

Experiment No

Title: LOSSES IN PIPE FRICTION

INTRODUCTION:

When a fluid is flowing through the pipe, it is subjected to resistance to flow due to shear forces between the pipe wall and fluid particles and between the fluid particles also. This resistance is generally called frictional resistance. This resistance depends upon the velocity of flow and area of surface in contact. It also depends upon the type of flow, i.e. laminar or turbulent. This frictional resistance causes loss of pressure in the direction of flow.

APPARATUS :-

The apparatus consist of four pipes with I. D.'s, 22.5 mm. G.I. pipe, 17.5 G. I. pipe 14 mm copper and 14 mm Aluminum pipe, so that loss of head can be compared for different diameters and different materials. A flow control valve is provided at outlet of pipes. This enables experiments to be conducted at different flow rates, i.e. at different velocities.

Tapping are provided along the length of pipes, so that drop of head can be visualized along the length of pipe. Each pipe is provided with valve at outlet, which enables heads to be controlled.

EXPERIMENTAL PROCEDURE :-

1. Fill up water in the sump tank. (This water should be free of any oil content.)
2. Open all the outlet valves and start the pump.
3. Check for leakages by closing three of outlet valves, for each pipe, and correct the leaks, if any.
4. Open the outlet valves of the pipe to be tested.
5. Remove all the air bubbles from manometer and connecting pipes.

6. Reduce the flow. Adjust outlet valves, so that water heads in manometer are to the readable height.
7. Note down the heads and flow rate.
8. Now, increase the flow and accordingly adjust the outlet valve, so that water will not overflow. Note down heads and flow.
9. Repeat the procedure for other pipes.

(Note - During measuring the heads, slight variation may occur due to voltage changes, valves etc. in such cases, average readings may be taken.)

OBSERVATION TABLE: -

Sr. No.	Type of pipe	Head drop 'h' cm	Time for 10 lit. Discharge of water. 't' sec
1	G.I. Ø 22.5 mm		
2	Cu Ø 14 mm		
3	Al Ø 14 mm		
4	G.I. Ø 17.5 mm		

Calculations:-

Sample calculation for reading No.

$$\text{Area of pipe, } A = \frac{\pi}{4} D^2 \text{ m}^2$$

$$\text{Discharge, } Q = \frac{0.01}{t} \text{ m}^3 / \text{Sec.}$$

$$\text{Velocity of water, } V = \frac{Q}{A} \text{ m / sec.}$$

Let, 'f' be the coefficient of friction. Test length of pipe is 1 meter.

For 1 meter length, drop of head, h_f

$\therefore h_f = \text{Manometer difference .}$

According to Darcy 's- Weish batch equation, head loss due to friction.

$$h_f = \frac{4fLV^2}{2gd}$$

Where, f = coefficient of friction.

L = Length of pipe = 1 m

V = Velocity of water m / sec.

g = Gravitational acceleration = 9.81 m/s²

d = Inside diameter of pipe, m

Then,

$$f = \frac{h_f gd}{2LV^2}$$

The value of coefficient of friction is not constant and depends upon roughness of pipe inside surface and Reynolds's number. Any oil content in water also affects value of 'f' .

[Repeat the same procedure for other pipes and prepare result table]

Result Table:

Sr. No.	Type of pipe	Value of h _f
1	G.I. Ø 22.5 mm	
2	Cu Ø 14 mm	
3	Al Ø 14 mm	
4	G.I. Ø 17.5 mm	

CONCLUSIONS :-

- 1] Loss of head due to friction is proportional to length of pipe and square of velocity.
- 2] Loss of head is inversely proportional to inside diameter of pipe.
- 3] Average value of 'f' for -
 - a] 22.5 mm. G.I. Pipe.-
 - b] 17.5 mm. G.I. Pipe.-
 - c] 14 mm. Copper Pipe -
 - d] 14 mm. Aluminum Pipe. -