

Definition of Hydraulics

Hydraulics is a branch of science and engineering concerned with the use of fluids to perform mechanical tasks. It is part of the more general discipline of fluid power.

The word "hydraulics" comes from the Greek word *hydraulikos* which means water organ which in turn means water and pipe.

Typically, the fluid used in a hydraulic system is an incompressible liquid such as a mineral based hydraulic oil. Pressure is applied by a piston to fluid in a cylinder, causing the fluid to press on another piston that delivers energy to a load. If the areas of the two pistons are different, then the force applied to the first piston will be different from the force exerted by the second piston.

This creates a mechanical advantage.

Pascal's Law

A change in pressure at any point in an enclosed fluid at rest is transmitted undiminished to all points in the fluid.

This principle is stated mathematically as:

$$\Delta P = \rho(\Delta h)$$

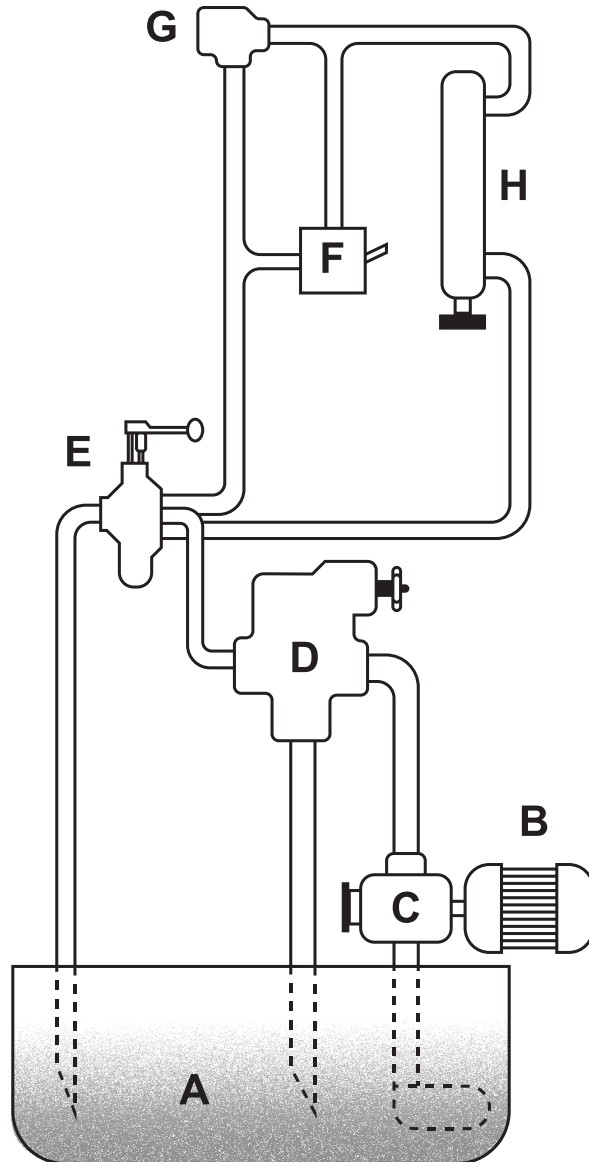
Introduction to Hydraulics

A hydraulic system is not a source of power.

The power source would be a prime mover such as an electric engine which drives the pump.

Advantages of Hydraulics

- **Variable Speed:** The actuator (A device for converting energy into mechanical energy i.e., a motor or cylinder.) in a hydraulic system can be driven at different speeds.
- **Reversible:** A hydraulic actuator can be reversed instantly while in full motion without damage.
- **Overload Protection:** The pressure relief valve in a hydraulic system protects the system from overload damage.
- **Small Components:** Hydraulic components, because of their high speed and pressure capabilities, can provide high power output with very small weight and size.
- **Can Be Stalled:** A hydraulic actuator can be stalled without damage when overloaded, and will start up immediately when the load is reduced.
- **Hydraulic Oil:** The oil transmits power readily since it is minimally compressible. The most desirable property of the oil is its lubricating ability.



Basic hydraulic system with a linear hydraulic actuator.

- A** Reservoir
- B** Electric Motor
- C** Pump
- D** Maximum Pressure Relief Valve
- E** Directional Valve
- F** Flow Control Valve
- G** Right-angle Check Valve
- H** Cylinder