

ENGR 4420 - Engineering Measurements

Venturi Meter Flow Rate Lab Report

Fall 2021

Lab Section: 201

Lab No. 4

Date Performed:

Date Submitted:

OBJECTIVE

In the lab the objective is to find the different pressures found in a restriction of a pipe. Different flows are applied and the values of pressure are measured by varying heights.

EQUIPMENT

- Venturi Apparatus with flow rate meter
- Ruler

EQUIPMENT CONFIGURATION

1. Initially the team had to set the water level of the head tank at 49cm and maintain this level by adjusting the controls on the pump.
2. Once this level was achieved, readings from the manometer board were taken.
3. Before dropping the level for the next reading, a measuring cup was filled while keeping time with a stopwatch.
4. Steps 1-3 were repeated with increments of 2cm until reaching 41cm. As follows
49cm, 47cm, 45cm, 43cm ,41cm.
5. After recording data for each increment, use the data to calculate the various flow rates for the Venturi meter.

EQUIPMENT SETTINGS

1. The venture pump is turned on by a switch
2. The flow is adjusted by varying the electricity and the flow kob
3. After the flow is set to a desired level, measurements are recorded

SAFETY MEASURES

- Close toed shoes were worn in order to protect oneself from possible dangers in the lab.
- The operator watched the machine to make sure there was no overflow of water.
- Safety glasses were worn in case water was splashed

PROCEDURE

1. Initially the team had to set the water level of the head tank at 49cm and maintain this level by adjusting the controls on the pump.
2. Once this level was achieved, readings from the manometer board were taken.
3. Before dropping the level for the next reading, a measuring cup was filled while keeping time with a stopwatch.
4. Steps 1-3 were repeated with increments of 2cm until reaching 41cm. As follows 49cm, 47cm, 45cm, 43cm ,41cm.
5. After recording data for each increment, use the data to calculate the various flow rates for the Venturi meter.

FINDINGS and OBSERVATIONS

In the lab we were not able to find the full results. We followed the instructions provided with the lab but due to errors in the venture machine we were not able to get the correct measurements making our data inconclusive. The data obtained were measurements taken at the indicated points in Figure 1 from 2 different Upstream or pump settings.

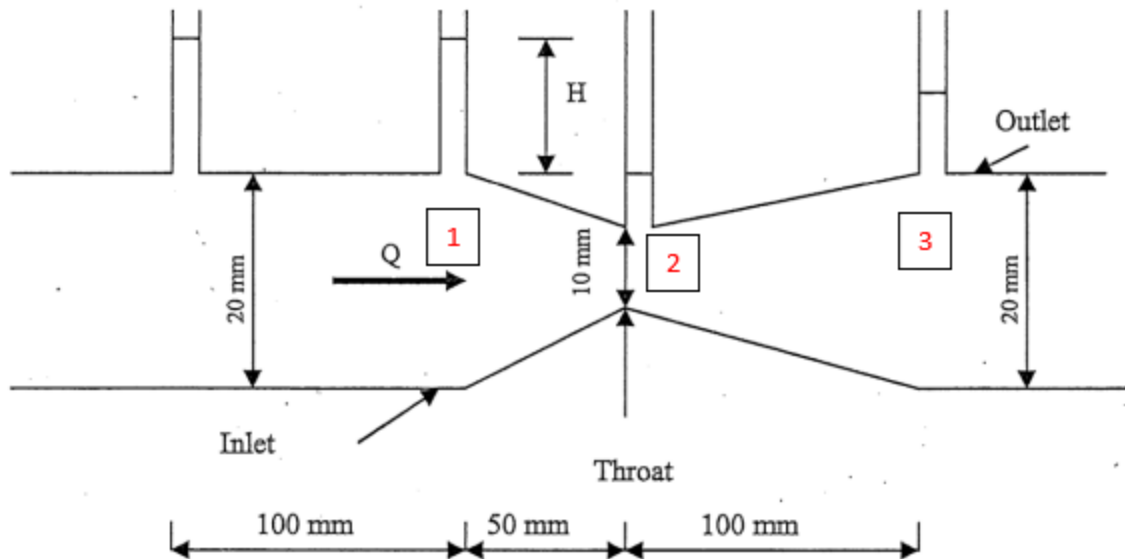


Figure 1- Shows the Venturi diagram used for theoretical calculations with labeled points of where the measurements in the experiment were taken.

DATA

	Upstream (cm)	P1	P2	P3	Downstream (cm)	Flow Rate(GPM)
Trial 1	39.7	41.6	39.4	40.7	37.6	0.8
Trial 2	44.7	45.9	38.9	43.5	40.3	1.6

SUMMARY

From the completion of the lab 4 experiment, we can see that the difference from theoretical values and actual values differed from each other. The reason for this may be caused by some human error when reading the manometer board or collecting water in the measuring cup. We can also note that most of the theoretical values from the experiment are higher than the actual flow rate. Again, this may be due to some error not accounted for during the procedures of the experiment. Although some of these readings

may be off from one another, we can still calculate the flow rates with roughly a 5-10% difference with the equations stated in the appendix below.

APPENDIX

$$\frac{p_2}{\gamma} + \frac{V_2^2}{2g} + z_2 = \frac{p_3}{\gamma} + \frac{V_3^2}{2g} + z_3 \quad z_2 = z_3$$

$$Q = VA = \text{constant, so } V_2 = \frac{Q}{A_2} \text{ and } V_3 = \frac{Q}{A_3}$$

$$[Equation] \quad p_2 + \gamma H = p_3 \text{ or } \frac{p_2 - p_3}{\gamma} = H$$

$$C_d = \frac{\sqrt{\frac{k_q}{2g}}}{A_n}$$

$$C_{dt} = \frac{1}{\sqrt{1 - \beta^4}}$$

$$Q = C_d A_2 \sqrt{2gH}$$

$$Q = C_{dt} A_2 \sqrt{2gH}, C_{dt} = \frac{1}{\sqrt{1 - \beta^4}}, \beta = \frac{d_2}{d_3}$$

REFERENCES

Previous Knowledge from Fluid Mechanics Course

Team Tasks

Adam Smith - Equipment used, Equipment settings

Dax Crow - Summary, References

Jose Garcia - Objective, Observations

Turner Ellis - Safety measures, Team Task

Maria Rodriguez - Data, Calculations, Results