MET E 352 FLUIDS LAB
FALL 2004
FRICTION LOSS ALONG A PIPE

Introduction:

In hydraulic engineering practice, it is frequently necessary to estimate the head loss Incurred by a fluid as it flows along a pipeline. For example, it may be desired to predict The rate of flow along a proposed pipe connecting two reservoirs at different levels, or it May be necessary to calculate what additional head would be required to double the rate Of flow along an existing pipeline.

Loss of head is incurred by fluid mixing which occurs at fittings such as bends or valves, And by frictional resistance at the pipe wall. Where there are numerous fittings and the Pipe is short, the major part of the head loss will be due to the local mixing near the Fittings. For a long pipeline, on the other hand, friction at the pipe wall will predominate. In this experiment, we investigate the frictional resistance to flow along a long straight Pipe with smooth walls.

Procedure:

1. Measure the necessary dimensions of the piping system and record the temperature of the water.
2. Adjust the appropriate valves to have the flow going through the 1 – inch pipe. Open the flow control fully.
3. Record the values displayed on the pressure gauges and flow meters along the system.
4. Using a large container and scale, record the amount of time it takes to accumulate fifty pounds of water from the system discharge.
5. Empty the container to the sump.
6. Repeat steps 3,4 & 5 with the flow control valve ¾ open, ½ open and ¼ open.
7. Repeat steps 3,4 & 5 for the ¾ inch pipe, ½ inch pipe and 3/8 inch pipe.

Assignment:

1. Calculate and compare the flow rates determined from the mass flow rate method and observation of the flow meters. From this data, calculate the Reynolds number for each condition. Was the flow laminar or turbulent? Next, calculate the friction factor from the head loss for each condition. Show a sample calculation for each calculation done. What does the changing magnitude of the friction factor “f” imply about its relationship to the corresponding change in the flow rate?

2. Plot the measured and calculate friction factor, f, vs. the Reynolds number. What outstanding characteristic of this graph stands out? What is its physical interpretation? How does your value correspond to the accepted value for this characteristic? Does the line on the graph representing the friction factor in the laminar region (if applicable) vary as you would expect if the flow was laminar? Please explain.
3. Plot Head loss vs. Reynolds number. Is the graph as expected?
4. What do the values of the experiment tell you about the roughness of the pipe for each size pipe. Compare it to the Moody Diagram.