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Study the effect of impact of error of calibration on measuring instruments

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Abstract: Water is vital component in history & survival of human being & all other species. Water management improvements can promote conservation and make best use of our limited water resources, but better management depends upon the ability to accurately measure and control the flow of water. Instrument calibration is one of the primary processes used to maintain instrument accuracy. The results of calibration are used to establish a relationship between the measurement technique used by the instrument and the known values. In the present study, effect of percentage of error on the Rotameter is analyzed by conducting experiments. In this present study from the results it was concluded that, no instrument has 100% accuracy. So the results of any experiment should be analyzed by more than one iterations.

Index Terms -.Calibration, error, accuracy, measurement.

1. INTRODUCTION

A rotameter consists essentially of a tapered metering - glass tube, inside of which is located a rotor or active element (Float) of the meter. The tube is provided with suitable inlet and outlet connections. The float has a specific gravity higher than that of the fluid to be metered. The spherical slots cut on a part of the float causes it to rotate slowly about the axis of the tube and keep it centered. This spinning helps also to prevent accumulation of any sediment on the top or sides of the float. Alternatively stability of the bob is ensured by employing a guide along which the float would slide. With increase i n the flow rate, the float rises i n the tu be and there occurs an increase i n the annul r area between the float and the tube. The float adjusts its position in relation to the discharge through the passage i.e. the float rides higher or lower depending on the flow rate.

2. LITERATURE REVIEW:

Many investigators have studied the different techniques for discharge measurement which are commonly used nowadays. Accuracy plays very important role in the measurement. There are different types of errors associated with all kinds of measurement. Many investigators have studied different types of errors and explained about its probable cause and sources). To minimize these errors calibration is necessary to do regularly. There are various calibration techniques invented by many investigators for flow measurement devices (Ref. 17-21). Review of literature shows that, study and investigation of different methods of calibration for flow measurement devices were discussed. Besides that it is necessary to analyze the calibration process for sources of errors. In this present study, calibration process is studied and the data obtained from current meter calibration was analyzed by using orifice meter as model.

3. EXPERIMENTAL SETUP AND METHODOLOGY:

The experiments were carried out at KG Reddy college of Engineering and Technology, R.R Dist Telangana. The study is carried out with 5 iteration process. The experimental setup consists of Supply of water from pump connected to the inlet of rotameter. A regulating valve is fitted i n between the rotameter and pump to regulate the supply of water. The outlet of rotameter is further connected to measuring tank fitted with piezometer tube. A sump tank is used to collect the water. Measure the area of measuring tank. Open the regulation valve and under the steady state conditions note the reading of Rotameter i.e.in LPM (liter per minute). Note the initial level of water in m e a s u r i n g tank. Collect t h e water in the measuring tank for certain time and n o t e the final level of water i n measuring tank. Calculate in actual discharge. Compare it with the flow rate of Rotameter. Repeat the same for different flow rates

4. OBSERVATIONS AND RESULT

Group-1: Tabular values

S.No	Set time (Seconds)	Initial water level (h_1) (CM)	Final water level (h_2) CM	Difference of water level (H= h_2-h_1) CM	Actual Flow rate $Q_{th}=\frac{A*H}{T}$ cm^3/sec	Rotameter Reading (LPM)	Error
	20	5	7.7	2.7	58	60	2
	25	7.7	13.2	5.5	69	70	1
	30	13.2	22.3	9.1	75	80	5

As per the above tabular column No:1 the less error we could see at 25 seconds with a difference of water level of 5.5 cm and an actual flow rate at 69 cm^3/sec.

Group-2 : Tabular values

S.No	Set time (Seconds)	Initial water level (h_1) (CM)	Final water level (h_2) CM	Difference of water level (H= h_2-h_1) CM	Actual Flow rate $Q_{th}=\frac{A*H}{T}$ cm^3/sec	Rotameter Reading (LPM)	Error
	30	5	8.5	3.5	29.95	30	0.05
	40	5	9.4	4.4	28.8	30	1.92
	50	9.4	15.5	6.1	30	30	0

As per the above tabular column No:2 the less error we could see at 50 seconds with a difference of water level of 6.1 cm and an actual flow rate at 30 cm^3/sec.

Group-3 : Tabular values

S.No	Set time (Seconds)	Initial water level (h_1) (CM)	Final water level (h_2) CM	Difference of water level (H= h_2-h_1) CM	Actual Flow rate $Q_{th}=\frac{A*H}{T}$ cm^3/sec	Rotameter Reading (LPM)	Error
	30	5	10	5	59.02	60	0.98
	35	10	15.5	5.5	67.5	70	2.5
	40	15.5	20.5	5	78.9	80	1.1

As per the above tabular column No:3 the less error we could see at 30 seconds with a difference of water level of 5 cm and an actual flow rate at 59.02 cm^3/sec.

Group-4: Tabular values

S.No	Set time (Seconds)	Initial water level (h_1) (CM)	Final water level (h_2) CM	Difference of water level (H= h_2-h_1) CM	Actual Flow rate $Q_{th}=\frac{A*H}{T}$ cm^3/sec	Rotameter Reading (LPM)	Error
	20	5	8.5	3.5	31	40	9
	25	8.5	15.5	5.5	32.5	40	7.5
	30	15.5	20.5	5	33.9	40	6.1

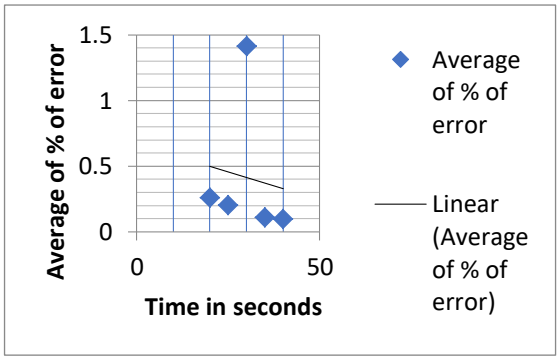
As per the above tabular column No:4 the less error we could see at 20 seconds with a difference of water level of 3.5 cm and an actual flow rate at 31 cm^3/sec.

Group-5: Tabular values

S.No	Set time (Seconds)	Initial water level (h_1) (CM)	Final water level (h_2) CM	Difference of water level (H= h_2-h_1) CM	Actual Flow rate $Q_{th}=\frac{A*H}{T}$ cm^3/sec	Rotameter Reading (LPM)	Error
	30	10	15.5	5.5	31.5	40	8.5
	35	15.5	20	4.5	46.5	50	3.5
	40	20	25.5	5.5	58.9	60	1.1

As per the above tabular column No:5 the less error we could see at 35 seconds with a difference of water level of 4.5 cm and an actual flow rate at 46.5 cm^3/sec.

5. Graph: Average % of error Vs Time



The above graph is plotted between time Vs Average percentage of error by taking average values of above five group tabular columns. Finally the graph obtained is a linear line in decreasing order.

6. CONCLUSIONS:

1. From the above plotted graph we can conclude that as the time increases the % of error decreases.
2. Try to conduct number of iterations for better results.

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