



INDUSTRIAL HYDRAULICS
SUPERIOR QUALITY. TRUSTED RELIABILITY.

THE SCIENCE OF HYDRAULICS

ENGINEERING SCIENCE PERTAINING TO LIQUID PRESSURE AND FLOW

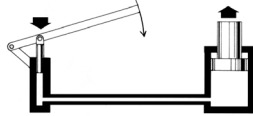


Hydraulic History

- The thinkers and experimenters, such as Galileo, Newton and Pascal, discovered interesting phenomena many years in advance of actual practical applications of their theories
- Pascal discovered and formulated the "Law of Hydraulics" about the year 1650, but nearly 150 years passed before that law was exploited in a practical application
- Pascal's law, which states "that an external force exerted on a unit area of a confined liquid will be transmitted undiminished to every unit area of the interior of the vessel," is the basis upon which every hydraulic device functions

PRINCIPLES OF HYDRAULICS

- When a mechanic pumps the handle of a hydraulic pump, they are exerting force with a small piston on an area of a confined liquid
- That force is transmitted by the liquid, through a hose or pipe to the interior area of the hydraulic cylinder, including the effective area of the piston
- The piston is forced to move
- A very simple example of this is shown here:

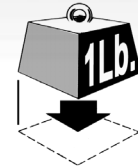
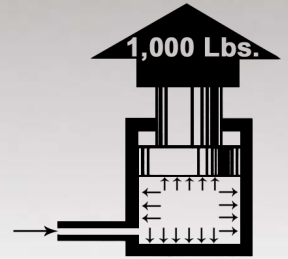


- In variations of the above example, the principle of hydraulics is not changed
 - The small piston may be moved by a lever, or by the rotary power of an electric motor or gasoline engine; the fluid flows through a pipe, a tube, or a hose; check valves, relief valves and control valves may be introduced into the system along with a reservoir of fluid and return lines; and, the ram may be of a number of different types or shapes. But the action remains the same.

The applications of hydraulic equipment are limitless

INPUT/OUTPUT MEASUREMENTS

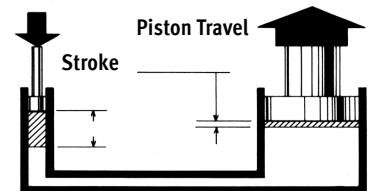
- The force in-put and force out-put of hydraulic devices can be very simply measured and calculated
 - The pressure produced by the piston on a confined liquid is measured in pounds per square inch, or psi
 - If ten pounds of force is exerted on an area of ten square inches, the pressure will still be 1 psi – but if 10 pounds of force is exerted on one sq. inch, the pressure will be 10 psi
- The force produced by liquid pressure against a piston will be measured in pounds or tons
 - If there is a pressure of 100 psi exerted on a piston with an area of 10 square inches, the total force will be 100 (psi) x 10 (sq. in) or 1,000 pounds



A one pound weight which is placed on an area of 1 sq. in. produced a pressure on that area of 1 psi

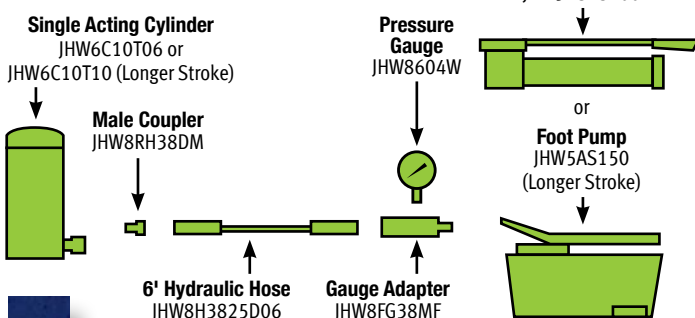
HOW HYDRAULIC FORCE WORKS

- When the small piston is "pushed down" in the pump cylinder, the amount of fluid it will displace will only be enough to move the larger piston a short distance. Therefore, while tremendous force advantage is gained, there is a sacrifice in "distance".
- There is another principle involved in the hydraulic process.
 - When a man pushes against a wall with his hand, the force he exerts is opposed by the resistance of the wall. If he pushes against no resistance he would not be able to exert force. His hand would pass freely through the air.
 - A hydraulic cylinder is the same. A pump may be rated with a pressure out-put of 10,000 psi, but unless there is a resistant force against the cylinder requiring 10,000 psi, the pump will develop only enough pressure to move the resistant force.
 - A cylinder rated at 10 tons at 10,000 psi and which is exerting a force of 1 tons, will require considerably less than the 10,000 psi potential out-put of the pump. The pressure will be 1/5 or 2,000 psi in the system.

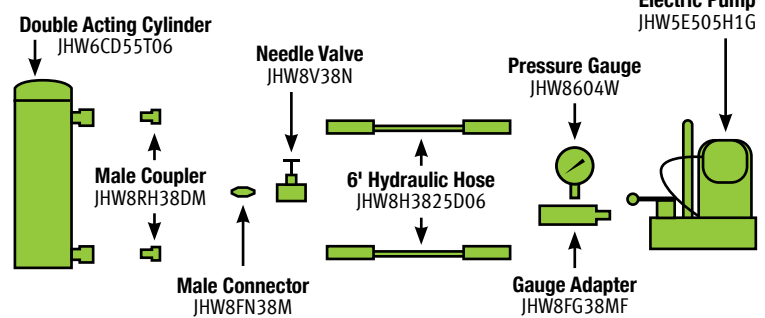


BASIC HYDRAULIC SYSTEM SETUPS

Single-Acting Cylinder Application



Double-Acting Cylinder Application



STRONG.

Williams® Hydraulics products are manufactured from high strength steel and aluminum alloys and are designed to withstand the harshest Industrial environments.

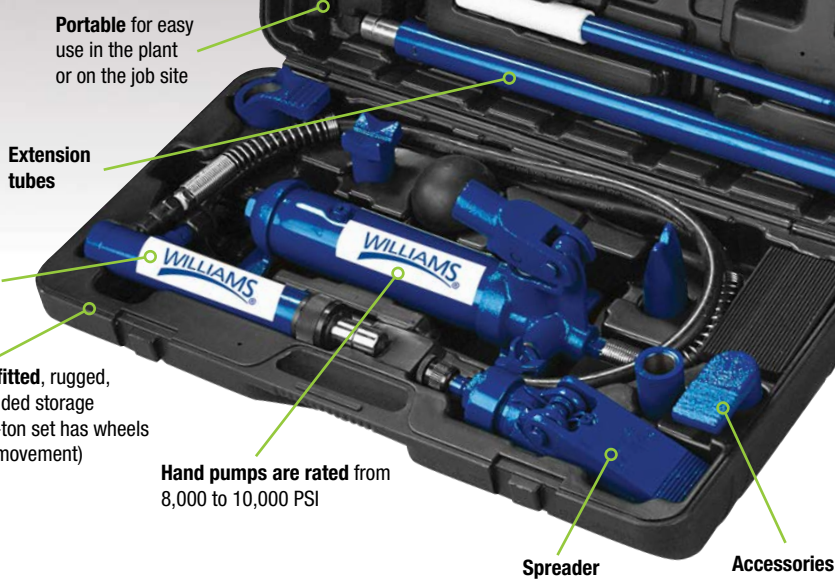
VALUED.

Superior quality hydraulics provide more reliability and increased safety.

THE WILLIAMS ADVANTAGE

- All Williams® Cylinders and Pumps undergo 100% functional quality control testing
- Marathon tested to 10,000 cycles
- All metal construction
- Hydraulic Service Center: 866-460-7995

MAINTENANCE KITS



Portable for easy use in the plant or on the job site

Extension tubes

Cylinder

Custom fitted, rugged, blow-molded storage case (10-ton set has wheels for easy movement)

Hand pumps are rated from 8,000 to 10,000 PSI

Spreader

Accessories

CYLINDERS

Williams® Cylinders feature 5-100 ton capacity and chrome plated pistons (vs competitors machined pistons)

Heavy-duty, heat-treated, grooved saddle provides better surface traction during operation

Rod wiper seals out dirt and contamination

Hard, chrome-plated rod prevents scratching and corrosion

1-Piece steel rod stopper for extra strength prevents over-travel

Polyurethane cup seal provides optimum performance

Rectangular return spring design eliminates spring breakage and provides quicker retraction

Steel stop ring for rod over-travel protection

Collar fixture threads

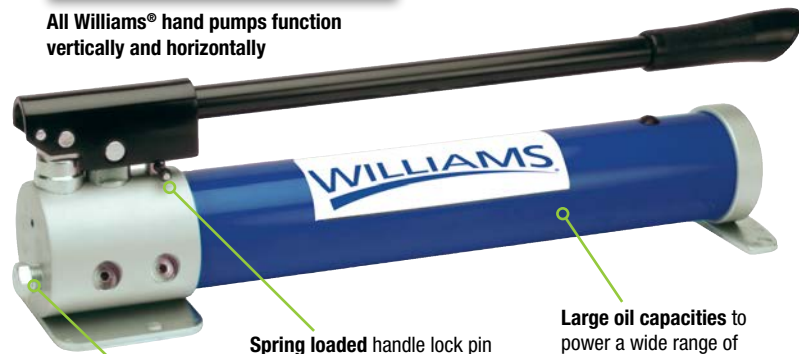
Burnish-rolled cylinders for smoother finish than honing which reduces scoring and prolongs seal life

1-Piece high grade alloy bearing for side load protection and long life

High flow ball coupler provides more flow than conventional couplers

HAND PUMPS

All Williams® hand pumps function vertically and horizontally



Spring loaded handle lock pin

Release valve for overload protection

Large oil capacities to power a wide range of cylinders and tools



DID YOU KNOW?

Williams® Territory Managers have the knowledge and experience to train your staff on the safe and effective use of Williams® Industrial Hydraulic Products. Contact your territory manager for more information.

WILLIAMS®

**WILLIAMS®
INDUSTRIAL
HYDRAULICS
ARE BUILT FOR
ANY CHALLENGE
IN ANY INDUSTRY.**



SHOP PRESSES

MINI JACKS



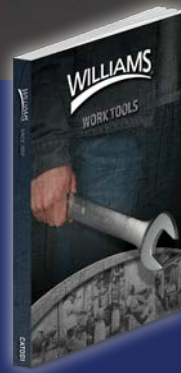
ELECTRIC PUMPS



SPREADERS



HAND PUMPS



**PUMP IT UP WITH
WILLIAMS HYDRAULICS
SOLUTIONS.**



Look for more information in the following pages of the new Williams® Tool Catalog.

PUMPS – PG 403

- Rugged durable design for the demands of industrial applications
- Hand Pumps, Air Pumps, Electric Pumps, Gas Pumps and Diesel Pumps

CYLINDERS – PG 391

- Ideal for lifting and pressing
- Types of Cylinders: Single acting, Double acting, Lock Nut, Aluminum, Flat Body, Hollow Hole, Pull, Threaded Hole, Low Profile
- Pump / Cylinder Combo Sets – Matched air & hand pump sets provide a combination of components for single acting cylinder applications

JACKS – PG 417

- Simple to use Mini, Toe and Side Pump Bottle Jacks

SPREADERS – PG 418

- Perfect for confined spaces for prying, wedging and opening

SHOP PRESSES – PG 415

- Ideal for the removal or installation of gears, universal joints, pulleys, wrists pins and other press jobs

MAINTENANCE KITS – PG 419

- Portable kits for easy use in the plant or on the job site
- Designed for applications of pushing, spreading, pressing and more

ACCESSORIES – PG 415, 420, 421

- Everything you need for your hydraulics needs such as gauges, hoses and couplings

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