

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.

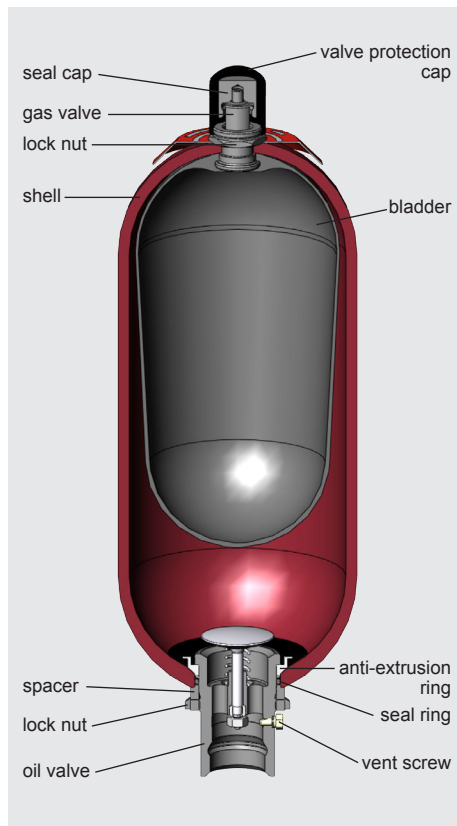
HYDAC bladder accumulators can be used in a wide variety of applications, some of which are listed below:

- 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 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 port is enlarged to allow higher flow rates.

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 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 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. 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 Working temperature and operating fluid

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 fluid must also be taken into account. The following table displays a selection of elastomer materials with temperature range and a rough overview of resistant and non-resistant fluids, on a case-by-case basis, information must be requested regarding the resistance and the resistance must be tested specifically:

| 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 | <ul style="list-style-type: none"> ● Mineral oil (HL, HLP) ● Flame-resistant fluids from the groups HFA, HFB, HFC ● Synthetic ester (HEES) ● Water ● Sea water | <ul style="list-style-type: none"> ● Aromatic hydrocarbons ● Chlorinated hydrocarbons (HFD-S) ● Amines and ketones ● Hydraulic fluids of type HFD-R ● Fuels |
| | | 5 | -50 °C ... + 50 °C | | |
| | | 9 | -30 °C ... + 80 °C | | |
| ECO | Ethylene oxide epichlorohydrin rubber | 3 | -30 °C ... +120 °C | <ul style="list-style-type: none"> ● Mineral oil (HL, HLP) ● Flame-resistant fluids from the HFB group ● Synthetic ester (HEES) ● Water ● Sea water | <ul style="list-style-type: none"> ● Aromatic hydrocarbons ● Chlorinated hydrocarbons (HFD-S) ● Amines and ketones ● Hydraulic fluids of type HFD-R ● Flame-resistant fluids from the groups HFA and HFC ● Fuels |
| IIR | Butyl rubber | 4 | -50 °C ... +100 °C | <ul style="list-style-type: none"> ● Hydraulic fluids of type HFD-R ● Flame-resistant fluids from the group HFC ● Water | <ul style="list-style-type: none"> ● Mineral oils and mineral greases ● Synthetic ester (HEES) ● Aliphatic, chlorinated and aromatic hydrocarbons ● Fuels |
| FKM | Fluorine rubber | 6 | -10 °C ... +150 °C | <ul style="list-style-type: none"> ● Mineral oil (HL, HLP) ● Hydraulic fluids of type HFD, ● Synthetic ester (HEES) ● Fuels ● Aromatic hydrocarbons ● Inorganic acids | <ul style="list-style-type: none"> ● Amines and ketones ● Ammonia ● Skydrol and HyJet IV ● Steam |

¹⁾ see section 2.2. Model code, material code, accumulator bladder

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 us for advice.

2.1.8 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

2.1.9 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.

The operating instruction must be followed!

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 damper ³⁾

B = bladder top-removable

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 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 ISO228 (BSP)

B = thread to DIN13 or ISO965/1 (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

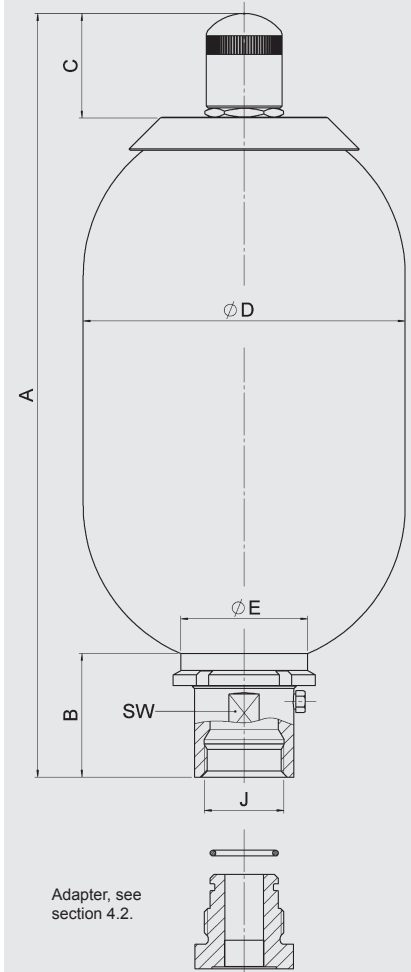
⁵⁾ observe temperature ranges, see section 2.1.

3. DIMENSIONS AND SPARE PARTS

3.1. DIMENSIONS

| Nominal volume | Type of valve, fluid side | max. operating pressure (PED) | Eff. gas volume | Weight approx. | A max. | W | C | Ø D max. | J thread | Ø E | SW | Q ¹⁾ | |
|------------------|---------------------------|-------------------------------|-----------------|----------------|--------|------|------|----------|----------|------|------|-----------------|---------|
| [l] | | [bar] | [l] | [kg] | [mm] | [mm] | [mm] | [mm] | ISO 228 | [mm] | [mm] | [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 | | | 67 | | | | | 115 |
| | | 550 | | 10 | 343 | | | | | | | | 123 |
| 2.5 | | 330 | 2.4 | 11 | 528 | 64 | 56 | 115 | G 1 1/4 | 67 | 50 | 10 | |
| | | 550 | 2.5 | 14 | 550 | | | 67 | 123 | | G 1 | 45 | 6 |
| 4 | | 330 | 3.7 | 15 | 412 | 65 | 56 | 170 | G 1 1/4 | 67 | 50 | 10 | |
| | | 400 | | | | | | | | | | | |
| 5 | | 550 | 4.9 | 17 | 876 | 64 | 56 | 123 | G 1 | 67 | 45 | 6 | |
| 6 | | 330 | 5.7 | 18 | 534 | 65 | 56 | 170 | G 1 1/4 | 67 | 50 | 10 | |
| 10 ²⁾ | | 330 | 9.3 | 31 | 810 | | | | | | | | 65 |
| 10 | | Standard | 330 | 9.3 | 33 | 582 | 101 | 56 | 229 | G 2 | 100 | 70 | 15 |
| | | N | | | 34 | | | | | | | | 25 |
| | | H | | | 9 | 38 | | | | | | | 617 |
| | Standard | 400 | 9.3 | 41 | 578 | 101 | 69 | 234 | G 2 | 100 | 70 | 15 | |
| | 500 | 8.8 | 46 | 598 | 101 | 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 |
| | Standard | 400 | | 40 | 695 | 101 | 69 | 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 |
| | Standard | 400 | 18.4 | 71 | 895 | 101 | 69 | 234 | G 2 | 100 | 70 | 15 | |
| | 500 | 17 | 77 | 913 | 101 | 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 |
| 32 | Standard | 330 | 33.9 | 80 | 1410 | 101 | 56 | 229 | G 2 | 100 | 70 | 15 | |
| | N | | | 81 | | | | | | | | 25 | |
| | H | | | 32.5 | 98 | | | | | | | 1445 | 136 |
| | Standard | 400 | 33.9 | 104 | 1410 | 101 | 69 | 234 | G 2 | 100 | 70 | 15 | |
| | 500 | 33.5 | 112 | 1423 | 101 | 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 |
| | Standard | 400 | | 137 | 1933 | 101 | 69 | 234 | G 2 | 100 | 70 | 15 | |
| | 500 | 48.3 | 167 | 1933 | 101 | 69 | 241 | 110 | | | | | 75 |
| 60 | Standard | 330 | | 60 | 160 | 1210 | 138 | 360 | G 2 1/2 | 125 | 90 | 30 | |
| 80 | | | | 85 | 200 | | | | | | | | 1460 |
| 100 | | | | 105 | 234 | | | | | | | | 1710 |
| 130 | | | | 133 | 283 | 2030 | | | | | | | |
| 160 | | | | 170 | 345 | 2059 | | | | | | | |
| 200 | | | | 201 | 403 | 2359 | | | | | | | |

DIMENSIONS

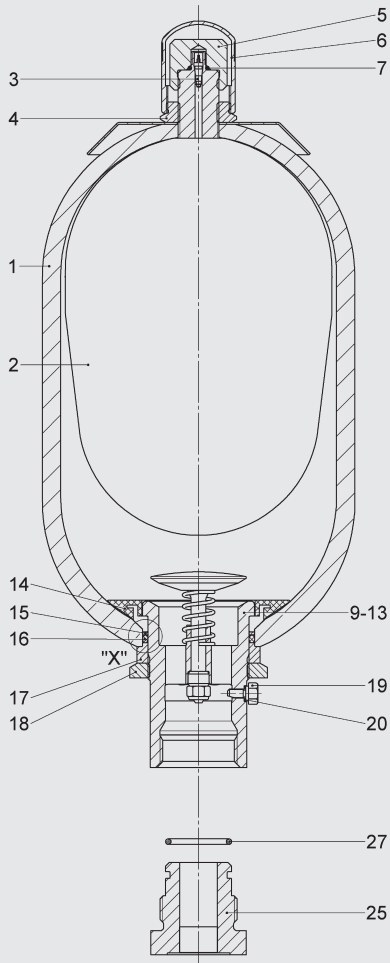


¹⁾ Q = max. flow rate of the operating fluid under optimum conditions

²⁾ slimline version, for confined installation spaces

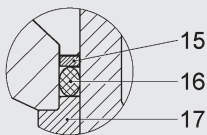
3.2. SPARE PARTS

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

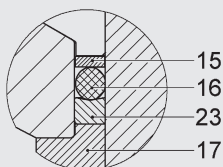


Detail "X"

SB330/400 – 0.5 to 10 l



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



| Description | Item |
|---------------------------------|------|
| Bladder assembly | |
| 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 |
| 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 | 9-13 |
| Anti-extrusion ring | 14 |
| Washer | 15 |
| O-ring | 16 |
| Spacer | 17 |
| Lock nut | 18 |
| vent screw | 19 |
| Back-up ring | 23 |

* available separately

¹⁾ when ordering, please state diameter of the smaller shell port

Accumulator shell (item 1) not available as a spare part

Air bleed screw (item 19) for NBR/carbon steel:
seal ring (item 20) included

Adapter (item 25) must be ordered as an accessory,
see 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 | 353621 | 3117512 |
| 10 | 236088 | | 2106212 |
| 13 | 376249 | | 2106216 |
| 20 | 236089 | | 2106220 |
| 24 | 376253 | | 2106224 |
| 32 | 235335 | | 2106228 |
| 50 | 235290 | | 2106252 |
| 60 | 3364274 | | 3102043 ¹⁾ |
| 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.

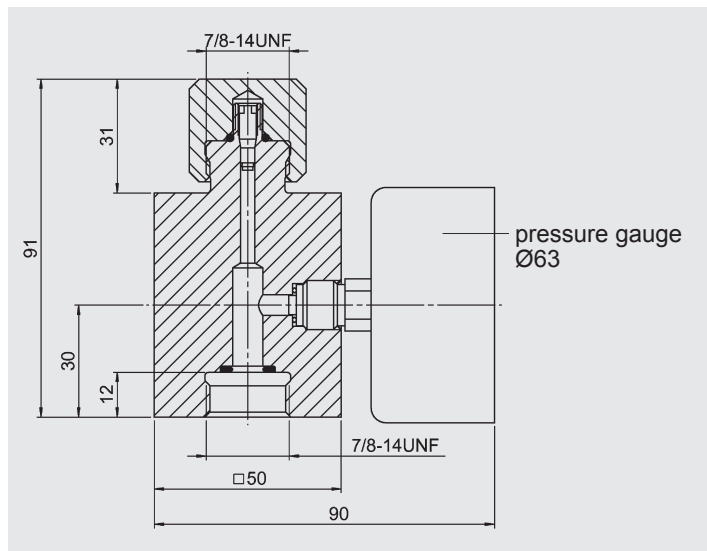
4.1.1 Adapter for safety equipment

Adapter for connecting safety equipment, such as bursting 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

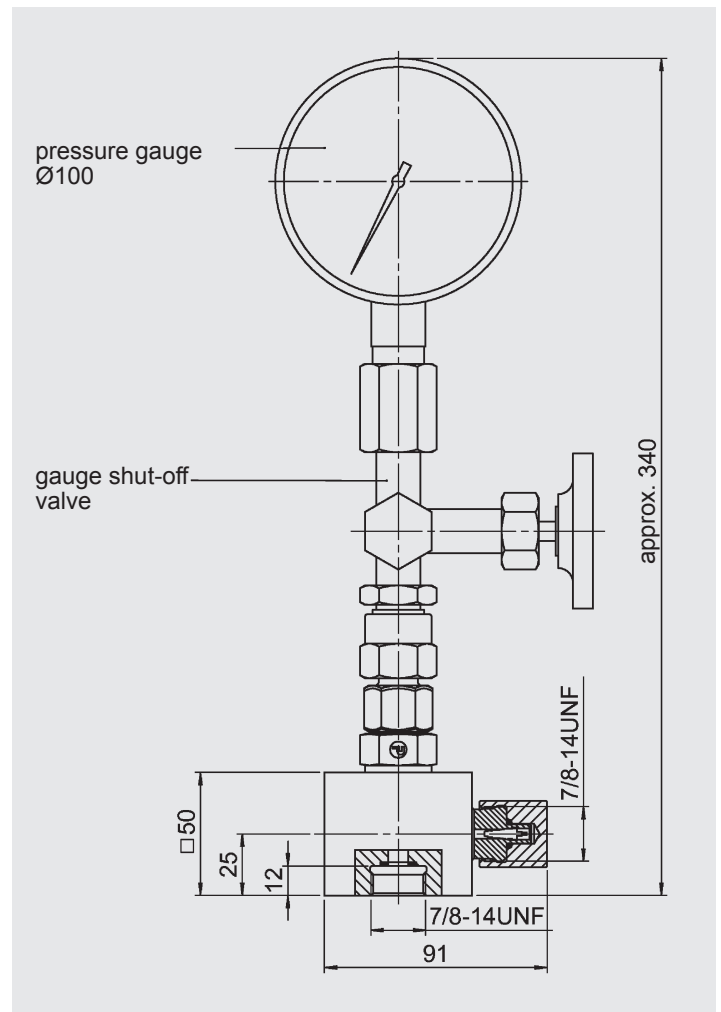


| Gauge indication range | Pressure gauge Part no. | Adapter* assembly Part no. |
|------------------------|-------------------------|----------------------------|
| – | – | 366621 |
| 0 - 10 bar | 614420 | 2108416 |
| 0 - 60 bar | 606886 | 3093386 |
| 0 - 100 bar | 606887 | 2104778 |
| 0 - 160 bar | 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.



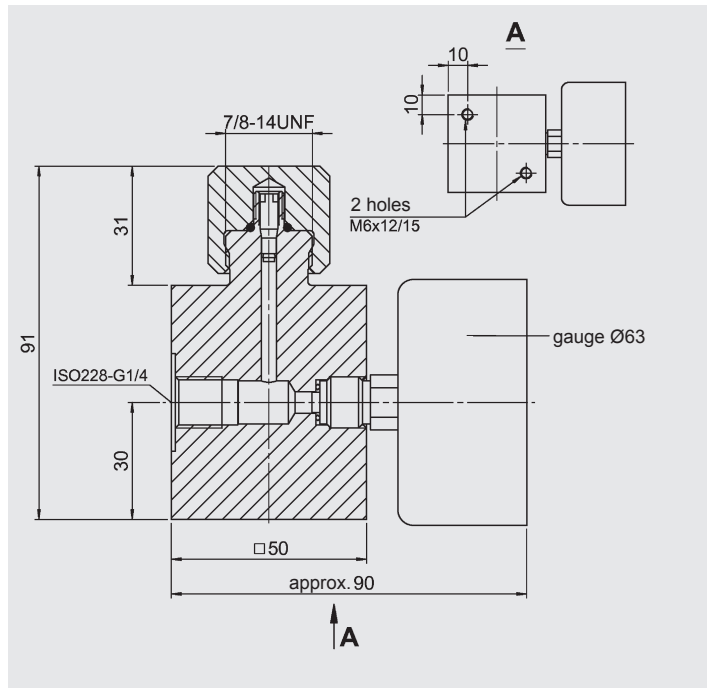
| Gauge indication range | Pressure gauge Part no. | Adapter* assembly Part no. |
|------------------------|-------------------------|----------------------------|
| – | – | 2103381 |
| 0 - 25 bar | 617928 | 3784725 |
| 0 - 60 bar | 606771 | 2110059 |
| 0 - 100 bar | 606772 | 3139314 |
| 0 - 160 bar | 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

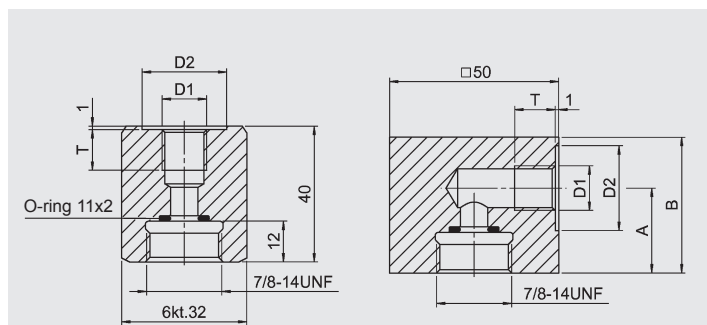


Figure 1

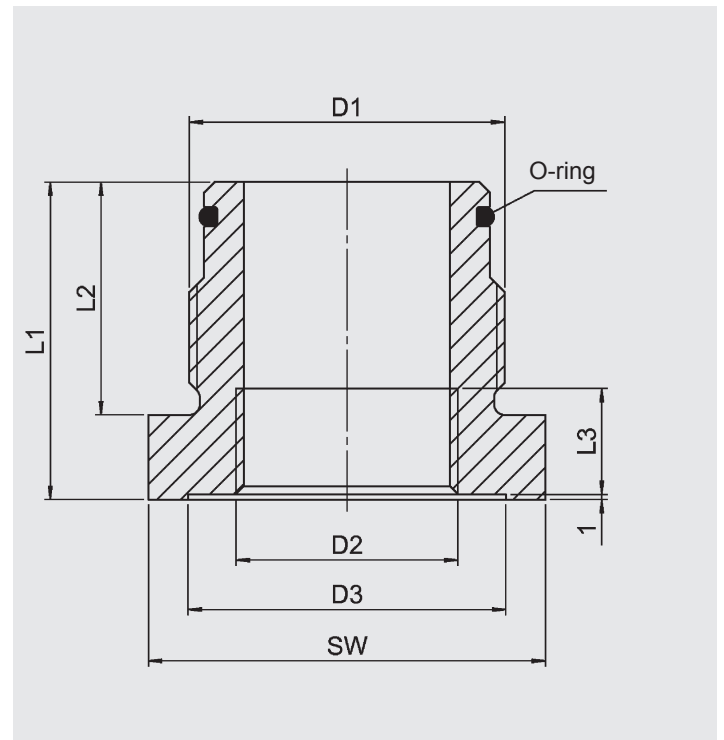
Figure 2

| D1 Threaded connection | D2 [mm] | T [mm] | A [mm] | B [mm] | Adapter* complete Part no. | Figure |
|------------------------|---------|--------|--------|--------|----------------------------|--------|
| ISO228- G 1/4 | 25 | 14 | - | - | 2109481 | 1 |
| | | | 25 | 40 | 2102042 | 2 |
| ISO228- G 3/8 | 28 | 14 | - | - | 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 ACCUMULATOR (FLUID SIZE)

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



| D1 Accum. conn.* | D2 | D3 [mm] | L1 [mm] | L2 [mm] | L3 [mm] | SW [mm] | O-ring [mm] | Part no. | | | |
|------------------|------------|---------|---------|---------|---------|---------|-------------|------------------|----|----|---------|
| ISO228-BSP | ISO228-BSP | 28 | 55 | 28 | 12 | 32 | 17x3 | NBR/Carbon steel | | | |
| | | | | | | | | 60 | 14 | 36 | 2104346 |
| G 3/4 | 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 | 18 | 2110124 |
| G 1 1/4 | 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 | 22 | 2105905 |
| G 2 | G 1 1/4 | 60 | 66 | 50 | 20 | 80 | 62x4 | 2127406 | | | |
| | | | | | | | | G 1 1/2 | 68 | 22 | 3243831 |
| | | | | | | | | G 2 | 96 | 27 | 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.

HYDAC Technology GmbH

Industriegebiet
66280 Sulzbach/Saar, Germany
 Tel.: 0049 (0) 68 97 / 509 - 01
 Fax: 0049 (0) 68 97 / 509 - 464
 Internet: www.hydac.com
 E-Mail: speichertechnik@hydac.com

