Experiment n°10

Determination of the critical Reynold's number

Objective

The aim of this experiment is to find the critical Reynold's number in different pipes and see the effect on the fluid.

Theories

The type of the flow is determined by the Reynold's Number: $Re_D = \frac{\rho UD}{\mu} = \frac{UD}{\nu}$

The transition between laminar and turbulent flow is for a Re beyond 2000

For a venturi tube, the basic theories is:

Bernoulli formula $Pa + \frac{1}{2}\rho Ua^2 + \rho gZa = Pb + \frac{1}{2}\rho Ub^2 + \rho gZb$

Flow rate equality: $Qv = UaSa = UbSb$

$$Pa - Pb = \frac{1}{2}\rho * (Ub^2 - Ua^2) \Leftrightarrow \frac{2}{\rho}(Pa - Pb) = Qv^2\left(\frac{1}{Sb^2} - \frac{1}{Sa^2}\right) \Leftrightarrow Qv = \sqrt{\frac{2\Delta P}{\rho\left(\frac{1}{Sb^2} - \frac{1}{Sa^2}\right)}}$$

Description

The HD98B bench is used with the pipe n°2. This pipe is equipped with a venturi tube in transparent material in order to observe the flow inside the pipe and see the behaviour of this flow.

Two U-shaped manometers are available one filled with water (ρ=1000 kg/m^3) the other one is filled with oil (ρ=900 kg/m^3).

Experiment

a) Check the opening of the exit valve;
b) Open the n°2 pipe;
c) Connect one of the two manometers;
d) Activate the pump;
e) Pick up the values of the manometer in the following table;

Qv m^3/s	h1 mm	h2 mm	Δh m	U m/s	Re	State of the fluid

Conclude on the valour of the critical Reynold's number in this pipe, conclude on the state of the fluid depending the Reynold's number.