COMPUTING LAB PRESS FORCE

The force that a press can generate is a function of the hydraulic fluid pressure and the effective area of the piston or cylinder on which pressure is being exerted by the compressed hydraulic fluid.

Pounds of Force Applied (F) =
Piston Area (A) x System Pressure (psi)

$$\text{Piston Area} = \pi r^2$$

- OR -

$$\text{Piston Area} = \left(\frac{\text{diameter}}{2}\right)^2 \times 3.1416$$

Generally, hydraulic presses are designed to generate their rated force or tonnage capacity when the hydraulic fluid has been compressed to a pressure of 10,000 psi, which is the maximum pressure that the hydraulic lines in most hydraulic systems are designed to tolerate. Presses with higher tonnage ratings have larger diameter pistons. For example, our 12 ton E-Z Press™ has a piston area of 2.4 square inches while the 20 ton E-Z Press™ and 20 ton Air-EZ™ have piston areas of 4.0 square inches, and all reach their rated capacities when the pressure of the hydraulic fluid is at 10,000 psi. In addition to the obvious differences in capacity, this means that a user of a manual 20 ton press will have to generate significantly less line pressure to reach 10 tons of force than will a user of a 12 ton press.

Example 1

A 12 ton E-Z Press™ with a 2.4 square inch cylinder operated at 8,000 psi will generate what force?

FORCE = 8,000 psi x 2.4 in2 = 19,200 pounds or 9.6 U.S. tons (8.72 metric tons) per square inch

Example 2: A 20 ton E-Z Press™ with a 4.0 inch2cylinder operated at 5,000 psi will generate what force?

FORCE = 5,000 psi x 4.0 in2 = 20,000 pounds or 10 U.S. tons (9.1 metric tons) per square inch

Computing the Pressure Applied To The Sample

When we use the term “force” in describing a laboratory press, we are describing the load that is driving the ram or platen. The force of a press does not change based upon sample size, but the pressure being applied to the sample does change. For example, if the press is generating 10 tons of force on the ram and the sample is one (1) square inch, then the pressure on the sample will be the same as the force on the platen – 10 tons. But when the sample is smaller or larger than one square inch, the formula is:

For example, when there is a load of 10 tons on the ram and a 1.25″ diameter die is being used, then the sample area is 1.227 square inches and the pressure being applied to the sample is 8.15 U.S. tons.

$$P\ (\text{lb/in}^2) = F/A$$

P = Pressure on Sample (lb/in^2)
F = Force
A = Area of Sample (in^2)

When a 1/2″ (13mm) die set is in use, the sample area is 0.1963 square inches and the same 10 ton load on the ram produces 50.9 tons per square inch of pressure on the sample.

$$\text{Pressure on Sample} = \frac{10\ \text{tons (Force)}}{1.227\ \text{in}^2\ \text{(Sample Area)}}$$

= 8.15 U.S. tons per square inch

Press operating manuals contain charts showing pressures corresponding to a range of both sample sizes and loads. Copies are available on request.

$$\text{Pressure on Sample} = \frac{10\ \text{tons (Force)}}{0.1963\ \text{in}^2\ \text{(Sample Area)}}$$

= 50.9 U.S. tons per square inch

International Crystal Laboratories
11 Erie St., Garfield, NJ 07026
973-478-8944 www.internationalcrystal.net
Em: iclmail@internationalcrystal.net