Experiment n°8

Evaluation of the performances of manometers in turbulent flow

# Objective

The aim of this experiment is to highlight the different measure of a same manometer in a laminar flow and in a turbulent flow in order to decide which manometer is the more suited for the task.

# Theories

Bernoulli formula

Flow rate equality:

For the venturi tube:

⬄) ⬄

For the orifice plate:

⬄) ⬄ introducing the Cd coefficient (because it is not a perfectly laminar flow) and the β=d/D, d diameter of the orifice (m), D diameter of the pipe (m)

Introducing C= Sb0 area of the orifice

Coefficient of discharge can be calculated with the Reader-Harris/Gallagher equation:

C=

A=

M2’=

L1=L2=0

For the flow rate, passing through multiple pipe in parallel involve that the flow rate in each pipe is the circuit entry flow rate divide by the number of pipe ( for example, a 100m3/s flow rate go through 2 pipe in parallel, the flow rate in each pipe is 50m3/s)

# Description

The HD98 bench is used, alongside pipes n°2, 3. Pipe n°2 is equipped with a venturi tube, a flow meter device based on the venturi effect. Pipe n°3 is also equipped with a venturi effect based flow meter: an orifice plate. The circuit use a rotameter (which will be considered the reference here).

# Experiment

1. Check the opening of the exit valve;
2. Calculate the flow rate maximal for a laminar flow in each flowmeter
3. Open one pipe;
4. Connect manometers to the desired pipes;
5. Activate the pump;
6. Open other pipe in order to divide the flow rate in each pipe;
7. Pick up values of the manometers in the following table;
8. Compare each manometer to the rotameter;
9. Conclude

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Qv m3/s | h1 mm | h2 mm | Δh m | Δp Pa | U m/s | Re |