Bladder Accumulators
Standard

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.

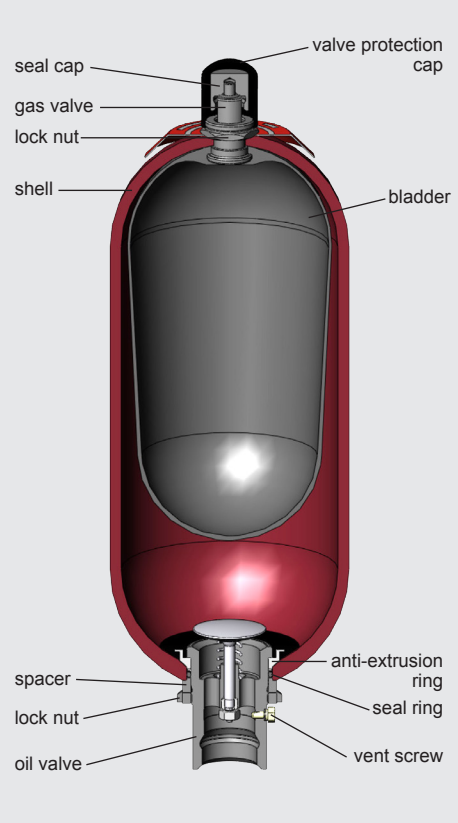
A bladder accumulator consists of a fluid section and a gas section with the bladder acting as the gas-proof screen. The fluid around the bladder is connected to the hydraulic circuit so that the bladder accumulator draws in fluid when the pressure increases and the gas is compressed.
When the pressure 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**
  The HYDAC standard bladder accumulators consists 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 SB330H, are high performance accumulators with a flow rate of up to 30 l/s. The fluid connection is enlarged to allow higher flow rates.

1.3. BLADDER MATERIAL

The bladder material must be selected in accordance with the particular operating fluid 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 in the elastomer. 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 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 volume and the maximum permitted flow rate of the operating fluid are reduced.

1.6. TYPE OF INSTALLATION

By using an appropriate adapter, HYDAC 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 accumulator supports or the HYDAC accumulator installation set.

See catalogue sections:

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

2. TECHNICAL SPECIFICATIONS

2.1. EXPLANATORY NOTES

2.1.1 **Operating pressure**

see tables in section 3.
(may differ from nominal pressure for foreign test certificates)

2.1.2 **Nominal volume**

see tables in section 3.

2.1.3 **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.

2.1.4 **Effective fluid volume**

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

2.1.5 **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.

2.1.6 **Operating temperature and operating fluid**

The permitted operating temperature of a bladder accumulator is dependent on the application limits of the metal materials and the bladder. Outside this temperature range, special material combinations must be used. The operating fluid must also be taken into account. The following table shows the standard selection of elastomer materials with temperature range and a rough overview of resistant and non-resistant fluids:

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-resistant fluids of the groups HFA, HFB, HFC ● Synthetic ester (HEES) ● Water ● Sea water	● Aromatic hydrocarbons ● Chlorinated hydrocarbons (HFD-S) ● Amines and ketones ● Hydraulic fluids of 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 of the group HFB ● Synthetic ester (HEES) ● Water ● Sea water	● Aromatic hydrocarbons ● Chlorinated hydrocarbons (HFD-S) ● Amines and ketones ● Hydraulic fluids of the group HFD-R ● Flame-resistant fluids of the groups HFA and HFC ● Fuels
IIR	Butyl rubber	4	-50 °C ... +100 °C	● Hydraulic fluids of the group HFD-R ● Flame-resistant fluids of the group HFC ● Water	● Mineral oils and mineral greases ● Synthetic ester (HEES) ● Skydrol and HyJet IV ● Aliphatic, chlorinated and aromatic hydrocarbons ● Fuels
FKM	Fluorine rubber	6	-10 °C ... +150 °C	● Mineral oil (HL, HLP) ● Hydraulic fluids of the group HFD ● Synthetic ester (HEES) ● Fuels ● Aromatic hydrocarbons ● Inorganic acids	● Amines and ketones ● Ammonia ● Skydrol and HyJet IV ● Steam

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

[2] others available on request

2.1.7 Gas charging

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

In principle, the accumulator may only be charged with nitrogen class 4.0, filtered to < 3 µm.
If other gases are to be used, please contact HYDAC for advice.

2.1.8 Limits for gas pre-charge pressure

$p_0 \leq 0.9 \bullet p1$

with a permitted pressure ratio of:
$p_2 : p_0 \leq 4 : 1$
p_2 = max. operating pressure
p_0 = pre-charge pressure

2.1.9 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.

Please read the operating manual! No. 3.201.BA

NOTE:
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

2.1.10 Gas side connection Standard

Series	Volume [l]	Gas valve type
SB330 / SB400	< 1	5/8-18UNF
	< 50	7/8-14UNF
	≥ 50	M50x1.5 / 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 = increased flow, standard oil valve dimensions
A = shock absorber
P = pulsation dampfer [3]
B = bladder top-repairable
E = bladder with foam filling
D = bladder integrity system
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 2.1.10)
2 = back-up version [4]
3 = gas valve 7/8-14UNF with M8 female 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

Bladder accumulator [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 DIN 13 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 port: 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 smaller shell port
[2] dependent on type and pressure level
[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 temperature ranges, see section 2.1.

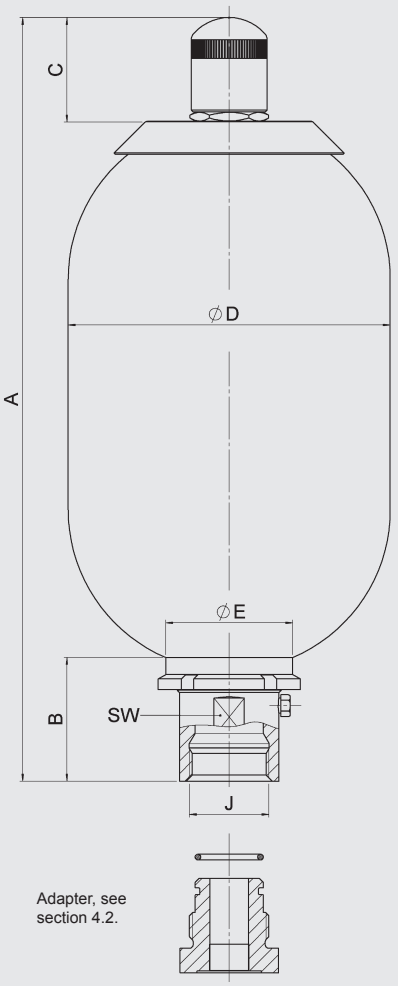
3. DIMENSIONS AND SPARE PARTS

3.1. DIMENSIONS

Nominal volume [l]	Type of valve, fluid side	Max. operating pressure (PED) [bar]	Eff. gas volume [l]	Weight approx. [kg]	A max. [mm]	B [mm]	C [mm]	Ø D max. [mm]	J thread ISO 228	Ø E [mm]	SW [mm]	Q [1] [l/s]
0.5	Standard	400	0.5	4	270	57	33.5	96	G 3/4	50	32	4
1		330	1	7	316		56	115				
		550		10	343	67		123	G 1	67	45	6
2.5		330	2.4	11	528	64		115	G 1 1/4		50	10
		550	2.5	14	550	67		123	G 1		45	6
4		330	3.7	15	412	65		170	G 1 1/4		50	10
		400										
5		550	4.9	17	876	64		123	G 1		45	6
6		330	5.7	18	534	65		170	G 1 1/4		50	10
10 [2]		330	9.3	31	810				G 1 1/4			
10	Standard	330	9.3	33	582	101	56	229	G 2	100	70	15
	N			34								25
	H		9	38	617	136			G 2 1/2	125	90	30
	Standard	400	9.3	41	578	101		234	G 2	100	70	15
		500	8.8	46	598		69	241				
13	Standard	330	12	46	695	101	56	229	G 2	100	70	15
	N			47								25
	H			45	730	136			G 2 1/2	125	90	30
	Standard	400		40	695	101		234	G 2	100	70	15
20	Standard	330	18.4	49	895	101	56	229	G 2	100	70	15
	N											25
	H		17.5	62	930	136			G 2 1/2	125	90	30
	Standard	400	18.4	71	895	101		234	G 2	100	70	15
		500	17	77	913		69	241		110	75	
24	Standard	330	23.6	72	1060	101	56	229	G 2	100	70	15
	N			73								25
	H		24	76	1095	136			G 2 1/2	125	90	30
32	Standard	330	33.9	80	1410	101	56	229	G 2	100	70	15
	N			81								25
	H		32.5	98	1445	136			G 2 1/2	125	90	30
	Standard	400	33.9	112	1410	101		234	G 2	100	70	15
		500	33.5		1423		69	241		110	75	
50	Standard	330	47.5	114	1933	101	69	229	G 2	100	70	15
	N			115								25
	H			128	1968	136			G 2 1/2	125	90	30
	Standard	400		137	1933	101		234	G 2	100	70	15
		500	48.3	167				241			75	
60	Standard	330	60	160	1210	138	69	360	G 2 1/2	125	90	30
80			85	200	1460							
100			105	234	1710							
130			133	283	2030							
160			170	345	2059	137		410				
200			201	403	2359							

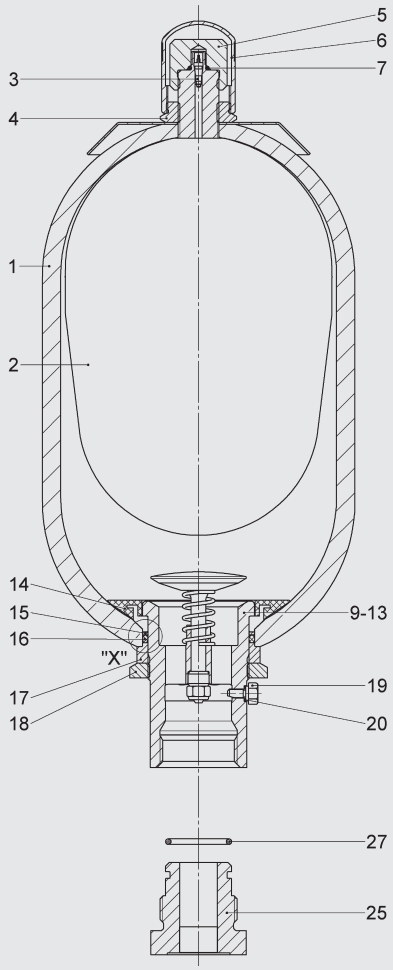
[1] Q =max. flow rate of the operating fluid under optimum conditions
[2] slimline version, for confined installation spaces

Dimensions

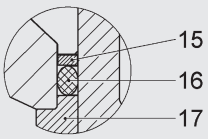


3.2. SPARE PARTS

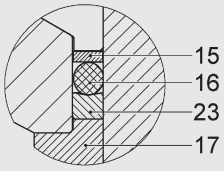
SB330/400/440/500/550
SB330H / SB330N



Detail "X"
SB330/400 – 0.5 ... 10 l



SB300/400/500 – 10 ... 200 l and
SB300H – 10 ... 50 l
SB550 – 1 ... 5 l



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

* available separately
[1] when ordering, please state diameter of the smaller shell port
Item 1 not available as a spare part
Item 19 for NBR/carbon steel: seal ring (item 20) included
Adapter (item 25) must be ordered as an accessory, see section 4.

SB300/400
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		3117512
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

* 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.

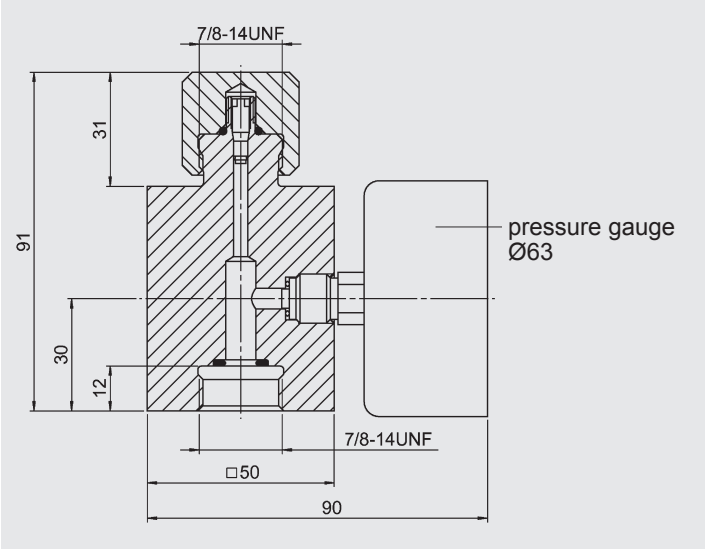
4.1.1 **Adapters for safety equipment**

Adapters for connecting of safety equipment, such as bursting disc or temperature fuse, see catalogue 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

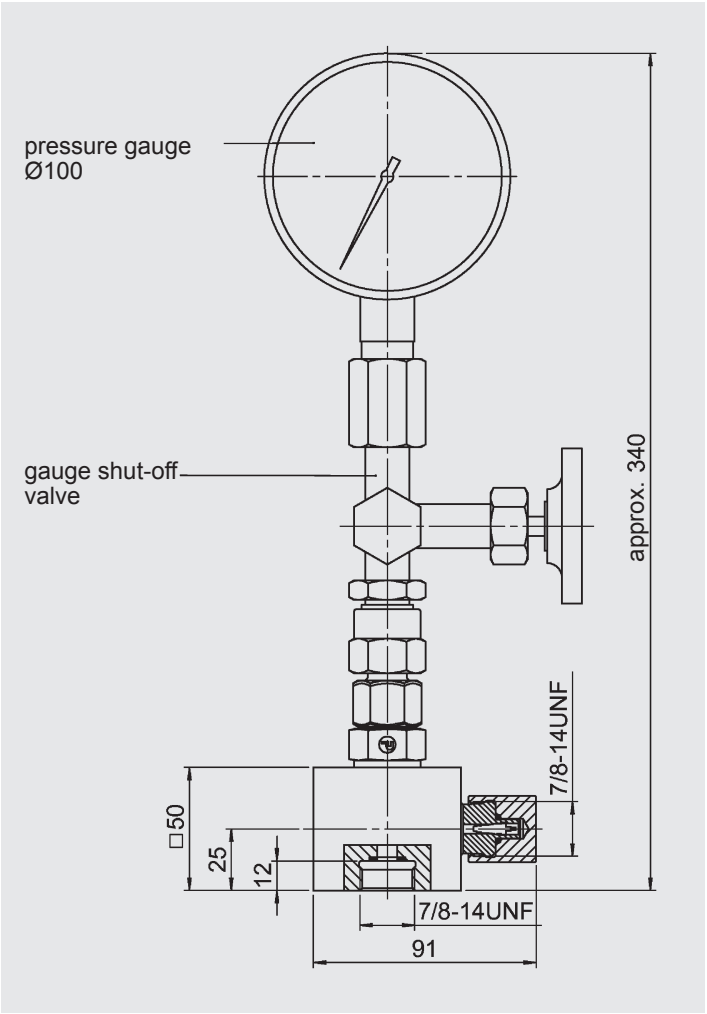


Gauge indication range	Pressure gauge Part no.	Adapter* assembly Part no.
–	–	366621
0 - 10 bar	614420	2108416
0 - 60 bar	606886	3093386
0 - 100 bar	606887	2104778
0 - 160 bar	606888	3032348
0 - 250 bar	606889	2100217
0 - 400 bar	606890	2102117

* 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.



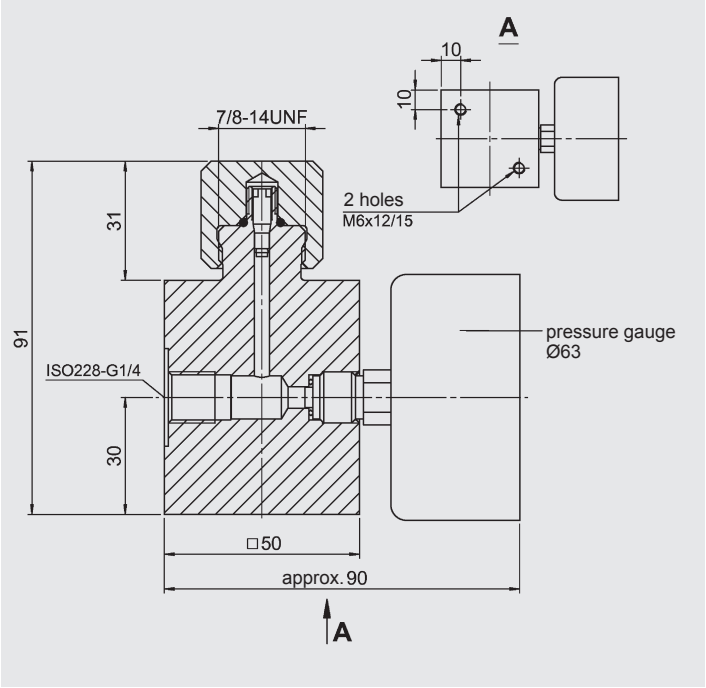
Gauge indication range	Pressure gauge Part no.	Adapter* assembly Part no.
–	–	2103381
0 - 25 bar	617928	3784725
0 - 60 bar	606771	2110059
0 - 100 bar	606772	3139314
0 - 160 bar	606773	3202970
0 - 250 bar	606774	3194154
0 - 400 bar	606775	2103226

* 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 with the hydraulic accumulator using appropriate lines, accumulator adapters are also available for connection at the top (see diagram 1) or for side-connection (see diagram 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

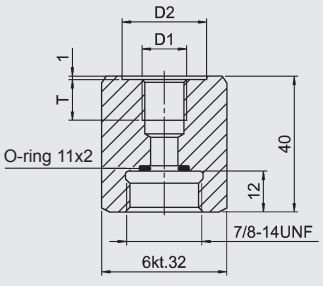


Diagram 1

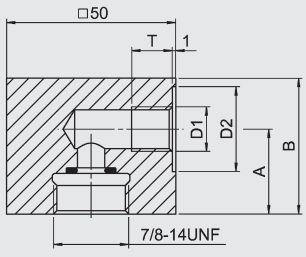


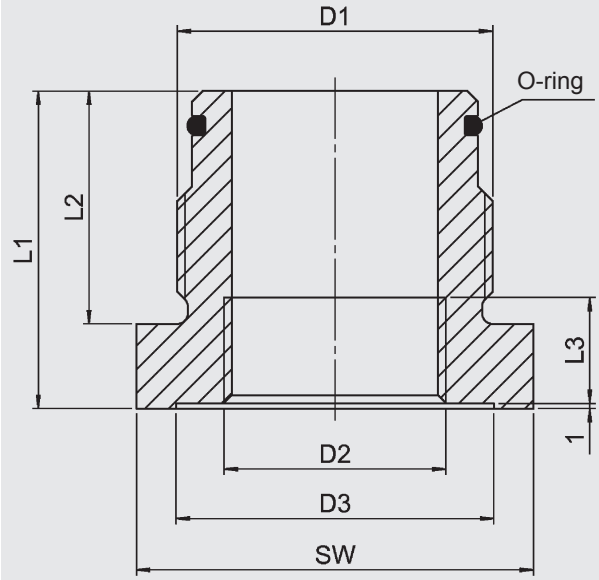
Diagram 2

D1 Threaded connection	D2 [mm]	T [mm]	A [mm]	B [mm]	Adapter* complete Part no.	Diag.
ISO228- G 1/4	25	14	-	-	2109481	1
			25	40	2102042	2
ISO228- G 3/8	28		-	-	2109483	1
			25	40	366607	2
ISO228- G 1/2	34	16	-	-	2110636	1
			31	55	366608	2

* p_{max} = 400 bar

4.2. ADAPTERS FOR STANDARD BLADDER ACCUMULATORS (FLUID SIDE)

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



D1 Accum. conn.* ISO228-BSP	D2 ISO228-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 3/4	44	60	44	16	65	48x3	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 applications described. For applications and operating conditions not described, please contact the relevant technical department. Subject to technical modifications.

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