Name of Experiment: Rotameter

Objective: Calibration of Rotameter (Flow meter)

Theory:

The rotameter is the most popular flowmeter. It consists essentially of a plummet or float which is free to move up or down in a vertical slightly tapered tube having its small end down. The fluid enters the lower end of the tube and causes the float to rise until the annular area between the tube and the float is such that the pressure drop across this construction is just sufficient to support the float. Typically, the tapered tube is of glass and carries etched upon it a nearly linear scale on which the position of the float may be usually noted as an indication of the flow.

Rotameter have proved satisfactory both for gasses and for liquids at high and low pressures. Rotameter required straight runs of pipe before or after the point of installation. Pressure losses are substantially constant over the whole flow range. In experimental work, for greatest precision, a rotameter should be calibrated with the fluid which is to be entered. However, most modern rotameters are precision-mode such that their performance closely corresponds to a master calibration plate for the type in question.

Fig. (1). Rotameter.
Procedures:
1. Select a rate of fluid flow through the rotameter.
2. Opening the inlet valve tell the float reaches the selected flow rate.
3. Estimating the time required to fill a fixed volume of output water.
4. The rotameter reading indicates the rotameter flow rate \( Q_{\text{rot.}} \) in \( \text{L/min} \); while the volume selected divided by the time measured indicates the actual flow rate \( Q_{\text{act.}} \) in \( \text{L/sec} \).
5. Repeating the procedures from 1 to 3 for other selecting flow rate.

Calculation and Results:
The actual volume flow rate is found from dividing the selected volume of water by the time required to accumulate that volume,

\[
Q_{\text{act.}} = \frac{V}{t} = \frac{A \times h}{t} = \frac{0.277 \times h}{t} \quad \text{in} \quad (\text{m}^3/\text{s})
\]

(1)

Where
- \( V \): is the volume of the water output accumulated in the storage tank, \( \text{m}^3 \).
- \( t \): is the time it takes to fill the selected volume, \( \text{sec} \).
- \( A \): is the cross-section area of the storage tank, \( 0.277 \text{ m}^2 \).
- \( h \): is the height of water in the storage tank, \( \text{m} \).

Record the selected value of rotameter and estimated value of actual flow rate in a table as shown in table below.

<table>
<thead>
<tr>
<th>No.</th>
<th>( Q_{\text{rot}} ) (( \text{m}^3/\text{sec} ))</th>
<th>( h ) (( \text{m} ))</th>
<th>( t ) (( \text{sec} ))</th>
<th>( V ) (( \text{m}^3 ))</th>
<th>( Q_{\text{act.}} ) (( \text{m}^3/\text{sec} ))</th>
<th>( C_f = Q_{\text{rot}} / Q_{\text{act.}} )</th>
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Calculating correction factor \((C_f)\), which is the ratio between the rotameter reading \((Q_{rot})\) divided by the actual volume flowrate \((Q_{act})\), for each reading, and then finding the average value of the correction factor.

Draw the calibration curve, the reading of the rotameter (on y-axis) against the measured actual volume flowrate (on x-axis). Also, find the average correction factor from Fig. (2) shown below, by finding the slope of the line.

![Calibration curve for rotameter.](image)

**Fig. (2).** Calibration curve for rotameter.

**Discussion:**

Discuss the relation between actual volume flow rate and rotameter reading. Also, compare between the average correction factor obtained from table and that obtain from the figure.