DEPARTMENT OF ENVIRONMENTAL, WATER RESOURCES, AND COASTAL ENGINEERING

MILITARY INSTITUTE OF SCIENCE AND TECHNOLOGY

FLUID MECHANICS SESSIONAL

EWCE 262

Experiment No. 3

FLOW THROUGH AN ORIFICE

1.1 General

An orifice is an opening in the wall of a tank or in a plate normal to the axis of a pipe, the plate being either at the end of pipe or in some intermediate location. An orifice is characterized by the fact that the thickness of the wall or plate is very small relative to the size of the opening. For a standard orifice there is only a line contact with fluid.

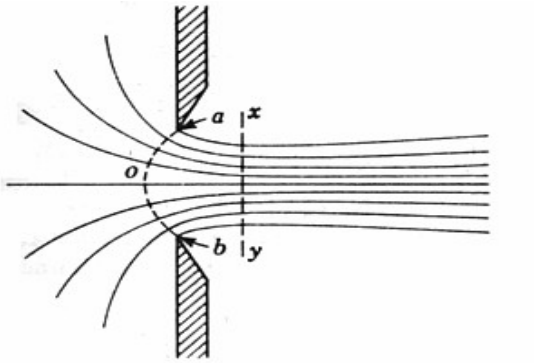
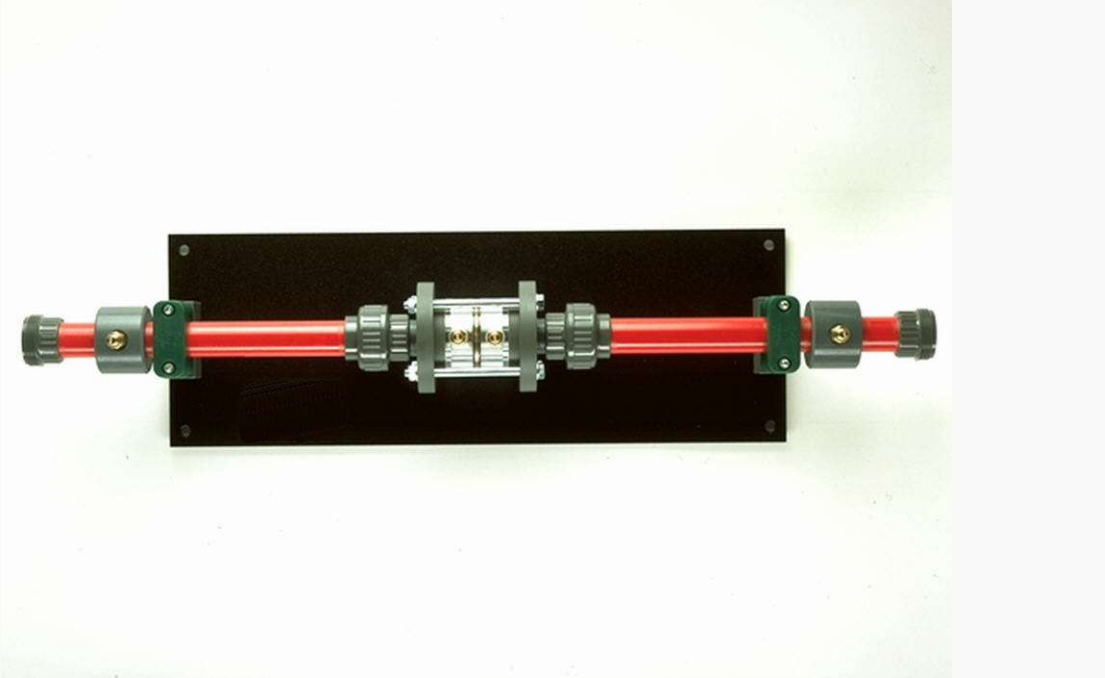


Fig 1 Jet contraction

1.2 Applications

The usual purpose of an orifice is the measurement or control of flow from a reservoir. The orifice is frequently encountered in engineering practice operating under a static head where it is usually not used for metering but rather as a special feature in a hydraulic design. Another problem of orifice flow, which frequently arises in engineering practice, is that of discharge from an orifice under falling head, a problem of unsteady flow.



1.3 Theory

Consider a small orifice having a cross-sectional area A and discharging water under a constant head H as shown in the above figure. Applying Bernoullis theorem between the water surface

$H = 0 + V^2/2g$

So $V_t = \sqrt{2gH}$

Where g is the acceleration due to gravity.

Let Q_a be the actual discharge.

So theoretical discharge, Qt is given by

$$Q_t = A\sqrt{2gH}$$

Then the coefficient of discharge, C_d, is given by

$$C_d = \frac{Q_a}{Q_t}$$

1.4Objectives

1. To find the value of C_d for the orifice.
2. 3 .To plot Q_a vs. H in log-log paper and to find the value of (a) the exponent of H and (b) C_d.
3. To find C_v for the orifice.
4. To find the head loss, H_L..
5. To plot v_a vs. H in log-log paper and to find (a) C_v and (b) the exponent of H.

1.5 Procedure

1. Measure the diameter of the orifice.
2. Measure the piezometer reading of fluid friction apparatus.
3. After measure the piezometer reading collect required time to store 10 liter water in hydraulic bench.
4. Repeat the procedure for different combinations of discharge.

1.6. Apparatus

Orifice meter, Fluid friction apparatus, hydraulic bench and stop watch etc.



Orifice meter



Stop Watch



Fluid friction apparatus

1.7 Experiment No. 1

FLOW THROUGH AN ORIFICE

Experimental Data Sheet

Experiment No. 3

d = _____

A = _____

Collection time = _____

Volume of water = _____

Discharge Q = _____

Group No	**Manometer reading h_1**	**Manometer reading h_2**	**$H = h_1 - h_2$**	**Q_a**	**Q_t**	**C_d**	**From graph C_d**	**Value of n from log -log graph**
1								
2								
3								
4								
5								
6								

Level / Term : **Dept. :**

Reg No. : **Section:**

Group No. : **Date :**

_____

Signature of the Teacher

Calculation from graph

Discussion

What are the possible errors in the experiment?

Compare and comment on results.

Practice Questions

1. What are the coefficient of velocity, coefficient of contraction and coefficient of discharge for an orifice? On what factors do these coefficients depend? What are the average values of these coefficients for a sharp-crested orifice?

2. What is a submerged orifice? What are the average values of the coefficient of velocity, coefficient of contraction and coefficient of discharge for a submerged orifice?

3. Why is the actual discharge through an orifice less than the theoretical discharge?

4. Define vena contracta. Why does it form?