JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Centrifugal Pump Test Rig.

Akshata Navnath Raskar.[1], Manasi Sanjay Dhavale.[2], Suraj Santosh Bhosale.[3],
Sonali Dinkar Vasav.[4] Shweta Gajanan Phapale.[5]
Mechanical Engineering Department, COEP, Phaltan, Satara, India.
Assistant Professor, Mechanical Engineering Department DBATU University, Lonere

Abstract-

In Mechanical Engineering branch students it is important to know what is the Centrifugal Pump, What is the actual work of Centrifugal Pump. Practically we need to study behavioural Characteristics of centrifugal pump test ring. And for that we need to study or work on different types of instruments.

In the world of hydraulics, the most preferred pumping devices are centrifugal pumps. This is due to their advantages like small in size, easier for maintenance, high efficiency, etc .The hydraulic machines which convert the mechanical energy into hydraulic energy are called hydraulic pumps. The hydraulic energy is in the form of pressure energy. A pump is a device that transfers fluids from one place to another by doing mechanical action. Thus according to the standard definition, Centrifugal pump is a device that converts Rotational form of energy (via motor) to energy in a moving fluid. The most essential parts that are included in centrifugal pump are Impeller. Casing, Suction pipe with a foot valve and strainer, and delivery pipe.We will discuss about this in depth afterwards.

Keywords- ***Centrifugal Pump, Water, PUC pipe and Motor etc.***

I. INTRODUCTION

The Hydraulic Machines which converts the Mechanical energy into Hydraulic energy are called Pumps. The Hydraulic energy is in the form of Pressure energy. If the mechanical energy is converted into Pressure energy by means of centrifugal force acting on the Fluid, the Hydraulic machines is called Centrifugal Pumps.

The centrifugal fan with consists of a blower driven by FHP Motor with a series of curved redial vanes. Air is drowning in near the hub, called the blower eye, and is whirled round at high speed by the vanes on the blower as the blower rotates at high rotational speed. The static pressure of the air increases from the eye of the blower to the tip of the blower in order to provide the centrifugal force on the air. As the air leaves the blower tip it is passed through diffuser passage which converted most of the kinetic energy of the air into an increase in enthalpy and hence the pressure of the air is further increased. The blower may be double sided, having an eye either side of the unit, so that air is drowning in both side. The advantages of this type are that the blower is subjected to approximately equal forces in an axial direction. In practice nearly half the total practice is achieved in blower and the remaining half the diffuser. A pressure ratio of around 4: 1 can be achieved with the centrifugal fan.

II.FIELD OF USE

We can used for fluid Machinery lab for Mechanical & Civil Engineering students. We can perform different type of experiment on this set up. Also we can test centrifugal pump performance.

III.LITERATURE SURVEY

The current research work on this particular topic was broadly studied by referring to the research work carried out by number of research scholars and their findings were thoroughly studied to arrive at the main objective of the research work.

First, we Looks Various Experiments Present in college lab after that we decided to do Project on Centrifugal Pump Test Rig. Centrifugal Pump Test Rig. Is an important experiment in fluid Mechanics in Mechanical Engineering. We are sure it will be very helpful for students for their study and it will be helpful for college also. For this experiment setup we study on different case study Jekim J. Damor, conducted experimental investigation, on centrifugal water pump with a 111 mm outlet impeller diameter, backward curved blades, formal discharge. We study on different parts like Centrifugal Pump, Motor (in this which company is better for motor selection), which pipe material was used etc... We study deeply and after that we are finalize all things and start to work on our project.

IV.WORKING

The unit consists of a centrifugal pump driven by a Dimmer Control motor. Input to motor is measured on energy meter. A measuring tank is provided to measure the discharge. Suction vacuum and discharge pressure is measure by gauges. A Ball valve on discharge pipe varies the head. The centrifugal pump consist of air valve , delivery pipe and inlet pipe delivery pipe connected to centrifugal pump which have delivery valve this delivery pipe deliver the water to the collecting tank . Sump tank store the water which required for measuring the pressure . Pressure gauge measures the pressure. Thus, performance of pump can be estimated at various speed and heads

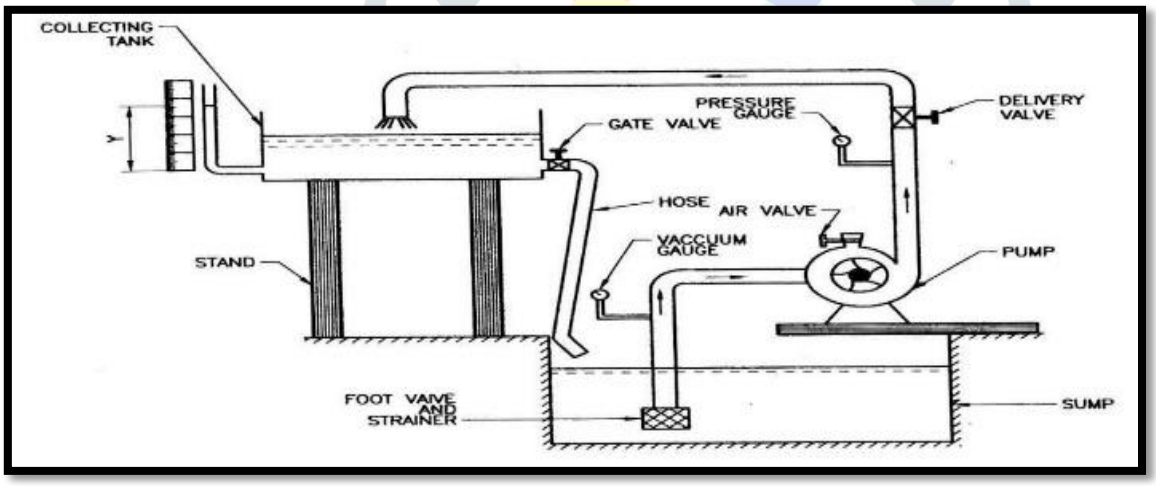

Figure: Centrifugal Pump test Rig.

PRECAUTIONS

Priming is must before starting the pump. Pump should never be run empty.

Use clean water in the sump tank.

Operate all the Controls Gently**.**

Figure : Set up of Centrifugal Pump Test Rig

SPECIFICATIONS: -

Centrifugal pump,2900 RPM, base mounted,

Motor: - 0.5 H.P. Dimmer Control motor directly coupled to pump.

Measuring tank 400 x 400 x450 mm. height, fitted with drain valve.

Sump tank 900 x 500 x 500 mm heights.

Ball valve to control the head.

Pressure gauge to measure discharge pressure.

Vacuum gauge to measure suction vacuum.

Energy meter to measure input the motor.

CALCULATION

OBSERVATION TABLE: -

Sr No.	Pump speed (RPM) N	Discharge Pressure (Kg/cm^2) Pd	Suction Vacuum (mm of Hg) Ps	Times for 10 lit water level rise (Sec) tw	Time for 10 rev of Energy meter (Sec) te
1	2400	0.35	200	5.65	20.9
2	2400	0.47	160	6.37	22.12
3	2400	0.57	130	8.22	23.06
4	2400	0.65	95	12.68	26.72

CALCULATIONS: -

1) Discharge Pressure Pd = 0.47 Kg / cm^2

For water, 10 m height corresponds to 1 kg / cm^2

Discharge head, h_d =0.47 x 10 = 4.7m of water

(**Discharge pressure** P_d = _____Kg/cm^2

For water, 10 m height corresponds to 1 Kg/ cm^2

Discharge head, $h_d = P_d$ x 10 = 4.7m of water)

2) Suction Head –

Suction vacuum, Ps = 160 mm of Hg = 160x13.6

Suction head, hs = --------- x --------

1000x1

= 2.18 m of water

Where, sp gravity of hg = 13.6

Sp. Gravity of water = 1

(Suction vacuum, P_s = _____mm of Hg

p_s = 13.6, Suction head, h_s = -----x------

1000x1

Where,

sp gravity of hg = 13.6, Sp. Gravity of water = 1)

3)Total Head, $h_t = h_d + h_s + h_r$

Where, h_r = 2 mtr. is the head loss due to friction

h_t = 4.7 + 2.18 + 3

= 9.88 m of water

(**Total Head,** $h_t = h_d + h_s + h_r$

Where, h_r = 2 mtr. is the head loss due to friction?)

4)Discharge –

Let time 10 lts. Level rise be tw sec.

0.01

Then, Discharge, Q = --------

6.37

= .90 x 10 m^3 / sec

(Let time for 10 CM. Level rise be t_w sec,

.380 x .380 x .010

Then, discharge, Q = ----------m^3/sec

t_w)

5)Output power (or water power)

W.Q.h

WP = ---------- kW

1000

Where, W = Specific weight of water = 9810 N / m^3

Q = Discharge m^3 / sec

Ht = Total head, mtrs

(W.Q.h_t

WP = ----------kw

1000

Where, W = Specific weight of water = 9810 N / m^3

Q = Discharge m^3 / sec

Ht = Total head, mtrs)

$9810 \times .90 \times 10^{-3} \times 9.88$

WP = ----------

1000

= 0.097 kW

6)Electrial Input –

Let time required for 10rev. of energy meter disc be t_e Sec. = 10x 3600

Electrical Input Power, IP = ---------- x ---------- = 22 1300

= 0.362 kW

Where. Energy meter constant = 1300 rev / kw / hr

Taking motor efficiency as 60% we have input shaft power

SP = 0.362 x 0.75= 0.29 kW

7)Overall efficiency of the pump

.097

η_o = -------- x 100%

= 0.29

= 22%

(WP

η_o = ----------X 100%

SP)

CONCLUSION

The main advantage of using this we can conduct different types of test on one set up. This increases the efficiency of the productivity. We can easily relocate. It require less space. This set up is useful for diploma as well as degree students.

FUTURE SCOPE

- Increase the efficiency of centrifugal pump.
- Study the different effect of construction/design parameter of pump on its performance.

ACKNOWLEDGET

We would like to thank Prof. Nalawade A.B. for his guidance. His enthusiasm and patience, as well as his technical expertise, were essential in helping us overcome many obstacles. Without him this dissertation would not have been possible.

REFERENCES

1] Wu, K . Numerical simulation and optimization of internal flow in micro high speed centrifugal pump. Master,Hangzhou: Zhejiang University, 2008.

2] Liang, C . Application of complex network in malfunction diagnosis of centrifugal pump. Jilin, China: Northeast Electric Power University, 2014.

3] Rathod Rohinkumar B | Jain Khushbu | Shah Maitrik **"A Review of Development Centrifugal Pump Testing Setup According to IS 9137 -1978 Standard**" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-2 | Issue-3, April 2018, pp.1556-1562, URL: https://www.ijtsrd.com/papers/ijtsrd11442.pdf

4] https://sumitshrivastva.blogspot.com/2017/07/centrifugal-pump-test-rig-manual.html?m=1