Experiment n°5

Head losses comparison for different technical solutions

Objective

The aim of this experiment is to highlight singular head losses in a hydraulic circuit.

Description of the installation

The HD98B Hydraulic bench is used for this experiment. Pipe n°9, 6 and 5 will be used.

Theories

Head losses follow the Darcy-Weisbach formula:

$$\Delta Ps = \xi * \frac{L}{D} * \frac{1}{2} * \rho * Um^2$$

For head losses induced by a single component in the circuit (singular head losses) the formula is:

$$\Delta Ps = K * \frac{1}{2}\rho Um^2$$ K singular head losse coefficient

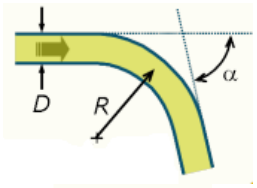
This formula is applicable for one singularity in the circuit, for example: if a circuit is equipped with 2 elbows and one valve, the formula is

$$\Delta Ps = (2Kelbow + Kvalve) * \frac{1}{2}\rho Um^2$$

For a singularity in the circuit, the coefficient K is given by the following formulas:

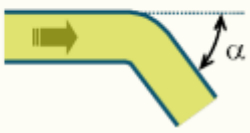
Rounded elbow:

$K=\frac{\alpha}{\pi}[0.131 + 1.847 * (\frac{D}{R})^{7/2}$



Elbow:

$K=(\sin\alpha)^2 + 2\,(\sin\frac{\alpha}{2})^4$

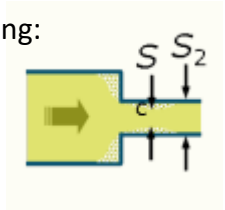


Rough entry:

K=0.5

Rough narrowing:

$K=\left(\frac{1}{\frac{Sc}{S2}-1}\right)^2$



Experiment

a) Check the opening of the exit valve;
b) Connect the U-shaped manometer to the desired singularity;

c) Adjust the flow rate by opening different pipes;
d) Pick up the value of the manometer;

Fill the following table:

Qv m^3/s	h1 mm	h2 mm	Δh m	K measured	K theoretical