

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.

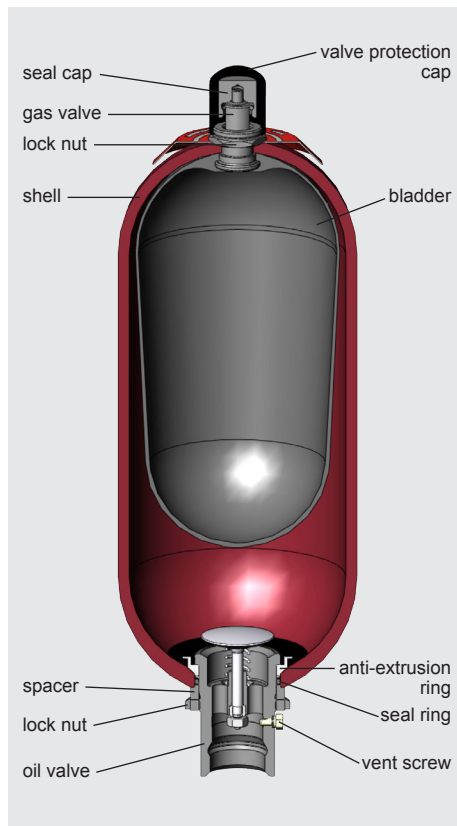
HYDAC bladder accumulators can be used in a wide variety of applications, some of which are listed below:

- 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

HYDAC standard bladder accumulators consist of the pressure vessel, the flexible bladder with gas valve and the hydraulic connection with check valve. The seamless pressure vessel is manufactured from high tensile steel.

● Bladder accumulator SB 330N

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 following elastomers are available as standard:

- NBR (acrylonitrile butadiene rubber, Perbunan),
- IIR (butyl rubber),
- FKM (fluoro rubber, Vitor®),
- ECO (ethylene oxide epichlorohydrin rubber).

The material must be selected according to the particular operating fluid and temperature.

When choosing the elastomer, allowances must be made for the fact that the gas can cool down to below the permitted elastomer temperature if there are adverse discharge conditions (high pressure ratio p_2/p_0 , high discharging velocity). 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 (may differ from nominal pressure for foreign test certificates)

2.1.2 Nominal volume
see tables

2.1.3 Effective gas volume
see tables
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 Fluids
The following sealing and bladder materials are suitable for the fluids listed below.

Material	Fluids
NBR	Mineral oils (HL, HLP, HFA, HFB, HFC), water
ECO	Mineral oil
IIR	Phosphate ester, water
FKM	Chlorinated hydrocarbons, petrol

Other fluids on request

2.1.7 Permitted operating temperatures
The permitted operating temperature of a bladder accumulator is dependent on the application limits of the metal materials and the bladder.

Outside these temperatures, special material combinations must be used. The following table shows the correlation between bladder material and application temperature.

Material	Temperature ranges
NBR20	-15 °C ... + 80 °C
NBR21	-50 °C ... + 80 °C
NBR22	-30 °C ... + 80 °C
ECO	-30 °C ... +120 °C
IIR	-55 °C ... +100 °C
FKM	-10 °C ... +150 °C

2.1.8 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.

2.1.9 Limits for gas pre-charge pressure

$$p_0 \leq 0.9 \cdot p_1$$

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
AU Australia	F ¹⁾
BY Belarus	A12
CE Canada	S1 ¹⁾
CH Switzerland	U
CN China	A9
HK Hong Kong	A9
IS Iceland	U
JP Japan	P
KR Korea (Republic)	A11
NO Norway	U
NZ New Zealand	T
RU Russia	A6
TR Turkey	U
UA Ukraine	A10
US USA	S
ZA South Africa	S2

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.CE

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

2.1.11 Gas side connection Standard

Series	Volume [l]	Gas valve type
SB330 /	< 1	5/8-18UNF
SB400	< 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 dampfer³⁾

B = bladder top-repairable

E = bladder with foam filling

D = bladder integrity system

L = lightweight

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 model (see point 2.1.11)

2 = back-up model⁴⁾

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 steel²⁾

6 = low temperature steel

Accumulator shell

0 = plastic coated (internally)

1 = carbon steel

2 = chemically nickel-plated (internal coating)

4 = stainless steel²⁾

6 = low temperature steel

Accumulator bladder¹⁾

2 = NBR20

3 = ECO

4 = IIR (butyl)

5 = NBR21 (low temperature)

6 = FKM

7 = Others

9 = NBR22

Certificate code

U = PED 97/23/EC

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 connection: F

A = DIN flange

B = flange ANSI 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 spare bladder, please state diameter of the smaller shell port

²⁾ Dependent on type and pressure range

³⁾ See catalogue section Hydraulic Dampers, No. 3.701

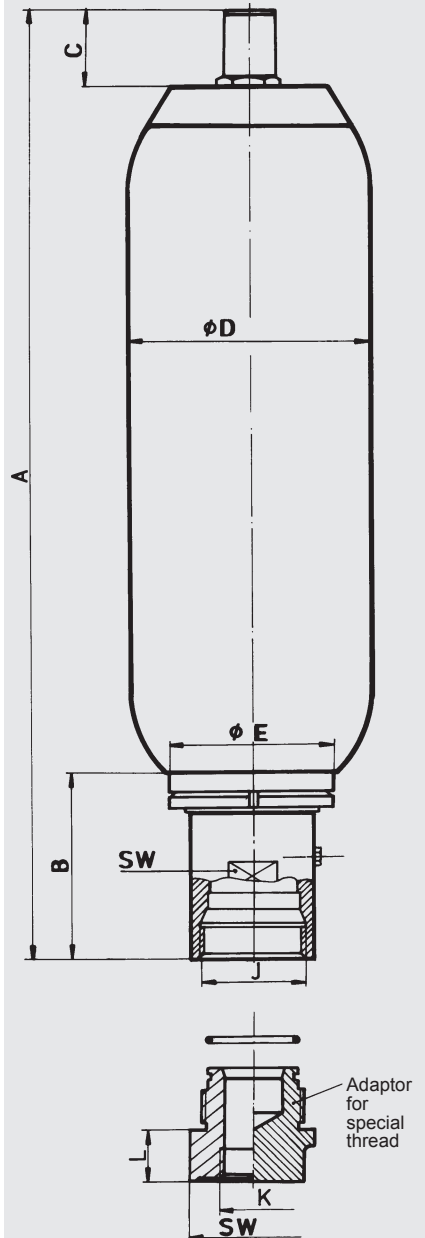
⁴⁾ See catalogue section Hydraulic accumulators with back-up nitrogen bottles, No. 3.553

3. DIMENSIONS AND SPARE PARTS

3.1. DIMENSIONS

Nominal volume	Type of valve, fluid side	Max. operating pressure (PED 97/23/EC)	Eff. gas volume	Weight approx.	A	B	C	Ø D	J	Ø E	SW	Q ¹⁾	
					max.			max.	thread				
[l]		[bar]	[l]	[kg]	[mm]	[mm]	[mm]	[mm]	ISO 228	[mm]	[mm]	[l/s]	
0.5	Standard	400	0.5	2.8	270	57	33.5	95.5	G 3/4	50	32	4	
1		330	1	4.5	302			68					118
		550		8.5	343	121	G 1		45	6			
2.5		330	2.4	10	531	63	58	118	G 1 1/4	67	50	10	
		550	2.5	550	68	121		G 1	45		6		
4		330	3.7	13.5	419	63	63	173	G 1 1/4	67	50	10	
		400			121	G 1		45	6				
5		550	4.9	23	879	68	63	121	G 1	67	45	6	
6		330	5.7	15	531	68		173	G 1 1/4		50	10	
10 ²⁾		330	9.3	25	808	63	58	229	G 1 1/4	100	70	15	
10		Standard	330	9.3	31.5	583			103		229	G 2	100
		N			25								
		H			9	34.5	618	138	G 2 1/2	125	90	30	
13		Standard	330	12	43	696	103	58	229	G 2	100	70	15
	N	25											
13	H	46	730	138	68	241	G 2	100	70	15			
	Standard	400	49	681						103	233	G 2	100
20	Standard	330	18.4	50.5	896	103	58	229	G 2	100	70	15	
	N			25									
	H			17.5	53.5	931	138	G 2 1/2	125	90	30		
	Standard			400	18.4	63.5	896	103	233	G 2	100	70	15
24	Standard	330	23.6	69	1062	103	58	229	G 2	100	70	15	
	N			25									
24	H	24	72	1097	138	68	241	G 2	100	70	15		
	Standard	400	33.9	87	1411					103	229	G 2	100
32	Standard	330	33.9	87	1411	103	58	229	G 2	100	70	15	
	N			25									
32	H	32.5	90	1446	138	68	241	G 2	100	70	15		
	Standard	400	33.9	104.5	1411					103	233	G 2	100
50	Standard	330	47.5	117.5	1931	103	58	229	G 2	100	70	15	
	N			25									
50	H	120.5	1966	138	68	241	G 2	100	70	15			
	Standard	400	142	1931						103	233	G 2	100
60	Standard	330	60	182	1206	138	68	356	G 2 1/2	125	90	30	
80				85	221								1456
100				105	255								1706
130				133	305								2026
160				170	396								2056
200				201	485								2356

Dimensions

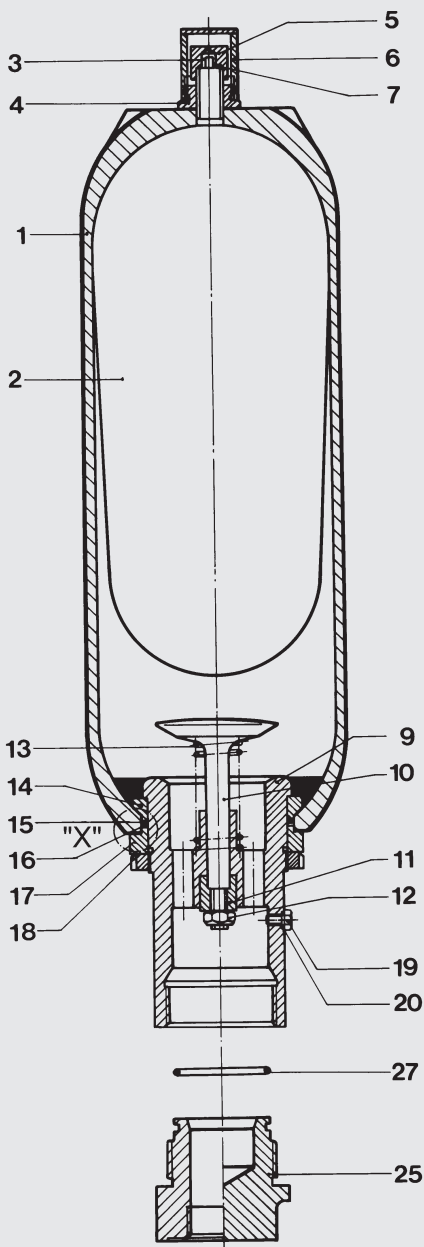


¹⁾ Q = max. flow rate of operating fluid for optimal conditions

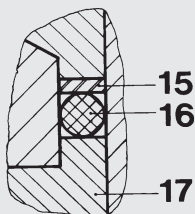
²⁾ slimline version, for confined spaces

3.2. SPARE PARTS

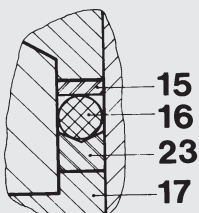
SB330/400/440/500/550
SB330H / SB330N



Detail "X"
SB330/400 – 0.5 ... 6 l



SB330/400/500 – 10 ... 200 l and
SB330H – 10 ... 200 l
SB550 – 1 ... 5 l



Designation	Item
Bladder assembly	
consisting of:	
Bladder	2
Gas valve insert*	3
Lock nut	4
Seal cap	5
Valve 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 (items 9-13)	9
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 Point 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	353621	3117512
10	236088		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 spaces

¹⁾ only for SB330

²⁾ only for SB400

others on request

When replacing seals and/or bladder, please read the instructions for assembly and repair (No. 3.201.M).

4. ACCESSORIES FOR BLADDER ACCUMULATORS

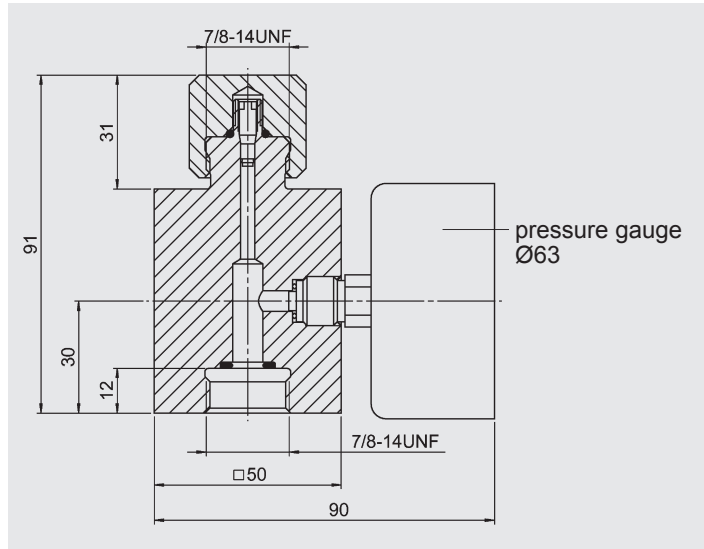
4.1. ADAPTERS (GAS SIDE)

To monitor the accumulator pre-charge pressure, HYDAC offers a selection of gas side adapters.

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

4.1.1 Pressure gauge model

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

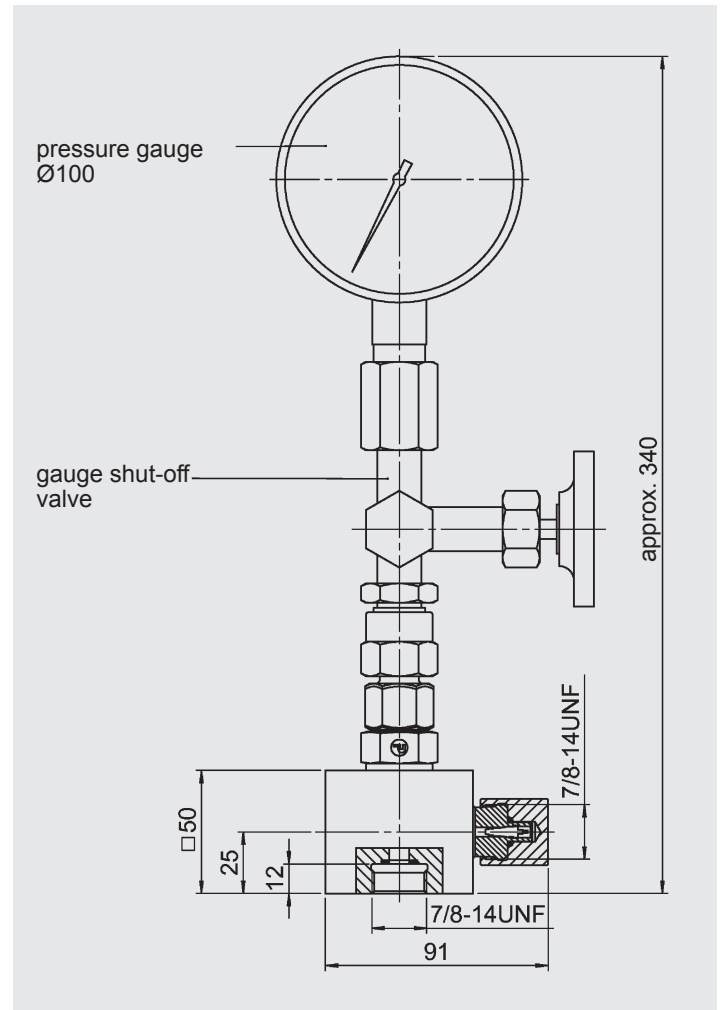


Gauge indication range	Pressure gauge Part no.	Adapter* assembly Part no.
–	–	366621
0 - 10 bar	614420	2108416
0 - 60 bar	606886	3093386
0 - 100 bar	606887	2104778
0 - 160 bar	606888	3032348
0 - 250 bar	606889	2100217
0 - 400 bar	606890	2102117

* $p_{max} = 400$ bar

4.1.2 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.

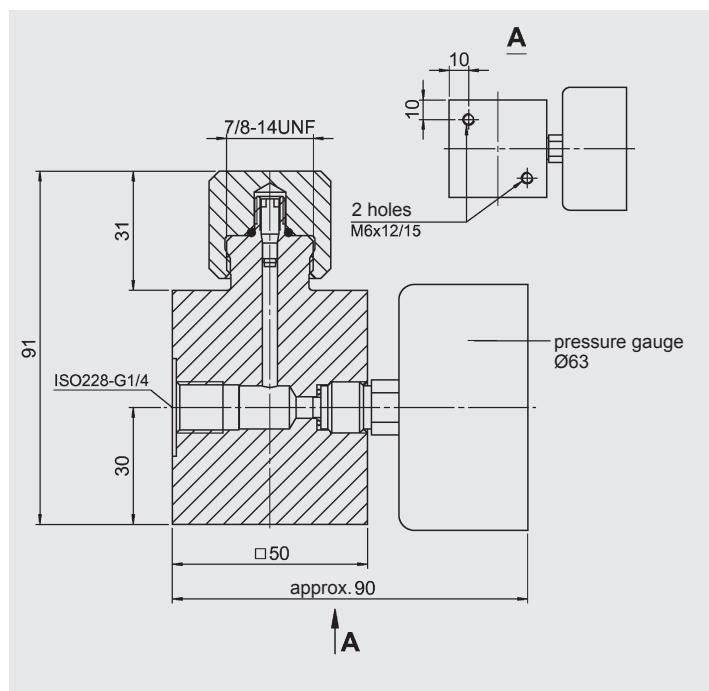


Gauge indication range	Pressure gauge Part no.	Adapter* assembly Part no.
–	–	2103381
0 - 25 bar	617928	3784725
0 - 60 bar	606771	2110059
0 - 100 bar	606772	3139314
0 - 160 bar	606773	3202970
0 - 250 bar	606774	3194154
0 - 400 bar	606775	2103226

* $p_{max} = 400$ bar

4.1.3 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

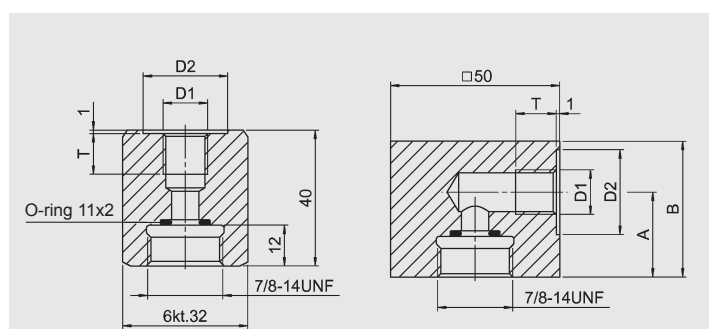


Diagram 1

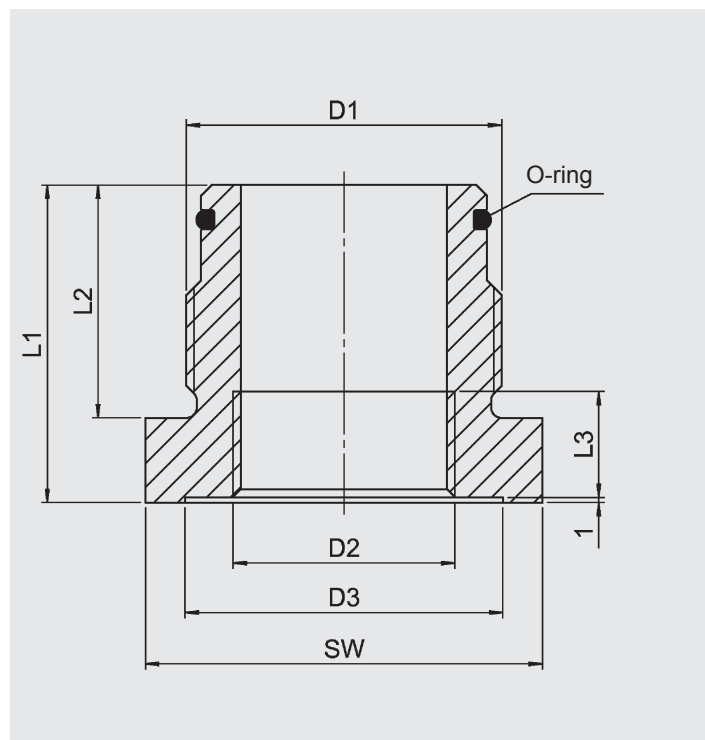
Diagram 2

D1 Threaded connection	D2 [mm]	T	Adapter assembly Part no.	Diag.
ISO228- G 1/4	25	14	2109481	1
			2102042	2
ISO228- G 3/8	28	14	2109483	1
			366607	2
ISO228- G 1/2	34	16	2110636	1
			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 [mm]	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			2104348
G 1 1/4	G 3/8	28	50	37	12	46	30x3	2116345
	G 1/2				34			14
	G 3/4	44			16			2104384
	G 1	50			18			2110124
G 2	G 3/4	44	60	44	16	65	48x3	2104849
	G 1 1/4	60			20			2107113
	G 1 1/2	68	80		22	2105905		

* 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.