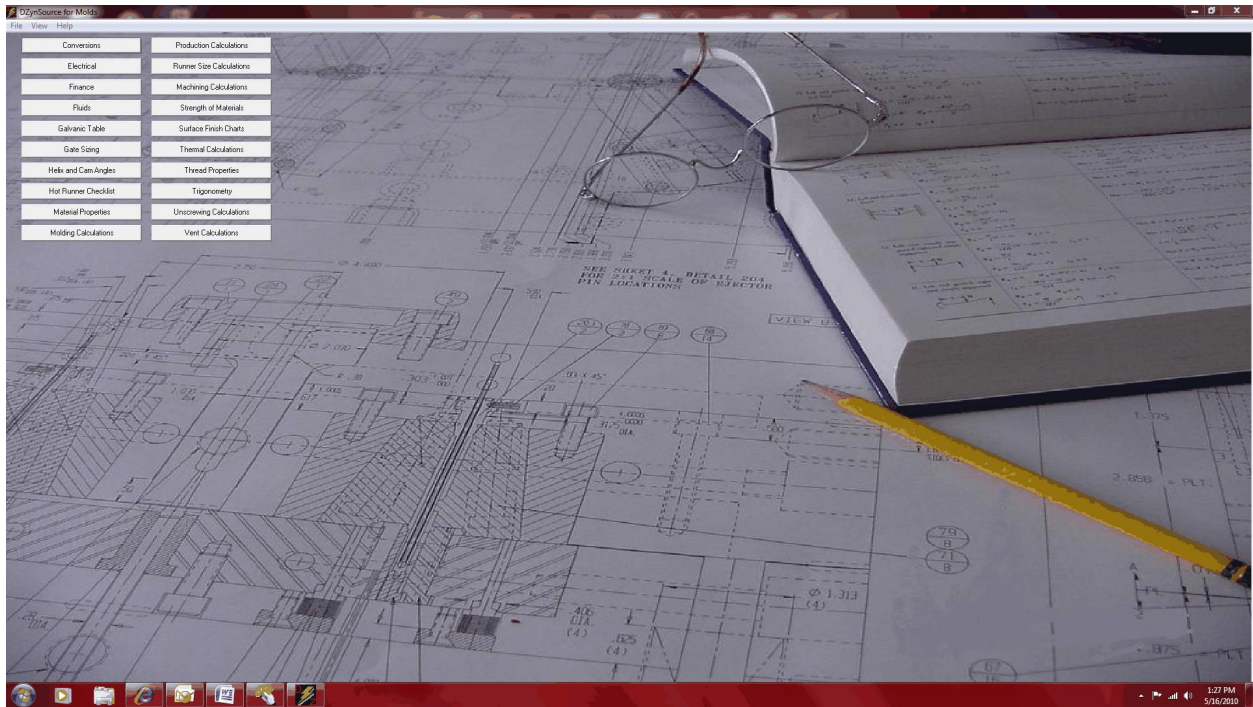


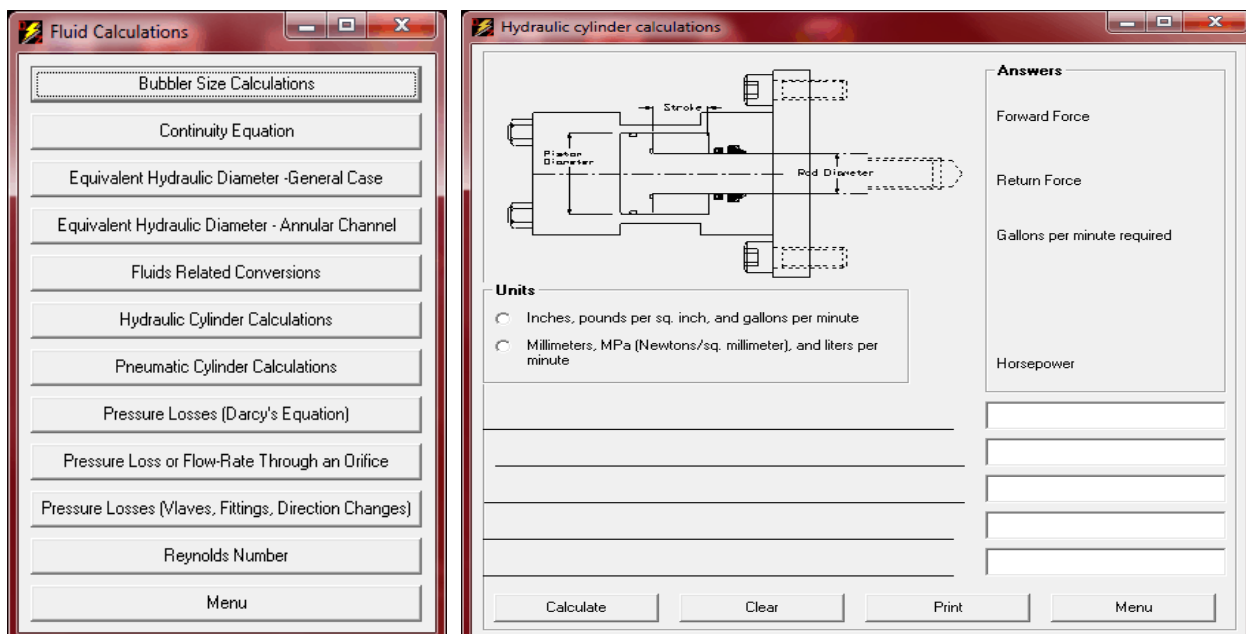
Hydraulic Cylinder Calculations

Hydraulic cylinder calculations need to be done quite often, as a matter of course, when designing molds. These calculations are done effortlessly, and in a matter of seconds, with [DZynSource Mold Engineering Software](#). The following steps show the beauty and simplicity of our software:

1. This is the main screenshot from [DZynSource](#), in this case click on the "Fluids" command button.



The Fluids sub-menu appears, and you choose the "Hydraulic Cylinder Calculations" command button.



The blank Hydraulic Cylinder worksheet appears, ready for you to enter your known data. Here is an example:

You have a hydraulic cylinder with a 2.000 diameter piston, a 1.000 diameter rod, a 12-inch stroke, and want to extend the rod in .5 seconds, and the system pressure is 1000 pounds per square inch.

We'll enter this data into the Hydraulics worksheet:

Hydraulic cylinder calculations

Diagram labels: Piston Diameter, Stroke, Rod Diameter

Units

- ☒ Inches, pounds per sq. inch, and gallons per minute
- ☐ Millimeters, MPa (Newtons/sq. millimeter), and liters per minute

Answers

- 3141.59 Pounds Forward Force
- 2356.19 Pounds Return Force
- 19.58 Gallons per minute required
- 11.43 Horsepower

Enter piston diameter in inches: 2

Enter piston rod diameter in inches: 1

Enter stroke in inches: 12

Enter hydraulic pressure in PSI: 1000

Enter time for piston stroke desired, in seconds: .5

Buttons: Calculate, Clear, Print, Menu

First, choose the units that you want to work in, enter the data, all of which you would know. Occasionally you might have to make assumptions about the pressure available, you would normally have that information up front. Press the Enter command button on the [DZynSource Mold Engineering Software](#) worksheet, and *Voila*, all of your answers appear.

Customers will very often call to find out how many gallons per minute their hydraulic pump will need to delivery to the mold, particularly with unscrewing molds. You can answer them in the blink of an eye, and not have to figure it out and call them back.

For those of you who are interested, here is an example ting that shows how to do the hydraulic cylinder calculations manually:

This article shows you how to do the three most basic, and common, calculations for designing with hydraulic cylinders. These three would be the forward force of the cylinder, the return force, and flow rate required for the forward portion of the cycle. The return flow rate and force are lower because the volume and area are reduced by the presence of the piston rod, and therefore is not included in these calculations. The working portion of the hydraulic cylinder cycle should be the piston forward movement, for the above-mentioned reasons.

The first choice to be made is the units you wish to work with, inch or metric.

To calculate the forces generated by the piston, you must enter the appropriate diameter or diameters and the pressure supplied to the cylinder, in the appropriate units. In order to calculate the required volumetric flow rate, you must also use the length of stroke and the time in seconds.

The familiar relationships for area are used to calculate these answers:

Piston forward area = (Piston diameter)² x Pi / 4

Piston return area = ((Piston diameter)² - (Rod diameter)²) x Pi / 4

Force = Pressure x Area

*GPM = (((Pi * (D²)) / 4) * S) * (60 / 231) / T*

where,

GPM = gallons per minute

D = Piston diameter in inches

S = Stroke in inches

T = time in seconds

the 60 factor converts seconds to minutes

If you have a hydraulic cylinder with a 2.000 diameter piston, a 1.000 diameter rod, a 12-inch stroke, and want to extend the rod in .5 seconds, and the system pressure is 1000 p.s.i., the calculations for force and gallons per minute are as follows.

Piston forward area = 2² x Pi/4 = 4 x Pi / 4 = Pi = 3.142 inches² (rounded)

Piston return area = ((2)² - (1)²) x Pi / 4 = 2.356 inches²

Forward Force = 1000 x 3.142 = 3142 pounds

Return Force = 1000 x 2.356 = 2356 pounds

Since the time to extend the piston rod is only affected by the diameter of the piston, we can ignore the piston's rod size.

$$GPM = (((\pi * (D^2)) / 4) * S) * (60 / 231) / T$$

$$GPM = ((3.142 \times 4) / 4) * S \times (60 / 231) / .5 = 19.58 \text{ gallons per minute.}$$

Of course, if you are going to have a continuously cycling hydraulic cylinder, you must do the flow rate calculations for both the piston side, and the rod side.

Do not exceed the manufacturers recommendation for pressure in your hydraulic cylinder. Make sure that there are pressure and temperature relief valves for safety, and if in doubt, get professional advice.

