HYDAC has been a name synonymous with advanced technology, design, manufacturing and application engineering for more than 50 years. HYDAC is the only manufacturer of all three types of accumulators – Bladder, Piston, & Diaphragm.

Functions
As an essential element in modern hydraulics, accumulators perform many useful functions, such as:

- reducing pump capacity and electrical energy
- providing auxiliary hydraulic power in case of an emergency
- limiting pressure fluctuations during temperature changes in a closed hydraulic loop
- compensation for leakage
- minimizing pump pulsations
- absorbing shocks

Benefits
- increasing system performance and efficiency
- lowering operating and maintenance costs
- providing fail-safe conditions
- avoiding pump, pipe and system failures to achieve longer life expectancy

Accessories
All accessories required for installation and maintenance of accumulators are available, including:

- safety and shut off blocks
- mounting components
- accumulator sets
- charging and gauging units

Development and Engineering
Based on research and development in our laboratories for testing of physical, chemical and mechanical properties, HYDAC achieves the highest quality of accumulators and related parts. Finite Element Analysis is implemented in the Computer Aided Design package supporting development and engineering to optimize the performance and safety of the components. Application assistance is available utilizing HYDAC computer software to simulate your system and optimize the sizing for energy savings, shock absorption or pulsation dampening.

Manufacturing and Assembly
Manufacturing and assembly at HYDAC are subject to strict quality control. HYDAC utilizes state-of-the-art manufacturing and quality assurance techniques.
United States
HYDAC Technology GmbH in D-66280 Sulzbach/Saar is authorized (effective August 21, 1985) by the “National Board of Boiler and Pressure Vessel Inspectors”, in conformity with the appropriate specification of the American Society of Mechanical Engineers (ASME), to use the Code Symbol as a stamp and for registration purposes.

European Union Member States (listed in bold below)
On November 29, 1999 the directive 97/23/EC (Pressure Equipment Directive) came into force and has been operative since May 29, 2002. This directive applies to the design, manufacture, conformity assessment and circulation of pressure equipment and assemblies with a maximum permissible pressure of over 0.5 bar. It guarantees the free movement of goods within the European Community. EU member states must not prohibit, restrict or obstruct the circulation and commissioning of pressure equipment on account of pressure-related hazards, if the equipment complies with the requirements of the pressure equipment directive, has the CE mark, and is subject to a conformity assessment.

China (Self quality for China)
HYDAC Technology GmbH is recognized as an importer of bladder, diaphragm and piston accumulators since March 30, 1998.

Japan (KHK certificate)
For the Japanese market, HYDAC Technology GmbH is approved as a “self inspecting manufacturer”. Therefore HYDAC is authorized to manufacture, test and import accumulators from outside Japan.

For details on other country certifications, please contact HYDAC.

Complete Country Code Listing
(European Union Member States listed in bold below)

<table>
<thead>
<tr>
<th>Certification</th>
<th>Bladder Accumulator Assembly Area</th>
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</thead>
<tbody>
<tr>
<td>Certification</td>
<td>Assembly of Piston Accumulators</td>
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</table>

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**Bladder Accumulators**

The standard bladder accumulator consists of a “closed” rubber bladder inside a forged steel shell. A mechanically actuated valve closes when the fluid has been expelled, blocking off the fluid port, thereby enclosing the bladder within the shell. Where high discharge rates are required, a high flow model is available.

Applications with corrosive environments may require shells furnished with an internal and/or external coating or manufactured from stainless steel.

The top repairable accumulator permits service and maintenance of the bladder without removing the accumulator from the hydraulic system.

When the pressure level of a system permits, a low pressure accumulator may be used. It is similar to a standard bladder accumulator, except that the poppet valve is replaced by a perforated plate covering the fluid port, and the shell may be of welded construction.

For lightweight applications, a Kevlar wrapped accumulator shell is available. The wrapping supports the thinner metal shell to provide a substantial weight reduction.

**Piston Accumulators**

A piston accumulator consists of a fluid section and a gas section with the piston acting as a gas-proof screen. The gas section is precharged with dry nitrogen gas. Auxiliary gas bottles are frequently used with piston accumulators to provide the required gas volume.

**Diaphragm Accumulators**

A diaphragm accumulator performs the same function as a bladder accumulator, however, it operates like a membrane. A poppet is molded into the bottom of the diaphragm to prevent its extrusion through the fluid port.

Diaphragm accumulators are frequently used where small volumes are required, weight is important, a higher pressure ratio is required (up to 10:1) or low cost is a prime factor.

Applications with corrosive environments may require a coating or be manufactured from stainless steel.
## Comparison of Standard Accumulators

<table>
<thead>
<tr>
<th>Type</th>
<th>Design</th>
<th>Nominal Volume</th>
<th>MAWP (psi)</th>
<th>Pressure Ratio</th>
<th>Flow Rate</th>
<th>Mounting Position</th>
<th>Weight</th>
<th>Cost</th>
</tr>
</thead>
</table>
| **Diaphragm** | • small volume and flow  
• low weight  
• compact design  
• good for shock applications (good response characteristics) | 5 in³ to 1 gal | 3000, 5000 (up to 10,000) | 8:1 typically (up to 10:1) | up to 60 gpm | any | lowest | lowest |
| **Bladder** | • best general purpose  
• wide range of standard sizes  
• good for shock applications (good response characteristics) | 1 qt. to 15 gal | 3000, 5000 (up to 10,000) | 4:1 | up to 480 gpm | prefer vertical | middle | middle |
| **Piston** | • best for large stored volumes  
• best for high flow rates  
• not recommended for shock applications  
• best for use with backup nitrogen bottles | 1 qt. to 100 gal | 3000, 5000 (up to 10,000) | ∞:1 | up to 2000 gpm | prefer vertical | highest | middle to highest |

### Accumulator Type Selection Considerations
- System Pressure
- System Temperature
- Volume / Usable Volume
- Flow Rate
- Pressure Ratio
- Installation Space and Position
- Chemical Compatibility

Use the comparison chart above as a quick reference guide.

### Stainless Steel Accumulators

Stainless steel piston and diaphragm accumulators are available in various sizes and pressure ranges. They offer special corrosion resistance that is required for chemical and off-shore industries, petro-chemical and nuclear power plants and for food applications.
Overview

**Accessories**
A full range of accessories for the installation, service and maintenance of all accumulators completes the program. In addition to the items shown, special valve blocks and adapters are available for your particular requirements.

**Metal Bellows**
Metal Bellows Accumulators are a unique type of dampener that use a metal bellows separation element between the fluid and gas side of the metal bellows accumulator. This makes the accumulator virtually gas-tight and maintenance free. By replacing the traditional elastomer element or seals, the metal bellows is fluid resistant in temperature ranges of -85 °F to +320 °F. These special features lend themselves to dampening applications in fuel injection systems in heavy diesel engines in the mobile, marine & industrial markets. The SM50P series has a fluid port diverter feature to maximize its dampening capability. The SM50 series has a threaded fluid connection to allow for easy retrofit of standard accumulators in existing systems.

**Accumulator Stations**
HYDAC supplies fully assembled piston accumulator stations which are ready for operation, complete with all the necessary valve controls, ball valves and safety equipment as an individual accumulator unit or in a back-up model with nitrogen bottles to increase the effective volume.
Dampeners

Pulsations and shocks in hydraulic lines can result in costly damage to the piping and other system components. Reciprocating piston pumps by design create pressure pulsations, vibrations, and noise in the system. HYDAC suction stabilizers, pulsation dampeners and silencers, when applied to piston pumps, will reduce pulsations and noise. Furthermore, pressure pulsations can make control in servo systems nearly impossible without installing a pulsation dampener. HYDAC shock absorbers can be applied to greatly reduce shock wave energy. These waves can be harmful to all components in your hydraulic system. Shock waves can be created by closing a valve in a high flow line, such as one found in a petroleum terminal.

PTFE Dampeners - Aggressive Media

HYDAC has developed an all-PTFE cup diaphragm and has patented its design and application. It is resistant to aggressive operating fluids and can be installed in almost all standard diaphragm accumulators which are available in both carbon steel and stainless steel.
Industries and Applications

Industrial Hydraulics

**Machine tools**
- Support for the hydraulics for tool drive or tool change
- Energy storage in the compact hydraulics of machining centers

**Plastics technology**
- Accumulator stations for energy storage during the injection molding process
- Pulsation damping on the hydraulic drive

**Die casting machines**
- Energy storage for injection process
- Volume compensation using diaphragm accumulators

**Steel industry**
- Energy storage in rolling mills
- Blast furnace hydraulics

**Power plants**
- Emergency supply for turbine control system
- Pulsation damping on pumps
- Lubrication, control and seal oil supply
- Water treatment

**Paper industry**
- Energy storage for emergency functions in friction bearing hydraulics
- Energy storage in high/low pressure power units

**Wind energy**
- Accumulators in the pitch control system
- Support of the pitch drive
- Accumulator on braking units

**Cranes and commercial vehicles**
- Accumulators for boom damping on mobile cranes
- Accumulators in steering systems of HGVs
- Accumulators in hydraulic switching systems

**Rail vehicles**
- Temperature and leakage oil adjustment
- Chassis controls
- Level control
- Pump noise damping

**Automotive**
- Automatic and manual transmission
- Automatic clutch systems
- Engine management systems
- Pump noise damping

**Process Technology**

**Chemical industry**
- Energy storage and pulsation damping on dosing pumps
- Suction flow stabilization on the suction side of pumps

**Oil & Gas / Offshore**
- Accumulators to support valve closing systems
- Energy storage for deep sea rams
- Blow Out Preventers (BOP): Emergency function for safety systems
- Accumulators on wellhead control systems

**Loading station / Refineries**
- Shock absorption for valve closing
- Pulsation damping on pipelines

**Mobile Technology**

**Agricultural and forestry machines**
- Front loader damping
- Accumulators in tractor suspension systems
- Stone strike protection for ploughs
- Boom suspension on field sprayers

**Construction machinery**
- Accumulator in braking systems
- Chassis damping
- Bucket damping
Safety Requirements Overview
Hydro-pneumatic accumulators are pressure equipments subjected to legal pressure regulations. For the operation and the testing of accumulator equipped hydraulics, all local regulations have to be observed to avoid any risks and to guarantee the safety for the whole lifetime of the units.

Therefore “safety devices in accordance with the PED 97/23/EC ANNEX 1:2.11” are available.

HYDAC offers various types of standard “safety devices”, which should be used on the gas and fluid sides to protect against pressures in excess of design parameters.

Failure or improper selection or improper use of the products and/or systems described herein or related items can cause death, personal injury and property damage.

This document and other information from HYDAC, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application and review the information concerning the product or system in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

HYDAC does not assume the risk of and shall not be liable for failure due to fire. HYDAC offers fire safety devices and recommends their use.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by HYDAC Corporation and its subsidiaries at any time without notice.

All accumulators should be visually inspected (signs of leakage etc.), tested for functionality and have a complete seal change out within 10 years of service.

Safety Devices
Protection on the Fluid Side

The fluid side has to be protected against excessive pressures with approved safety valves. HYDAC provides the pressure relief valve (DB12 Series) which has a pressure setting (set by HYDAC) up to 5800 psi (400 bar). The sealed valves carry a CE mark, and are integrated into the Safety and Shut-off Blocks in nominal sizes DN10 to DN32.

(See pages S3-S9 for more details)

Note: The information in this brochure relates to the operating conditions and applications described. For applications or operating conditions not described, please contact Product Management at HYDAC.

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