



Material

Item-no.	Qty.	Description
DM405-2P	1	Hydraulic press, working model
DM340-2W	1	Tank, round, with outlet-tube
P7050-1A	1	Powder dye, red
C6100-2A	1	Syringe, 120ml, plastics
C5991-1S	1	Silicone oil for syringes, 3 ml, bottle with brush

Purpose

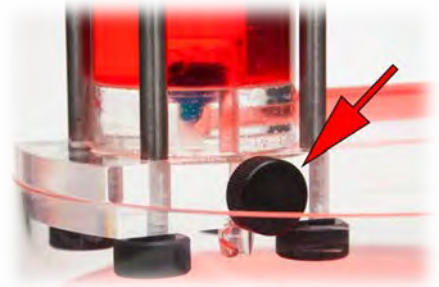
Explanation of the functioning and operation of a hydraulic press as well as the function of valves.

Preparation

Initially colour around 1000 ml of water.

How to fill the press with water?

Loosen the drain screw so that air can escape and
Pull both pistons approximately 3 cm up.



Hold the press upside down (with the suction hose up).

Draw up 120 ml of water with the syringe and push the water into the press through the suction hose.

An inclined position of the press ensures that the two cylinders and the connecting channel remain free of air bubbles.

As soon as water comes out of the outlet opening at the drain screw, the pump is filled. Now fasten the drain screw carefully.

Place the pump on the tank now.

The notch of the support plate must snap into the inner edge of the tank to ensure a stable hold.

Check if outlet nozzle of the tank is screwed on.
Afterwards pour 600 ml of water into the tank.
Make sure that the suction hose reaches the water.

In order to check whether the piston also runs smoothly, it is slowly moved up and down.
If this is not the case, see the maintenance note below)

If the piston is too high the drain screw can be loosened and then the piston can be pressed down.



Experiment 1 – Deforming a Styrofoam ball

Remove the press bolt from the pressure plate and place a Styrofoam ball in the centre of the piston plate.

By slowly pumping the working piston we press the sucked-in water into the press cylinder, thereby lifting the pressure piston and pressing it against the pressure plate.

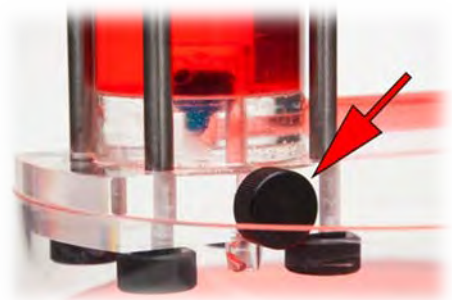
Observe the opening and closing of the two valves while pumping.



Result

The Styrofoam ball can be pressed almost flat.
The deformation that can be achieved is remarkable.

After completing the test, the drain screw is loosened so that the piston can be pressed down.



Experiment 2 – Cracking a nut

A nut is given to the students to illustrate how hard this shell is.

Instead of the Styrofoam ball we place this nut on the pressure plate. The rest of the procedure is the same as in the 1st experiment.



Result

The nut can be cracked with relatively little effort.



Experiment 3 – Bending an iron pin

Screw the press bolt into the thread on the bottom side of the pressure plate
The pressure plate is set into the lower position.

The abutment (U-bracket) is placed on this plate.
An iron pin is placed in the notches of the legs of the abutment and aligned normal to the long side of the press bolt. The rest of the procedure is the same as in experiment 1.



Result

The iron pin can be bent with relatively little effort.

Explanation

The hydraulic press works on the principle of pressure spreading from all sides in liquids.

$$\textit{Force} = \textit{Pressure} \times \textit{Area}$$

$$F = p \times A$$

Pressure piston: D = 16 mm	Area (A) =	2.0 cm ²
Press piston: D = 56 mm	Area (A) =	24.6 cm ²

Thus the ratio of the two piston areas is about 1: 12.3.

The force amplification behaves accordingly.

If you exert a force of e.g. 10 N, this results in a pressure of 500 hPa in the liquid.
This pressure causes the piston to exert a force of 123 N.

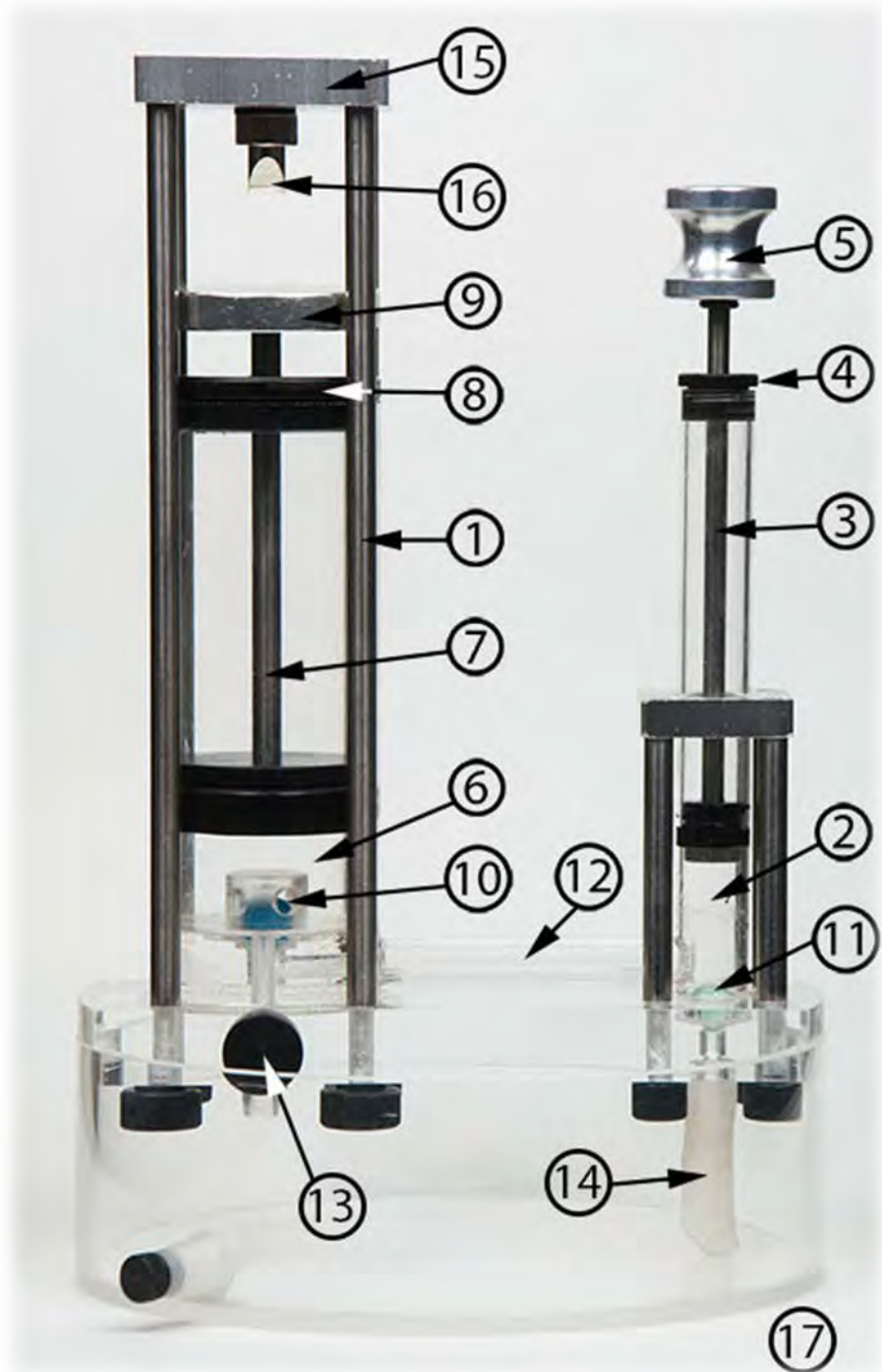
The “pressing forces” exerted with this model can reach values of around 500 N!

Practical information

While with hydraulic jacks the up and down movement of the working piston (= pumping) is done by hand, motor-driven pumps are used with lifting platforms, excavators and almost all other hydraulic equipment.

Mineral oils or glycols are used as hydraulic fluids (e.g. as brake fluid)

- 1 Press frame
- 2 Pressure cylinder
- 3 Pressure piston
- 4 Cap for Pressure piston
- 5 Handle for Pressure piston
- 6 Press cylinder
- 7 Press piston
- 8 Cap for Press piston
- 9 Press plate
- 10 Press piston valve
- 11 Pressure piston valve
- 12 Junction
- 13 Drain screw
- 14 Suction hose
- 15 Pressure plate
- 16 Press bolt
- 17 Round tank with outlet DM340-2W



- 18 Abutment
- 19 Iron pins
- 20 Styrofoam ball



Emptying the cylinders and the tank

Loosen the drain plug at the end of the experiment.

Press the piston down so that the water runs out from the two cylinders.

To push the water out of the cylinders completely hold the model at an specific angle - the drain opening should be the lowest point. If necessary shake the model a bit.

If water has reached the upper area of the cylinder remove the cap so that it can be emptied. Afterwards remove the coloured water from the tank.

Pour clear water into the tub, do an entire pumping process with clear water and then empty the pump model and the tank again.

Note

Do not push in the piston completely, leave a distance of about 2 cm.
If the pump model is not used for a long time, the piston seal can "stick" to the conveyor cylinder. If this happens, you can lightly hit the handle of the piston with the ball of your hand before the seal loosens again.

Piston maintenance

If the pressure piston is very difficult to move, or if the pressure piston is not tight enough, the existing seal can be adjusted.

To do this, the cap of the piston must be unscrewed and the piston and cap pulled out of the cylinder (caution: do not lose the valve ball!).

Clean the lower outer edge of the piston and lightly brush with silicone oil.

Then insert the piston and screw the cap back on.