Bladder Accumulators
Standard model

1. DESCRIPTION

1.1. FUNCTION

Fluids are practically incompressible and cannot therefore store pressure energy.

The compressibility of a gas is utilised in hydraulic accumulators for storing fluids. HYDAC bladder accumulators are based on this principle, using nitrogen as the compressible medium.

A bladder accumulator consists of a fluid section and a gas section with the bladder acting as the gas-proof separation element.
The fluid around the bladder is connected to the hydraulic circuit so that the bladder accumulator draws in fluid when the pressure increases and the gas is compressed.
When the pressure drops, the compressed gas expands and forces the stored fluid into the circuit.

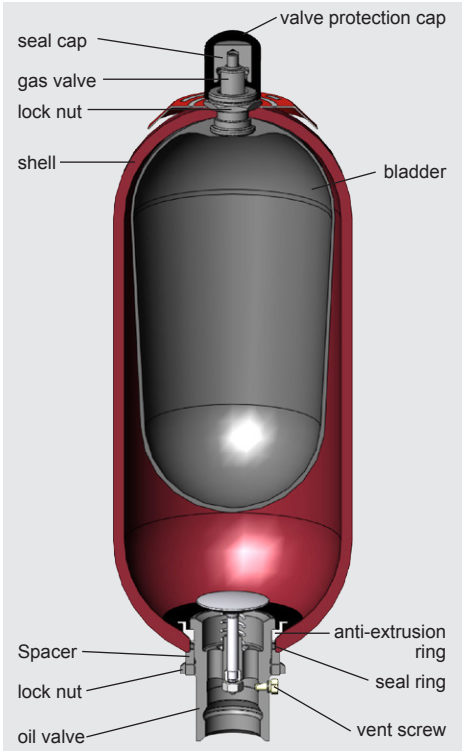
HYDAC bladder accumulators can be used in a wide variety of applications, some of which are listed below:

- energy storage
- emergency operation
- force equilibrium
- leakage compensation
- volume compensation
- shock absorption
- vehicle suspension
- pulsation damping

See catalogue section:

- Hydraulic Dampers
  No. 3.701

1.2. DESIGN



Design

- **Standard bladder accumulator SB330/400/500/550**
  HYDAC standard bladder accumulators consist of the pressure vessel, the flexible bladder with gas valve and the hydraulic connection with check-valve. The pressure vessels are seamless and manufactured from high tensile steel.
- **Bladder accumulator SB330N**
  The flow-optimised design of the standard oil valve enables the maximum possible operating fluid flow rate to increase to 25 l/s on this accumulator type.
- **High flow bladder accumulator SB330H**
  HYDAC high flow bladder accumulators type SB330 are high performance accumulators with a flow rate of up to 30 l/s. The fluid port is enlarged to allow higher flow rates.
- **SB600**
  For higher pressures, with ASME U stamp, HYDAC provides the series SB600 with approval S (p_{max} 345 bar / 5000 psi).

1.3. BLADDER MATERIAL

The bladder material must be selected in accordance with the particular operating medium or operating temperature, see section 2.1.
If discharge conditions are unfavourable (high p_2/p_0 pressure ratio, rapid discharge speed), the gas may cool to below the permitted temperature. This can cause cold cracking. The gas temperature can be calculated using the HYDAC Accumulator Simulation Program **ASP**.

1.4. CORROSION PROTECTION

For operation with chemically aggressive media, the accumulator shell can be supplied with corrosion protection, such as chemical nickel-plating. If this is insufficient, then stainless steel hydraulic accumulators must be used.

1.5. INSTALLATION POSITION

HYDAC bladder accumulators can be installed vertically, horizontally and at a slant. When installing vertically or at a slant, the oil valve must be at the bottom. On certain applications listed below, particular positions are preferable:

- Energy storage: vertical
- Pulsation damping: any position from horizontal to vertical
- Maintaining constant pressure: any position from horizontal to vertical
- Volume compensation: vertical

If the installation position is horizontal or at a slant, the effective fluid volume and the maximum permitted flow rate of the operating fluid are reduced.

1.6. TYPE OF INSTALLATION

By using an appropriate adapter, HYDAC hydraulic accumulators, up to size 1 l, can be installed directly inline.

For strong vibrations and volumes above 1 litre, we recommend the use of HYDAC support clamps or the HYDAC accumulator installation set.

See catalogue sections:

- Supports for Hydraulic Accumulators
  No. 3.502
- ACCUSET SB
  No. 3.503

2. SPECIFICATIONS

2.1. EXPLANATIONS, NOTES

2.1.1 Operating pressure

see tables in section 3. (PED)
May differ from nominal pressure for other test certificates.

2.1.2 Permitted operating temperature of the hydraulic accumulator

-10 °C ... +80 °C
standard design, others on request

2.1.3 Nominal volume

see tables in section 3.

2.1.4 Effective gas volume

see tables in section 3.
Based on nominal dimensions, this differs slightly from the nominal volume and must be used when calculating the effective fluid volume.

2.1.5 Effective volume

Volume of fluid which is available between the operating pressures p_2 and p_1.

2.1.6 Max. flow rate of the operating fluid

In order to achieve the max. flow rate given in the tables, the accumulator must be installed vertically. It must be noted that a residual fluid volume of approx. 10 % of the effective gas volume remains in the accumulator.
The maximum fluid flow rate was determined under specific conditions and is not applicable in all operating conditions.

2.1.7 Working temperature and operating medium

The permitted working temperature of a bladder accumulator is dependent on the application limits of the metal materials and the bladder. Outside this temperature range, special materials must be used. The operating medium must also be taken into account.
The following table displays a selection of elastomer materials including max. temperature range and a rough overview of resistant and non-resistant fluids. Please contact us for help in selecting a suitable elastomer.

Materials		Material code [1]	Temperature range	Overview of the fluids [2]	
				Resistant to	Not resistant to
NBR	Acrylonitrile butadiene rubber	2	-15 °C ... + 80 °C	● Mineral oil (HL, HLP) ● Flame-retardant fluids from the groups HFA, HFB, HFC ● Synthetic esters (HEES) ● Water ● Sea water	● Aromatic hydrocarbons ● Chlorinated hydrocarbons (HFD-S) ● Amines and ketones ● Operating fluids from the group HFD-R ● Fuels
		5	-50 °C ... + 50 °C		
		9	-30 °C ... + 80 °C		
ECO	Ethylene oxide epichlorohydrin rubber	3	-30 °C ... +120 °C	● Mineral oil (HL, HLP) ● Flame-resistant fluids from the group HFB ● Synthetic esters (HEES) ● Water ● Sea water	● Aromatic hydrocarbons ● Chlorinated hydrocarbons (HFD-S) ● Amines and ketones ● Operating fluids from the group HFD-R ● Flame-resistant fluids from the groups HFA and HFC ● Fuels
IIR	Butyl rubber	4	-50 °C ... +100 °C	● Operating fluids of type HFD-R ● Flame-resistant fluids from the group HFC ● Water	● Mineral oils and mineral greases ● Synthetic esters (HEES) ● Aliphatic, chlorinated and aromatic hydrocarbons ● Fuels
FKM	Fluorine rubber	6	-10 °C ... +150 °C	● Mineral oil (HL, HLP) ● Hydraulic fluids from the group HFD, ● Synthetic esters (HEES) ● Fuels ● Aromatic hydrocarbons ● Inorganic acids	● Amines and ketones ● Ammonia ● Skydrol and HyJet IV ● Steam

[1] see section 2.2. Model code, material code, accumulator bladder

[2] others on request

2.1.8 Gas charging

Hydraulic accumulators must only be charged with nitrogen.
Never use other gases.
Risk of explosion!

In principle, only use nitrogen of at least Class 4.0 (filtration < 3 µm).
If other gases are to be used, please contact us for advice.

2.1.9 Limits for gas pre-charge pressure

$p_0 \leq 0.9 \bullet p_1$

with a permitted pressure ratio of:

$p_2 : p_0 \leq 4 : 1$

p_2 = max. operating pressure
p_0 = pre-charge pressure

2.1.10 Certificate codes

Country	Certificate code (AKZ)
EU member states	U
Australia	F [1)]
Belarus	A6
Canada	S1 [1)]
China	A9
Hong Kong	A9
Iceland	U
Japan	P
Korea (Republic)	A11
New Zealand	T
Norway	U
Russia	A6
South Africa	S2
Switzerland	U
Turkey	U
Ukraine	A10
USA	S

[1)] = registration required in the individual territories or provinces
others on request

On no account must any welding, soldering or mechanical work be carried out on the accumulator shell. After the hydraulic line has been connected it must be completely vented.

Work on systems with hydraulic accumulators (repairs, connecting pressure gauges etc.) must only be carried out once the pressure and the fluid have been released.

The operating instruction must be observed!
No. 3.201.BA

Notice:
Application examples, accumulator sizing, instructions and extracts from approvals and transport regulations relating to hydraulic accumulators can be found in the following catalogue section:

- HYDAC Accumulator Technology No. 3.000

2.1.11 Gas-side connection standard model

Series	Volume [l]	Gas valve type
SB330 / SB400	< 1	5/8-18UNF
	< 50	7/8-14UNF
	≥ 50	M50x1.5 / 7/8-14UNF
SB500 / SB600	10 ... 50	M50x1.5 / 7/8-14UNF
SB550	1 ... 5	7/8-14UNF

other pressure ranges on request

2.2. MODEL CODE

Not all combinations are possible. Order example.
For further information, please contact HYDAC.

SB330 (H) – 32 A 1 / 112 U – 330 A 050

Series

Type code
no details = standard
H = high flow
N = flow-optimised valve, fluid side
A = shock absorber
P = pulsation damper [3]
B = bladder top-removable
E = bladder with foam filling
DA = bladder integrity system, industry model (others on request)
L = light weight
Combinations must be agreed with HYDAC.

Nominal volume [l]

Fluid connection
A = standard connection, thread with internal seal face
F = flange connection
C = valve mounting with screws on underside
E = sealing surfaces on front interface (e.g. on thread M50x1.5 - valve)
G = male thread
S = special connection, to customer specification

Gas side
1 = standard design (see section 2.1.11)
2 = back-up version [4]
3 = gas valve 7/8-14UNF with M8 internal thread
4 = gas valve 7/8-14UNF with gas valve connection 5/8-18UNF
5 = gas valve M50x1.5 in accumulators smaller than 50 l
6 = 7/8-14UNF gas valve
7 = M28x1.5 gas valve
8 = M16x1.5 gas valve (with M14x1.5 bore in gas valve)
9 = special gas valve, to customer specification

Material code
dependent on operating medium
standard model = 112 for mineral oils
others on request

Fluid connection
1 = carbon steel
2 = high tensile steel
3 = stainless steel [2]
6 = low temperature steel

Accumulator shell
0 = plastic coated (internally)
1 = carbon steel
2 = chemically nickel-plated (internal coating)
4 = stainless steel [2]
6 = low temperature steel

Accumulator bladder [1]
2 = NBR [5]
3 = ECO
4 = IIR
5 = NBR [5]
6 = FKM
7 = other
9 = NBR [5]

Certification code
U = European Pressure Equipment Directive (PED)

Permitted operating pressure [bar]

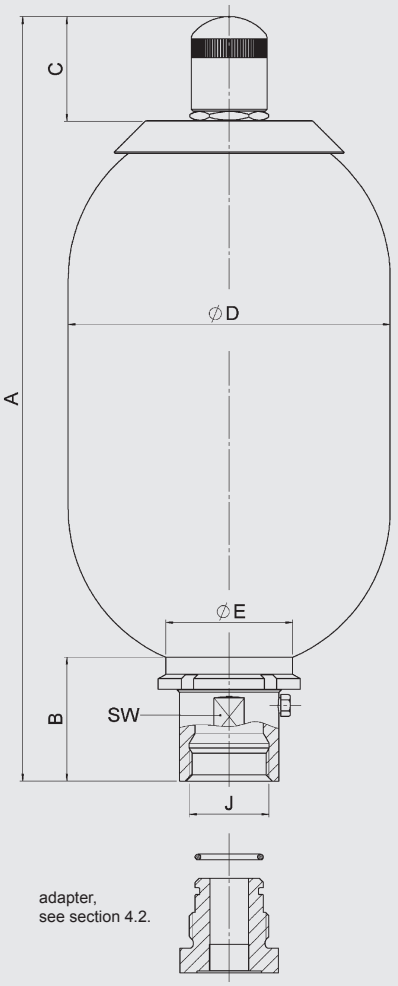
Connection, fluid side
Thread, codes for fluid connections: A, C, E, G
A = thread to ISO 228 (BSP)
B = thread to DIN13 or ISO 965/1 (metric)
C = thread to ANSI B1.1 (UN..-2B seal SAE J 514)
D = thread to ANSI B1.20.1 (NPT)
S = special thread, to customer specification
Flange, codes for fluid connection: F
A = EN 1092-1 welding neck flange
B = flange ASME B16.5
C = SAE flange 3000 psi
D = SAE flange 6000 psi
S = special flange, to customer specification

Pre-charge pressure p_0 [bar]) at 20 °C, must be stated clearly, if required!

[1] when ordering a replacement bladder, state diameter of the smaller shell port
[2] dependent on type and pressure range
[3] see catalogue section Hydraulic Dampers, No. 3.701
[4] see catalogue section Hydraulic accumulators with back-up nitrogen bottles, No. 3.553
[5] observe temperate ranges, see section 2.1.

3. DIMENSIONS AND SPARE PARTS

3.1. DIMENSIONS



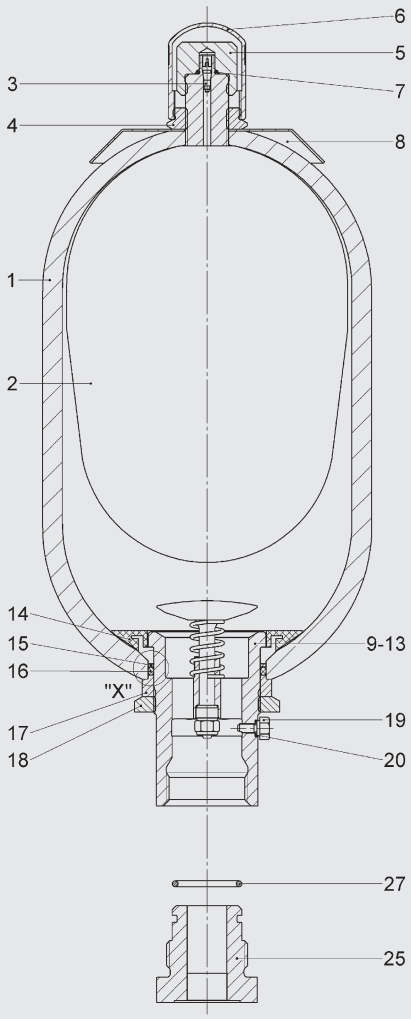
NBR, carbon steel

Nominal volume	Series	Max. operating pressure				Eff. gas volume	A max.	W	C	Ø D max.	J Thread	Ø E	SW	Q [1]	Weight
		Certificate code (AKZ) U		Certificate code (AKZ) S											
[l]		[bar]	Part no.	[bar]	Part no.	[l]	[mm]	[mm]	[mm]	[mm]	ISO 228	[mm]	[mm]	[l/s]	[kg]
0.5	SB400	400	3047163	–	–	0.5	270	57	33.5	96	G 3/4	50	32	4	4
1	SB330	330	3047162	–	–	1	316	57	56	115	G 3/4	50	32	4	7
	SB550	550	3110531	–	–		343	67		123	G 1	67	45	6	10
2.5	SB330	330	3047165	–	–	2.4	528	64	56	115	G 1 1/4	67	50	10	11
	SB550	550	3068916	–	–	2.5	550	67		123	G 1		45	6	14
4	SB330	330	3047166	–	–	3.7	412	65	56	170	G 1 1/4	67	50	10	15
	SB400	400	3017905	–	–										
5	SB550	550	3090654	–	–	4.9	876	64	56	123	G 1	67	45	6	17
6	SB330	330	3047168	–	–	5.7	534	65	56	170	G 1 1/4	67	50	10	18
10 [2]	SB330	330	3047170	–	–	9.3	810	65	56	170	G 1 1/4	67	50	10	31
10	SB330	330	3047172	262	3141237	9.3	582	101	56	229	G 2	100	70	15	33
	SB330N		3156632	–	–									25	34
	SB330H		3079081	–	–	9	617	136			G 2 1/2	125	90	30	38
	SB400	400	3107393	–	–	9.3	578	101		234	G 2	100	70	15	41
	SB500	500	3130252	–	–	8.8	598		69	241					46
	SB600	–	–	345	332265										
13	SB330	330	3047173	–	–	12	695	101	56	229	G 2	100	70	15	46
	SB330N		–	–	–									25	47
	SB330H		–	–	–		730	136			G 2 1/2	125	90	30	45
	SB400	400	–	–	–		695	101		234	G 2	100	70	15	49
20	SB330	330	3047174	262	3117153	18.4	895	101	56	229	G 2	100	70	15	49
	SB330N		3162982	–	–									25	
	SB330H		3092659	–	–	17.5	930	136			G 2 1/2	125	90	30	62
	SB400	400	3115007	–	–	18.4	895	101		234	G 2	100	70	15	71
	SB500	500	3118156	–	–	17	913		69	241		110	75		77
	SB600	–	–	345	332266										
24	SB330	330	3047175	–	–	23.6	1060	101	56	229	G 2	100	70	15	72
	SB330N		–	–	–									25	73
	SB330H		–	–	–	24	1095	136			G 2 1/2	125	90	30	76
32	SB330	330	3047176	262	3117154	33.9	1410	101	56	229	G 2	100	70	15	80
	SB330N		3220899	–	–									25	81
	SB330H		3059515	–	–	32.5	1445	136			G 2 1/2	125	90	30	98
	SB400	400	3125141	290	–	33.9	1410	101		234	G 2	100	70	15	104
	SB500	500	3760577	–	–	33.5	1423		69	241		110	75		112
	SB600	–	–	345	332267										
50	SB330	330	3047177	262	362904	47.5	1933	101	69	229	G 2	100	70	15	114
	SB330N		3185604	–	–									25	115
	SB330H		3089605	–	–		1968	136			G 2 1/2	125	90	30	128
	SB400	400	3114662	–	–		1933	101		234	G 2	100	70	15	137
	SB500	500	3130253	–	–	48.3				241			75		167
	SB600	–	–	345	332268										
60	SB330	330	3341217	–	–	60	1210	138	69	360	G 2 1/2	125	90	30	160
80	SB330	330	–	–	–	85	1460	138	69	360	G 2 1/2	125	90	30	200
100	SB330	330	3098489	–	–	105	1710	138	69	360	G 2 1/2	125	90	30	234
130	SB330	330	–	–	–	133	2030	138	69	360	G 2 1/2	125	90	30	283
160	SB330	330	–	–	–	170	2059	137	69	410	G 2 1/2	125	90	30	345
200	SB330	330	–	–	–	201	2359	137	69	410	G 2 1/2	125	90	30	403

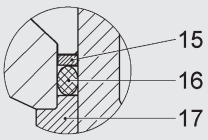
[1] Q = max. flow rate of the operating fluid under optimum conditions
[2] slimline version, for confined installation spaces

3.2. SPARE PARTS

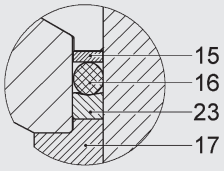
SB330/400/500/550/600
SB330H / SB330N



Detail “X”
SB330/400 – 0.5 ... 6 l
SB330 – 10 l slimline version



SB330/400/500/600 – 10 ... 50 l
SB330 - 60 ... 200 l
SB330H/N – 10 ... 50 l
SB550 – 1 ... 5 l



Description	Item
Bladder assembly [1] consisting of:	
Bladder	2
Gas valve insert*	3
Lock nut	4
Seal cap	5
Protective cap	6
O-ring	7
Seal kit consisting of:	
O-ring	7
Washer	15
O-ring	16
Vent screw	19
Support ring	23
O-ring	27
Repair kit [1] consisting of:	
Bladder assembly (see above)	
Seal kit (see above)	
Oil valve assembly consisting of:	
Valve	9-13
Anti-extrusion ring*	14
Washer	15
O-ring	16
Spacer	17
Lock nut	18
Vent screw	19
Support ring	23

* available separately
[1] when ordering, please state diameter of the smaller shell port
Accumulator shell (item 1) and company label (item 8) not available as a spare part
Vent screw (item 19) for NBR/carbon steel: seal ring (item 20) included
Adapter (item 25) incl. O-ring (item 27) available as an accessory, section 4.

SB330/400
NBR, carbon steel
standard gas valve

Volume [l]	Bladder assembly	Seal kit	Repair kit
0.5	365263	353606	2128169 [2]
1	237624		2106261
2.5	236171	353609	2106200
4	236046		2106204
5	240917		2106208
6	2112097		2112100
10*	2127255 [1]		3117512 [1]
10	236088	353621	2106212
13	376249		2106216
20	236089		2106220
24	376253		2106224
32	235335		2106228
50	235290		2106252
60	3364274	3102043 [1]	3117513
80	3364312		3117514
100	3127313		3117515
130	3201384		3117516
160	3184769		3117517
200	3461300		3117558

Volume [l]	Oil valve assembly	Anti-extrusion ring	Gas valve insert
0.5	2102355	2105411	632865
1			
2.5	236045	2105431	
4	238523	2105451	
5	236045	2105431	
6	238523	2105451	
10*			
10	352572	2105491	
13			
20			
24			
32			
50			
60	3273734	3102326	
80			
100			
130			
160			
200			

* slimline version, for confined installation spaces
[1] only for SB330
[2] only for SB400
others on request

When replacing seals and/or bladders, please read the Instructions for Assembly and Repair (No. 3.201.M).

4. ACCESSORIES FOR BLADDER ACCUMULATORS

4.1. ADAPTERS (GAS SIDE)

The adapters shown below are available for standard connections on bladder accumulators and must be specified separately in the order.

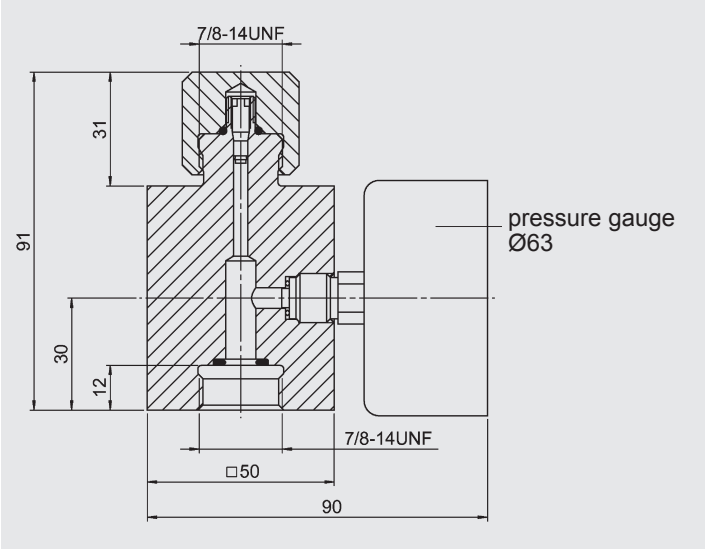
4.1.1 **Adapter for safety devices**

Adapter for connecting safety devices, such as burst disc or temperature fuse, see brochure section:

- Safety Equipment for Hydraulic Accumulators No. 3.552

4.1.2 **Pressure gauge model**

Gas-side connection on the bladder accumulator for permanent monitoring of the pre-charge pressure

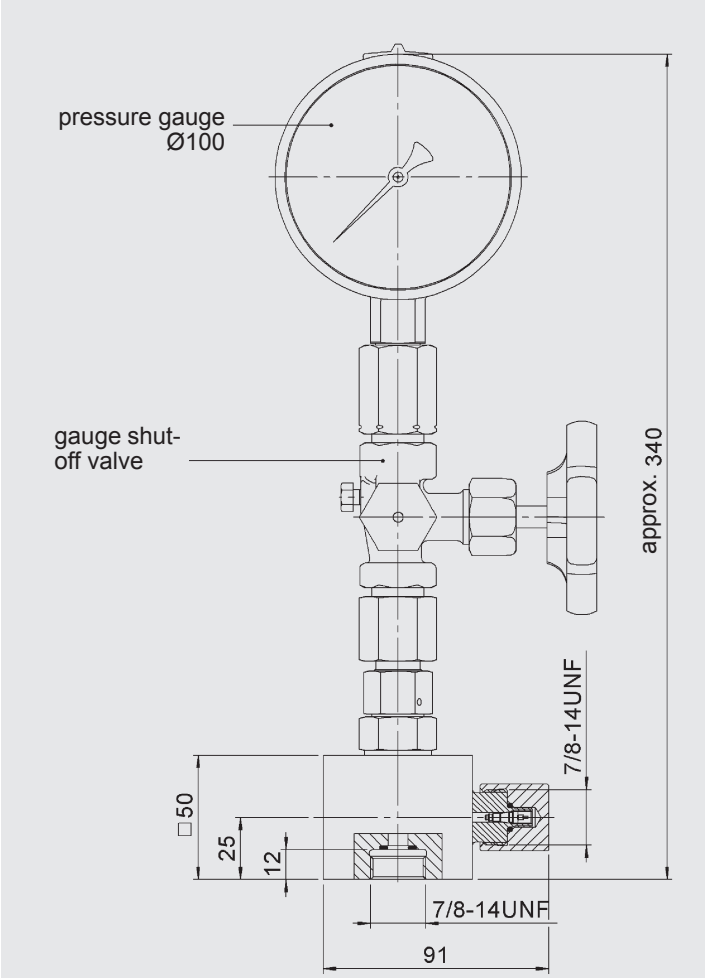


Gauge indication range	Pressure gauge Part no.	Adapter* assembly Part no.
–	–	366621
0 - 10 bar	614420	2108416
0 - 60 bar	606886	3093386
0 - 100 bar	606887	2104778
0 - 160 bar	606888	3032348
0 - 250 bar	606889	2100217
0 - 400 bar	606890	2102117

* p_{max} = 400 bar

4.1.3 **Pressure gauge model with shut-off valve**

Gas side connection on the bladder accumulator for permanent monitoring of the pre-charge pressure with shut-off option.



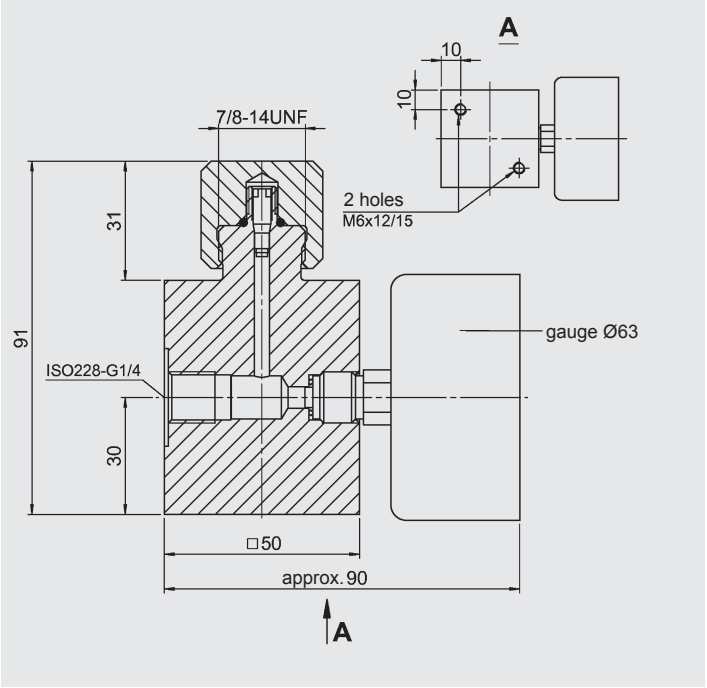
Gauge indication range	Pressure gauge Part no.	Adapter* assembly Part no.
–	–	2103381
0 - 25 bar	617928	3784725
0 - 60 bar	606771	2110059
0 - 100 bar	606772	3139314
0 - 160 bar	606773	3202970
0 - 250 bar	606774	3194154
0 - 400 bar	606775	2103226

* p_{max} = 400 bar

4.1.4 **Remote monitoring of the pre-charge pressure**

To monitor the pre-charge pressure in hydraulic accumulators remotely, gas-side adapters with pressure gauge and mounting holes are available.

In order to connect these adapters directly to the hydraulic accumulator using appropriate lines, accumulator connectors are also available for connection at the top (see figure 1) or for side-connection (see figure 2).



Gauge indication range	Pressure gauge Part no.	Adapter* assembly Part no.
–	–	3037666
0 - 10 bar	614420	3095818
0 - 60 bar	606886	3095819
0 - 100 bar	606887	3095820
0 - 160 bar	606888	3095821
0 - 250 bar	606889	3095822
0 - 400 bar	606890	3095823

* p_{max} = 400 bar

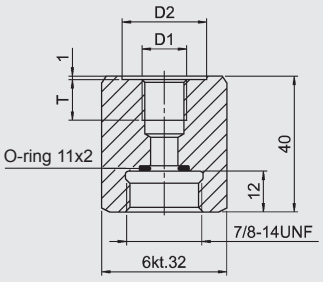


Figure 1

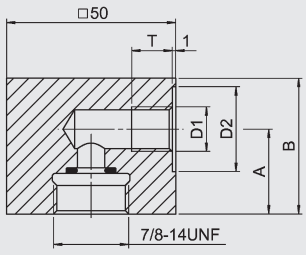


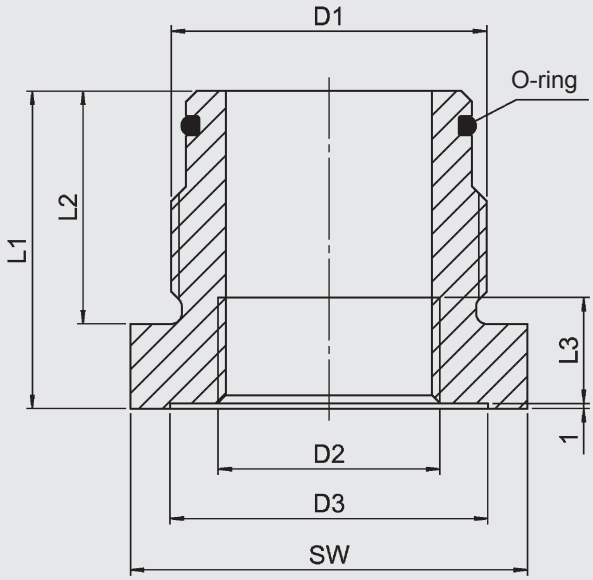
Figure 2

D1 Threaded connection	D2 [mm]	T [mm]	A [mm]	B [mm]	Adapter* assembly Part no.	Figure
ISO 228 - G 1/4	25	14	-	-	2109481	1
			25	40	2102042	2
ISO 228 - G 3/8	28		-	-	2109483	1
			25	40	366607	2
ISO 228 - G 1/2	34	16	-	-	2110636	1
			31	55	366608	2

* p_{max} = 400 bar

4.2. ADAPTERS FOR STANDARD BLADDER ACCUMULATOR (FLUID SIDE)

to connect the bladder accumulator to threaded pipe fittings. These are available separately.



D1 Accum. conn.* ISO 228 - BSP	D2 ISO 228 - BSP	D3 [mm]	L1 [mm]	L2 [mm]	L3 [mm]	SW [mm]	O-ring [mm]	Part no. NBR/ Carbon steel
G 3/4	G 3/8	28	55	28	12	32	17x3	2104346
	G 1/2		60		14	36		2104348
G 1 1/4	G 3/8	28	50	37	12	46	30x3	2116345
	G 1/2	34			14			2105232
	G 3/4	44			16			2104384
	G 1	50	67		18	65		2110124
G 2	G 1/2	34	60	44	14	65	48x3	2104853
	G 3/4	44			16			2104849
	G 1	50			18			2124831
	G 1 1/4	60			20			2107113
	G 1 1/2	68	80		22	70		2105905
G 2 1/2	G 1 1/4	60	66	50	20	80	62x4	2127406
	G 1 1/2	68			22			3243831
	G 2	96	88		27	100		2113403

* others on request

5. NOTE

The information in this brochure relates to the operating conditions and fields of application described. For fields of application and operating conditions not described, please contact the relevant technical department. Subject to technical modifications.

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