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RESEARCH ARTICLE OPEN ACCESS

Magnetic Coupling Centrifugal Pump

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ABSTRACT
The research describe the need of such pump to perform zero leakage which is demand for application where fluid is ither aggressive, toxic, and flammable.
We will study practically the pump characteristic curves that relate function between flow rate , delivered pressure ,consumed energy .
The practical study will run on G.O.N.T Water system

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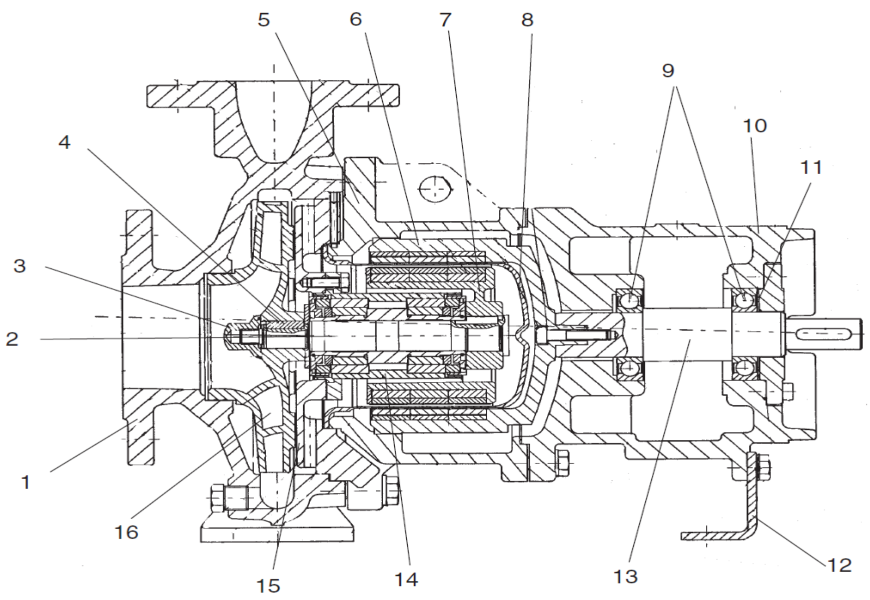
I. Introduction

The magnetic coupling pump is a standard chemical pump designed for engineering process in chemical factories.
The magnetic coupling pump we study is centrifugal single stage pump driven by electric motor connected to the pump by mean of flexible coupling

This magnetic coupling centrifugal pump is suitable for aggressive, toxic, pure and flammable liquids which have zero leakage from shaft seal.

Magnetic coupling pumps are available in an enormous range of shapes and designs in different type of, materials, construction and installation sizes. Look for figure 1) .



(Figure 1) MAGNETIC COUPLING CENTRIFUGAL PUMP

1	Housing
2	Pump rotor shaft
3	Impeller nut

9	Radial ball bearing
10	Bearing support
11	Spring washer

4	Fitting key
5	Lantern
6	Drive rotor
7	Pump rotor
8	Slotted plate

12	Prop
13	Drive shaft
14	Slide-bearing insert
15	Slide-bearing support
16	Impeller

II. Pump function

With a housing made of wear-resistant cast iron and spheroidal graphite, magnetic coupling pump possesses an axial suction inlet and radial pressure outlet. The pump can be emptied completely via its housing's drainage screw.
With a closed design, the impeller is attached via a nut and fitting key to the rotor shaft.
The slide-bearing insert is lubricated and cooled by the medium flowing around it.
The pump rotor is equipped with a permanent magnet protected against the conveyed medium by a corrosion-resistant coating.

The pump rotor and rotor shaft comprise a single piece each.
The metallic slotted plate seals the pump's interior tightly against the atmosphere.
The lantern protects the slotted plate against damage by the drive motor at the contact surface if the roller bearing develops a fault.
The bearing support contains pre-greased radial ball bearings which cannot be re-lubricated and are sealed at both ends.
The torque output by the motor is transmitted from the drive shaft
During rotation, magnets glued to the inside of the drive rotor generate an eddy current in the slotted plate which heats the rinsing flow. This flow is routed via the slide bearing back to the slotted plate.
This pump is used to convey corrosive, toxic, solid-loaded, neutral and clean media.

III. Literature survey

3.1 A REVIEW ON IMPROVEMENT OF EFFICIENCY OF CENTRIFUGAL PUMP

The operating flow of the pump is a function of the delivered pressure through the system and the arrangement of the system terms length [1].

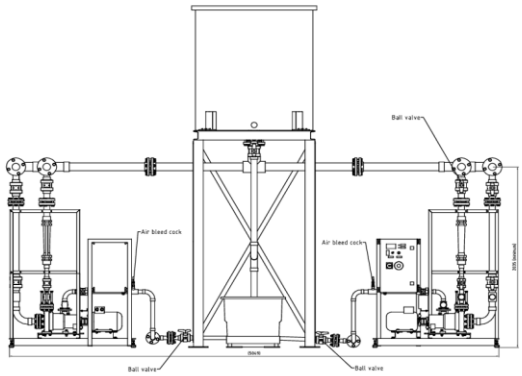
3.2 Pre Improving the Hydraulic Efficiency of centrifugal electric pump.

. We shall present this general case first and then indicate briefly how the results will simplify for our special cases [2].

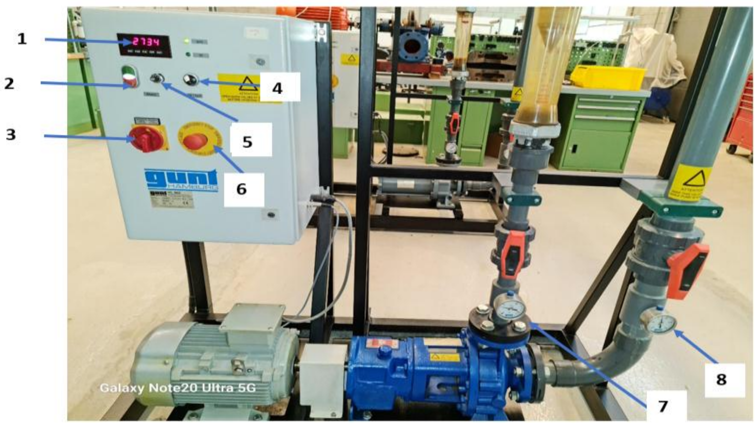
3.3 A Experimental Study on Centrifugal Pump to Determine the Effect of Radial Clearance on Pressure Pulsations, Vibrations and Noise .

The main advantages of a centrifugal pump includes its higher discharging capacity, higher operating speeds , lifting highly viscous liquids such as oils [3].

IV. Water supply system



(Figure 2) Water supply system



(Figure 3) magnetic coupling pump panel

1	**Digital panel**
2	**On/off button**
3	**Power switch**
4	**Power/rpm switch**

5	**Speed controller**
6	**Emergency switch**
7	**Delivery pressure**
8	**Suction pressure**

V. Magnetic coupling pump Characteristic

We are going to study the relation between the total head (TH) of pump via different flow rates, to do this will take readings of flow rate, suction pressure, deliver pressure , consumed mechanical energy at standard condition.

Symbols:

Total head in j/N	*TH*
pump delivery level in *m*	h_d
pump suction level in *m*	h_s
delivery pressure in Pa	p_d
Suction pressure in Pa	p_s
Delivery velocity in m/s	v_d
Suction velocity in m/s	v_s
water Density = 1000 kg/m^3	ρ
gravity Acceleration = 9.81 m/s^2	g
flow rate m^3/s	Q

Three terms to calculate TH :

$h_d - h_s$: Height Difference between suction and delivery of pump.

$\frac{v_d^2 - v_s^2}{2 \times g}$: Difference speed between suction and delivery of and outlet

We can get the Total head equation for a pump as:

$$TH = (pd - ps)x\,10 + 1x\ (pd - ps) \quad (1)$$

$h_d - h_s$= 0.02 m for the experiment rig

$v_d = Q \div 0.00196$ in m/s (outlet area = *0.00196* m^2, *d = 50 mm*).

$v_s = Q \div 0.00332$ in m/s (inlet area = *0.00332* m^2, *d = 65 mm*).

The pump Total efficiency of is the ratio of the hydraulic power HP to the electrical power consumption EP.

$$\eta = \frac{HP}{EP} \times 100 \quad \% \quad (2)$$

Equation of Hydraulic power in HP w is calculated as:

$$HP = \rho \times g \times Q \times TH \quad (w) \quad (3)$$

VI. Experimental Procedure

6-**1 start up;**

1. Switch on the pump .
2. Adjust the pump speed to 2800 rpm.
3. Start the globe valve at zero flow .
4. Increase the flow through the globe valve 100 L/min .
5. Repeat step 4

6-2 **Measured values**

Flowing readings taken during pump running

Flow M^3/hr	Suction pressure bar	Delivery pressure bar	Electric Power w
0	0.2	3.8	575
1	0.2	3.85	575
2	0.15	3.8	942
3	- 0.1	3.75	731
4	- 0.1	3.7	692
5	- O.2	3.6	660
6	- 0.3	3.6	1029
7	- 0.3	3.5	1218
8	- 0.3	3.5	1547
9	-0.33	3.2	1629
10	-0.33	3	1814

Measured values

6.3 calculations

Calculations and are shown in table (2)

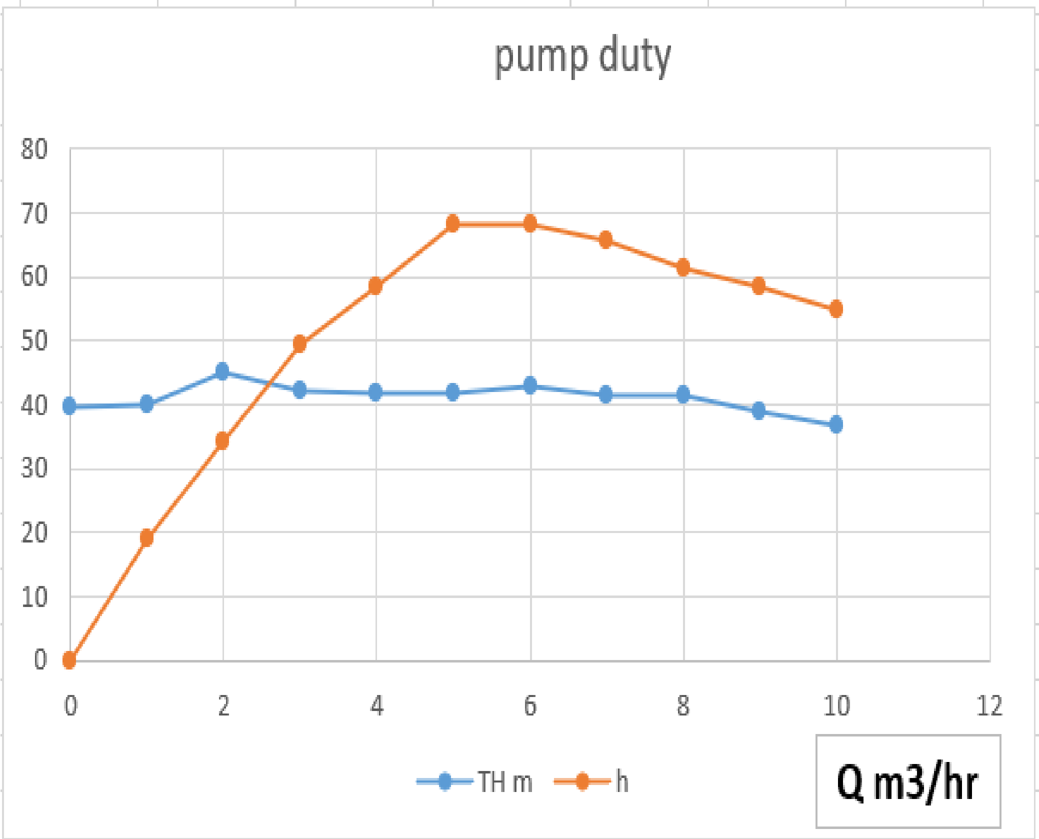
Flow	Head	Hydraulic Power	Efficiency

M^3/hr	m	w	%
0	39.6	0	0
1	40.15	109.4	19
2	45.15	246	34.2
3	42.35	364.2	49.8
4	41.8	455.6	58.4
5	41.8	569.5	68.3
6	42.9	701.4	68.2
7	41.8	797.3	65.5
8	41.8	951.57	61.5
9	38.8	951.57	58.4
10	36.63	998.1	55

Calculated values

7 Results

From previous calculation we get three relations:
1- The flow rate [Q m^3/hr] via [total head TH m]
2- The flow rate [Q m3/hr] via [pump efficiency h %]
As seen in graph .



VII. Conclusion

- From the graph pump should work at low rate (4.5 m^3/hr) that called the pump set point.
- At set point (4.5 m^3/hr) pump will rise total head (TH 41.8 m) .
- Pump efficiency at set point (4.5 m^3/hr), (TH 41.8 m) will be the maximum efficiency (68.8 %) .

VIII. Recommendation

- Pump should run at set point to gain maximum efficiency .
- During rotation, magnets glued to the inside of the drive rotor generate an eddy current in the slotted plate which heats the rinsing flow.
- Before start the pump Check whether the drive shaft can be turned easily by hand.
- Before start the pump Check the pump's direction of rotation: when viewed from the motor, the pump should rotate clockwise.
- never run the pump dry**.**
- Regular inspections are necessary to ensure safe and reliable operation.
- The bearing support's temperature should not exceed
- 50°C above ambient temperature.

References

[1]. Mr. Amitkumar Bhimrao Salunkhe Vice Principal, Shree Shivajirao Deshmukh Institute of Technology, Red-Shirala, Maharashtra, India
[2]. Abdallah Ait Moussa*, Lin Yunhao* *(Department of Engineering and Physics, University of central Oklahoma, 100 University Drive, Edmond, Oklahoma, USA 73034.)
[3]. Amit Suhane Assistant Professor, Mechanical Engineering Department, M.A.N.I.T., Bhopal, M.P. India-462051
[4]. G.U.N.T (PUMP AND VALVE) water supply system .
[5]. Frank D. Graham Audels pumps hydraulics air compressors Theo. AUDEL & CO. New York 1943
[6]. GRUNDFOS RESEARCH AND TECHNOLOGY (The Centrifugal Pump).