

HYDAC | **INTERNATIONAL**



Accumulators

Bladder, Piston, Diaphragm





HYDAC stands for worldwide presence and accessibility to the customer. HYDAC has over 1000 distributors worldwide and more than 50 wholly owned branches. HYDAC accumulators – a name synonymous with advanced technology, design, manufacturing and application engineering for more than 50 years, is considered a global leader throughout the hydraulic industry.

HYDAC Products



HYDAC is the only worldwide manufacturer producing bladder, piston, and diaphragm accumulators and hydraulic dampeners. Not only does HYDAC supply the most comprehensive hydraulic accumulator range, but also the best technical solution to every application. HYDAC accumulators are supplied with the appropriate pressure vessel certifications to the laws governing the country of installation.



HYDAC Quality



HYDAC stands for quality and customer service. HYDAC achieves the highest quality accumulators and related parts through continuous research and development in our laboratories for testing of physical, chemical, and mechanical properties. To ensure that HYDAC accumulators and related products are as innovative as possible with optimum performance and safety, a Finite Element Analysis is implemented during the Computer Aided Design process.



HYDAC Customer Service



Our internal staff and worldwide distribution network take care of the important matter of customer service. HYDAC values high standards, professional ethics, and mutual respect in all transactions with customers, vendors, and employees. We invest in our relationships by providing expertise, quality, dependability, and accessibility to foster growth and a sense of partnership. Our customer service representatives are committed to serving the customers' needs.



Energy and Environmental Technology

HYDAC accumulators have played a key role in providing innovative solutions resulting in lowering operational costs and increasing hydraulic system performance in hydroelectric, wind, and waste power plants. HYDAC has vast expertise in applying accumulator technology within the power generation industry.



Offshore Shipbuilding and Marine Technology

Maritime technology places special demands on material functionality and reliability. HYDAC accumulators meet these demands due to our high quality and test standards. HYDAC accumulators have been applied under the toughest conditions from drilling rigs to deep sea applications.



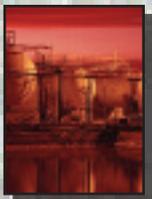
Mobile Market

The aim of our engineers has always been to reduce volume and weight, resulting in increased product performance. HYDAC provides compact high performance accumulators for the Mobile Market. HYDAC accumulators can be found on all types of construction, forestry, and agricultural equipment.



Industrial Engineering

Our knowledge and expertise in a diverse set of industries translates into a comprehensive range of versatile hydraulic accumulators. HYDAC offers many solutions for machine tools, plastic injection molding machines, test equipment, presses, and metal forming machines. Other industrial applications include: steel and heavy industry, power transmission and paper mills.



Process Technology

HYDAC accumulators can be found in paper mills, steel mills, manufacturing plants, foundries, power plants, and in the chemical, petrochemical and plastics industries worldwide. For more than 50 years HYDAC has been supplying accumulators to companies who require the most advanced process technology.

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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

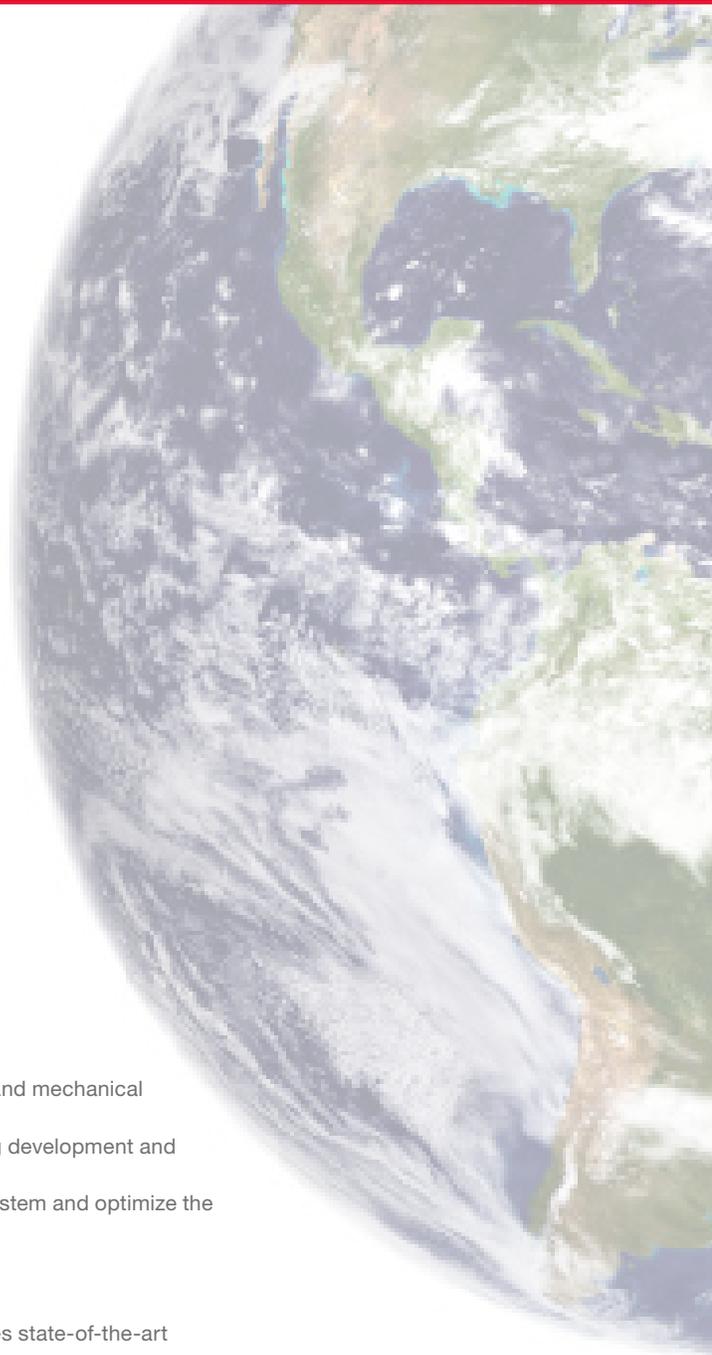
Based on research and development in our laboratories for testing of physical, chemical and mechanical properties, HYDAC achieves the highest quality of accumulators and related parts.

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.



CAD and Finite Element Analysis (FEA)



Electron-beam welding of diaphragm accumulators



Precharging of a Diaphragm Accumulator

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.



Bladder Accumulator Assembly Area



Assembly of Piston Accumulators

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)

| | | | | | |
|----------------|-------------------|--------------------|-----------------|-----------------------|-----------------|
| Algeria | S ³⁾ | Hong Kong | A9 | Pakistan | S ³⁾ |
| Argentina | S ³⁾ | Hungary | U ³⁾ | Peru | S ³⁾ |
| Australia | F ¹⁾ | Iceland | U ³⁾ | Philippines | S ³⁾ |
| Austria | U | India | S ³⁾ | Poland | U |
| Bahamas | E | Indonesia | S ³⁾ | Portugal | U |
| Barbados | S ³⁾ | Iran | U | Puerto Rico | S ³⁾ |
| Belgium | U | Iraq | S ³⁾ | Romania | U |
| Bermuda | S ³⁾ | Ireland | U | Russia (CIS) | A6 |
| Bolivia | S ³⁾ | Israel | U ³⁾ | Saudi Arabia | S ³⁾ |
| Brazil | S ³⁾ | Italy | U | Singapore | U |
| Canada | S ¹⁾²⁾ | Japan | P | Slovakia | A8 |
| Chile | S ³⁾ | Jordan | S ³⁾ | South Africa | S ³⁾ |
| China | A9 | Korea | S ³⁾ | Spain | U |
| Costa Rica | E ³⁾ | Kuwait | S ³⁾ | Sudan | S ³⁾ |
| Czech Republic | U | Lebanon | S ³⁾ | Sweden | U |
| Denmark | U | Libya | S ³⁾ | Switzerland | U |
| Ecuador | S ³⁾ | Luxembourg | U | Syria | U |
| Egypt | U | Malaysia | S ³⁾ | Taiwan | S ³⁾ |
| Finland | U | Mexico | S ³⁾ | Thailand | S ³⁾ |
| France | U | New Zealand | T | Tunisia | S ³⁾ |
| Germany | U | Netherlands | U | Turkey | U |
| Greece | U | Nigeria | S ³⁾ | United Kingdom | U |
| | | Norway | U ³⁾ | USA | S |
| | | | | Venezuela | S ³⁾ |

- 1) approval required in the individual territories
 2) approval required in the individual provinces
 3) alternative certificates possible

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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

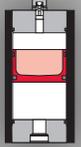
A diaphragm accumulator performs the same function as a bladder accumulator, however, it operates like a membrane. A poppet is molded into the bottom of the diaphragm to prevent its extrusion through the fluid port.

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

| Type | Design | Nominal Volume | MAWP (psi) | Pressure Ratio | Flow Rate | Mounting Position | Weight | Cost |
|---|--|----------------------------|---------------------------|----------------------------|----------------|-------------------|---------|-------------------|
| Diaphragm  | <ul style="list-style-type: none"> • small volume and flow • low weight • compact design • good for shock applications (<i>good response characteristics</i>) | 5 in ³ to 1 gal | 3000, 5000 (up to 10,000) | 8:1 typically (up to 10:1) | up to 60 gpm | any | lowest | lowest |
| Bladder  | <ul style="list-style-type: none"> • best general purpose • wide range of standard sizes • good for shock applications (<i>good response characteristics</i>) | 1 qt. to 15 gal | 3000, 5000 (up to 10,000) | 4:1 | up to 480 gpm | prefer vertical | middle | middle |
| Piston  | <ul style="list-style-type: none"> • 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, petrochemical and nuclear power plants and for food applications.



Piston



Diaphragm



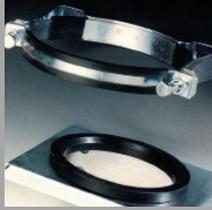
Bladder

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.



Safety & Shut-off Blocks



Mounting



Charging Units



Permanent Gauge Block



Nitrogen Bottles



Nitrogen Charging Servers

For more information on these accessories, see page 67

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.



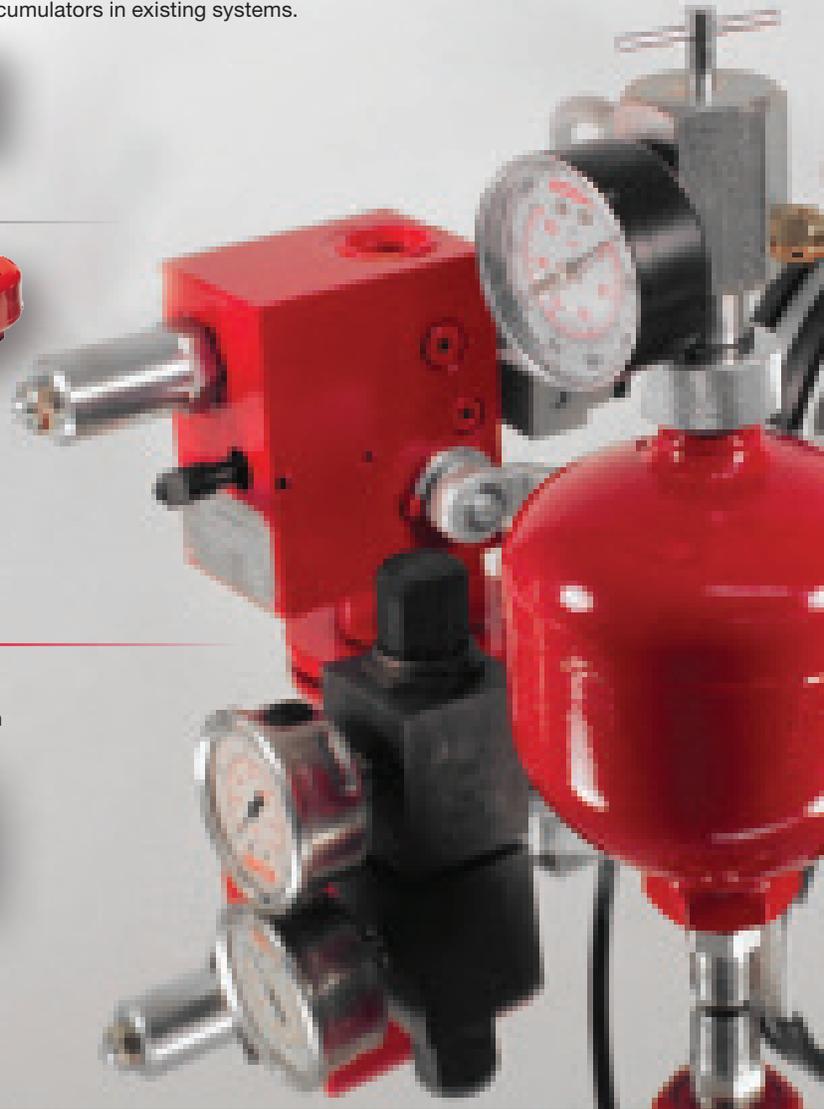
Threaded Connection for Retrofit



Flange Connection w/ Flow Diverter

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

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

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



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.

WARNING!



CAUTION!

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 53-59 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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Protection on the Gas Side

Excess pressure on the gas side, especially by increased ambient temperatures (e.g. in case of a fire) has to be reduced completely or controlled with safety devices.

To achieve this, HYDAC offers three different types of protection which are available as optional equipment:

Thermal Fuse Caps and Plugs



Protection by means of complete discharge in the case of excessive temperature and pressure.

Thermal Fuse Cap and Plugs are “safety devices” and are used for permissible working pressures of up to 690 bar in a temperature range of -40° to 176°F. Their melting point is approximately 320° to 356°F and bleeds off the gas pressure by discharging the nitrogen completely when the rise in temperature reaches unacceptable levels (e.g. in case of fire).

| Model Code | Part Number |
|---|-------------|
| Thermal Fuse Caps 7/8-14UNF | 363501 |
| GMP6-10-CE1637.6.G.120L/S.350Bar ISO228-G 1/4 | 3517438 |
| GMP6-10-CE1637.6.G.120L/S.350Bar ISO228-G 1/2 | 3517439 |

Burst Discs



Protection by means of complete discharge when pressure exceeds the permitted level.

Burst discs are designed for different pressure settings and will be supplied with a Declaration of Conformity.

If their set pressure is exceeded, the burst disc is destroyed. The passage remains open and discharges the nitrogen completely.

Burst discs are made entirely of stainless steel and/or stainless steel / nickel alloy.

| Model Code | Burst Pressure $\pm 10\%$ at 122°F | Part Number |
|-------------------------|------------------------------------|-------------|
| Burst Disc Plug 1/4 NPT | 3045 psi (210 bar) | 3156148 |
| Burst Disc Plug 1/4 NPT | 3626 psi (250 bar) | 3156150 |
| Burst Disc Plug 1/4 NPT | 5076 psi (350 bar) | 3156152 |
| Burst Disc Plug 1/4 NPT | 6527 psi (450 bar) | 3156155 |

Note: higher pressures on request

Gas Safety Valves



Protection by means of controlled pressure reduction when pressure exceeds the permitted level.

The Gas Safety Valve (*GSV6 Series*) is a direct-operating, spring loaded safety valve with a setting range of 435 to 5366 psi (30 to 370 bar) within a temperature range of -4° to 176°F (-20° to 80°C).

All the components of the valve are in stainless steel and therefore suitable for a variety of applications. The GSV6 Series will be supplied with a Declaration of Conformity and an operating instruction manual. Due to its self-centering seal ring, fitting is simple and safe.

| Model Code | Pressure Setting $\pm 5\%$ | Part Number |
|--------------------------------------|----------------------------|-------------|
| GSV6-10-CE1637.ISO4126-1.6.G.015.030 | 450 psi (30 bar) | 3123965 |
| GSV6-10-CE1637.ISO4126-1.6.G.095.160 | 2320 psi (160 bar) | 3124038 |
| GSV6-10-CE1637.ISO4126-1.6.G.125.210 | 3045 psi (210 bar) | 3124043 |
| GSV6-10-CE1637.ISO4126-1.6.G.148.250 | 3626 psi (250 bar) | 3124047 |
| GSV6-10-CE1637.ISO4126-1.6.G.205.350 | 5076 psi (350 bar) | 3124057 |

Note: Others available on request



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SB Series Bladder Accumulators

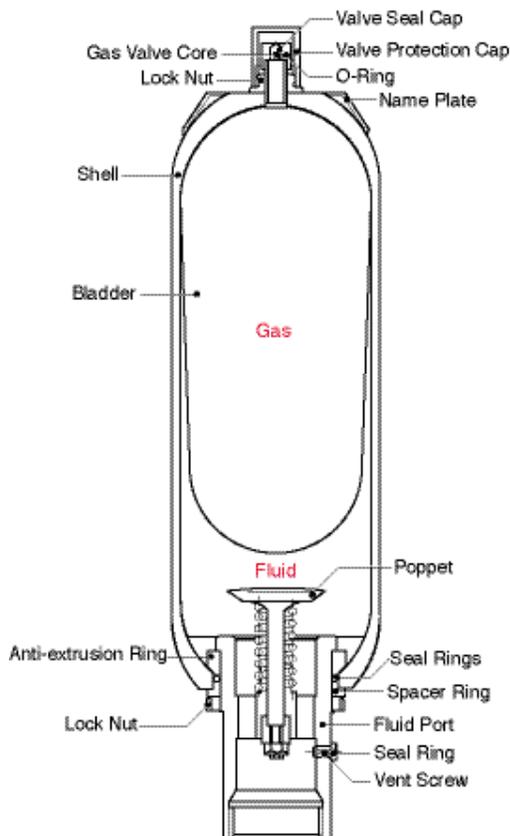


Description

Bladder accumulators are a very versatile and cost effective option for numerous types of hydraulic systems involving energy storage, shock absorption, pulsation dampening, leakage loss compensation and volume compensation. They are a first choice for a great variety of general applications and have the widest range of standard sizes and model options. Bladder accumulators also have very quick shock response characteristics in sizes much larger than diaphragm accumulators (see pg. 24)

Construction

HYDAC bladder accumulators consist of a welded or forged pressure vessel (*shell*), a bladder and ports for gas and fluid inlet. The gas and fluid sides are separated by the bladder.



Bladder Materials

Not all fluids are compatible with every elastomer at all temperatures. Therefore, HYDAC offers the following choice of elastomers:

- NBR (*Standard Nitrile*)
- LT-NBR (*Low Temperature Nitrile*)
- ECO (*Epichlorohydrin*)
- IIR (*Butyl*)
- FPM (*Fluoroelastomer*)
- Others (*available upon request*)

To determine which material is appropriate...

ALWAYS REFER TO FLUID MANUFACTURER'S RECOMMENDATION

Corrosion Protection

For use with certain aggressive or corrosive fluids, or in a corrosive environment, HYDAC offers protective coatings and corrosive resistant materials (i.e. stainless steel) for the accumulator parts that come in contact with the fluid, or are exposed to the hostile environment.

Mounting Position

HYDAC bladder accumulators can be installed in any orientation depending upon the application. When installing vertically or at an angle, the fluid port must be at the bottom. On certain applications listed below, specific positions are preferable:

- Energy Storage: vertical
- Pulsation Dampening: any position from vertical to horizontal
- Maintaining Constant Pressure: any position from vertical to horizontal
- Volume Compensation: any position from vertical to horizontal

Caution: Mounting a HYDAC bladder accumulator horizontally or at an angle will decrease the amount of usable volume available.

System Mounting

HYDAC bladder accumulators are designed to be screwed directly onto the system. We also recommend the use of our mounting components, which are detailed on page 70, to minimize risk of failure due to system vibrations.

Applications

Some common applications of bladder accumulators are:

- Agricultural Machinery & Equipment
- Forestry Equipment
- Oil Field & Offshore
- Machine Tools
- Mining Machinery & Equipment
- Mobile & Construction Equipment
- Off-Road Equipment

For specific examples of applications using bladder accumulators, please see pages 75 and 76.

Model Code

Model Codes containing RED selections are non-standard items – Contact HYDAC for information and availability
Not all combinations are available

SB 330 - 20 A 1 / 112 S - 210 C XXX

Series

- SB 330 = Bladder accumulator (3000 psi, Typically)
- SB 600 = Bladder accumulator (5000 psi, Typically)

Design

- (omit) = Standard (bottom repairable)
- N = Modified Flow (396 gpm)
- H = High Flow (480 gpm)
- TR = Standard (top repairable)
- NTR = Modified Flow (396 gpm) (top repairable)

Size (in Liters, see dimension tables on following pages for most common sizes)

- 1 = 1 quart
- 4 = 1 gallon
- 6 = 1.5 gallons
- 10 = 2.5 gallons
- 20 = 5 gallons
- 32 = 10 gallons
- 42 = 11 gallons
- 54 = 15 gallons

Line Connection

- A = Threaded
- F = Flanged

Gas Port

- 1 = Standard model, HYDAC gas valve version 4 (8V1 - ISO 4570)

Material Code

Depending on Application

- 112 = Standard for oil service (mineral oil)

Fluid Port

- 0 = Synthetic coated carbon steel (PTFE solid film, internal & external for water service)
- 1 = Carbon steel
- 2 = High strength stainless steel (typically 17-4 PH)
- 3 = Stainless steel (corrosion resistance, typically 316 ss)
- 4 = Chemically plated carbon steel (internal & external for water service)
- 6 = Low temperature carbon steel (<-40°F, min)

Shell

- 0 = Synthetic coated carbon steel (PTFE solid film, internal & external for water service)
- 1 = Carbon steel
- 2 = Chemically plated carbon steel (internal & external for water service)
- 6 = Low temperature carbon steel (<-40°F, min)
- 7 = Others available on request

Bladder Compound

- 2 = NBR (Buna N)
- 3 = ECO (Hydrin)
- 4 = IIR (Butyl)
- 5 = LT-NBR (low temp. Buna)
- 6 = FPM (Fluoroelastomer)
- 7 = Others (available on request)

| Compound | Oper. Temp Range | Typical Fluids |
|--------------|------------------|--|
| NBR | 5° to 180°F | mineral oils |
| | 32° to 180°F | water & water-glycols (5% minimum glycol) |
| LT-NBR | -50° to 180°F | mineral oils |
| ECO...113... | -20° to 250°F | mineral oils |
| ECO...663... | -40° to 250°F | mineral oils (with low temperature CS shell) |
| IIR | -20° to 200°F | phosphate esters & brake fluids |
| FPM | 5° to 300°F | chlorinated hydrocarbons |

Country of Installation

- S = USA
- S1 = Canada (CRN registered)
- W1 = ABS Type Approval
- W3 = DNV Type Approval
- U = PED/CE

(for other countries see page 3 for proper code designation)

Maximum Working Pressure in bar

- 210 = 3000 psi
- 345 = 5000 psi

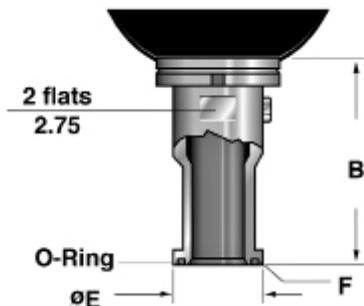
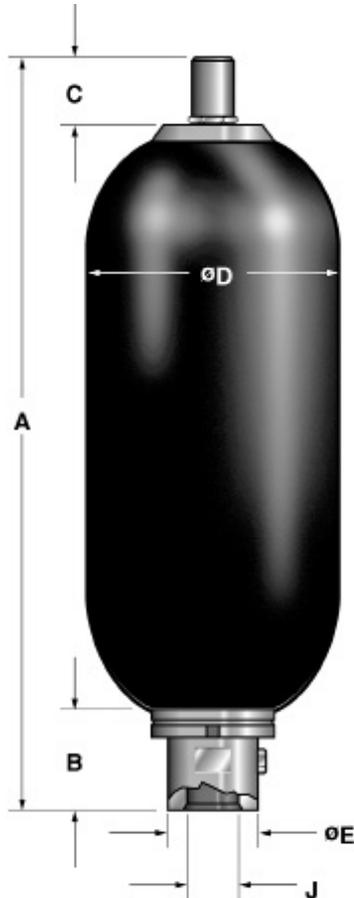
Fluid Port Connection

- Threaded
 - A = BSPP (ISO 228) Radial Seal Design NOT Axial
 - B = Metric (DIN 13)
 - C = SAE (ANSI B1.1)
 - D = NPT (ANSI B1.2)
- Flanged
 - E = SAE 2" - 3000 psi (Code 61)
 - F = SAE 1 1/2" - 6000 psi (Code 62)
 - G = SAE 1 1/4" - 3000 psi (Code 61) (only available in sizes 4 liters & 6 liters)
 - H = SAE 1" - 6000 psi (Code 62) (only available in sizes 1 liter & 4 liters)

Gas Precharge Pressure (P_o) in bar

- xxx = 3 digits

Dimensions Bottom Repairable



SB 330... (3000 psi)

| Size (L) | Nom. Vol. (gal.) | Eff. Gas Vol. in ³ / (gal.) | Weight | A | B ⁽¹⁾ | C | ØD | ØE | Thread-J | | Q ⁽²⁾ gpm |
|----------|------------------|--|-----------|-------------|------------------|----------|-----------|----------|-----------------------|-----------|----------------------|
| | | | | | | | | | SAE | NPTF BSPP | |
| 1 | 1/4 | 66 (0.29) | 10 (4.5) | 12.0 (303) | 2.0 (51) | 2.3 (58) | 4.6 (117) | 1.4 (36) | 1 1/16-12 UN (SAE-12) | 3/4" | 60 |
| 4 | 1 | 226 (0.98) | 30 (14) | 16.3 (415) | 2.6 (66) | 2.3 (58) | 6.6 (168) | 2.1 (53) | 1 5/8-12 UN (SAE-20) | 1 1/4" | 160 |
| 6 | 1 1/2 | 340 (1.47) | 33 (15) | 20.5 (521) | 2.6 (66) | 2.3 (58) | 6.6 (168) | 2.1 (53) | 1 5/8-12 UN (SAE-20) | 1 1/4" | 160 |
| 10 | 2 1/2 | 566 (2.45) | 86 (39) | 22.0 (559) | 3.1 (80) | 2.3 (58) | 9.1 (231) | 3.0 (76) | 1 7/8-12 UN (SAE-24) | 2" | 240 |
| 20 | 5 | 1125 (4.87) | 140 (63) | 34.5 (876) | 3.1 (80) | 2.3 (58) | 9.1 (231) | 3.0 (76) | 1 7/8-12 UN (SAE-24) | 2" | 240 |
| 32 | 10 | 2080 (9.00) | 226 (102) | 54.7 (1390) | 3.1 (80) | 2.3 (58) | 9.1 (231) | 3.0 (76) | 1 7/8-12 UN (SAE-24) | 2" | 240 |
| 42 | 11 | 2320 (10.04) | 270 (123) | 60.2 (1530) | 3.1 (80) | 2.3 (58) | 9.1 (231) | 3.0 (76) | 1 7/8-12 UN (SAE-24) | 2" | 240 |
| 54 | 15 | 3205 (13.87) | 330 (150) | 78.3 (1990) | 3.1 (80) | 2.3 (58) | 9.1 (231) | 3.0 (76) | 1 7/8-12 UN (SAE-24) | 2" | 240 |

See notes at bottom of page

Dimensions are for general information only, all critical dimensions should be verified.
Dimensions are in inches/(mm) and lbs/(kg)

SB 600... (5000 psi)

| Size (L) | Nom. Vol. (gal.) | Eff. Gas Vol. in ³ / (gal.) | Weight | A | B ⁽¹⁾ | C | ØD | ØE | Thread-J | | Q ⁽²⁾ gpm |
|----------|------------------|--|-----------|-------------|------------------|----------|-------------------|----------|------------------------|-----------|----------------------|
| | | | | | | | | | SAE | NPTF BSPP | |
| 1 | 1/4 | 66 (0.29) | 17 (7.7) | 13.2 (335) | 2.4 (62) | 2.3 (58) | 4.8 (122) | 2.1 (53) | 1 5/8-12 UN (SAE - 20) | 1 1/4" | 160 |
| 4 | 1 | 226 (0.98) | 33 (15) | 16.3 (415) | 2.5 (64) | 2.3 (58) | 6.8 (173) | 2.1 (53) | 1 5/8-12 UN (SAE - 20) | 1 1/4" | 160 |
| 10 | 2 1/2 | 566 (2.45) | 154 (70) | 22.4 (568) | 3.1 (80) | 2.8 (70) | 9.1-9.7 (232-247) | 3.0 (76) | 1 7/8-12 UN (SAE - 24) | 2" | 240 |
| 20 | 5 | 1125 (4.87) | 248 (113) | 35.0 (888) | 3.1 (80) | 2.8 (70) | 9.1-9.7 (232-247) | 3.0 (76) | 1 7/8-12 UN (SAE - 24) | 2" | 240 |
| 32 | 10 | 2080 (9.00) | 413 (188) | 55.2 (1402) | 3.1 (80) | 2.8 (70) | 9.1-9.7 (232-247) | 3.0 (76) | 1 7/8-12 UN (SAE - 24) | 2" | 240 |
| 54 | 15 | 3180 (13.77) | 611 (278) | 78.8 (2002) | 3.1 (80) | 2.8 (70) | 9.1-9.7 (232-247) | 3.0 (76) | 1 7/8-12 UN (SAE - 24) | 2" | 240 |

See notes at bottom of page

Dimensions are for general information only, all critical dimensions should be verified.
Dimensions are in inches/(mm) and lbs/(kg)

Split Flange Connection (sizes 10 - 54)

| Series | B | ØE | F Split Flange Connection | Q ⁽²⁾ gpm |
|------------------------------------|-----------|------------|----------------------------------|----------------------|
| SB 330 SB 330 TR ⁽³⁾ | 4.1 (104) | 2.8 (71.4) | SAE 2" - 3000 psi Code 61 | 240 |
| SB 600 SB 600 TR ⁽³⁾ | 5.5 (140) | 2.5 (63.5) | SAE 1 1/2" - 5000 psi Code 62 | 240 |

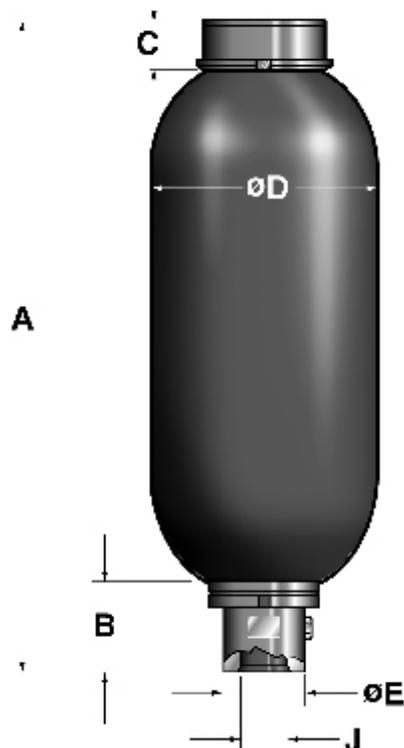
NOTE: Higher pressure may be available. Please consult HYDAC for more information.

1) Applies to SAE thread type only. For Split Flange, see separate chart and illustration.

2) Maximum discharge flow rate recommended for vertically mounted accumulators.

3) Sizes 10 to 54 only.

Top Repairable and Modified Flow



SB 330 TR... (3000 psi)

| Size (L) | Nom. Vol. (gal.) | Eff. Gas Vol. in ³ / (gal.) | Weight | A | B ⁽¹⁾ | C | ØD | ØE | Thread-J | | Q ⁽²⁾ gpm |
|----------|------------------|--|-----------|-------------|------------------|----------|-----------|----------|------------------------|-----------|----------------------|
| | | | | | | | | | SAE | NPTF BSPP | |
| 10 | 2.5 | 566 (2.45) | 94 (43) | 21.3 (540) | 3.1 (80) | 1.6 (40) | 9.1 (231) | 3.0 (76) | 1 7/8-12 UN (SAE - 24) | 2" | 240 |
| 20 | 5 | 1125 (4.87) | 140 (63) | 34.8 (883) | 3.1 (80) | 1.6 (40) | 9.1 (231) | 3.0 (76) | 1 7/8-12 UN (SAE - 24) | 2" | 240 |
| 32 | 10 | 2080 (9.00) | 226 (102) | 55.0 (1397) | 3.1 (80) | 1.6 (40) | 9.1 (231) | 3.0 (76) | 1 7/8-12 UN (SAE - 24) | 2" | 240 |
| 42 | 11 | 2320 (10.04) | 270 (123) | 60.2 (1530) | 3.1 (80) | 1.6 (40) | 9.1 (231) | 3.0 (76) | 1 7/8-12 UN (SAE - 24) | 2" | 240 |
| 54 | 15 | 3205 (13.87) | 330 (150) | 78.6 (1997) | 3.1 (80) | 1.6 (40) | 9.1 (231) | 3.0 (76) | 1 7/8-12 UN (SAE - 24) | 2" | 240 |

See notes at bottom of page

Dimensions are for general information only, all critical dimensions should be verified.

Dimensions are in inches/(mm) and lbs/(kg)

SB 600 TR... (5000 psi)

| Size (L) | Nom. Vol. (gal.) | Eff. Gas Vol. in ³ / (gal.) | Weight | A | B ⁽¹⁾ | C | ØD | ØE | Thread J | | Q ⁽²⁾ gpm |
|----------|------------------|--|-----------|-------------|------------------|----------|-------------------|----------|----------------------|-----------|----------------------|
| | | | | | | | | | SAE | NPTF BSPP | |
| 10 | 2.5 | 566 (2.45) | 154 (70) | 20.9 (531) | 3.1 (80) | 1.6 (40) | 9.1-9.7 (232-247) | 3.0 (76) | 1 7/8-12 UN (SAE-24) | 2" | 240 |
| 20 | 5 | 1125 (4.87) | 248 (113) | 33.5 (851) | 3.1 (80) | 1.6 (40) | 9.1-9.7 (232-247) | 3.0 (76) | 1 7/8-12 UN (SAE-24) | 2" | 240 |
| 32 | 10 | 2080 (9.00) | 413 (188) | 53.7 (1364) | 3.1 (80) | 1.6 (40) | 9.1-9.7 (232-247) | 3.0 (76) | 1 7/8-12 UN (SAE-24) | 2" | 240 |
| 54 | 15 | 3205 (13.87) | 611 (278) | 77.3 (1964) | 3.1 (80) | 1.6 (40) | 9.1-9.7 (232-247) | 3.0 (76) | 1 7/8-12 UN (SAE-24) | 2" | 240 |

See notes at bottom of page

Dimensions are for general information only, all critical dimensions should be verified.

Dimensions are in inches/(mm) and lbs/(kg)

SB 330 NTR... (3000 psi, Modified Flow)

| Size (L) | Nom. Vol. (gal.) | Eff. Gas Vol. in ³ / (gal.) | Weight | A | B ⁽¹⁾ | C | ØD | ØE | Thread J | | Q ⁽²⁾ gpm |
|----------|------------------|--|-----------|-------------|------------------|----------|-----------|----------|----------------------|-----------|----------------------|
| | | | | | | | | | SAE | NPTF BSPP | |
| 10 | 2.5 | 566 (2.45) | 94 (43) | 21.3 (540) | 3.1 (80) | 1.6 (40) | 9.1 (231) | 3.0 (76) | 1 7/8-12 UN (SAE-24) | 2" | 240 |
| 20 | 5 | 1125 (4.87) | 140 (63) | 34.8 (883) | 3.1 (80) | 1.6 (40) | 9.1 (231) | 3.0 (76) | 1 7/8-12 UN (SAE-24) | 2" | 240 |
| 32 | 10 | 2080 (9.00) | 226 (102) | 55.0 (1397) | 3.1 (80) | 1.6 (40) | 9.1 (231) | 3.0 (76) | 1 7/8-12 UN (SAE-24) | 2" | 240 |
| 54 | 15 | 3205 (13.87) | 330 (150) | 77.3 (1964) | 3.1 (80) | 1.6 (40) | 9.1 (231) | 3.0 (76) | 1 7/8-12 UN (SAE-24) | 2" | 240 |

Dimensions are for general information only, all critical dimensions should be verified.

Dimensions are in inches/(mm) and lbs/(kg)

Note:

- 1) Applies to SAE thread type only. For Split Flange, see chart and illustration on previous page.
- 2) Maximum discharge flow rate recommended for vertically mounted accumulators.

Water Service

RED selections are non-standard items – Contact HYDAC for information and availability
Not all combinations are available

| Size (L) | Effective Gas Vol (in3) | MAWP psi/(bar) | Model Code | P/N | Fluid Connection Thread Size |
|----------|-------------------------|----------------|---|---------|------------------------------|
| 1 | 66 | 3000 (210) | SB330-1A1/002S-210C | 2055285 | SAE 1 1/16" - 12 UN |
| 4 | 226 | 3000 (210) | SB330-4A1/002S-210C | 2055070 | SAE 1 5/8" - 12 UN |
| 4 | 226 | 3000 (210) | SB330-4A1/005S-210C | 2092089 | SAE 1 5/8" - 12 UN |
| 4 | 226 | 3000 (210) | SB330-4A1/006S-210D (USES 1.25" NPT ADAP) | 2091080 | 1 1/4" NPT |
| 6 | 340 | 3000 (210) | SB330-6A1/002S-210D (USES 1.25" NPT ADAP) | 2092310 | 1 1/4" NPT |
| 10 | 566 | 3000 (210) | SB330-10A1/002S-210C | 2055224 | SAE 1 7/8" - 12 UN |
| 10 | 566 | 3000 (210) | SB330-10A1/002S-210D | 2087571 | 2" NPT |
| 10 | 566 | 3000 (210) | SB330-10F1/002S-210E | 2069474 | Flanged SAE 2" (Code 61) |
| 20 | 1125 | 3000 (210) | SB330-20A1/002S-210C | 2054720 | SAE 1 7/8" - 12 UN |
| 20 | 1125 | 3000 (210) | SB330-20A1/002S-210D | 2087570 | 2" NPT |
| 20 | 1125 | 3000 (210) | SB330-20A1/002S1-210A CRN | 2082666 | 2" BSPP |
| 20 | 1125 | 3000 (210) | SB330-20A1/002S1-210C CRN | 2084359 | SAE 1 7/8" - 12 UN |
| 20 | 1125 | 3000 (210) | SB330-20F1/002S-210E | 2072909 | Flanged SAE 2" (Code 61) |
| 32 | 2080 | 3000 (210) | SB330-32A1/002S-210C | 2083387 | SAE 1 7/8" - 12 UN |
| 32 | 2080 | 3000 (210) | SB330-32A1/002S-210D | 2063921 | 2" NPT |
| 32 | 2080 | 3000 (210) | SB330-32F1/002S-210E | 2072536 | Flanged SAE 2" (Code 61) |
| 54 | 3205 | 3000 (210) | SB330-54A1/002S-210C | 2055269 | SAE 1 7/8" - 12 UN |
| 54 | 3205 | 3000 (210) | SB330-54A1/002S-210D | 2069311 | 2" NPT |
| 54 | 3205 | 3000 (210) | SB330-54A1/002S1-210A CRN | 2082667 | 2" BSPP |
| 54 | 3205 | 3000 (210) | SB330-54F1/002S-210E | 2055105 | Flanged SAE 2" (Code 61) |

| | | | | | |
|----|------|------------|---------------------------|---------|------------------------------|
| 1 | 66 | 5000 (345) | SB600-1A1/002S-345C | 2054911 | SAE 1 5/8" - 12 UN |
| 1 | 66 | 5000 (345) | SB600-1F1/002S-345H | 2094814 | Flanged SAE 1" (Code 62) |
| 4 | 226 | 5000 (345) | SB600-4A1/002S-345C | 2055063 | SAE 1 5/8" - 12 UN |
| 10 | 566 | 5000 (345) | SB600-10A1/002S-345C | 2055093 | SAE 1 7/8" - 12 UN |
| 10 | 566 | 5000 (345) | SB600-10A1/002S1-345C CRN | 2093123 | SAE 1 7/8" - 12 UN |
| 10 | 566 | 5000 (345) | SB600-10F1/002S-345F | 2089028 | Flanged SAE 1 1/2" (Code 62) |
| 20 | 1125 | 5000 (345) | SB600-20A1/002S-345C | 2056383 | SAE 1 7/8" - 12 UN |
| 20 | 1125 | 5000 (345) | SB600-20F1/002S-345F | 2083359 | Flanged SAE 1 1/2" (Code 62) |
| 32 | 2080 | 6000 (414) | SB600-32A1/002S-414A | 2070756 | 2" BSPP |
| 32 | 2080 | 5000 (345) | SB600-32F1/002S-345F | 2076097 | Flanged SAE 1 1/2" (Code 62) |
| 54 | 3180 | 5000 (345) | SB600-54A1/002S-345C | 2062971 | SAE 1 7/8" - 12 UN |
| 54 | 3180 | 5000 (345) | SB600-54A1/006S-345C | 2094879 | SAE 1 7/8" - 12 UN |
| 54 | 3180 | 5000 (345) | SB600-54F1/002S-345F | 2074828 | Flanged SAE 1 1/2" (Code 62) |

Model Code

Model Codes containing RED selections are non-standard items – Contact HYDAC for information and availability
Not all combinations are available

SB 90 - 20 S 11/ 332S1-82C

Series
 SB 50 = Bladder Accumulator (725 psi, Nominal)
 SB 90 = Bladder accumulator (1190 psi, Nominal)

Size
 10 = 2.5 gal
 20 = 5 gal
 35 = 10 gal
 50 = 15 gal

Line Connection
 S = Threaded (SAE Lock Nut)
 F = Flanged (SAE Lock Nut)

Gas Port
 11 = 2pc 316 SS Gas Valve (MS28889-2)
 (see page 68 for permanent gauge blocks. See page 60 for charging and gauging info, FPO is recommended)

Fluid port
 3 = 316 Stainless steel

Shell
 3 = 316 Stainless steel (Static Storage Temp -40 Deg C to 100 Deg C) Vessel Only

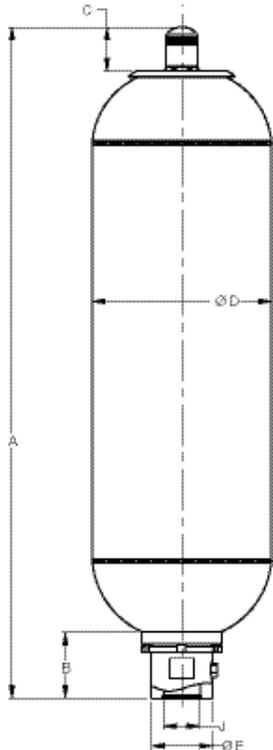
Bladder Compound

| Compound | Oper. Temp Range | Typical Fluids |
|----------|------------------|--|
| NBR | 5° to 180°F | mineral oils |
| 3 | 32° to 180°F | water & water-glycols (5% minimum glycol) |
| 4 | -20° to 250°F | mineral oils |
| 5 | -50° to 180°F | mineral oils |
| 6 | -20° to 250°F | mineral oils |
| 7 | -40° to 250°F | mineral oils (with low temperature CS shell) |
| IIR | -20° to 200°F | phosphate esters & brake fluids |
| FPM | 5° to 300°F | chlorinated hydrocarbons |

Country of Installation
 S1 = USA & Canada

Maximum Working Pressure (in bar)
 50 = SB50's 725 PSI
 82 = SB90's 1189 PSI

Fluid Port Connection (316SS)
 Threaded
 C = SAE
 D = NPT
 Flanged
 E = SAE 2" - 3000 psi



SB 90... (1190 psi)

| Nom. Vol. (L) | Eff. Gas Vol. in ³ / (gal.) | Weight | A | B ⁽¹⁾ | C | ØD | ØE | Thread J | |
|---------------|--|----------|-------------|------------------|----------|-----------|----------|----------------------|------|
| | | | | | | | | SAE | NPTF |
| 10 | 566 | 59 (31) | 21.2 (538) | 3.1 (80) | 2.3 (58) | 8.6 (219) | 3.0 (76) | 1 7/8-12 UN (SAE-24) | 2" |
| 20 | 1125 | 102 (46) | 33.4 (848) | 3.1 (80) | 2.3 (58) | 8.6 (219) | 3.0 (76) | 1 7/8-12 UN (SAE-24) | 2" |
| 35 | 2080 | 146 (66) | 53.9 (1368) | 3.1 (80) | 2.3 (58) | 8.6 (219) | 3.0 (76) | 1 7/8-12 UN (SAE-24) | 2" |
| 50 | 3205 | 212 (96) | 77.9 (1978) | 3.1 (80) | 2.3 (58) | 8.6 (219) | 3.0 (76) | 1 7/8-12 UN (SAE-24) | 2" |

Dimensions are in inches/(mm) and lbs/(kg)

Additional sizes available.

For sizes above 15 gal., contact HYDAC Accumulator Product Management.

| Model Code | Part Number |
|---------------------|-------------|
| SB90-10S11/332S-82C | 2200084 |
| SB90-20S11/332S-82C | 2200090 |
| SB90-35S11/332S-82C | 2200097 |
| SB90-50S11/332S-82C | 2200101 |

Model Code

Model Codes containing RED selections are non-standard items – Contact HYDAC for information and availability
 Not all combinations are available

SB 330 - 20 S 11 / 112 S - 210 C XXX

Series

- SB 330 = Bladder accumulator (3000 psi, Typically)
- SB 600 = Bladder accumulator (5000 psi, Typically)

Design

- (omit) = Standard (bottom repairable)
- TR = Top Repairable

Size (see dimension tables on the previous pages for most common sizes)

- 10 = 2.5 gallons
- 20 = 5 gallons
- 32 = 10 gallons
- 42 = 11 gallons
- 54 = 15 gallons

Line Connection

- S = Threaded (SAE Lock Nut)
- F = Flanged (SAE Lock Nut)

Gas Port

- 11 = 2 Piece Gas Valve (see pg 19 for details)

Material Code

Depending on Application

- 112 = Standard for oil service (mineral oil)

Fluid Port

- 0 = Synthetic coated carbon steel (PTFE solid film, internal & external for water service)
- 1 = Carbon steel
- 2 = High strength stainless steel (typically 17-4 PH)
- 3 = Stainless steel (corrosion resistance) (typically 316SS)
- 4 = Chemically plated carbon steel (internal & external for water service)
- 6 = Low temperature carbon steel (<-40°F, min)
- 7 = Others available on request

Shell

- 0 = Synthetic coated carbon steel (PTFE solid film, internal & external for water service)
- 1 = Carbon steel
- 2 = Chemically plated carbon steel (internal & external for water service)
- 6 = Low temperature carbon steel (<-40°F)
- 7 = Others available on request

Bladder Compound

| Compound | Oper. Temp Range | Typical Fluids |
|-----------------------------------|------------------|--|
| 2 = NBR (Buna N) | -10° to 220°F | mineral oils |
| 3 = ECO (Hydrin) | -10° to 220°F | water & water-glycols (5% minimum glycol) |
| 4 = IIR (Butyl) | -50° to 180°F | mineral oils |
| 5 = LT-NBR (low temp. Buna) | -20° to 250°F | mineral oils |
| 6 = FPM (Fluoroelastomer) | -40° to 250°F | mineral oils (with low temperature CS shell) |
| 7 = Others (available on request) | -20° to 200°F | phosphate esters & brake fluids |
| | 5° to 300°F | chlorinated hydrocarbons |

Country of Installation

- S = USA
- W1 = ABS Type Approval
- W3 = DNV Type Approval
- S1 = Canada (CRN Registration)
- U = PED/CE

(for other countries see page 3 for proper code designation)

Maximum Working Pressure

- 210 = 3000 psi
- 345 = 5000 psi
- 414 = 6000 psi

Fluid Port Connection

Threaded

- C = SAE (ANSI B1.1)
- D = NPT (ANSI B1.2)

Flanged

- E = SAE 2" - 3000 psi (Code 61)
- F = SAE 1 1/2" - 6000 psi (Code 62)

Gas Precharge Pressure (P₀) in bar

- xxx = 3 digits

Note: For the full line of bladder accumulators please refer to page 4.

Bladder Accumulators SB Series Bottom Repairable

SB 330... (3000 psi)

| Size (L) | Nom. Vol. (gal.) | Eff. Gas Vol. in ³ / (gal.) | Weight | A | B | C | ØD | ØE | Thread-J NPTF | | Q ⁽¹⁾ gpm |
|----------|------------------|--|-----------|-------------|----------|----------|-----------|----------|---------------|----|----------------------|
| | | | | | | | | | | | |
| 10 | 2 1/2 | 566 (2.45) | 86 (39) | 22.0 (559) | 3.1 (80) | 2.3 (58) | 9.1 (231) | 3.0 (76) | 1 1/4 | 2" | 240 |
| 20 | 5 | 1125 (4.87) | 140 (63) | 34.5 (876) | 3.1 (80) | 2.3 (58) | 9.1 (231) | 3.0 (76) | 1 1/4 | 2" | 240 |
| 32 | 10 | 2080 (9.00) | 226 (102) | 54.7 (1390) | 3.1 (80) | 2.3 (58) | 9.1 (231) | 3.0 (76) | 1 1/4 | 2" | 240 |
| 42 | 11 | 2320 (10.04) | 270 (123) | 60.2 (1530) | 3.1 (80) | 2.3 (58) | 9.1 (231) | 3.0 (76) | 1 1/4 | 2" | 240 |
| 54 | 15 | 3205 (13.87) | 330 (150) | 78.3 (1990) | 3.1 (80) | 2.3 (58) | 9.1 (231) | 3.0 (76) | 1 1/4 | 2" | 240 |

See notes at bottom of page

Dimensions are for general information only, all critical dimensions should be verified.
Dimensions are in inches/(mm) and lbs/(kg)

SB 600... (5000 psi)

| Size (L) | Nom. Vol. (gal.) | Eff. Gas Vol. in ³ / (gal.) | Weight | A | B | C | ØD | ØE | Thread-J NPTF | | Q ⁽¹⁾ gpm |
|----------|------------------|--|-----------|-------------|----------|----------|--------------------|----------|---------------|----|----------------------|
| | | | | | | | | | | | |
| 10 | 2 1/2 | 566 (2.45) | 154 (70) | 22.4 (568) | 3.1 (80) | 2.8 (70) | 9.1-9.7 (232 -247) | 3.0 (76) | 1 1/4 | 2" | 240 |
| 20 | 5 | 1125 (4.87) | 248 (113) | 35.0 (888) | 3.1 (80) | 2.8 (70) | 9.1-9.7 (232-247) | 3.0 (76) | 1 1/4 | 2" | 240 |
| 32 | 10 | 2080 (9.00) | 413 (188) | 55.2 (1402) | 3.1 (80) | 2.8 (70) | 9.1-9.7 (232-247) | 3.0 (76) | 1 1/4 | 2" | 240 |
| 54 | 15 | 3180 (13.77) | 611 (278) | 78.8 (2002) | 3.1 (80) | 2.8 (70) | 9.1-9.7 (232-247) | 3.0 (76) | 1 1/4 | 2" | 240 |

See notes at bottom of page

Dimensions are for general information only, all critical dimensions should be verified.
Dimensions are in inches/(mm) and lbs/(kg)

Split Flange Connections (sizes 10 - 54)

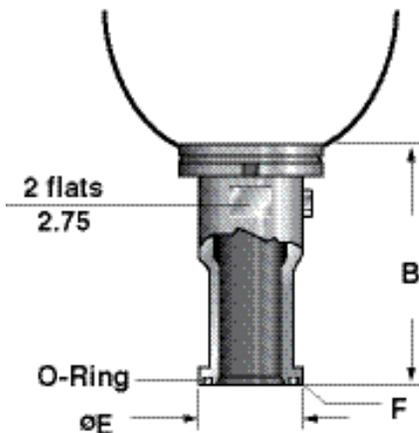
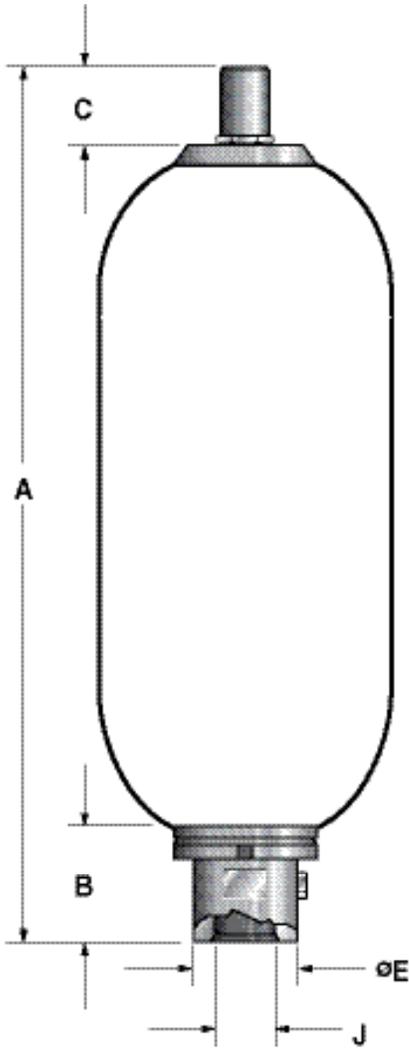
| Series | B | ØE | Split Flange Connection F | Q ⁽¹⁾ gpm |
|---------------------|--------------|---------------|----------------------------------|----------------------|
| SB 330 SB 330 TR | 4.1 (104) | 2.8 (71.4) | SAE 2" - 3000 psi Code 61 | 240 |
| SB 600 SB 600 TR | 5.5 (140) | 2.5 (63.5) | SAE 1 1/2" - 5000 psi Code 62 | 240 |

See notes at bottom of page

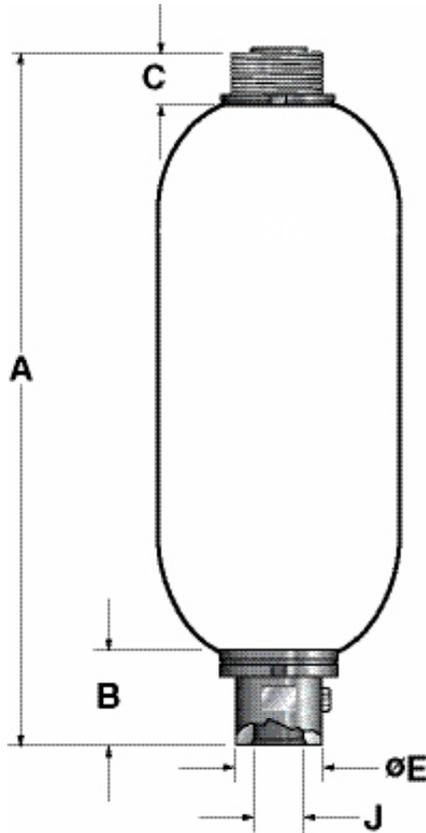
Dimensions are for general information only, all critical dimensions should be verified.
Dimensions are in inches/(mm) and lbs/(kg)

Note:

1) Maximum discharge flow rate recommended for vertically mounted accumulators.



Top Repairable



SB 330 TR... (3000 psi)

| Size (L) | Nom. Vol. (gal.) | Eff. Gas Vol. in ³ / (gal.) | Weight | A | B | C | ØD | ØE | Thread-J NPTF | | Q ⁽¹⁾ gpm |
|----------|------------------|--|-----------|-------------|----------|----------|-----------|----------|---------------|----|----------------------|
| | | | | | | | | | | | |
| 10 | 2 1/2 | 566 (2.45) | 94 (43) | 21.3 (540) | 3.1 (80) | 1.6 (40) | 9.1 (231) | 3.0 (76) | 1 1/4 | 2" | 240 |
| 20 | 5 | 1125 (4.87) | 140 (63) | 34.8 (883) | 3.1 (80) | 1.6 (40) | 9.1 (231) | 3.0 (76) | 1 1/4 | 2" | 240 |
| 32 | 10 | 2080 (9.00) | 226 (102) | 55.0 (1397) | 3.1 (80) | 1.6 (40) | 9.1 (231) | 3.0 (76) | 1 1/4 | 2" | 240 |
| 42 | 11 | 2320 (10.04) | 270 (123) | 60.2 (1530) | 3.1 (80) | 1.6 (40) | 9.1 (231) | 3.0 (76) | 1 1/4 | 2" | 240 |
| 54 | 15 | 3205 (13.87) | 330 (150) | 78.6 (1997) | 3.1 (80) | 1.6 (40) | 9.1 (231) | 3.0 (76) | 1 1/4 | 2" | 240 |

See note at bottom of page

Dimensions are for general information only, all critical dimensions should be verified.
Dimensions are in inches/(mm) and lbs/(kg)

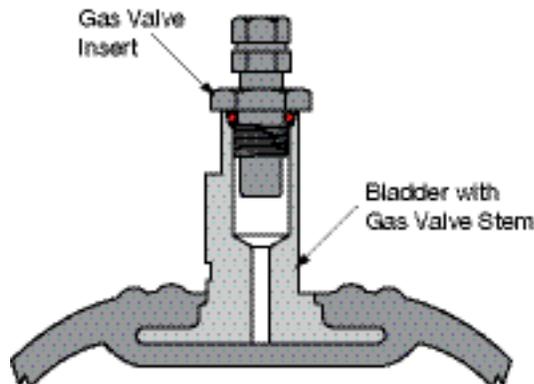
SB 600 TR... (5000 psi)

| Size (L) | Nom. Vol. (gal.) | Eff. Gas Vol. in ³ / (gal.) | Weight | A | B | C | ØD | ØE | Thread-J NPTF | | Q ⁽¹⁾ gpm |
|----------|------------------|--|-----------|-------------|----------|----------|--------------------|----------|---------------|----|----------------------|
| | | | | | | | | | | | |
| 10 | 2.5 | 566 (2.45) | 154 (70) | 20.9 (531) | 3.1 (80) | 1.6 (40) | 9.1-9.7 (232 -247) | 3.0 (76) | 1 1/4 | 2" | 240 |
| 20 | 5 | 1125 (4.87) | 248 (113) | 33.5 (851) | 3.1 (80) | 1.6 (40) | 9.1-9.7 (232 -247) | 3.0 (76) | 1 1/4 | 2" | 240 |
| 32 | 10 | 2080 (9.00) | 413 (188) | 53.7 (1364) | 3.1 (80) | 1.6 (40) | 9.1-9.7 (232-247) | 3.0 (76) | 1 1/4 | 2" | 240 |
| 54 | 15 | 3205 (13.87) | 611 (278) | 77.3 (1964) | 3.1 (80) | 1.6 (40) | 9.1-9.7 (232-247) | 3.0 (76) | 1 1/4 | 2" | 240 |

See note at bottom of page

Dimensions are for general information only, all critical dimensions should be verified.
Dimensions are in inches/(mm) and lbs/(kg)

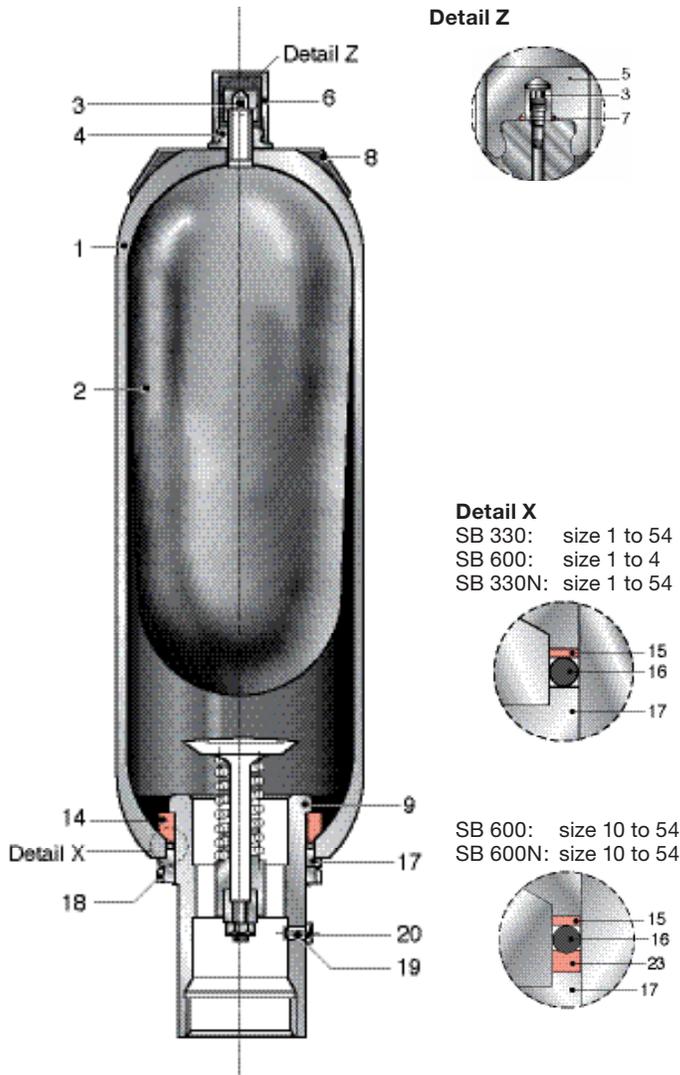
2 Piece Gas Valve MS28889-2



Note: Maximum discharge flow rate recommended for vertically mounted accumulators.

Bladder Accumulators - Spare Parts

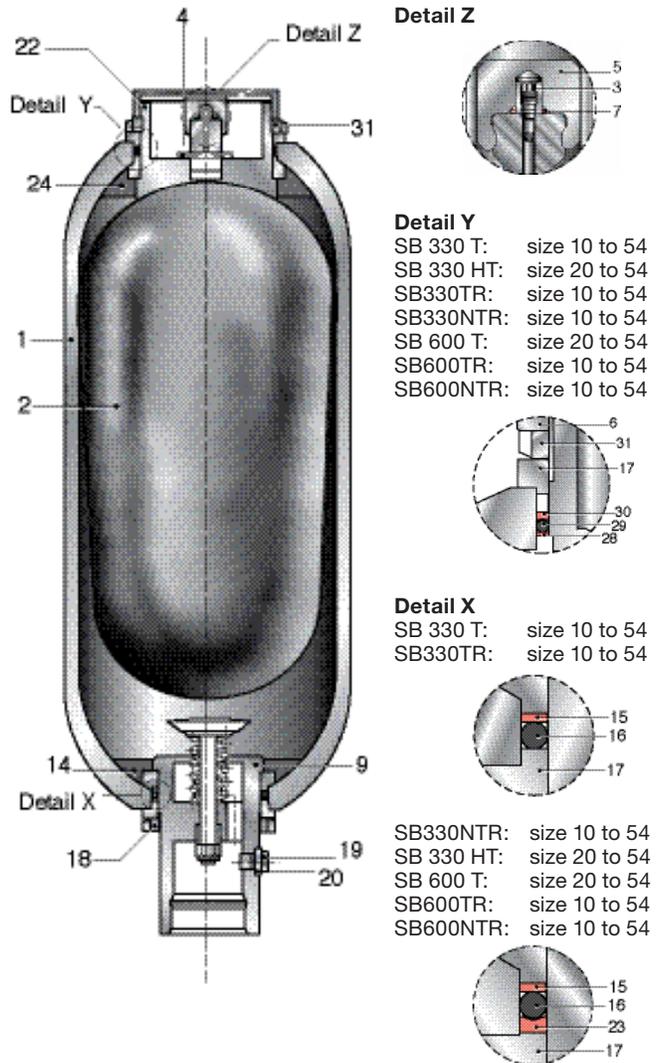
Bottom Repairable SB330, SB330H, SB330N SB600, SB600N



Repair Kits consist of items
2, 3, 4 (SB 600 only), 5, 7, 15, 16, 23 (where applicable)

Seal Kits consist of items
15, 16, 23 (where applicable)

Top Repairable SB330T, SB330HT, SB330TR, SB330NTR, SB 600T, SB600TR, SB600NTR



Repair Kits consist of items
SB330T, SB330TR, SB330NTR SB600T, SB600TR, SB600NTR:
2, 3, 5, 7, 15, 16, 23 (where applicable), 28, 29, 30
SB330HT: 2, 3, 5, 7, 23 (where applicable), 28, 29, 30

Seal Kits consist of items
15, 16, 23 (where applicable), 28, 29, 30

Parts Legend

Gas Side

- | | |
|------------------------|------------------------|
| 1 Shell | 8 Name Plate |
| 2 Bladder | 22 Gas Port Adapter |
| 3 Gas Valve Core | 24 Anti-extrusion Ring |
| 4 Gas Side Lock Nut | 28 Flat Ring |
| 5 Valve Seal Cap | 29 O-ring |
| 6 Valve Protection Cap | 30 Back-up Ring |
| 7 O-ring | 31 Gas Port Lock Nut |

Fluid Side

- | |
|------------------------|
| 9 Fluid Port |
| 14 Anti-extrusion Ring |
| 15 Flat Ring |
| 16 O-ring |
| 17 Spacer Ring |
| 18 Fluid Port Lock Nut |
| 19 Vent Screw |
| 20 Seal Ring |
| 23 Back-up Ring |

Seal Kits

For seal kits and repair kits other than Buna N, and for sizes not listed please consult factory.

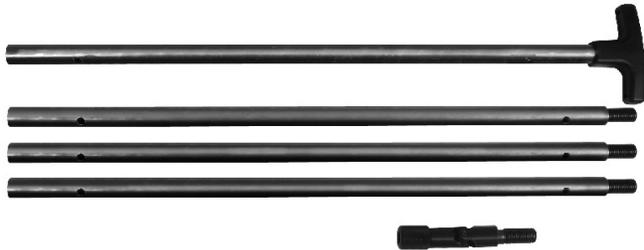
Bottom Repairable - Buna N*

| Size | 3000 PSI | | 5000 PSI | |
|---------------|---------------------|--------------------|---------------------|--------------------|
| | Fluid Port Seal Kit | Bladder Repair Kit | Fluid Port Seal Kit | Bladder Repair Kit |
| 1 (1 qt.) | 2054031 | 2054034 | 2054032 | 2054455 |
| 4 (1 gal.) | 2054032 | 2054035 | 2054032 | 2054035 |
| 6 (1.5gal.) | 2054032 | 2054677 | N/A | N/A |
| 10 (2.5 gal.) | 2054033 | 2054036 | 2054283 | 2054279 |
| 20 (5 gal.) | 2054033 | 2054037 | 2054283 | 2054280 |
| 32 (10 gal.) | 2054033 | 2054038 | 2054283 | 2054281 |
| 42 (11 gal.) | 2054033 | 2075963 | N/A | N/A |
| 54 (15 gal.) | 2054033 | 2054039 | 2054283 | 2054282 |

*For seal kits and repair kits other than Buna N, and for sizes and types not listed please contact HYDAC.

Tools

| Item | Part Number |
|--|-------------|
| Pull Rod (Schrader Valve) | 2092306 |
| Pull Rod (G 1/4" valve) | 2094570 |
| Gas Valve Torque Wrench | 2080987 |
| Gas Valve Core Tool | 0616886 |
| Spanner Wrenches: | |
| 1 Qt. - 52-55 mm | 2054547 |
| 1-15 Gal - 68-100 mm | 2054545 |
| High Flow and Top Repairable 120-130 mm | 2054548 |

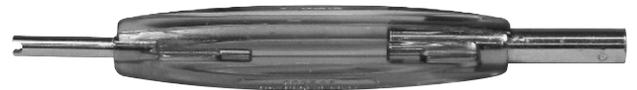


Pull Rod: Comes complete with fitting for gas valve, and 4 extension segments to accommodate accumulators up to 54 liter

Gas Valve Torque Wrench



Gas Valve Core Tool



Spanner Wrench



WARNING: Only qualified persons should perform maintenance on any type of accumulator. Complete maintenance instructions are available - Contact HYDAC.

Competitive Crossover Bladder Accumulators

Standard Bottom Repairable 3000 PSI / Oil Service / Buna N / SAE Thread



| Size | HYDAC | Accum Inc. ³ | Bosch | Greer | Oil Air | Parker |
|---------|---------|-------------------------|----------------|--------|-----------|--------------|
| 1 qt | 2054003 | A1QT3100-3 | 0-531-112-640 | 851550 | 1QT-100-6 | BA002B3T01A1 |
| 1 gal | 2054004 | A13100-3 | 0-531-113-640 | 841720 | 1-100-6 | BA01B3T01A1 |
| 2.5 gal | 2054005 | A2.53100-3 | 0-531-114-640 | 849760 | 2.5-100-6 | BA02B3T01A1 |
| 5 gal | 2054006 | A53100-3 | 0-531-115-640 | 849392 | 5-100-6 | BA05B3T01A1 |
| 10 gal | 2054007 | A103100-3 | 0-531-115-650 | 850670 | 10-100-6 | BA10B3T01A1 |
| 15 gal | 2054008 | A153100-3 | 0-531-116-6401 | 849910 | 15-100-6 | BA15B3T01A1 |

Repair Kits¹⁰ Replacement Bladder

| Size | HYDAC | Accum Inc. ³ | Bosch ² | Greer | Oil Air | Parker |
|--|---------|-------------------------|--------------------|---------|------------|-------------|
| 1 qt 5/8" Gas Valve | 2054655 | AI-1QT-3KT | N/A | 7029283 | A1QT-3003 | 08506930023 |
| 1 qt 7/8" Gas Valve (HYDAC standard) | 2054034 | AI-1QT-3KT | 9-534-232-0243 | 702928 | A1QT-300 | N/A |
| 1 gal | 2054035 | AI-1-3KT | 9-534-232-025 | 702956 | A1-300 | 0850693010 |
| 2.5 gal | 2054036 | AI-2.5-3KT | 9-534-232-026 | 702970 | A2.5-2-300 | 0850693025 |
| 5 gal | 2054037 | AI-5-3KT | 9-534-232-027 | 702984 | A5-2-300 | 0850693050 |
| 10 gal | 2054038 | AI-10-3KT | 9-534-232-028 | 702998 | A10-2-300 | 0850693100 |
| 15 gal | 2054039 | AI-15-3KT | 9-534-232-0291 | 703026 | A15-2-300 | 0850693150 |

Top Repairable 3000 PSI / Oil Service / Buna N / SAE Thread



| Size | HYDAC | Accum Inc. ³ | Bosch ⁵ | Greer | Oil Air | Parker |
|---------|---------|-------------------------|--------------------|--------|--------------|-------------|
| 2.5 gal | 2089035 | A2.5TR3100-3 | 9-530-230-075 | 851420 | TR-2.5-100-6 | BA02T3T01A1 |
| 5 gal | 2081834 | A5TR3100-3 | 9-530-230-085 | 851430 | TR-5-100-6 | BA05T3T01A1 |
| 10 gal | 2079383 | A10TR3100-3 | 9-530-230-095 | 851590 | TR-10-100-6 | BA10T3T01A1 |
| 15 gal | 2079385 | A15TR3100-3 | 9-530-230-1051 | 852480 | TR-15-100-6 | BA15T3T01A1 |

Repair Kits¹⁰ Replacement Bladder

| Size | HYDAC | Accum Inc. ⁴ | Bosch ^{2,4} | Greer | Oil Air | Parker |
|---------|---------|-------------------------|----------------------|--------|------------|------------|
| 2.5 gal | 2062823 | AI-2.5-3KT | N/A | 702970 | A2.5-2-300 | 0850693025 |
| 5 gal | 2054104 | AI-5-3KT | 9-534-232-027 | 702984 | A5-2-300 | 0850693050 |
| 10 gal | 2054105 | AI-10-3KT | 9-534-232-028 | 702998 | A10-2-300 | 0850693100 |
| 15 gal | 2054106 | AI-15-3KT | 9-534-232-0291 | 703026 | A15-2-300 | 0850693150 |

Standard Bottom Repairable 5000 PSI / Oil Service / Buna N / SAE Thread



| Size | HYDAC | Accum Inc. ³ | Bosch ⁵ | Greer | Oil Air | Parker |
|---------|---------|-------------------------|--------------------|--------|---------------|-------------|
| 1 qt | 2054188 | N/A | N/A | 851120 | N/A | N/A |
| 1 gal | 2054189 | N/A | N/A | 851130 | N/A | BA01B5T01A1 |
| 2.5 gal | 2054276 | A2.55100-3 | N/A | 851150 | G-2.5-5-100-6 | BA02B5T01A1 |
| 5 gal | 2054275 | A55100-3 | N/A | 855360 | G-5-5-100-6 | BA05B5T01A1 |
| 10 gal | 2054277 | A105100-3 | N/A | 850680 | G-10-5-100-6 | BA10B5T01A1 |
| 15 gal | 2054278 | A155100-3 | N/A | 855370 | G-15-5-100-6 | BA15B5T01A1 |

Repair Kits¹⁰ Replacement Bladder

| Size | HYDAC | Accum Inc. ⁹ | Bosch ^{2,4} | Greer | Oil Air | Parker |
|---------|----------------------|-------------------------|----------------------|--------|--------------|-------------|
| 1 qt | 2054455 ⁷ | N/A | N/A | 704040 | N/A | N/A |
| 1 gal | 2054035 ⁷ | N/A | N/A | 704060 | N/A | N/A |
| 2.5 gal | 2054279 ⁸ | AI-2.5-5-3KT | N/A | 704080 | AG-2.5-5-300 | 08619050258 |
| 5 gal | 2054280 ⁸ | AI-5-5-3KT | N/A | 704100 | AG-5-5-300 | 08619050508 |
| 10 gal | 2054281 ⁸ | AI-10-5-3KT | N/A | 704120 | AG-10-5-300 | 08619051008 |
| 15 gal | 2054282 ⁸ | AI-15-5-3KT | N/A | 704140 | AG-15-5-300 | 08619051508 |

Footnotes

- 1 Only 14 gallon
- 2 Bladder only
- 3 Size of gas valve stem may be different than HYDAC standard (7/8"-14 UNF)
- 4 Style of gas valve stem (top-repairable) may differ (i.e. has flat) from HYDAC
- 5 Not ASME approved; TUV approved accumulators only
- 6 Top-repairable only
- 7 Gas valve stem 7/8"-14 UNF
- 8 Gas valve stem 2"
- 9 Size and/or style of gas valve may be different than HYDAC standard
- 10 HYDAC Repair Kit consists of:
 - Bladder
 - Lock Nut (SB 600 only)
 - Seal Kit
 - Gas Valve Core
 - Valve Seal Cap

SBO Series Diaphragm Accumulators



Description

Diaphragm accumulators are a cost effective option for numerous functions involving energy storage, shock absorption or pulsation dampening in a hydraulic or fluid system. They are well suited for applications where smaller fluid volumes and flow rates are adequate and that require or involve:

- Compact design
- Low weight
- Flexible mounting positions
- Extremely quick shock response
- Low cost
- Low lubricity fluids, like water

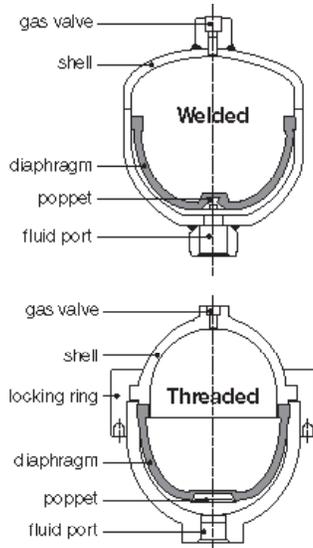
Diaphragm Accumulators have been successfully applied in both industrial and mobile applications for energy storage, maintaining pressure, leakage compensation, and vehicle hydraulic systems.

HYDAC manufactures two types of diaphragm accumulators:

- Non-repairable (welded)
- Repairable (threaded)

Construction

Both types of diaphragm accumulators have the same basic construction. The difference is in the shell. The welded version has a shell that is electron-beam welded, and therefore cannot be repaired. The threaded type has a shell made up of two halves (*top and bottom*) which are held together by a threaded locking ring.



Diaphragm Materials

Not all fluids are compatible with every elastomer at all temperatures, therefore, HYDAC offers the following materials:

- NBR (*Standard Nitrile*)
- LT-NBR (*Low Temperature Nitrile*)
- ECO 30 (*Epichlorohydrin*)
- IIR (*Butyl*)
- FPM (*Fluorelastomer*)
- others (*available upon request*)

To determine which material is appropriate, always refer to fluid manufacturer's recommendation.

Corrosion Protection

For use with certain aggressive or corrosive fluids, or in a corrosive environment, HYDAC offers protective coatings and corrosive resistant materials (*i.e. stainless steel*) for the parts that interface with the fluid or are exposed to the hostile environment.

Mounting Position

Diaphragm accumulators are designed to mount in any position. In systems where contamination is a problem, we recommend a vertical mount with the fluid port oriented downward.

System Mounting

HYDAC diaphragm accumulators are designed to be screwed directly onto the system. We also recommend the use of our mounting components, (detailed on page 86) to minimize the risk of failure due to system vibrations.

Applications

Some common applications of diaphragm accumulators are:

- Agricultural Machinery & Equipment
- Forestry Equipment
- Machine Tools
- Mining Machinery & Equipment
- Mobile & Construction Equipment
- Off-Road Equipment

For specific examples of applications using diaphragm accumulators, please see pages 75 and 76.

Model Code

Model Codes containing RED selections are non-standard items – Contact HYDAC for information and availability

Not all combinations are available

SBO 210 - 1 E4 / 112 S - 210 CK XXX

Series _____
 SBO XXX = Diaphragm Accumulator (XXX = series designation)
 (see tables on following pages for most common series and size selections)

Size (in Liters, see tables on dimension pages to follow) _____
 0.075 = 0.075 Liters
 ...see tables on following pages for complete list of sizes, and which versions they are available in
 3.5 = 3.5 Liters

Shell Construction and Gas Port Design _____
 E1 = Welded Construction, rechargeable, HYDAC Gas Valve Version 1 (M 28 x 1.5)
 E2 = Welded Construction, factory precharged and sealed, (not rechargeable)
 (Not available on SBO330 or on any accumulator larger than 1.4 liters)
 E4 = Welded Construction, rechargeable, HYDAC Gas Valve Version 4 (8VI-ISO 4570)
 A6 = Threaded Construction, rechargeable, HYDAC Gas Valve Version 1 (M 28 x 1.5)

Material Code _____
 Depending on Application
 112 = Standard for oil service (mineral oil)

Fluid Port _____
 1 = Carbon steel
 3 = Stainless steel
 4 = Chemically plated carbon steel (ONLY WETTED SURFACES for water service)
 6 = Low temperature carbon steel (< -20°F)

Shell _____
 0 = Synthetic coated carbon steel (Applied internally & externally for water service)
 1 = Carbon steel
 2 = Chemically plated carbon steel (internal & external for water service)
 4 = Stainless steel (please note: MAWP decreases for most stainless models - see tables)
 6 = Low temperature carbon steel (< -20°F)

Diaphragm Compound _____

| Compound | Oper. Temp Range | Typical Fluids |
|--------------|------------------|--|
| NBR | 5° to 180°F | mineral oils |
| Low Temp NBR | 32° to 180°F | water & water-glycols (5% minimum glycol) |
| ECO...113... | -50° to 180°F | mineral oils |
| ECO...663... | -20° to 250°F | mineral oils |
| IIR | -40° to 250°F | mineral oils & water (with low temperature CS shell) |
| IIR | -20° to 200°F | phosphate esters & brake fluids |
| FPM | 5° to 300°F | chlorinated hydrocarbons |

2 = NBR (Buna N)
 3 = ECO (Hydrin)
 4 = IIR (Butyl)
 5 = LT-NBR (low temp. Buna)
 6 = FPM (fluoroelastomer)
 7 = Others (available on request)

Country of Installation _____
 S = USA
 (for other countries see page 3 for proper code designation)

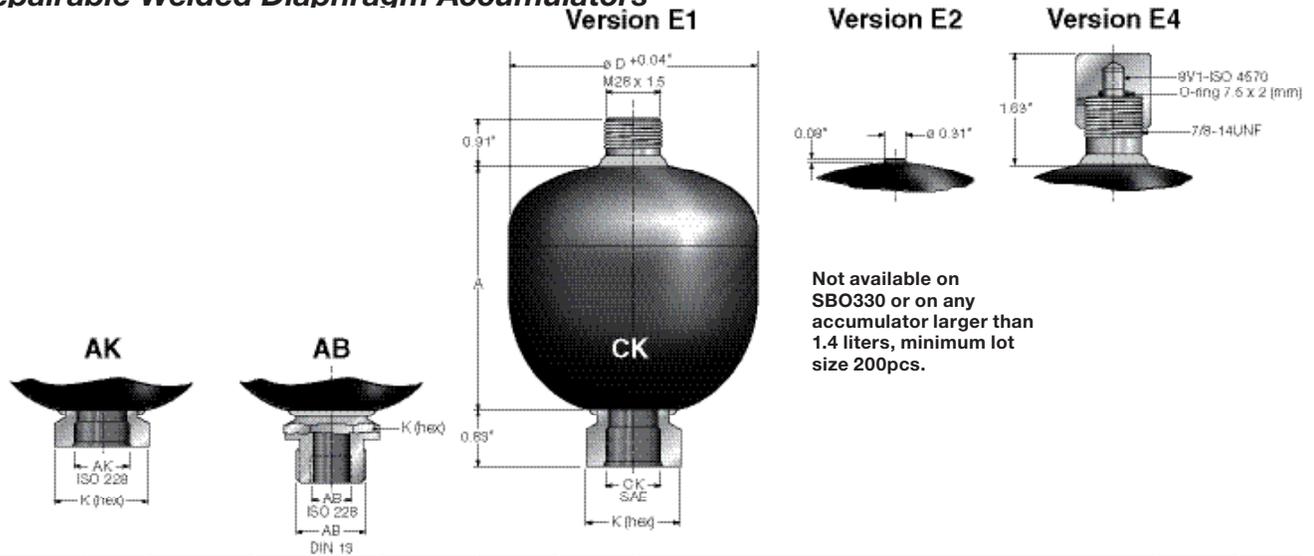
Maximum Working Pressure in bar (see tables on dimension pages to follow) _____
 100 = 1500 psi
 140 = 2000 psi
 200 = 3000 psi
 210 = 3000 psi
 250 = 3600 psi
 330 = 4700 psi
 400 = 5800 psi
 450 = 6500 psi
 500 = 7200 psi
 750 = 10000 psi

Fluid Port Connection _____
 AK = BSP connection
 AB = Male / Female combination connection
 CK = Standard SAE connection
 (other fluid ports available upon request — consult factory)

Gas Precharge Pressure (P₀) in bar (always required for E2 model gas valve) _____
 xxx = 3 digits

Dimensions

Non-Repairable Welded Diaphragm Accumulators



Not available on SBO330 or on any accumulator larger than 1.4 liters, minimum lot size 200pcs.

| Series | Max. p2:p0 | Size (L) | Effective Gas Vol (in ³) | MAWP psi/(bar) | Weight lbs/(kg) | A in (mm) | øD** in (mm) | Thread-F | | | | K-Hex in (mm) | Q gpm |
|---------|------------|----------|--------------------------------------|----------------|-----------------|---------------|--------------|----------------|-----------------|-----------------|-----------------|---------------|-------|
| | | | | | | | | CK | | AB | | | |
| | | | | | | | | (SAE - female) | (BSPP - female) | (BSPP - female) | (DIN 13 - male) | | |
| SBO 250 | 8:1 | 0.075 | 5 | 3600 (250) | 1.5 (0.7) | 2.68 (68.0) | 2.52 (64.0) | 9/16-18 UNF | G 1/2 | N/A | N/A | 1.18 (30) | 10 |
| SBO 210 | 8:1 | 0.16 | 10 | 2600/(180)* | 1.8 (0.8) | 3.15 (80.0) | 2.91 (74.0) | 9/16-18 UNF | G 1/2 | N/A | N/A | 1.18 (30) | 10 |
| | | | | 3000/(210) | | | | | | | | | |
| SBO 210 | 8:1 | 0.32 | 20 | 2400/(160)* | 2.9 (1.3) | 3.66 (93.0) | 3.66 (93.0) | 3/4-16 UNF | G 1/2 | N/A | N/A | 1.42 (36) | 25 |
| | | | | 3000/(210) | | | | | | | | | |
| SBO 210 | 8:1 | 0.5 | 30 | 3000 (210) | 3.7 (1.7) | 4.35 (124.0) | 4.13 (105.0) | 3/4-16 UNF | G 1/2 | N/A | N/A | 1.42 (36) | 25 |
| SBO 330 | 8:1 | 0.6 | 36 | 4700 (330) | 7.3 (3.3) | 5.04 (128.0) | 4.53 (115.0) | 3/4-16 UNF | G 1/2 | G 1/2 | M33 x 1.5 | 1.42 (36) | 25 |
| SBO 210 | 8:1 | 0.75 | 45 | 2000/(140)* | 6.2 (2.8) | 4.88 (124.0) | 4.76 (121.0) | 3/4-16 UNF | G 1/2 | G 1/2 | M33 x 1.5 | 1.42 (36) | 25 |
| | | | | 3000/(210) | | | | | | | | | |
| SBO 330 | 8:1 | 0.75 | 45 | 4700 (330) | 8.9 (4.0) | 4.78 (122.0) | 4.96 (126.0) | 3/4-16 UNF | G 1/2 | G 1/2 | M33 x 1.5 | 1.42 (36) | 25 |
| SBO 200 | 8:1 | 1 | 60 | 3000 (210) | 7.9 (3.6) | 5.39 (137.0) | 5.35 (136.0) | 3/4-16 UNF | G 1/2 | G 1/2 | M33 x 1.5 | 1.42 (36) | 25 |
| SBO 140 | 8:1 | 1.4 | 85 | 2000 (140) | 8.6 (3.9) | 5.91 (150.0) | 5.71 (145.0) | 3/4-16 UNF | G 1/2 | G 1/2 | M33 x 1.5 | 1.42 (36) | 25 |
| SBO 210 | 8:1 | 1.4 | 85 | 3000 (210) | 11.9 (5.4) | 6.14 (156.0) | 5.91 (150.0) | 3/4-16 UNF | G 1/2 | G 1/2 | M33 x 1.5 | 1.42 (36) | 25 |
| SBO 330 | 8:1 | 1.4 | 85 | 4700 (330) | 16.6 (7.5) | 6.33 (160.0) | 6.1 (155.0) | 3/4-16 UNF | G 1/2 | G 1/2 | M33 x 1.5 | 1.42 (36) | 25 |
| SBO 100 | 8:1 | 2 | 120 | 1500/(100)* | 8.8 (4.0) | 6.57 (167.0) | 6.3 (160.0) | 1 1/16 -12 UNF | G 3/4 | G 3/4 | M45 x 1.5 | 1.81 (46) | 40 |
| | | | | 1500/(100) | | | | | | | | | |
| SBO 210 | 8:1 | 2 | 120 | 3000 (210) | 14.6 (6.6) | 6.81 (173.0) | 6.57 (167.0) | 1 1/16 -12 UNF | G 3/4 | G 3/4 | M45 x 1.5 | 1.81 (46) | 40 |
| SBO 330 | 8:1 | 2 | 120 | 4700 (330) | 17.7 (8.0) | 7.12 (180.0) | 6.77 (172.0) | 1 1/16 -12 UNF | G 3/4 | G 3/4 | M45 x 1.5 | 1.81 (46) | 40 |
| SBO 210 | 4:1 | 2.8 | 170 | 3000 (210) | 18 (8.2) | 8.94 (227.0) | 6.57 (167.0) | 1 1/16 -12 UNF | G 3/4 | G 3/4 | M45 x 1.5 | 1.81 (46) | 40 |
| SBO 250 | 4:1 | 3.5 | 230 | 3000 (210) | 24.6 (11.2) | 11.14 (283.0) | 6.69 (170.0) | 1 1/16 -12 UNF | G 3/4 | G 3/4 | M45 x 1.5 | 1.81 (46) | 40 |
| SBO 330 | 4:1 | 3.5 | 230 | 4700 (330) | 30.6 (13.8) | 10.78 (274.0) | 6.77 (172.0) | 1 1/16 -12 UNF | G 3/4 | G 3/4 | M45 x 1.5 | 1.81 (46) | 40 |

Dimensions are for general information only, all critical dimensions should be verified.

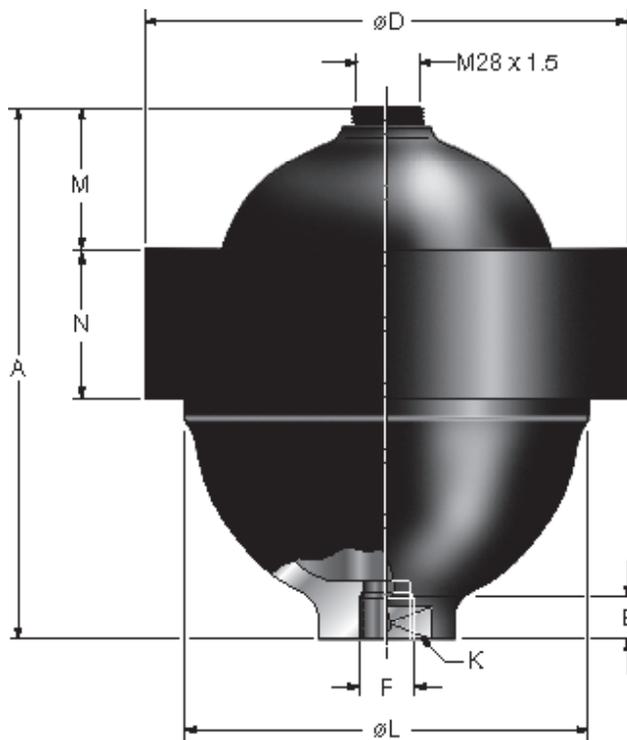
Dimensions are in inches/(mm) and lbs/(kg)

*Reduced MAWP values for stainless steel models

**Diameter at electron beam weld at shell seam may be up to +0.150" larger in diameter

HYDAC Diaphragm Accumulators

Repairable Threaded Diaphragm Accumulators



| Series | Max. p2:p0 | Size | Eff Gas Vol (in3) | MAWP psi/(bar) | Weight Lbs/(kg) | A in/(mm) | B in/(mm) | Ø D in/(mm) | Thread F | | K - Hex in/(mm) | Ø L in/(mm) | M in/(mm) | N in/(mm) | Q gpm |
|---------|------------|------|-------------------|----------------|-----------------|------------|-----------|-------------|-----------------|------------------|-----------------|-------------|-----------|-----------|-------|
| | | | | | | | | | CK (SAE-female) | AK (BSPP-female) | | | | | |
| SBO 500 | 10:1 | 0.1 | 6 | 7200 (500) | 4.2 (1.9) | 4.33 (110) | 1.18 (30) | 3.74 (95) | 3/4 - 16 UNF | G 1/2 | 1.26 (68) | 2.68 (68) | 0.87 (22) | 1.38 (35) | 25 |
| SBO 500 | 10:1 | 0.25 | 15 | 5000/(350)* | 8.6 (3.9) | 5.04 (128) | 0.79 (20) | 4.53 (115) | 3/4 - 16 UNF | G 1/2 | 1.42 (36) | 3.62 (92) | 0.71 (18) | 2.17 (55) | 25 |
| | | | | 7200/(500) | | | | | | | | | | | |
| SBO 750 | 10:1 | 0.25 | 15 | 8700/(600)* | 19.8 (9.0) | 5.35 (136) | 0.43 (11) | 6.02 (153) | 3/4 - 16 UNF | G 1/2 | 1.42 (36) | 4.49 (114) | 0.59 (15) | 2.48 (63) | 25 |
| | | | | 10,000/(750) | | | | | | | | | | | |
| SBO 450 | 10:1 | 0.6 | 36 | 3600/(250)* | 12.6 (5.7) | 6.69 (170) | 0.75 (19) | 5.51 (140) | 3/4 - 16 UNF | G 1/2 | 1.61 (41) | 4.53 (115) | 1.77 (45) | 2.24 (57) | 25 |
| | | | | 4700/(330) | | | | | | | | | | | |
| SBO 210 | 10:1 | 1.3 | 80 | 3000 (210) | 18.7 (8.5) | 7.48 (190) | 0.31 (8) | 6.69 (170) | 3/4 - 16 UNF | G 1/2 | 1.26 (32) | 5.71 (145) | 2.24 (57) | 2.17 (55) | 25 |
| SBO 400 | 10:1 | 1.3 | 80 | 5800 (400) | 24.7 (11.2) | 7.75 (197) | 1.1 (28) | 7.91 (201) | 3/4 - 16 UNF | G 3/4 | 1.97 (50) | 6.3 (160) | 1.97 (50) | 2.56 (65) | 25 |
| SBO 250 | 10:1 | 2.0 | 120 | 2600/(180)* | 25.1 (11.4) | 8.93 (227) | 0.67 (17) | 7.91 (201) | 1 1/16-12 UNF | G 3/4 | 1.61 (41) | 6.61 (168) | 2.44 (62) | 2.52 (64) | 40 |
| | | | | 3600/(250) | | | | | | | | | | | |

Dimensions are for general information only, all critical dimensions should be verified.
Dimensions are in inches/(mm) and lbs/(kg)

*Reduced MAWP values for stainless steel models

Diaphragm Spare Parts

| | |
|--|---|
| 2075359 Vent Screw M8 (w/ NBR Seal Ring) Version 1 | 2067728 Metal Valve Protection Cap, Version 1 |
| 2100344 Vent Screw M8 only | 632865 Gas valve core (Version 4) |
| 6004771 NBR Seal Ring, U9.3X13.3X1 | 237977 Valve seal cap (Version 4) |
| 2127517 Plastic Valve Protection Cap, Version 1 | 626488 O-ring 7.5x2 (Buna) |

Water Service Accumulators

RED selections are not standard item - Contact HYDAC for information and availability.

| Size (liters) | Effective Gas Vol (in3) | MAWP psi/(bar) | Model Code | Part Number | Fluid Connection Thread Size |
|--|-------------------------|----------------|-----------------------------|-------------|------------------------------|
| Stainless Steel Port / Stainless Steel Shell | | | | | |
| 0.16 | 10 | 2600 / 180 | SBO210-0.16E1/342S-180CA | 3344456 | SAE 3/4"-16UNF-2A male |
| 0.16 | 10 | 2600 / 180 | SBO210-0.16E1/342S-180HA | 2104224 | 1/2" NPTF male |
| 0.16 | 10 | 2600 / 180 | SBO210-0.16E1/346S-180HA | 2108258 | 1/2" NPTF male |
| 0.16 | 10 | 2600 / 180 | SBO210-0.16E1/346U-180AK | 3041996 | G 1/2" BSPP female |
| 0.25 | 15 | 5000 / 345 | SBO500-0.25A6/342S-350AK | 2110031 | G 1/2" BSPP female |
| 0.25 | 15 | 5000 / 345 | SBO500-0.25A6/346S-350AK | 2122000 | G 1/2" BSPP female |
| 0.25 | 15 | 10,800 / 745 | SBO750-0.25A6/342S-750AK | 2103443 | G 1/2" BSPP female |
| 0.25 | 15 | 10,800 / 745 | SBO750-0.25A6/342S-750CK | 2110811 | SAE 3/4" -16 UNF female |
| 0.25 | 15 | 10,800 / 745 | SBO750-0.25A6/342U-750AK | 3042064 | G 1/2" BSPP female |
| 0.32 | 20 | 2300 / 160 | SBO210-0.32E1/342S-160HF | 2111137 | 3/4" NPTF male |
| 0.32 | 20 | 2300 / 160 | SBO210-0.32E1/346S-160HF | 2111138 | 3/4" NPTF male |
| 0.6 | 36 | 3600 / 250 | SBO450-0.6A6/342S-250AK | 2121077 | G 1/2" BSPP female |
| 0.6 | 36 | 3600 / 250 | SBO450-0.6A6/346U-250AK | 3042074 | G 1/2" BSPP female |
| 0.75 | 45 | 2000 / 140 | SBO210-0.75E1/342S-140HD | 2108260 | 1" NPTF male |
| 0.75 | 45 | 2000 / 140 | SBO210-0.75E1/343S-140HD | 2108850 | 1" NPTF male |
| 0.75 | 45 | 2000 / 140 | SBO210-0.75E1/346S-140HD | 2106833 | 1" NPTF male |
| 2.0 | 120 | 1450 / 100 | SBO100-2E1/342S-100HC | 2106047 | 1 1/4" NPTF male |
| 2.0 | 120 | 1450 / 100 | SBO100-2E1/342U-100AK | 2105229 | G 3/4" BSPP female |
| 2.0 | 120 | 1450 / 100 | SBO100-2E1/346S-100HC | 2108262 | 1 1/4" NPTF male |
| 2.0 | 120 | 2600 / 180 | SBO250-2A6/342S-180AK | 2103395 | G 3/4" BSPP female |
| 4.0 | 260 | 725 / 50 | SBO50-4E1/342U-50AB | 3107029 | G 3/4" BSPP / M45 x 1.5 |
| 4.0 | 260 | 725 / 50 | SBO50-4E1/346U-50AB | 3108261 | G 3/4" BSPP / M45 x 1.5 |
| 4.0 | 260 | 2600 / 180 | SBO250-4E1/344U-180CK | 3586865 | SAE 1 1/16" - 12 UNF female |
| Plated Port / Plated Shell | | | | | |
| 0.16 | 10 | 3000 / 210 | SBO210-0.16E2/422S-210HB031 | 2067722 | 1/2" NPTF male |
| 0.16 | 10 | 3000 / 210 | SBO210-0.16E2/422S-210HB034 | 2100033 | 1/2" NPTF male |
| 0.16 | 10 | 3000 / 210 | SBO210-0.16E2/422S-210HB086 | 2106845 | 1/2" NPTF male |
| 0.75 | 45 | 5000 / 340 | SBO330-0.75E1/422S-345AK | 2120586 | G 1/2" BSPP female |
| Stainless Steel Port / Synthetic Coated Shell | | | | | |
| 0.6 | 36 | 4700 / 320 | SBO330-0.6E1/302U-330AB | 2111755 | G 1/2" BSPP / M45 x 1.5 |
| 0.75 | 45 | 3000 / 210 | SBO210-0.75E1/302S-210HD* | 2114229 | 1" NPTF male |
| 0.75 | 45 | 3000 / 210 | SBO210-0.75E1/302S-210HD048 | 2084342 | 1" NPTF male |
| 3.5 | 230 | 3000 / 210 | SBO250-3.5E4/302S-210HC | 2101745 | 1-1/4" NPTF male |

Fluid Port / Shell Material Combinations Which Are Not Available

| | | |
|-----|------------------------|-------------------------|
| 32x | Stainless Steel Port | Chemically Plated Shell |
| 40x | Chemically Plated Port | Synthetic Coated Shell |
| 44x | Synthetic Coated Port | Chemically Plated Shell |

SK Series Piston Accumulators



Description

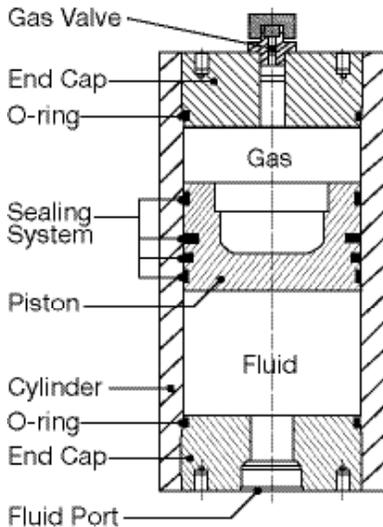
Piston Accumulators are a cost effective option for numerous functions involving energy storage, and sometimes shock absorption in a hydraulic or fluid system. They are well suited for applications needing:

- High Pressure Ratios
- Large Volumes of Oil
- High Fluid flow rates
- Volume monitoring by way of piston position sensor or switch systems

Construction

HYDAC piston accumulators consist of:

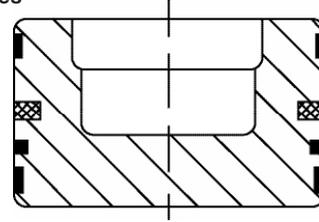
- A cylinder with a finely finished internal surface
- An end cap on the gas side and fluid side, sealed with o-rings
- A lightweight metal piston
- A variety of sealing systems are available depending on the application



Piston Types

TYPE 2

Without Check Valves



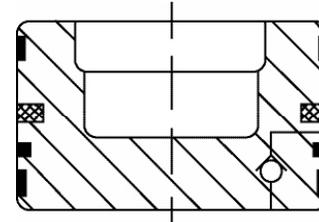
Application (without Check Valve)

Low-friction design for higher piston speeds, slow movements without stick-slip effect and high number of actuations (millions). Actual cycles achieved will vary with operating parameters.

Notes: Filtration $\leq 10 \mu\text{m}$ absolute. (ISO 17/15/12)
Max. continuous velocity = 12 ft/sec

TYPE 2

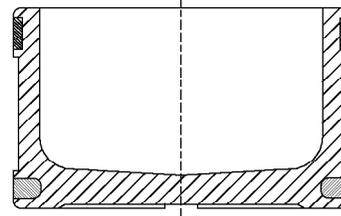
With Check Valves



Application (with Check Valve)

The addition of a check valve drastically reduces the oil pumping to the gas side of the piston.

TYPE 3



Application

Actual cycles achieved will vary with operating parameters.

Notes: Filtration $\leq 10 \mu\text{m}$ absolute. (ISO 17/15/12)

Max. continuous velocity = 3 ft/sec

Sealing Systems

Precise information about the proposed operating conditions is required in order to select the most appropriate sealing system. Important criteria for this selection are:

- Number of actuations or cycles
- Piston speed
- Temperature fluctuation
- Operating fluid
- Cleanliness of fluid
- Maintenance requirements

Seal Materials

The following sealing elastomers are available, depending on the operating conditions:

- NBR (acrylic nitrile butadiene rubber)
- FPM (fluoro-elastomer)
- PUR (polyurethane)

Suitable materials are also available for low temperature applications.

Fluids

The following sealing materials are suitable for the fluids listed below:

NBR, resistant to:

- Mineral Oils (HL and HLP)
- Non-flammable fluids from groups HFA, HFB, and HFC
- Water and seawater up to approx. 100°C

NBR, not resistant to

- Aromatic hydrocarbons
- Chlorinated hydrocarbons
- Amines and ketones
- Hydraulic fluids from the HFD Groups

FPM, resistant to:

- Mineral Oils (HL and HLP)
- Hydraulic fluids from the HFD Groups
- Fuels as well as aromatic and chlorinated hydrocarbons
- Inorganic acids (but not all, please contact HYDAC)

FPM not resistant to:

- Ketones and amines
- (Anhydrous) ammonia
- Organic acids such as formic acid and acetic acid

PUR resistant to:

- Mineral Oils (HL and HLP)
- Non-flammable fluids from the HFA group

PUR not resistant to:

- Water and water-glycol mixtures
- Alkalis
- Acids

Corrosion Protection

For use with certain aggressive or corrosive fluids, or in a corrosive environment, HYDAC offers protective coatings and corrosive resistant materials (i.e. stainless steel) for the accumulator parts that come in contact with the fluid, or are exposed to the hostile environment.

System Mounting

HYDAC piston accumulators may operate in any position. Vertical installation is preferable with the gas side up. We recommend the use of our mounting components, which are detailed on page 86, to minimize risk of failure due to system vibrations.

Effects of Seal Friction

The permissible piston velocity depends on the sealing friction. Higher piston velocities are possible where there is less sealing friction.

HYDAC piston accumulators with low friction piston seals allow continuous operating velocities of up to 12 ft/sec with short bursts, up to 15 ft/sec (see type 2 piston).

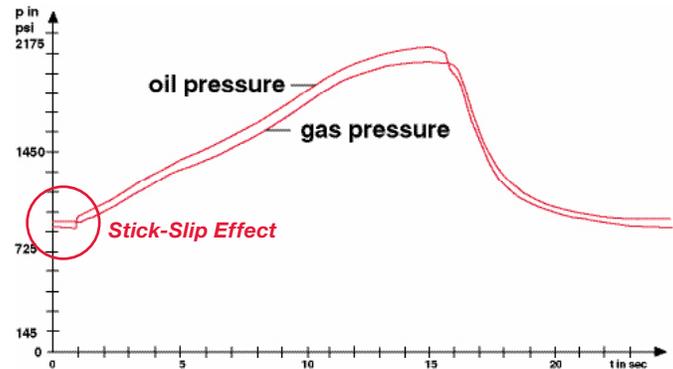
Small pressure differentials between gas and oil side improve the effectiveness of HYDAC piston accumulators. To emphasize the friction effect on the pressure curve during an accumulation cycle, measurements with various sealing systems are illustrated.

The measurement graphs below are a true representation of the gas and oil pressure of piston accumulators with different sealing systems. The comparison of these two measurements clearly shows the difference in the pressure differential between gas and oil side:

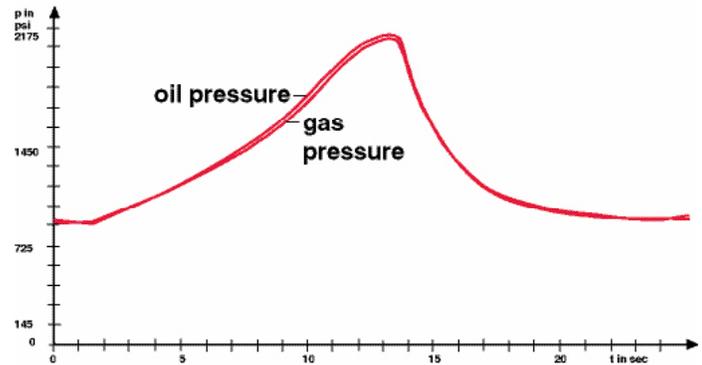
Graph 1: Δp max. \approx 125 psi

Graph 2: Δp max. \approx 14.5 psi

The effect of the sealing friction on the working pressure is particularly striking in traditional piston designs. Abrupt piston movements (*the stick-slip effect*) are caused by the seal friction as shown in Graph 1. The low sealing friction of HYDAC type 2 pistons drastically reduces the stick-slip effect therefore maximizing piston responsiveness.



Graph 1: Traditional piston designs



Graph 2: Piston Type 2 and Type 3 (low friction model)

Advantages of Using the Low-friction Sealing System (type 2):

- Minimum friction.
- Suitable for low pressure differentials.
- No start-up friction, no stick-slip.
- Low noise, no vibration.
- High piston speeds up to 12 ft/sec continuous.
- Improved accumulator efficiency.
- High life expectancy, low maintenance requirements.

Advantages of HYDAC Piston Accumulators

- Complete size range from 1 qt. to 100 gallons nominal volume.
- High ratios possible between precharge pressure and maximum working pressure.
- High flow rates - up to 4700 gpm from one accumulator.
- Power savings.
- Gas-proof and leak-free.
- No sudden discharge of gas when seal is worn.
- Space efficient.
- Piston location monitoring available.

SK 210 Series (Non-ASME) 3000 psi

Advantages

The piston accumulator series SK210 & 250 are an intermediate bore diameter with repairable design. They are HYDAC certified, designed in accordance with ASME pressure code. Features of this series are:

- Bore Diameter up to 6" ID
- Sizes from 1 quart to 15 gallons
- Largest range of standard models for quick delivery times
- Military Style Gas Valve MS28889-2 / M6164-2, repairable

Application

- Mobile Hydraulic
- Industrial Hydraulic

SK 250 Series (Non-ASME) 3600 psi

Advantages

The piston accumulator series SK350 are an intermediate bore diameter with repairable design. They are HYDAC certified, designed in accordance with ASME pressure code. Features of this series are:

- Bore Diameter up to 6" ID
- Sizes from 1 quart to 15 gallons
- Largest range of standard models for quick delivery times
- Military Style Gas Valve MS28889-2 / M6164-2, repairable

Application

- Mobile Hydraulic
- Industrial Hydraulic

SK 280 Series (Non-ASME) 4000 psi

Advantages

The piston accumulator series SK280 is a weight optimized, non-repairable design. The non-repairable design and special production process of these HYDAC accumulators save cost, making this series an economic option.

- Cost-effective – due to the non-repairable design and an optimized production process
- Weight reduced series
- Reduced installation space
- Standard-gas valve (HYDAC Version 1) with integrated

M28x1.5 male thread

- Quick delivery for models with standard connection
- SAE fluid ports are available
- PED/CE pressure code certification

Application

- Mobile Hydraulic
- Weight Sensitive Industrial Hydraulic

SK 350 Series (Non-ASME) 5000 psi

Advantages

The piston accumulator series SK350 are an intermediate bore diameter with repairable design. They are HYDAC certified, designed in accordance with ASME pressure code. Features of this series are:

- Bore Diameter up to 6" ID
- Sizes from 1 quart to 15 gallons
- Largest range of standard models for quick delivery times
- Military Style Gas Valve MS28889-2 / M6164-2, repairable

Application

- Mobile Hydraulic
- Industrial Hydraulic

SK 350 (ASME) 3000 psi SK 600 Series (ASME) 5000 psi

Advantages

The piston accumulator series SK350 & 600 is HYDAC's most versatile series with a repairable design and large selection of options. The largest range of possible sizes, material construction, and other options are offered. Standard and Low Friction piston designs are available for superior performance and flow rates. Features of this series are:

- Bore Diameters from 2.4" ID to 19.3" ID
- Sizes from 1 quart to 200 gallons
- Largest range of possible sizes and material options
- Standard and Low Friction piston designs available
- Largest variety of gas and fluid port options
- A variety of piston position sensor monitoring systems are available
- ASME, CRN, PED/CE and other pressure code certifications are available

Application

- Heavy Mobile Hydraulic
- Industrial Hydraulic

Model Code

Model Codes containing RED selections are non-standard items – Contact HYDAC for information and availability
 Not all combinations are available

SK 210 - 20 / 2112 S - 210 F C F - V E - 18 - H

Series _____
 SK 210 = Piston Accumulator (3000 psi, Typically)
 SK 250 = Piston Accumulator (3600 psi, Typically)
 SK 280 = Piston Accumulator (4000 psi, Typically) - Non-Repairable
 SK 350 = Piston Accumulator (3000 psi, Typically)
 SK 600 = Piston Accumulator (5000 psi, Typically)

Size (in Liters, see tables on dimension pages to follow) _____
 20 = 20 Liters
...see tables on following pages for complete list of sizes, and which versions they are available in

Material and Piston Type _____
 For series SK 210 & SK 250, only material combination 3218 is available
 For series SK 280, only material combinations 3218, 3268, 3265 are available

Piston Type (see page 38) _____
 2 = Low Friction Model (only available for series SK350 & SK600)
 3 = General Duty

Piston Material _____
 1 = Aluminum
 2 = Carbon steel (machined)
 3 = Stainless steel
 4 = Carbon steel with surface protection (machined)
 5 = Steel (cold impact formed)

Cylinder and End Cap Material _____
 1 = Carbon steel (machined)
 2 = Carbon steel with surface protection (machined)
 3 = Stainless steel
 6 = Low temperature carbon steel (< -20°F)

Seal Material (including piston seals) _____
 2 = NBR (-4 to 180°F)
 5 = Low Temperature NBR (-50° to 180°F)
 6 = FPM fluoroelastomer (5 to 320°F)
 8 = PUR Polyurethane (-22 to 180°F)

Country of Installation _____
 S = USA
 S1 = Canada (CRN registered)
 U = PED/CE
(for other countries see page 3 for proper code designation)

Maximum Working Pressure in bar (based upon first choice - SERIES) _____
 210 = 3000 psi (SK 210...H, 350 Typically)
 250 = 3600 psi (SK 250...H Typically)
 280 = 4000 psi (SK 280 Typically)
 345 = 5000 psi (SK 600 Typically)

Fluid Port Connection _____

Type of Connection (refer to tables on the following page) _____
 A = Threaded, Female
 F = Flanged

Standard / Specification of Type of Connection (refer to tables on the following page) _____
 A, B, C, D

Size of Connection (refer to tables on the following page) _____
 A, B, C, D, E, ...

Gas Side Connection _____

Type of Connection (refer to tables on the following page) _____
 A = Threaded, Female
 F = Flanged
 V = Gas Valve
 KCH = Gas Valve MS28889-2 (with protective cover) Requires an FPO Charging Kit or a FPK Charging Kit with an A9 Adapter
 000 = Factory Precharged and sealed (not rechargeable) for SK280 series only. Required min order qty. 200

Standard/Specification of Type of Connection (OMIT if V was selected from Type of Connection, refer to tables on the following page) _____
 (omit), A, B, C, D

Size of Connection (refer to tables on the following page) _____
 A, B, C, D, E, ...

Piston Diameter (Some piston diameters are only available in certain series) _____
 05 = 50mm 12 = 125mm 25 = 250mm
 06 = 60mm 15 = 150mm
 08 = 80mm 18 = 180mm 35 = 355mm
 10 = 100mm 49 = 490mm

Supplementary Equipment (only available for series SK350 & SK600) _____
 A = Electrical Limit Switch (35mm stroke) M = Magnetic flapper indication
 B = Electrical Limit Switch (200mm stroke) S = Cable tension measurement system
 C = Electrical Limit Switch (500mm stroke) U = Ultrasonic measurement system
 K = Protruding Piston Rod E... = Special switch1 (fixed and adjustable)

Safety Devices _____
 1 = Burst Disc (indicate nominal pressure)
 2 = Gas safety valve
 3 = Thermal fuse cap (see page 51 and 52)

H = Made in the USA (not available for series SK280) _____

1) Consult HYDAC for assistance with specifying switch details

Connections

SK 210 & SK 250 Series (Non-ASME)

Maximum Working Pressure - 3000 PSI
 Operating Temperature - 14°F to 180°F
 Standard Seal for Petroleum-Based Oils - Polyurethane
 Military Style Gas Valve - MS28889-2 / M6164-2
 Paint - Black Primer
 Pre-Charge - None

Model Code Support Tables for Fluid Connections

Female Threaded Connections: A Sample Code = A¹ C² K³

| Code | Type of Connection | A | B | C | D | E | F | G | H | J | K | L | M |
|----------|--|---------------------|--------------------|---------------------|--------------------|---------------------|--------------------|---------------------|-----------------------|-----------------------|-----------------------|----------------------|----------------------|
| C | ANSI B1.1 (UN...-2B) Seal SAE J 514 | SAE-2 5/16-24UNF | SAE-3 3/8-24UNF | SAE-4 7/16-20UNF | SAE-5 1/2-20UNF | SAE-6 9/16-18UNF | SAE-8 3/4-16UNF | SAE-10 7/8-14UNF | SAE-12 1 1/16-12UN | SAE-14 1 3/16-12UN | SAE-16 1 5/16-12UN | SAE-20 1 5/8-12UN | SAE-24 1 7/8-12UN |
| D | NPT (ANSI B1.20.3) | 1/16-27 | 1/8-27 | 1/4-18 | 3/8-18 | 1/2-14 | 3/4-14 | 1-11 1/2 | 1 1/4-11 1/2 | 1 1/2-11 1/2 | 2 1/2-11 1/2 | 2 1/2-8 | n/a |

Note: Bold copy indicates standard size.

- 1) use "A" as the first character of the connection code for all Female Threaded Connections.
- 2) Enter the letter of the ROW (red) as the second character of the connection code.
- 3) Enter the letter of the COLUMN (gray) as the third character of the connection code.

Flange Connections: F⁴ Sample Code = F⁴ C⁵ E⁶

| Code | Type of Connection | A | B | C | D | E | F |
|----------|------------------------|------|------|----|--------|--------|----|
| C | SAE Code 61 (3000 psi) | 1/2" | 3/4" | 1" | 1 1/4" | 1 1/2" | 2" |

- 4) Use "F" as the first character of the connection code for all Flange Connections.
- 5) Use "C" as the second character of the connection code for all flange connections.
- 6) Enter the letter of the COLUMN (gray) as the third character of the connection code.

Dimensions

SK 210 & SK 250 Series (Non-ASME)

| Series | Nominal Size gal. | Eff Gas Volume (Vo) in ³ / L | Weight lbs / kg | A in / mm | øD1 in / mm | øD2 in / mm |
|--------|-------------------|---|-----------------|-------------|-------------|-------------|
| SK 210 | 0.25 | 77.5 / 1.27 | 38 / 17 | 18 / 457 | 4 / 100 | 4.92 / 125 |
| | 0.5 | 138 / 2.27 | 50 / 23 | 22 / 569 | 4 / 100 | 4.92 / 125 |
| | 1 | 260 / 4.27 | 71 / 32 | 31 / 791 | 4 / 100 | 4.92 / 125 |
| | 2 | 504 / 8.27 | 107 / 49 | 45 / 1131 | 4 / 100 | 4.92 / 125 |
| | 1 | 294 / 4.82 | 94.7 / 43 | 17.1 / 435 | 6 / 150 | 6.89 / 175 |
| | 1.5 | 416 / 6.82 | 107.4 / 48.8 | 21.7 / 550 | 6 / 150 | 6.89 / 175 |
| | 2.5 | 660 / 10.82 | 132 / 60.1 | 30.5 / 775 | 6 / 150 | 6.89 / 175 |
| | 5 | 1270 / 20.82 | 194.5 / 88.4 | 52.8 / 1340 | 6 / 150 | 6.89 / 175 |
| | 7.5 | 1759 / 28.82 | 245.2 / 111.4 | 70.9 / 1800 | 6 / 150 | 6.89 / 175 |
| SK 250 | 10 | 2491 / 40.82 | 319.6 / 145.3 | 97.4 / 2475 | 6 / 150 | 6.89 / 175 |
| | 1 | 294 / 4.82 | 112 / 51 | 18 / 451 | 6 / 150 | 6.89 / 175 |
| | 1.5 | 416 / 6.82 | 125 / 57 | 22 / 566 | 6 / 150 | 6.89 / 175 |
| | 2.5 | 660 / 10.82 | 150 / 68 | 31 / 791 | 6 / 150 | 6.89 / 175 |
| | 5 | 1270 / 20.82 | 215 / 98 | 53 / 1358 | 6 / 150 | 6.89 / 175 |
| | 7.5 | 1759 / 28.82 | 269 / 122 | 72 / 1836 | 6 / 150 | 6.89 / 175 |

| | |
|--|---------------------|
| Maximum Working Pressure | 3000 PSI |
| Operating Temperature | 14°F to 180°F |
| Standard Seal for Petroleum-Based Oils | Polyurethane |
| Military Style Gas Valve | MS28889-2 / M6164-2 |
| Paint | Black Primer |
| Pre-Charge | None |

4" Clamp Part Number 444505 see page 71

6" Clamp Part Number 3627520 see page 71

Seals Included with Piston Seal Kit

Seal Kits

| Piston Diameter | *Piston Seal Kits |
|-----------------|--------------------------------|
| 10 (100 mm) | Rebuild Kit SK210..10 /2123414 |
| 15 (150 mm) | Rebuild Kit SK210..15 /3145418 |

*Includes the following
 End Cap O-rings (2)
 Guide Ring (1)
 Center Seal (1)
 (number of components)

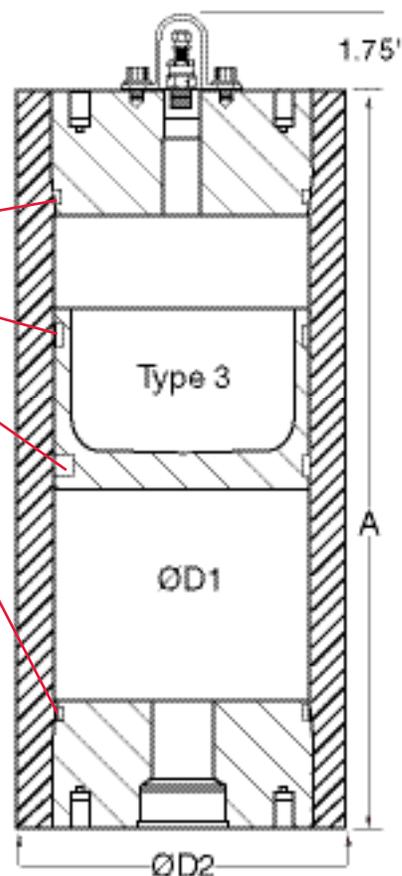
Replacement Gas Valve
 Model Code: GAS VALVE M6164-2 W/CAP
 Part Number : 2054712

Replacement Pistons

| Piston Diameter | Replacement Piston PN |
|-----------------|-----------------------|
| 10 (100 mm) | 2115547 |
| 15 (150 mm) | 3016231 |

Tools

| Diameter | Seal Assembly | Piston Insertion |
|------------|---------------|------------------|
| 10 (100mm) | 00352198 | 00290056 |
| 15 (150mm) | 02124157 | 02124161 |



Standard Product Offering

| Nom. Size (gal.) | ØD1 (in Nom.) / (mm) | Fluid Port | Model Code | Max Working Pressure (psi) |
|------------------|----------------------|----------------------|--------------------------------|----------------------------|
| 0.25 | 4 / (100) | SAE-20 (1 5/8-12 UN) | SK210-1/3218S-210-ACL-KCH-10HP | 3000 |
| 0.50 | 4 / (100) | SAE-20 (1 5/8-12 UN) | SK210-2/3218S-210-ACL-KCH-10HP | 3000 |
| 1 | 4 / (100) | SAE-20 (1 5/8-12 UN) | SK210-4/3218S-210-ACL-KCH-10HP | 3000 |
| 2 | 4 / (100) | SAE-20 (1 5/8-12 UN) | SK210-8/3218S-210-ACL-KCH-10HP | 3000 |
| 1 | 6 / (150) | SAE-24 (1 7/8-12 UN) | SK210-4/3218S-210ACM-KCH-15HP | 3000 |
| 1.5 | 6 / (150) | SAE-24 (1 7/8-12 UN) | SK210-6/3218S-210ACM-KCH-15HP | 3000 |
| 2.5 | 6 / (150) | SAE-24 (1 7/8-12 UN) | SK210-10/3218S-210ACM-KCH-15HP | 3000 |
| 5 | 6 / (150) | SAE-24 (1 7/8-12 UN) | SK210-20/3218S-210ACM-KCH-15HP | 3000 |
| 7.5 | 6 / (150) | SAE-24 (1 7/8-12 UN) | SK210-28/3218S-210ACM-KCH-15HP | 3000 |
| 10 | 6 / (150) | SAE-24 (1 7/8-12 UN) | SK210-40/3218S-210ACM-KCH-15HP | 3000 |

Connections

SK 280 Series (Non-ASME) 4000 psi

Female Threaded Connections: $A^{(1)}$ Sample Code = $A^{(1)}$ $A^{(2)}$ $A^{(3)}$

| Code | Type of Connection | D | E | F | H | K |
|----------|--------------------------------------|-------|---------------------|--------------------|-----------------------|-----------------------|
| A | BSPP (ISO 228) | G 1/2 | G 3/4 | G1 | | |
| C | ANSI B1.1 (UN.-2B) Seal SAE J 514 | | SAE-6 9/16-18UNF | SAE-8 3/4-16UNF | SAE-12 1 1/16-12UN | SAE-16 1 5/16-12UN |

- 1) use "A" as the first character of the connection code for all Female Threaded Connections.
- 2) Enter the letter of the ROW (red) as the second character of the connection code.
- 3) Enter the letter of the COLUMN (gray) as the third character of the connection code.

Standard Dimensions

SK 280 Series (Non-ASME) 4000 psi

(Non-repairable)

| Nominal Volume (L) | A +/- 3 (mm) | Thread F | | Weight (kg) | D1 (mm) | D2 (mm) |
|--------------------|--------------|-------------|--------------|-------------|---------|---------|
| | | BSPP female | SAE female | | | |
| 0.16 | 160 | G 1/2 | 9/16-18-2B | 2 | 50 | 60 |
| 0.32 | 240 | G 1/2 | 9/16-18-2B | 2.5 | | |
| 0.5 | 335 | G 1/2 | 3/4-16-2B | 3.1 | | |
| 0.75 | 460 | G 1/2 | 3/4-16-2B | 4 | | |
| 1 | 590 | G 1/2 | 3/4-16-2B | 4.8 | | |
| 2.5 | 205 | G 1/2 | 3/4-16-2B | 3 | 60 | 75 |
| 0.5 | 265 | G 1/2 | 3/4-16-2B | 3.5 | | |
| 0.75 | 355 | G 1/2 | 3/4-16-2B | 4.2 | | |
| 1 | 445 | G 1/2 | 3/4-16-2B | 5.1 | | |
| 1.5 | 620 | G 1/2 | 3/4-16-2B | 6.4 | | |
| 2 | 800 | G 1/2 | 3/4-16-2B | 7.8 | | |
| 2.5 | 975 | G 1/2 | 3/4-16-2B | 9.2 | | |
| 0.5 | 210 | G 3/4 | 1 1/16-12-2B | 6.5 | 80 | 95 |
| 0.75 | 260 | G 3/4 | 1 1/16-12-2B | 7.2 | | |
| 1 | 310 | G 3/4 | 1 1/16-12-2B | 8 | | |
| 1.5 | 410 | G 3/4 | 1 1/16-12-2B | 9.5 | | |
| 2 | 510 | G 3/4 | 1 1/16-12-2B | 11.5 | | |
| 2.5 | 605 | G 3/4 | 1 1/16-12-2B | 13 | | |
| 3 | 705 | G 3/4 | 1 1/16-12-2B | 14.5 | | |
| 3.5 | 805 | G 3/4 | 1 1/16-12-2B | 16 | | |
| 4 | 905 | G 3/4 | 1 1/16-12-2B | 17.5 | | |
| 6 | 235 | G 1 | 1 5/16-12-2B | 14 | | |
| 1 | 265 | G 1 | 1 5/16-12-2B | 15 | | |
| 1.5 | 330 | G 1 | 1 5/16-12-2B | 17 | | |
| 2 | 395 | G 1 | 1 5/16-12-2B | 19 | | |
| 3 | 520 | G 1 | 1 5/16-12-2B | 23.5 | | |
| 4 | 650 | G 1 | 1 5/16-12-2B | 28 | | |
| 5 | 775 | G 1 | 1 5/16-12-2B | 32.5 | | |
| 6 | 900 | G 1 | 1 5/16-12-2B | 37 | | |

Clamps for D1=50mm D2=60mm Part Number 3018442

Clamps for D1=60mm D2=70mm Part Number 3018444

Clamps for D1=80mm D2=95mm Part Number 444995

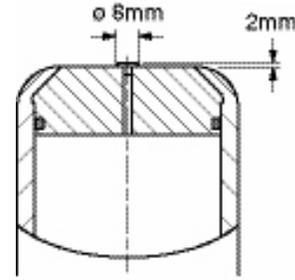
Clamps for D1=100mm D2=125mm Part Number 444505

see page 71 for details

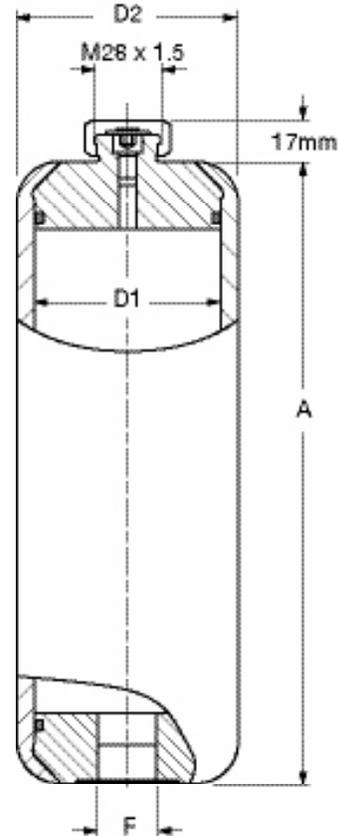
Dimensions are for general information only, all critical dimensions should be verified.

Dimensions

000 Connection -
Not Rechargeable



VB Connection - Refillable



Connections SK 350 Series (Non-ASME) 5000 psi

Model Code Support Tables for Fluid Connections

Female Threaded Connections: A Sample Code = A¹ C² K³

| | | | | | | | | | | | | 4" | 6" |
|----------|---|-------------------------|------------------------|-------------------------|------------------------|-------------------------|------------------------|-------------------------|---------------------------|---------------------------|---------------------------|----------------------------------|----------------------------------|
| Code | Type of Connection | A | B | C | D | E | F | G | H | J | K | L | M |
| C | ANSI B1.1 (UN..-2B) Seal SAE J 514 | SAE-2 5/16- 24UNF | SAE-3 3/8- 24UNF | SAE-4 7/16- 20UNF | SAE-5 1/2- 20UNF | SAE-6 9/16- 18UNF | SAE-8 3/4- 16UNF | SAE-10 7/8- 14UNF | SAE-12 1 1/16- 12UN | SAE-14 1 3/16- 12UN | SAE-16 1 5/16- 12UN | SAE-20 1 5/8 12UN | SAE-24 1 7/8 12UN |
| D | NPT (ANSI B1.20.3) | 1/16-27 | 1/8-27 | 1/4-18 | 3/8-18 | 1/2-14 | 3/4-14 | 1-11 1/2 | 1 1/4- 11 1/2 | 1 1/2- 11 1/2 | 2 1/2- 11 1/2 | 2 1/2-8 | n/a |

Note: Bold copy indicates standard size.

1) use "A" as the first character of the connection code for all Female Threaded Connections.

2) Enter the letter of the ROW (red) as the second character of the connection code.

3) Enter the letter of the COLUMN (gray) as the third character of the connection code.

Flange Connections: F⁴

Sample Code = F⁴ C⁵ E⁶

| Code | Type of Connection | A | B | C | D | E | F |
|----------|-------------------------------|------|------|----|--------|--------|----|
| C | SAE Code 61 (3000 psi) | 1/2" | 3/4" | 1" | 1 1/4" | 1 1/2" | 2" |

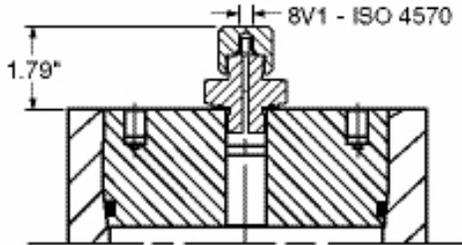
4) Use "F" as the first character of the connection code for all Flange Connections.

5) Use "C" as the second character of the connection code for all flange connections.

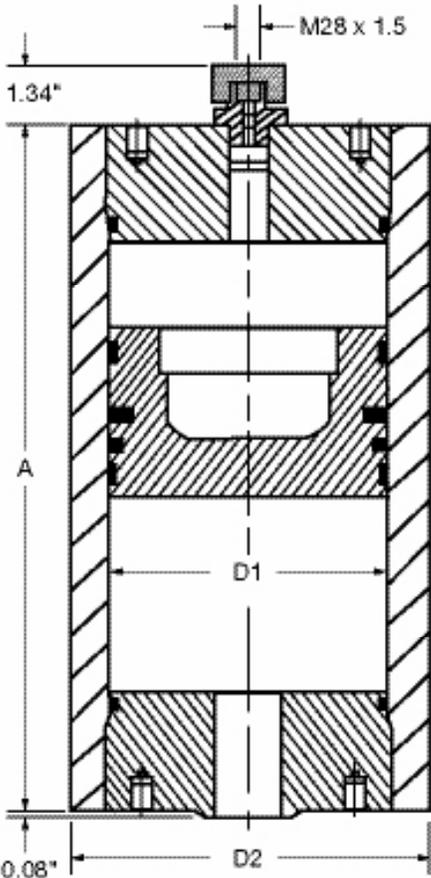
6) Enter the letter of the COLUMN (gray) as the third character of the connection code.

Type 2 Dimensions SK 350 Series (Non-ASME) 5000 psi

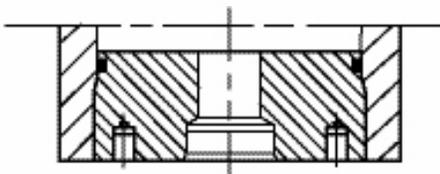
Gas Valve Version 4 (code designation VE)
Uses Charging Unit FPS



Gas Valve Version 1 (code designation VA)
Uses Charging Unit FPK



Flange Connection (code designation F_ _)
(specified by model code)



Threaded Connection (code designation A_ _)
(specified by model code)

5000 psi maximum working pressure

| Size liters | Effective Gas Volume gal | Weight lbs / (kg) | A in / (mm) | ø D1 in / (mm) | ø D2 in / (mm) |
|----------------|-----------------------------|----------------------|----------------|-------------------|-------------------|
| 0.2 | 0.05 | 15 / (7) | 8.6 / (218) | 2.36 (60) | 3.15 (80) |
| 0.5 | 0.125 | 20 / (9) | 12.8 / (325) | | |
| 1 | 0.25 | 26 / (12) | 19.8 / (502) | | |
| 0.5 | 0.125 | 24 / (11) | 9.8 / (250) | 3.15 (80) | 3.94 (100) |
| 1 | 0.25 | 29 / (13) | 13.8 / (350) | | |
| 2 | 0.5 | 40 / (18) | 21.7 / (550) | | |
| 2.5 | 0.625 | 62 / (28) | 20.9 / (532) | 3.94 (100) | 4.96 (126) |
| 5 | 1.25 | 88 / (40) | 33.5 / (850) | | |
| 7.5 | 1.875 | 115 / (52) | 46.1 / (1170) | | |
| 2 | 0.5 | 82 / (37) | 13.6 / (345) | 4.92 (125) | 6.30 (160) |
| 5 | 1.25 | 115 / (52) | 23.2 / (590) | | |
| 15 | 3.75 | 225 / (102) | 55.3 / (1405) | | |
| 6 | 1.5 | 128 / (58) | 21.5 / (545) | 5.91 (150) | 7.09 (180) |
| 20 | 5 | 231 / (105) | 52.6 / (1335) | | |
| 40 | 10 | 386 / (175) | 97.2 / (2470) | | |

Note: Other sizes available on request. Intermediate sizes are possible, depending on the length/diameter required. Please consult factory for details on special sizes.

Dimensions are for general information only, all critical dimensions should be verified.

Connections

SK 350 & SK 600 Series (ASME) 3000 psi

Model Code Support Tables for Gas & Fluid Connections

Female Threaded Connections: **A**⁽¹⁾ Sample Code = **A**⁽¹⁾ **A**⁽²⁾ **A**⁽³⁾

| Code | Type of Connection | Code, Size | | | | | | | | | | | |
|----------|-------------------------------------|-------------------------|------------------------|-------------------------|------------------------|-------------------------|------------------------|-------------------------|---------------------------|---------------------------|---------------------------|-------------------------|-------------------------|
| | | A | B | C | D | E | F | G | H | J | K | L | M |
| A | BSP (ISO 228) | G1/8 | G1/4 | G3/8 | G1/2 | G3/4 | G1 | G1 1/4 | G1 1/2 | G2 | G2 1/2 | G3 | N/A |
| B | DIN 13 or ISO 965/1 (Metric) | M10x1 | M12x1.5 | M14x1.5 | M16x1.5 | M18x1.5 | M22x1.5 | M27x2 | M33x2 | M42x2 | M48x2 | M60x2 | N/A |
| C | ANSI B1.1 (UN...-2B) Seal SAE J 514 | SAE-2 5/16- 24UNF | SAE-3 3/8- 24UNF | SAE-4 7/16- 20UNF | SAE-5 1/2- 20UNF | SAE-6 9/16- 18UNF | SAE-8 3/4- 16UNF | SAE-10 7/8- 14UNF | SAE-12 1 1/16- 12UN | SAE-14 1 3/16- 12UN | SAE-16 1 5/16- 12UN | SAE-20 1 5/8 12UN | SAE-24 1 7/8 12UN |
| D | ANSI B1.20.3 | 1/16-27 | 1/8-27 | 1/4-18 | 3/8-18 | 1/2-14 | 3/4-14 | 1-11 1/2 | 1 1/4-11 1/2 | 1 1/2-11 1/2 | 2-11 1/2 | 2 1/2-8 | N/A |

1) use "A" as the first character of the connection code for all Female Threaded Connections.

2) Enter the letter of the ROW (red) as the second character of the connection code.

3) Enter the letter of the COLUMN (gray) as the third character of the connection code.

Flange Connections: **F**⁽⁴⁾ Sample Code = **F**⁽⁴⁾ **C**⁽⁵⁾ **B**⁽⁶⁾

| Code | Type of Connection | Code, Size | | | | | | | | | | | |
|----------|------------------------|------------|------|----|--------|--------|----|--------|-----|--------|-----|-----|-----|
| | | A | B | C | D | E | F | G | H | J | K | L | M |
| C | SAE Code 61 (3000 psi) | 1/2" | 3/4" | 1" | 1 1/4" | 1 1/2" | 2" | 2 1/2" | 3" | 3 1/2" | 4" | 5" | N/A |
| D | SAE Code 62 (6000 psi) | 1/2" | 3/4" | 1" | 1 1/4" | 1 1/2" | 2" | N/A | N/A | N/A | N/A | N/A | N/A |

4) use "F" as the first character of the connection code for all Flange Connections.

5) Enter the letter of the ROW (red) as the second character of the connection code.

6) Enter the letter of the COLUMN (gray) as the third character of the connection code.

Gas Valve Connections: **V**⁽⁷⁾ Sample Code = **V**⁽⁷⁾ (omit)⁽⁸⁾ **A**⁽⁹⁾

| Code | Type of Connection |
|----------|---|
| A | G 3/4 male with M28x1.5/M8 (standard HYDAC gas valve version 1) |
| B | M28 x 1.5 / M8 Integrated in gas side end-cap |
| E | G 3/4 male with 7/8-14 UNF-VG8 (standard HYDAC gas valve version 4) |

7) use "V" as the first character of the connection code for all Gas Valve Connections.

8) OMIT the second character of the connection code.

9) Enter the letter of the ROW as the third character of the connection code.

Other Connections & Custom Solutions are Available:

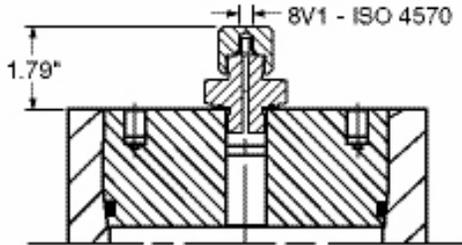
HYDAC has the capabilities to produce accumulators with many other types of connections. The options listed above are simply the most common, and most readily available. Other connection options include:

- Male threads
- Protruding flanges
- ANSI flanges
- DIN flanges
- Autoclave
- High Pressure Block FLANGE (Rexroth, AVIT, HAVIT) PN320

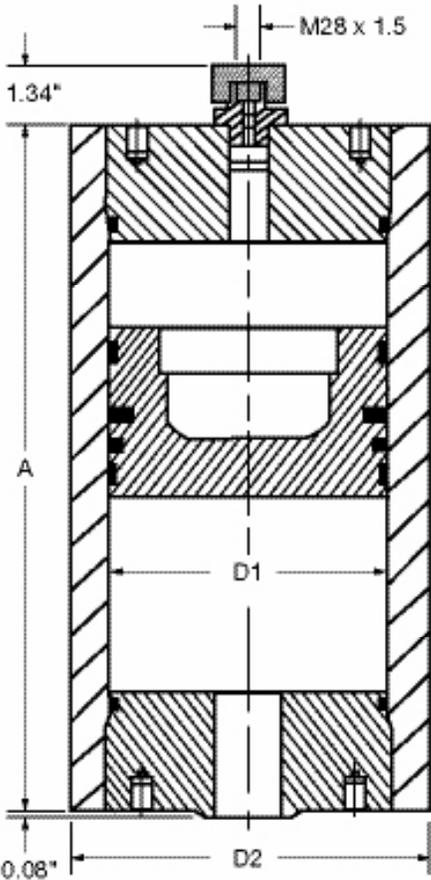
Custom solutions that incorporate valve/manifold assemblies are also available, for more information on special connections and custom solutions, consult factory.

Type 2 Dimensions SK 350 Series (ASME) 3000 psi

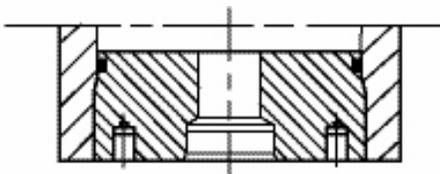
Gas Valve Version 4 (code designation VE)
Uses Charging Unit FPS



Gas Valve Version 1 (code designation VA)
Uses Charging Unit FPK



Flange Connection (code designation F_ _)
(specified by model code)



Threaded Connection (code designation A_ _)
(specified by model code)

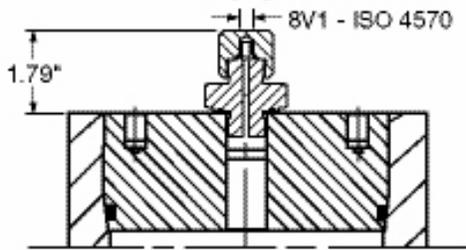
3000 psi maximum working pressure

| Size liters | Effective Gas Volume gal | Weight lbs / (kg) | A in / (mm) | ø D1 in / (mm) | ø D2 in / (mm) |
|----------------|-----------------------------|----------------------|----------------|-------------------|-------------------|
| 10 | 2.5 | 235 / (106) | 28 / (710) | 7.09 (180) | 8.62 (219) |
| 20 | 5 | 318 / (144) | 43.4 / (1103) | | |
| 28 | 7.5 | 383 / (174) | 55.8 / (1418) | | |
| 38 | 10 | 465 / (211) | 71.3 / (1811) | | |
| 47 | 12.5 | 540 / (245) | 85.2 / (2165) | | |
| 57 | 15 | 622 / (282) | 100.7 / (2558) | | |
| 40 | 10 | 788 / (357) | 49 / (1245) | 9.84 (250) | 12.21 (310) |
| 50 | 12.5 | 882 / (400) | 57.1 / (1450) | | |
| 60 | 15 | 974 / (442) | 65 / (1651) | | |
| 75 | 20 | 1114 / (505) | 77.1 / (1958) | | |
| 100 | 25 | 1347 / (611) | 97.1 / (2466) | | |
| 115 | 30 | 1488 / (675) | 109.2 / (2774) | | |
| 135 | 35 | 1676 / (760) | 125.3 / (3183) | | |
| 150 | 40 | 1816 / (824) | 137.4 / (3490) | 13.98 (355) | 17.09 (434) |
| 170 | 45 | 2004 / (909) | 152.4 / (3871) | | |
| 190 | 50 | 2194 / (994) | 168.4 / (4277) | | |
| 100 | 25 | 1859 / (843) | 61.9 / (1572) | | |
| 115 | 30 | 1986 / (901) | 67.9 / (1725) | | |
| 150 | 40 | 2287 / (1037) | 81.8 / (2078) | | |
| 190 | 50 | 2630 / (1193) | 97.7 / (2482) | 121.6 / (3089) | 141.5 / (3594) |
| 250 | 65 | 3144 / (1426) | 121.6 / (3089) | | |
| 300 | 80 | 3572 / (1620) | 141.5 / (3594) | | |

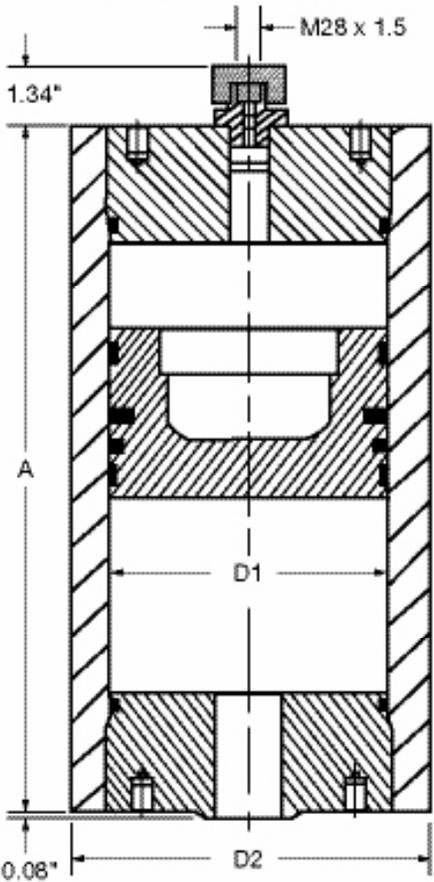
Clamps for D1=180mm Part Number 237401 see page 71
Clamps for D1=250mm Part Number 237389 see page 71
Clamps for D1=355mm (refer to factory)

Type 2 Dimensions SK 600 Series (ASME) 5000 psi

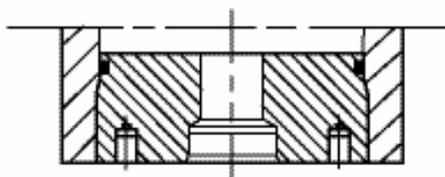
Gas Valve Version 4 (code designation VE)
Uses Charging Unit FPS



Gas Valve Version 1 (code designation VA)
Uses Charging Unit FPK



Flange Connection (code designation F_ _)
(specified by model code)



Threaded Connection (code designation A_ _)
(specified by model code)

5000 psi maximum working pressure

| Size liters | Effective Gas Vol gal | Weight lb (kg) | A in (mm) | ø D1 in / (mm) | ø D2 in / (mm) |
|----------------|--------------------------|-------------------|----------------|-------------------|-------------------|
| 10 | 2.5 | 302 / (137) | 28 / (711) | 7.09 (180) | 9.61 (244) |
| 16 | 4 | 402 / (182) | 37.2 / (945) | | |
| 20 | 5 | 447 / (203) | 43.4 / (1102) | | |
| 30 | 7.5 | 606 / (275) | 58.9 / (1496) | | |
| 40 | 10 | 736 / (334) | 74.4 / (1890) | | |
| 50 | 12.5 | 884 / (401) | 89.9 / (2283) | 9.84 (250) | 13.31 (338) |
| 40 | 10 | 1110 / (503) | 49 / (1245) | | |
| 50 | 12.5 | 1254 / (569) | 57.1 / (1450) | | |
| 60 | 15 | 1396 / (633) | 65 / (1651) | | |
| 75 | 20 | 1611 / (731) | 77.1 / (1958) | | |
| 100 | 25 | 1969 / (893) | 97.1 / (2466) | | |
| 115 | 30 | 2184 / (990) | 109.2 / (2774) | | |
| 135 | 35 | 2472 / (1121) | 125.3 / (3183) | | |
| 150 | 40 | 2689 / (1220) | 137.4 / (3490) | | |
| 170 | 45 | 2977 / (1350) | 153.5 / (3899) | | |
| 190 | 50 | 3265 / (1481) | 169.5 / (4305) | | |

*Dimensions are for general information only, all critical dimensions should be verified
Consult factory for clamps on these accumulators..*

Piston Accumulators - Spare Parts

Seal Kits & Replacement Pistons

For seal kits other than Buna N, and for sizes not listed please consult factory.

Example: SK 350 - 20 / 2112 S - 210 FCF - VE - 18 E - 1 (see page 38 for details)

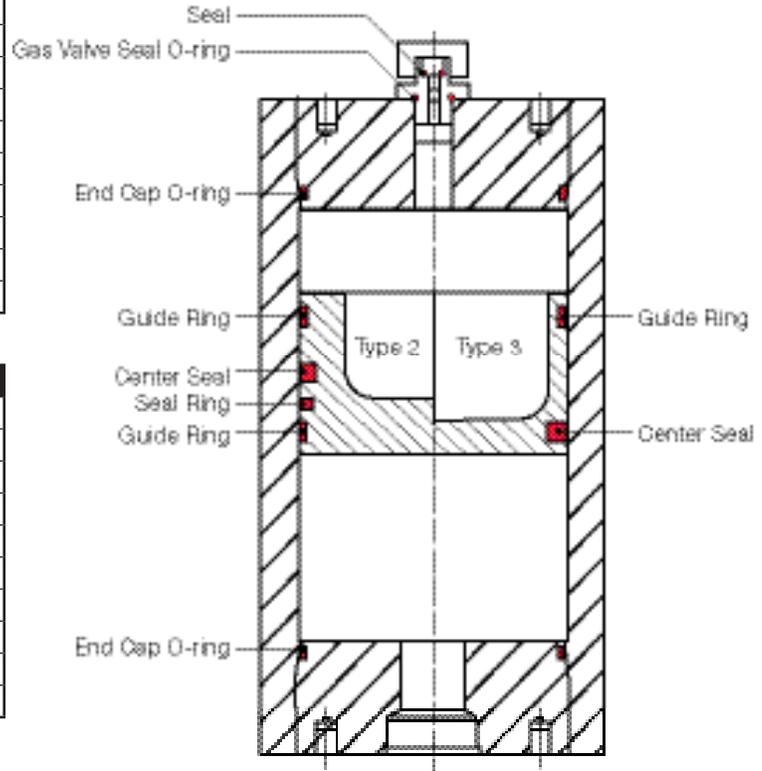
Piston Type Diameter

Piston Seal Kits

| Diameter | Type 2 (NBR) | Type 3 (PUR/NBR) |
|-------------|--------------|------------------|
| 06 (60mm) | — | 3016210 |
| 08 (80mm) | 2123890 | 3013230 |
| 10 (100 mm) | 3671731 | 2123414 |
| 12 (125 mm) | — | 2128104 |
| 15 (150 mm) | 3016235 | 3145418 |
| 18 (180 mm) | 363270 | 2123415 |
| 25 (250 mm) | 3671733 | 3016213 |
| 31 (310 mm) | 3016200 | — |
| 35 (355 mm) | 363272 | — |
| 49 (490 mm) | 3104100 | — |

Replacement Pistons - w/ Seals

| Diameter | Type 2 (NBR) | Type 3 (PUR/NBR) |
|-------------|--------------|------------------|
| 06 (60mm) | — | 3009372 |
| 08 (80mm) | 352225 | 2119931 |
| 10 (100 mm) | 356847 | 2115547 |
| 12 (125 mm) | 3016232 | 3016150 |
| 15 (150 mm) | 3016228 | 3016231 |
| 18 (180 mm) | 2118451 | 3046277 |
| 25 (250 mm) | 353980 | 3016171 |
| 31 (310 mm) | 3004987 | — |
| 35 (355 mm) | 356382 | — |
| 49 (490 mm) | 3462428 | — |



Tools

When repairing a piston accumulator, it is critical to use the appropriate tools to avoid seal damage.

There are two tools required:

Seal Assembly Tool:

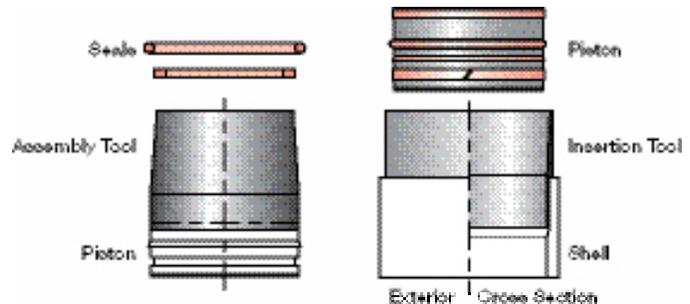
allows for gradual and even stretching of the seals when installing them onto the piston.

Piston Insertion Tool:

a tapered shroud that protects the seals from the threaded portion of the shell, and provides even seal compression and piston alignment when inserting the piston into the shell.

Tools

| Diameter | Seal Assembly | Piston Insertion |
|-------------|---------------|------------------|
| 08 (80 mm) | 359537 | 359614 |
| 10 (100 mm) | 352198 | 290056 |
| 12 (125mm) | 3016278 | 2128223 |
| 15 (150 mm) | 2124157 | 2124161 |
| 18 (180 mm) | 350148 | 290049 |
| 25 (250 mm) | 290035 | 290046 |
| 31 (310 mm) | 2127304 | 2127305 |
| 35 (355 mm) | 354147 | 3389677 |
| 49 (490mm) | 3114220 | 3440695 |



For items not listed please contact HYDAC.

WARNING: Only qualified persons should perform maintenance on any type of accumulator. Complete maintenance instructions are available - Contact HYDAC.

SN Series

Description

Nitrogen bottles can be used in accumulator applications where large volumes of gas are required for an accumulator. The nitrogen bottle serves to store a large portion of the gas externally from the accumulator in order to reduce or minimize the size and cost of the accompanying accumulator. Nitrogen bottles are typically paired with piston accumulators and sometimes bladder accumulators. The nitrogen bottles themselves are based on either bladder or piston accumulator pressure vessel shells.

Model Code

*Model Codes containing RED selections are non-standard items – Contact HYDAC for information and availability
Not all combinations are available*

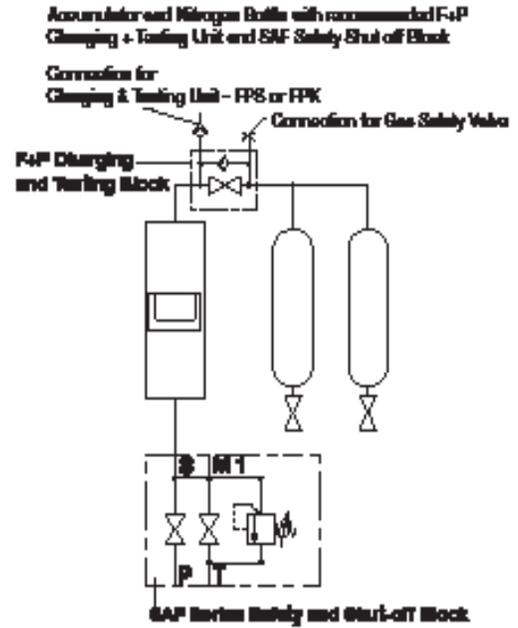
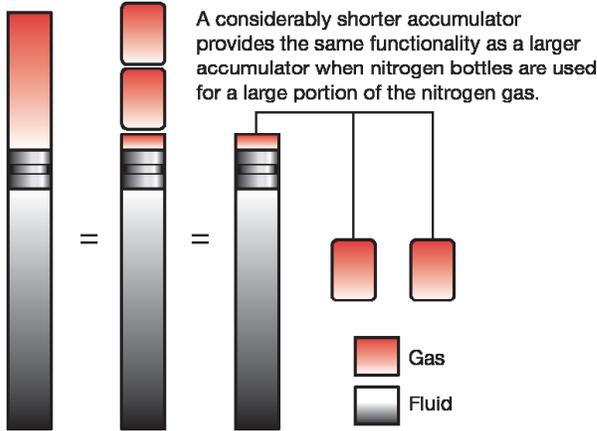
| | | | | | | |
|--|--------------|----------|-------------|-----------------|----------------|-----------|
| | SN330 | B | - 57 | CC / 010 | S - 210 | EF |
| Series | _____ | | | | | |
| SN 330 = Nitrogen Bottle (3000 psi typically) | | | | | | |
| SN 600 = Nitrogen Bottle (5000 psi typically) | | | | | | |
| Design Code* | _____ | | | | | |
| (omit) = Standard Nitrogen Bottle | | | | | | |
| B = Based on Bladder Accumulator Shell (see page 13 for details) | | | | | | |
| TR = Top Repairable (Based on Bladder Accumulator Shell) see page 14 for details | | | | | | |
| K = Based on Piston Accumulator Shell | | | | | | |
| Size* | _____ | | | | | |
| 54 = 54 Liters | | | | | | |
| 57 = 57 Liters | | | | | | |
| 100 = 100 Liters | | | | | | |
| Connection Type | _____ | | | | | |
| Connection 1 (see table 1 on following page) | _____ | | | | | |
| A = BSP (ISO 228) | | | | | | |
| B = Metric (DIN 13 According to ISO 965/1) | | | | | | |
| C = SAE (ANSI B1.1) (standard) | | | | | | |
| D = NPT (ANSI B2.1) | | | | | | |
| F = Flange | | | | | | |
| Connection 2 (see table 1 on following page) | _____ | | | | | |
| A = BSP (ISO 228) | | | | | | |
| B = Metric (DIN 13 According to ISO 965/1) | | | | | | |
| C = SAE (ANSI B1.1) (standard) | | | | | | |
| D = NPT (ANSI B2.1) | | | | | | |
| F = Flange | | | | | | |
| Material Code | _____ | | | | | |
| Ports | _____ | | | | | |
| 0 = No Components (standard) | | | | | | |
| 1 = Carbon steel | | | | | | |
| 3 = Stainless steel | | | | | | |
| 4 = Carbon steel (coated) | | | | | | |
| Shell | _____ | | | | | |
| 1 = Carbon steel (standard) | | | | | | |
| 2 = Carbon steel (coated) | | | | | | |
| 4 = Stainless steel | | | | | | |
| Seal Material | _____ | | | | | |
| 0 = No Elastomer (standard) | | | | | | |
| 2 = NBR (Buna N) | | | | | | |
| 4 = IIR (Butyl) | | | | | | |
| 6 = FPM (Fluoroelastomer) | | | | | | |
| Country of Installation | _____ | | | | | |
| S = USA (for other countries see page 3 for proper code designation) | | | | | | |
| Maximum Working Pressure in bar | _____ | | | | | |
| 210 = 3000 psi | | | | | | |
| 345 = 5000 psi | | | | | | |
| Connection Size (see table 1 on following page) | _____ | | | | | |
| Connection 1 | _____ | | | | | |
| Connection 2 | _____ | | | | | |

* Size offering listed is for standard nitrogen bottles. For design types other than standard nitrogen bottles, (Eg. piston type) consult factory.

HYDAC Nitrogen Bottles

F+P Charging and Testing Block

| Description | MAWP bar/psi | Weight (kg/lbs) | Part Number |
|--|--------------|-----------------|-------------|
| F+P-16-3/4-16UNF-6112-02X | 400/5800 | 4.3/9.5 | 2068047 |
| F+P-32-1 5/8-12UN-6112-02X | 350/5076 | 14/31 | 2067162 |
| F+P-32-1 5/8-12UN-6112-02X(VERS 4-FPS) | 350/5076 | 14/31 | 2075698 |



Dimensions

| Size (MAWP) | Connections (1 and 2) | Vol. (gallons) | Weight (lbs) | A (inches) | D (inches) | Part Number |
|----------------|-----------------------|----------------|--------------|------------|------------|-------------|
| 54 (5000 psi) | 1 5/16-12UN | 15 | 353 | 72" | 9" | C/F |
| 57 (3000 psi) | 1 5/16-12UN | 15 | 247 | 72" | 9" | 2096345 |
| 75 (3000 psi) | 1 5/16-12UN | 20 | 317 | 80.7" | 9" | C/F |
| 100 (3000 psi) | 1 5/16-12UN | 25 | 386 | 89.4" | 10.5" | C/F |

Connections:

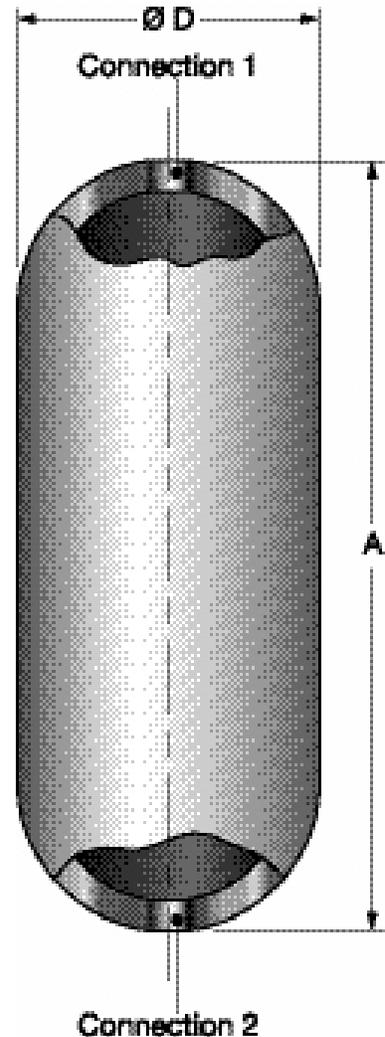
Example Model Code

SN... -57CC/010S-210EF
 CE = SAE 1 5/16" -12UN
 CF = SAE 1 5/8" -12UN

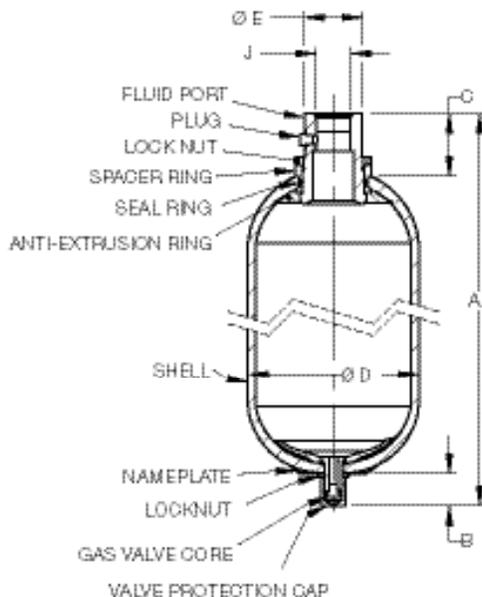
| Type | A | B | C | D | F |
|------|--------------|--------------------------------|--------------|-----------------|-------------------------|
| Size | BSP (ISO228) | Metric (DIN 13 Acc. ISO 965/1) | (ANSI B1.1) | NPT (ANSI B2.1) | SAE Flange |
| A | G 1/4" | M 12 x 1.5 | 7/16"-20 UNF | 1/4" | 1/2" 3000 psi Code 61 |
| B | G 3/8" | M 18 x 1.5 | 9/16"-18UNF | 3/8" | 3/4"-3000 psi Code 61 |
| C | G 1/2" | M 22 x 0.5 | 3/4"-16UNF | 1/2" | 1" 3000 psi Code 61 |
| D | G 3/4" | M 27 x 2 | 1 1/16"-12UN | 3/4" | 1 1/4" 3000 psi Code 61 |
| E | G 1" | M 33 x 2 | 1 5/16"-12UN | 1" | 1 1/2" 3000 psi Code 61 |
| F | G 1 1/4" | M 42 x 2 | 1 5/8"-12UN | 1 1/4" | 2" 3000 psi Code 61 |
| G | G 1 1/2" | M 48 x 2 | 1 7/8"-12UN | 1 1/2" | 1/2" 6000 psi Code 62 |
| H | G 2" | M 14 x 1.5 | 2 1/2"-12UN | 2" | 3/4" 6000 psi Code 62 |
| I | G 1 3/4" | M 8 | 1/2"-20UNF | — | 1" 6000 psi Code 62 |
| J | — | — | — | — | 1 1/4" 6000 psi Code 62 |
| K | — | — | 7/8"-14UNF | 5/8" | 1 1/2" 6000 psi Code 62 |
| L | — | — | — | — | 2" 6000 psi Code 62 |

Items in RED are using the basic design with an adapter.

Dimensions are for general information only, all critical dimensions should be verified by requesting a certified print.



SN 300 SN330B- C4/112S-210G

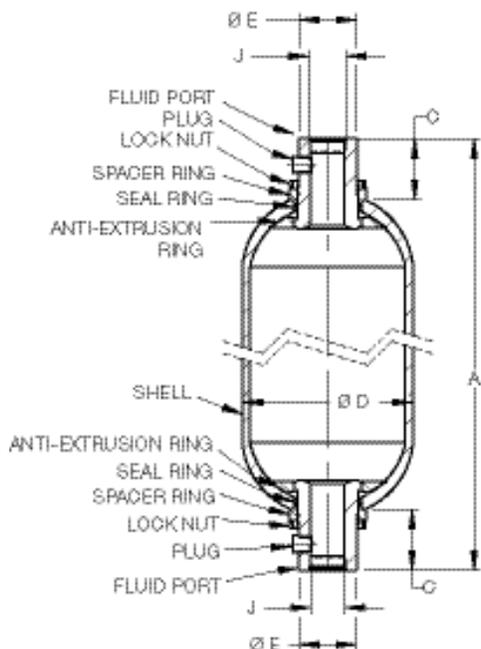


Bottom Repairable

| Nom. Vol. (L.) | Eff. Gas Vol. in ³ | Weight | A | B | C | ØD | ØE | Thread J |
|----------------|-------------------------------|-----------|-------------|----------|----------|-----------|----------|----------------------|
| | | | | | | | | SAE |
| 10 | 566 | 86 (39) | 22.0 (559) | 3.1 (80) | 1.6 (40) | 9.1 (231) | 3.0 (76) | 1 7/8-24 UN (SAE-24) |
| 20 | 1125 | 140 (63) | 34.5 (876) | 3.1 (80) | 1.6 (40) | 9.1 (231) | 3.0 (76) | 1 7/8-24 UN (SAE-24) |
| 32 | 2080 | 226 (102) | 54.7 (1390) | 3.1 (80) | 1.6 (40) | 9.1 (231) | 3.0 (76) | 1 7/8-24 UN (SAE-20) |
| 54 | 3205 | 330 (150) | 78.3 (1980) | 3.1 (80) | 1.6 (40) | 9.1 (231) | 3.0 (76) | 1 7/8-24 UN (SAE-24) |

*Consult factory for more details
Dimensions are for general information only, all critical dimensions should be verified.
Dimensions are in inches/(mm) and lbs/(kg)*

GG



Top Repairable

| Nom. Vol. (L.) | Eff. Gas Vol. in ³ | Weight | A | C | ØD | ØE | Thread J |
|----------------|-------------------------------|-----------|-------------|----------|-----------|----------|----------------------|
| | | | | | | | SAE |
| 10 | 566 | 86 (43) | 23.5 (597) | 3.1 (80) | 9.1 (231) | 3.0 (76) | 1 7/8-24 UN (SAE-24) |
| 20 | 1125 | 140 (63) | 36.5 (927) | 3.1 (80) | 9.1 (231) | 3.0 (76) | 1 7/8-24 UN (SAE-24) |
| 32 | 2080 | 226 (102) | 56.2 (1428) | 3.1 (80) | 9.1 (231) | 3.0 (76) | 1 7/8-24 UN (SAE-24) |
| 54 | 3205 | 330 (150) | 79.8 (2027) | 3.1 (80) | 9.1 (231) | 3.0 (76) | 1 7/8-24 UN (SAE-24) |

*Consult factory for more details
Dimensions are for general information only, all critical dimensions should be verified.
Dimensions are in inches/(mm) and lbs/(kg)*

SB...P and SBO...P Series Pulsation Dampeners



Description

The pressure fluctuations occurring in hydraulic systems can be periodic or single occurrence problems due to:

- Flow rate fluctuations from displacement pumps
- Actuation of shut-off and control valves with short opening and closing times
- Switching pumps on and off
- Sudden linking of hydraulic circuits with different pressure levels

Dampeners have two fluid connections for inline mounting. The volume of flow is directed straight at the bladder or diaphragm by diverting it into the fluid valve. This causes direct contact of the fluid flow with the bladder or diaphragm which balances the flow rate fluctuations via the gas volume. It is particularly effective with higher frequency oscillations. The gas precharge pressure is adjusted for the specific systems operating conditions.

Construction

HYDAC pulsation dampeners consist of:

- The welded or forged pressure vessel in carbon steel; for chemically aggressive fluids they are available in coated carbon steel or stainless steel
- The special fluid valve with inline connection, which guides the flow into the vessels (threaded or flange connections available)
- The bladder or diaphragm in various compounds as listed below

Compound Materials

Not all fluids are compatible with every elastomer at all temperatures. Therefore, HYDAC offers the following choice of elastomers:

- NBR (Standard Nitrile)
- LT-NBR (Low Temperature Nitrile)
- ECO (Epichlorohydrin)
- IIR (Butyl)
- FPM (Fluoroelastomer)
- others (available upon request)

To determine which material is appropriate...

ALWAYS REFER TO FLUID MANUFACTURER'S RECOMMENDATION

Corrosion Protection

For use with certain aggressive or corrosive fluids, or in a corrosive environment, HYDAC offers protective coatings and corrosive resistant materials (*i.e. stainless steel*) for the accumulator parts that come in contact with the fluid, or are exposed to the hostile environment.

Mounting Position

The mounting position of hydraulic dampeners is dependent on the dampener chosen and the specific application. The preferred position is typically vertical.

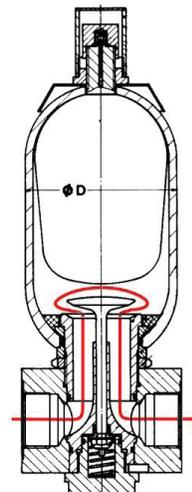
System Mounting

Dampeners should be mounted as close as possible to the pulsation source.

Applications

Pulsation dampeners are used to:

- Reduce vibrations caused by pipes, valves, couplings, etc. in order to prevent pipe and valve damage
- Protect measurement instruments and eliminate the impaired performance caused by pulsations
- Reduce system noise
- Increase machine performance
- Allow the connection of multiple pumps to one line
- Increase the allowable rpm and feed pressure of pumps
- Reduce system breakdowns and increase the service life of the system



Model Code

Model Codes containing RED selections are non-standard items – Contact HYDAC for information and availability
 Not all combinations are available

SBXXX P 10 A 1 / 112 S - 210 AI 010

Series

- SB XXX = Bladder Style (XXX = series designation)
 - SBO XXX = Diaphragm Style (XXX = series designation)
- (see tables on following pages for most common series and size selections)

Design

- P = Pulsation Dampener
- PH = Pulsation Dampener/High Flow
- S = Suction Stabilizer

Size (in Liters, see tables on dimension pages to follow)

Type of Connection

- A = Threaded
- E = Threaded (for SBO welded design only)
- F = Flanged

Gas Port

For series SB

- 1 = HYDAC gas valve version 4 (8V1-I504570)

For series SBO

- 1 = HYDAC gas valve version 1 (M28x1.5)
- 4 = HYDAC gas valve version 4 (8V1-I504570)
- 6 = HYDAC gas valve version 1 (M28x1.5/ for SBO design only)

Material Code

Depending on Application

- 112 = Standard for oil service (mineral oil)

Fluid Port

- 1 = Carbon steel
- 3 = Stainless steel
- 6 = Low temperature carbon steel (< -20°F)

Shell

- 0 = Synthetic coated carbon steel (internal/water service)
- 1 = Carbon steel
- 2 = Chemically plated carbon steel (internal/water service)
- 4 = Stainless steel
- 6 = Low temperature carbon steel (< -20°F)

Bladder / Diaphragm Compound

- 2 = NBR (Buna N)
- 3 = ECO (hydrin)
- 4 = IIR (Butyl)
- 5 = NBR (Low temperature Buna N)
- 6 = FPM (Fluoro-elastomer)
- 7 = Others

| Compound | Oper. Temp Range | Typical Fluids |
|--------------|------------------|--|
| NBR | 5° to 180°F | mineral oils |
| | 32° to 180°F | water & water-glycols (5% minimum glycol) |
| Low Temp NBR | -50° to 180°F | mineral oils |
| ECO...113... | -20° to 250°F | mineral oils |
| ECO...663... | -40° to 250°F | mineral oils & water (with low temperature CS shell) |
| IIR | -20° to 200°F | phosphate esters & brake fluids |
| FPM | 5° to 300°F | chlorinated hydrocarbons |

Country of Installation

- S = USA

(for other countries see page 3 for proper codes designation)

Maximum Work Pressure

- 210 = 3000 psi
- 345 = 5000 psi

Fluid Port Connection

Threaded

- AI = BSPP (ISO 228)
- AK = BSP (for sizes 0.075 & 0.16)
- CI = SAE (ANSI B1.1)
- CK = SAE (for sizes 0.075 & 0.16)

Flanged

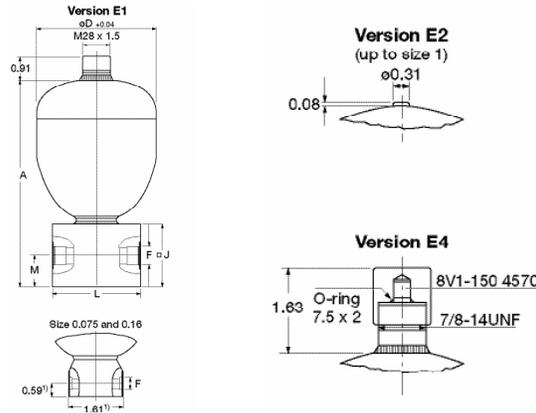
- FI = SAE 1 1/2" - 6000 psi (code 62)

Gas Precharge Pressure (P₀) (in bar)

- XXX = 3 digits

SBO Welded Diaphragm Series

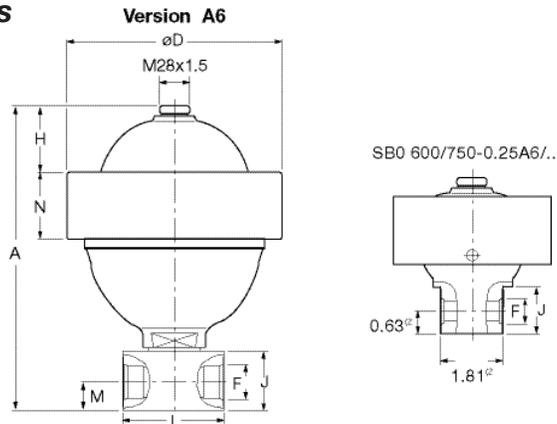
Dimensions



| Series | Size | Gas Volume (in ³) | Max. working pressure | | Weight (lbs) | A (in) | $\phi D^{(3)}$ (in) | Thread F | | J (in) | L (in) | M (in) | Q ⁽²⁾ (gpm) |
|---------|-------|-------------------------------|-----------------------|-----|--------------|--------|---------------------|--------------|--------------|--------|--------|--------|------------------------|
| | | | psi | bar | | | | SAE | BSP | | | | |
| SBO250P | 0.075 | 5 | 3600 | 250 | 2.2 | 4.57 | 2.52 | 9/16-18UNF | ISO 228-G1/4 | - | - | - | 5 |
| SBO210P | 0.16 | 10 | 3000 | 210 | 2.5 | 5.04 | 2.91 | 9/16-18UNF | ISO 228-G1/4 | - | - | - | 5 |
| SBO210P | 0.32 | 20 | 3000 | 210 | 5.8 | 5.96 | 3.66 | 3/4-16UNF | ISO 228-G1/2 | 1.97 | 3.15 | 0.99 | 10 |
| SBO210P | 0.5 | 30 | 3000 | 210 | 8.7 | 6.51 | 4.13 | 3/4-16UNF | ISO 228-G1/2 | 1.97 | 3.15 | 0.99 | 10 |
| SBO330P | 0.6 | 36 | 4700 | 330 | 12.3 | 7.74 | 4.53 | 1 5/16-12UNF | ISO228-G 1 | 2.36 | 4.13 | 1.18 | 40 |
| SBO210P | 0.75 | 45 | 3000 | 210 | 11.2 | 7.58 | 4.76 | 1 5/16-12UNF | ISO228-G 1 | 2.36 | 4.13 | 1.18 | 40 |
| SBO200P | 1 | 60 | 3000 | 210 | 12.9 | 8.02 | 5.35 | 1 5/16-12UNF | ISO228-G 1 | 2.36 | 4.13 | 1.18 | 40 |
| SBO210P | 2 | 120 | 3000 | 210 | 19.6 | 9.47 | 6.57 | 1 5/16-12UNF | ISO228-G 1 | 2.36 | 4.13 | 1.18 | 40 |

SBO Threaded Diaphragm Series

Dimensions



| Series | Size (liters) | Gas Volume (in ³) | Max. working pressure | | Weight (lbs) | A (in) | ϕD (in) | Thread-F | | H (in) | J (in) | L (in) | M (in) | N (in) | Q ⁽²⁾ (gpm) |
|------------------------|---------------|-------------------------------|-----------------------|-----|--------------|--------|---------------|-------------|--------------|--------|--------|--------|--------|--------|------------------------|
| | | | psi | bar | | | | SAE | BSP | | | | | | |
| SBO350P ⁽⁴⁾ | 0.25 | 15 | 5000 | 350 | 11.5 | 6.30 | 4.53 | 3/4-16UNF | ISO 228-G1/2 | 0.70 | 1.97 | 3.15 | 0.99 | 2.17 | 10 |
| SBO500P | 0.25 | 15 | 7200 | 500 | 11.5 | 6.30 | 4.53 | 3/4-16UNF | ISO 228-G1/2 | 0.70 | 1.97 | 3.15 | 0.99 | 2.17 | 10 |
| SBO600P ⁽⁴⁾ | 0.25 | 15 | 8700 | 600 | 22.7 | 6.77 | 6.02 | 3/4-16UNF | ISO 228-G1/2 | 0.60 | 2.17 | 2.16 | 0.71 | 2.48 | 10 |
| SBO750P | 0.25 | 15 | 10000 | 750 | 22.7 | 6.77 | 6.02 | 3/4-16UNF | ISO 228-G1/2 | 0.60 | 2.17 | 2.16 | 0.71 | 2.48 | 10 |
| SBO250P ⁽⁴⁾ | 0.6 | 36 | 3600 | 250 | 17.6 | 8.31 | 5.51 | 1 5/16-12UN | ISO228-G 1 | 1.77 | 2.36 | 4.13 | 1.18 | 2.24 | 40 |
| SBO330P | 0.6 | 36 | 4700 | 330 | 17.6 | 8.31 | 5.51 | 1 5/16-12UN | ISO228-G 1 | 1.77 | 2.36 | 4.13 | 1.18 | 2.24 | 40 |
| SBO210P | 1.3 | 80 | 3000 | 210 | 23.7 | 10.26 | 6.69 | 1 5/16-12UN | ISO228-G 1 | 2.45 | 2.36 | 4.13 | 1.18 | 2.17 | 40 |
| SBO400P | 1.3 | 80 | 5800 | 400 | 29.7 | 10.47 | 7.83 | 1 5/16-12UN | ISO228-G 1 | 1.97 | 2.36 | 4.13 | 1.18 | 2.56 | 40 |
| SBO180P ⁽⁴⁾ | 2 | 120 | 2600 | 180 | 30.1 | 11.52 | 7.83 | 1 5/16-12UN | ISO228-G 1 | 2.54 | 2.36 | 4.13 | 1.18 | 2.40 | 40 |
| SBO250P | 2 | 120 | 3600 | 250 | 34.0 | 11.75 | 6.60 | 1 5/16-12UN | ISO228-G 1 | 2.54 | 2.36 | 4.13 | 1.18 | 2.52 | 40 |

1) For SAE threads only

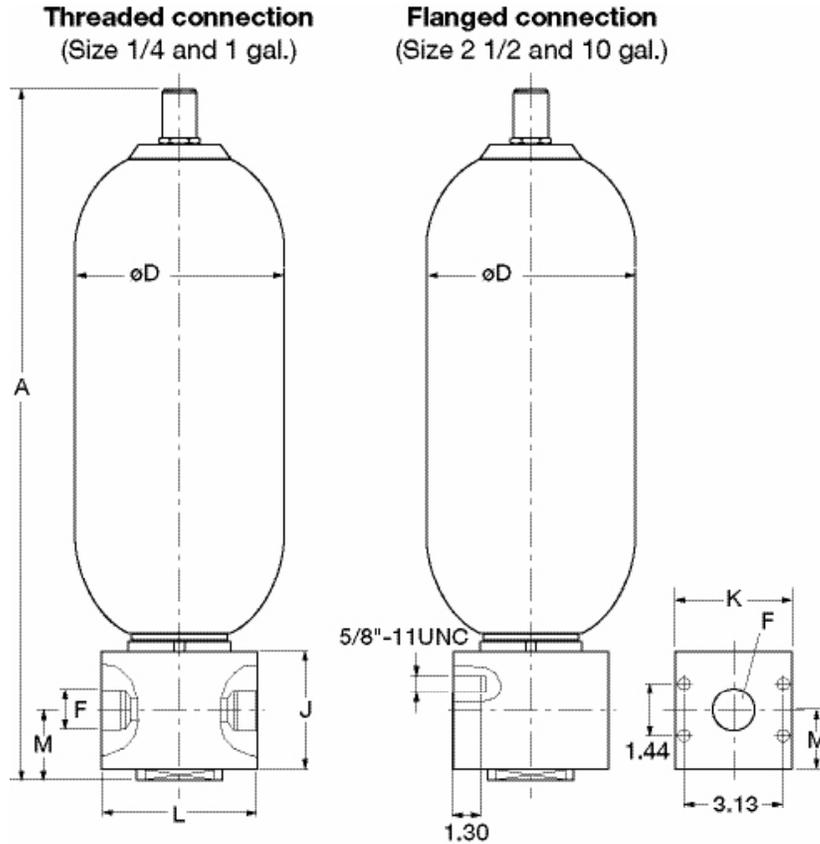
2) Pressure loss at Q (viscosity 32 cSt) approx. 50 psi

3) Diameter at electron beam weld may be up to +0.150" larger

4) Only available in stainless steel

Dimensions are for general information only, all critical dimensions should be verified.

SB Bladder Accumulator Series Dimensions



SB 330 P (3000 psi max. working pressure)

| Size | Vol. (gal) | Gas Volume (in ³) | Weight (lbs) | A (in) | øD (in) | Connection F | J (in) | K (in) | L (in) | M (in) | Q ¹⁾ (gpm) |
|------|------------|-------------------------------|--------------|--------|---------|-------------------------------------|--------|--------|--------|--------|-----------------------|
| 1 | 1/4 | 66 | 24 | 14.4 | 4.6 | ISO 228-G1 1/4 | 3.15 | 3.15 | 4.72 | 2.24 | 80 |
| 4 | 1 | 226 | 40 | 18.0 | 6.6 | ISO 228-G1 1/4 | 3.15 | 3.15 | 4.72 | 2.24 | 80 |
| 10 | 2 1/2 | 566 | 90 | 24.4 | 9.1 | SAE 1 1/2" - 6000 psi (code 62 SAE) | 3.94 | 4.50 | 6.69 | 3.35 | 140 |
| 20 | 5 | 1125 | 154 | 36.3 | 9.1 | SAE 1 1/2" - 6000 psi (code 62 SAE) | 3.94 | 4.50 | 6.69 | 3.35 | 140 |
| 32 | 10 | 2080 | 220 | 56.9 | 9.1 | SAE 1 1/2" - 6000 psi (code 62 SAE) | 3.94 | 4.50 | 6.69 | 3.35 | 140 |

SB 600 P (5000 psi max. working pressure)

| Size | Vol. (gal) | Gas Volume (in ³) | Weight (lbs) | A (in) | øD (in) | Connection F | J (in) | K (in) | L (in) | M (in) | Q ¹⁾ (gpm) |
|------|------------|-------------------------------|--------------|--------|---------|-------------------------------------|--------|--------|--------|--------|-----------------------|
| 1 | 1/4 | 66 | 24 | 14.4 | 4.6 | ISO 228-G1 1/4 | 3.15 | 3.15 | 4.72 | 2.24 | 80 |
| 4 | 1 | 226 | 49 | 18.0 | 6.6 | ISO 228-G1 1/4 | 3.15 | 3.15 | 4.72 | 2.24 | 80 |
| 10 | 2 1/2 | 566 | 102 | 24.4 | 9.7 | SAE 1 1/2" - 6000 psi (code 62 SAE) | 3.94 | 4.50 | 6.69 | 3.35 | 140 |
| 20 | 5 | 1125 | 183 | 36.3 | 9.7 | SAE 1 1/2" - 6000 psi (code 62 SAE) | 3.94 | 4.50 | 6.69 | 3.35 | 140 |
| 32 | 10 | 2080 | 269 | 56.9 | 9.7 | SAE 1 1/2" - 6000 psi (code 62 SAE) | 3.94 | 4.50 | 6.69 | 3.35 | 140 |

1) Pressure loss at Q (viscosity 32 cSt) approx. 50 psi

Dimensions are for general information only, all critical dimensions should be verified.

SM50 & SM50P Metal Bellows



Description

In addition to Bladder, Piston and Diaphragm accumulators, HYDAC can now offer a fourth series – Metal Bellows Accumulators.

A metal separating element is used between the fluid and gas side of the metal bellows accumulator. This makes it virtually gas tight, eliminating elastomer separating elements and seals from the accumulator and providing a solution for some very challenging accumulator pulsation application conditions.

- Heavy Diesel Engines-Mobile, Marine & Industrial: Fuel injection systems in heavy diesel engines generate significant cyclic pressure fluctuations or pulsations. The Metal Bellows Accumulator can be used as a pulsation dampener on both the supply and return lines close to the engine which generates the pulsations. The metal bellows element provides a more robust method of separating the nitrogen gas from the diesel fuel and also manages the next two related problems.
- Elastomer Resistance to Fuels & High Temperature: Alternatives to diesel fuels, such as bio-oils or heavy fuel oil require higher fuel injection temperatures up to 320°F. Even FKM (Viton®) will have compatibility problems and shortened service life with fluids of this type under these extreme conditions. Metal Bellows Accumulators eliminate this elastomer compatibility issue.
- Nitrogen Gas Loss Through the Elastomer - Permeation: The high fuel fluid temperatures compound and nitrogen gas permeation through the elastomers creating higher gas losses and increase the need for gas monitoring and gas precharge maintenance. If nitrogen gas losses become excessive, a bladder or diaphragm will experience damage and possible failure in operation.

The recently developed solution from HYDAC is the Metal Bellows Accumulator. Instead of a bladder or diaphragm, a metal bellows is used as the flexible separating element between fluid and gas. The metal bellows is resistant to all conventional fuels over a very wide temperature range. Heavy fuel oil at temperatures from -85 °F to 320 °F is easily handled these dampers. The metal bellows is welded to the other components and is therefore completely gas tight. It is able to expand and contract inside the accumulator without any friction or abrasion and it can operate for a very long period of time (years) with a single adjustment. Monitoring and maintenance for this type of damper is therefore reduced to a minimum.

Construction

Metal Bellows Accumulators are available in two different styles:

- SM50P – Flange connection with fluid diverter design and
- SM50 – Threaded connection w/o fluid diverter, good for applications requiring a retrofit of competitors accumulators.

A diverting block is built into the fuel side of the damper which forces the fuel directly into the accumulator, thereby increasing the damping efficiency considerably. If two dampers are fitted to the fuel system (in both supply and return line), no pressure fluctuations can leave the engine before passing through one of the metal bellows dampers.

If a conventional accumulator can no longer perform its function, this can lead to expensive maintenance and repair work. We can offer a retrofit alternative - Replacement without the need for modification.

Features

There are two different design types of metal bellows; convoluted (formed) and diaphragm (welded). Each has a slightly different design and performance advantages also vary.

Convoluted bellows (formed)

- Heavy Diesel Engines
- Very good dampening features
- Resistant to contamination



Diaphragm bellows (welded)

- Very suitable for high pressures
- Very good energy storage features
- High displacement volume
- Compact



Areas of Application

- Pulsation dampening
- Volume compensation

Industry Sectors

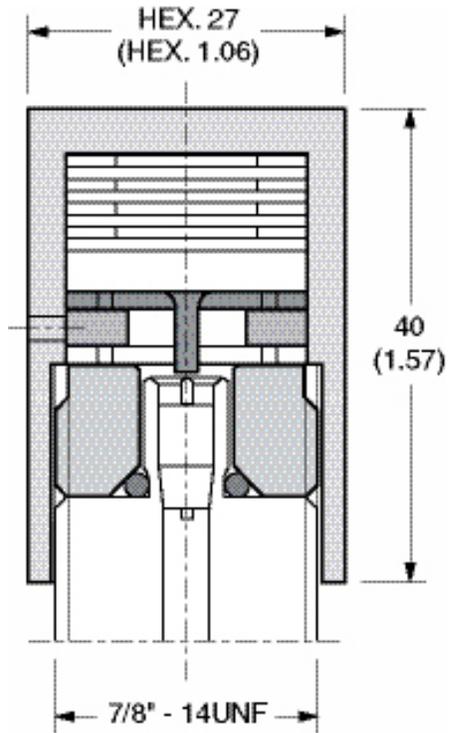
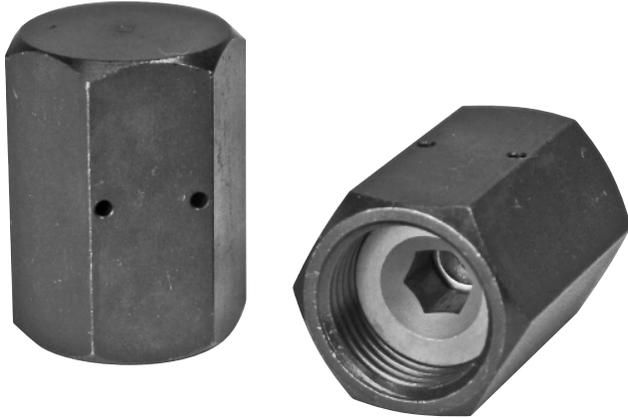
- Heavy diesel engines (e.g. power plants and ships)
- Process technology
- Wind energy

Metal Bellows SM50 & SM50P Technical Information

| Technical specifications HYDAC Metal Bellows Accumulators | Flange Connection Design | Threaded Connection Design |
|--|--|--|
| Series | SM50P | SM50 |
| Max. design pressure | 725 psi | 725 psi |
| Max. working pressure * | 43.5 psi - 174 psi | 43.5 psi - 174 psi |
| Max. pre-charge pressure at Tmax | 58 psi | 116 psi |
| Design Temperature range | 14 F° - 320 F° | |
| Operating media | Diesel and heavy fuel oil, boifuels | |
| Size | 0.5 - 3.8 L | 0.5 - 1.6L |
| Effective gas volume | ≈0.5 L (nitrogen) | |
| Gas side pre-charge fluid | 0.6 L (ethylene glycol) | 0.3 L (ethylene glycol) |
| Fluctuating volume * | max 0.04 L | |
| Material | Carbon steel (primed externally) | |
| Design and Approval * | e.g.: PED, ABS, DNV, LR, BV, GL, RMRS | |
| Fluid connection * | Diverting block SAE 1 1/4" Diverting block SAE 2" Diverting block SAE 3" | 2" BSP (female) or with adapter also for 1 1/2" BSP (male) |
| Gas connection | M28x 1.5 for Universal Charging and Testing Unit - FPU-1 | |
| Mounting position * | vertical (gas connection at top) | preferably vertical (gas connection at top) |
| Weight | 48.5 - 73lbs | 20lbs |

*Others on request

Thermal Fuse Caps



Description

HYDAC Thermal Fuse Caps are safety devices that automatically bleed accumulator gas pressure in the event of a fire. These devices are installed on the HYDAC version 4 gas valve. When the critical temperature (320°F to 340°F) is reached, a support ring melts, allowing for the spring to depress the gas valve core.

Applications

HYDAC Thermal Fuse Caps can be applied as a safety measure on any HYDAC accumulator with a Version 4 Gas Valve. Application of these devices may result in a reduction in insurance premium (*check with provider*).

Installation

Simply remove and discard the standard Gas Valve Protection Cap and Valve Seal Cap. Screw on the Thermal Fuse Cap and torque to 30 N-m (22 lb-ft.)

Operation

Once installed, the thermal fuse cap requires no attention. In the event of a fire, the support ring will melt and the spring will expand, causing the pin to depress the gas valve core. The melted support and gas will then exit through the gas bleed ports in the side of the thermal fuse cap.

Model Code

There are no options for this product, therefore a model code is not given.

Order Part No. 00363501

Technical Data

Maximum Working Pressure

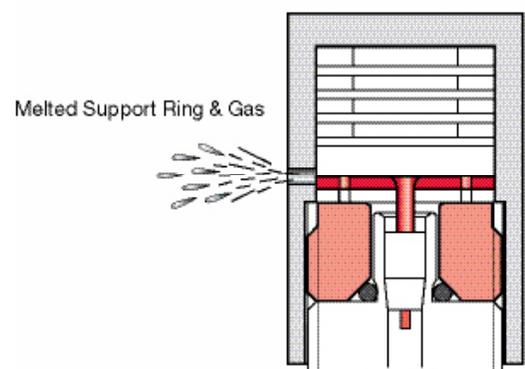
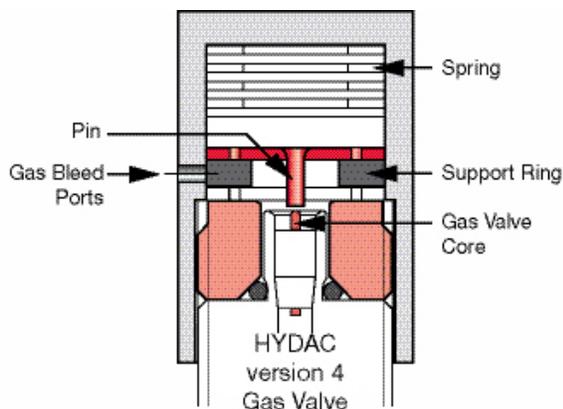
- 5000 psi (345 bar)

Maximum Working Temperature

- 200°F (93.5°C)

Fusing Temperature

- 320 to 340°F (160 to 171°C)



Thermal Fuse Plugs, GMP6 CE certified



Description

HYDAC GMP6 Thermal Fuse Plugs are safety devices that automatically bleed accumulator gas pressure in the event of a fire. The Thermal Fuse Plug mounts directly to the gas end cap of a piston type accumulator, via a permanent gauging block for bladder and diaphragm type accumulators.

Advantages

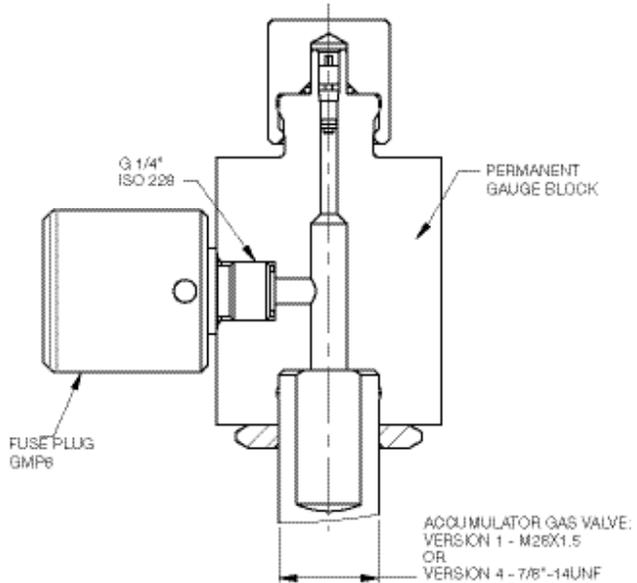
- safety device approved according to PED 97/23/EC with CE-marking and Declaration of Conformity
- variable capability of connecting to bladder, piston and diaphragm accumulators
- suitable for large volume accumulators
- particularly suitable for outdoor applications (e.g. Offshore)

Installation

The GMP6 Thermal Fuse Plug screws directly onto a piston accumulator. However, the use of a permanent gauging block is required for connection to a bladder or diaphragm accumulator.

Operation

Once installed, the thermal fuse plug requires no attention. When the critical temperature (320°F to 356°F) is reached, an internal ring melts and a plug releases, allowing the gas to exit through the gas bleed ports in the side of the thermal fuse plug.



GMP6 Thermal Fuse Plug shown with Permanent Gauge Block for use with a bladder or diaphragm accumulator

Model Code

GMP6-10-CE1637.6.G.120L/S.420bar

| Part No. | Connection Type |
|----------|-----------------|
| 3716128 | ISO 228 - G 1/4 |

Technical Data

Permitted operating pressure:

- 725 to 6090 psi

Temperature range:

- -40° F to 176° F

Melting point:

- Between 320° F and 356° F

Material:

- Stainless Steel

SAF Series Safety & Shut-off Blocks



Description

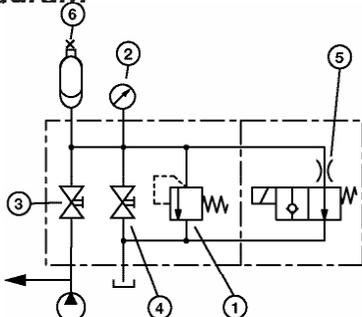
HYDAC safety and shut-off blocks are designed to protect, shut-off, and discharge hydraulic accumulators or user units. The compact design simplifies the hydraulic system connection and offers the following advantages:

- minimum space compared to individual components
- reduced installation time
- various system connections
- system lockout

Safety & Shut-off Block Features

- 1 – pressure relief valve (DB12)
- 2 – pressure gauge (optional)
- 3 – main shut-off valve
- 4 – manual bleed valve
- 5 – 2-way solenoid operated bleed valve (optional)
- 6 – accumulator

Circuit Diagram



Note: When using hydro-pneumatic accumulators for stored hazardous energy, HYDAC recommends the use of its Safety and Shut-off Block (SAF) with solenoid operated bleed valve.

Technical Specifications

Fluids

Mineral oil, hydraulic oil, water glycol, non-flammable fluids
(other fluids upon request)

Temperature (for carbon steel)

5° to 180°F (-15° to 80°C)

Maximum Working Pressure

up to 5800 psi (400 bar)

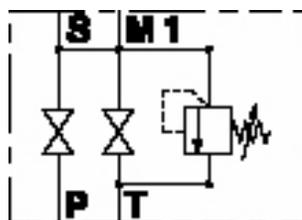
Construction

The Safety and Shut-off Block consists of a valve block, a built-in pressure relief valve, a main shut-off valve, and a manually operated bleed valve. In addition, an optional solenoid operated bleed valve allows automatic pressure relief of the accumulator or user unit and therefore relief of the hydraulic system in an emergency or during shut-down. The necessary return line connection is provided in addition to the gauge connection.

Standard Models

Model with manually operated bleed valve

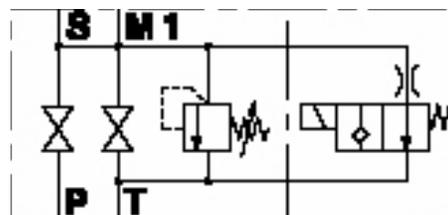
The basic model type “M” contains a manually operated bleed valve for manual pressure release of the accumulator.



Sizes: SAF 10 M
SAF 20 M
SAF 32 M

Model with solenoid operated bleed valve

In addition to the features of the type “M” block, the type “E” model also contains a solenoid operated bleed valve for automatic pressure release of the accumulator.



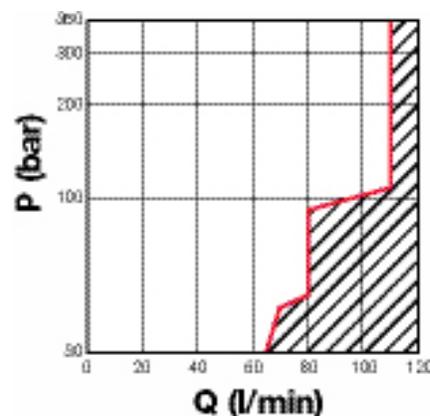
Sizes: SAF 10 E
SAF 20 E
SAF 32 E

Connections

- S – Accumulator Connection
- P – System Connection
- T – Tank Connection
- M1 – Gauge Connection

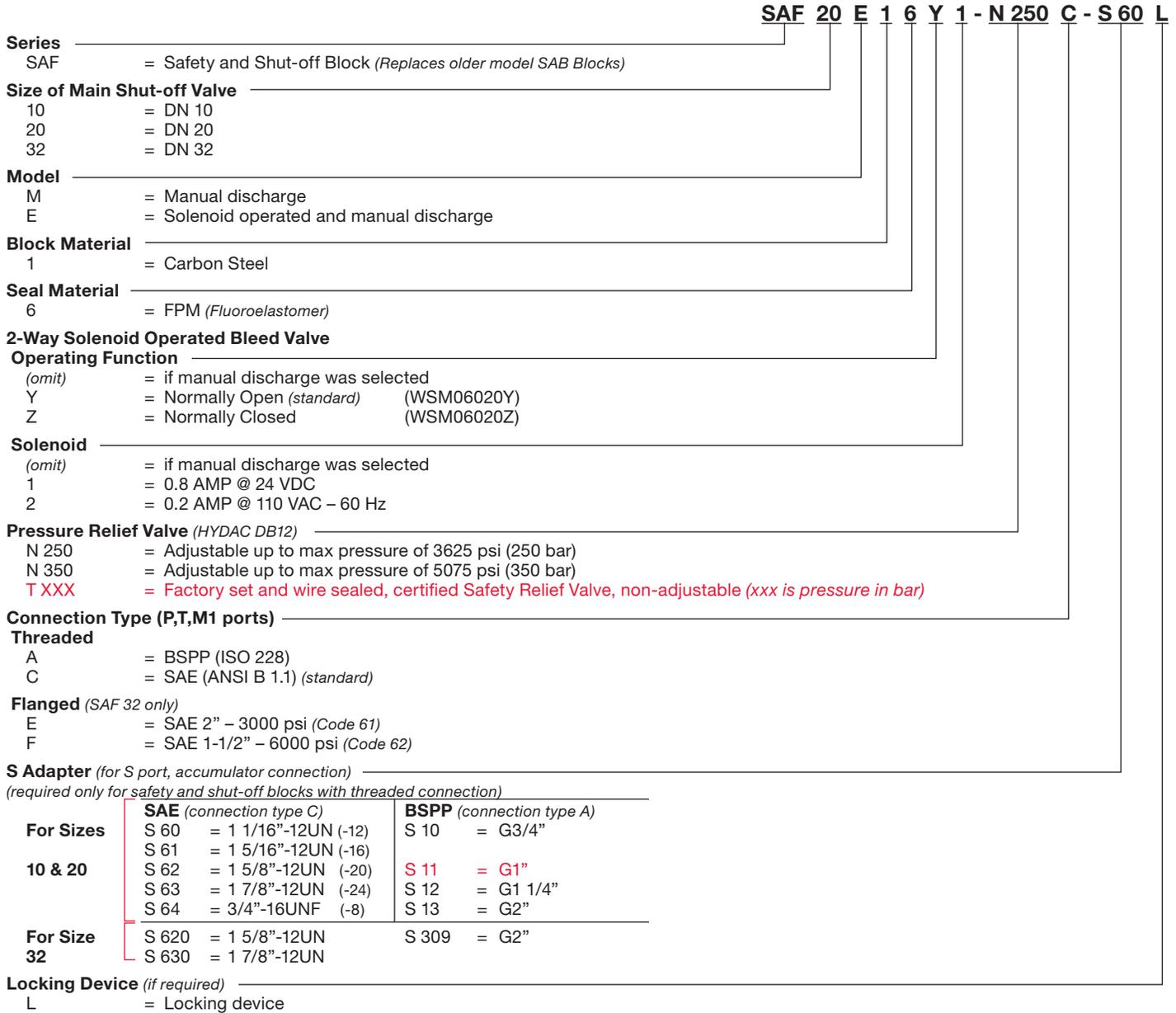
Pressure Relief Valve (DB12)

This valve cannot be set to values in the shaded area



Model Code

Model Codes containing RED selections are non-standard items – Contact HYDAC for information and availability
 Not all combinations are available



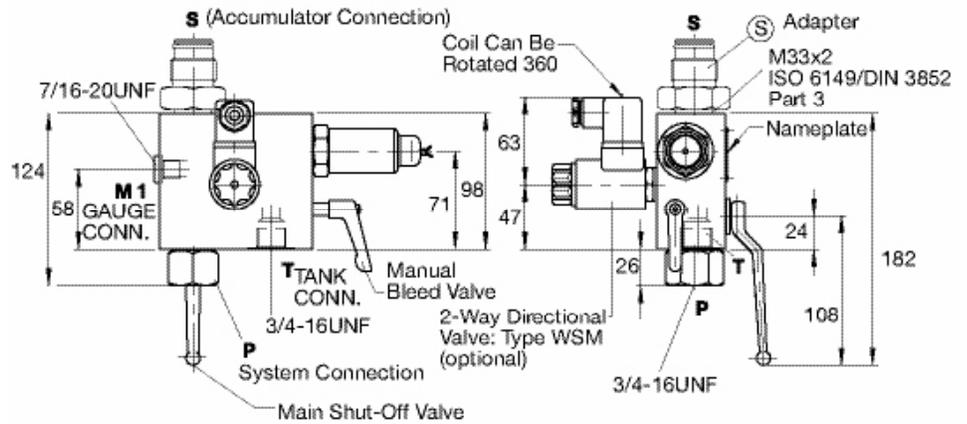
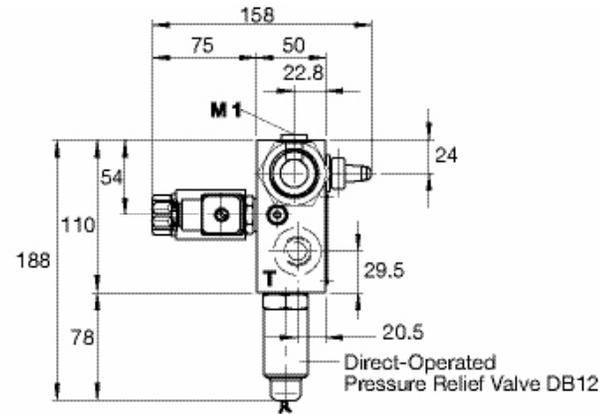
Dimensions

SAF 10 M/E...C

| Type | Approximate Weight | |
|----------|--------------------|--------|
| | kg | (lbs.) |
| SAF 10 M | 4.2 | (9.3) |
| SAF 10 E | 4.6 | (10.1) |

Dimensions in millimeters.

Note: for "M" Type block the 2-way directional valve is replaced with a plug



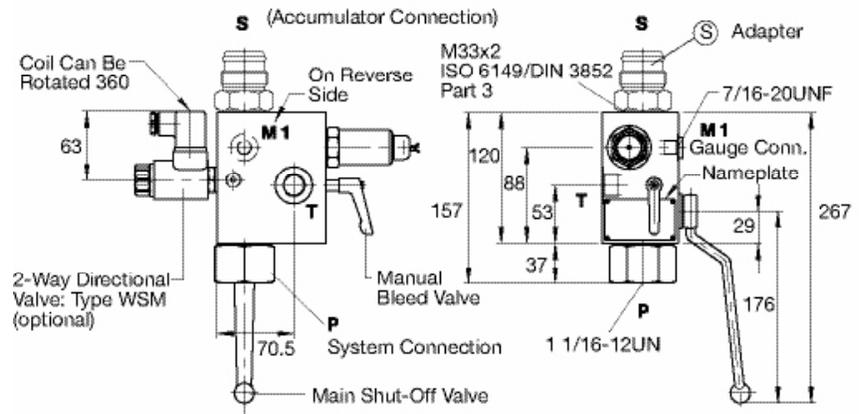
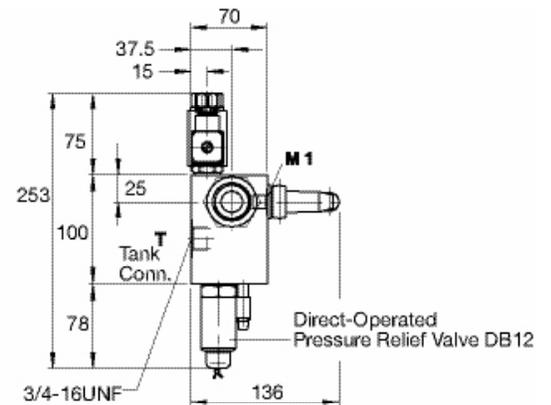
Dimensions are for general information only, all critical dimensions should be verified.

SAF 20 M/E...C

| Type | Approximate Weight | |
|----------|--------------------|--------|
| | kg | (lbs.) |
| SAF 20 M | 6.8 | (15.0) |
| SAF 20 E | 7.2 | (15.8) |

Dimensions in millimeters.

Note: for "M" Type block the 2-way directional valve is replaced with a plug



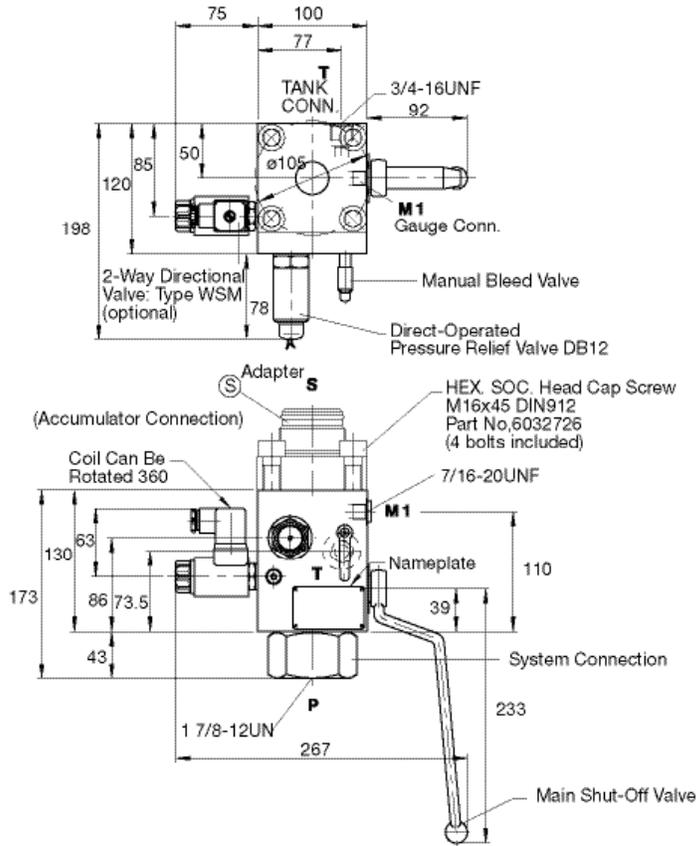
Dimensions are for general information only, all critical dimensions should be verified.

SAF 32 M/E...C

| Type | Approximate Weight | |
|----------|--------------------|--------|
| | kg | (lbs.) |
| SAF 32 M | 12.0 | (26.4) |
| SAF 32 E | 12.4 | (27.2) |

Dimensions in millimeters.

Note: for "M" Type block the 2-way directional valve is replaced with a plug



Dimensions are for general information only, all critical dimensions should be verified.

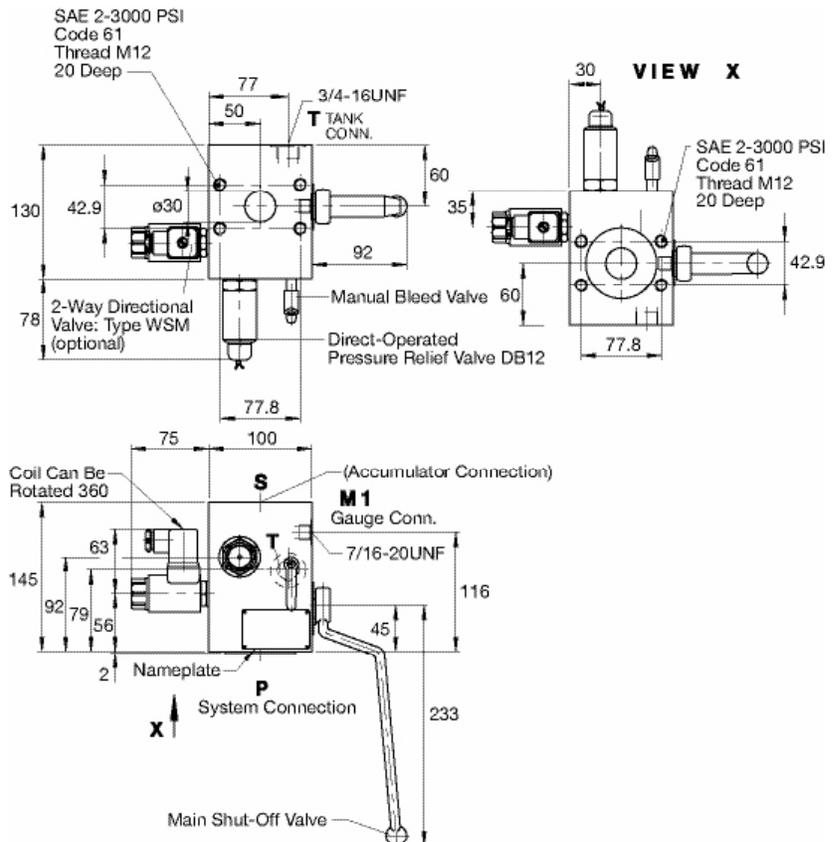
SAF 32 M/E...E

| Type | Approximate Weight | |
|----------|--------------------|--------|
| | kg | (lbs.) |
| SAF 32 M | 15.0 | (33.1) |
| SAF 32 E | 15.4 | (33.9) |

*Hexagonal socket head cap screws M12x35 - 8.8 SCHS (HYDAC Part No. 602100) have to be ordered separately

Dimensions in millimeters

Note: for "M" Type block the 2-way directional valve is replaced with a plug



Dimensions are for general information only, all critical dimensions should be verified.

Dimensions

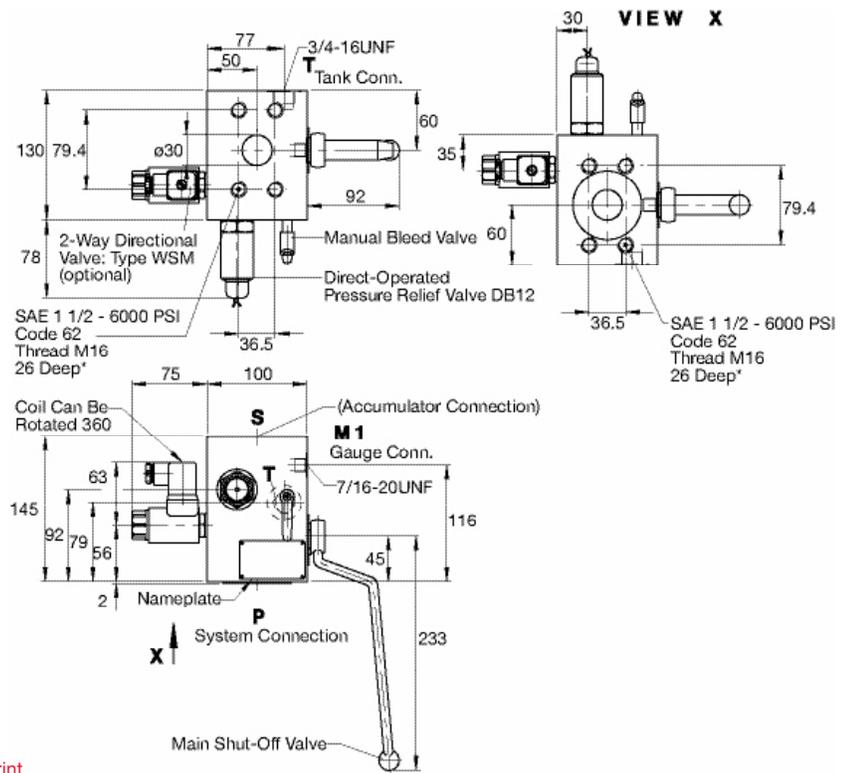
SAF 32 M/E...F

| Type | Approximate Weight | |
|----------|--------------------|--------|
| | kg | (lbs.) |
| SAF 32 M | 15.0 | (33.1) |
| SAF 32 E | 15.4 | (33.9) |

*Hexagonal socket head cap screws
M16x55 - 8.8 SCHS (HYDAC Part No. 00601496)
have to be ordered separately

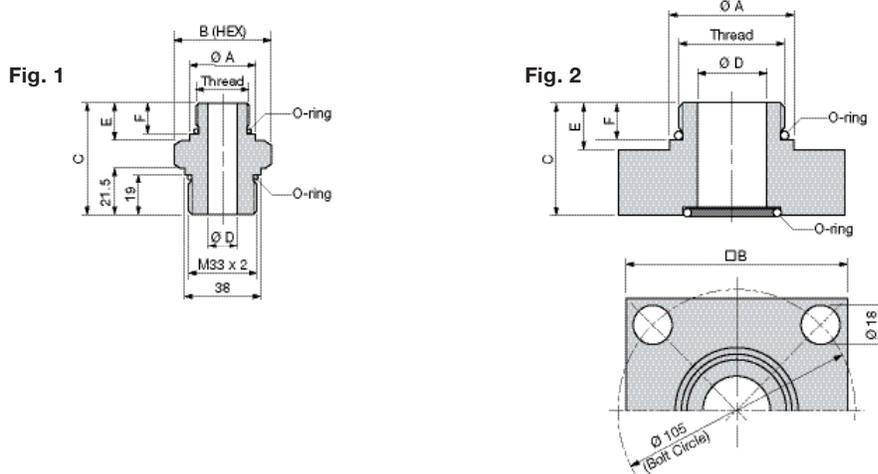
Dimensions in millimeters

Note: for "M" Type block the 2-way directional valve is replaced with a plug



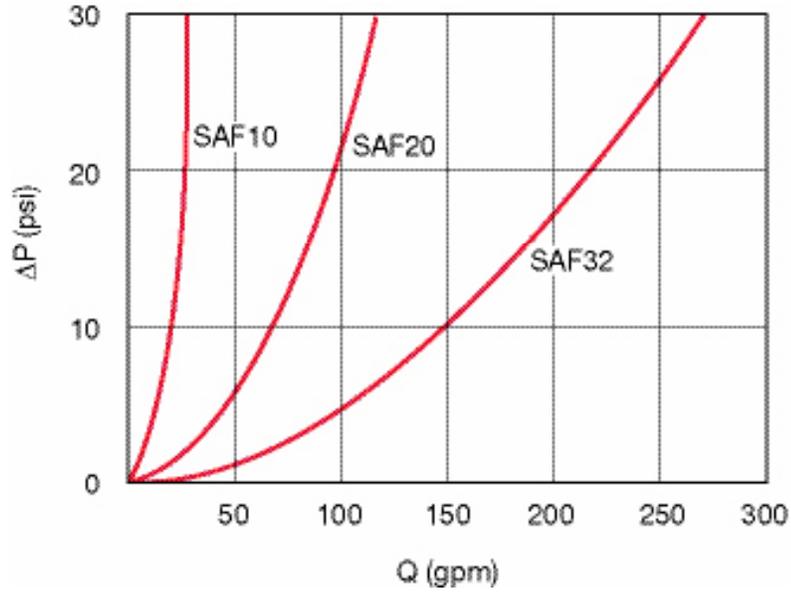
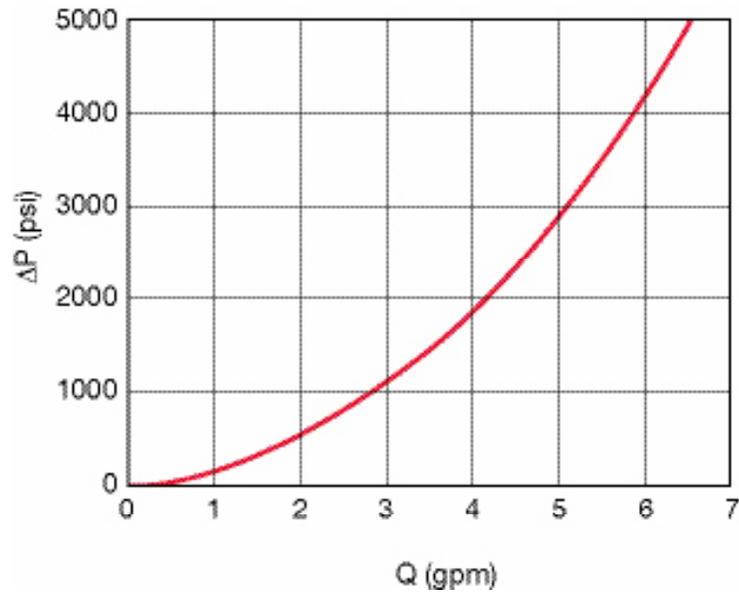
Dimensions are for general information only,
all critical dimensions should be verified by requesting a certified print.

S Adapters



| Type SAF | Accumulator Type | Adapter | Fig. | Thread | A | B | C | D | E | F |
|-----------|--|---------|------|--------------|----|-----|----|----|----|----|
| SAF 10/20 | SB330-Size 1 / SBO-Size 2 to 3.5 | S 60 | 1 | 1 1/16-12 UN | 32 | 41 | 55 | 14 | 19 | 15 |
| | SBO-Size 1.4, 29 3.5 SK280-100mm bore | S 61 | 1 | 1 5/16-12 UN | 38 | 41 | 55 | 20 | 19 | 15 |
| | SB330-Size 4 to 6 / SB600-Size 1 to 4 | S 62 | 1 | 1 5/8-12 UN | 48 | 66 | 57 | 23 | 19 | 15 |
| | SB330/600-Size 10 to 54 | S 63 | 1 | 1 7/8-12 UN | 54 | 66 | 57 | 23 | 19 | 15 |
| | SBO-Size 0.32 to 1.4 | S 64 | 1 | 3/4-16 UNF | 23 | 41 | 51 | 10 | 15 | 11 |
| SAF 32 | SB330-Size 4 to 6 / SB600-Size 1 to 4 | S 620 | 2 | 1 5/8-12 UN | 48 | 100 | 49 | 22 | 19 | 15 |
| | SB330/600-Size 10 to 54 | S 630 | 2 | 1 7/8-12 UN | 54 | 100 | 49 | 30 | 19 | 15 |

Dimensions in millimeters
Dimensions are for general information only,
all critical dimensions should be verified.

Pressure Drop Charts**Through Main Shut-off Valve****Through Solenoid Valve**

Safety & Shut-off Blocks - Spare Parts

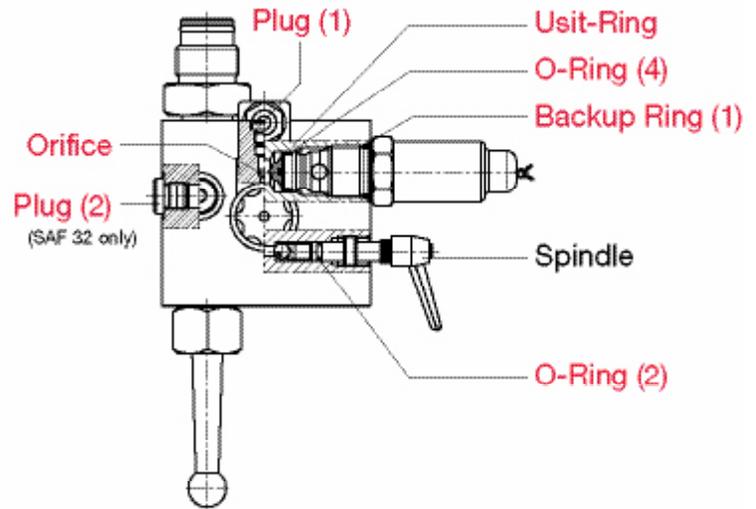
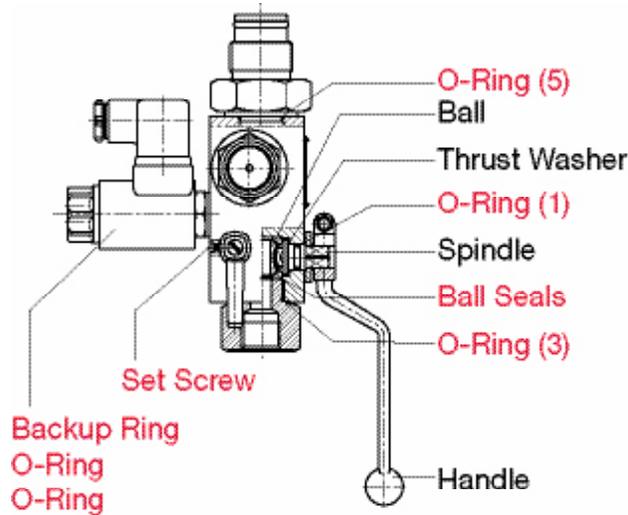
Seal Kits & Repair Kits

Repair Kits

| Series | Part Number |
|-----------|---------------|
| SAF 10... | 3154715 (FPM) |
| SAF 20... | 3154716 (FPM) |
| SAF 32... | 3154717 (FPM) |

Seal Kit (includes parts marked in red)

| Series | Part Number |
|-----------|---------------|
| SAF 10... | 3154712 (FPM) |
| SAF 20... | 3154713 (FPM) |
| SAF 32... | 3154714 (FPM) |



Dimensions for Spare Parts

| Item | SAF 10... | SAF 20... | SAF 32... |
|-----------------|-----------------|-----------------|-----------------|
| O-Ring (1) | 10 x 2 | 15 x 2.5 | 20 x 3 |
| O-Ring (2) | 6 x 2 | 6 x 2 | 6 x 2 |
| O-Ring (3) | 21 x 2 | 34 x 2.5 | 53 x 2.5 |
| O-Ring (4) | 18 x 2 | 18 x 2 | 18 x 2 |
| O-Ring (5) | 29.7 x 2.8 | 29.7 x 2.8 | 37.2 x 3 |
| Usit-ring | 18.3 x 21.5 x 1 | 18.3 x 21.5 x 1 | 18.3 x 21.5 x 1 |
| Backup Ring (1) | 23.47 x 2.62 | 23.47 x 2.62 | 23.47 x 2.62 |
| Plug (1) | 7/16-20UNF | 3/4-16UNF | 3/4-16UNF |
| Plug (2) | N/A | N/A | G1/8 |

O-ring dimensions are in mm

Spindle Manual Bleed Valve, Repair Kit

Consists of Spindle, Handle, Ball, O-Ring, and Set Screw

| | |
|----------|---------------|
| Part No. | 2115649 (FPM) |
|----------|---------------|

Solenoid

| 2-way solenoid operated bleed valve (without coil) | Old 2SV5 | New WSM |
|--|----------|---------|
| Normally Open (for SAF...E16Y) | N/A | 3055295 |
| Normally Closed (for SAF...E16Z) | N/A | 3055276 |

| Coil Kit for 2-way solenoid operated bleed valve | Old 2SV5 | New WSM |
|--|----------|---------|
| 24 V DC | 715003 | 2083644 |
| 110 V AC | 715033 | 2083645 |

Note: For complete solenoid replacement, both the 2-way solenoid valve and the coil kit are required. 2SV5 coils and WSM coils are not interchangeable. When replacing a 2SV5 with a WSM you must also replace the coil with the WSM design.

FPK & FPS Series Charging & Gauging Units



Description

To maintain system performance HYDAC recommends that the gas precharge pressure is checked regularly. The inevitable loss of gas precharge pressure due to permeability will change the system effectiveness (performance) and could cause damage to the bladder, diaphragm, or piston accumulator.

HYDAC charging and gauging units allow hydro-pneumatic accumulators to be precharged with dry nitrogen. For these purposes, a charging and gauging unit is connected to a commercially available nitrogen bottle via a flexible charging hose.

These units also allow maintenance personnel to check the current gas precharge pressure of an accumulator. For critical systems, consider the use of a permanent gauging block (see page 68) which will provide for continuous monitoring.

All HYDAC charging and gauging units incorporate a gauge and check valve in the charging connection, and a manual bleed valve with a T-handle.

HYDAC offers two types of charging and gauging units:

- FPK for use with HYDAC version 1 gas valve
- FPS for use with HYDAC version 4 gas valve

Model Code

Note: For Oil, Gas & Marine specific charging & gauging units please refer to page 62

| | FPK | FPS | 250 | F | 2.5 | G4 | K |
|---|-----|---|-----|---|-----|----|---|
| Series | | | | | | | |
| FPK | = | for use with Gas Valve Version 1 (M28 x 1.5) for SBO and SK | | | | | |
| FPS | = | for use with Gas Valve Version 4 (8VI-ISO 4570) for SB, SBO and SK | | | | | |
| NOTE: SB Top repairable bladder accumulators must use FPK with Adapter A3 (FPK/SB), PN 291533 | | | | | | | |
| Gauge Pressure Range | | | | | | | |
| 10 | = | 0 to 145 psi | | | | | |
| | | (0 to 10 bar) | | | | | |
| 25 | = | 0 to 350 psi | | | | | |
| | | (0 to 25 bar) | | | | | |
| 100 | = | 0 to 1400 psi | | | | | |
| | | (0 to 100 bar) | | | | | |
| 250 | = | 0 to 3500 psi | | | | | |
| | | (0 to 250 bar) | | | | | |
| 400 | = | 0 to 5800 psi | | | | | |
| | | (0 to 400 bar) | | | | | |
| Charging Hose | | | | | | | |
| F | = | with cap screw G1 (thread W24, 32x1/14 - DIN477) | | | | | |
| Charging Hose Length | | | | | | | |
| 2.5 | = | 8 ft. (2.5 m) | | | | | |
| 4.0 | = | 13 ft. (4 m) | | | | | |
| Adapter | | | | | | | |
| G4 | = | USA (only for CGA 580 gas bottle connections) | | | | | |
| G4.1 | = | USA (only for CGA 680 gas bottle connections) | | | | | |
| | | only available with 400 bar Gauge and adapter integrated onto 4m high pressure hose | | | | | |
| G1 | = | Germany (integral part of charging hose) | | | | | |
| G2 | = | Great Britain, India | | | | | |
| G3 | = | France, Mexico | | | | | |
| G5 | = | Italy | | | | | |
| G6 | = | Japan | | | | | |
| G7 | = | South Korea | | | | | |
| G8 | = | Brazil, Columbia, Peru | | | | | |
| G9 | = | Taiwan | | | | | |
| G10 | = | Russia, Venezuela | | | | | |
| G11 | = | China | | | | | |
| G12 | = | Australia | | | | | |
| Case | | | | | | | |
| K | = | plastic carrying case (standard) | | | | | |

Additional Accessories:

ADAPTER A3 (FPK/SB) = adapter for using FPK Charging Unit to fit HYDAC gas valve version 4, including top repairable bladder accumulators

NOTE: for other adapters please consult factory.

6mm Allen Wrench (for HYDAC Gas Valve Version 1, included with FPK Kits)

14mm Open End Wrench (for HYDAC gauge, optional)

Operating and Installation Instructions are included with each charging kit.

This is also available for download in PDF format on our web site: www.hydacusa.com

For spare parts see page 66.

Model FPS

For use with gas valve version 4.
(Except for top repairable bladder accumulators)



Model FPK

For use with gas valve version 1.



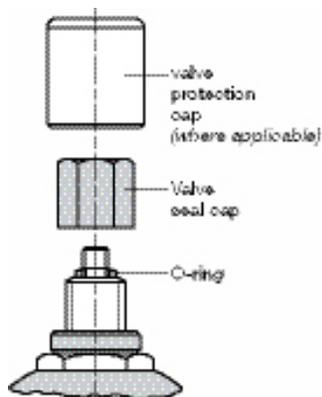
Adapter A3 (FPK/SB)

Part No. 291533

The A3 (FPK/SB) adapter can be used with the FPK to connect to any HYDAC version 4 gas valve for both bottom and top repairable bladder accumulators. The A3 adapter also serves as the required spacer for top repairable bladder accumulators.

Gas Valve Version 4

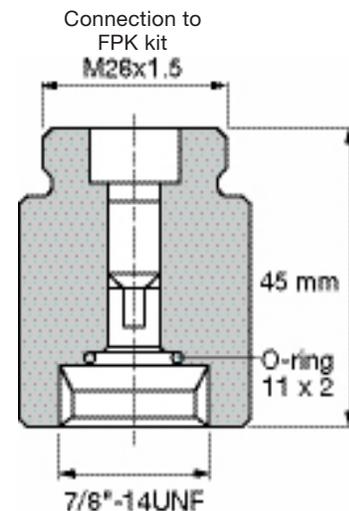
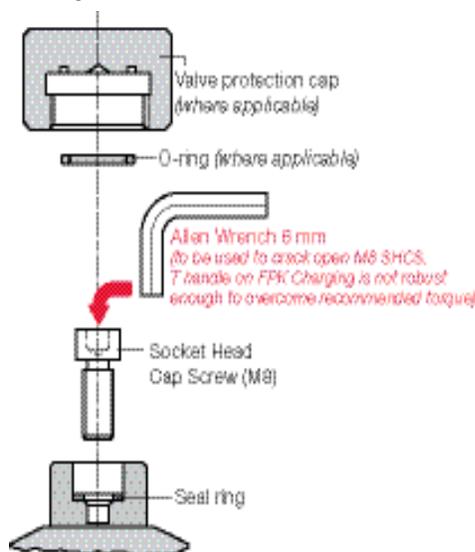
On a Bottom Repairable Bladder Accumulator as well as Diaphragm Accumulators with E4 gas valve and piston accumulators with VE Gas Valve.



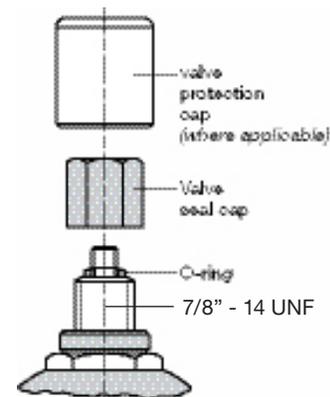
Gas Valve Version 1

Metric, M28 x 1.5

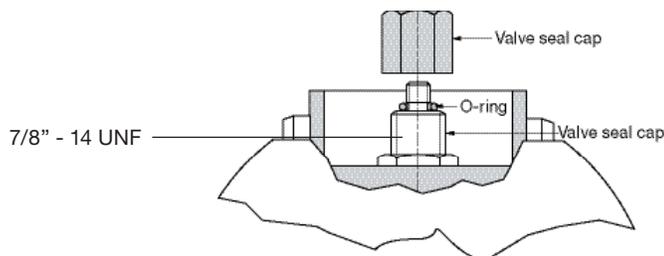
Used on Diaphragm Accumulators w/ E1 gas valves and Piston Accumulators w/ VA or VB gas valves



Connection to Version 4 Gas Valve



Bottom Repairable



Top Repairable

FPO Series Charging and Gauging Units



Description

To maintain system performance HYDAC recommends that the gas precharge pressure is checked regularly. The inevitable loss of gas precharge pressure due to permeability will change the system effectiveness (performance) and could cause damage to the bladder, diaphragm, or piston accumulator.

HYDAC charging and gauging units allow hydro-pneumatic accumulators to be precharged with dry nitrogen. For these purposes, a charging and gauging unit is connected to a commercially available nitrogen bottle via a flexible charging hose.

These units also allow maintenance personnel to check the current gas precharge pressure of an accumulator. For critical systems, consider the use of a permanent gauging block (see page 68) which will provide for continuous monitoring.

All HYDAC charging and gauging units incorporate a gauge and check valve in the charging connection, and a manual bleed valve with a T-handle.

This charging kit is used for oil & gas / offshore type accumulators having the repairable 2 piece gas valve (denoted by "11" in the gas port segment in the accumulator model code).

Model Code

| | | | | | | |
|--|-----|-----|---|---|---|---|
| Charging and Gauging Unit | FPO | 210 | F | 3 | - | K |
| FPO = for use with Gas Valve Version 4 (8VI-ISO 4570) for SB, SBO and SK | | | | | | |
| Gauge Pressure Range | 210 | | | | | |
| 210 = 0 to 3000 psi (0 to 210 bar) | | | | | | |
| Charging Hose | F | | | | | |
| F = with nitrogen bottle connection CGA-580 | | | | | | |
| Charging Hose Length | 3.0 | | | | | |
| 3.0 = 10 ft. (3 m) | | | | | | |
| Case | K | | | | | |
| K = plastic carrying case (standard) | | | | | | |

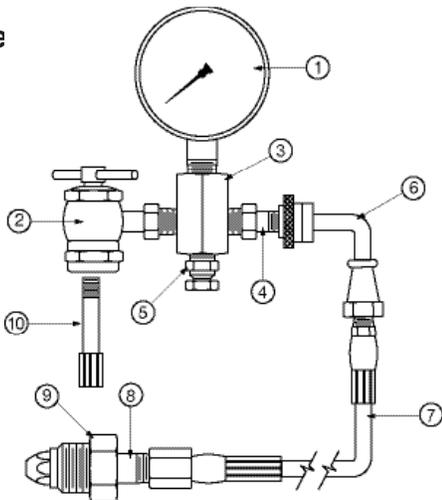
Additional Accessories:

Gas Valve Extension Rod - to be used with top repairable accumulators

Operating and Installation Instructions are included with each charging kit.

This is also available for download in PDF format on our web site: www.hydacusa.com

Spare

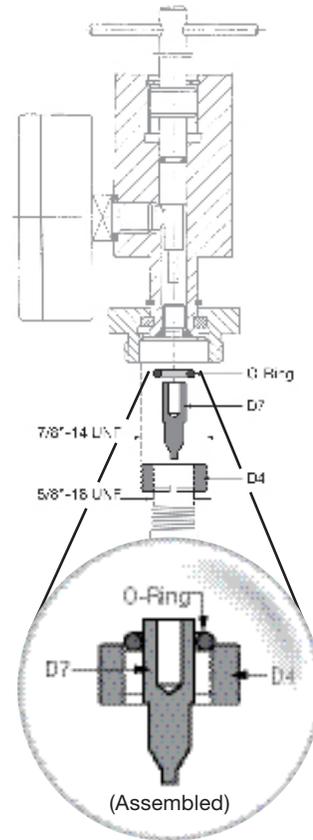
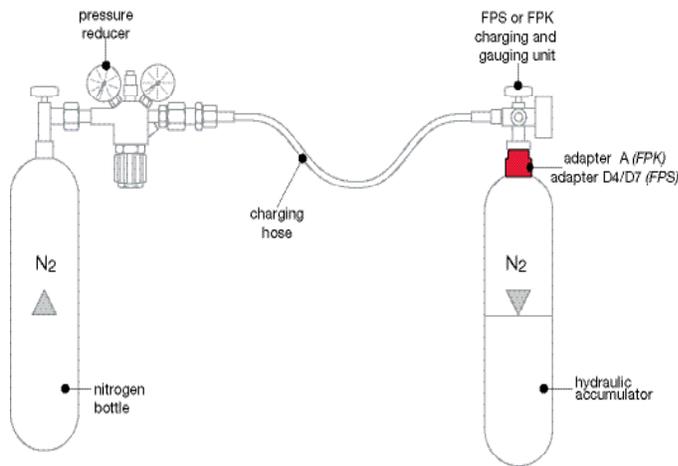


| Part Description | Item | Quantity | Part No. |
|--|-------|----------|-----------------|
| FPO 210 Replacement Kit consists of: | | | |
| Pressure Gauge, 3000 PSI | 1 | 1 | 2701622 |
| T-Handle Lock Chuck | 2 | 1 | 2701615 |
| Charging Manifold, FPO | 3 | 1 | consult factory |
| Tank Valve | 4 | 1 | 2701617 |
| Bleeder Valve | 5 | 1 | consult factory |
| Charging Manifold / Bleeder Valve Assembly | 3 / 5 | | 2089952 |
| Hose Assembly FPO 210 (CGA 580) consists of: | | | |
| High Pressure Coupling (swivel) 1/8" NPT | 6 | 1 | 2701590 |
| Hose, FPO 3000 PSI, 3m | 7 | 1 | 2701621 |
| Nipple Gland, CGA-580 | 8 | 1 | 2701620 |
| Nut, CGA-580 | 9 | 1 | 2701619 |
| Top Repairable Gas Valve Extension | 10 | 1 | 2701741 |

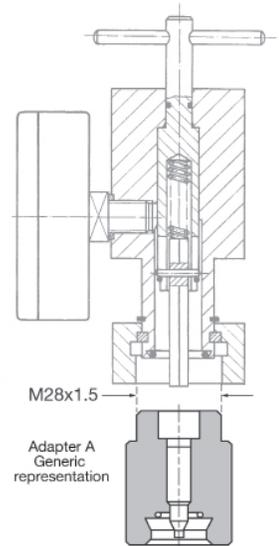
Adapters

Connecting Charging & Gauging Units to 3000 psi Accumulators

FPS Unit with Adapter D4/D7



FPK Unit with Adapter A*



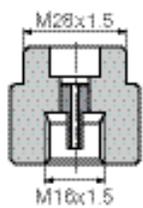
Adapter D4/D7 Part Number 02067646

Used with FPS Charging & Gauging Unit

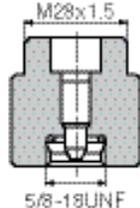
*A Adapters

Used with FPK Charging & Gauging Unit

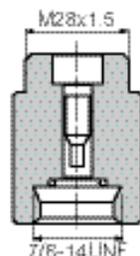
A1
PN 00361619



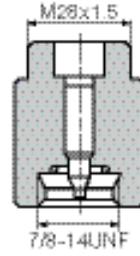
A2
PN 0361606



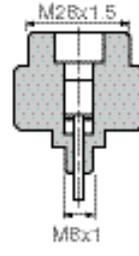
A3 (ADAPTER FPK/SB)
PN 00291533



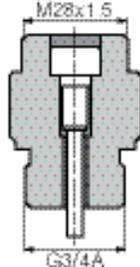
A4
PN 00291536



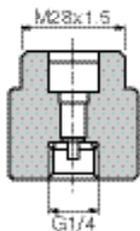
A5
PN 00291531



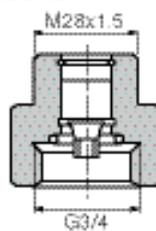
A6
PN 02106819



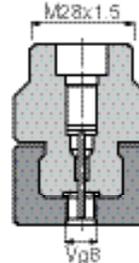
A7
PN 02110629



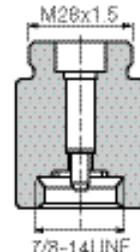
A8
PN 02124524



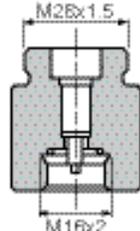
A9
PN 02126638



A10
PN 02126649

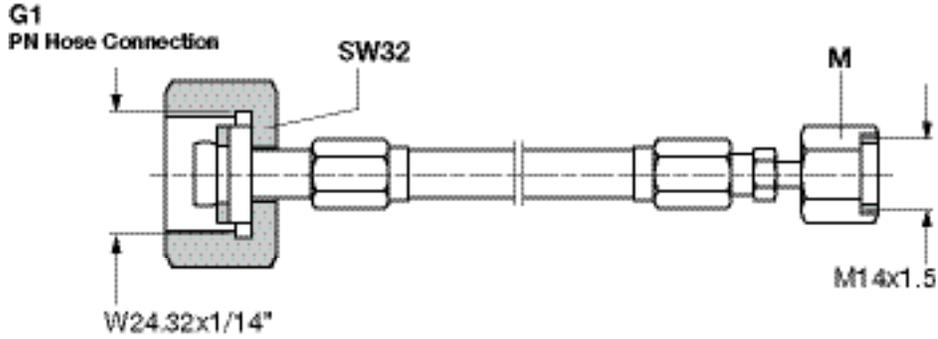


A11
PN 03016210



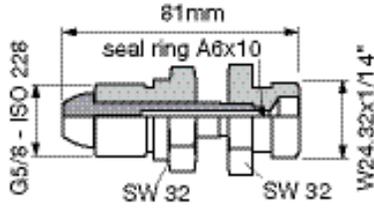
G Adapters - Connects Charging Hose to Gas Bottle

G2 through G11 to be used to adapt from G1 connection on 3000psi hose to N₂ Bottle or regulator

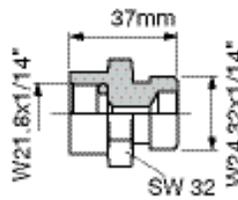


**Included in all charging kits

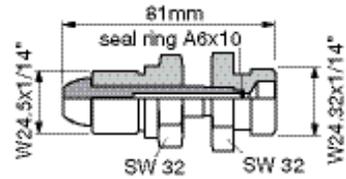
G2
PN 00236376



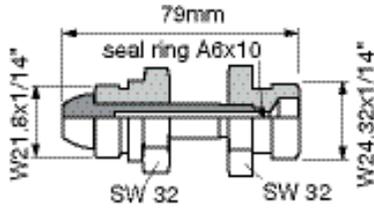
G3
PN 02103421



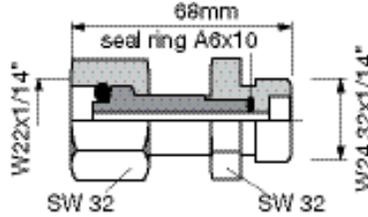
G4
PN 02068737



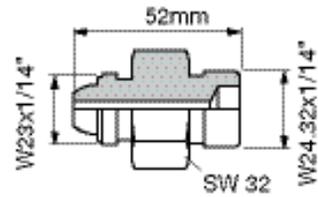
G5
PN 00236373



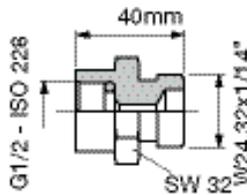
G6
PN 02103423



G7
PN 00236377



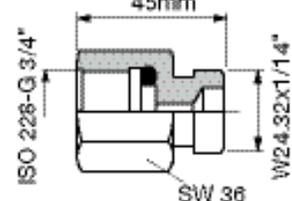
G8
PN 02103425



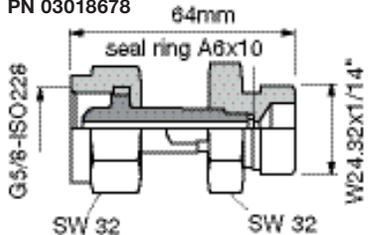
G9
PN 00241168



G10
PN 02103427

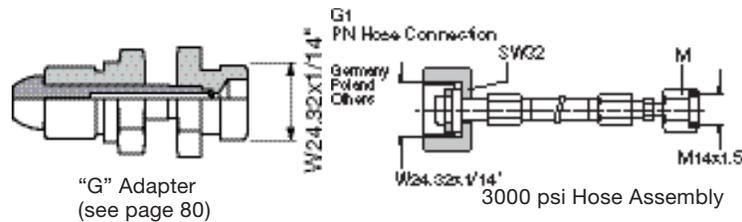
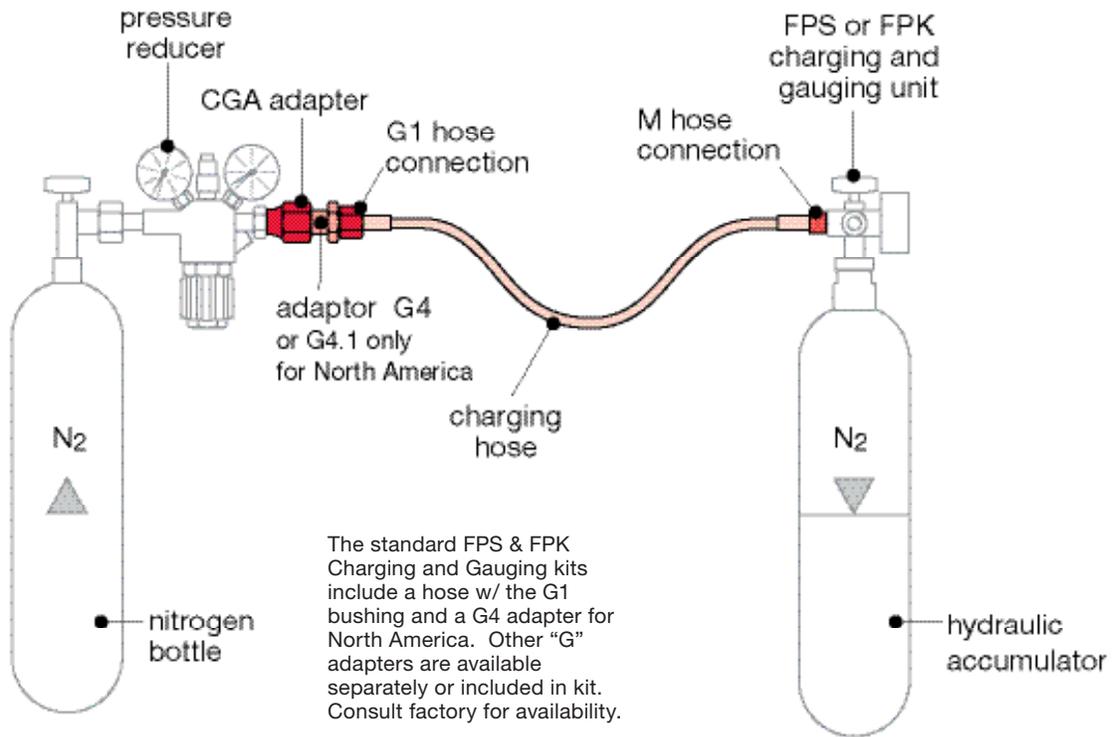


G11
PN 03018678



| G1 | G2 | G3 | G4 | G5 | G6 | G7 | G8 | G9 | G10 | G11 |
|-----------------------------|---|---|-------------------------|-------|-------|-------|----------------------------|--------|---|-------|
| Germany Poland Others | India Argentina Great Britain Vietnam Indonesia Others | France Egypt Mexico Israel Others | Canada USA Brazil | Italy | Japan | Korea | Peru Columbia Others | Taiwan | Russia Trinidad & Tobago Venezuela | China |

Connecting Charging Hose to Gas Bottle

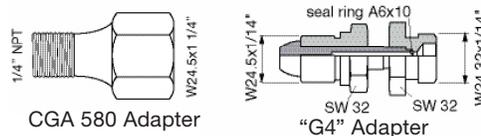


Charging Hoses

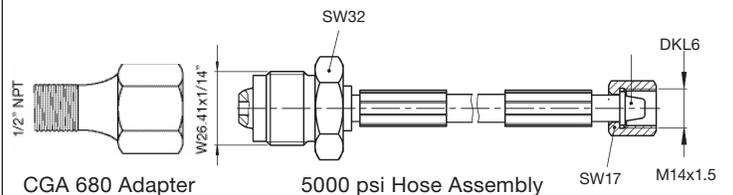
| WP | Length | Part No. |
|----------|--------|----------|
| 3000 psi | 2.5 m | 236514 |
| | 4.0 m | 236515 |
| | 10.0 m | 373405 |
| | 15.0 m | 2115552 |
| | 20.0 m | 2109765 |
| | 28.0 m | 2109574 |

| WP | Length | Part No. |
|----------|--------|----------|
| 5000 psi | 2.5 m | 3053703 |
| | 4.0 m | 3053704 |
| | 10.0 m | 3117720 |

CGA 580 Adapter (for USA only)
 PN 02701355
 From G4 Adapter to Regulator



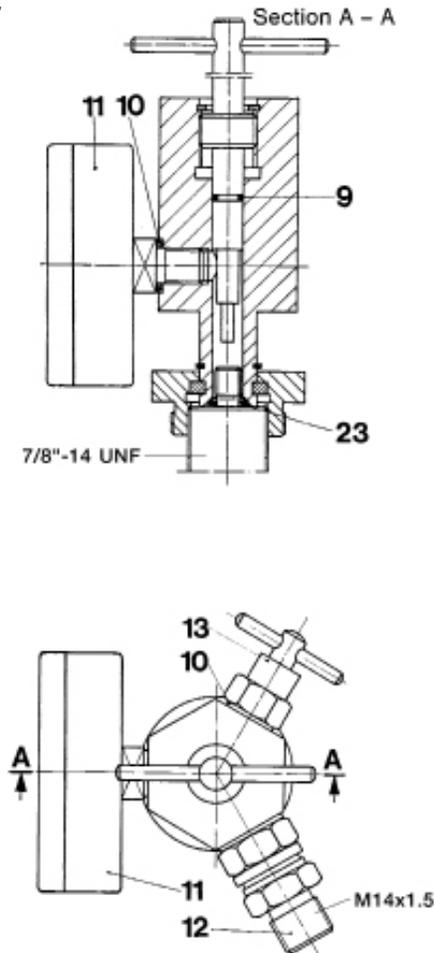
CGA 680 Adapter (for USA only)
 PN 02701356
 From G4.1 Adapter to Regulator



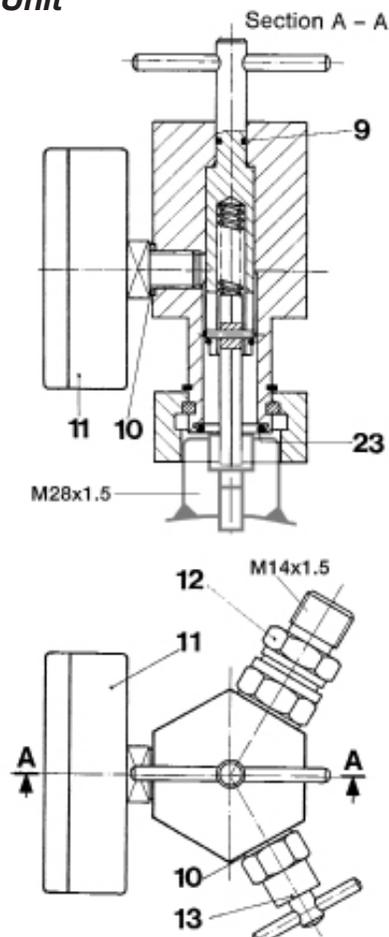
Charging & Gauging Units

Spare Parts

FPS Unit



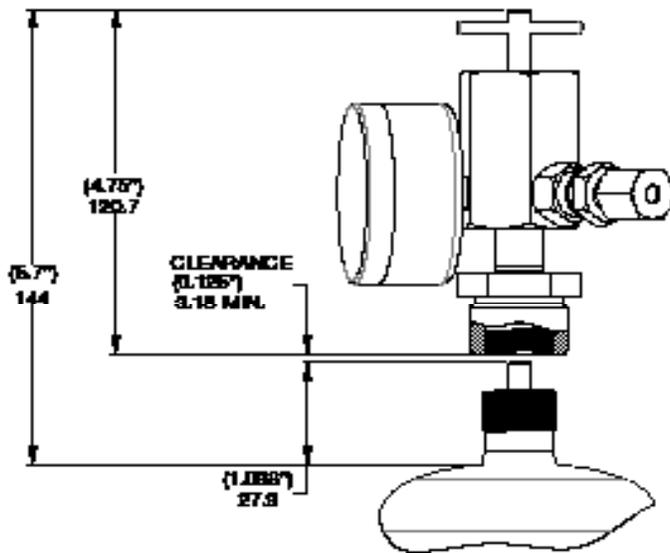
FPK Unit



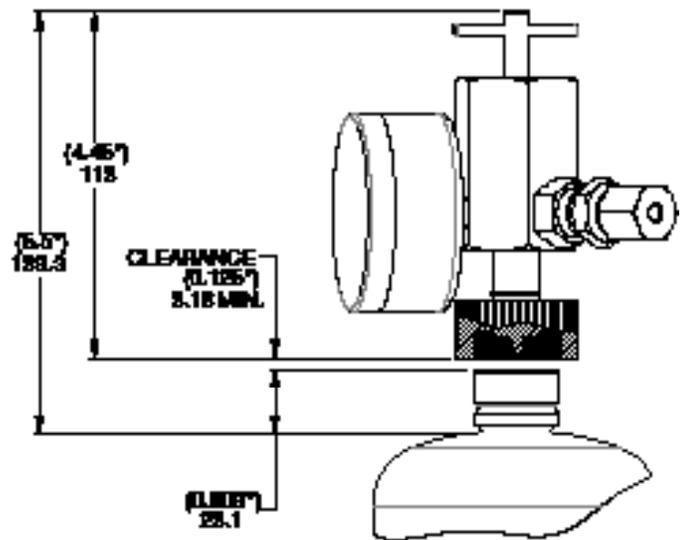
| Item | Description | Part No. |
|------|--|----------|
| 9 | O-Ring | 601032 |
| 10 | Seal-Ring | 601228 |
| 11 | Gauge (<i>select pressure range below</i>) | |
| | 10 (0 to 145 psi) | 606759 |
| | 25 (0 to 350 psi) | 606760 |
| | 100 (0 to 1400 psi) | 606761 |
| | 250 (0 to 3600 psi) | 606762 |
| | 400 (0 to 5800 psi) | 606763 |
| 12 | Check Valve | 610004 |
| 13 | Manual Bleed Valve | 236445 |
| 23 | O-Ring - FPS | 626488 |
| | O-Ring - FPK | 601049 |
| - | 2.5m Hose | 236514 |
| - | 4m Hose | 236515 |
| - | 10m Hose | 373405 |
| - | ADAPTER G4 | 2068737 |
| - | ADAPTER A3 (FPK/SB) | 291533 |
| - | O-Ring - ADAPTER A3 (FPK/SB) | 601964 |

WARNING: Only qualified persons should perform maintenance on any type of accumulator. Complete maintenance instructions are available - Contact HYDAC.

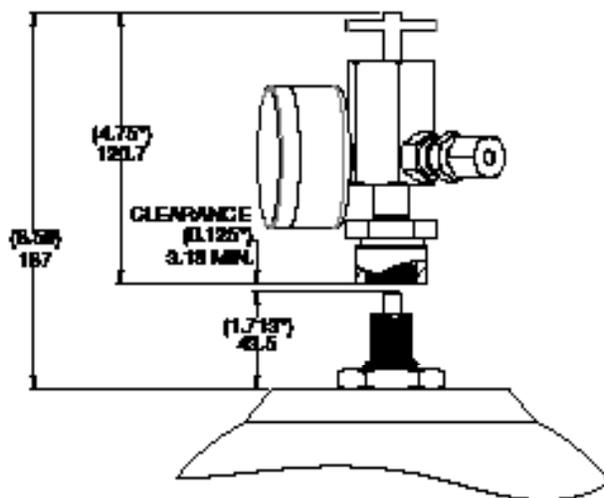
Minimum Clearances for Charging & Gauging Kits Diaphragm (SBO) and Bladder (SB) Accumulators



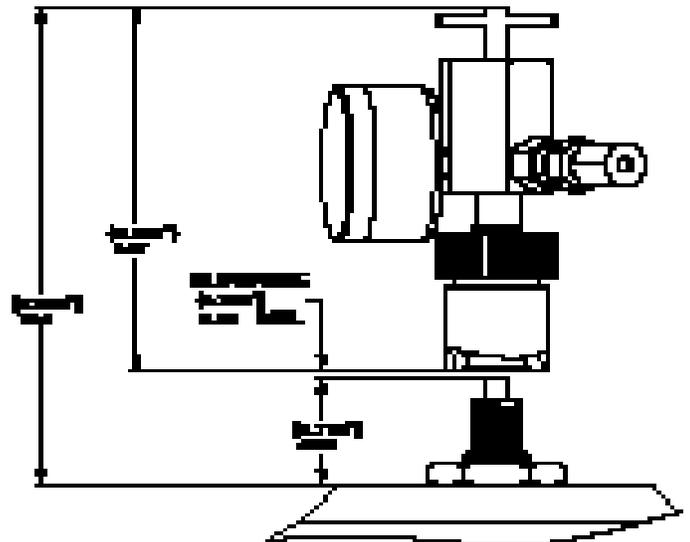
**Diaphragm (SBO), Version 4 Gas Valve
(8VI-ISO 4570) FPS Charging & Gauging Kit**



**Diaphragm (SBO), Version 1 Gas Valve
(M28 x 1.5) FPS Charging & Gauging Kit**



**Bladder (SB), Version 4 Gas Valve
(8VI-ISO 4570) FPS Charging & Gauging Kit**



**Bladder (SB), Version 4 Gas Valve
(8VI-ISO 4570) FPK Charging & Gauging Kit
with A3 Adapter**

Permanent Gauging Block



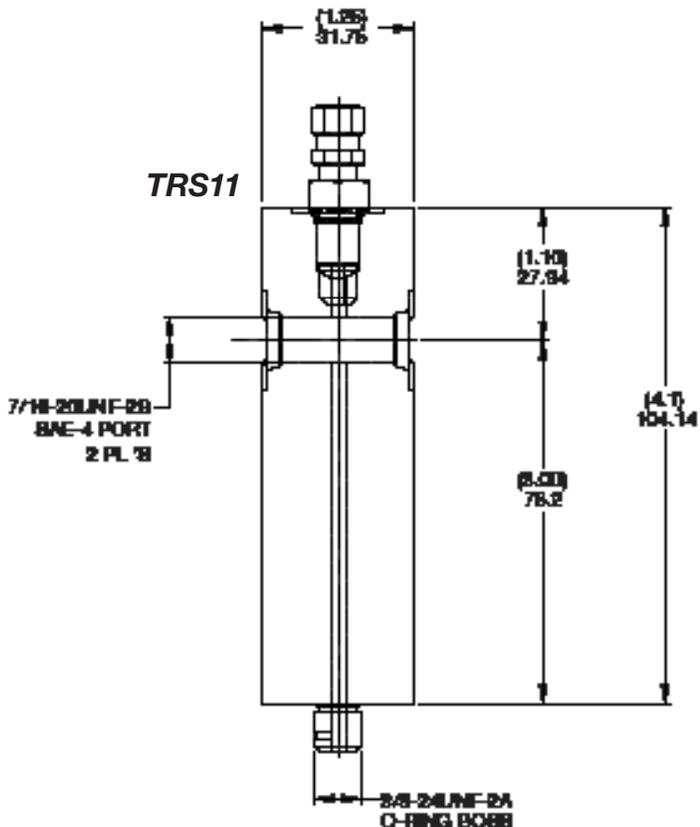
Description

The HYDAC Permanent Gauging Block allows constant monitoring of gas pressure while a system is in operation. This helps users monitor pressure loss, and determine when charging is needed. They are designed to fit bladder, diaphragm, and piston style accumulators with HYDAC Gas Valve Version 4. Use of these blocks facilitates trouble shooting and simplifies maintenance by eliminating the need to attach a charging and gauging unit to monitor pressure. Charging of the accumulator is accomplished by simply attaching a HYDAC charging kit to the gas valve on top of the Permanent Gauging Block in exactly the same manner as attaching to an accumulator without the Permanent Gauging Block.

Special Tools Required

- Charging and Gauging Unit
- Gas Valve Core Tool
- 50 mm Open End Wrench (for bottom repairable accumulator)
- 32 mm Open End Wrench (for top repairable accumulator)
- Torque Wrench(es)

Note: The gas valve core (for Version 4) or the M8 SHCS (for Version 1) gas valves must be removed to allow unrestricted gas flow from the accumulator into the Permanent Gauge Block. Read all instructions thoroughly before beginning any type of service or repair work Refer to additional information contained in the "Operating and Installation Instructions for HYDAC Accumulators."



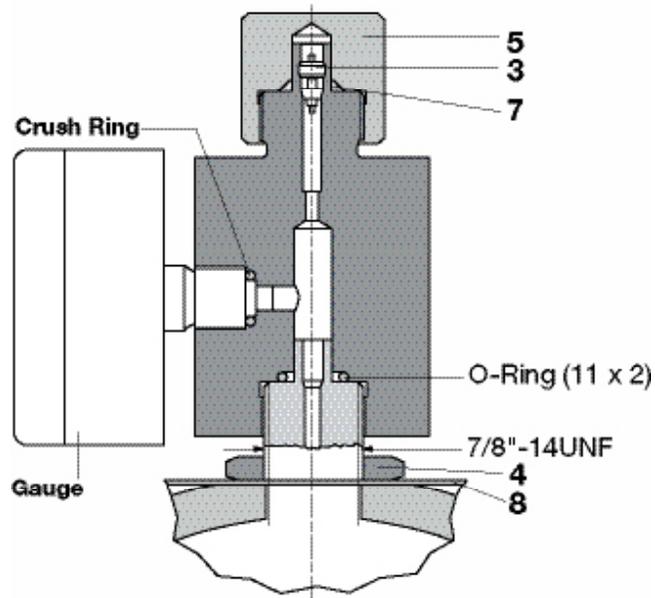
Model Code

| | | | |
|-----------------------------|--|-------------|------------|
| | PERM GAUGING BLOCK | VER4 | 850 |
| Series | Perm Gauging Block | | |
| Gas Valve Type | VER1 = HYDAC gas valve version 1 (M28x1.5) VER4 = HYDAC gas valve version 4 (7/8"-14UNF) | | |
| Accumulator Type | (omit) = Bottom Repairable (standard) TR = Top Repairable TR S11 = Top Repairable (Oil & Gas / Offshore) | | |
| Gauge Pressure Range | 850 = 0 to 850 psi 1450 = 0 to 1450 psi 2300 = 0 to 2300 psi 3600 = 0 to 3600 psi 5800 = 0 to 5800 psi | | |

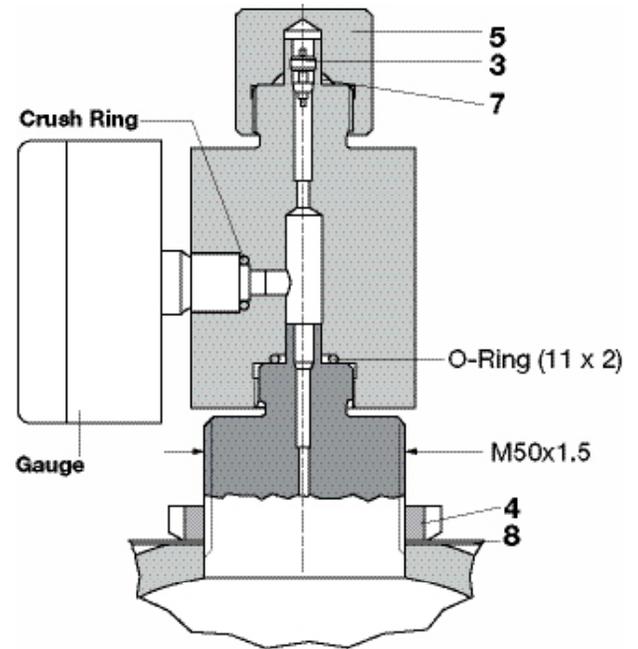
Installation Drawings

Permanent Gauging Blocks for HYDAC Gas Valve Version 4

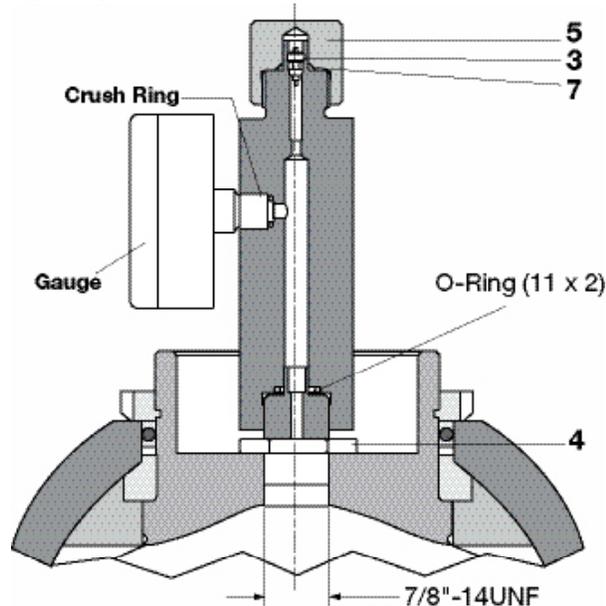
Bottom Repairable Bladder



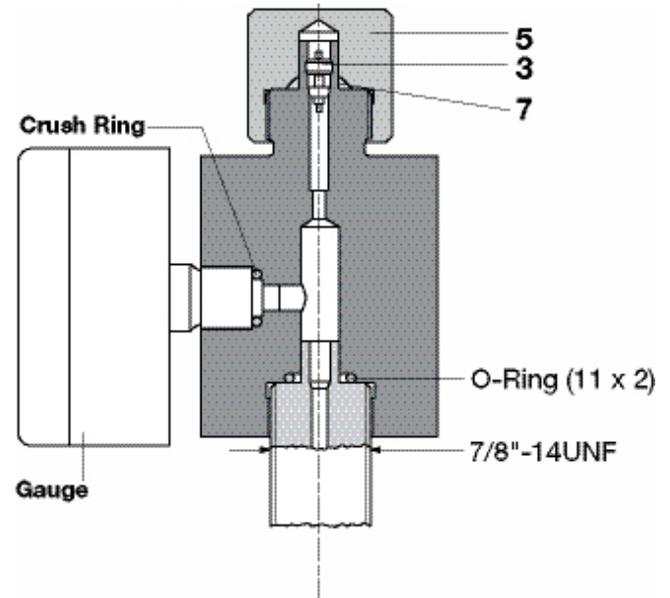
Bottom Repairable Bladder with M50 Gas Valve



Top Repairable Bladder



Piston & Diaphragm



Parts Legend

| | |
|---|------------------|
| 3 | Gas Valve Core |
| 4 | Lock Nut |
| 5 | Valve Seal Cap |
| 7 | O-ring (7.5 x 2) |
| 8 | Name Plate |

Mounting Components

HYDAC mounting components are used to mount all types of hydro-pneumatic accumulators safely and simply, regardless of the mounting position. Our wide range includes suitable mounting components for every type of static hydro-pneumatic accumulator.

Function

Mounting components are used primarily for the following:

- to fix the accumulator into its position
- to carry the weight of the accumulator
- to counteract the forces exerted by the hydraulic lines

Types

HYDAC offers three styles of clamps:

- HyRac
- Regular Duty (HS)
- Heavy Duty (HSS)

Additionally, for larger accumulators, HYDAC offers:

- Base Brackets (KBK & KMS)
- Mounting Sets (SEB)

Refer to the illustrations and photos to the right.

Construction

They are constructed out of zinc-plated steel with a stainless steel strap (depending on style), utilizing a rubber insert to absorb vibration.

The HyRac and regular duty have a one piece construction with center adjustment.

Conversely, the heavy duty clamps have a two piece construction. This allows for easy installation and removal while improving the strength to weight ratio.

HYDAC also offers base brackets for larger accumulators for proper support and isolation from system vibrations. The brackets incorporate a rubber support ring for this reason.

All mounting components can be easily bolted to your system.

Application guides are provided on the following pages to easily match the appropriate mounting components with HYDAC accumulators.

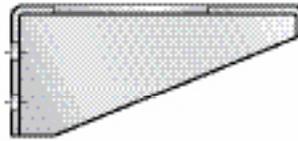
HS - Regular Duty Clamp



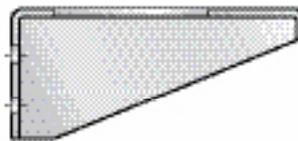
HSS - Heavy Duty Clamp



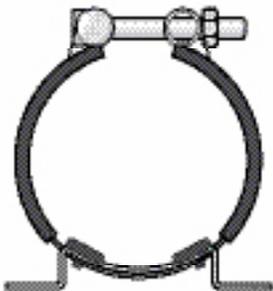
KBK - Base Bracket



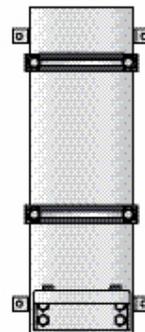
KMS - Base Bracket for Threaded Diaphragm



HyRac Clamp



SEB - Complete Mounting Sets



Mounting Component Selection Guide

These are the mounting solutions that HYDAC recommends for each accumulator

Bladder Accumulators and Nitrogen Bottles

SB 330... & SN 330...

| Accumulator Size (capacity) | Clamp Type (quantity) | Part Number | Base Bracket Type | Part Number |
|-----------------------------|-----------------------|-------------|-------------------|-------------|
| 1 (0.25 gal) | HyRac 110-118 ST (1) | 3627484 | None | |
| 4 to 6 (1 to 1.5 gal) | HS 167 (1) | 2110642 | KBK 167/G | 2107989 |
| 10 to 20 (2.5 to 5 gal) | HSS 222/229 (1) | 235224 | KBK 222/G | 2100651 |
| 32 to 54 (10 to 15 gal) | HSS 222/229 (2) | 235224 | KBK 222/G | 2100651 |

SB 600...

| Accumulator Size (capacity) | Clamp Type (quantity) | Part Number | Base Bracket Type | Part Number |
|-----------------------------|-----------------------|-------------|-------------------|-------------|
| 1 (0.25 gal) | HyRac 121-129 ST (1) | 3627515 | None | |
| 4 to 6 (1 to 1.5 gal) | HyRac 167-175 ST (1) | 3627520 | KBK 167/G | 2107989 |
| 10 to 20 (2.5 to 5 gal) | HSS 242 (1) | 362712 | KBK 222/G | 2100651 |
| 32 to 54 (10 to 15 gal) | HSS 242 (2) | 362712 | KBK 222/G | 2100651 |

Piston Accumulators

SK 350...

| Accumulator Piston Size ⁽¹⁾ | Clamp Type (quantity) | Part Number | Base Bracket Type | Part Number |
|--|-----------------------|-------------|-------------------|-------------|
| 15 (150 mm) | HyRac 176-185 ST | 3627522 | KBK 219 | 238042 |
| 18 (180 mm) | HSS 219 (2) | 237401 | KBK 219 | 238042 |
| 25 (250 mm) | HSS 310 (2) | 237389 | KBK 310 | 238043 |
| 35 (355 mm) | consult factory | | consult factory | |

1) Example: SK350-20/2112S-210FCF-VE-18 (see page 35 for details)

SK 280...

| Piston Size ⁽¹⁾ | Clamp Type (quantity) | Part Number |
|----------------------------|-------------------------------|-------------|
| 05 (50 mm) | HRGKSM 0 R 58-61/62 ST (2) | 3018442 |
| 06 (60 mm) | HRGKSM 0 R 70-73/73 ST (2) | 3018444 |
| 08 (80 mm) | HRGKSM 0 R 92-95/96 ST (2) | 444995 |
| 10 (100 mm) | HRGKSM 0 R 119-127/124 ST (2) | 444505 |

1) Example: SK280-1/3218U-280 AAD VB 05 (see page 34 for details)

SK 210...15H

| Piston Size ⁽¹⁾ | Clamp Type (quantity) | Clamp Part Number | Qty Per Accumulator |
|----------------------------|---------------------------|-------------------|---------------------|
| 10 (100 mm) | HRGKSM 1 R 119-127/124 ST | 444505 | 2 |
| 15 (150 mm) | HyRac 167-175 ST | 3627520 | 2 |

1) Example: SK210-20/3218S-210ACM-KCH-15H (see page 32 for details)

Diaphragm Accumulators

SBO...E... (Welded type)

| Accumulator Type | Clamp Type ⁽²⁾ | Part Number |
|------------------|---------------------------|-------------|
| SBO 250-0.075 E | HyRac 62-65 ST | 3627423 |
| SBO 210-0.16 E | HyRac 73-76 ST | 3627424 |
| SBO 210-0.32 E | HyRac 89-92 ST | 3627475 |
| SBO 210-0.5 E | HyRac 100-105 ST | 3627480 |
| SBO 330-0.6 E | HyRac 110-118 ST | 3627484 |
| SBO 210-0.75 E | HyRac 121-129 ST | 3627515 |
| SBO 200-1 E | HyRac 133-142 ST | 3627516 |
| SBO 140-1.4 E | HyRac 143-151 ST | 3627517 |
| SBO 210-1.4 E | HyRac 143-151 ST | 3627517 |
| SBO 100-2 E | HyRac 160-167 ST | 3627520 |
| SBO 210-2 E | HS 167 | 2110642 |
| SBO 210-2.8 E | HS 167 | 2110642 |
| SBO 250-3.5 E | HS 167 | 2110642 |
| SBO 330-0.75 E | HyRac 121-129 ST | 3627515 |
| SBO 330-1.4 E | HyRac 143-151 ST | 3627517 |
| SBO 330-2.0 E | HyRac 167-175 ST | 3627520 |
| SBO 330-3.5 E | HyRac 167-175 ST | 3627520 |

2) Only one clamp needed for all accumulators listed.

SBO...A6... (Threaded type)

| Accumulator Type | Clamp Type | Part Number |
|------------------|------------------|-------------|
| SBO 350-0.25 A6 | HyRac 110-118 ST | 3627484 |
| SBO 500-0.25 A6 | HyRac 110-118 ST | 3627484 |
| SBO 250-0.6 A6 | HyRac 133-142 ST | 3627516 |
| SBO 330-0.6 A6 | HyRac 133-142 ST | 3627516 |
| SBO 600-0.25 A6 | HyRac 143-151 ST | 3627517 |
| SBO 750-0.25 A6 | HyRac 143-151 ST | 3627517 |

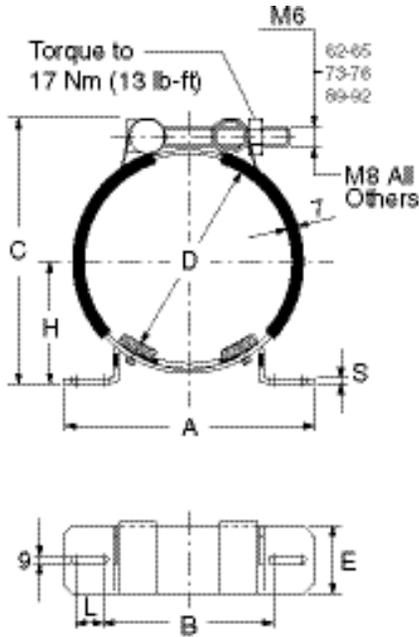
| Accumulator Type | Base Bracket Type | Part Number |
|------------------|-------------------|-------------|
| SBO 210-1.3 A6 | KMS 200 | 359931 |
| SBO 400-1.3 A6 | KMS 210 | 358989 |
| SBO 180-2 A6 | KMS 220 | 359922 |
| SBO 250-2 A6 | KMS 220 | 359922 |

Note: Either one clamp or one Base Bracket is needed for each accumulator listed.

Dimensions

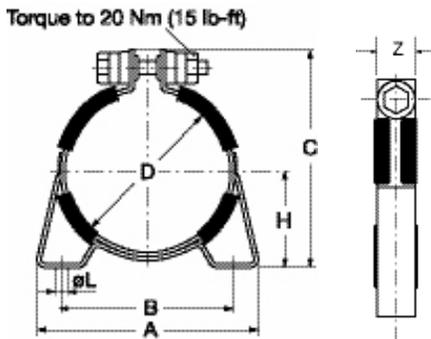
Use the Selection Guide on page 71 to select the appropriate components.

HyRac - Stainless Steel Strap with swivel-bolt adjustment



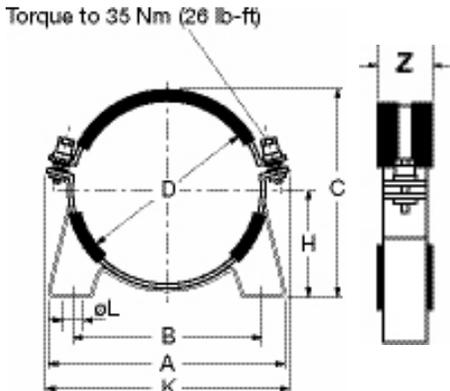
| Clamp Model | A | B | C | D (range) | E | H | L | S | Weight kg (lbs) |
|------------------|-------------|-------------|--------------|--------------------|-----------|------------------------|------------|-----------|-----------------|
| HyRac 62-65 ST | 120 4.72 | 85 3.34 | 90 3.54 | 62-65 2.4-2.6 | 40 1.6 | 39-40.5 1.5-1.6 | 6 0.24 | 3 0.12 | 0.16 (0.35) |
| HyRac 73-76 ST | 120 4.72 | 85 3.34 | 101 3.98 | 73-76 2.9-3.0 | 40 1.6 | 49.5-46 1.9-1.8 | 6 0.24 | 3 0.12 | 0.16 (0.35) |
| HyRac 89-92 ST | 120 4.72 | 85 3.34 | 116 4.57 | 89-92 3.5-3.6 | 40 1.6 | 51.5-53 2.0-2.1 | 6 0.24 | 3 0.12 | 0.17 (0.37) |
| HyRac 100-105 ST | 156 6.14 | 100 3.94 | 135 5.31 | 100-105 3.9-4.1 | 60 2.4 | 59-62 2.3-2.4 | 18 0.71 | 3 0.12 | 0.40 (0.88) |
| HyRac 106-114 ST | 156 6.14 | 100 3.94 | 143 5.63 | 106-114 4.2-4.5 | 60 2.4 | 62.5-66 2.5-2.6 | 18 0.71 | 3 0.12 | 0.41 (0.9) |
| HyRac 110-118 ST | 156 6.14 | 100 3.94 | 156 6.14 | 110-118 4.3-4.6 | 60 2.4 | 72.5-77 2.8-3.0 | 18 0.71 | 3 0.12 | 0.42 (0.93) |
| HyRac 121-129 ST | 156 6.14 | 100 3.91 | 165 6.50 | 121-129 4.8-5.1 | 60 2.4 | 75.5-80 3.0-3.1 | 18 0.71 | 3 0.12 | 0.43 (0.95) |
| HyRac 133-142 ST | 156 6.14 | 100 3.91 | 174 6.85 | 133-142 5.2-5.6 | 60 2.4 | 76.5-82 3.0-3.2 | 18 0.71 | 3 0.12 | 0.44 (0.97) |
| HyRac 143-151 ST | 156 6.14 | 100 3.91 | 182 7.17 | 143-151 5.6-5.9 | 60 2.4 | 83-86.5 3.3-3.4 | 18 0.71 | 3 0.12 | 0.45 (0.99) |
| HyRac 152-159 ST | 156 6.14 | 100 3.91 | 191 7.52 | 152-159 6.0-6.3 | 60 2.4 | 87-91 3.4-3.6 | 18 0.71 | 3 0.12 | 0.46 (1.01) |
| HyRac 160-167 ST | 236 9.29 | 152 5.98 | 197 7.76 | 160-167 6.3-6.6 | 60 2.4 | 89-93 3.5-3.7 | 32 1.3 | 4 0.16 | 0.7 (1.54) |
| HyRac 167-175 ST | 236 9.29 | 152 5.98 | 207 8.15 | 167-175 6.6-6.9 | 60 2.4 | 92.5-96.5 3.6-3.8 | 32 1.3 | 4 0.16 | 0.72 (1.59) |
| HyRac 202-210 ST | 236 9.29 | 152 5.98 | 245 9.65 | 202-210 7.9-8.3 | 60 2.4 | 116-120 4.6-4.7 | 32 1.3 | 4 0.16 | 0.76 (1.68) |
| HyRac 209-217 ST | 236 9.29 | 152 5.98 | 255 10.04 | 209-217 8.2-8.5 | 60 2.4 | 122.5-126.5 4.8-5.0 | 32 1.3 | 4 0.16 | 0.77 (1.70) |

HS - Regular Duty Clamp, with single center adjustment



| Clamp Model | D | D (range) | A | B | C (ref.) | H | ØL | Z | Weight kg (lbs) |
|-------------|-------------|----------------------|-------------|-------------|-------------|--------------|-----------|------------|-----------------|
| HS 167 | 167 6.57 | 164-170 6.46-6.69 | 185 7.28 | 153 6.02 | 211 8.31 | 92.5 3.64 | 9 0.35 | 30 1.18 | 0.9 2.0 |

HSS - Heavy Duty Clamp with two-piece construction

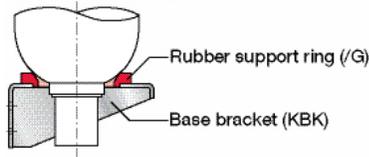


| Clamp Model | D | D (range) | A | B | C (ref.) | H | K | ØL | Z | Weight kg (lbs) |
|-------------|--------------|------------------------|--------------|--------------|--------------|-------------|--------------|------------|------------|-----------------|
| HSS 219 | 219 8.62 | 216-222 8.50-8.74 | 268 10.55 | 216 8.50 | 240 9.45 | 123 4.84 | 285 11.22 | 15 0.59 | 40 1.57 | 1.7 3.8 |
| HSS 222/229 | 226 8.90 | 220-231 8.66-9.10 | 270 10.63 | 216 8.50 | 244 9.61 | 123 4.84 | 295 11.61 | 15 0.59 | 40 1.57 | 1.7 3.8 |
| HSS 242 | 242 9.53 | 231-242 9.10-9.53 | 268 10.55 | 216 8.50 | 265 10.43 | 136 5.35 | 305 12.01 | 15 0.59 | 40 1.57 | 1.7 3.8 |
| HSS 286 | 286 11.26 | 283-289 11.14-11.38 | 332 13.07 | 280 11.02 | 314 12.36 | 163 6.42 | 355 13.98 | 15 0.59 | 40 1.57 | 2.1 4.6 |
| HSS 310 | 310 12.20 | 307-313 12.09-12.32 | 332 13.07 | 280 11.02 | 333 13.11 | 170 6.69 | 380 14.96 | 15 0.59 | 40 1.57 | 2.1 4.6 |

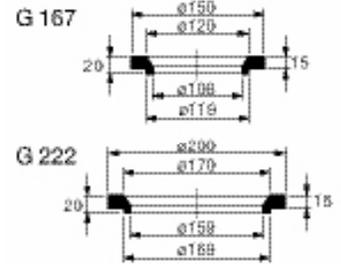
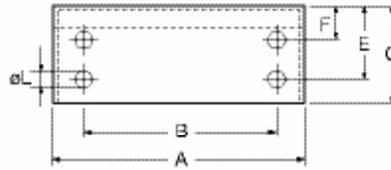
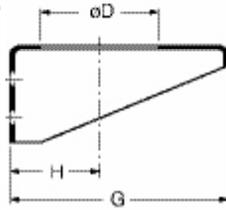
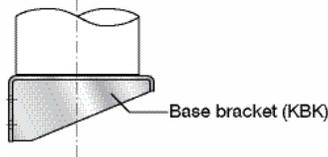
Dimensions are in mm with inches shown below.
Dimensions are for general information only,
All critical dimensions should be verified.

KBK - Base Bracket for Bladder and Piston Accumulators

Bladder Accumulator



Piston Accumulator



Base Bracket with Rubber Support Ring

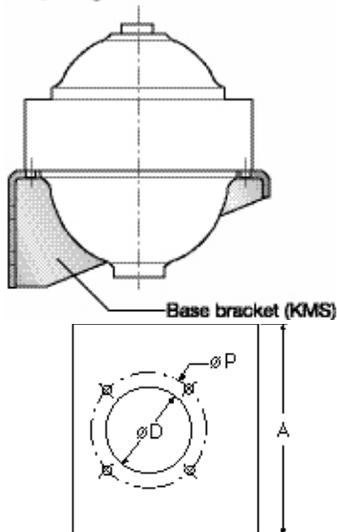
| Model | A | B | C | ϕD | E | F | G | H | ϕL | Weight kg.(lbs) | Rubber Support Ring |
|-----------|--------------|-------------|-------------|-------------|------------|------------|-------------|-------------|------------|-----------------|---------------------|
| KBK 167/G | 260 10.24 | 200 7.87 | 100 3.94 | 120 4.72 | 75 2.95 | 35 1.38 | 225 8.86 | 92 3.62 | 14 0.55 | 2.6 (5.7) | G 167 |
| KBK 222/G | 260 10.24 | 200 7.87 | 100 3.94 | 170 6.69 | 75 2.95 | 35 1.38 | 225 8.86 | 123 4.84 | 14 0.55 | 2.4 (5.3) | G 222 |

Base Brackets without Rubber Support Ring

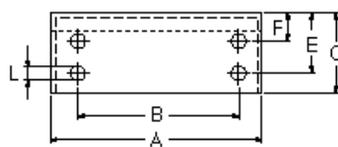
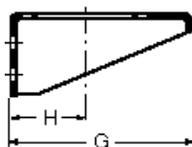
| | | | | | | | | | | | |
|---------|--------------|-------------|-------------|-------------|-------------|------------|--------------|-------------|------------|----------------|------|
| KBK 126 | 175 6.89 | 100 3.94 | 60 2.36 | 65 2.56 | 36 1.42 | N/A | 150 5.91 | 77 3.03 | 14 0.55 | 1.1 (2.43) | None |
| KBK 219 | 270 10.63 | 180 7.09 | 100 3.94 | 135 5.31 | 80 3.15 | 40 1.57 | 250 9.84 | 123 4.84 | 14 0.55 | 6.5 (14.4) | None |
| KBK 310 | 330 12.99 | 220 8.66 | 200 7.87 | 190 7.48 | 140 5.51 | 60 2.36 | 340 13.39 | 170 6.69 | 14 0.55 | 18.3 (40.4) | None |

KMS - Base Bracket for Threaded Diaphragm Accumulators

Diaphragm Accumulator

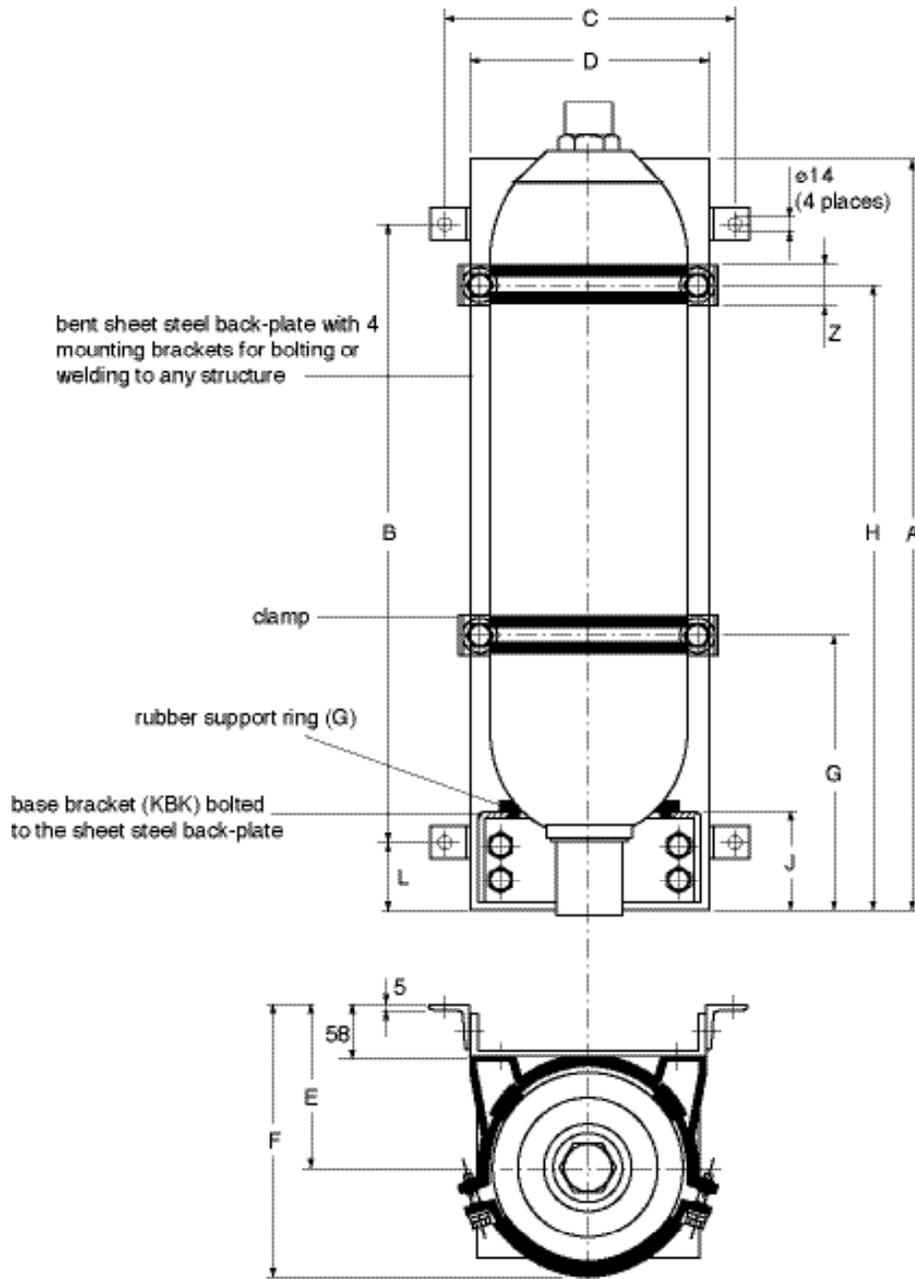


| Base Bracket Model | A | B | C | ϕD | ϕP | E | F | G | H | ϕL | Weight kg.(lbs) |
|--------------------|--------------|-------------|-------------|--------------|--------------|-------------|------------|--------------|-------------|------------|-----------------|
| KMS 200 | 270 10.63 | 180 7.09 | 100 3.94 | 148 5.83 | 160 6.30 | 80 3.15 | 40 1.57 | 250 9.84 | 123 4.84 | 14 0.55 | 6.5 (14.4) |
| KMS 210 | 260 10.24 | 200 7.87 | 100 3.94 | 170 6.69 | 180 7.09 | 75 2.95 | 35 1.38 | 225 8.86 | 123 4.84 | 14 0.55 | 2.4 (5.3) |
| KMS 220 | 260 10.24 | 200 7.87 | 100 3.94 | 170 6.69 | 188 7.40 | 75 2.95 | 35 1.38 | 225 8.86 | 123 4.84 | 14 0.55 | 2.4 (5.3) |
| KMS 250 | 260 10.24 | 200 7.87 | 100 3.94 | 192 7.56 | 204 8.03 | 75 2.95 | 35 1.38 | 225 8.86 | 123 4.84 | 14 0.55 | 2.4 (5.3) |
| KMS 280 | 330 12.99 | 220 8.66 | 200 7.87 | 215 8.46 | 230 9.06 | 140 5.51 | 60 2.36 | 340 13.39 | 170 6.69 | 22 0.87 | 18.3 (40.4) |
| | | 36 1.42 | 200 7.87 | 220 8.66 | 235 9.25 | 140 5.51 | 60 2.36 | 340 13.39 | 170 6.69 | 22 0.87 | 18.3 (40.4) |
| | | 36 1.42 | 200 7.87 | 245 9.65 | 265 10.43 | 140 5.51 | 60 2.36 | 340 13.39 | 170 6.69 | 22 0.87 | 18.3 (40.4) |
| | | 36 1.42 | 200 7.87 | 290 11.42 | 305 12.01 | 140 5.51 | 60 2.36 | 340 13.39 | 170 6.69 | 22 0.87 | 18.3 (40.4) |



Dimensions are in mm with inches shown below.
Dimensions are for general information only,
All critical dimensions should be verified.

SEB - Mounting Sets for SB 330 Bladder Accumulators



| Set Type | Accum. size in gallons | Base Bracket | | Clamp | | Dimensions in mm (inches shown below) | | | | | | | | | |
|----------|------------------------|--------------|------|-------------|------|---------------------------------------|---------------|--------------|--------------|-------------|--------------|--------------|---------------|------------|-------------|
| | | Type | Qty. | Type | Qty. | A | B | C | D | E | F (Ref) | G | H | L | J |
| SEB 4 | 1 | KBK 167/G | 1 | HS 167 | 1 | 410 16.14 | 320 12.60 | 330 12.99 | 270 10.63 | 152 5.98 | 265 10.43 | - | 270 10.63 | 45 1.77 | 95 3.74 |
| SEB 10 | 2.5 | KBK 222/G | 1 | HSS 222/229 | 1 | 570 22.44 | 420 16.54 | 330 12.99 | 270 10.63 | 180 7.09 | 317 12.48 | - | 330 12.99 | 75 2.95 | 111 4.37 |
| SEB 20 | 5 | KBK 222/G | 1 | HSS 222/229 | 1 | 570 22.44 | 420 16.54 | 330 12.99 | 270 10.63 | 180 7.09 | 317 12.48 | - | 500 19.69 | 75 2.95 | 111 4.37 |
| SEB 32 | 10 | KBK 222/G | 1 | HSS 222/229 | 2 | 1340 52.76 | 1190 46.85 | 330 12.99 | 270 10.63 | 180 7.09 | 317 12.48 | 500 19.69 | 1160 45.67 | 75 2.95 | 111 4.37 |
| SEB 54 | 15 | KBK 222/G | 1 | HSS 222/229 | 2 | 1340 52.76 | 1190 46.85 | 330 12.99 | 270 10.63 | 180 7.09 | 317 12.48 | 500 19.69 | 1160 45.67 | 75 2.95 | 111 4.37 |

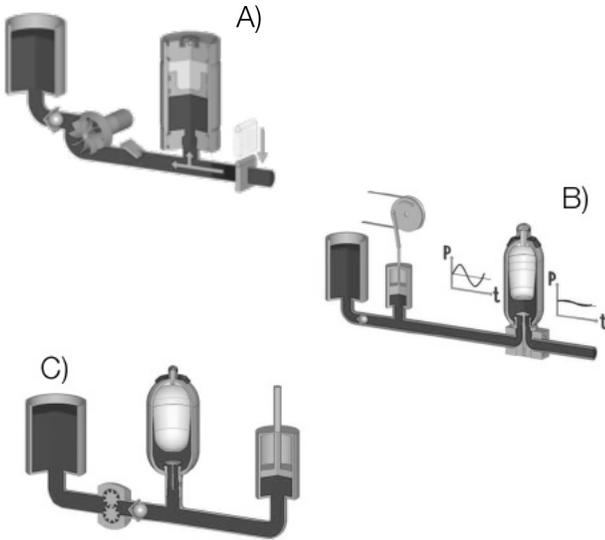
Typical Applications

There are three common applications for Accumulators:

- (A) Shock Absorption
- (B) Pulsation Dampening
- (C) Energy Storage

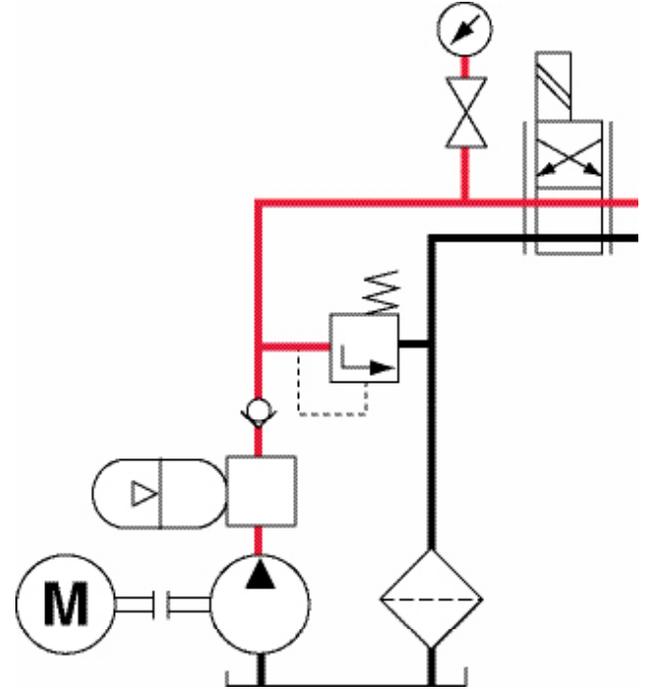
The pages and sizing forms that follow can be used as a guide.

These forms are available online at www.hydacusa.com



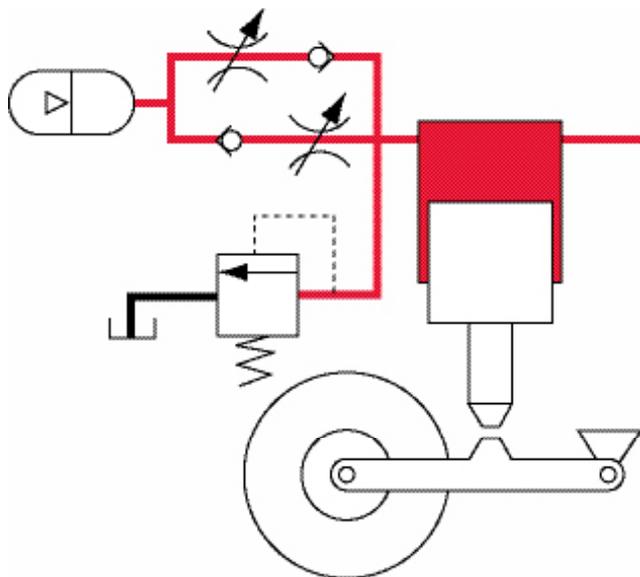
Pulsation Dampeners for Displacement Pumps

The non uniformity of displacement pumps creates pulsations in the fluid which can be dampened with a pulsation dampener.



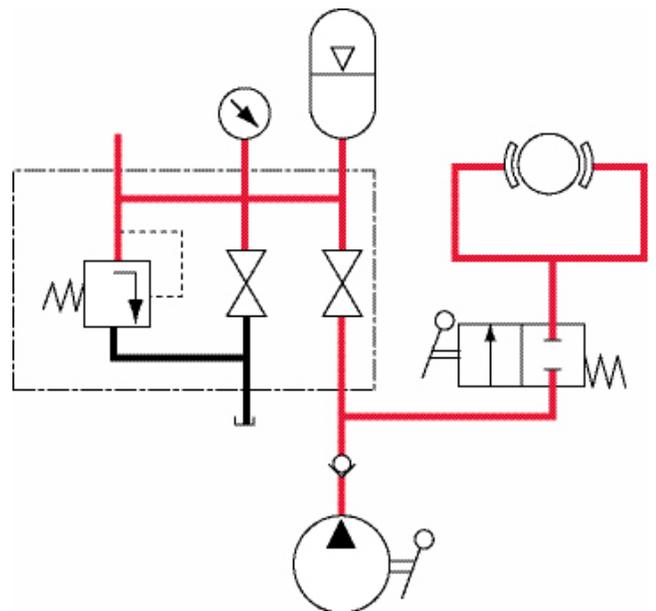
Shock Absorption - Spring Element

The compressibility of the gas in the accumulator works like a spring. By throttling the flow in and out of the accumulator, the spring stiffness can be adjusted.



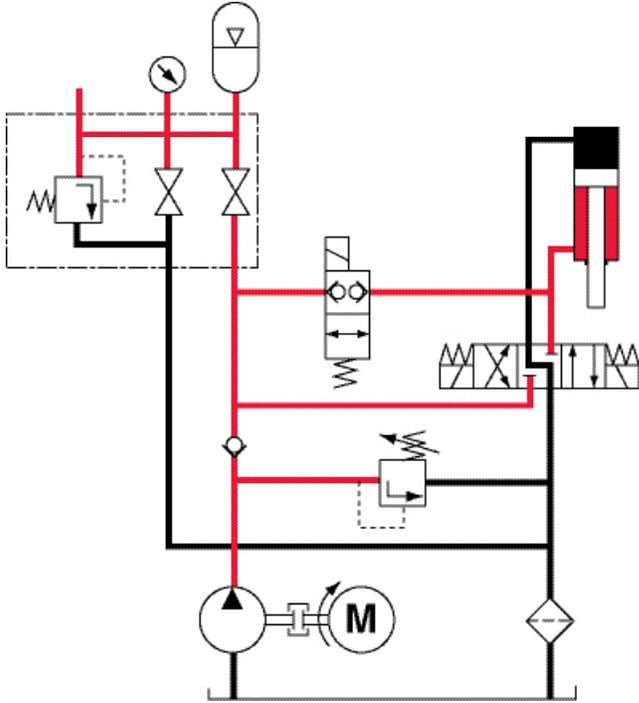
Energy Storage - Emergency Brakes

Emergency actuation, the accumulator provides the stored hydraulic energy to apply the brake should the main power source fail.



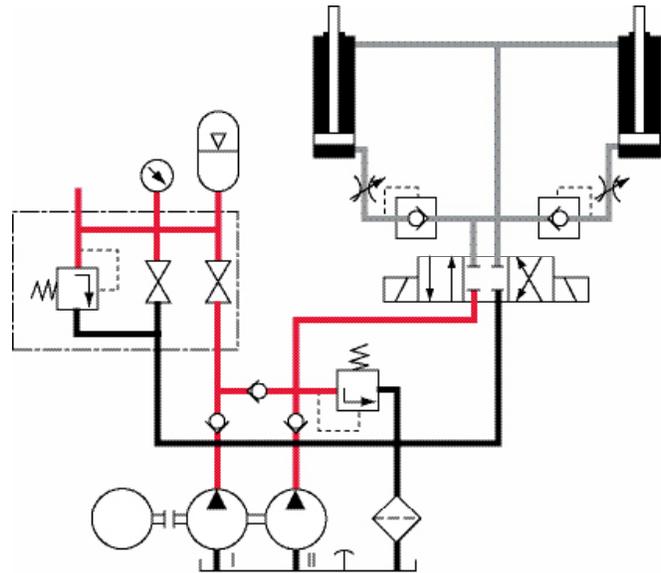
Energy Storage - Emergency Operation of a Hydraulic Cylinder

In an emergency condition, e.g., during a power failure, the accumulator automatically drives the system (cylinder) to a fail safe position.



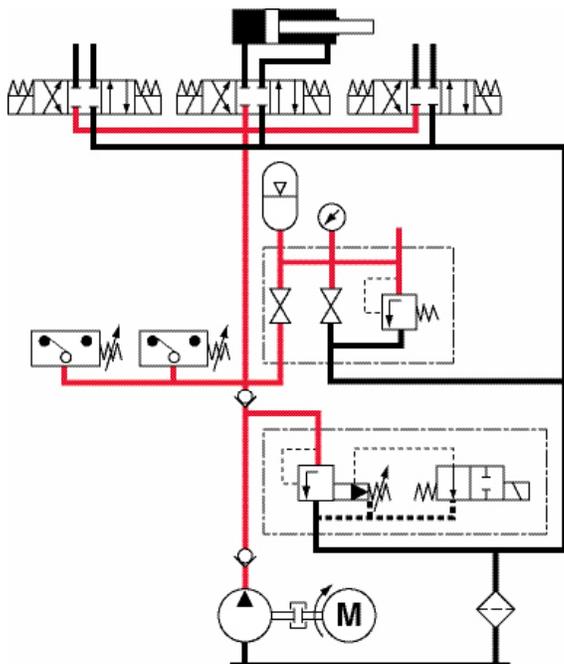
Energy Storage and Shortening of Cycle Time

The hydraulic energy stored during a pause in the work cycle is used to supplement the pump and shorten the stroke time.



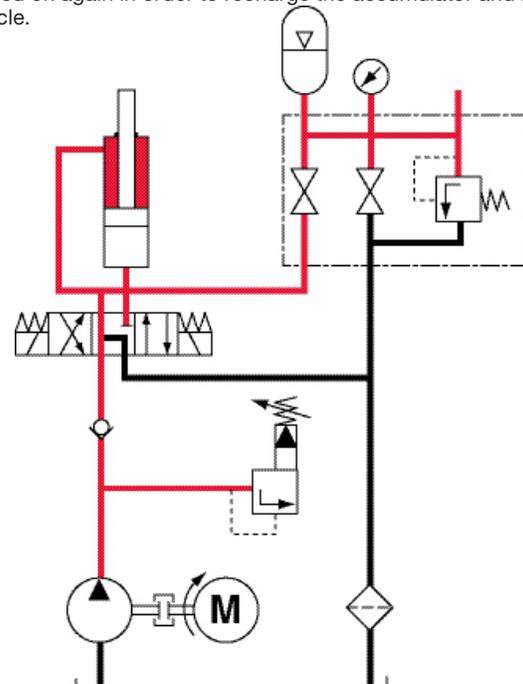
Energy Storage in an Injection Molding Machine

The hydraulic energy stored during a pause in the work cycle, is used to supplement the pump and increase the power output for peak requirements. Through design, the electrical power requirement is reduced.



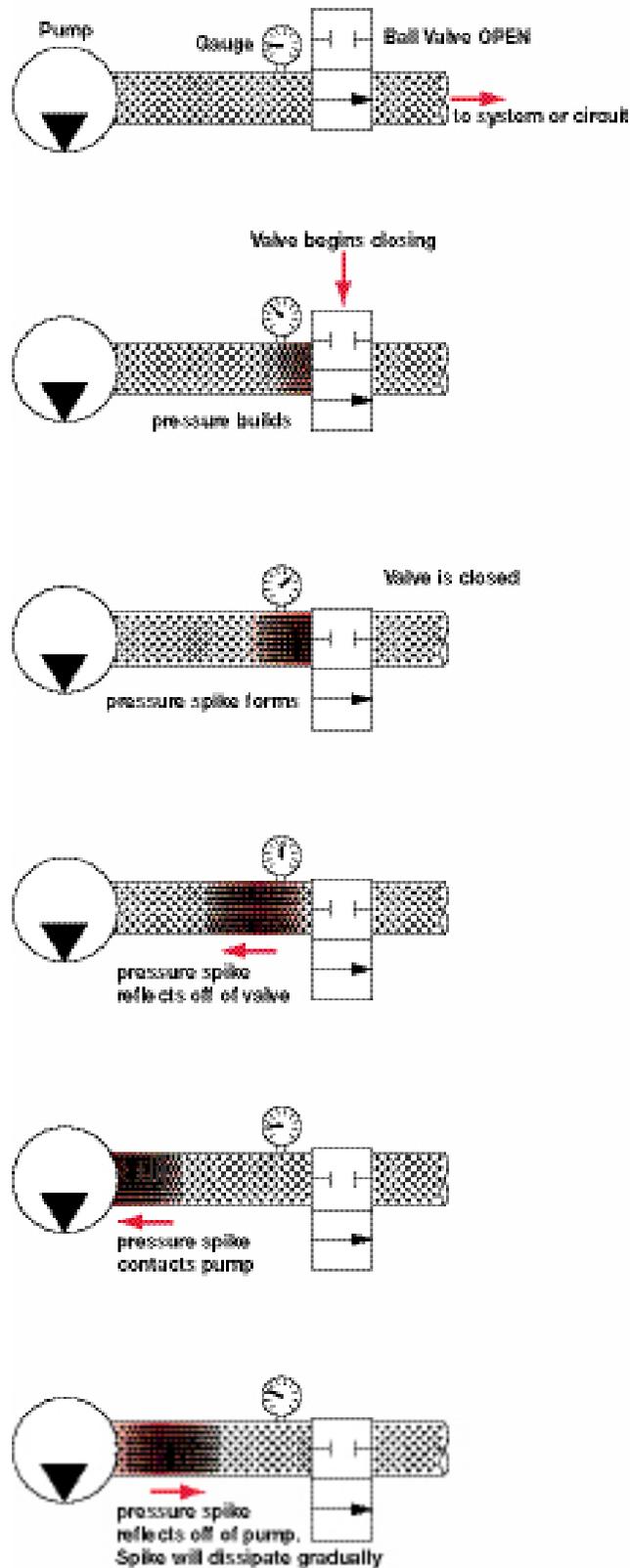
Energy Storage - Leakage Oil Compensation

The accumulator is charged to a predetermined pressure; the pump is switched off. Now the accumulator makes up for the leakage of the system until the minimum pressure is reached and the pump is switched on again in order to recharge the accumulator and repeat the cycle.

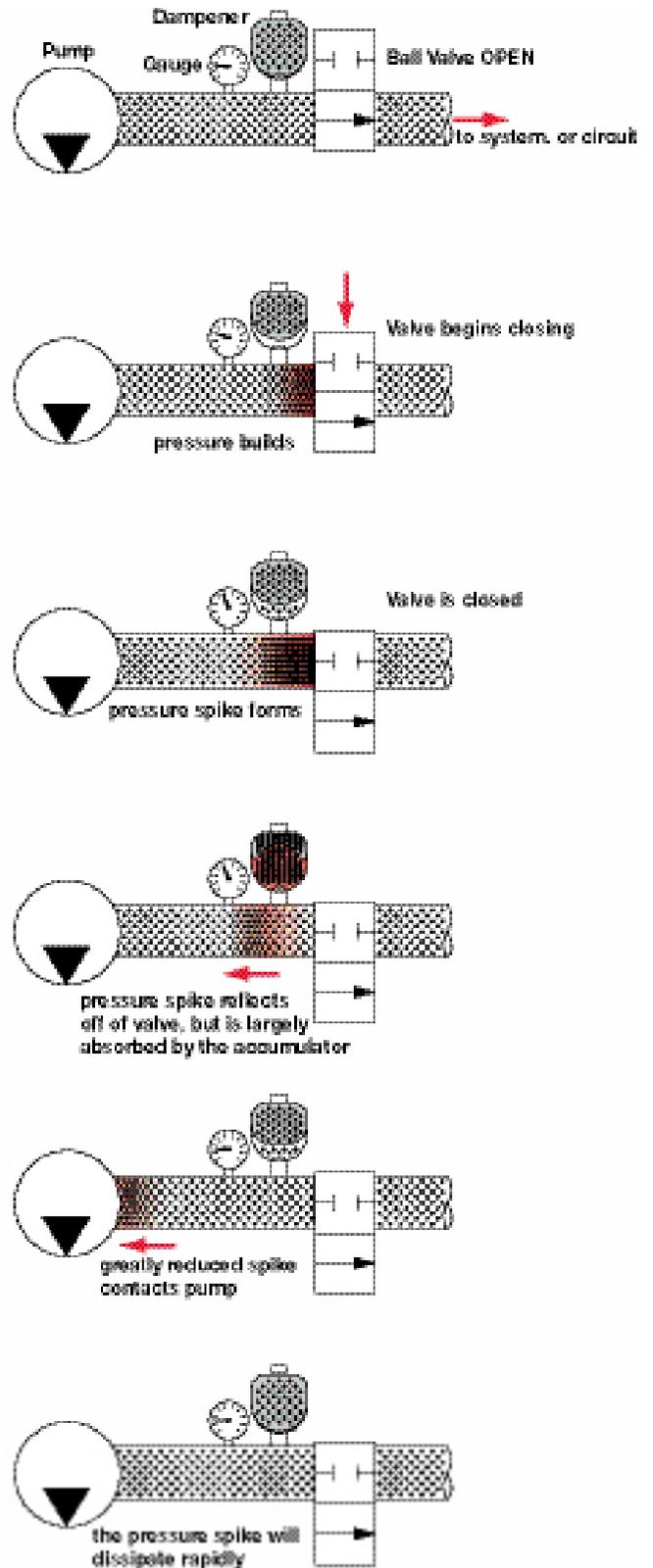


Graphic Example of a Pressure Spike

Without Accumulator



With Accumulator



For assistance in sizing pulsation dampeners, shock absorbers, and suction stabilizers, please contact the HYDAC Accumulator Group.

Basic Accumulator Terms

p_0 = gas precharge pressure

p_1 = minimum working pressure

p_2 = maximum working pressure

V_0 = effective gas volume of the accumulator
(this an internal net volume)

V_1 = gas volume at p_1

V_2 = gas volume at p_2

T_0 = temperature at precharging

T_1 = minimum ambient temperature

T_2 = maximum ambient temperature

$p_{0@T_0}$ = gas precharge pressure at precharge ambient temperature

$p_{0@T_1}$ = gas precharge pressure at minimum ambient temperature

$p_{0@T_2}$ = gas precharge pressure at maximum ambient temperature

Accumulator Operational Sequence Steps

Bladder

1 The bladder accumulator is precharged with nitrogen to system design specified precharge pressure prior to accumulator installation.

- The expanded, pressurized bladder causes the fluid port poppet to close, preventing the bladder from extruding into the fluid port.
- No fluid is inside the accumulator at this step until the accumulator is installed in the hydraulic system and the system pressure becomes greater than the precharge pressure, P_0 .
- Once the system working fluid pressure becomes greater than P_0 , the poppet will open and the bladder will begin to compress.

2 The accumulator is installed in the hydraulic system and the fluid is increased to the maximum working system pressure, P_2 . This is often called "charging" the accumulator.

- At P_2 , the gas volume in the bladder accumulator is V_2 .
- At this step the maximum amount of fluid possible for a particular system pressure range is inside the accumulator and the fluid is compressing the bladder and nitrogen gas to smallest gas volume.

3 During operation, the minimum working system pressure, P_1 , is reached and the gas volume is now V_1 . This is often called "discharging" the accumulator.

- V_1 is the maximum gas volume during hydraulic system operation and correlates to the smallest possible fluid volume inside the accumulator during system operation.
- The amount of fluid that is expelled, or supplied, to the hydraulic system is ΔV , where $\Delta V = V_1 - V_2$
- A small amount of fluid should remain inside the accumulator at P_1 , in order to prevent the bladder from rubbing or chaffing against the fluid port poppet which will cause bladder damage.
- Therefore the precharge pressure, P_0 , should always be slightly lower than the minimum working system pressure, P_1 .

Diaphragm

1 The diaphragm accumulator is precharged with nitrogen to system design specified precharge pressure prior to accumulator installation.

- The expanded, pressurized diaphragm causes the integral poppet in the diaphragm to close over the fluid port opening, preventing the diaphragm from extruding into the fluid port.
- No fluid is inside the accumulator at this step until the accumulator is installed in the hydraulic system and the system pressure becomes greater than the precharge pressure, P_0 .
- Once the system working fluid pressure becomes greater than P_0 , the diaphragm with an integrated poppet, will begin to compress and cause the integral poppet to move away from the fluid port opening.

2 The accumulator is installed in the hydraulic system and the fluid is increased to the maximum working system pressure, P_2 . This is often called "charging" the accumulator.

- At P_2 , the gas volume in the diaphragm accumulator is V_2 .
- At this step the maximum amount of fluid possible for a particular system pressure range is inside the accumulator and the fluid is compressing the diaphragm and nitrogen gas to smallest gas volume.

3 During operation, the minimum working system pressure, P_1 , is reached and the gas volume is now V_1 . This is often called "discharging" the accumulator.

- P_1 is the maximum gas volume during hydraulic system operation and correlates to the smallest possible fluid volume inside the accumulator during system operation.
- The amount of fluid that is expelled, or supplied, to the hydraulic system is ΔV , where $\Delta V = V_1 - V_2$
- A small amount of fluid should remain inside the accumulator at P_1 , in order to prevent the diaphragm from rubbing or chaffing against the shell which will cause diaphragm damage.
- Therefore the precharge pressure, P_0 , should always be slightly lower than the minimum working system pressure, P_1 .

Piston

1 The Piston accumulator is precharged with nitrogen to system design specified precharge pressure prior to accumulator installation.

- The pressurized nitrogen will cause the piston to move completely over to the fluid port side.
- No fluid is inside the accumulator at this step until the accumulator is installed in the hydraulic system and the system pressure becomes greater than the precharge pressure, P_0 .
- Once the system working fluid pressure becomes greater than P_0 , the fluid pressure will begin to compress the gas by overcoming the precharge pressure, and cause piston to move away from the fluid port opening.

2 The accumulator is installed in the hydraulic system and the fluid is increased to the maximum working system pressure, P_2 . This is often called "charging" the accumulator.

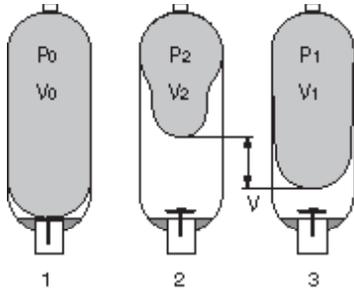
- At P_2 , the gas volume in the piston accumulator is V_2 .
- At this step the maximum amount of fluid possible for a particular system pressure range is inside the accumulator and the fluid is exerting force on the piston and compressing nitrogen gas to the smallest gas volume.

3 During operation, the minimum working system pressure, P_1 , is reached and the gas volume is now V_1 . This is often called "discharging" the accumulator.

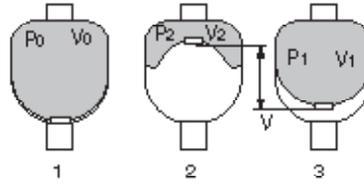
- P_1 is the maximum gas volume during hydraulic system operation and correlates to the smallest possible fluid volume inside the accumulator during system operation.
- The amount of fluid that is expelled, or supplied, to the hydraulic system is ΔV , where $\Delta V = V_1 - V_2$
- A small amount of fluid should remain inside the accumulator at P_1 , in order to prevent the piston from impacting the end cap for any system cycle.
- Therefore the precharge pressure, P_0 , should always be slightly lower than the minimum working system pressure, P_1 .

Accumulators

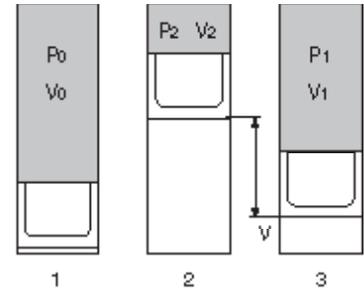
Bladder



Diaphragm



Piston



Precharge Recommendations

For energy storage:

$$p_0 = 0.9 \times p_1$$

p_1 = minimum working pressure

For shock absorption:

$$p_0 = (0.6 \text{ to } 0.9) \times p_m$$

p_m = median working pressure at free flow

For pulsation damping:

$$p_0 = (0.6 \text{ to } 0.8) \times p_m$$

p_m = median working pressure

Temperature Effect

Due to the Ideal Gas Laws, the precharge pressure of an accumulator is affected by the ambient temperature of the accumulator's operating environment. Given the constant volume of an accumulator shell when the temperature rises, the gas pressure will increase and conversely as the temperature goes lower, the gas pressure decreases. This temperature effect on precharge gas pressure will affect operation of the accumulator in a hydraulic fluid system. Therefore it is critical to consider the precharge pressure at T_2 , maximum ambient temperature, and T_1 , the minimum ambient temperature, when sizing an accumulator to ensure that the accumulator is sized large enough to operate properly over the entire operating ambient temperature range. The formula below describes the ambient temperature and precharge pressure relationship to any temperature. Refer to the sizing example on page 97 to see how the formula is applied in the sizing calculation process.

Fahrenheit

$$p_{0@T_0} = p_{0@T_x} \times \left(\frac{T_0 + 460}{T_x + 460} \right)$$

T_0 = precharge temperature in °F

T_x = actual ambient operating temperature in °F, where T_x is $T_1 \leq T_x \leq T_2$

$p_{0@T_0}$ = gas precharge pressure at precharge ambient temperature

$p_{0@T_x}$ = gas precharge pressure at maximum ambient operating temperature, where T_x is $T_1 \leq T_x \leq T_2$

Celsius

$$p_{0@T_0} = p_{0@T_x} \times \left(\frac{T_0 + 273}{T_x + 273} \right)$$

T_0 = precharge temperature in °C

T_x = maximum operating temperature in °C, where T_x is $T_1 \leq T_x \leq T_2$

$p_{0@T_0}$ = gas precharge pressure at precharge ambient temperature

$p_{0@T_x}$ = gas precharge pressure at maximum ambient operating temperature, where T_x is $T_1 \leq T_x \leq T_2$

Gas Behavior

The compression and expansion processes taking place in hydro-pneumatic accumulators are governed by the general gas laws. The following applies for ideal gases:

$$p_0 \times V_0^n = p_1 \times V_1^n = p_2 \times V_2^n$$

where the time related change of state is represented by the polytropic exponent "n". For slow gas expansion and compression processes which occur almost isothermally, the polytropic exponent can be assumed to be n = 1.

For rapid processes, the adiabatic change of state can be calculated using n = k = 1.4 (for nitrogen as a diatomic gas)

For pressures above 3000 psi the real gas behavior deviates considerably from the ideal one, which reduces the effective fluid volume ΔV. In such cases a correction is made which takes into account an adiabatic exponent (k) even greater than 1.4; n = k > 1.4. By using the following formulas, the required gas volume V₀ can be calculated for various calculations.

For low pressure applications of less than 150 psi absolute gas pressures must always be used in the formulas.

Calculation Formulas

polytropic:

$$V_0 = \frac{\Delta V}{\left(\frac{p_0}{p_1}\right)^{1/n} - \left(\frac{p_0}{p_2}\right)^{1/n}}$$

isothermal:
(n=1)

$$V_0 = \frac{\Delta V}{\left(\frac{p_0}{p_1}\right) - \left(\frac{p_0}{p_2}\right)}$$

adiabatic:
(n = k = 1.4)

$$V_0 = \frac{\Delta V}{\left(\frac{p_0}{p_1}\right)^{0.714} - \left(\frac{p_0}{p_2}\right)^{0.714}}$$

Correction factors to take into account the real gas behavior¹²

For isothermal change of condition:

$$V_{0,real} = C_i \times V_{0,ideal} \text{ or } \Delta V_{0,real} = \frac{\Delta V_{ideal}}{C_i}$$

for adiabatic change of condition:

$$V_{0,real} = C_a \times V_{0,ideal} \text{ or } \Delta V_{real} = \frac{\Delta V_{0,ideal}}{C_a}$$

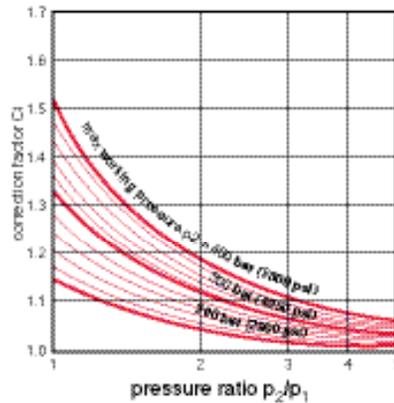
The C_i and C_a can be determined from the following Correction factor graphs.

Calculate the ratio of Max/Min pressure, p₂/p₁.

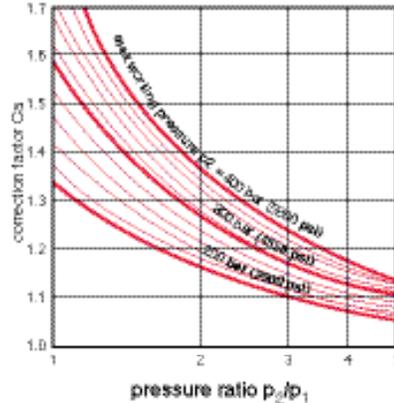
On the graph find the intersection of p₂/p₁ and the maximum working system pressure p₂, which is shown as a curve on the graphs for either an isothermal or adiabatic change of condition.

Project the intersection point to the Y-axis to determine the appropriate correction factor, C_i or C_a.

Correction factor C_i Isothermal change of condition



Correction factor C_a Adiabatic change of condition



Sizing Example

An additional operation is to be added to an existing machine which requires 1.35 gallons of oil in 2.5 seconds for optimal operation. The system must operate between 3000 psi and 1500 psi. The operating ambient temperature range is 75 to 120°F. The machine's hydraulic fluid pump is sufficient to fully recharge the accumulator in the 8 second machine dwell time. Total machine cycle time = 10.5s.

Given:

maximum system working pressure
p₂ = 3000 psi

minimum system working pressure
p₁ = 1500 psi

required fluid volume of the system
ΔV = 1.35 gallons

maximum ambient operating temperature
T₂ = 120°F

minimum ambient operating temperature
T₁ = 75°F

Determine the following:

Necessary accumulator size, taking into account the real gas behavior by using correction factors

Calculate gas precharge pressure p₀ at 68°F (T₀)

Select accumulator size and type

Solution:

Since it is a rapid process, the change of condition of the gas can be assumed to be adiabatic.

1. Calculation for the required ideal gas volume:

a) gas precharge pressure at T₂:

$$p_0@T_2 = 0.9 \times p_1 = 0.9 \times 1500 = 1350 \text{ psi}$$

b) gas precharge pressure at T₁:

$$p_0@T_1 = p_0@T_2 \times \left(\frac{T_1 + 460}{T_2 + 460}\right)$$

$$p_0@T_1 = 1350 \text{ psi} \times \left(\frac{75 + 460}{120 + 460}\right) = 1245 \text{ psi}$$

c) ideal gas volume:

$$V_{0,ideal} = \frac{\Delta V}{\left(\frac{p_0(T_1)}{p_1}\right)^{0.714} - \left(\frac{p_0(T_2)}{p_2}\right)^{0.714}}$$

$$V_{0,ideal} = \frac{1.35}{\left(\frac{1245}{1500}\right)^{0.714} - \left(\frac{1245}{3000}\right)^{0.714}} = 1.95 \text{ gals.}$$

2. Calculation for the required real gas volume:

a) Determine the adiabatic correction factor, C_a

$$\frac{p_2}{p_1} = \frac{3000 \text{ psi}}{1500 \text{ psi}} = 2$$

From the correction factor for adiabatic change condition graph, using the 3000psi curve:

$$C_a \approx 1.16$$

b) Real gas volume:

$$V_{0,real} = C_a \times V_{0,ideal} = 1.16 \times 3.95 \text{ gal.} = 4.6 \text{ gal.}$$

3. Select actual accumulator size by rounding up to nearest nominal size accumulator listed in catalog:

Selected size: 5 Gallon = 20 Liter

4. Calculation of gas precharge pressure p₀ at 68°F:

$$p_0@T_0 = p_0@T_2 \times \left(\frac{T_0 + 460}{T_2 + 460}\right) = 1350 \text{ psi} \times \left(\frac{68 + 460}{120 + 460}\right) = 1230 \text{ psi}$$

3. Selected: Size 20 (5 gallon)

Recommended Model: SB330-20A1/112S-210C, Precharged to 1230 psi at 68°F

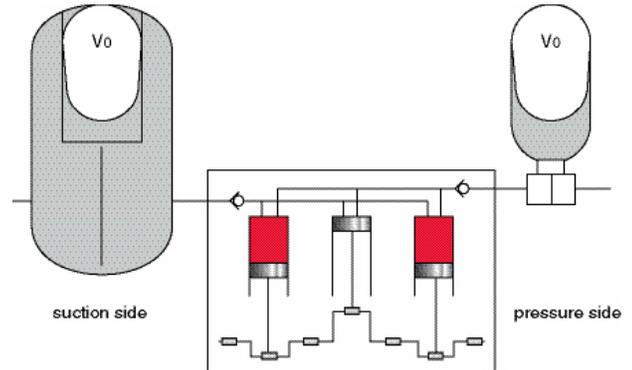
Pulsation Dampeners & Suction Flow Stabilizers

On the suction and pressure side of piston pumps almost identical conditions regarding non-uniformity of the flow rate occur. Therefore the same formulas for determining the effective gas volume are used for calculating the dampener size. That in the end two totally different dampener types are used is due to the different acceleration and pressure ratios on the two sides.

Not only is the gas volume V_0 a decisive factor but also the connection size of the pump has to be taken into account when selecting the pulsation dampener. In order to avoid additional cross section changes which represent reflection points for vibrations, and also to keep pressure drops to a reasonable level, the connection cross section of the dampener has to be the same as the pipe line.

The gas volume V_0 of the dampener is determined with the aid of the formula for adiabatic changes of state.

A simulation of the pressure performance can be carried out by means of a computer program for real pipe line conditions.



Formulas

$$V_0 (l) = \frac{\Delta V}{0.695 \times \left[1 - \left(\frac{100}{100 + x} \right)^{0.714} \right]}$$

$$X (\%) = \left(\frac{100}{1 - \frac{\Delta V}{0.695 \times V_0}} \right)^{1.4} - 100$$

$$\Delta V (l) = k q$$

$$X (\%) = \frac{\hat{p} - p_m}{p_m} \times 100 = \frac{\check{p} - p_m}{p_m} \times 100$$

V_0 = required gas volume

ΔV = fluctuating fluid volume

$q(l)$ = stroke volume per cylinder

$\hat{p} - p_m = \check{p} - p_m$ = amplitude of pressure fluctuations

X = residual pulsations

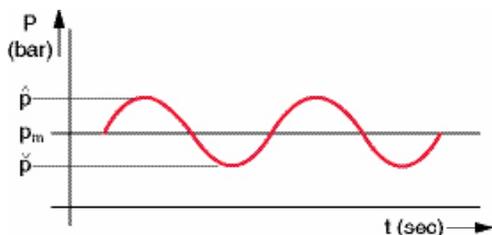
\hat{p} = max. working pressure

\check{p} = min. working pressure

p_m = pump flow rate or pressure in the suction line

= Coefficient of cyclic variation of the pump

z = No. of compressions / effective cylinders per revolution
factors for other types, i.e. gear, axial, and radial piston pumps on request



| Types of Pump | z | k |
|---------------|--------|------------|
| Gear Pump | 7 - 14 | 0.1 - 0.3 |
| Piston Pump | 1 - 11 | 0.01 - 0.6 |
| e.g. | 1 | 0.6 |
| | 2 | 0.25 |
| | 3 | 0.13 |
| | 4 | 0.12 |
| | 5 | 0.05 |
| | 6 | 0.13 |
| | 7 | 0.02 |
| | 9 | 0.01 |

Calculation Example

Parameters:

Single acting 3-plunger pump

piston diameter 2.36 inches (60 mm)

piston stroke 3.15 (80 mm)

rpm 370

flow rate 64.44 gpm (244 l/min.)

operating temp. 68°F (20°C)

operating pressure

pressure side 3625 psi (250 bar)

suction side 58 psi (4 bar)

Required:

- Suction flow stabilizer for a residual pulsation of $\pm 2.5\%$
- Pulsation dampener for a residual pulsation of 0.5%

Solution:

a) Determination of required suction flow stabilizer

$$V_0 (in^3) = \frac{0.13 \cdot \left(\frac{2.36^2 \times \pi}{4} \right) \cdot 3.15}{0.695 \left[1 - \left(\frac{100}{100 + 2.5} \right)^{0.714} \right]}$$

Selected: SB 330-4 (see table on page 13)

b) Determination of required pulsation dampener

$$V_0 (in^3) = \frac{0.13 \cdot \left(\frac{2.36^2 \times \pi}{4} \right) \cdot 3.15}{0.695 \left[1 - \left(\frac{100}{100 + 0.5} \right)^{0.714} \right]}$$

Selected: SB 330 P-20 (see table on page 47)

For assistance in sizing pulsation dampeners, shock absorbers, and suction stabilizers, please contact the HYDAC Accumulator Group at 1-877-GO HYDAC.

Energy Storage Form

| | | |
|---------------|--------------|-----------|
| Name _____ | Title _____ | |
| Company _____ | E-mail _____ | |
| Address _____ | | |
| Phone _____ | State _____ | Zip _____ |
| Phone _____ | Fax _____ | |

Please attach any special requirements or drawings to the fax or e-mail.

Operation of Pump

| | | |
|--|---------------------------|------|
| <input type="checkbox"/> Continuous Operation | | |
| <input type="checkbox"/> Emergency Operation | | |
| Maximum Operating Pressure | (P2) <input type="text"/> | PSI |
| Minimum Operating Pressure | (P1) <input type="text"/> | PSI |
| Precharge Pressure at 68°F (20°C) | (P0) <input type="text"/> | PSI |
| Temperature Range of Environment | (T) <input type="text"/> | °F |
| Temperature Range of Fluid or System | (TF) <input type="text"/> | °F |
| Pump Flow Rate | (QP) <input type="text"/> | GPM |
| Total Cycle Time of System | (TE) <input type="text"/> | Sec. |
| Number of Actuators (<i>cylinders, etc.</i>) | (NV) <input type="text"/> | |

Actuator Time Schedule and Flow

| | | |
|---|---------------------------------|-------------------------------------|
| QVi = Required Actuator Flow (GPM) | Ei = Actuator Start Time | Ai = Actuator Shut Down Time |
| <i>(i = 1 for first actuator, i = 2 for second actuator, etc. up to NV)</i> | | |
| QV1 = <input type="text"/> | E1 = <input type="text"/> | A1 = <input type="text"/> |
| QV2 = <input type="text"/> | E2 = <input type="text"/> | A2 = <input type="text"/> |
| QV3 = <input type="text"/> | E3 = <input type="text"/> | A3 = <input type="text"/> |
| QV4 = <input type="text"/> | E4 = <input type="text"/> | A4 = <input type="text"/> |
| QV5 = <input type="text"/> | E5 = <input type="text"/> | A5 = <input type="text"/> |

Fluid

Required Mounting Orientation

Country of Final Installation (for country codes please see page 3)

Required Quantity

Annual Usage _____ Target Price _____ Competitor _____ Quantity _____

Additional Remarks

Shock Applications Form

| | | |
|---------------|--------------|-----------|
| Name _____ | Title _____ | |
| Company _____ | E-mail _____ | |
| Address _____ | | |
| Phone _____ | State _____ | Zip _____ |
| Phone _____ | Fax _____ | |

Please attach any special requirements or drawings to the fax or e-mail.

What is the source of the shock? (i.e. valve closing, pump start, or other - please describe)

At the instance the shock occurs what is the...

Flow rate: _____ GPM

Normal Operating Pressure: _____ PSI ; Maximum Spike Pressure: _____ PSI

The system's maximum allowable design pressure: _____ PSI

Information is required on all piping from the shock source to the anticipated location of the shock absorber (*accumulator*).

Please continue to answer the following:

Total Number of pipes: _____ (up to 10 pipes)

Starting at the shock source, please answer the following:

| Pipe | Inner Diameter (inches) | Length (feet) | Pipe | Inner Diameter (inches) | Length (feet) |
|------|-------------------------|----------------------|------|-------------------------|----------------------|
| 1 | <input type="text"/> | <input type="text"/> | 6 | <input type="text"/> | <input type="text"/> |
| 2 | <input type="text"/> | <input type="text"/> | 7 | <input type="text"/> | <input type="text"/> |
| 3 | <input type="text"/> | <input type="text"/> | 8 | <input type="text"/> | <input type="text"/> |
| 4 | <input type="text"/> | <input type="text"/> | 9 | <input type="text"/> | <input type="text"/> |
| 5 | <input type="text"/> | <input type="text"/> | 10 | <input type="text"/> | <input type="text"/> |

If the vertical height from the shock source to the anticipated location of the shock absorber is greater than 10 feet please state this distance.

Vertical Height: _____ feet

Fluid

Required Mounting Orientation

Country of Final Installation (for country codes please see page 3)

Required Quantity

Annual Usage _____ Target Price _____ Competitor _____ Quantity _____

Additional Remarks

Pulsation Dampening Form

| | |
|---------------|-----------------------|
| Name _____ | Title _____ |
| Company _____ | E-mail _____ |
| Address _____ | |
| Phone _____ | State _____ Zip _____ |
| Phone _____ | Fax _____ |

Please attach any special requirements or drawings to the fax or e-mail.

What type of pump is causing the pulsation?

Please name or describe (ie piston pump, gear pump, etc.)

What is the...

Flow rate: _____ GPM

Pump: _____ RPM

Pump Piston Diameter: _____ (inches)

Pump Piston Stroke: _____ (inches)

Number of Rotating Elements: _____ (3 piston, 13 tooth gear, etc)

Operating Pressure: _____ psi

The system's maximum allowable pressure: _____ psi

Line Size where pulsation dampener will be fitted into: _____

(The I.D. of the line is what is really required)

Note: A pulsation dampener should always be installed as close to the pulsation source as possible to optimize its performance. A pulsation dampener should never be placed greater than 10 ft away from the pulsation source.

Fluid

Required Mounting Orientation

Country of Final Installation (for country codes please see page 3)

Required Quantity

Annual Usage _____ Target Price _____ Competitor _____ Quantity _____

Additional Remarks

360° of

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