

Measurement of Velocity Profile and Head Loss/Friction Factor in Pipe Flow

1. Turn on air flow with switch.
2. Make sure all valves are closed.
Measure air temperature and pipe temperature.
3. Open 2 inch pipe & 2 inch venturi.
4. Using manometer, measure water height on venturi using yellow tape. Open on both sides.
These can remain open through-out.
5. Then on the top of the valves open reservoir pressure and measure height on manometer.
6. With reservoir closed, measure top left four taps for friction.
7. Then begin pitot tube measurement.
8. Set
9. Measure ___ times each ambient and real

Close valves and shut off flow.

Guidelines for TA:

- The air-pipe assembly (see Figure 3): Flow should exist only in one experimental pipe and in one venturi meter at a time. When one valve in each set of three is open, the other two must be closed. Failure to do so will cause incorrect discharge results.
- Use of the simple manometer (see Appendix A): With a finger valve on the tap valve manifold open, use the manometer knob to adjust the column on the scale until the meniscus of the water in the column is even with the reference line on the vernier marker. A head reading, in feet of water, can be then taken from the scale. By appropriate conversion, the head value, in feet of air, at the location of the pressure tap on the pipe can be determined.
- Use of the differential manometer (see Appendix A): Finger valves A and D should be open at all times. Valve pair B is used to bleed the manometer. Valve pair C should be closed at all times. Valve pairs 1, 2, and 3 allow measurements across the 0.5", 1.0", and 2.0" venturi meters, respectively.
- The steps included in a measurement sequence using the differential manometer are the following. Start with valve pairs 1, 2 and 3 closed. Briefly open pair B to balance the water columns and then close. Set the lines on the sliding meniscus of each water column, and note the zeroed scale reading. Open a finger valve pair and read the corresponding head drop by sliding the markers to the meniscus of each column. This reading, in feet of water, must be converted to feet of air before compute the air discharge with the provided venturi equation. If a new measurement is needed, close the previous finger valve pair and open the new corresponding pair.
Note: When one pair of finger valves is open the other two pairs must be closed.

- Both the simple and differential manometer use a vernier scale to allow for measurements of 0.001 feet. The increments on the primary scale are 0.01 feet. The vernier scale has ten equal increments and a total length of 0.009 feet. Therefore, the two scales do not line up exactly. The ratio of the last coincident number on the vernier to the total vernier length will equal the fraction of a whole primary scale division indicated by the index position. For the example shown in Figure 1 Appendix A, the reading would be 2.323 feet.
- About the manifold finger valves (see Figure 5): At the top of the manifold, finger valve R, S, and T should be closed at all times. Before measuring, all valves on the valve manifold should be closed. Only one valve should be open at a time for measurement. Failure to do so will give an inaccurate head reading.
- Setting the discharge in the facility: The differential manometer measuring Δh across the venturi meters is limited to a maximum reading of 3.5 ft of water for each meter. This dictates which venturi meter will be used for approximating the selected discharges.
- Setting the location for velocity measurements across the pipe: Firstly determine the 0 position for the micrometer. This is done by using the 0 position set on the scale glued on the vernier, turning on the micrometer, and setting 0 on the micrometer's scale. A test of the accuracy of this positioning is made by measuring (while the system is on) the stagnation heads at two symmetric position w.r.t. centerline. If the readings are roughly the same (within 0.01 ft) the setting is OK. If no, repeat the above operations until these readings are as close as possible.
The suggested space interval between successive measurements for each half-diameter is: 0 (centerline), 5, 10, 15, 20, 22.5, and 25 mm.