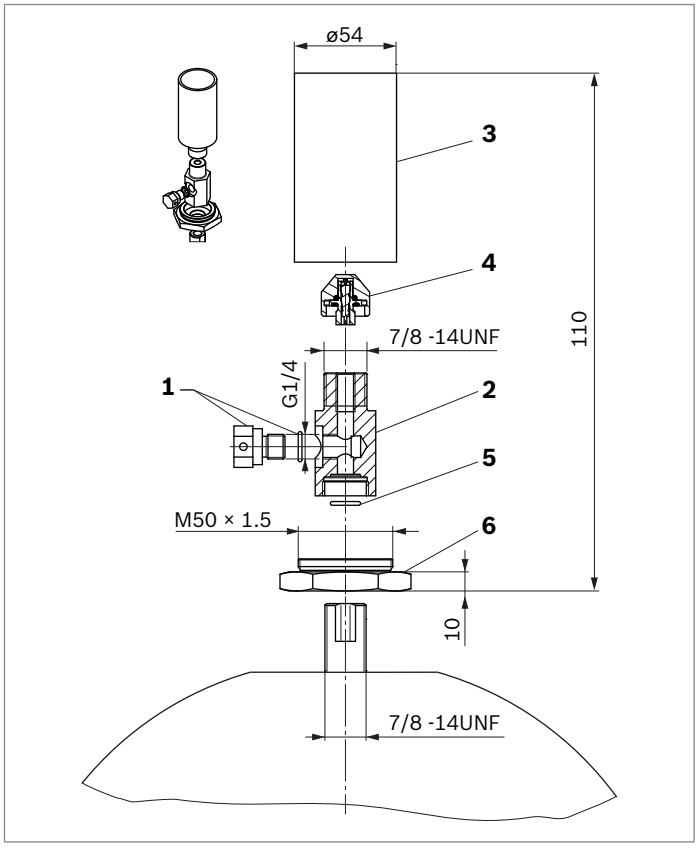
▼ **Reducing nipple for pipe connection**



Nominal volume [l]	acc. to ISO 228		acc. to ISO 228		Dimensions [mm]				
	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
2,5 to 6	G1/14	450^{+45}	G1/2	115^{+12}	8	37	60	24	55
	G1/14	450^{+45}	G3/4	180^{+18}	8	37	60	24	55
10 to 50	G2	500^{+50}	G1/2	115^{+12}	20	44	75	30	65
	G2	500^{+50}	G3/4	180^{+18}	20	44	75	30	65
	G2	500^{+50}	G1	310^{+31}	20	44	75	30	65
	G2	500^{+50}	G1 1/2	450^{+45}	40	44	75	32	65

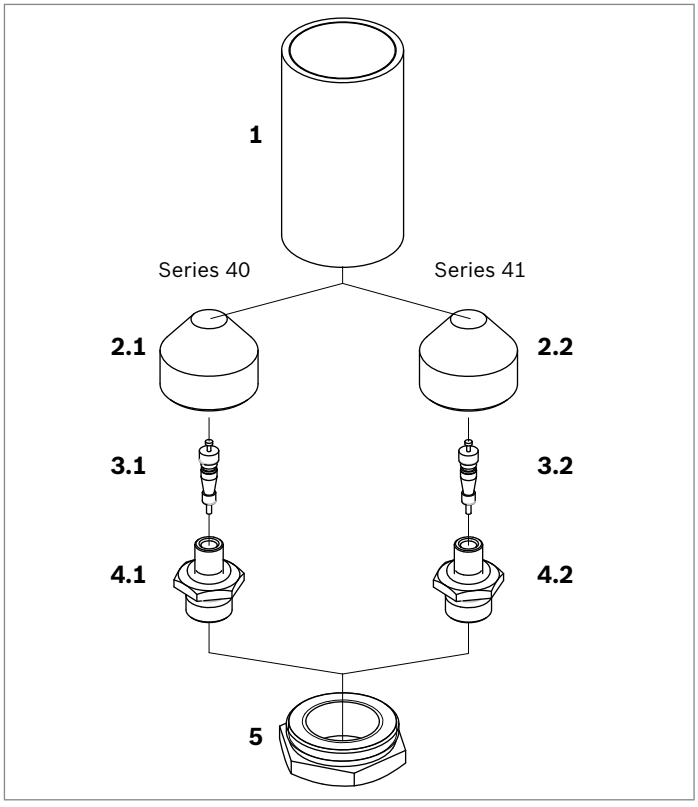
Pressure safeguarding

Pressure protection kit		
Consists of		Quantity
1	Bursting disk, 360 bar	1
2	Adapter	1
3	Protection cap	1
4	O-ring	2
5	Adapter nut (1 to 32 l)	1



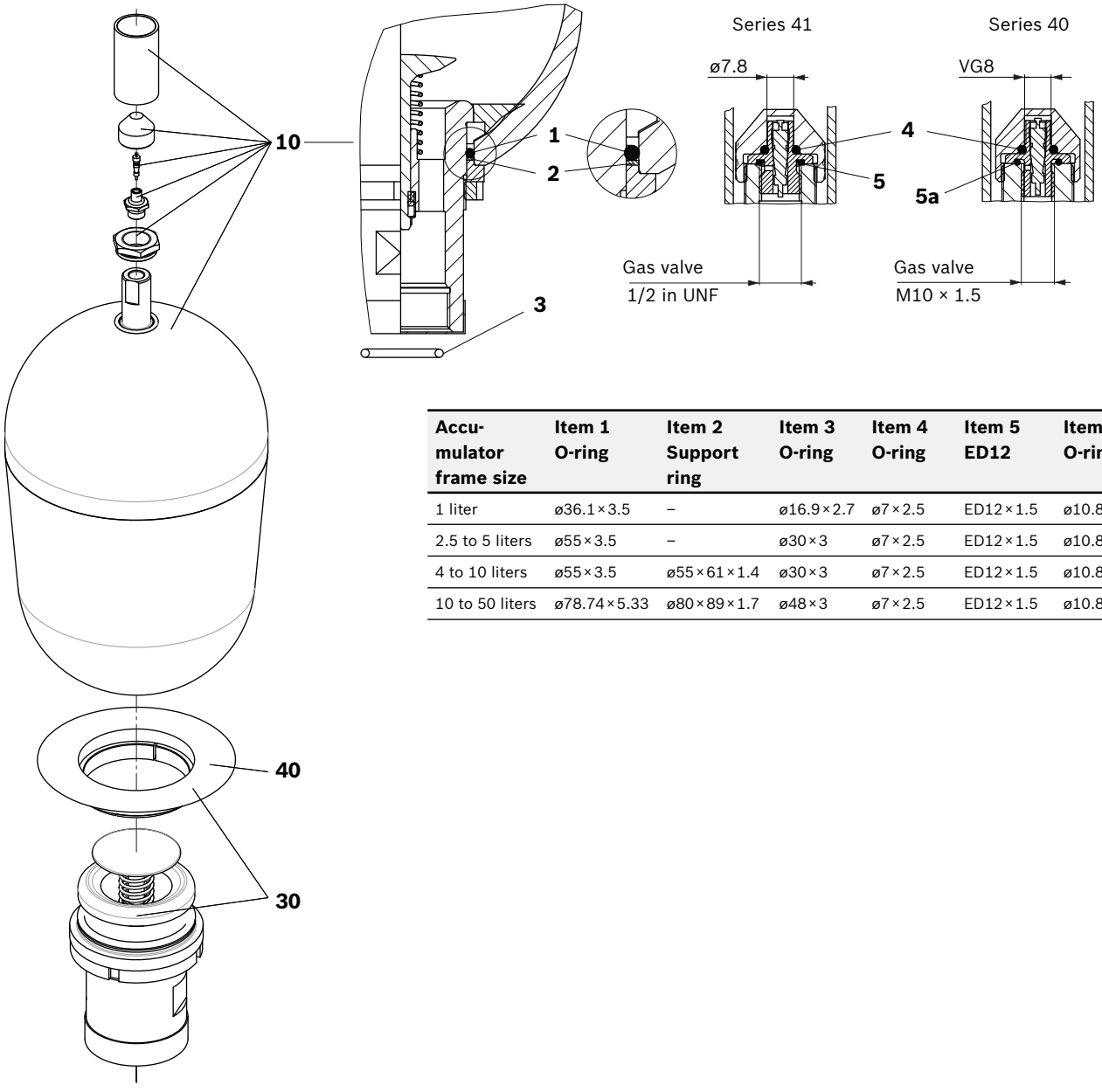
Gas valves

Gas valve spare parts kit		
Consists of		Quantity
1	Protection cap	1
2.1	Sealing cap, series 40	1
3.1	Valve insert, series 40	1
4.1	Gas valve, series 40	1
2.2	Sealing cap, series 41	1
3.2	Valve insert, series 41	1
4.2	Gas valve, series 41	1
5	Nut	1



Spare parts

Accumulator size	10 Spare bladder with gas valve 41 and seal set NBR	 ECO	30 Oil valve kit consisting of retaining ring and oil valve	40 Retaining ring
1 liter		–	–	
2.5 liters		–	–	
4 liters				
6 liters		–		
10 liters				
20 liters		–		
35 liters		–		
50 liters		–		



Accumulator frame size	Item 1 O-ring	Item 2 Support ring	Item 3 O-ring	Item 4 O-ring	Item 5 ED12	Item 5a O-ring
1 liter	ø36.1×3.5	–	ø16.9×2.7	ø7×2.5	ED12×1.5	ø10.82×1.78
2.5 to 5 liters	ø55×3.5	–	ø30×3	ø7×2.5	ED12×1.5	ø10.82×1.78
4 to 10 liters	ø55×3.5	ø55×61×1.4	ø30×3	ø7×2.5	ED12×1.5	ø10.82×1.78
10 to 50 liters	ø78.74×5.33	ø80×89×1.7	ø48×3	ø7×2.5	ED12×1.5	ø10.82×1.78

Intended use

bladder-type accumulators HAB..-4X are designed for installation in hydraulic drive systems in stationary machines and systems.
In mobile application or application in which acceleration forces act on the bladder-type accumulator during intended operation, use is only permitted with the prior approval of the responsible product manager. Please contact the Technical Sales department.
bladder-type accumulators HAB..-4X are not intended for private use.

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

Safety instructions on hydraulic accumulators

For hydraulic accumulators, compliance with the specifications valid at the place of installation must be ensured before commissioning and during operation.
The operator bears the sole responsibility for compliance with all applicable specifications.
General instructions for hydraulic accumulators in hydraulic systems are provided by DIN EN ISO 4413.

Documents provided must be kept in a safe place. They will be needed by experts conducting regular examinations.

Warning!
Do not perform any welding, soldering or mechanical work on the accumulator vessel.

- Risk of explosion during welding or soldering work!
- Risk of bursting and loss of operating license in the event of mechanical processing!
  Do not charge the hydraulic accumulator with oxygen or air. Risk of explosion!

Depressurize prior to working on hydraulic systems and protect against switching back on.
Serious accidents may be caused by incorrect installation. Commissioning may only be performed by qualified specialist personnel.

Legal regulations

Hydraulic accumulators are pressure vessels and are subject to the national specifications and regulations applicable at the place of installation.
In Germany the Ordinance on Industrial Safety and Health (BetrSichV) applies.
Special stipulations are to be observed in shipbuilding, aircraft construction, mining, etc.
Equipment is designed, manufactured and tested in accordance with the appendices of EN 14359. Installation, fitting and operation are governed by the "Technical Regulations for Pressure Vessels".

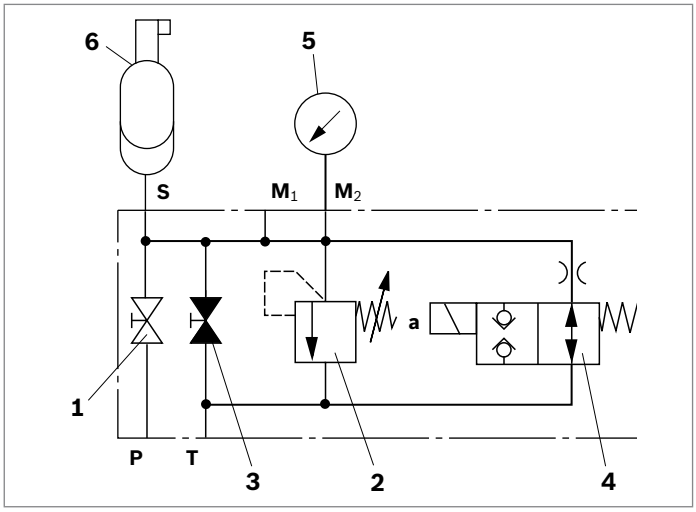
Note!
All vessel classes shall be protected by a pressure-relief valve according to directive 97/23/EG.

Qualifi ed persons
Qualifiedpersonsarepersonswhohaveacquiredthe nec-essary specialist knowledge on account of their vocational training, professional experience and recent professional activities.

Safety devices

In accordance with the “Technical Regulations for Pressure Accumulators” (TRB), additional safety equipment is necessary. The safety devices are summarized in the compact accumulator safety block:

- Type ABZSS in accordance with data sheet
- Type 0532VAW in accordance with data sheet



1 System shut-off cock
2 Pressure relief valve
3 Manual unloading
4 Electro-magnetic unloading, optional
5 Pressure measurement device
6 Safety device against excessive temperatures

M_1; M_2 Measuring port
P Pump connection
S Accumulator port
T Tank port