**VERIFICATION OF BERNOULIS THEOREM**

**INRTRODUCTION:**

Most of the hydraulics studies are based on the principle of Bernoulli’s theorem. Verification of above principle experimentally helps in better understanding of the principles of hydraulics flow. The theorem is based on the law of conservation of energy. According to the Bernoulli’s theorem in an ideal incompressible steady and continues flow, the sum of the pressure energy ,potential energy, and the kinematic energy per unit weight of the fluid is constant.

**OBJECTIVE:**

To verify Bernoulli’s theorem.

**EQUIPMENT:**

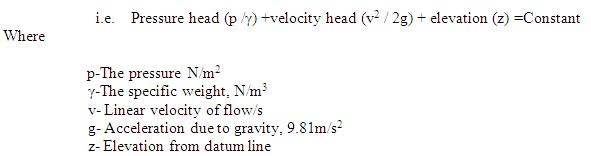
a) Apparatus for the verification of Bernoulli’s theorem.

b) Measuring tank and

c) A stop watch

**THEORY:**

Bernoulli’s theorem states that for a stream lined, steady, frictionless and incompressible fluid flow, the sum of pressure head, velocity head and potential head is a constant



Water at constant head from a tank is allowed to flow through a horizontal pipe line of varying cross section. The pressure heads Hp1, Hp2, etc are noted from piezometers fitted at cross sections A1, A2Etc .By measuring the actual discharge, the actual velocities of flow at A1, A2 etc are calculated.

The actual discharge Qa= ax h/t m3/s

Where

A-area of measuring tank in cm 2.

H-Level difference of water in the measuring tank in cm.

t-The mean time to collect water

The velocity of flow at the cross section A1 is given by

V1=Qa/A1

The velocity head is given by Hv1=V12/2g

Assuming that the pipe line has negligible frictional loss in flow, Bernoulli’s equation for the horizontal pipe at cross section A1 can be verified as:

Pressure head Hp1+ velocity head Hv1=constant

**OBSERVATIONS:**

**Constants**

* Measuring tank size, a m2
* The height (hm) for which the time t1 and t2 are noted to collect water in the measuring tank.
* The areas of cross section A1,A2, etc

**Variables**

* The piezometer readings HP1,HP2 etc in m of water
* Time tm seconds required to collect water for a height of hm in the measuring tank as mean value of readings t1 and t2

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S no** | **h(m)** | **t1(s)** | **t2(s)** | **Qa(m3/s)** | **A(m2)** | **V(m/s)** | **He(m)** | **Hp(m)** | **Total** |
| **1** |  |  |  |  |  |  |  |  |  |
| **2** |  |  |  |  |  |  |  |  |  |
| **3** |  |  |  |  |  |  |  |  |  |
| **4** |  |  |  |  |  |  |  |  |  |
| **5** |  |  |  |  |  |  |  |  |  |

**MANUAL:**

Start the experiment by pressing the start button with default values of discharge, length and depth of convergent and divergent passages and keep the values of collecting tank as fixed.

**Observation1:**

1) The water should start flowing from the flow channels through inlet (conduit) and it should fill the balancing tank up to certain level.

2) Then water shall start flowing through the convergent and divergent passage of rectangular cross sections, while flowing trough that sections, the level in the piezoometers start rising

**Observation2:**

1) The level in the piezometer should be maintained constant to keep constant head.

2) After raising the flow in the piezometers, pressure head should be maintained at various cross sections of the conduit by scale provided on the piezometer.

**Observation3:**

1) After measuring the pressure head water should start flowing from the outlet the to the collecting tank, then the collecting tank should be filled with water up to some height.

2) Then water shall start rising in the collecting tank with In 10cms rise of interval.

3) Note the time for collection of water to the rise of every 10cms in the collecting tank.

4) Change the discharge and size of the conduit (convergent and divergent) and repeat the experiment for different trials.

Graph: The graph of pressure head, on various cross sections. Take cross section area on x-axis.

Result: To verify the Bernoulli’s theorem by calculating total head

**QUIZ:**

* Bernoulli’s equation holds good for non ideal fluids
* True
* False
* The pressure head is given by
* P/γ
* V2/2g
* Incompressible ideal fluids are fluids which have constant density.
* True
* False
* If the flowing fluid medium is a real one then the difference in Bernoulli’s theorem is to add the head loss.
* True
* False
* Is the Bernoulli’s theorem is applicable to gases and vapors too.
* *True*
* *False*
* Are the datum pressure, velocity energies inter compatible
* True
* False
* A flow in which fluid particles do not rotate about there mass centers and retains their original orientation is called irrigational flow.
* True
* False
* There is a difference in the energy level between the supply reservoir and that at the fluid pressure top location.
* True
* False
* Calculation of velocity head at various sections along the conduit using the average velocity at that section is
* True
* False
* Bernoulli’s theorem deals with law conservation of momentum
* True
* false

**REFERENCES:**

* Fluid mechanics - Dr.R.K.Bansal
* Experiments in fluid mechanics - Sarabjit Singh
* Wikipedia