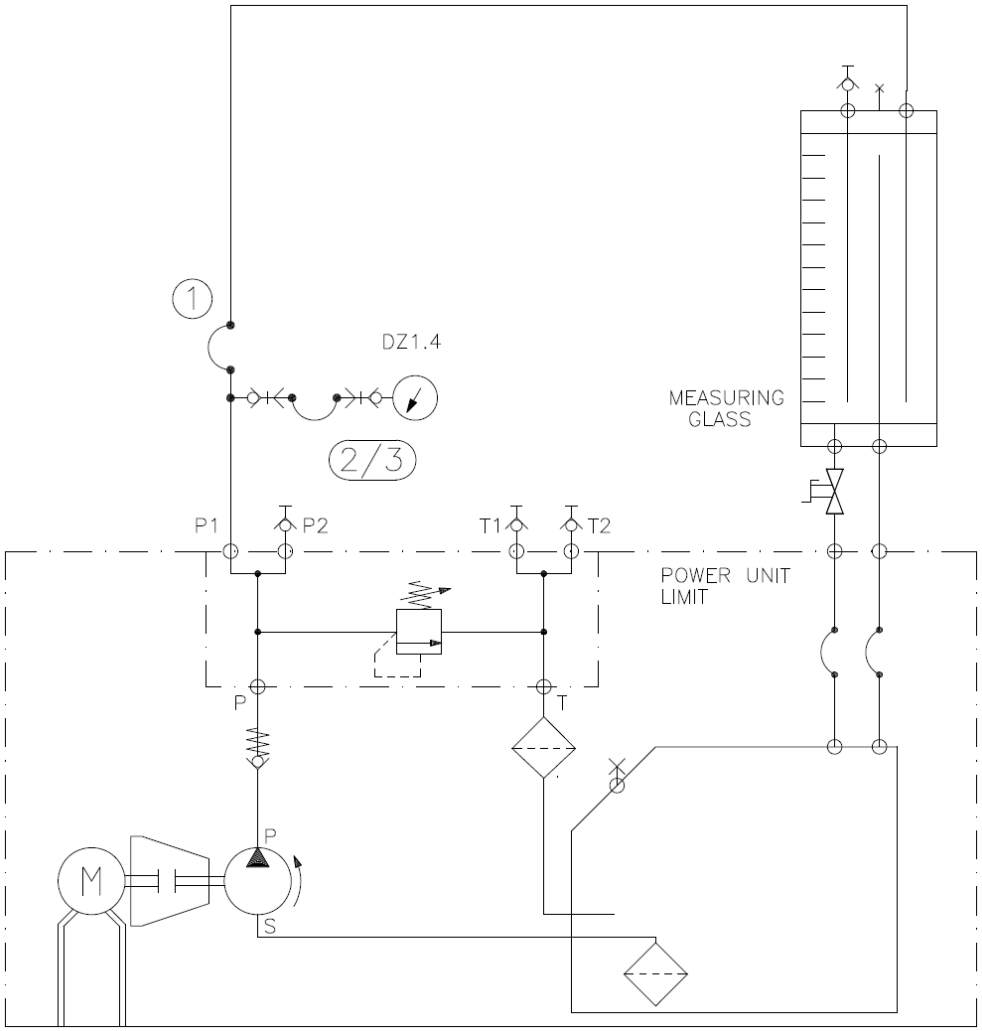
Displacement of a Hydraulic Pump

Fundamentals:
Pumps can be classified as either positive or non-positive displacement. The pumps which are typically used in hydraulic systems are of the positive displacement variety whereby a defined volume of fluid is delivered with each revolution of the input shaft. In this way pumps can be considered the flow generators in the hydraulic system.

Objective:
Determine the displacement value of the pump which is installed on the hydraulic training stand.

Connections:
Utilizing the schematic below as a guide follow these steps to connect a circuit on the hydraulic trainer.

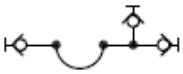
1) Using an appropriate length hose connect from port ‘P1’ of the P connection block to one connection of the measuring glass
2) Mount a pressure gauge ‘DZ1.4’ on the mounting grid where it can be easily read
3) Connect the capillary hose of the pressure gauge to the hose assembly c/w gauge connection

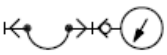


Components:

You will require the following components

1x	Hose assembly c/w gauge connection
1x	Pressure gauge DZ1.4



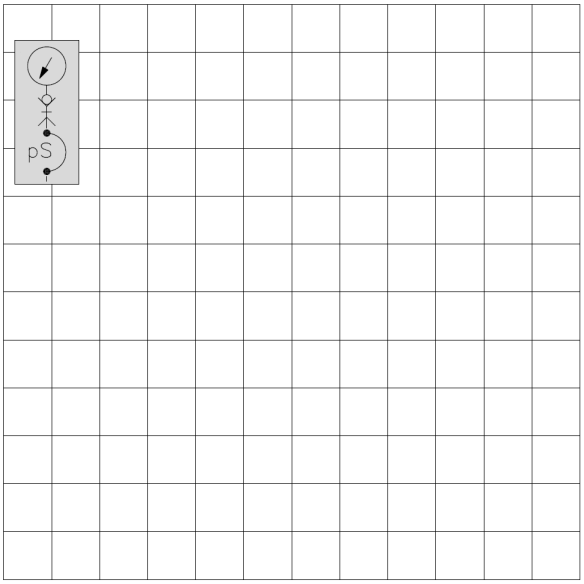


Stopwatch

Before beginning the experiment read the **Rules for hydraulic trainer operation** sheet.

Mount the components onto the trainer grid and interconnect them according to the schematic diagram.

Layout



Instructions
Utilizing the measuring glass and stopwatch determine the flow rate being delivered by the pump which is installed on the hydraulic trainer.

Procedure
Steps in the experimental procedure:
1. Has your instructor checked the constructed circuit?
2. Check again that all connection hoses are firmly coupled. (pull/turn to test)
3. Ensure the red E-STOP button is not engaged on either of the starters. (rotate the button to reset)
4. Open the shut-off valve on the bottom of the measuring glass to enable the glass to drain.
5. Switch on the pump via the green START push button.

a) Close the shut-off valve on the measuring glass. Measure the time between oil level readings of 1 litre and 2 litres. Record this time as well as the pressure read at the gauge.

t = 8.0 seconds, p = 2 bar

b) Switch off the pump via the red STOP push button and drain the measuring glass by opening the shut-off valve.
c) Conventionally the flow rate is given as liters per minute (l/min). We will also follow this convention. We can calculate this flow rate using the following formula.

$$Q = \frac{\text{volume (1 litre)}}{\text{measured time (sec)}} \text{ x } \frac{60 \text{ seconds}}{1 \text{ minute}}$$

Q = 7.5 l/min

$$Q = \frac{60}{\text{measured time (sec)}}$$

Determine the speed of the electric motor via either a tachometer or by reading the motor nameplate data.

Calculate the displacement of the pump by using the following formula

$$Vg = \frac{Q \bullet 1000}{n}$$

Vg = displacement in cc/rev

Q = flow rate in l/min = 7.5 l/min

n = pump shaft speed (RPM) = 3450 RPM

Vg = 2.2 cc/rev

Conclusions:

1) The job of the hydraulic pump is to produce flow .

2) The flow rate produced by a positive displacement pump depends up on the pump size/displacement and the prime mover speed .

3) What was the pressure shown on the gauge? Why?

Pressure is very low. Only resistances caused by the fluid conductors (hose and fittings) are Causing this pressure (low resistance = low pressure)