

LAWS OF PHYSICS AND COMMON EQUATIONS

Pascal's Law

Pressure exerted on a confined fluid is transmitted undiminished in all directions, and acts with equal force on all equal areas and at right angles to them.

Hydraulics

Simply, a means of power transmission.

Work

Force acting through distance.

WORK = FORCE x DISTANCE

Example: Work = lbs. x inches,
or Force (lbs.) x Distance (ins.)

Power

The rate of doing work.

Power = $\frac{\text{Work}}{\text{Time}} = \frac{\text{Force} \times \text{Distance}}{\text{Time}}$

Force

The Force (pounds) exerted by a piston can be determined by multiplying the piston area (sq. inches) by the pressure applied (psi).

Force = Pressure x Area

Volume

To determine volume (cubic inches) required to move a piston a given distance, multiply the piston cross sectional area (sq. inches) by the stroke required (inches).

Volume = Area x L

Compression of Hydraulic Oil

Hydraulic oil serves as an excellent lubricant, is practically non-compressible. It will compress approximately 0.4 of 1% at 1000 psi and 1.1% at 3000 psi at 1200.

Weight of Hydraulic Oil

The weight of hydraulic oil may vary with a change in viscosity; however, 55 to 58 lbs. per cubic foot covers the viscosity range from 150 SSU to 900 SSU at 1000°F.

Pressure in a Column of Oil

The pressure at the bottom of a one-foot column of oil will be approximately 0.4 psi. To find the approximate pressure in psi at the bottom of any column of oil, multiply the height in feet by 0.4.

Atmospheric pressure

Equivalent to 14.7 PSIA at sea level. ΔP means pressure difference.

Gage readings

Gage readings do not include atmospheric pressure unless marked PSIA.

Pressure drop

There must be a pressure drop (pressure difference) across an orifice or restriction to cause flow through it. Conversely, if there is no flow, there will be no pressure drop.

Pumps and fluids

Fluid is pushed, not drawn, into a pump. If pumping from an open reservoir, atmospheric pressure pushes the fluid into the pump. Some pumps are used specifically to create pressure. Any resulting flow is incidental. A pump does not pump pressure; its purpose is to create flow. A pump used to transmit power is usually positive displacement type.

Pressure

Pressure is caused by resistance to flow. A pressure gage indicates the pressure in a given unit, measured in PSI.