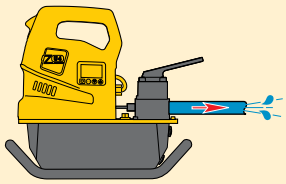
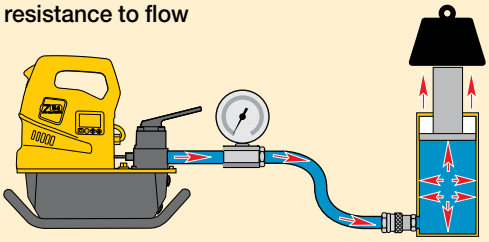
Flow

A hydraulic pump produces flow



Pressure

Pressure occurs when there is resistance to flow



Pascal's Law

Pressure applied at any point upon a confined liquid is transmitted undiminished in all directions (Fig.1).
This means that when more than one hydraulic cylinder is being used, each cylinder will lift at its own rate, depending on the force required to move the load at that point (Fig. 2). Cylinders with the lightest load will move first, and cylinders with the heaviest load will move last (Load A), as long as the cylinders have the same capacity.

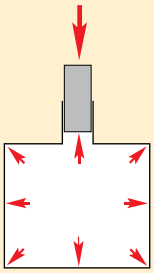


Figure 1

To have all cylinders operate uniformly so that the load is being lifted at the same rate at each point, either control valves (see Valve section) or Synchronous Lift System components (see Cylinder section) must be added to the system (Load B).

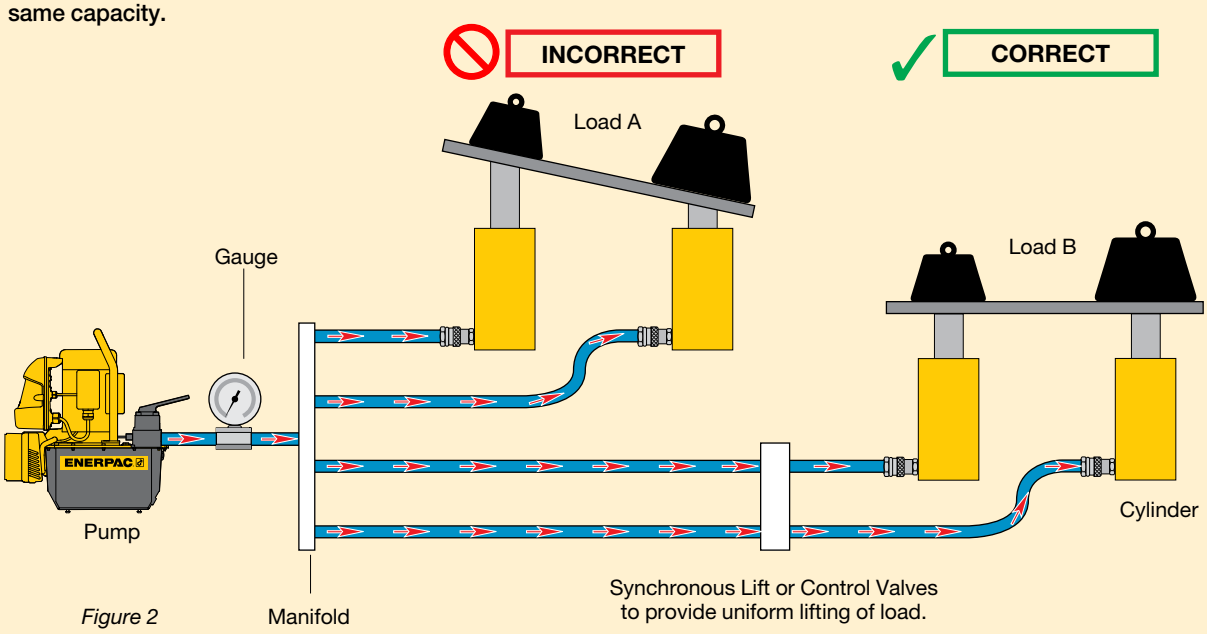


Figure 2

CAUTION!

When lifting or pressing, always use a gauge.
A gauge is your "window" to the system. It lets you see what's going on. You will find the gauges in the System Components section.

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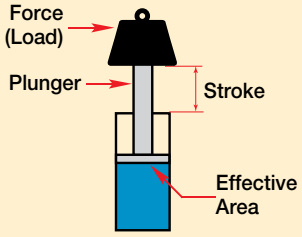
Learn more about hydraulics

Visit **www.enerpac.com** to learn more about hydraulics and system set-ups.

Force

The amount of force a hydraulic cylinder can generate is equal to the hydraulic pressure times the "effective area" of the cylinder (see cylinder selection charts).



Force	=	Hydraulic Working Pressure	x	Cylinder Effective Area
F	=	P	x	A

Use this formula to determine either force, pressure or effective area if two of the variables are known.

Example 1
An RC-106 cylinder with 2.24 in^2 effective area operating at 8,000 psi will generate what force?
Force = 8,000 psi x 2.24 in^2 = 17,920 lbs.

Example 2
An RC-106 cylinder lifting 14,000 lbs will require what pressure?
Pressure = 14,000 lbs ÷ 2.24 in^2 = 6,250 psi.

Example 3
An RC-256 cylinder with 5.15 in^2 effective area is required to produce a force of 41,000 lbs. What pressure is required?
Pressure = 41,000 lbs. ÷ 5.15 in^2 = 7961 psi.

Example 4
Four RC-308 cylinders each with 6.49 in^2 effective area are required to produce a force of 180,000 lbs. What pressure is required?
Pressure = 180,000 lbs ÷ (4 x 6.49 in^2) = 6933 psi.
Remember, since four cylinders are used together, the area for one cylinder must be multiplied by the number of cylinders used.

Example 5
A CLL-2506 cylinder with 56.79 in^2 effective area is going to be used with a power source that is capable of 7,500 psi. What is the theoretical force available from that cylinder?
Force = 7,500 psi x 56.79 in^2 = 425,925 lbs.

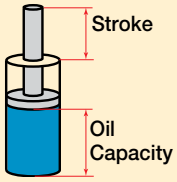
Cylinder Oil Capacity

The volume of oil required for a cylinder (cylinder oil capacity) is equal to the effective area of the cylinder times the stroke*.

Cylinder Oil Capacity	=	Cylinder Effective Area	x	Cylinder Stroke

* Note: these are theoretical examples and do not take into account the compressibility of oil under high pressure.

Example 1
An RC-158 cylinder with 3.14 in^2 effective area and an 8 in. stroke will require what volume of oil?
Oil Capacity = 3.14 in^2 x 8 in = 25.12 in^3



Example 2
An RC-5013 cylinder has an effective area of 11.05 in^2 and a stroke of 13.25 in. How much oil will be required?
Oil Capacity = 11.05 in^2 x 13.25 in = 146.41 in^3

Example 3
An RC-10010 cylinder has an effective area of 20.63 in^2 and a stroke of 10.25 in. How much oil will it require?
Oil Capacity = 20.63 in^2 x 10.25 in = 211.46 in^3

Example 4
Four RC-308 cylinders are being used, each with an effective area of 6.49 in^2 and stroke of 8.25 in. How much oil will be required?
Oil Capacity = 6.49 in^2 x 8.25 in = 53.54 in^3 for one cylinder
Multiply by four to obtain the required capacity: 214.17 in^3

Enerpac oil will compress 2.28% at 5,000 psi and 4.1% at 10,000 psi.

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