Experiment No.3

STUDY AND TRIAL ON A CENTRIFUGAL PUMP

AND PLOTTING OF OPERATING CHARACTERISTICS

Name of the student:

Roll No:

Date of Performance :

Date of Submission

Marks Scored:

Signature of Staff

Experiment No : 03

1. **Title** : Study & trial on a centrifugal pump & plotting of operating characteristics.

2. **Aim :** To conduct a test on a single stage centrifugal pump at various speeds to obtain the pump characteristics.

3. **Equipment :** Variable Speed Centrifugal Pump Test Rig

Description:

A Centrifugal Pump consists of an impeller rotating 'inside a casing. The impeller has a number of curved vanes. Due to the centrifugal force developed by the rotation of the impeller, water entering at the center flows outwards to the periphery. Here it is collected in a gradually increasing passage in the casing known as a volute chamber. This chamber converts a part of the velocity head (kinetic energy) of the water into pressure head (potential energy). For higher heads, multistage centrifugal pumps having two or more impellers in series will have to be used.

The test pump is a single stage centrifugal pump of size 1 "x 1" (25mmx25mm). It is coupled to a 1 HP capacity single phase AC motor by means of a cone pulley belt drive system.

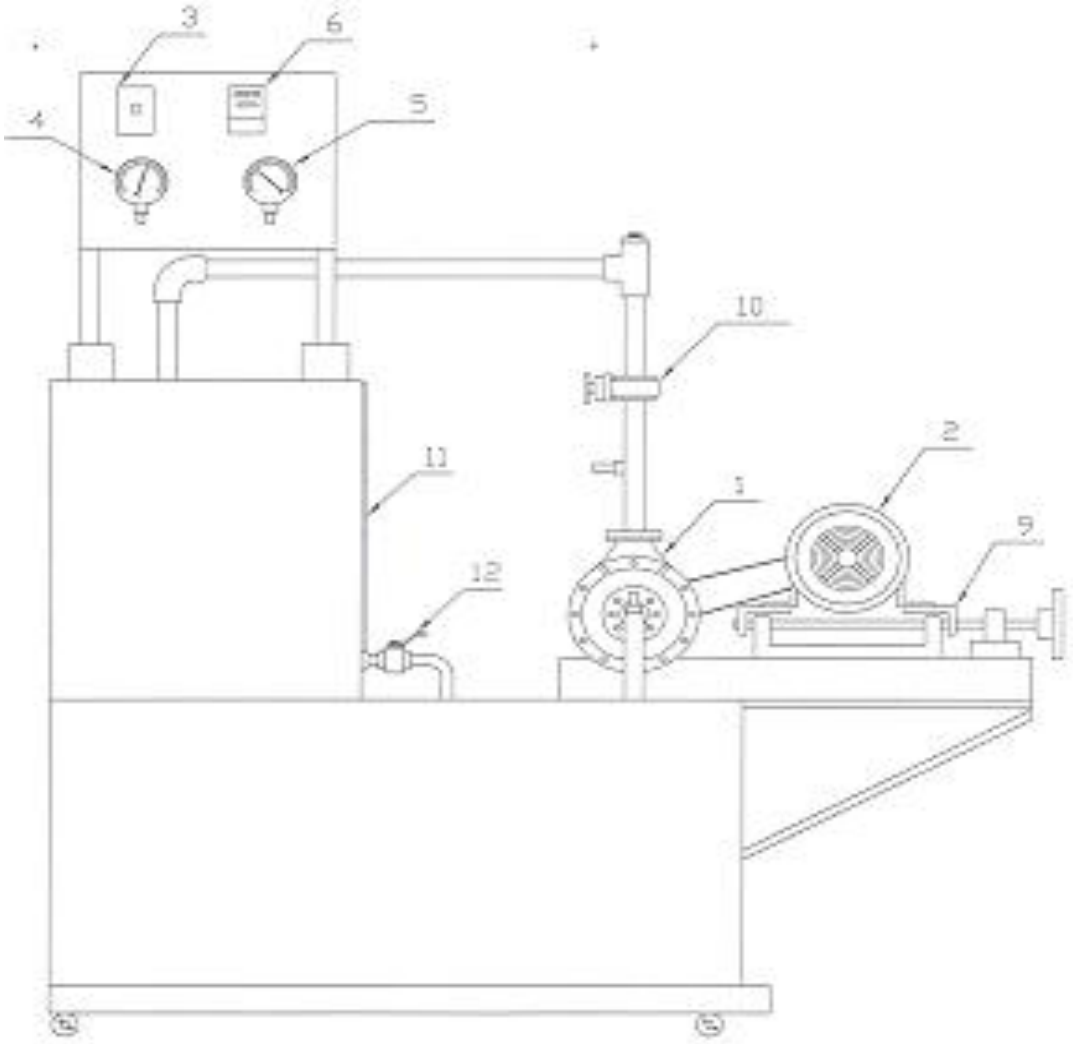
An energy meter and a stop watch are provided to measure the input to the motor and a collecting tank to measure the actual discharge. A pressure gauge and a vacuum gauge are fitted in the delivery and suction pipe lines to measure the pressure.

NOTE : Since the centrifugal pump is not self priming, the pump must be filled with water (priming) before starting. For this reason, water should not be allowed to drain and a foot valve is provided.

4. Experimental procedure:

1. Loosen the V-belt by rotating the hand wheel of the motor bed and position the V-belt in the required groove of the pulley.
2. Prime the pump with water if required.
3. Close the delivery gate valve completely.
4. Start the motor and adjust the gate valve to required pressure and delivery.
5. Note the observations

Take 3 or 4 sets of readings by varying the held from a maximum at shut off to a minimum where gate valve is fully open. The experiment is repeated for other pump speeds.


3
6
4
5
10
11
2
1
9
12

5. Specification of the pump :

1. Type = Variable Speed centrifugal
2. Energy meter constant (N) = 900 revs/KW Hr
3. Efficiency of motor = 80% (assumed)
4. Transmission efficiency = 90% (assumed)

6. Observations :

1. The Pressure gauge reading = P kg/sq.cm
2. The vacuum gauge reading = V mm of Hg.
3. Time for 10 revolutions of energy meter disc = T secs
4. Time for 1O cm rise in the collecting tank = t secs
5. Area of tank A = 0.5 x 0.5 sq m = 0.25 sq.m
6. Rise of level H = 0.1 m
7. Volume collected AH = 0.025 cu.m
8. Time taken = t secs
9. Time for 10 revolution = T secs
10. Pump speed = N rpm

7. Observation Table:

Sr.No	Pump Speed N rpm	Pressure gauge P Kg/sq cm	Vacuum Gauge V mm of Hg	Time for 10cm rise in Collecting Tank t seconds	Time for 10 revolutions of energy meter disc T seconds
1					
2					
3					
4					
5					
6					

7					
8					
9					
10					

8. Calculations:

1. Discharge Q = Volume/Time
   = 0.025 / t cu .m/see
2. Total Head H = 10 (P + V/760) m of water
3. Pump output = (9.81x QxH) KW
4. Input to motor = (3600x10) / (N x T) KW
5. Motor output = 0.8 x 3600 x 10 / (900xT) KW
   = 32/T KW
6. Pump input = Motor input x 0.80 x .090 KW
   = 28.8/T KW
7. Efficiency of the Pump = **Pump output/Pump input**

9. Result Table

S.No	Total Head H m of water	Discharge x lO^{-3} Q Cu .m/sec	Input KW	Output KW	Efficiency %
1					
2					
3					
4					
5					
6					

7					
8					
9					
10					

10. Operating Characteristics :

i) Discharge Vs Efficiency
ii) Discharge Vs Power
iii) Discharge Vs Head

11. Conclusions :

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Signature of Staff
(Prof. A.B VERMA)