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⚠ WARNING

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 Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having expertise. It is important that you analyze all aspects of your application, including consequences of any failure 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.

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

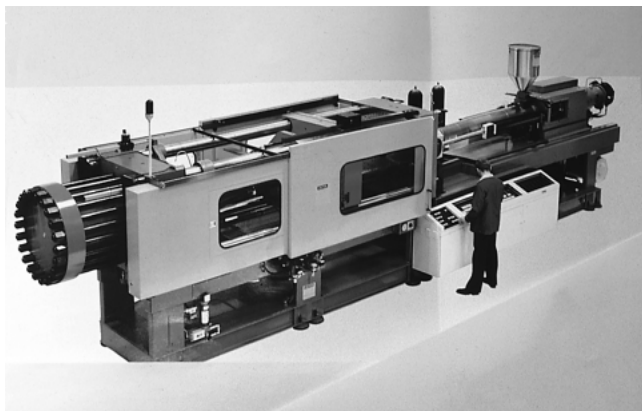
Parker's Accumulators are designed to optimize the performance of your hydraulic system, while adding safeguards that prolong equipment life. Reduced operating costs and savings from less downtime and maintenance are the benefits.

Parker Accumulators specifically...

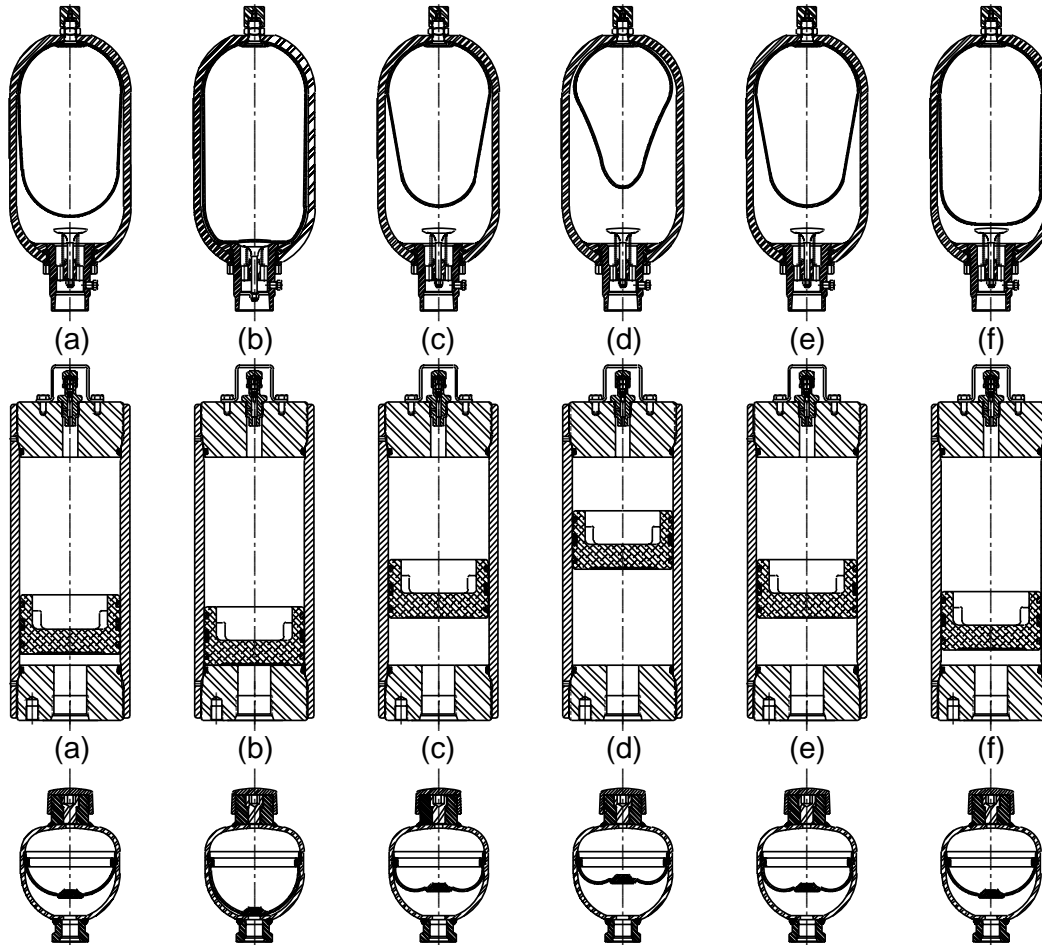
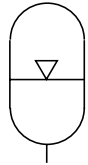
- Provide an auxiliary power source by holding supplemental power to be used during peak periods. This allows the use of smaller pumps, motors, and reservoirs reducing installation and operating costs.
- Protect hydraulic systems and circuit components from damage due to thermal expansion and contraction in a closed system.
- Make up changes in fluid volume to assure a positive pressure.
- Reduce costly damage to piping systems, fittings, and gauges by absorbing hydraulic line shocks.
- Supply emergency fail-safe power to complete a work safety cycle in the event of a pump or electric power failure.
- Hold necessary high pressure for long periods of time while preventing oil overheating, reducing pump wear, and saving energy.
- Dispense lubricants in a slow, constant rate to critical equipment wear areas.

Typical Applications include...

- Construction & Mining Equipment – emergency backup for steering, brake, and pilot circuits.
- Hydrostatic Drives – shock absorption when changing directions.
- Injection Molding & Die Casting – high pressure and flows in a short time period.
- Plunger & Diaphragm Pumps – reduces pump pulsations.
- Fork Lifts & Cherry Pickers – pressure spike dampening.
- Machine Tools – maintains pressure, reduces pump size.
- Transportation Vehicles – suspension systems and braking systems.
- Turbine Engines – oil supply for lubrication.
- Winches – maintaining line tension.



Parker manufactures hydro-pneumatic type accumulators, the most commonly used accumulators in industrial systems. This type of accumulator applies a force to a liquid by using compressed inert gas, such as nitrogen. The gas and liquid sides of the accumulator are separated by a moveable sealed piston, an elastic bladder, or an elastic diaphragm.



There are six stages of operation for hydro-pneumatic accumulators: stage (a), the accumulator is empty – no gas precharge; stage (b), the accumulator has been precharged with dry nitrogen; stage (c), system pressure exceeds precharge pressure and hydraulic fluid flows into accumulator; stage (d) system pressure peaks, maximum fluid has entered the accumulator; stage (e), system pressure drops,

precharge pressure forces fluid from the accumulator into system; stage (f), system pressure reaches minimum needed to do work.

Each of the three common types of hydro-pneumatic accumulators – piston, bladder and diaphragm – has its relative advantages, they are:

Piston Advantages

- extremely high flow rates
- high/low temperature tolerance
- high compression ratios
- withstands external forces
- unlimited sizes/mounting
- work well with gas bottles
- fully serviceable

Bladder Advantages

- dirt tolerant
- universal application
- safety
- quick response
- works well on water/low lubricity fluids
- fully serviceable

Diaphragm Advantages

- lightweight, compact
- simple, cost effective
- dirt tolerant
- quick response

Accumulators and Gas Bottles are pressure vessels which are subject to safety laws, regulations, and/or ordinances which are valid in the state or country of set-up. For example, in the US most states require ASME Certification on larger bore accumulators and gas bottles. Similar laws, regulations, and/or ordinances apply in other countries as well. Other particular regulations must be observed in certain industries such as ship building, aircraft, mining, etc.

As a standard option, most of Greer's accumulator and gas bottle products can be certified to one or both of the most widely used standards – ASME, TÜV and DNV. Many other approvals are available as well on a “as ordered” basis – consult the factory for details.

ASME Certification

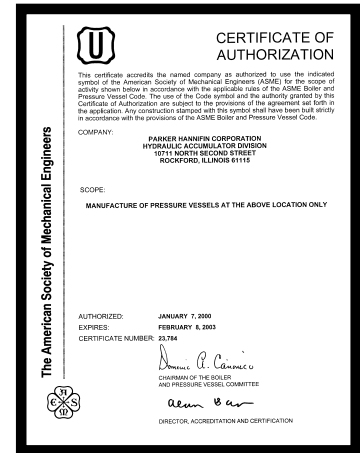
ASME (American Society of Mechanical Engineers) is an organization that regulates the design and manufacture of pressure vessels in the United States. Accumulators are categorized as unfired pressure vessels and fall under the jurisdiction of ASME Code when required by state law. Most states require ASME Certification on pressure vessels used within their boundaries. Accumulators specifically fall under the section of the code referred to as Section VIII, Division 1. This section requires certification on vessels with internal diameters of 6" or greater and that certified vessels carry the “U” symbol on them as evidence that they were designed and manufactured in accordance with the Code. The “U” symbol is an internationally recognized symbol of design and manufacturing quality

The essential criteria of ASME Certification is a requirement of strength and material traceability. Accumulators must be manufactured from materials that meet ASME specifications and require a design factor of 4:1 in the ratio of burst pressure to rated pressure. This 4:1 requirement is mandatory for all accumulators with ASME Certification with the exception of those that comply with a specific rule within the Code called “Appendix 22”.

Appendix 22 permits that accumulators manufactured with “forged” shells, with openings of a specified maximum size, may be Certified with a design factor of 3:1 in the ratio of burst pressure to rated pressure.

ASME requires that each vessel be marked with the design pressure at the Minimum Design Metal Temperature (MDMT) for the vessel.

ASME Certification requires third party surveillance of an approved quality system and requires witness by a third party of all hydrostatic testing. And at present, unlike many other standards around the world, there is no ASME national requirement for periodic inspection of accumulators after installation. However, local laws would dictate such inspections.



TÜV Certification

TÜV (Technischer Überwachungs-Verien) is another internationally known symbol of pressure vessel quality. All pressure vessels used in Germany (and some other European countries) being of a value derived from the formula Volume (Liters) x Pressure (Bars) > 200 Bar-Liters require TÜV design and testing approval. It is possible to obtain “Type” approval, as Greer has done, under TÜV rules. This “Type” approval allows the manufacturer to make previously design approved vessels without the necessity of witness by TÜV authorities. This Certification is maintained by yearly audits of the manufacturers quality assurance program and approved Quality Manual for compliance with TÜV requirements.

The major difference between TÜV and ASME is in the design criteria. While ASME concerns itself with the brute strength of the vessel, TÜV design parameters are more concerned with the expected fatigue life of the vessel. This

can result in accumulator pressure ratings with burst to rated pressure design factors below the 4:1 or 3:1 required by ASME but with limits placed on life cycle expectancy or range of operating pressure. Also, TÜV requires periodic inspection of certain accumulators after they are installed by TÜV personnel.



Other Certifications

There are numerous other certifications required by other countries around the world including DNV (Det Norske Veritas), a Norwegian Standards Agency; Lloyds, the Standards Agency for the UK; ISPESEL for Italy; DRIR for France; and many others. The new European common

pressure vessel code that is known as the Pressure Equipment Directive symbolized by “CE” markings, will go into full effect at the end of June, 2002. The CE marking will eliminate the necessity of individual European countries' pressure vessel certification. For availability of any of these or other Certifications, please consult the factory.

Parker...Your Best Source for Hydraulic Accumulators!

Parker is the leading manufacturer of hydro-pneumatic accumulators for industrial and mobile applications in North America. With over 50 years experience and one of the world's broadest accumulator product offerings, Parker has the products and application expertise to be your best source for your next accumulator solution.

Parker's Capabilities Include:

- Expanded product line to meet any application
- In-house manufacturing capabilities
- Exclusive in-house bladder molding facility
- TÜV and ASME approved manufacturing plant
- UL and FM approved manufacturing plant
- Quick delivery response
- National distribution network with factory trained sales representatives
- Localized factory sales support
- Application and engineering support
- Worldwide capabilities

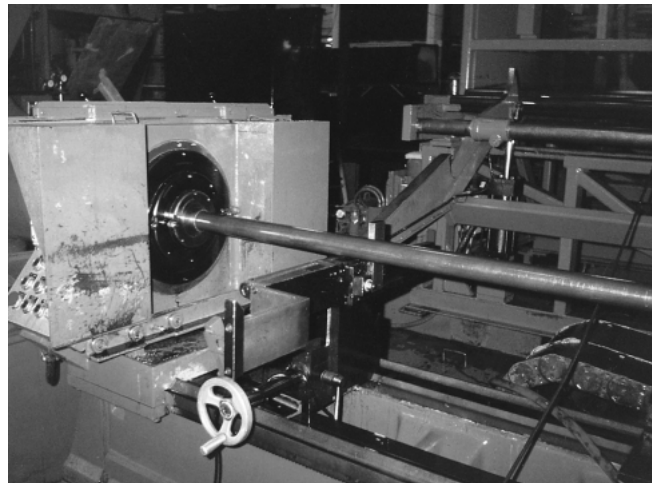


Parker Inter-Plant Fleet

In House Capabilities Include:



Bladder Molding Facilities

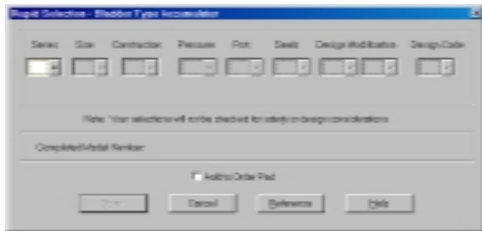
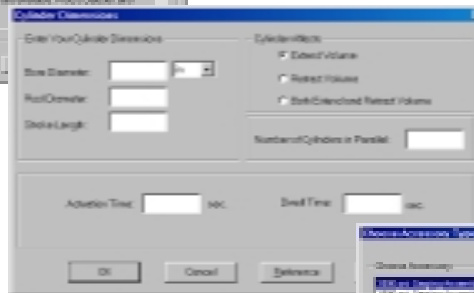
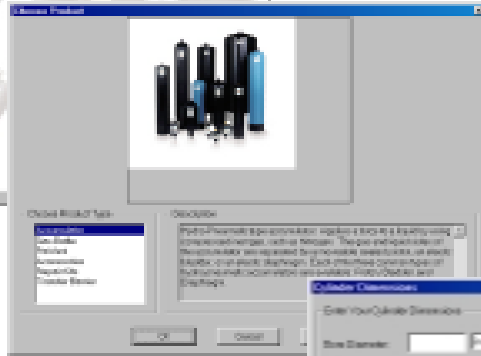
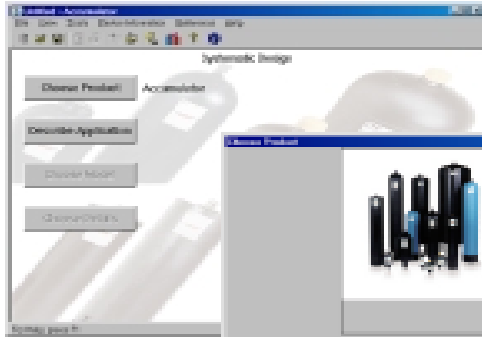


Tube Skiving Machinery



Shell End Finishing Machine

Parker *inPHorm*™ Version 3.5 Software for Accumulator Division Products Makes Sizing and Selection Easy



Rapid Selection

Parker offers leading edge application assistance with its *inPHorm*™ for Accumulators, Version 3.5. This program allows you to select the proper Parker accumulator product for your application. Using *inPHorm* will increase your efficiency and minimize the engineering time required to design in accumulators.

This updated version of *inPHorm* for Accumulators is written for use with Windows95 or 98 or Windows NT 4.0, which makes it extremely user friendly. You can use the program to develop a model number. *inPHorm* for Accumulators guides you through the selection process, performs the calculations, and eases the process of sorting through catalog drawings, charts and tables. You can also employ the "Rapid Selection" module to build a model number based on a selection of options. In either case, you can view a dimensioned drawing, generate a print or DXF file and even create a quote request or order form.

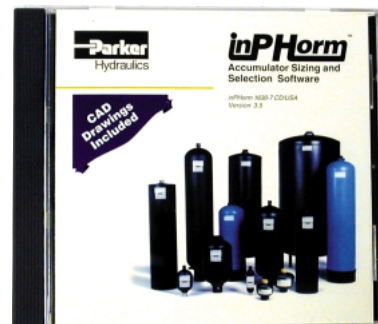
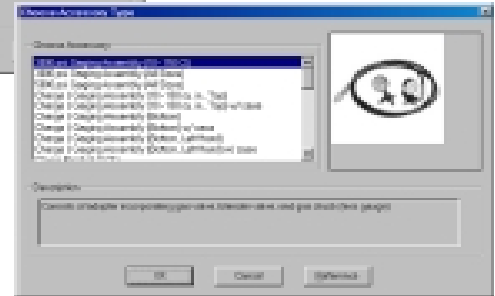
"Advisor" options within the program offer additional assistance with special modifications and design considerations. During any portion of the program, reference material can be accessed or printed for future use.

inPHorm for Accumulators is also available on the web at www.parker.com/accumulator.

System Highlights

- Accumulator Sizing and Selection
- Parametric Drawing Creation
- Input Formats:
 - Rapid Selection
 - Systematic Design
- Available Information Outputs:
 - HPGL CAD Drawing
 - CAD File (*.dxf)
 - Selection Summary Printout
 - RFQ/Order Sheet Printout

Systematic Design



For further information or to order a CD, call your local Parker distributor or contact us at (815) 636-4100.