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

1.2.1 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 vessel is 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.

1.2.2 Bladder material

The following elastomers are available as standard:

- NBR (acrylonitrile butadiene rubber, Perbunan),
- IIR (butyl rubber),
- FKM (flouro rubber, Viton®),
- ECO (ethylene oxide epichlorohydin 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.

1.2.3 Corrosion protection

For operation with chemically aggressive media, the accumulator shell can be supplied with corrosion protection, such as plastic coating on the inside or chemical nickel-plating. If this is insufficient, then stainless steel accumulators must be used.
1.3. MOUNTING 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 mounting position is horizontal or at a slant, the effective volume and the maximum permitted flow rate of the operating fluid are reduced.

1.4. TYPE OF MOUNTING
By using an appropriate adapter, HYDAC accumulators, up to size 1 l, can be mounted directly inline.
For strong vibrations and volumes above 1 l, we recommend the use of HYDAC accumulator supports or the HYDAC accumulator mounting 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 volume.

2.1.4 Effective volume
Volume of fluid which is available between the operating pressures $p_2$ and $p_1$.

2.1.5 Max. flow rate of operating fluid
In order to achieve the max. flow rate given in the tables, the accumulator must be mounted vertically. It must be remembered that a residual fluid volume of approx. 10% of the effective gas volume remains in the accumulator.

2.1.6 Fluids
The following sealing and bladder materials are suitable for the fluids listed below.

<table>
<thead>
<tr>
<th>Material</th>
<th>Fluids</th>
</tr>
</thead>
<tbody>
<tr>
<td>NBR20</td>
<td>Mineral oils (HL, HLP, HFA, HFB, HFC), water</td>
</tr>
<tr>
<td>ECO</td>
<td>Mineral oil</td>
</tr>
<tr>
<td>IIR</td>
<td>Phosphate ester</td>
</tr>
<tr>
<td>FKM</td>
<td>Chlorinated hydrocarbons, petrol</td>
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</tbody>
</table>

2.1.7 Permitted operating temperature
The permitted operating temperatures are dependent on the application limits of the metallic materials and the bladders. The standard valve bodies, gas valves and accumulator shells are suitable for temperatures from $-10 \degree C ... +80 \degree C$. Outside these temperatures, special material combinations must be used. The following table shows the correlation between bladder material and application temperature.

<table>
<thead>
<tr>
<th>Material</th>
<th>Temperature ranges</th>
</tr>
</thead>
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<tr>
<td>NBR20</td>
<td>$-15 \degree C ... +80 \degree C$</td>
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<tr>
<td>NBR21</td>
<td>$-50 \degree C ... +80 \degree C$</td>
</tr>
<tr>
<td>NBR22</td>
<td>$-30 \degree C ... +80 \degree C$</td>
</tr>
<tr>
<td>ECO</td>
<td>$-30 \degree C ... +120 \degree C$</td>
</tr>
<tr>
<td>IIR</td>
<td>$-40 \degree C ... +100 \degree C$</td>
</tr>
<tr>
<td>FKM</td>
<td>$-10 \degree C ... +150 \degree C$</td>
</tr>
</tbody>
</table>

2.1.8 Gas charging
Always only charge with nitrogen class 4.5, filtered to $<3 \mu m$.
If other gases are to be used, please contact HYDAC for advice. Hydraulic accumulators must only be charged with nitrogen. Never use other gases.

Risk of explosion!

2.1.9 Limits for gas pre-charge pressure
$p_0 \leq 0.9 \cdot p_1$
with a permitted pressure ratio of:
$p_0 = \text{max. operating pressure}$
$p_0 = \text{gas pre-charge pressure}$

2.1.10 Certificate codes

<table>
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<th>Country</th>
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<td>China</td>
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<td>EU member states</td>
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<td>Japan</td>
<td>P</td>
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<tr>
<td>Canada</td>
<td>S1 2)</td>
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<tr>
<td>Switzerland</td>
<td>U</td>
</tr>
<tr>
<td>USA</td>
<td>S</td>
</tr>
<tr>
<td>others on request</td>
<td></td>
</tr>
</tbody>
</table>

1) Alternative certificates possible
2) Approval required in the individual provinces

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 and extracts from approvals regulations on hydraulic accumulators can be found in the following catalogue section:
- Accumulators No. 3.000
2.2. MODEL CODE
(Also order example)

Series
H = high flow
N = increased flow, standard oil valve dimensions
A = shock absorber
P = pulsation damper
S = suction flow stabiliser
B = bladder top-repairable
Combinations possible, e.g. HB - High flow with a top-repairable bladder
PH - pulsation damper with high flow rate.
No details = standard

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 \(^1\)
2 = back-up model
3 = gas valve 7/8-14UNF with M8 female thread
4 = 5/8" gas valve
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
9 = special gas valve, to customer specification

Material code \(^1\)
Standard model = 112 for mineral oil
Depending on operating fluid others on request

Fluid connection
1 = carbon steel
2 = high tensile steel
3 = stainless steel \(^3\)
6 = low temperature steel

Accumulator shell
D = plastic coated (internally)
1 = carbon steel
2 = chemically nickel-plated (internal coating)
4 = stainless steel \(^3\)
6 = low temperature steel

Accumulator bladder \(^2\)
2 = NBR20
3 = ECO
4 = IIR (butyl)
5 = NBR21 (low temperature)
6 = FKM
7 = other
9 = NBR22

Certification code
U = PED 97/23/EC

Permitted operating pressure [bar]

Connection
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 separately, if required!

---

\(^1\) Not all combinations are possible
\(^2\) When ordering spare bladders, please state smallest bladder connection port size
\(^3\) Depending on type and pressure rating
\(^4\) Gas valve type in SB < 50 l = 7/8 - 14 UNF, in SB ≥ 50 l = M50x1.5
### 3. DIMENSIONS AND SPARE PARTS

#### 3.1. DIMENSIONS

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<td>90</td>
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<td>30</td>
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</tbody>
</table>

1) Q = max. flow rate of pressure fluid  
2) slimline version, for confined spaces
3.2. SPARE PARTS

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

3.3. REPAIR KITS

NBR, carbon steel
Nom. volume: 0.5 ... 200 litres
Standard gas valve

<table>
<thead>
<tr>
<th>Nom. volume [l]</th>
<th>Part no.</th>
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<tbody>
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<td>0.5</td>
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<td>02106261</td>
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<td>200</td>
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</table>

*) slimline version for confined spaces
others on request

Description Item

Bladder kit 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
- Support ring 23
- O-ring 27

Repair kit ¹)
consisting of:
- Bladder kit (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
- Vent screw 19
- Support ring 23

* available separately
¹) When ordering please state smallest bladder connection port size.
Item 1 not available as a spare part.
Item 19 for NBR/Carbon steel:
seal ring (item 20) included
Item 25 must be ordered as an accessory
(see Point 4).

Detail "X"
SB330/400 – 0.5 ... 6 l
SB330/400/500 – 10 ... 200 l and
SB330H – 10 ... 200 l
SB550 – 1 ... 5 l
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. These must be ordered separately.

4.1.1 Pressure gauge model:
Gas side connection on the bladder accumulator for permanent monitoring of the pre-charge pressure.

<table>
<thead>
<tr>
<th>Gauge indication range</th>
<th>Part no.</th>
<th>Adapter body* Part no.</th>
<th>Adapter assembly Part no.</th>
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</tr>
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* \( p_{max} = 400 \) bar

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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.

<table>
<thead>
<tr>
<th>Gauge indication range</th>
<th>Part no.</th>
<th>Adapter body* Part no.</th>
<th>Adapter assembly Part no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>0 - 25 bar</td>
<td>00631380</td>
<td>00363713</td>
<td>02103381</td>
</tr>
<tr>
<td>0 - 60 bar</td>
<td>00606771</td>
<td></td>
<td>02105216</td>
</tr>
<tr>
<td>0 - 100 bar</td>
<td>00606772</td>
<td></td>
<td>02110059</td>
</tr>
<tr>
<td>0 - 160 bar</td>
<td>00606773</td>
<td></td>
<td>03139314</td>
</tr>
<tr>
<td>0 - 250 bar</td>
<td>00606774</td>
<td></td>
<td>03202970</td>
</tr>
<tr>
<td>0 - 400 bar</td>
<td>00606775</td>
<td></td>
<td>03194154</td>
</tr>
</tbody>
</table>

* \( p_{max} = 400 \) 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).

4.2. ADAPTERS FOR STANDARD BLADDER ACCUMULATORS (FLUID SIDE)

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

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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.