HYDAC INTERNATIONAL

Accumulators

Bladder, Piston, Diaphragm

PN#02068195 / 1.15 / ACU1102-1326

HYDAC About HYDAC

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.

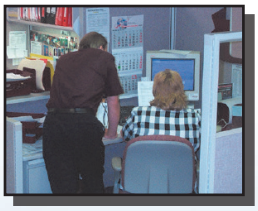
HYDAC Products

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

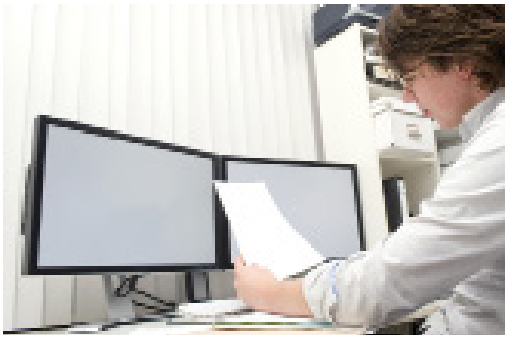
Based on research and development in our laboratories for testing of physical, chemical and mechanical properties, HYDAC achieves the highest quality of accumulators and related parts.

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.

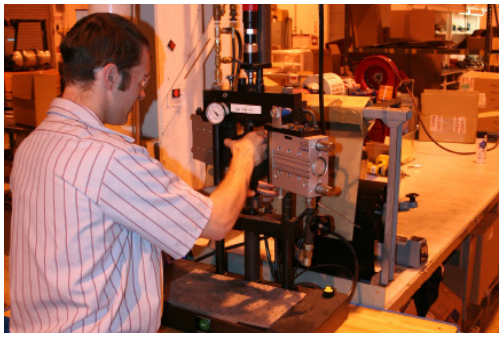
Manufacturing and Assembly

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

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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

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.

Assembly of Piston Accumulators

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	S1[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

Information and related materials are subject to change without notice. This catalog, and all information and related materials it contains, are provided "as is." HYDAC makes no representation or warranty whatsoever regarding the completeness, accuracy, "up-to-dateness", or adequacy of the HYDAC-NA domain and this catalog.

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.

Low Pressure

Bottom Repairable

Top Repairable

High Pressure

High Flow

Kevlar Wrapped

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.

Standard

Extending Piston Rod

Electric Proximity Switches

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.

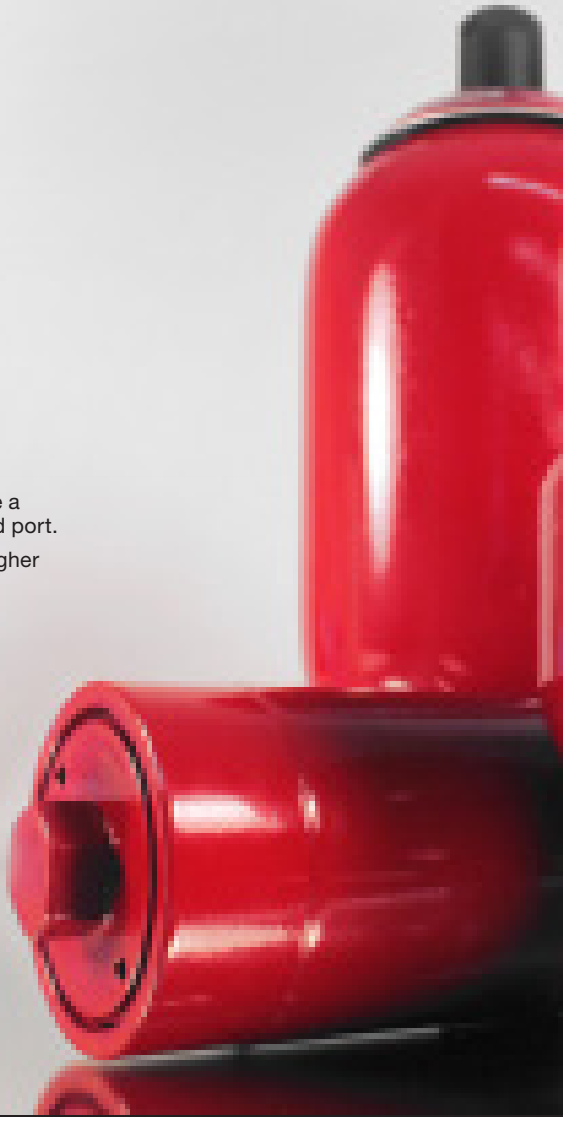
Diaphragm accumulators are frequently used where small volumes are required, weight is important, a higher pressure ratio is required (up to 10:1) or low cost is a prime factor.

Applications with corrosive environments may require a coating or be manufactured from stainless steel.

Welded
(non-repairable)

Threaded
(repairable)

Sealed
Factory Precharge
OEM - (non-repairable)



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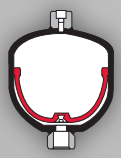
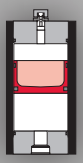
Comparison of Standard Accumulators

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

Accumulator Type Selection Considerations

- System Pressure
- System Temperature
- Volume / Usable Volume
- Flow Rate
- Pressure Ratio
- Installation Space and Position
- Chemical Compatibility

Use the comparison chart above as a quick reference guide.

Stainless Steel Accumulators

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

Piston

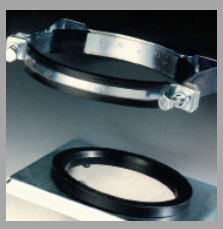
Diaphragm

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

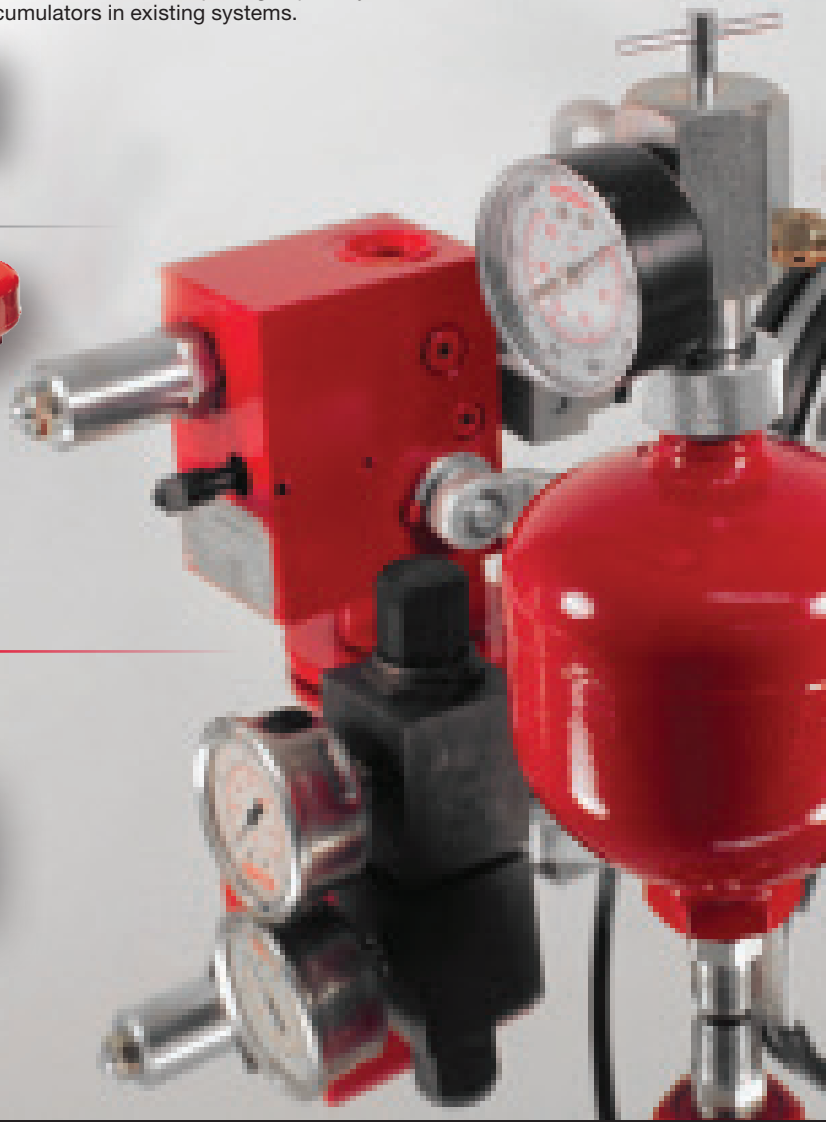
For more information on these accessories, see page 67

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.

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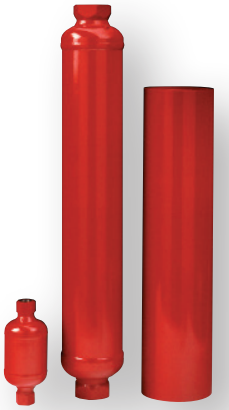
Dampeners

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.

Diaphragm Dampener

Standard & High Pressure Bladder Dampener

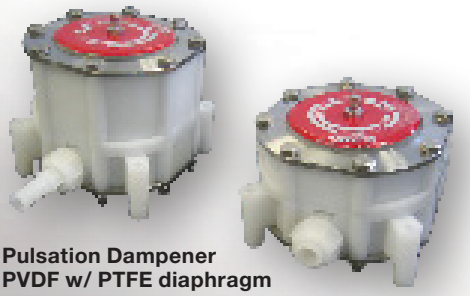


Silencers

Suction Flow Stabilizer

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.



Pulsation Dampener PVDF w/ PTFE diaphragm

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

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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)

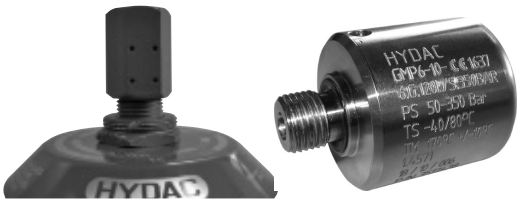
Note: The information in this brochure relates to the operating conditions and applications described. For applications or operating conditions not described, please contact Product Management at HYDAC.

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

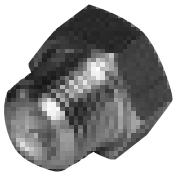


Protection by means of complete discharge in the case of excessive temperature and pressure.

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 ±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 ±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

WARNING: 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.

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For applications or operating conditions not described, please contact Product Management at HYDAC.

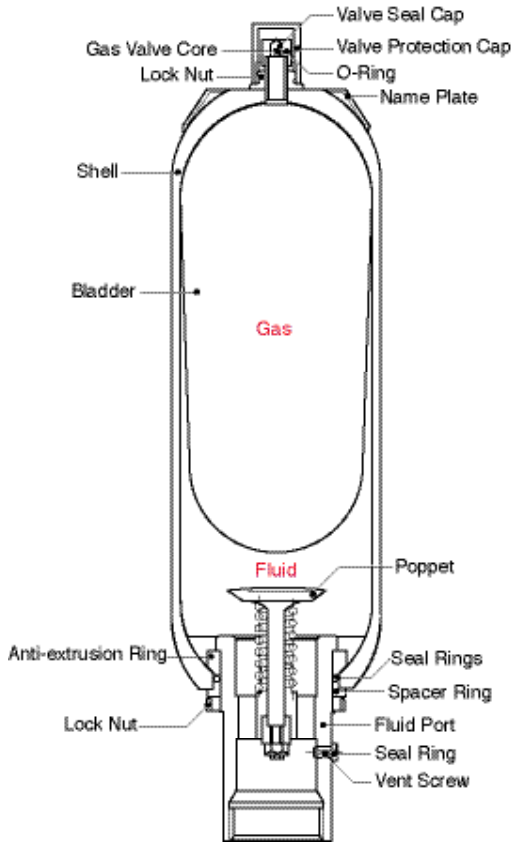
SB Series
Bladder Accumulators

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

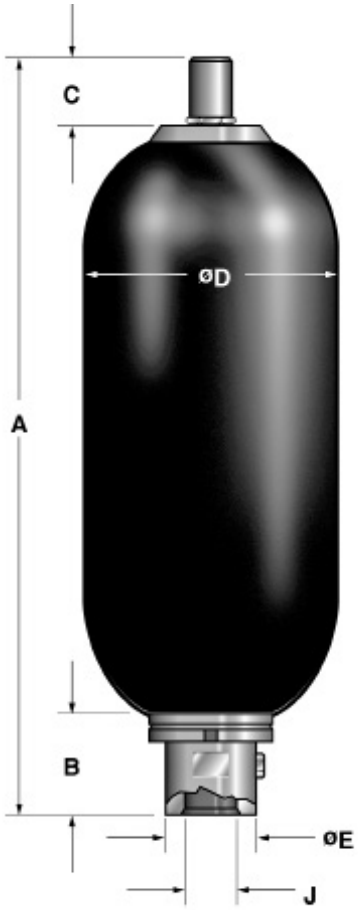
Threaded
- A = BSPP (ISO 228) Radial Seal Design NOT Axial
- B = Metric (DIN 13)
- C = SAE (ANSI B1.1)
- D = NPT (ANSI B1.2)

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

PN#02068195 / 1.15 / ACU1102-1326

Dimensions
Bottom Repairable



SB 330... (3000 psi)

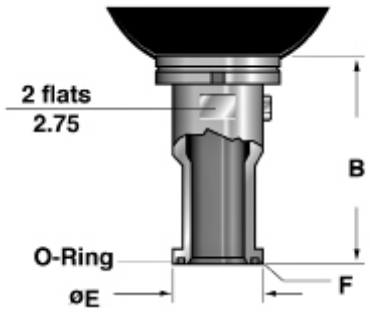
Size (L)	Nom. Vol. (gal.)	Eff. Gas Vol. in³/(gal.)	Weight	A	B(1	C	ØD	ØE	Thread-J		Q(2 gpm
									SAE	NPTF BSPP	
1	1/4	66 (0.29)	10 (4.5)	12.0 (303)	2.0 (51)	2.3 (58)	4.6 (117)	1.4 (36)	1 1/16-12 UN (SAE-12)	3/4”	60
4	1	226 (0.98)	30 (14)	16.3 (415)	2.6 (66)	2.3 (58)	6.6 (168)	2.1 (53)	1 5/8-12 UN (SAE-20)	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. in³/(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)

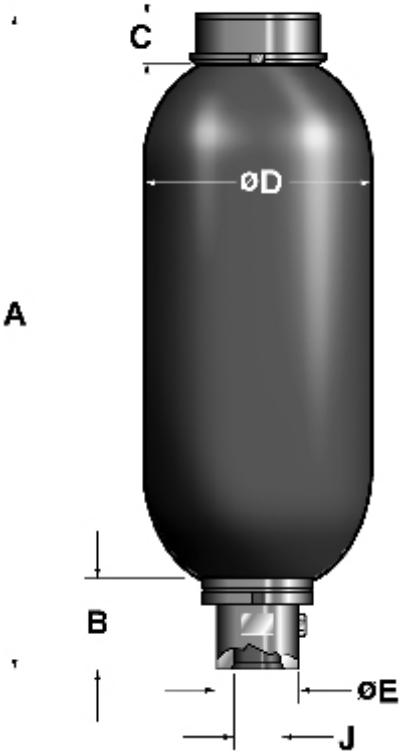


Split Flange Connection (sizes 10 - 54)

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. in³/(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. in³/(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. in³/(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

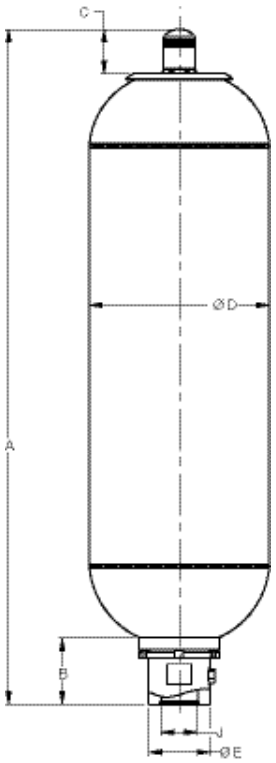
Bladder Compound
2 = NBR (Buna N)
3 = ECO (Hydrin)
4 = IIR (Butyl)
5 = LT-NBR (low temp. Buna)
6 = FPM (Fluoroelastomer)
7 = Others *(available on request)*

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
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. in³/(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
- 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	-10˚ to 220˚F	mineral oils
	-10˚ to 220˚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
- 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)

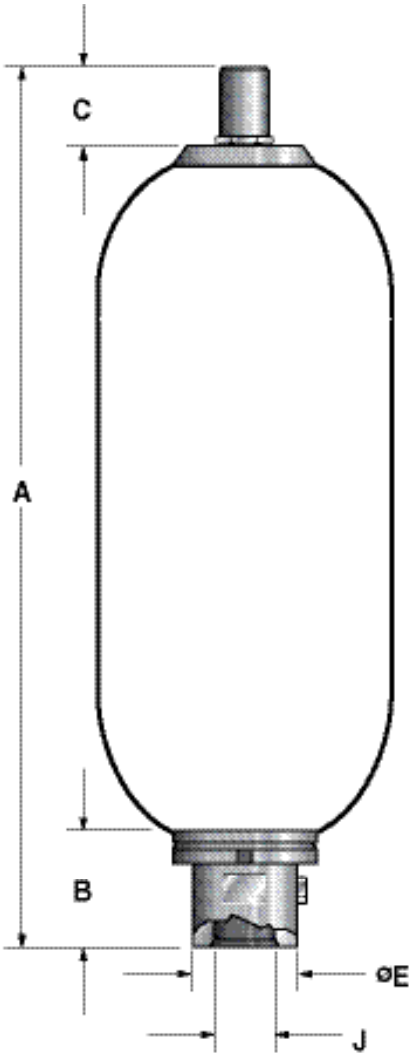
Maximum Working Pressure
- 210 = 3000 psi
- 345 = 5000 psi
- 414 = 6000 psi

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 (P_o) 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)

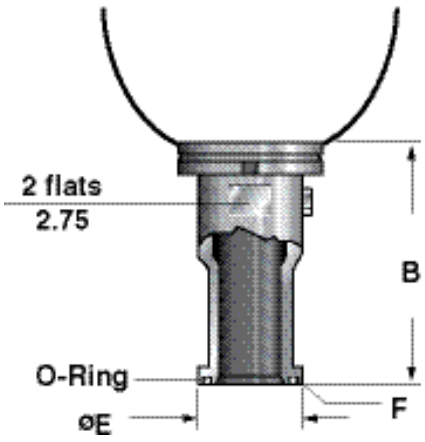
Size (L)	Nom. Vol. (gal.)	Eff. Gas Vol. in³/(gal.)	Weight	A	B	C	ØD	ØE	Thread-J NPTF		Q[1] gpm
10	2 1/2	566 (2.45)	86 (39)	22.0 (559)	3.1 (80)	2.3 (58)	9.1 (231)	3.0 (76)	1 1/4	2”	240
20	5	1125 (4.87)	140 (63)	34.5 (876)	3.1 (80)	2.3 (58)	9.1 (231)	3.0 (76)	1 1/4	2”	240
32	10	2080 (9.00)	226 (102)	54.7 (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. in³/(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)

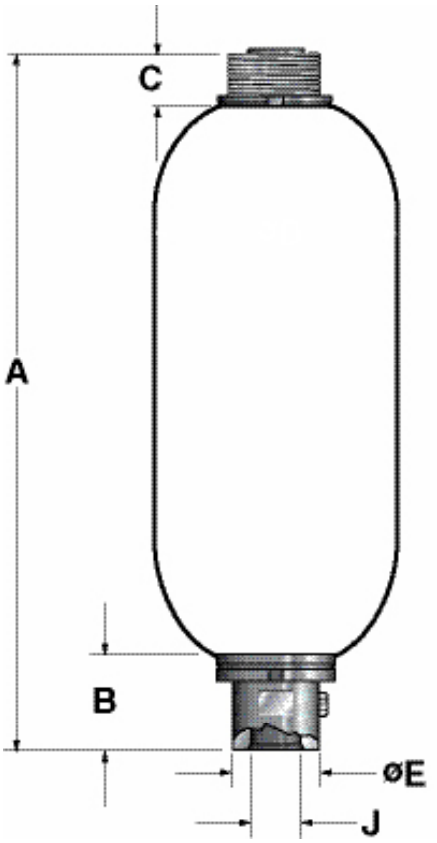
Series	B	øE	Split Flange Connection F	Q[1] gpm
SB 330 SB 330 TR	4.1 (104)	2.8 (71.4)	SAE 2” – 3000 psi Code 61	240
SB 600 SB 600 TR	5.5 (140)	2.5 (63.5)	SAE 1 1/2” – 5000 psi Code 62	240

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.

PN#02068195 / 1.15 / ACU1102-1326

Top Repairable



SB 330 TR... (3000 psi)

Size (L)	Nom. Vol. (gal.)	Eff. Gas Vol. in³/(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

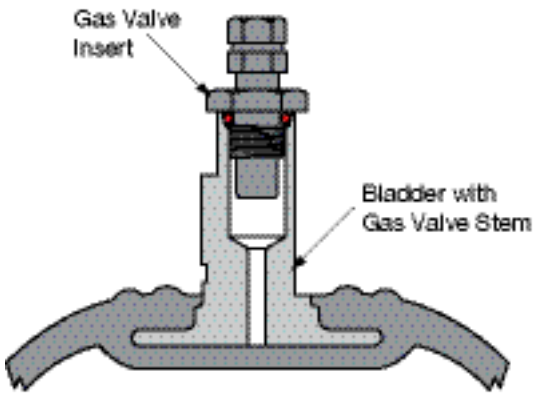
See note at bottom of page
Dimensions are for general information only, all critical dimensions should be verified.
Dimensions are in inches/(mm) and lbs/(kg)

SB 600 TR... (5000 psi)

Size (L)	Nom. Vol. (gal.)	Eff. Gas Vol. in³/(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)

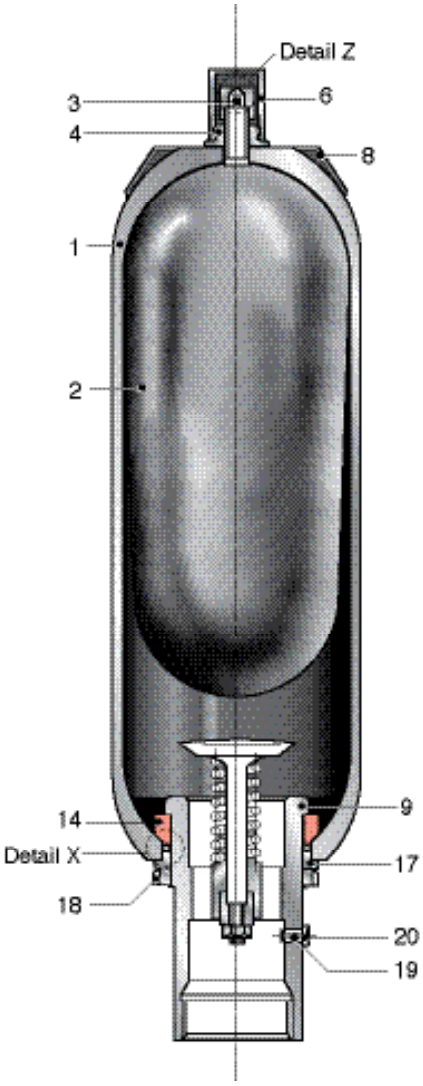
2 Piece Gas Valve MS28889-2



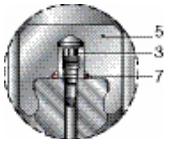
Note: Maximum discharge flow rate recommended for vertically mounted accumulators.

Bladder Accumulators - Spare Parts

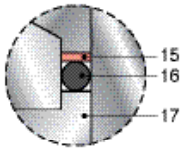
Bottom Repairable SB330, SB330H, SB330N SB600, SB600N



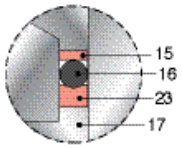
Detail Z



Detail X
SB 330: size 1 to 54
SB 600: size 1 to 4
SB 330N: size 1 to 54



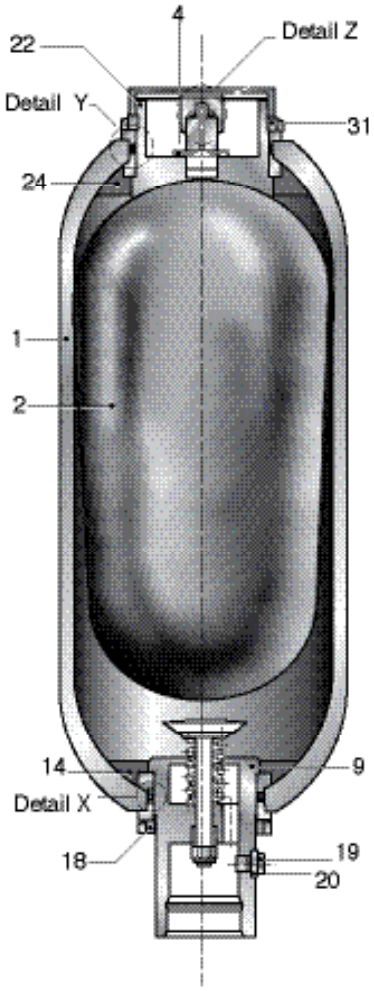
SB 600: size 10 to 54
SB 600N: size 10 to 54



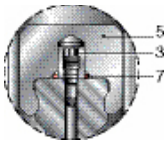
Repair Kits consist of items
2, 3, 4 *(SB 600 only)*, 5, 7, 15, 16, 23 *(where applicable)*

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

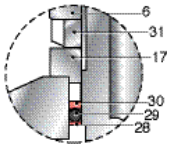
Top Repairable SB330T, SB330HT, SB330TR, SB330NTR, SB 600T, SB600TR, SB600NTR



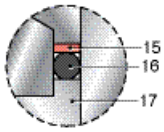
Detail Z



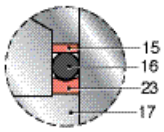
Detail Y
SB 330 T: size 10 to 54
SB 330 HT: size 20 to 54
SB330TR: size 10 to 54
SB330NTR: size 10 to 54
SB 600 T: size 20 to 54
SB600TR: size 10 to 54
SB600NTR: size 10 to 54



Detail X
SB 330 T: size 10 to 54
SB330TR: size 10 to 54



SB330NTR: size 10 to 54
SB 330 HT: size 20 to 54
SB 600 T: size 20 to 54
SB600TR: size 10 to 54
SB600NTR: size 10 to 54



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

PN#02068195 / 1.15 / ACU1102-1326

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 accomodate 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 Kits[10] 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	2054034 *(HYDAC standard)*	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 Kits[10] 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 Kits[10] 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

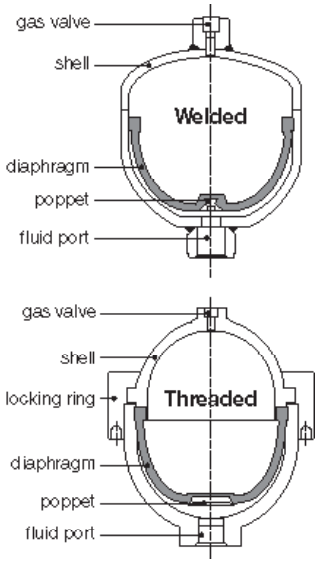
Diaphragm Accumulators have been successfully applied in both industrial and mobile applications for energy storage, maintaining pressure, leakage compensation, and vehicle hydraulic systems.

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
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)
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 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

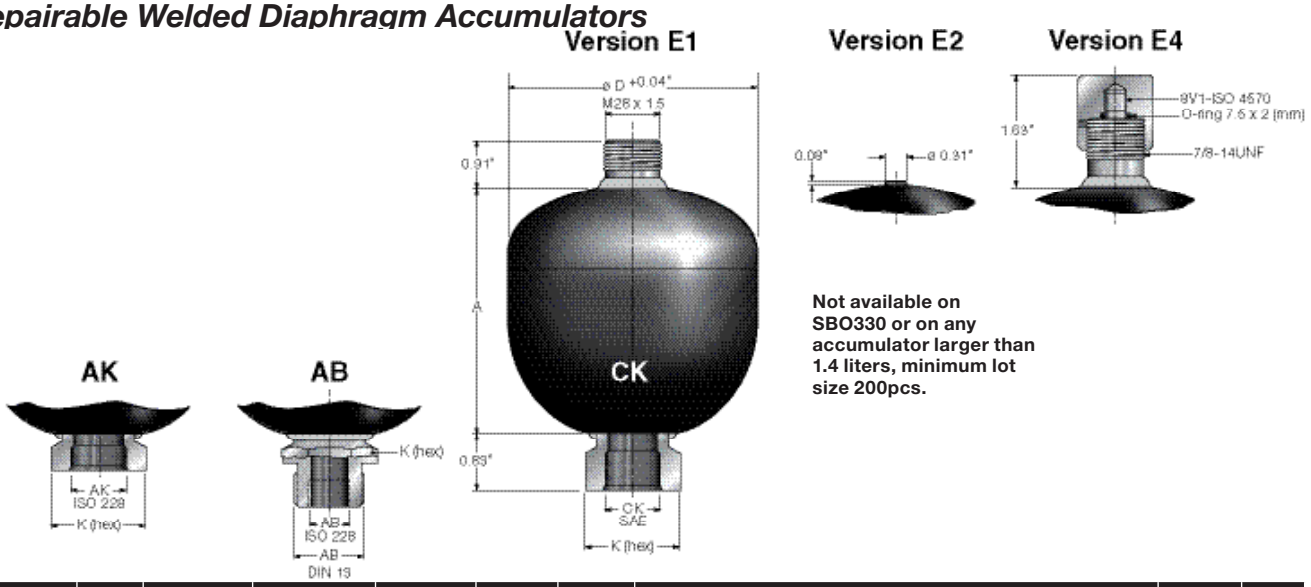
Fluid Port Connection
AK = BSP connection
AB = Male / Female combination connection
CK = Standard SAE connection
(other fluid ports available upon request — consult factory)

Gas Precharge Pressure (P_0) in bar *(always required for E2 model gas valve)*
xxx = 3 digits

PN#02068195 / 1.15 / ACU1102-1326

Dimensions

Non-Repairable Welded Diaphragm Accumulators

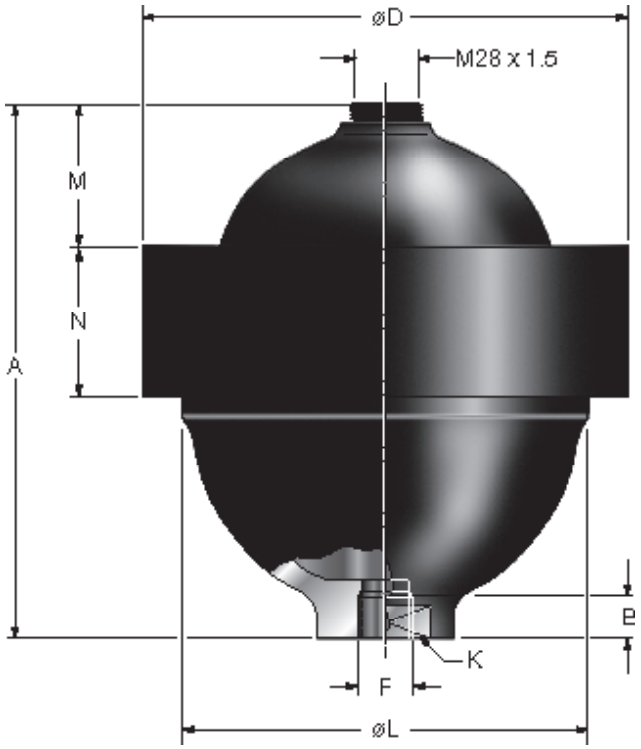


Not available on SBO330 or on any accumulator larger than 1.4 liters, minimum lot size 200pcs.

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	AK	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)* 3000/(210)	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
SBO 210	8:1	0.32	20	2400/(160)* 3000/(210)	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
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)* 3000/(210)	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
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)* 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
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

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)* 7200/(500)	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
SBO 750	10:1	0.25	15	8700/(600)* 10,000/ (750)	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
SBO 450	10:1	0.6	36	3600/(250)* 4700/(330)	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
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)* 3600/(250)	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

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	SBO50-4E1/346U1-50AB	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

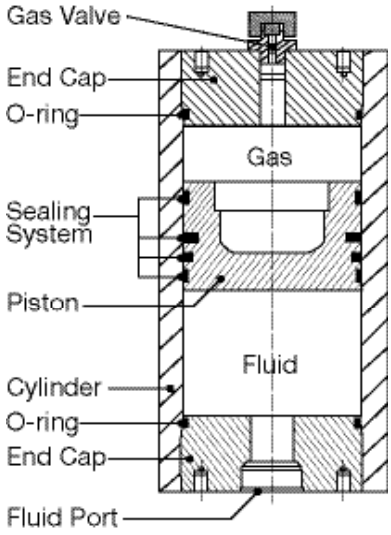
Piston Accumulators are a cost effective option for numerous functions involving energy storage, and sometimes shock absorption in a hydraulic or fluid system. They are well suited for applications needing:

- 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:

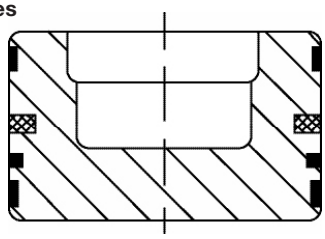
- A cylinder with a finely finished internal surface
- An end cap on the gas side and fluid side, sealed with o-rings
- A lightweight metal piston
- A variety of sealing systems are available depending on the application



Piston Types

TYPE 2

Without Check Valves



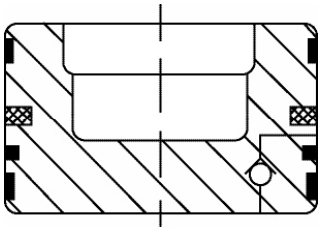
Application (without Check Valve)

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 ≤ 10 µm absolute. (ISO 17/15/12)
Max. continuous velocity = 12 ft/sec

TYPE 2

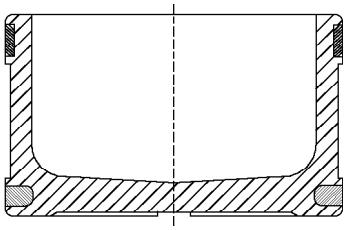
With Check Valves



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 ≤ 10 µm 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-gylcol 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)*.

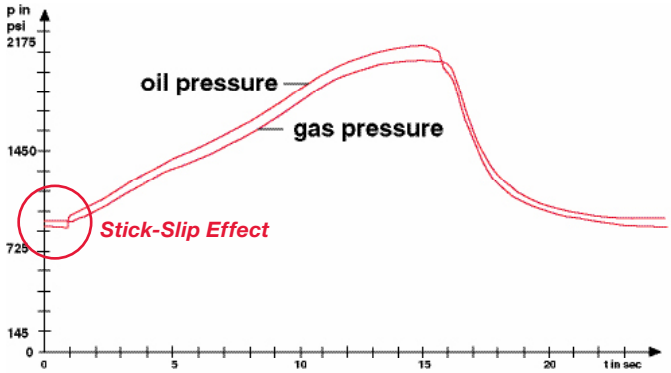
Small pressure differentials between gas and oil side improve the effectiveness of HYDAC piston accumulators. To emphasize the friction effect on the pressure curve during an accumulation cycle, measurements with various sealing systems are illustrated.

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:

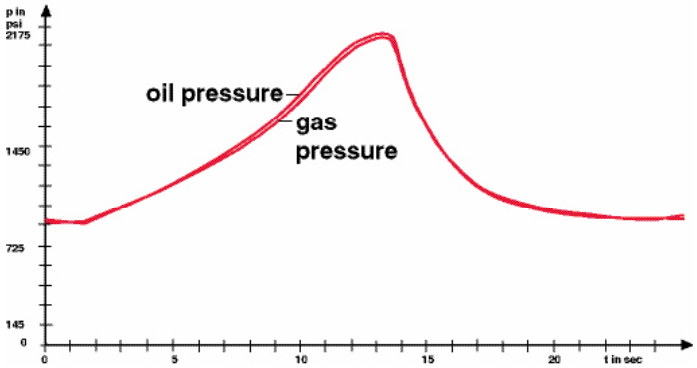
Graph 1: Δp max. ≈ 125 psi

Graph 2: Δp max. ≈ 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

PN#02068195 / 1.15 / ACU1102-1326

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 180F)*
- 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		35 = 355mm	
08 = 80mm		18 = 180mm		49 = 490mm	
10 = 100mm					

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 = A[1] C[2] K[3]**

Code	Type of Connection	A	B	C	D	E	F	G	H	J	K	4" L	6" 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: F[4] **Sample Code = F[4] C[5] E[6]**

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) in³ / 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	1945 / 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
	10	2491 / 40.82	319.6 / 145.3	97.4 / 2475	6 / 150	6.89 / 175
SK 250	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
	10	2491 / 40.82	344 / 156	98 / 2491	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)

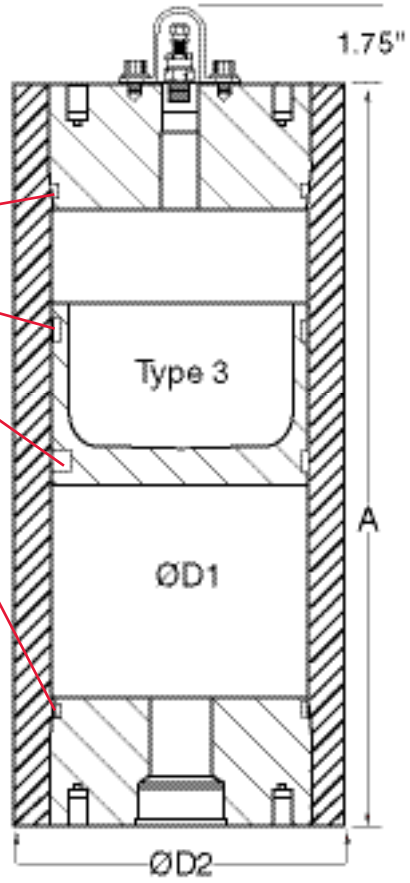
Replacement Gas Valve
Model Code: GAS VALVE M6164-2 W/CAP
Part Number : 2054712

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-210ACMKCH-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

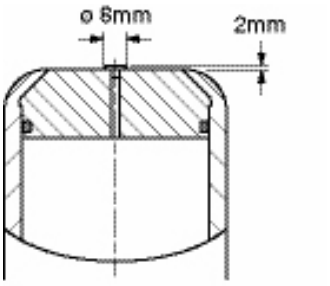
(Non-repairable)

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		
0.32	205	G 1/2	3/4-16-2B	3	60	70
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		
0.75	235	G 1	1 5/16-12-2B	14	100	125
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		

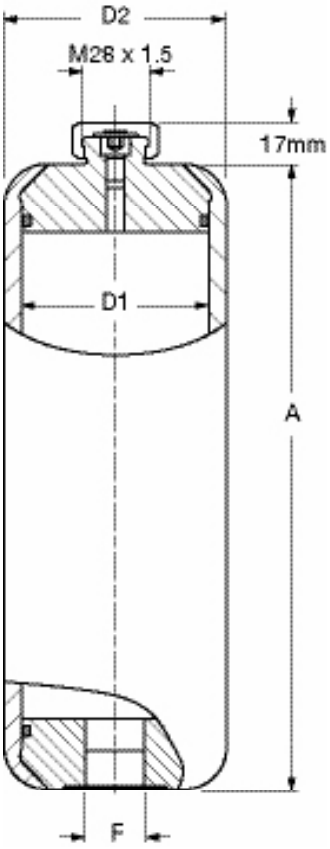
Clamps for D1=50mm D2=60mm Part Number 3018442
Clamps for D1=60mm D2=70mm Part Number 3018444
Clamps for D1=80mm D2=95mm Part Number 444995
Clamps for D1=100mm D2=125mm Part Number 444505
see page 71 for details

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

Dimensions
000 Connection -
Not Rechargeable



VB Connection - Refillable



PN#02068195 / 1.15 / ACU1102-1326

Connections
SK 350 Series (Non-ASME) 5000 psi

Model Code Support Tables for Fluid Connections

Female Threaded Connections: A **Sample Code = A[1] C[2] K[3]**

Code	Type of Connection	A	B	C	D	E	F	G	H	J	K	4" L	6" 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.

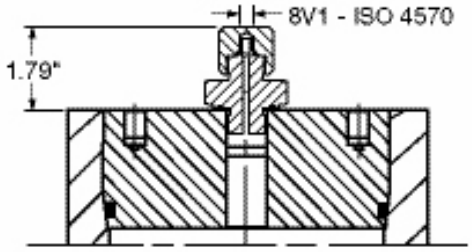
Flange Connections: F[4] **Sample Code = F[4] C[5] E[6]**

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"

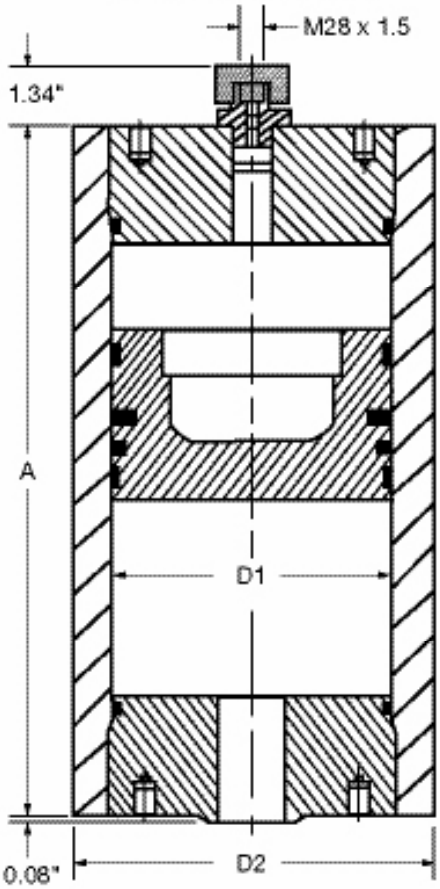
4) Use "F" as the first character of the connection code for all Flange Connections.
5) Use "C" as the second character of the connection code for all flange connections.
6) Enter the letter of the COLUMN (gray) as the third character of the connection code.

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

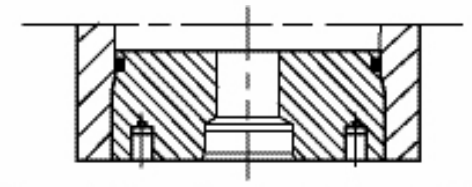
Gas Valve Version 4 (code designation VE)
Uses Charging Unit FPS



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	BSPP (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:

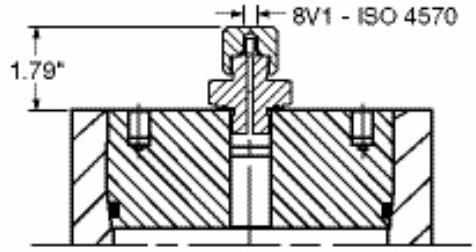
HYDAC has the capabilities to produce accumulators with many other types of connections. The options listed above are simply the most common, and most readily available. Other connection options include:

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

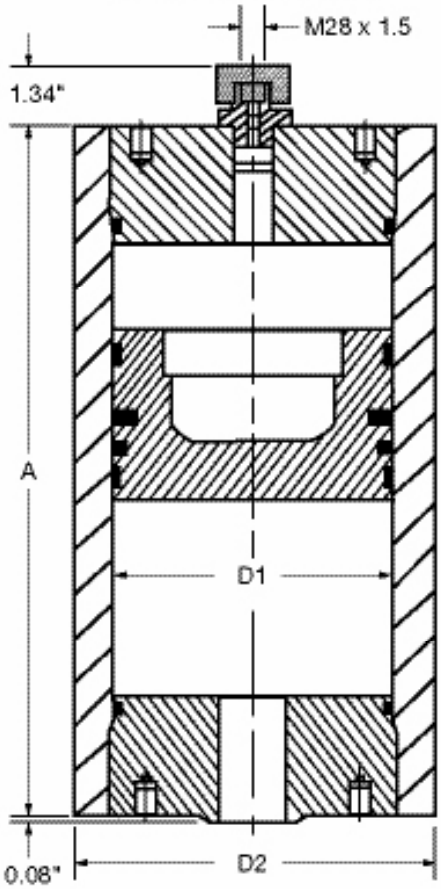
Custom solutions that incorporate valve/manifold assemblies are also available, for more information on special connections and custom solutions, consult factory.

Type 2 Dimensions
SK 350 Series (ASME) 3000 psi

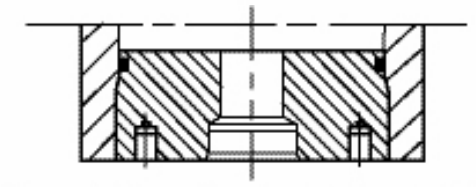
Gas Valve Version 4 (code designation VE)
Uses Charging Unit FPS



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)

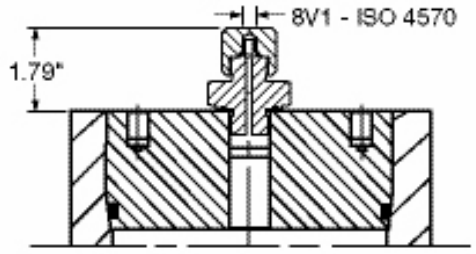
3000 psi maximum working pressure

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)		
170	45	2004 / (909)	152.4 / (3871)		
190	50	2194 / (994)	168.4 / (4277)		
100	25	1859 / (843)	61.9 / (1572)	13.98 (355)	17.09 (434)
115	30	1986 / (901)	67.9 / (1725)		
150	40	2287 / (1037)	81.8 / (2078)		
190	50	2630 / (1193)	97.7 / (2482)		
250	65	3144 / (1426)	121.6 / (3089)		
300	80	3572 / (1620)	141.5 / (3594)		

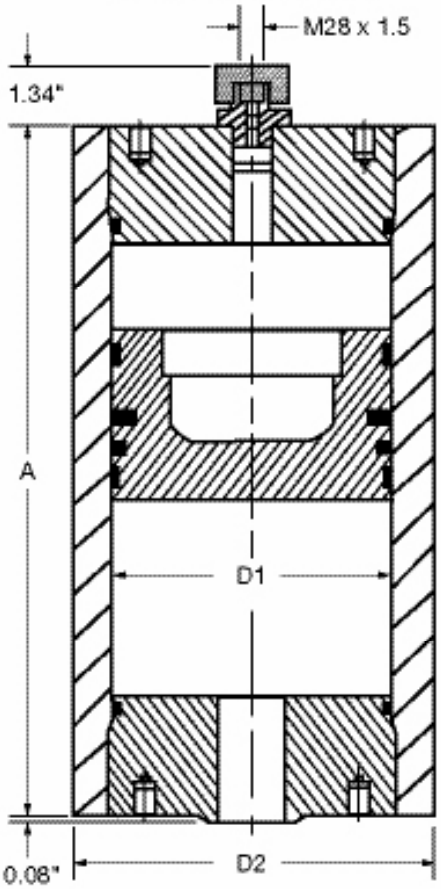
Clamps for D1=180mm Part Number 237401 *see page 71*
Clamps for D1=250mm Part Number 237389 *see page 71*
Clamps for D1=355mm (refer to factory)

Type 2 Dimensions
SK 600 Series (ASME) 5000 psi

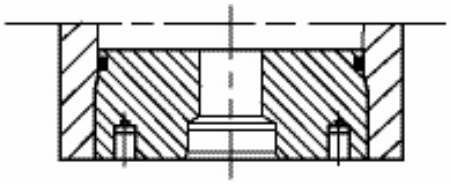
Gas Valve Version 4 (code designation VE)
Uses Charging Unit FPS



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)		
40	10	1110 / (503)	49 / (1245)	9.84 (250)	13.31 (338)
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..

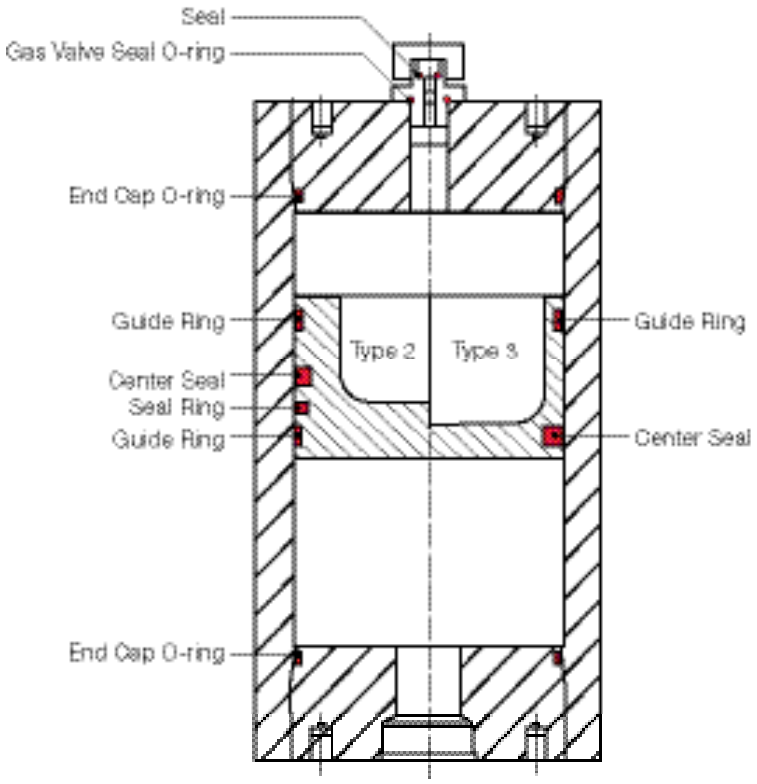
Piston Accumulators - Spare Parts

Seal Kits & Replacement Pistons

For seal kits other than Buna N, and for sizes not listed please consult factory.
Example: SK 350 - 20 / **2**112 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:

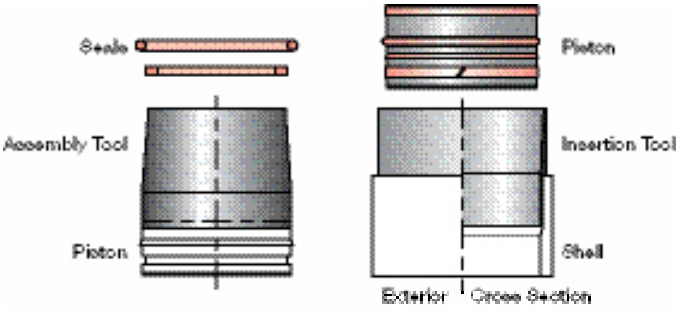
allows for gradual and even stretching of the seals when installing them onto the piston.

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)*

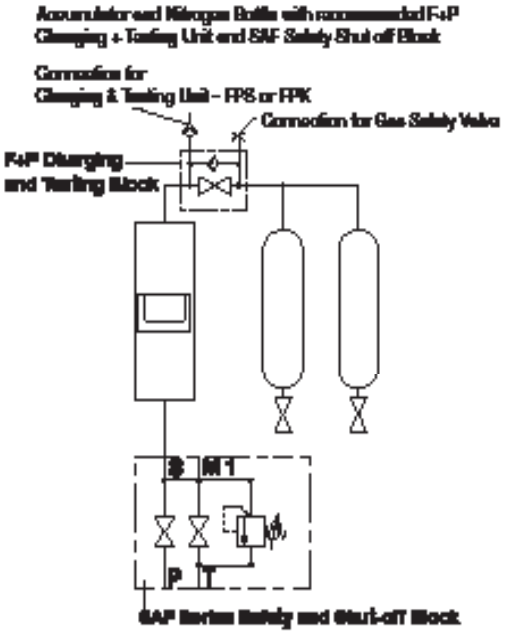
Connection 1

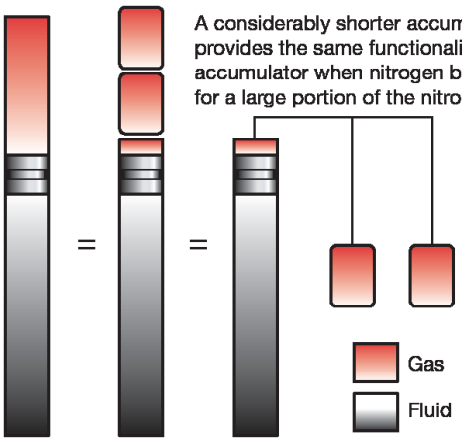
Connection 2

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

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

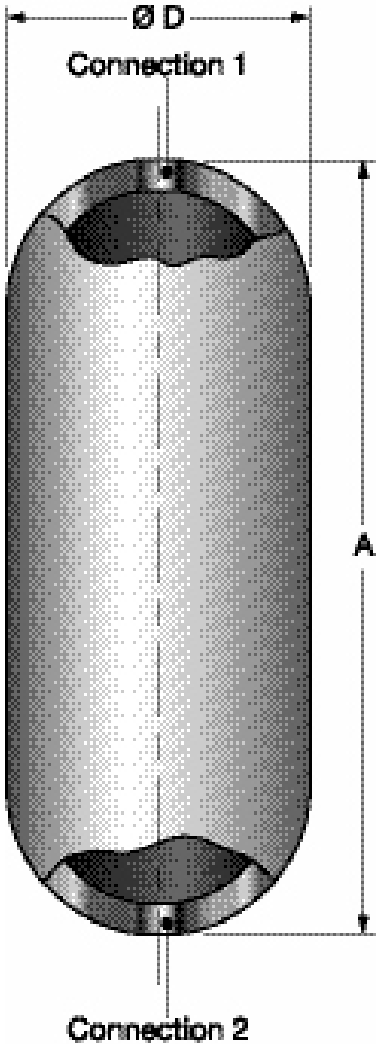
Size (MAWP)	Connections (1 and 2)	Vol. (gallons)	Weight (lbs)	A (inches)	D (inches)	Part Number
54 (5000 psi)	1 5/16-12UN	15	353	72”	9”	C/F
57 (3000 psi)	1 5/16-12UN	15	247	72”	9”	2096345
75 (3000 psi)	1 5/16-12UN	20	317	80.7	9”	C/F
100 (3000 psi)	1 5/16-12UN	25	386	89.4”	10.5”	C/F

Connections:

Example Model Code

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

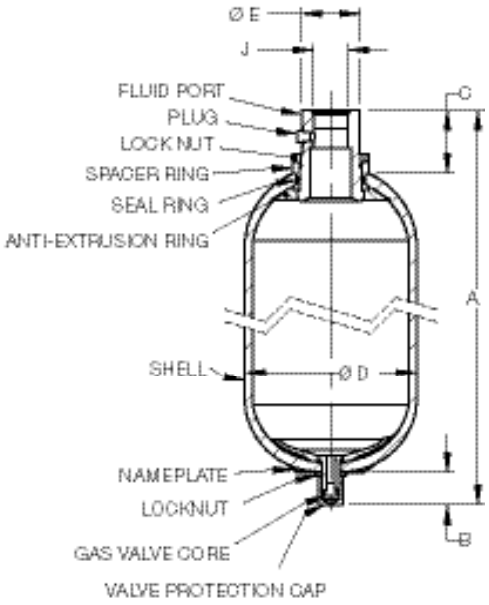
Type	A	B	C	D	F
Size	BSP (ISO228)	Metric (DIN 13 Acc.ISO 965/1)	(ANSI B1.1)	NPT (ANSI B2.1)	SAE Flange
A	G 1/4”	M 12 x 1.5	7/16”-20 UNF	1/4”	1/2” 3000 psi Code 61
B	G 3/8”	M 18 x 1.5	9/16”-18UNF	3/8”	3/4”-3000 psi Code 61
C	G 1/2”	M 22 x 0.5	3/4”-16UNF	1/2”	1” 3000 psi Code 61
D	G 3/4”	M 27 x 2	1 1/16”-12UN	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

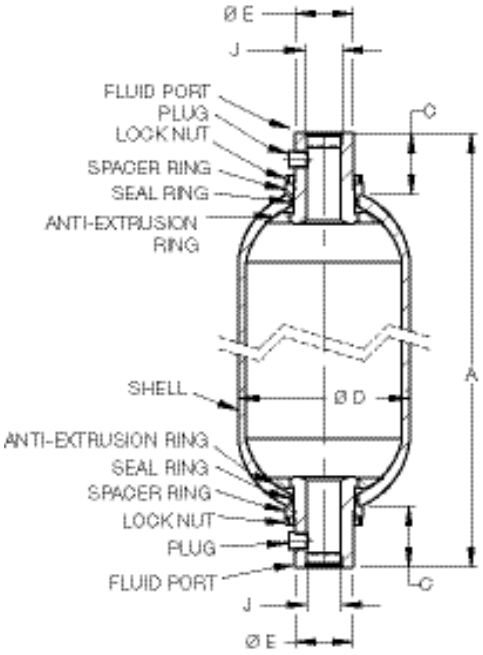


Bottom Repairable

Nom. Vol. (L.)	Eff. Gas Vol. in³	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. in³	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.

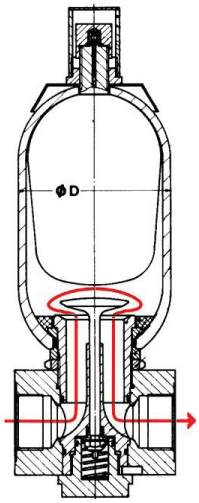
System Mounting

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



PN#02068195 / 1.15 / ACU1102-1326

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)

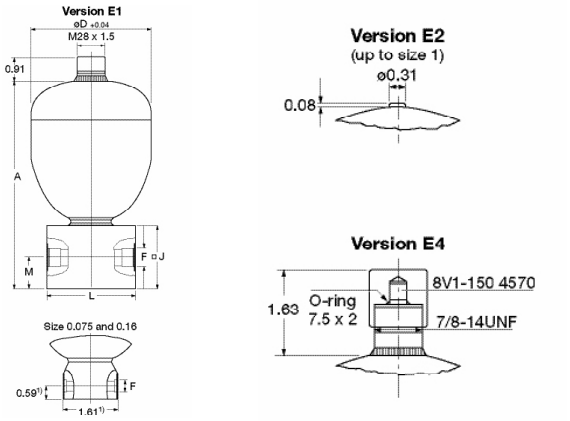
Maximum Work Pressure
210 = 3000 psi
345 = 5000 psi

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)*

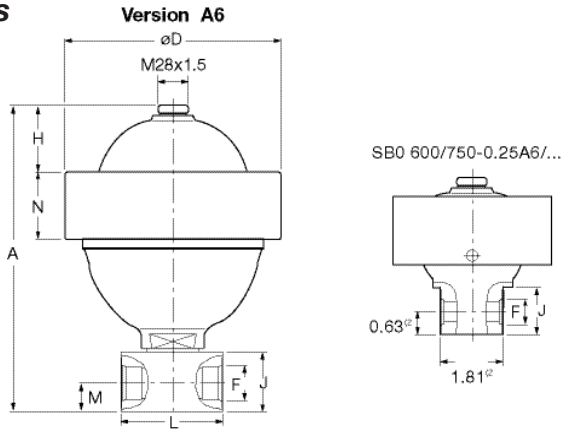
Gas Precharge Pressure (P_0) *(in bar)*
XXX = *3 digits*

SBO Welded Diaphragm Series
Dimensions



Series	Size	Gas Volume (in³)	Max. working pressure		Weight (lbs)	A (in)	øD[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

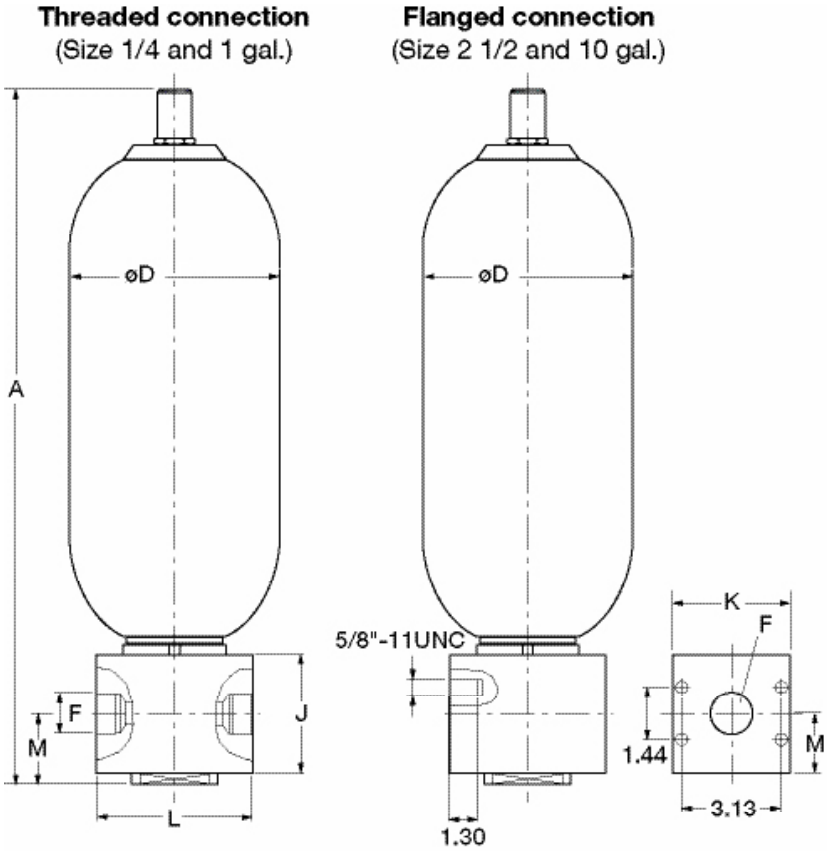


Series	Size (liters)	Gas Volume (in³)	Max. working pressure		Weight (lbs)	A (in)	øD (in)	Thread-F		H (in)	J (in)	L (in)	M (in)	N (in)	Q[2] (gpm)
			psi	bar				SAE	BSP						
SBO350P[4]	0.25	15	5000	350	11.5	6.30	4.53	3/4-16UNF	ISO 228-G1/2	0.70	1.97	3.15	0.99	2.17	10
SBO500P	0.25	15	7200	500	11.5	6.30	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 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.

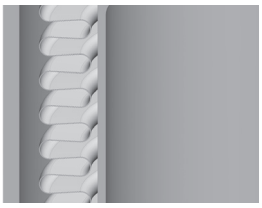
If a conventional accumulator can no longer perform its function, this can lead to expensive maintenance and repair work. We can offer a retrofit alternative - Replacement without the need for modification.

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

PN#02068195 / 1.15 / ACU1102-1326

Model Code

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

SM50 P 0.5 W E 1/ 116 U - 50 AAJ 2.5

Series

Design

	=	accumulator without diverting block*
L	=	light-weight accumulator
P	=	damper with diverter block

Size

SM50	=	0.5 to 1.6L
SM50P	=	0.5 to 3.8L

Verison

W	=	convoluted bellows
M	=	diaphragm bellows*

Type of Shell

A	=	screw type
E	=	weld type*
G	=	formed type*

Gas Connection

1	=	gas pressure adjustable (M28 x 1.5)
2	=	gas pressur pre-set, non-adjustable gas locking screw*
3	=	gas pressure adjustable (M16x 1.5)

Material Code

Fluid Connection

1	=	carbon steel
2	=	carbon steel with corrosion protection
3	=	stainless steel

Shell

1	=	carbon steel
2	=	carbon steel with corrosion protection
4	=	stainless steel

Seal Compound

0	=	no seal
2	=	NBR*
5	=	low temperature NBR*
6	=	FKM

Country of Installation

U	=	PED *(For other countries see page 3 for proper code designation)*

Maximum Working Pressure *(in bar)*

Fluid Port Connection

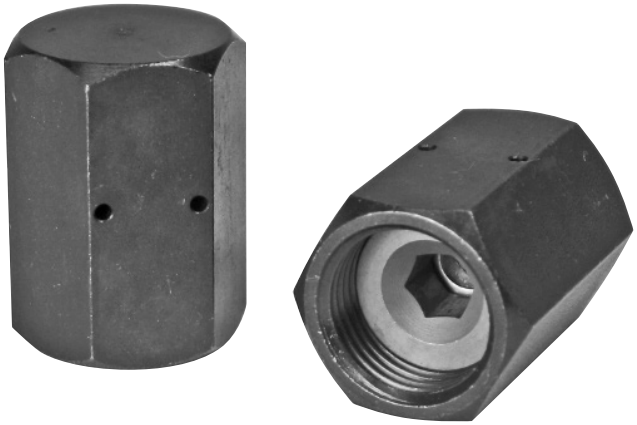
Pre-charge pressure *(in bar)*

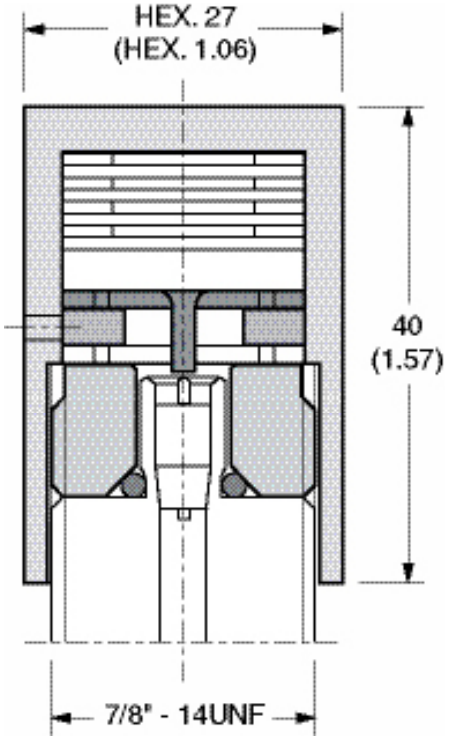
Metal Bellows SM50 & SM50P
Technical Information

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 alson 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

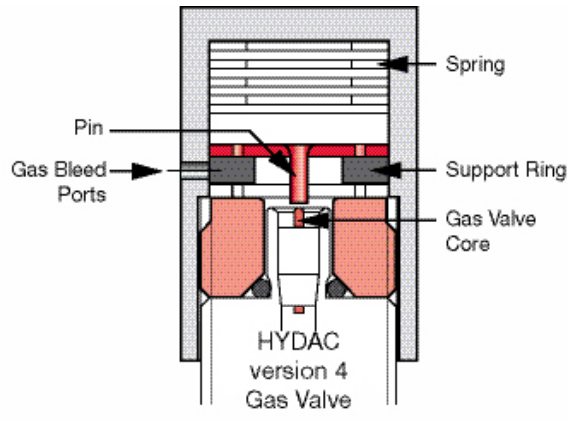
- 5000 psi (345 bar)

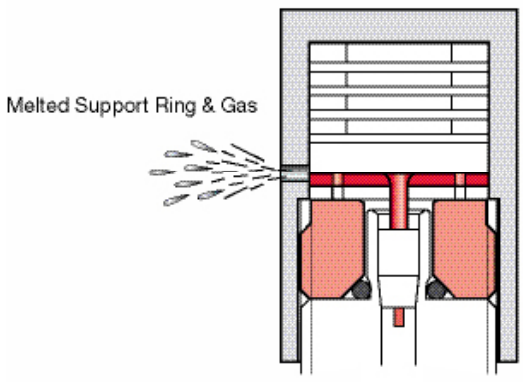
Maximum Working Temperature

- 200˚F (93.5˚C)

Fusing Temperature

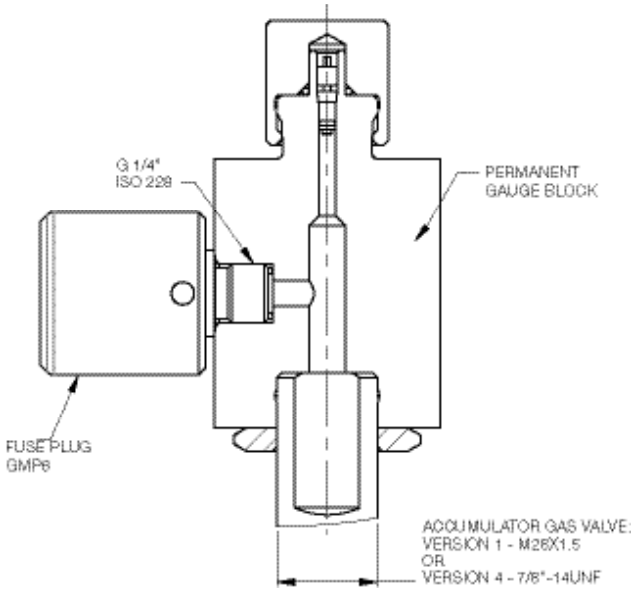
- 320 to 340˚F (160 to 171˚C)





Thermal Fuse Plugs, GMP6

CE certified



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

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 Themal 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.

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

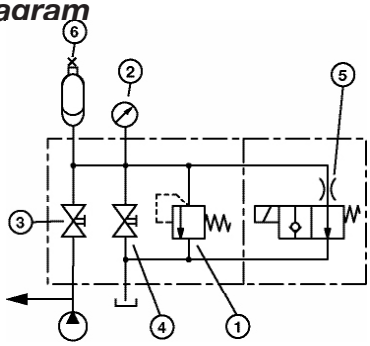
HYDAC safety and shut-off blocks are designed to protect, shut-off, and discharge hydraulic accumulators or user units. The compact design simplifies the hydraulic system connection and offers the following advantages:

- 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)

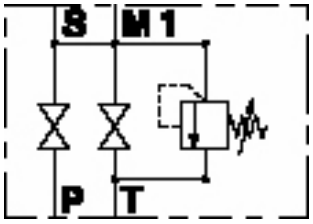
Construction

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

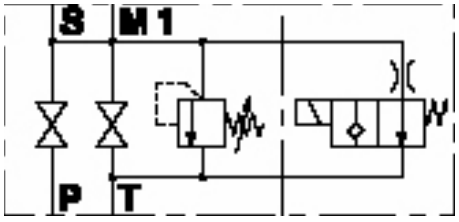
The basic model type “M” contains a manually operated bleed valve for manual pressure release of the accumulator.



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.



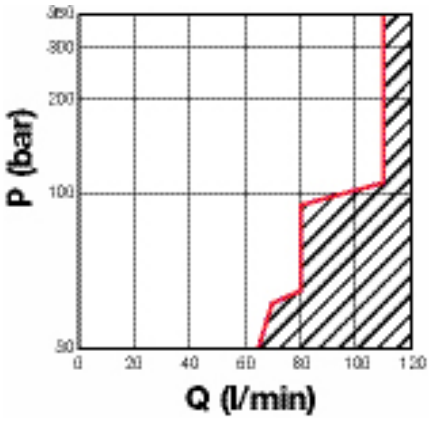
Sizes: SAF 10 E
SAF 20 E
SAF 32 E

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

SAF 20 E 1 6 Y 1 - N 250 C - S 60 L

Series
SAF = Safety and Shut-off Block *(Replaces older model SAB Blocks)*

Size of Main Shut-off Valve
10 = DN 10
20 = DN 20
32 = DN 32

Model
M = Manual discharge
E = Solenoid operated and manual discharge

Block Material
1 = Carbon Steel

Seal Material
6 = FPM *(Fluoroelastomer)*

2-Way Solenoid Operated Bleed Valve Operating Function
(omit) = if manual discharge was selected
Y = Normally Open *(standard)* (WSM06020Y)
Z = Normally Closed (WSM06020Z)

Solenoid
(omit) = if manual discharge was selected
1 = 0.8 AMP @ 24 VDC
2 = 0.2 AMP @ 110 VAC – 60 Hz

Pressure Relief Valve *(HYDAC DB12)*
N 250 = Adjustable up to max pressure of 3625 psi (250 bar)
N 350 = Adjustable up to max pressure of 5075 psi (350 bar)
T XXX = Factory set and wire sealed, certified Safety Relief Valve, non-adjustable *(xxx is pressure in bar)*

Connection Type (P,T,M1 ports)
Threaded
A = BSPP (ISO 228)
C = SAE (ANSI B 1.1) *(standard)*

Flanged *(SAF 32 only)*
E = SAE 2” – 3000 psi *(Code 61)*
F = SAE 1-1/2” – 6000 psi *(Code 62)*

S Adapter *(for S port, accumulator connection)*
(required only for safety and shut-off blocks with threaded connection)

	SAE *(connection type C)*		**BSPP** *(connection type A)*	
For Sizes	S 60	= 1 1/16”-12UN (-12)	S 10	= G3/4”
	S 61	= 1 5/16”-12UN (-16)		
10 & 20	S 62	= 1 5/8”-12UN (-20)	S 11	= G1”
	S 63	= 1 7/8”-12UN (-24)	S 12	= G1 1/4”
	S 64	= 3/4”-16UNF (-8)	S 13	= G2”
For Size 32	S 620	= 1 5/8”-12UN	S 309	= G2”
	S 630	= 1 7/8”-12UN		

Locking Device *(if required)*
L = Locking device

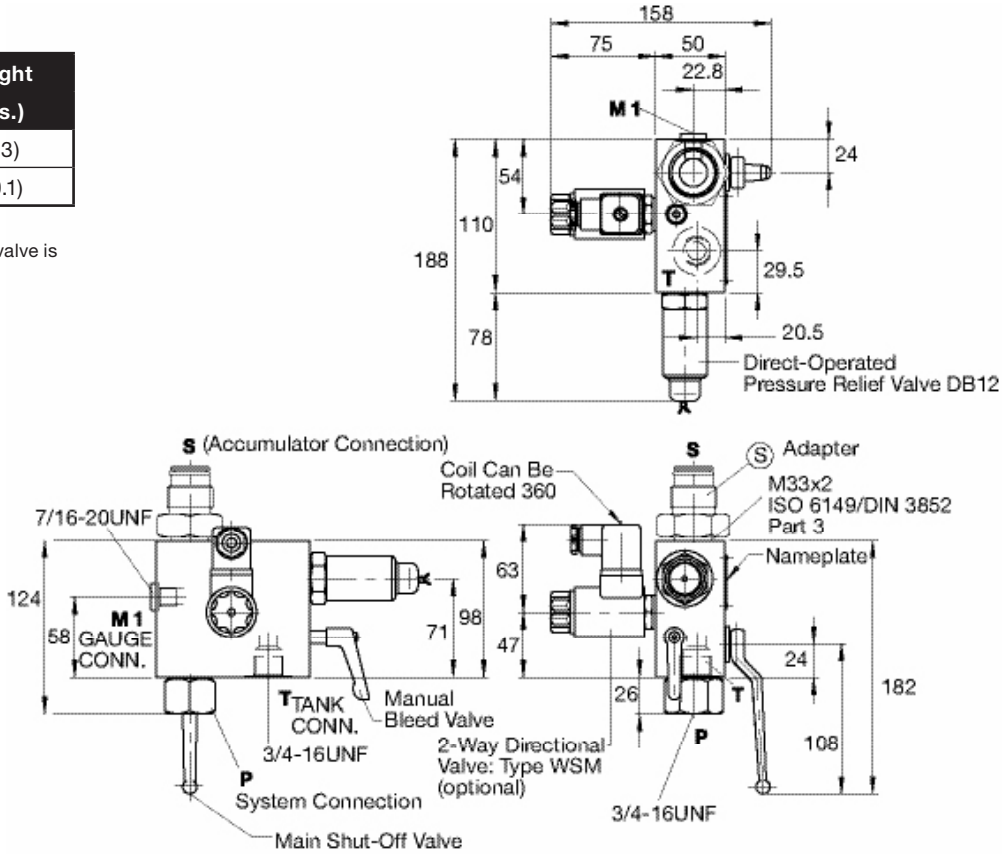
PN#02068195 / 1.15 / ACU1102-1326

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

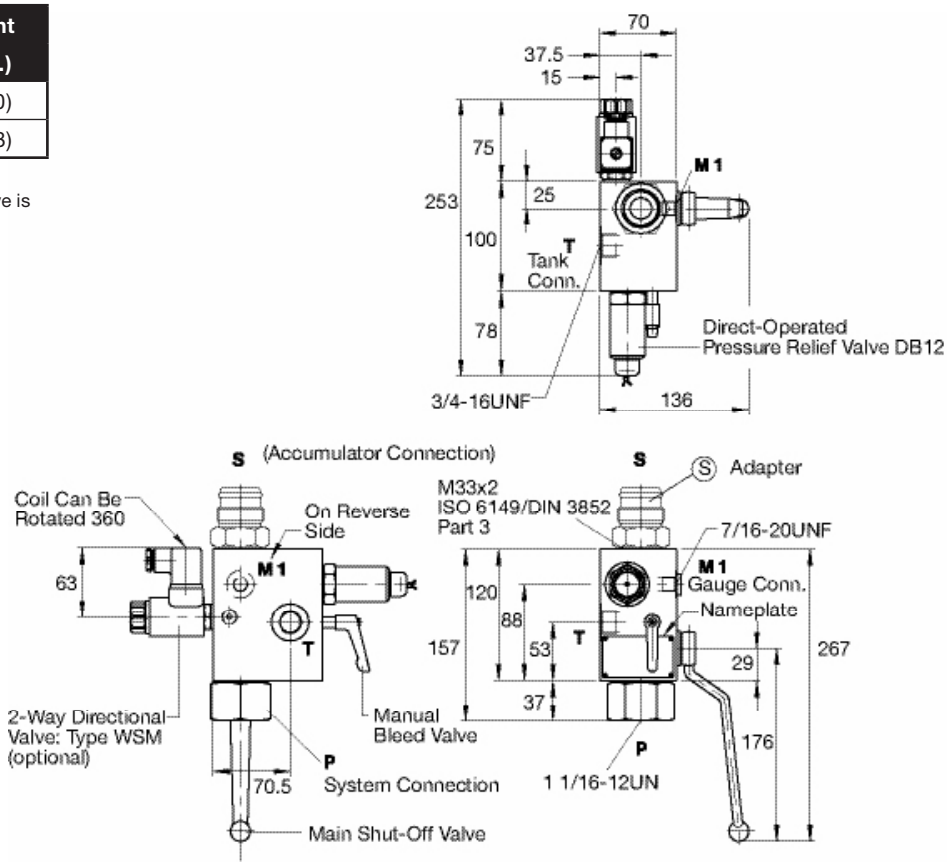


Dimensions are for general information only, all critical dimensions should be verified.

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

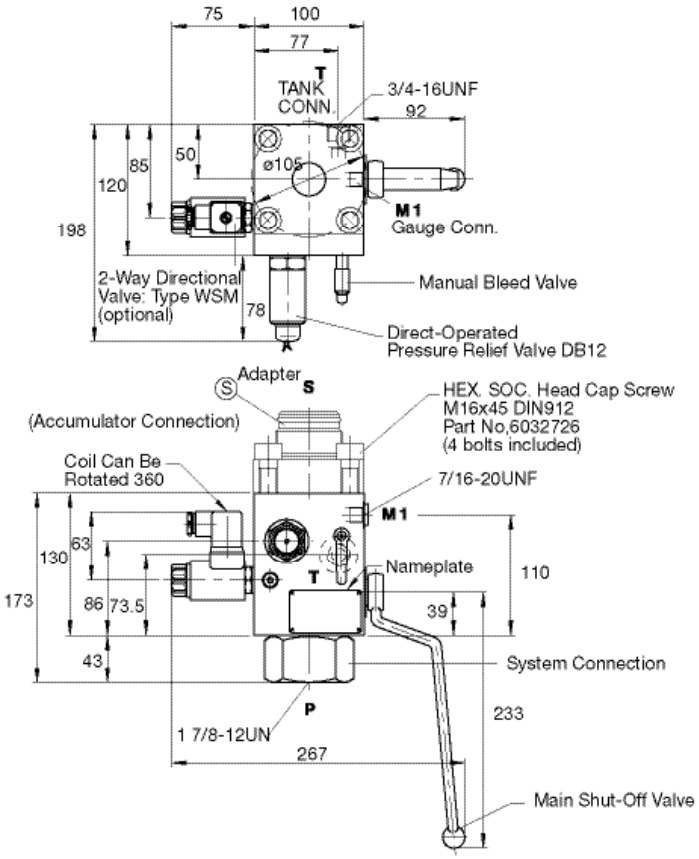


Dimensions are for general information only, all critical dimensions should be verified.

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



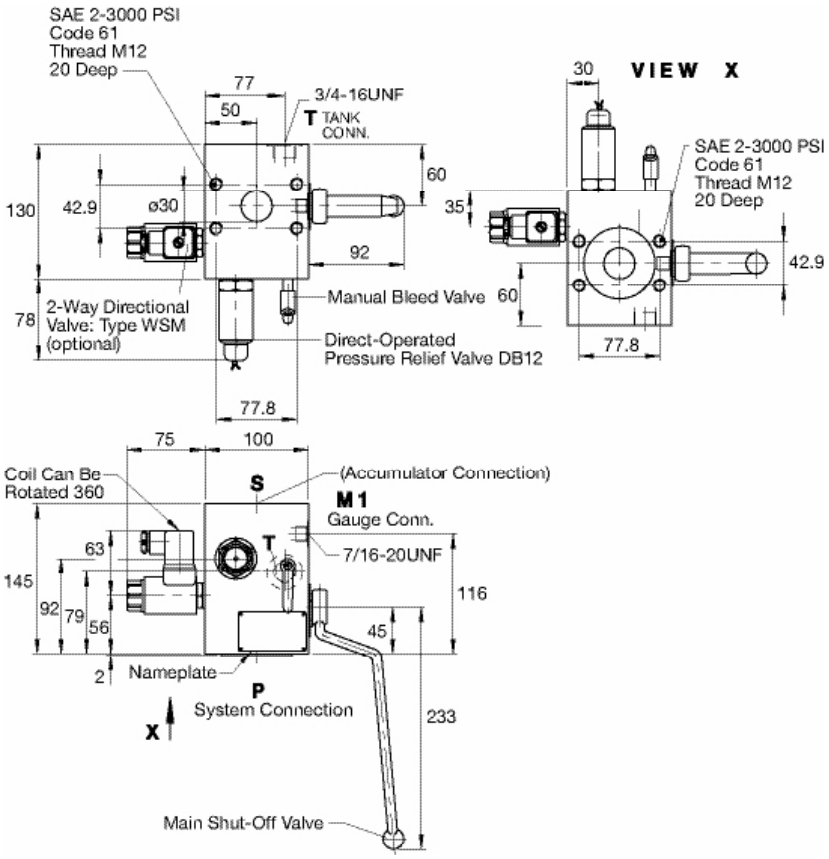
Dimensions are for general information only,
all critical dimensions should be verified.

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.

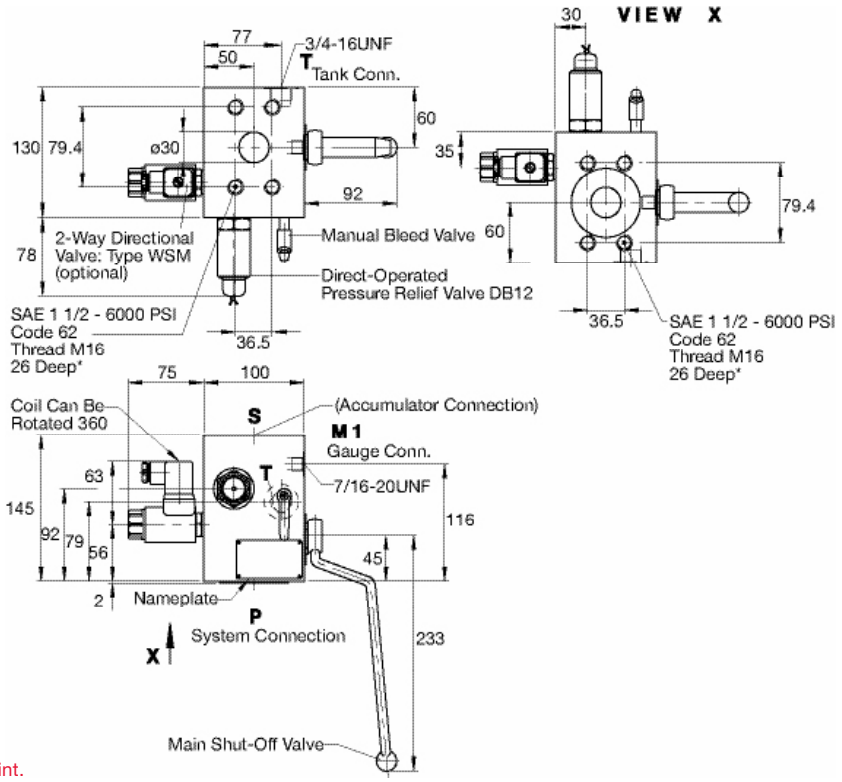
Dimensions

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

Fig. 1

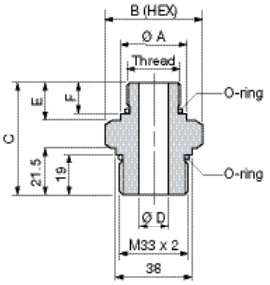
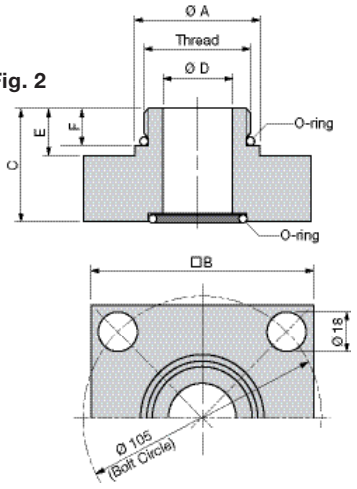


Fig. 2

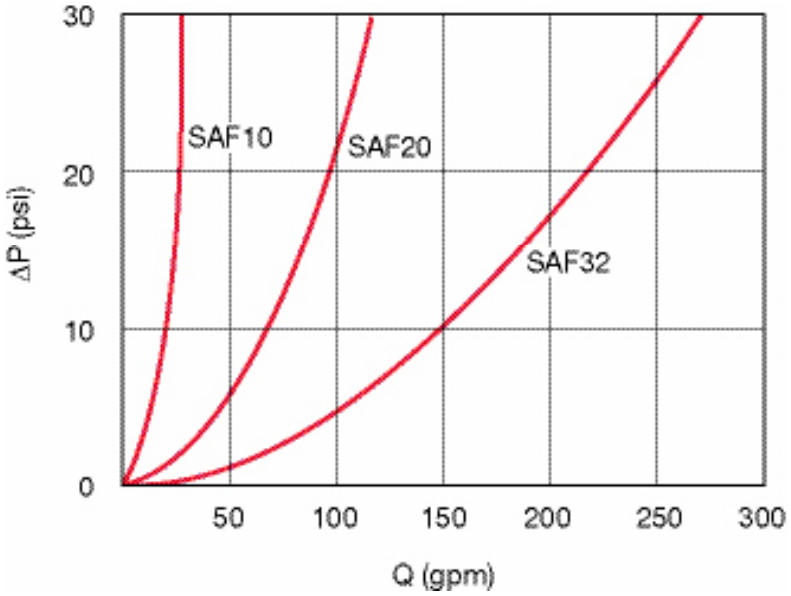


Type SAF	Accumulator Type	Adapter	Fig.	Thread	A	B	C	D	E	F
SAF 10/20	SB330-Size 1 / SBO-Size 2 to 3.5	S 60	1	1 1/16-12 UN	32	41	55	14	19	15
	SBO-Size 1.4, 29 3.5 SK280-100mm bore	S 61	1	1 5/16-12 UN	38	41	55	20	19	15
	SB330-Size 4 to 6 / SB600-Size 1 to 4	S 62	1	1 5/8-12 UN	48	66	57	23	19	15
	SB330/600-Size 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

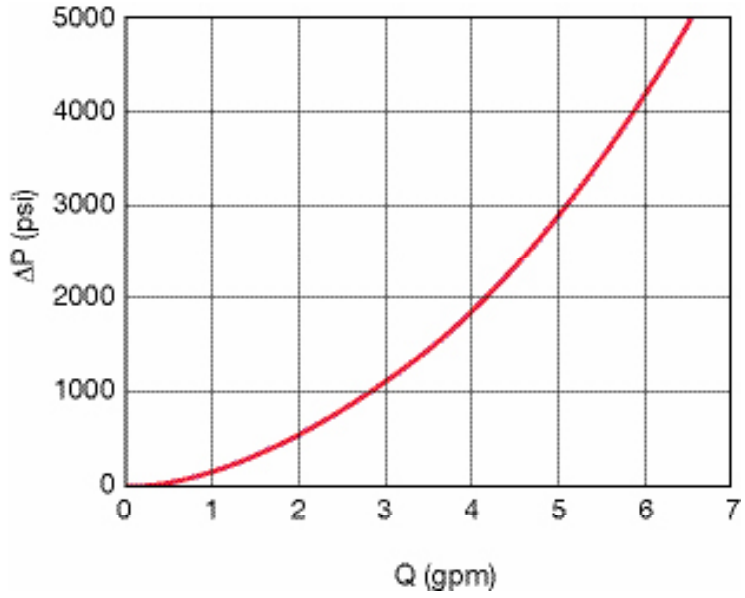
Dimensions In millimeters
Dimensions are for general information only,
all critical dimensions should be verified.

Pressure Drop Charts

Through Main Shut-off Valve



Through Solenoid Valve



Safety & Shut-off Blocks - Spare Parts

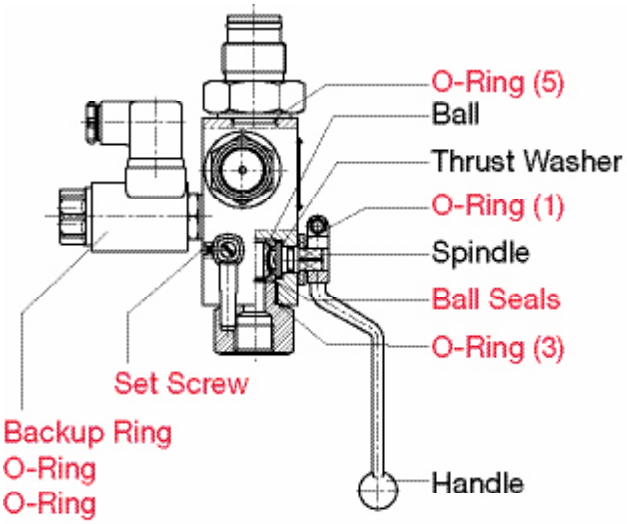
Seal Kits & Repair Kits

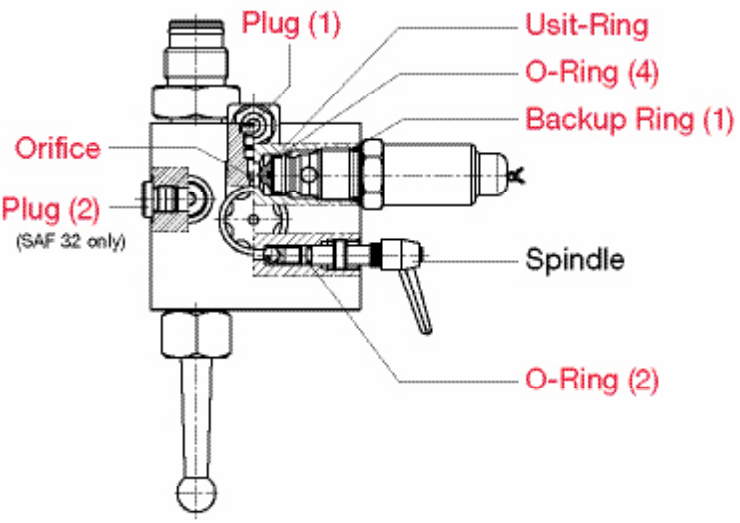
Repair Kits

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

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 Guage 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, Venezula
- G11 = China
- G12 = Australia

Case
- K = plastic carrying case *(standard)*

Additional Accessories:

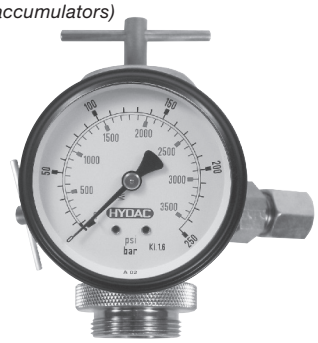
ADAPTER A3 (FPK/SB) = adapter for using FPK Charging Unit to fit HYDAC gas valve version 4, including top repairable bladder accumulators
NOTE: for other adapters please consult factory.
6mm Allen Wrench *(for HYDAC Gas Valve Version 1, included with FPK Kits)*
14mm Open End Wrench *(for HYDAC gauge, 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.

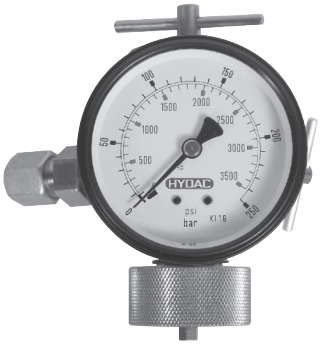
Model FPS

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



Model FPK

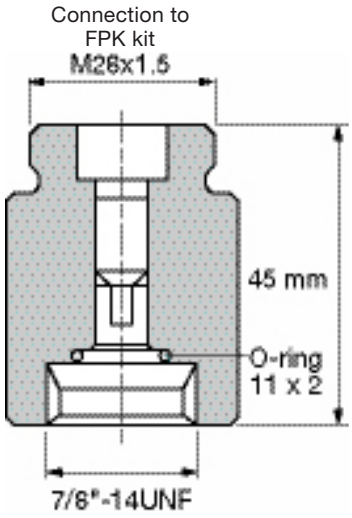
For use with gas valve version 1.



Adapter A3 (FPK/SB)

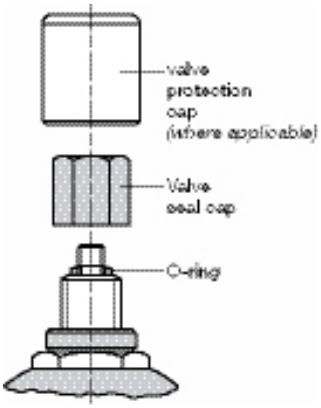
Part No. 291533

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

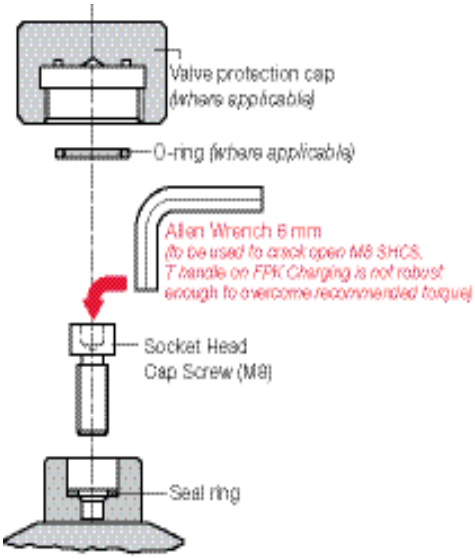
On a Bottom Repairable Bladder Accumulator as well as Diaphragm Accumulators with E4 gas valve and piston accumulators with VE Gas Valve.

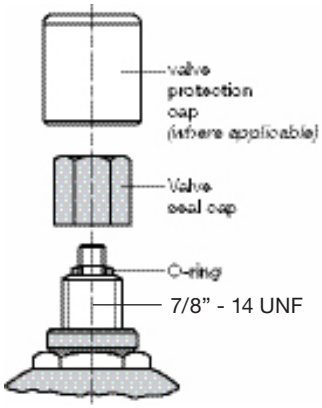


Gas Valve Version 1

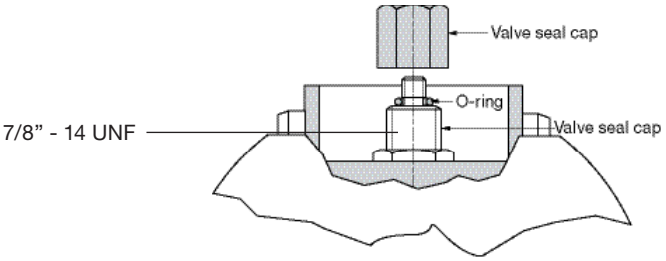
Metric, M28 x 1.5

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





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

FPO 210 F 3 - K

Charging and Gauging Unit
FPO = for use with Gas Valve Version 4 (8VI-ISO 4570) for SB, SBO and SK

Gauge Pressure Range
210 = 0 to 3000 psi (0 to 210 bar)

Charging Hose
F = with nitrogen bottle connection CGA-580

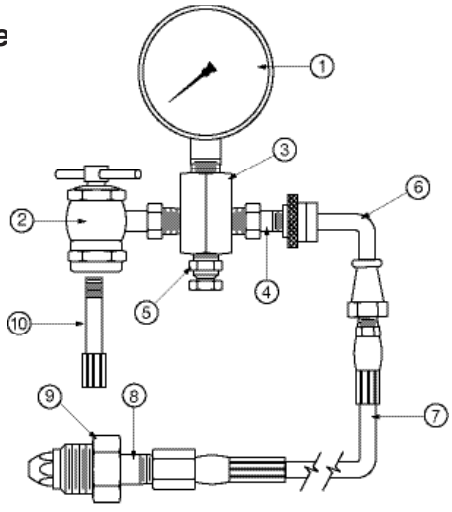
Charging Hose Length
3.0 = 10 ft. (3 m)

Case
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

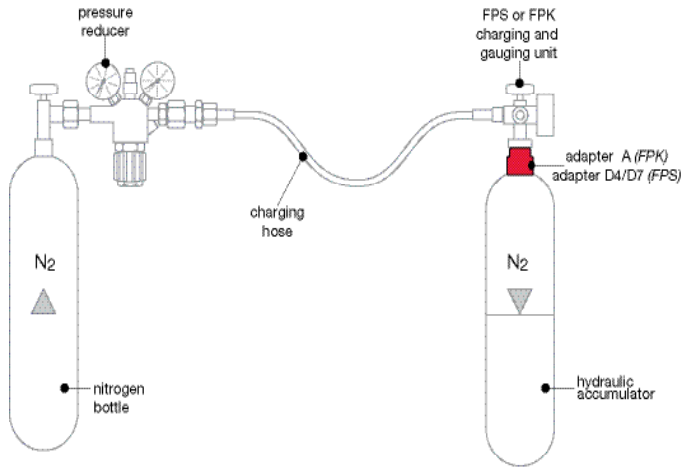


Part Description	Item	Quantity	Part No.
FPO 210 Replacement Kit consists of:			2083385
Pressure Gauge, 3000 PSI	1	1	2701622
T-Handle Lock Chuck	2	1	2701615
Charging Manifold, FPO	3	1	*consult factory*
Tank Valve	4	1	2701617
Bleeder Valve	5	1	*consult factory*
Charging Manifold / Bleeder Valve Assembly	3 / 5		2089952
Hose Assembly FPO 210 (CGA 580) consists of:			2086622
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

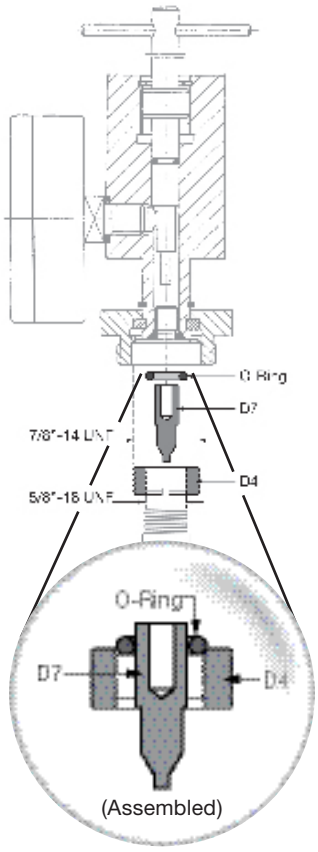
PN#02068195 / 1.15 / ACU1102-1326

Adapters

Connecting Charging & Gauging Units to 3000 psi Accumulators



FPS Unit with Adapter D4/D7

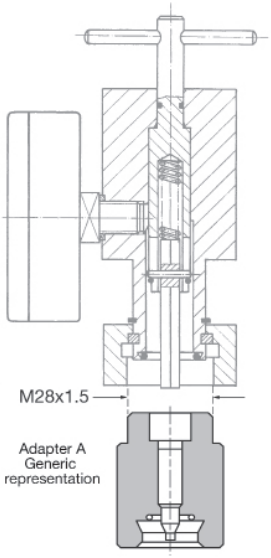


Adapter D4/D7

Part Number 02067646

Used with FPS Charging & Gauging Unit

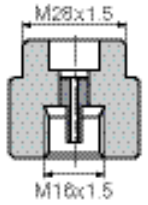
FPK Unit with Adapter A*



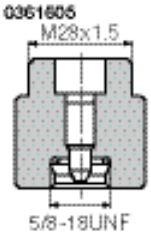
*A Adapters

Used with FPK Charging & Gauging Unit

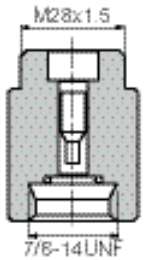
A1
PN 00361519



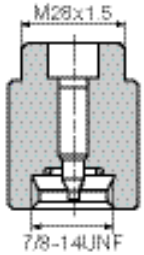
A2
PN 0361605



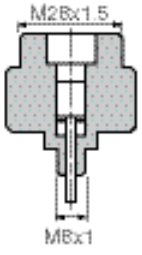
A3 (ADAPTER FPK/SB)
PN 00291533



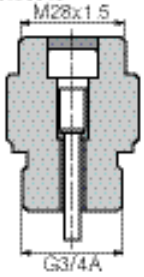
A4
PN 00291535



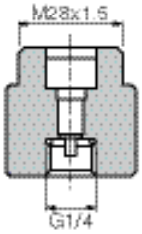
A5
PN 00291531



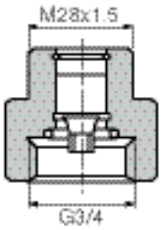
A6
PN 02108819



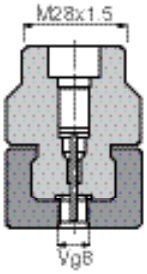
A7
PN 02110629



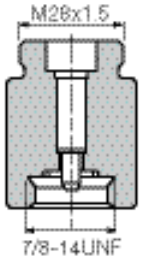
A8
PN 02124524



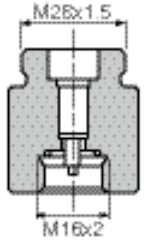
A9
PN 02128638



A10
PN 02128649



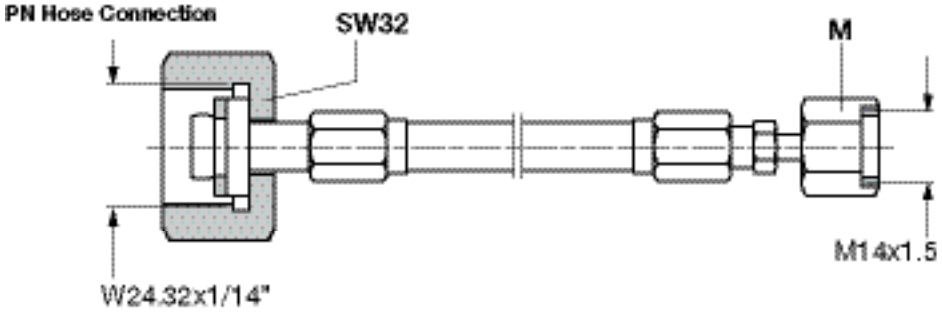
A11
PN 03018210



G Adapters - Connects Charging Hose to Gas Bottle

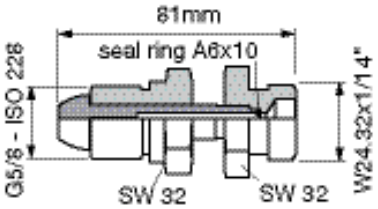
G2 through G11 to be used to adapt from G1
connection on 3000psi hose to N_2 Bottle or regulator

G1
PN Hose Connection

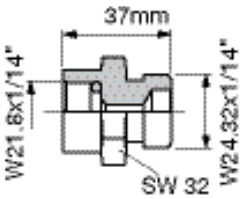


**Included in all charging kits

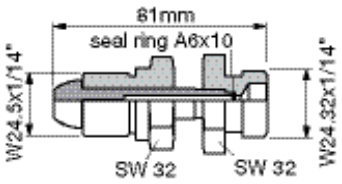
G2
PN 00236376



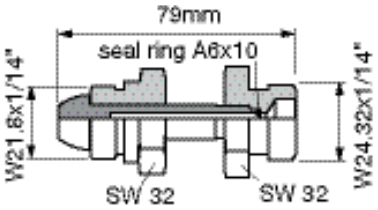
G3
PN 02103421



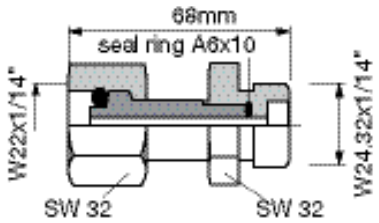
G4
PN 02068737



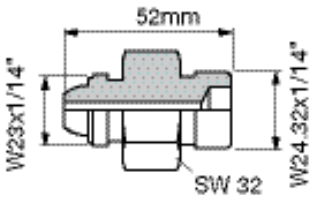
G5
PN 00236373



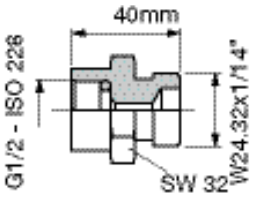
G6
PN 02103423



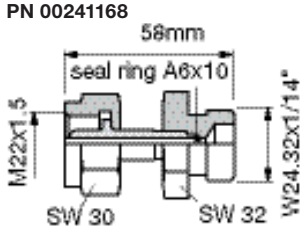
G7
PN 00236377



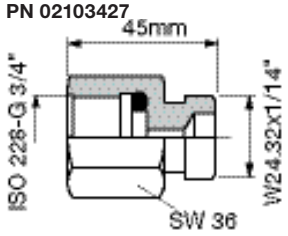
G8
PN 02103425



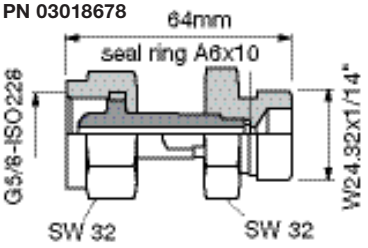
G9
PN 00241168



G10
PN 02103427

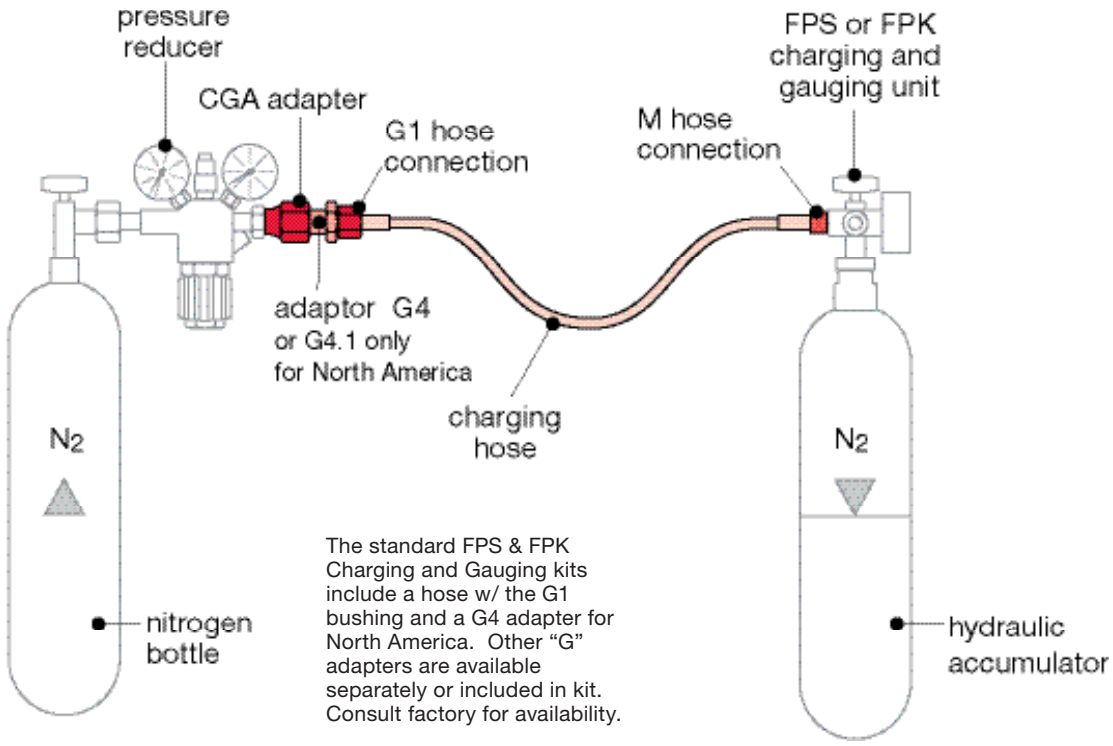


G11
PN 03018678

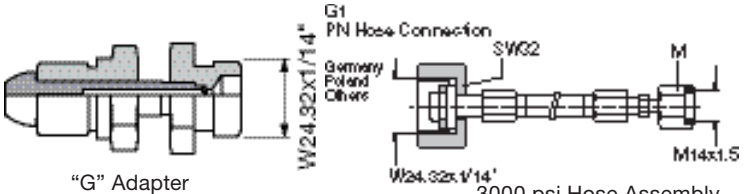


G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	G11
Germany Poland Others	India Argentina Great Britain Vietnam Indonesia Others	France Egypt Mexico Israel Others	Canada USA Brazil	Italy	Japan	Korea	Peru Columbia Others	Taiwan	Russia Trinidad & Tobago Venezuela	China

Connecting Charging Hose to Gas Bottle



The standard FPS & FPK Charging and Gauging kits include a hose w/ the G1 bushing and a G4 adapter for North America. Other "G" adapters are available separately or included in kit. Consult factory for availability.



"G" Adapter (see page 80)

3000 psi Hose Assembly

Charging Hoses

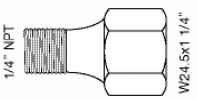
WP	Length	Part No.
3000 psi	2.5 m	236514
	4.0 m	236515
	10.0 m	373405
	15.0 m	2115552
	20.0 m	2109765
	28.0 m	2109574

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

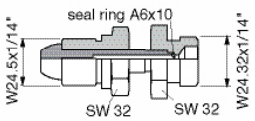
CGA 580 Adapter *(for USA only)*

PN 02701355

From G4 Adapter to Regulator



CGA 580 Adapter

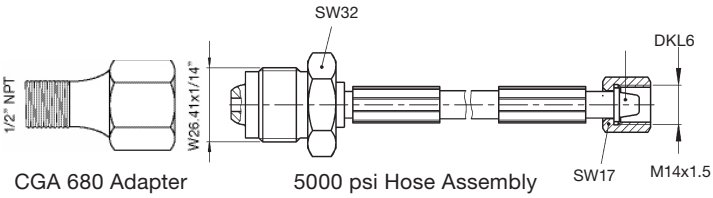


"G4" Adapter

CGA 680 Adapter *(for USA only)*

PN 02701356

From G4.1 Adapter to Regulator



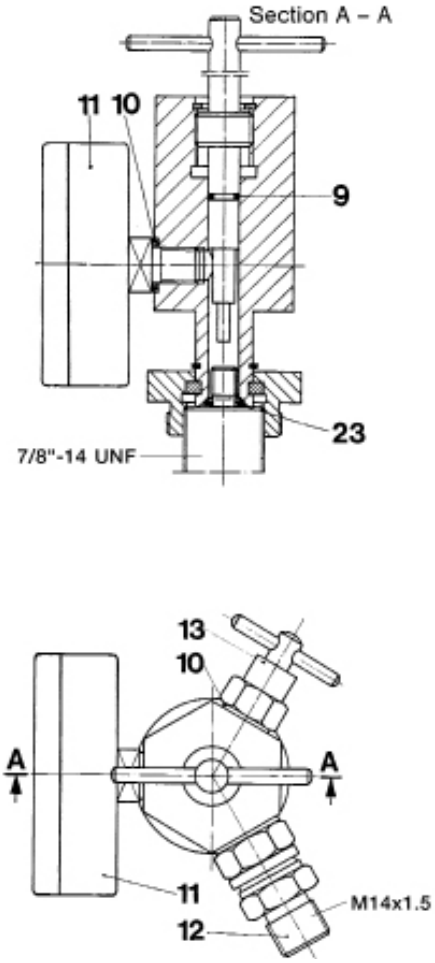
CGA 680 Adapter

5000 psi Hose Assembly

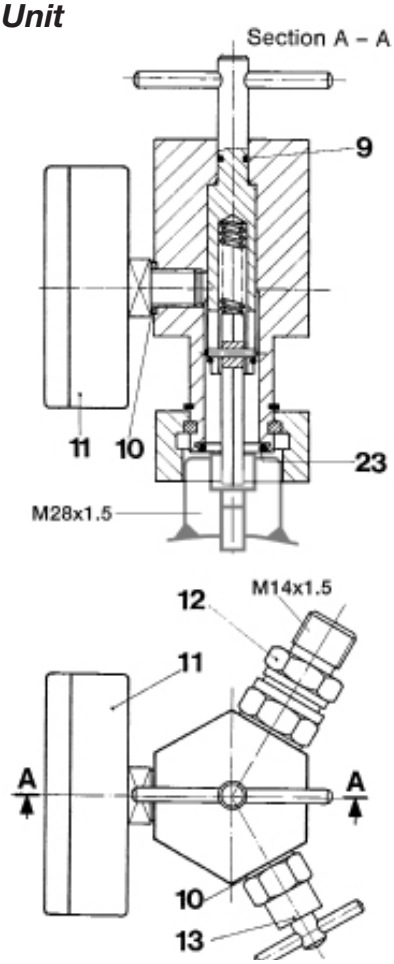
Charging & Gauging Units

Spare Parts

FPS Unit



FPK Unit

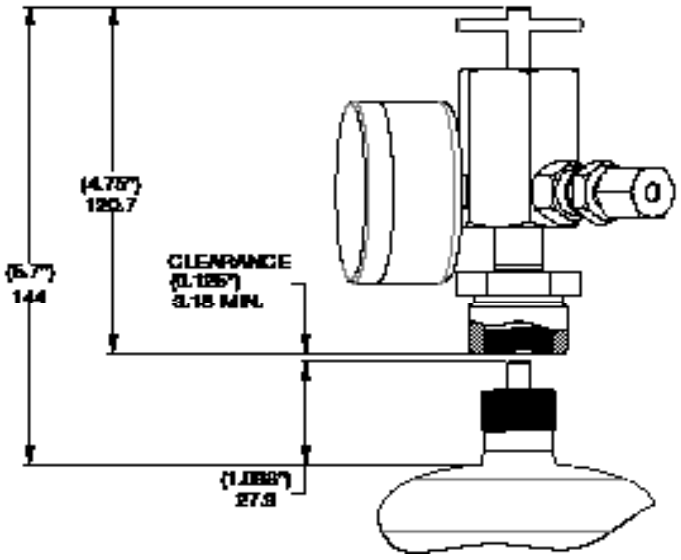


Item	Description	Part No.
9	O-Ring	601032
10	Seal-Ring	601228
11	Gauge *(select pressure range below)*	
	10 (0 to 145 psi)	606759
	25 (0 to 350 psi)	606760
	100 (0 to 1400 psi)	606761
	250 (0 to 3600 psi)	606762
	400 (0 to 5800 psi)	606763
12	Check Valve	610004
13	Manual Bleed Valve	236445
23	O-Ring - 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

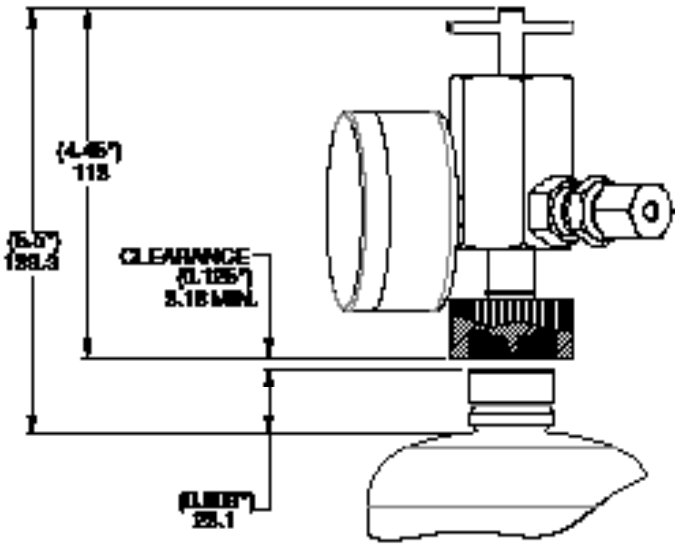
WARNING: Only qualified persons should perform maintenance on any type of accumulator. Complete maintenance instructions are available - Contact HYDAC.

Minimum Clearances for Charging & Gauging Kits

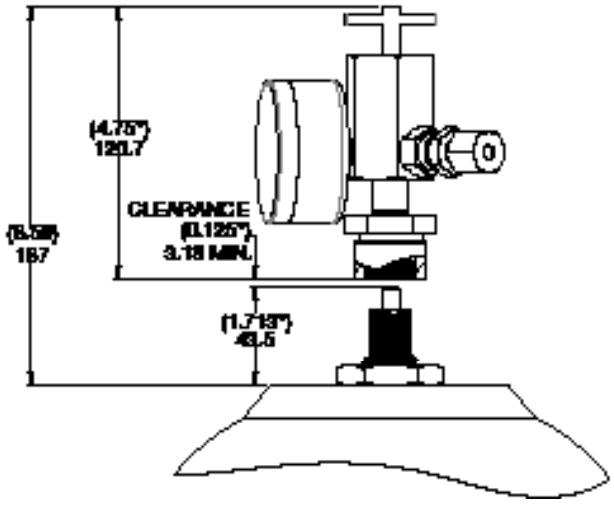
Diaphragm (SBO) and Bladder (SB) Accumulators



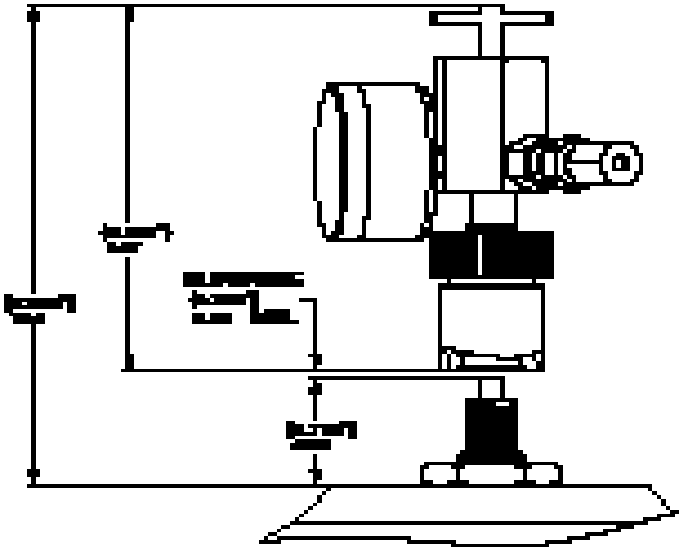
Diaphragm (SBO), Version 4 Gas Valve (8VI-ISO 4570) FPS Charging & Gauging Kit



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

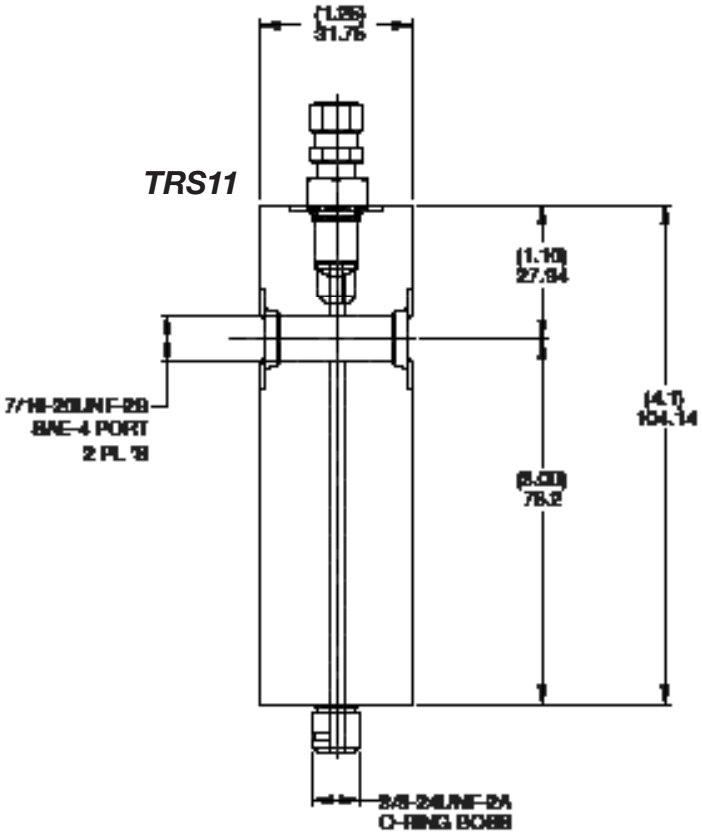


Bladder (SB), Version 4 Gas Valve (8VI-ISO 4570) FPS Charging & Gauging Kit



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)

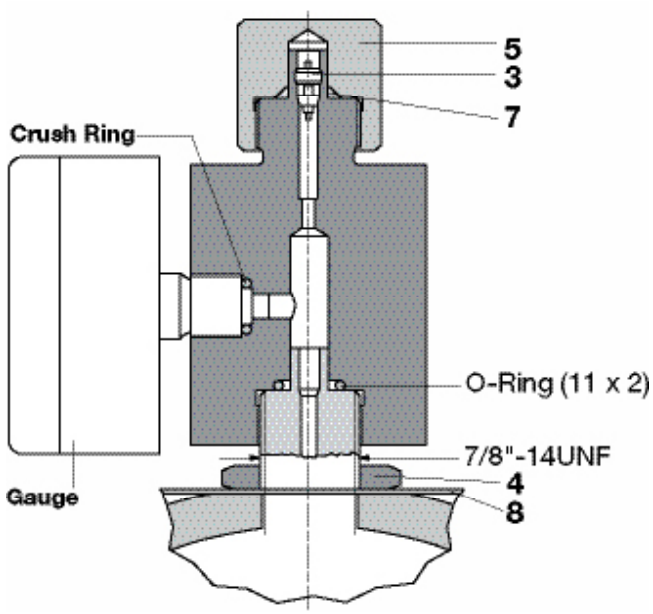
Accumulator Type
(omit) = Bottom Repairable *(standard)*
TR = Top Repairable
TR S11 = Top Repairable *(Oil & Gas / Offshore)*

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

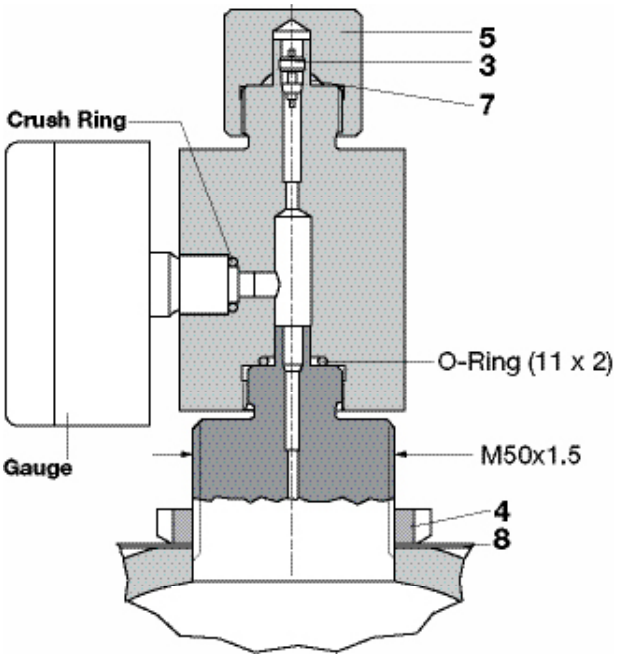
PN#02068195 / 1.15 / ACU1102-1326

Installation Drawings
Permanent Gauging Blocks for HYDAC Gas Valve Version 4

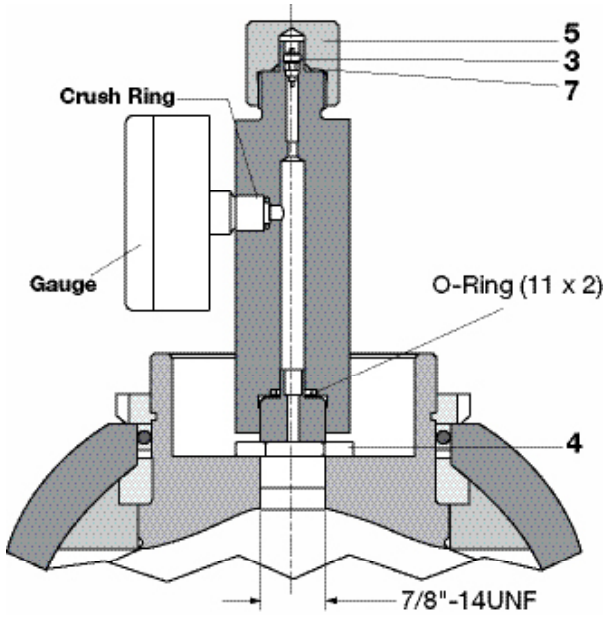
Bottom Repairable Bladder



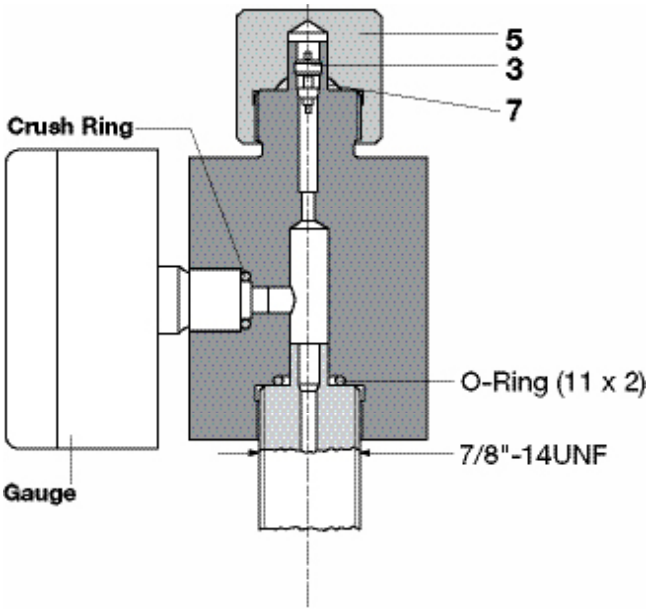
Bottom Repairable Bladder with M50 Gas Valve



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.

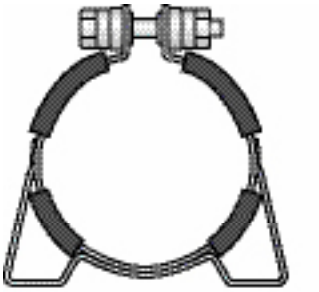
Conversely, the heavy duty clamps have a two piece construction. This allows for easy installation and removal while improving the strength to weight ratio.

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.

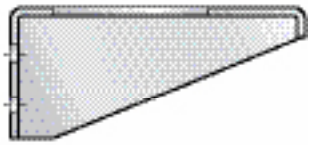
Application guides are provided on the following pages to easily match the appropriate mounting components with HYDAC accumulators.

HS - Regular Duty Clamp

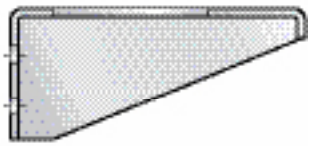


HSS - Heavy Duty Clamp

KBK - Base Bracket

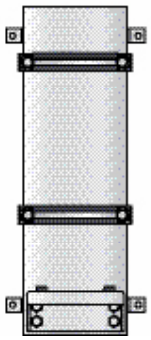


KMS - Base Bracket for Threaded Diaphragm



HyRac Clamp

SEB - Complete Mounting Sets



PN#02068195 / 1.15 / ACU1102-1326

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-**15**H *(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

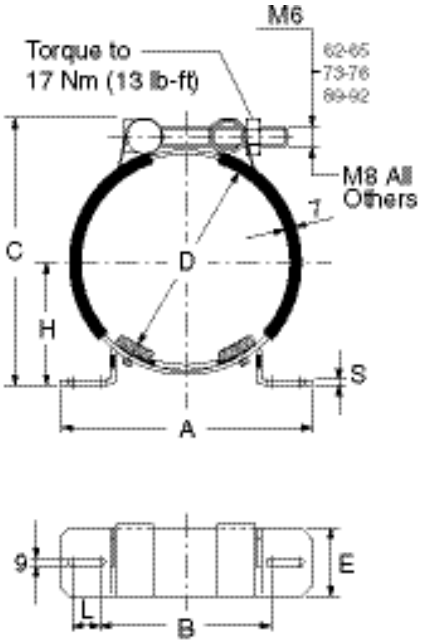
Accumulator Type	Base Bracket Type	Part Number
SBO 210-1.3 A6	KMS 200	359931
SBO 400-1.3 A6	KMS 210	358989
SBO 180-2 A6	KMS 220	359922
SBO 250-2 A6	KMS 220	359922

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

Dimensions

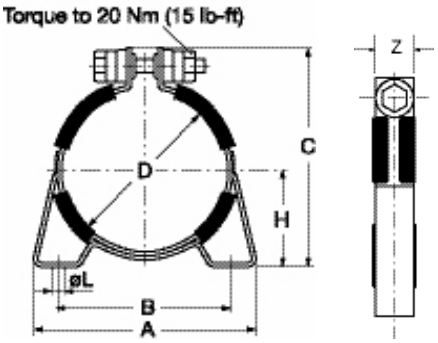
Use the Selection Guide on page 71 to select the appropriate components.

HyRac - Stainless Steel Strap with swivel-bolt adjustment



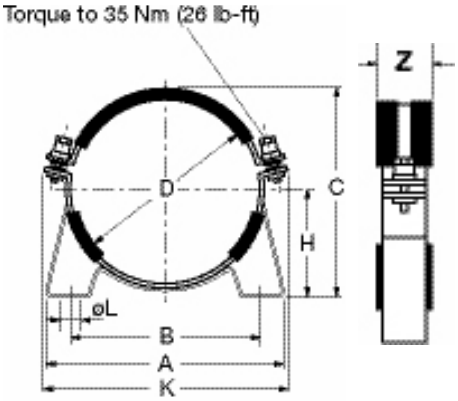
Clamp Model	A	B	C	D (range)	E	H	L	S	Weight kg (lbs)
HyRac 62-65 ST	120 4.72	85 3.34	90 3.54	62-65 2.4-2.6	40 1.6	39-40.5 1.5-1.6	6 0.24	3 0.12	0.16 (0.35)
HyRac 73-76 ST	120 4.72	85 3.34	101 3.98	73-76 2.9-3.0	40 1.6	49.5-46 1.9-1.8	6 0.24	3 0.12	0.16 (0.35)
HyRac 89-92 ST	120 4.72	85 3.34	116 4.57	89-92 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

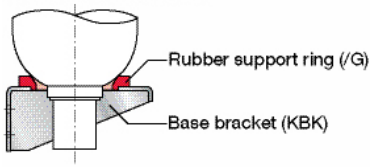


Clamp Model	D	D (range)	A	B	C (ref.)	H	K	ØL	Z	Weight kg.(lbs)
HSS 219	219 8.62	216-222 8.50-8.74	268 10.55	216 8.50	240 9.45	123 4.84	285 11.22	15 0.59	40 1.57	1.7 3.8
HSS 222/229	226 8.90	220-231 8.66-9.10	270 10.63	216 8.50	244 9.61	123 4.84	295 11.61	15 0.59	40 1.57	1.7 3.8
HSS 242	242 9.53	231-242 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

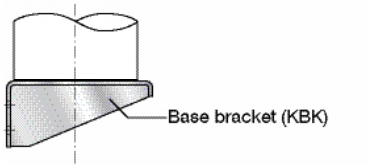
Dimensions are in mm with inches shown below.
Dimensions are for general information only,
All critical dimensions should be verified.

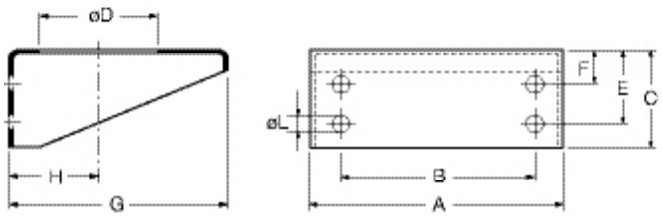
KBK - Base Bracket for Bladder and Piston Accumulators

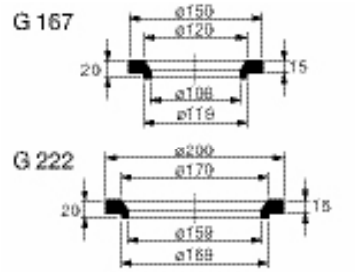
Bladder Accumulator



Piston Accumulator







Base Bracket with Rubber Support Ring

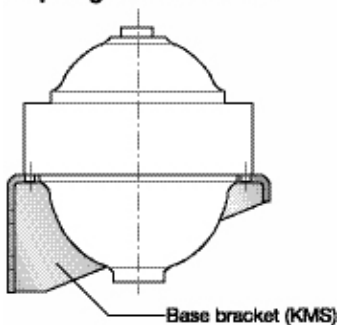
Model	A	B	C	øD	E	F	G	H	øL	Weight kg.(lbs)	Rubber Support Ring
KBK 167/G	260 10.24	200 7.87	100 3.94	120 4.72	75 2.95	35 1.38	225 8.86	92 3.62	14 0.55	2.6 (5.7)	G 167
KBK 222/G	260 10.24	200 7.87	100 3.94	170 6.69	75 2.95	35 1.38	225 8.86	123 4.84	14 0.55	2.4 (5.3)	G 222

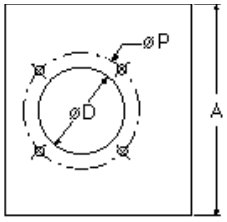
Base Brackets without Rubber Support Ring

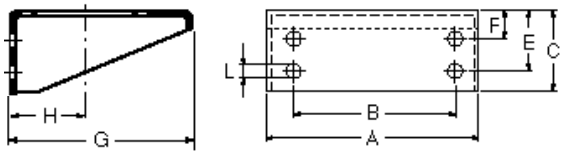
KBK 126	175 6.89	100 3.94	60 2.36	65 2.56	36 1.42	N/A	150 5.91	77 3.03	14 0.55	1.1 (2.43)	None
KBK 219	270 10.63	180 7.09	100 3.94	135 5.31	80 3.15	40 1.57	250 9.84	123 4.84	14 0.55	6.5 (14.4)	None
KBK 310	330 12.99	220 8.66	200 7.87	190 7.48	140 5.51	60 2.36	340 13.39	170 6.69	14 0.55	18.3 (40.4)	None

KMS - Base Bracket for Threaded Diaphragm Accumulators

Diaphragm Accumulator



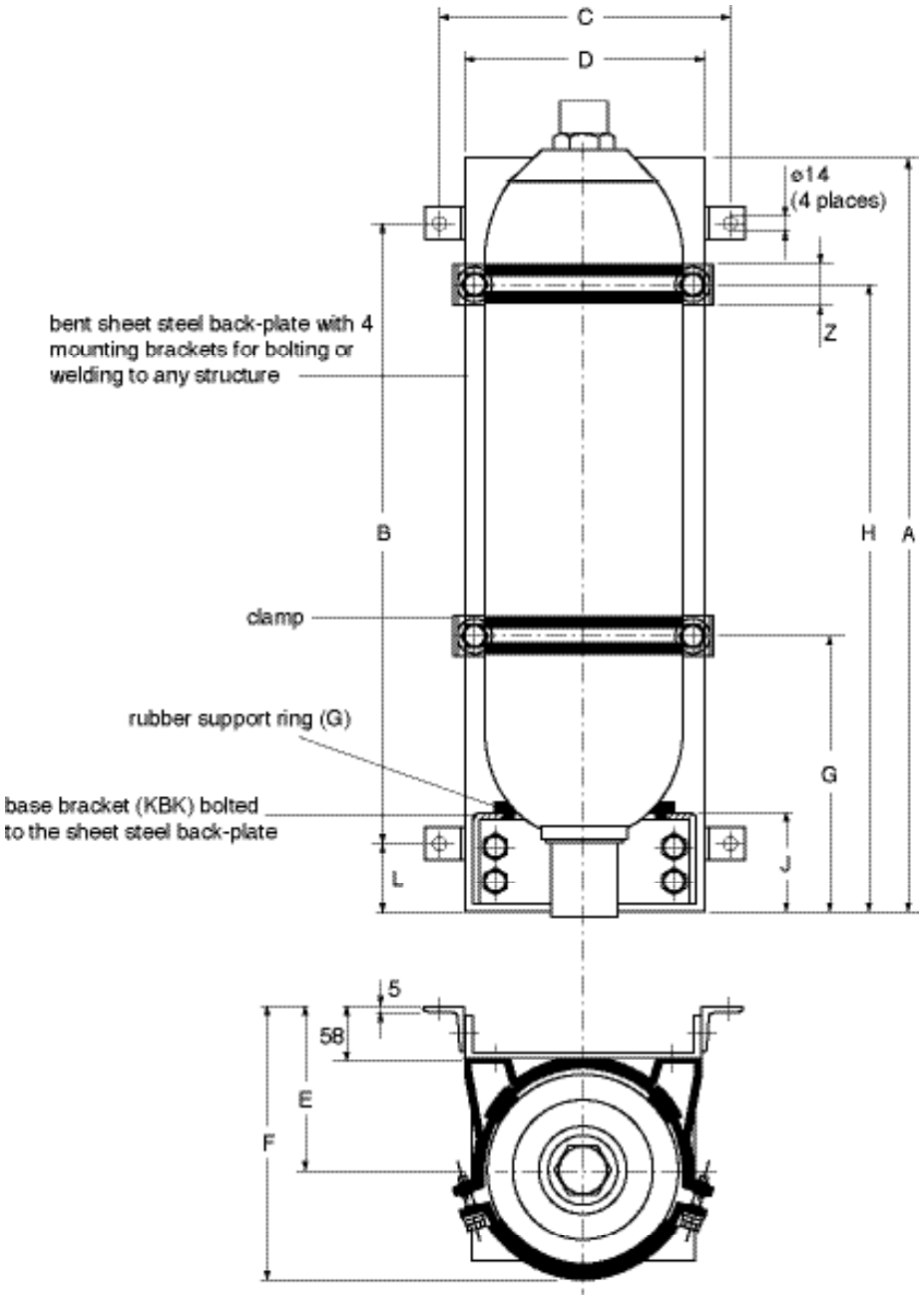




Base Bracket Model	A	B	C	øD	øP	E	F	G	H	øL	Weight kg.(lbs)
KMS 200	270 10.63	180 7.09	100 3.94	148 5.83	160 6.30	80 3.15	40 1.57	250 9.84	123 4.84	14 0.55	6.5 (14.4)
KMS 210	260 10.24	200 7.87	100 3.94	170 6.69	180 7.09	75 2.95	35 1.38	225 8.86	123 4.84	14 0.55	2.4 (5.3)
KMS 220	260 10.24	200 7.87	100 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	220	200	215	230	140	60	340	170	22	18.3
		36	7.87	8.46	9.06	5.51	2.36	13.39	6.69	0.87	(40.4)
		20	200	220	235	140	60	340	170	22	18.3
		36	7.87	8.66	9.25	5.51	2.36	13.39	6.69	0.87	(40.4)
		20	200	245	265	140	60	340	170	22	18.3
		36	7.87	9.65	10.43	5.51	2.36	13.39	6.69	0.87	(40.4)
		20	200	290	305	140	60	340	170	22	18.3
		36	7.87	11.42	12.01	5.51	2.36	13.39	6.69	0.87	(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

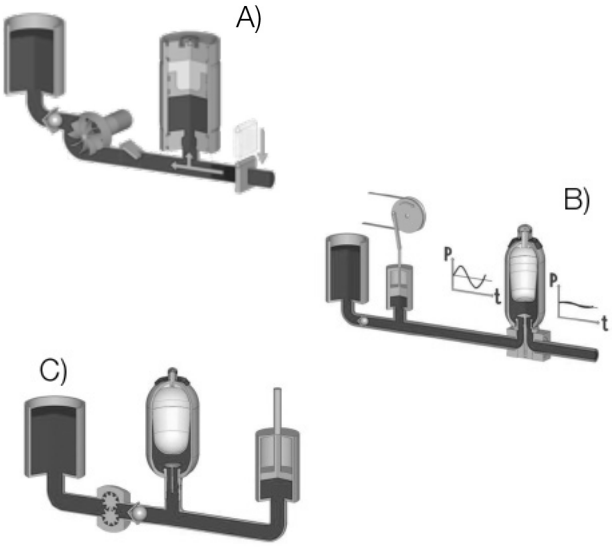
Typical Applications

There are three common applications for Accumulators:

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

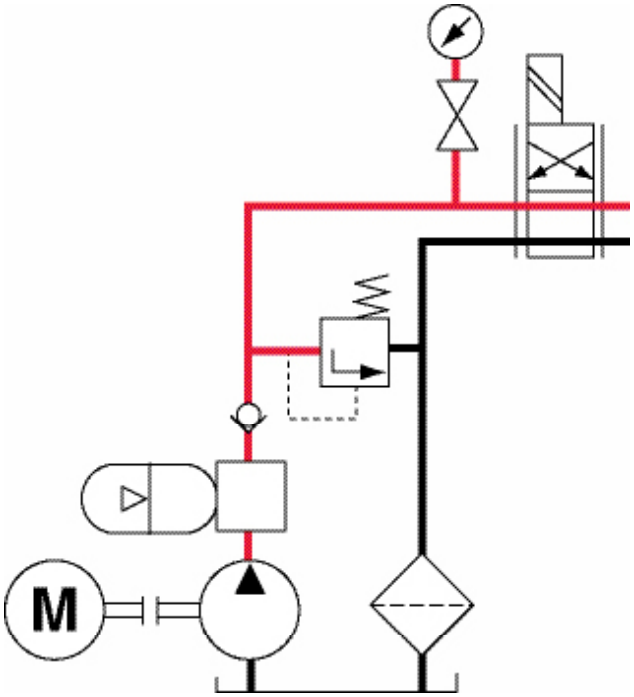
The pages and sizing forms that follow can be used as a guide.

These forms are available online at www.hydacusa.com



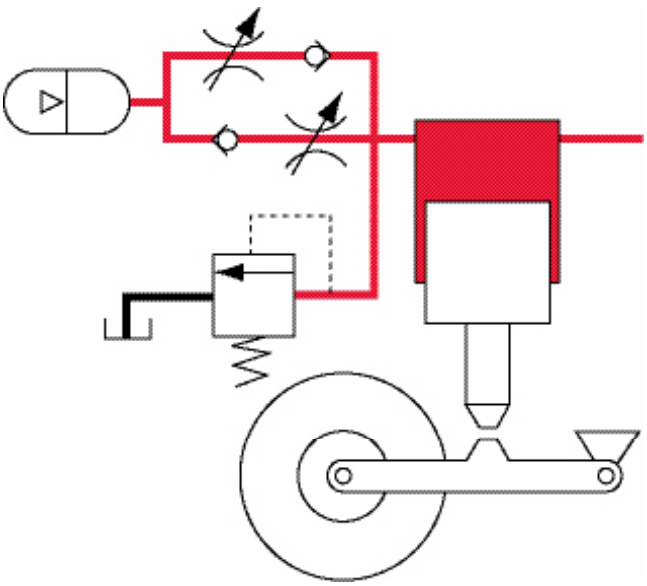
Pulsation Dampeners for Displacement Pumps

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



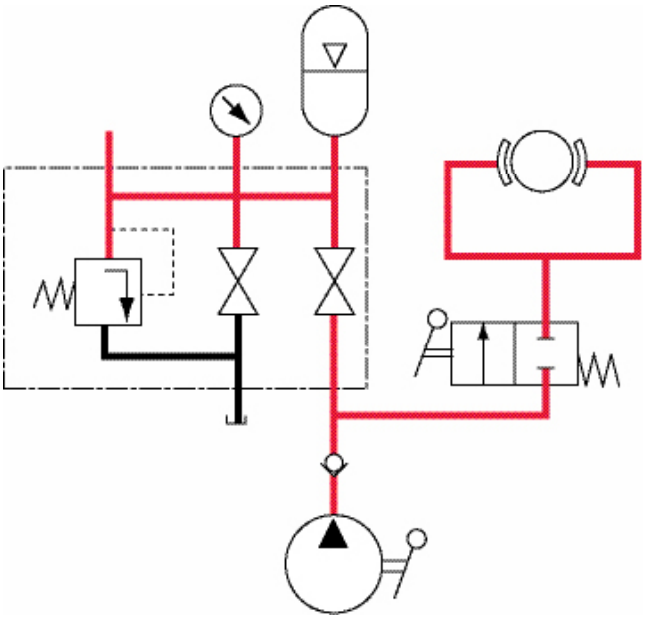
Shock Absorption - Spring Element

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.



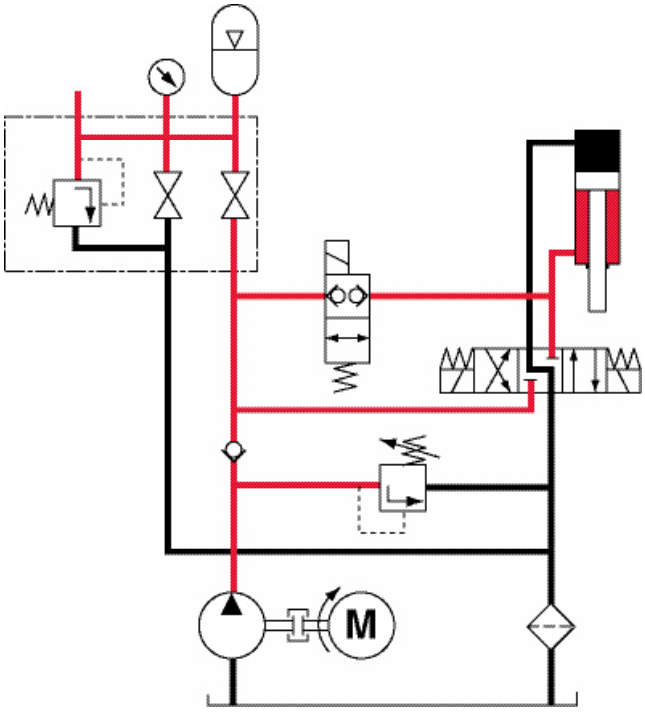
Energy Storage - Emergency Brakes

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



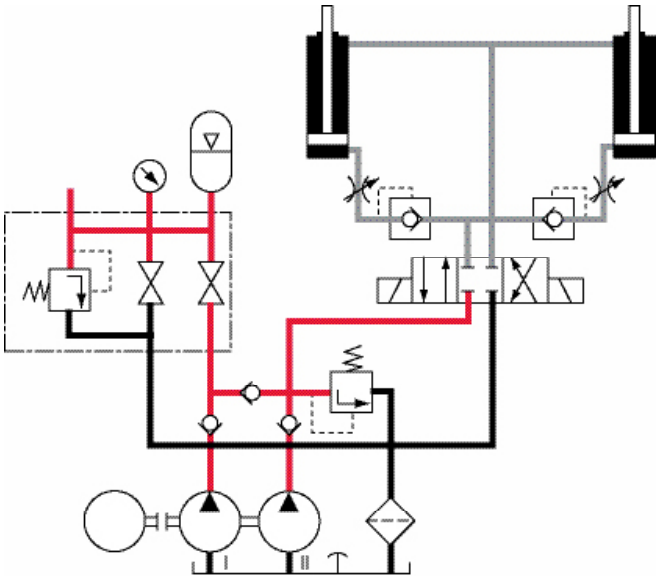
Energy Storage - Emergency Operation of a Hydraulic Cylinder

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



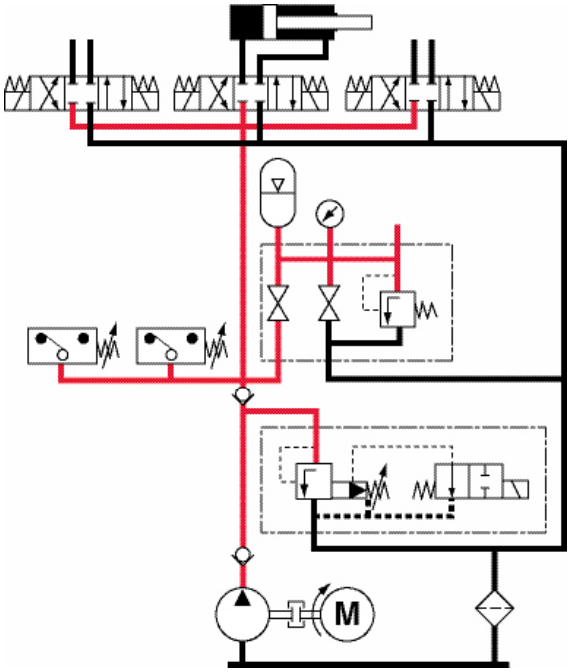
Energy Storage and Shortening of Cycle Time

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



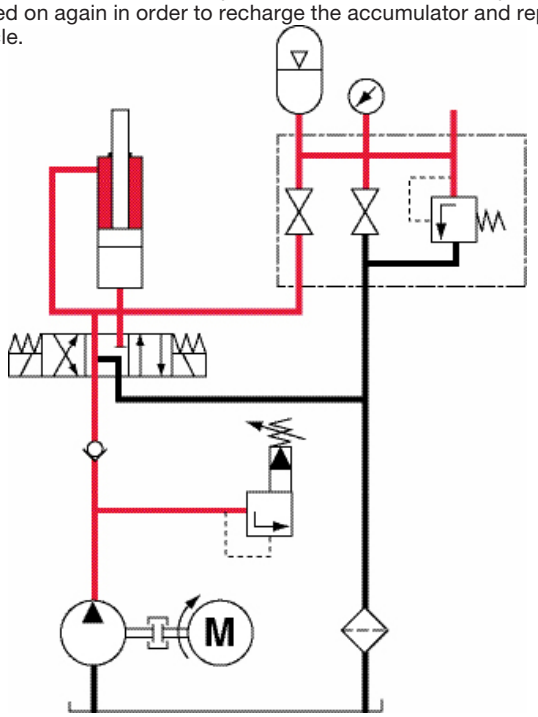
Energy Storage in an Injection Molding Machine

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.



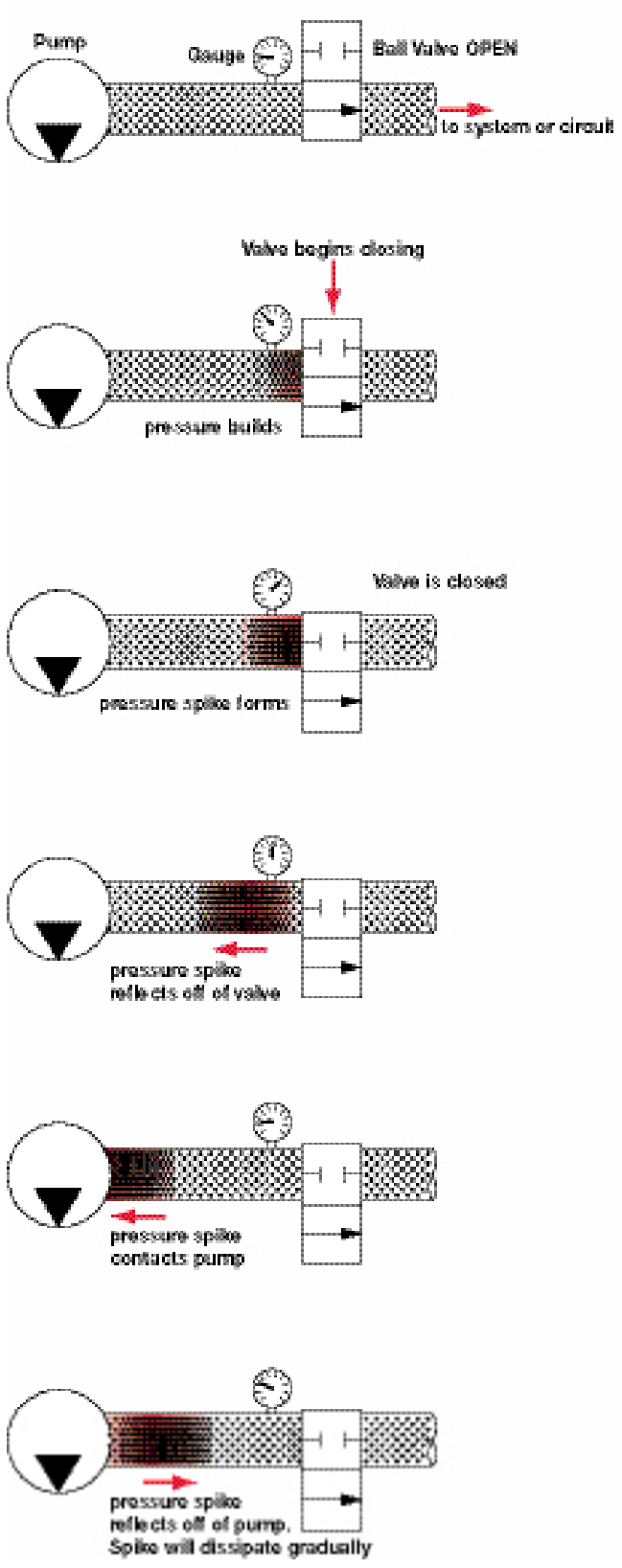
Energy Storage - Leakage Oil Compensation

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.

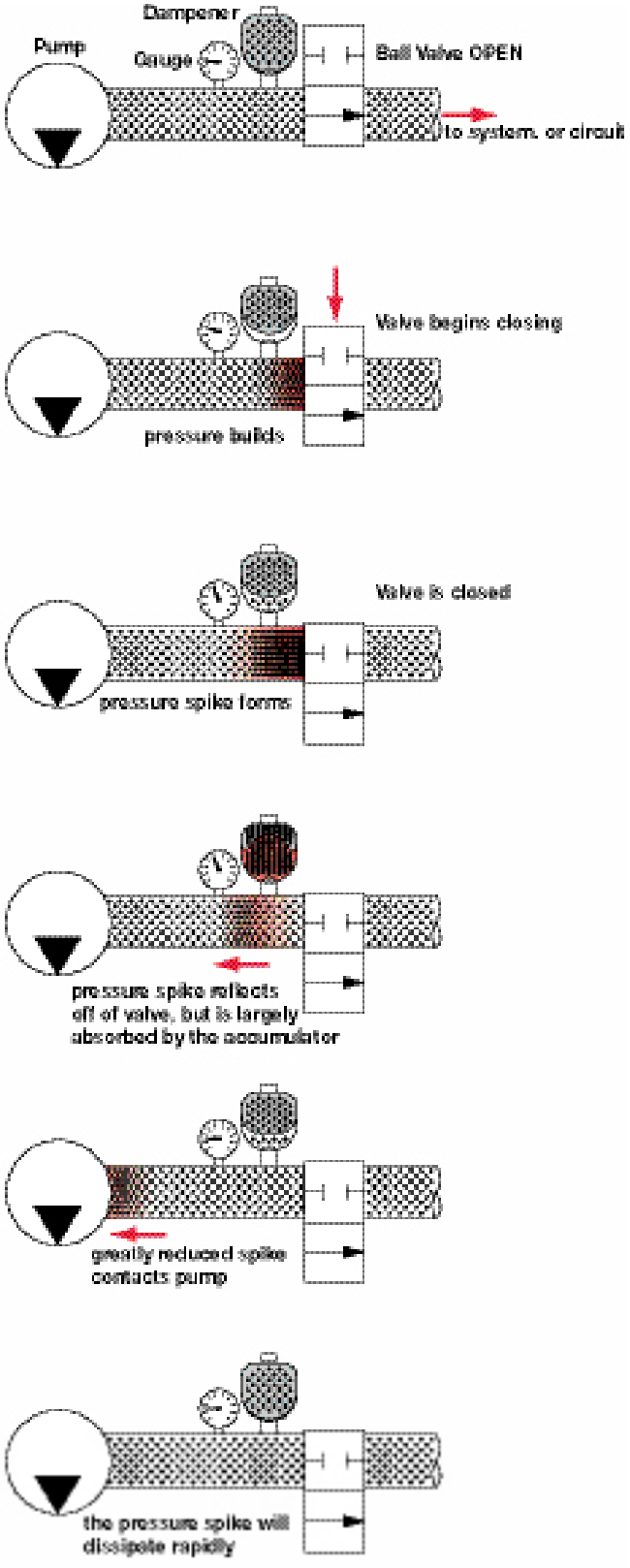


Graphic Example of a Pressure Spike

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 p1

V_2 = gas volume at p2

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.

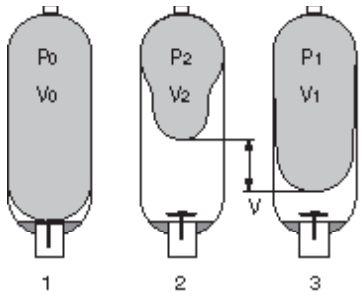
- At P_2, the gas volume in the piston accumulator is V_2.
- At this step the maximum amount of fluid possible for a particular system pressure range is inside the accumulator and the fluid is exerting force on the piston and compressing nitrogen gas to the smallest gas volume.

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.

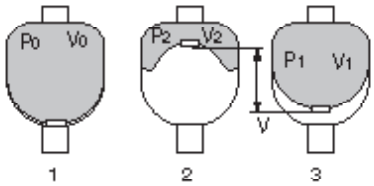
- P_1 is the maximum gas volume during hydraulic system operation and correlates to the smallest possible fluid volume inside the accumulator during system operation.
- The amount of fluid that is expelled, or supplied, to the hydraulic system is ΔV, where $\Delta V = V_1 - V_2$
- A small amount of fluid should remain inside the accumulator at P1, 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

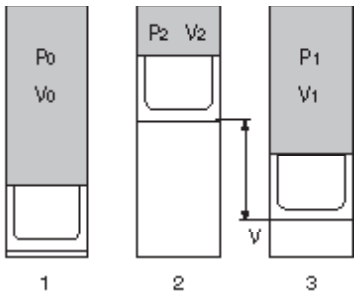
Bladder



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 dampening:

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

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 $T_1 \le T_x \le T_2$

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

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

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 $T_1 \le T_x \le T_2$

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

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

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 isothermically, 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 V_0 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 behavior[2]

For isothermal change of condition:

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

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

for adiabatic change of condition:

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

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

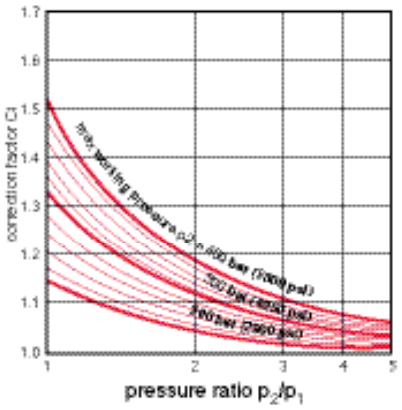
The C_i and C_a can be determined from the following Correction factor graphs.

Calculate the ratio of Max/Min pressure, p_2/p_1.

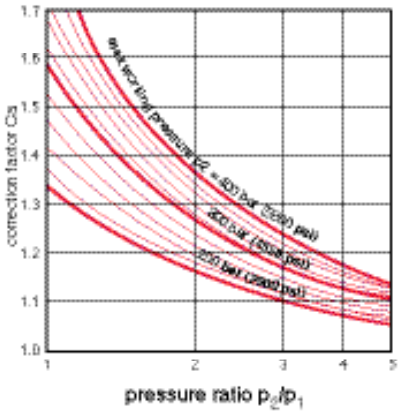
On the graph find the intersection of p_2/p_1 and the maximum working system pressure p_2, which is shown as a curve on the graphs for either an isothermal or adiabatic change of condition.

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
p_2 = 3000 psi

minimum system working pressure
p_1 = 1500 psi

required fluid volume of the system
ΔV = 1.35 gallons

maximum ambient operating temperature
T_2 = 120°F

minimum ambient operating temperature
T_1 = 75°F

Determine the following:

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

Calculate gas precharge pressure p_0 at 68°F (T_0)

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 T_2:

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

b) gas precharge pressure at T_1:

$$p_0@_{T1} = p_{0\,@\,T_2} \times \left(\frac{T_1 + 460}{T_2 + 460}\right)$$

$$p_0@_{T1} = 1350 \text{ psi} \times \left(\frac{75 + 460}{120 + 460}\right) = 1245 \text{ psi}$$

c) ideal gas volume:

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

$$V_{0\,ideal} = \frac{1.35}{\left(\frac{1245}{1500}\right)^{0.714} - \left(\frac{1245}{3000}\right)^{0.714}} = 3.95 \text{ gals.}$$

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:

$V_{0,\,real} = C_a \times V_{0,\,ideal} = 1.16 \times 3.95$ gal.
= 4.6 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 p_0 at 68°F:

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

3. Selected: Size 20 (5 gallon)

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

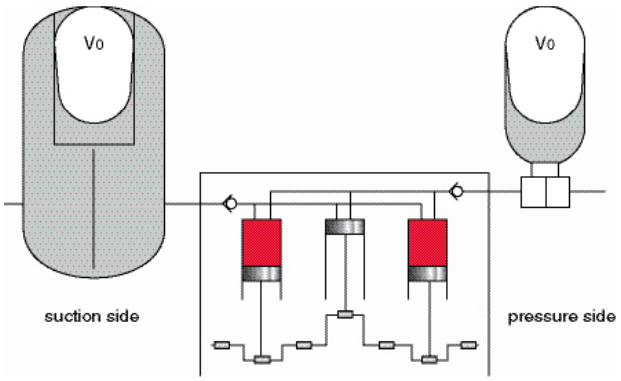
Pulsation Dampeners & Suction Flow Stabilizers

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

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

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

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

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

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

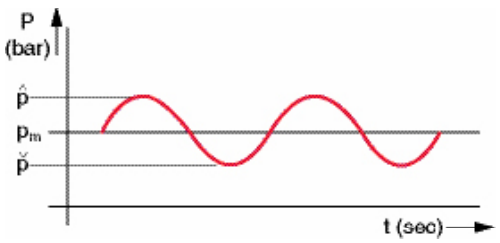
$\hat{p}$ = max. working pressure

$\check{p}$ = min. working pressure

pm = 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 ± 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

☐ Continuous Operation

☐ Emergency Operation

Maximum Operating Pressure	(P2)		PSI
Minimum Operating Pressure	(P1)		PSI
Precharge Pressure at 68˚F (20˚C)	(P0)		PSI
Temperature Range of Environment	(T)		˚F
Temperature Range of Fluid or System	(TF)		˚F
Pump Flow Rate	(QP)		GPM
Total Cycle Time of System	(TE)		Sec.
Number of Actuators *(cylinders, etc.)*	(NV)		

Actuator Time Schedule and Flow

QVi = Required Actuator Flow (GPM) **Ei** = Actuator Start Time **Ai** = Actuator Shut Down Time

(i = 1 for first actuator, i = 2 for second actuator, etc. up to NV)

QV1 =	E1 =	A1 =
QV2 =	E2 =	A2 =
QV3 =	E3 =	A3 =
QV4 =	E4 =	A4 =
QV5 =	E5 =	A5 =

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			6		
2			7		
3			8		
4			9		
5			10		

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 Stoke: _____ *(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 be 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 HYDAC

Global Presence. Local Expertise.

HYDAC has become the first US manufacturer capable of producing bladder, piston and diaphragm accumulators in the United States. Our customers can have it all – superior engineering producing state-of-the-art products in record time. That's customer service!

Industries and Applications for:

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- Oil and Gas
- Loading Station / Refineries
- Chemical Industry
- Agricultural & Forestry Machines
- Construction Machinery
- Cranes & Commercial Vehicles
- Rail Vehicles
- Automotive
- Machine Tools
- Plastics Technology
- Die Casting Machines
- Steel Industry
- Power Plants

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Global Headquarters
HYDAC INTERNATIONAL GMBH

Industriegebiet
D – 66280 Sulzbach/Saar
Germany

Tel.: +49 6897 509-01

Fax: +49 6897 509-577

Internet: **www.hydac.com**
Email: info@hydac.com

HYDAC North America Locations

USA

www.HYDACusa.com

HYDAC TECHNOLOGY CORPORATION
Filter Division
2260 City Line Road
Bethlehem, PA 18017
+1.610.266.0100

HYDAC TECHNOLOGY CORPORATION
Accessory Division
Marketing
2204 Avenue C
Bethlehem, PA 18017
+1.610.266.0100

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HYDAC CORPORATION
Accumulator Division
90 Southland Drive
Bethlehem, PA 18017
+1.610.266.0100

HYDAC TECHNOLOGY CORPORATION
Filter System Division
Process Filter Division
580 West Park Road
Leetsdale, PA 15056
+1.724.318.1100

HYDAC TECHNOLOGY CORPORATION
Hydraulic Division - Compact Hydraulics
450 Windy Point Drive
Glendale Heights, IL 60139
+1.630.545.0800

HYDAC TECHNOLOGY CORPORATION
Mobile Hydraulic Division
1660 Enterprise Parkway • Suite E
Wooster, OH 44691
+1.610.266.0100

HYDAC CYLINDERS LLC
540 Carson Road North
Birmingham, AL 35217
+1.205.520.1220

HYDAC TECHNOLOGY CORPORATION
Cooling System Division
1051 Airlie Parkway
Denver, NC 28037
+1.610.266.0100

HYDAC TECHNOLOGY CORPORATION
Cooling System Division - Industrial Office
445 Windy Point Drive
Glendale Heights, IL 60139
+1.630.545.0800

HYDAC TECHNOLOGY CORPORATION
HYDAC CORPORATION
Sales Office & Operations
1718 Fry Road, Suite 100
Houston, TX 77084
+1.281.579.8100

HYDAC TECHNOLOGY CORPORATION
HYDAC CORPORATION
NE Sales Office
1660 Enterprise Parkway • Suite E
Wooster, OH 44691
+1.610.266.0100

HYDAC TECHNOLOGY CORPORATION
HYDAC CORPORATION
SE Sales Office
1051 Airlie Parkway
Denver, NC 28037
+1.610.266.0100

HYDAC TECHNOLOGY CORPORATION
HYDAC CORPORATION
NW Sales Office
1201 NE 144th St. Bldg. B, Suite 111
Vancouver, WA 98685
+1.610.266.0100

Canada

www.HYDAC.ca

HYDAC CORPORATION
14 Federal Road
Welland, Ontario, Canada L3B 3P2
+1.905.714.9322

HYDAC CORPORATION
Sales Office
Montreal, Québec, Canada J2M 1K9
+1.877.539.3388

HYDAC CORPORATION
Sales Office
101 - 18207 114 AVE W
Edmonton, Alberta, Canada T5S 2P6
+1.780.484.4228

Mexico

www.HYDACmex.com

HYDAC INTERNATIONAL SA de CV
Calle Alfredo A Nobel #35
Col Puente de Vigas
Tlalnepantla, Edo Mexico
CP. 54075
+011.52.55.4777.1262