

# Analysis of Fault in Centrifugal Pump using Voltage Current Analysis

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**Abstract:-** Centrifugal pump is an component in manufacturing, refrigeration and power plant industry used in various applications. So it becomes important to find an efficient way to maintain the pumps for the better process control and to avoid any kind of disruption in the activities that may lead to huge financial, physical losses. So our project concentrates on finding a way to detect, isolate and diagnose a fault on the basis of current and voltage fluctuations because electricity is easily accessible in every part of the country and it is easier to analyze the output and then diagnose the faults because there are lot of softwares to analyze current and voltage fluctuations. There are other options also but we need to find a pocket friendly approach for the same and our project helps in that cause.

**Keywords:** Voltage & Current Analysis; Arduino; Fault Detection; Flow Rate; Centrifugal Pump.

## I. INTRODUCTION

All of us know that centrifugal pumps are used in various industries from beverage, chemical, water distribution for residential areas, fire protection systems etc. So it is necessary to maintain it and also ensure that the process is feasible and pocket friendly.

There are Various Techniques that are used to Identify Faults in Centrifugal Pumps which Involve:

- Parameter estimation
- Residue generation
- Voltage current analysis
- Audio and vibration based
- Machine learning based

The faults usually detected in the centrifugal pumps are-The detection parameters are vibration analysis, mass unbalance, crack, bearing systems, lubrication, wear, degradation factor and so on. Common problem in centrifugal pump is its inability to deliver the required flow and head due to wearing out of impeller, unusual vibration and leakage along the shafts.

In our project we are going to use the current and voltage analysis which uses the fluctuations compared to that of a healthy machine to understand the status of failure in the pump and try to locate.

### ➤ Description of Components

#### • Arduino Nano

This is a small compact breadboard friendly board based on the atmega 328p. It provides all the features of uno argumentation in a small size. It can be programmed using the Arduino software Integrated Development Environment (IDE), which is common to all Arduino boards running online and offline.



Fig 1 Arduino Nano

#### • ACS712

The ACS712 is a fully integrated Hall effect linear current sensor with 2.1 kVRMS voltage isolation and an integrated low resistance current lead.



Fig 2 ACS712

#### • Voltage Sensor

A voltage sensor is a sensor used to calculate and monitor the amount of voltage in an object. Voltage sensors can determine the level of AC or DC voltage. The input of this sensor is voltage, while the output is switches, analog voltage signal, current signal or audio signal.



Fig 3 Voltage Sensor

• Diode 1N4007

The 1N4007 is a widely used general purpose diode. It is usually designed for use as a rectifier in the power supply section of electronic equipment to convert AC to DC with other filter capacitors.



Fig 4 Diode 1N4007

• 16\*2 LCD Display

The operating voltage of this LCD is 4.7V to 5.3V. It contains two lines where each line can contain 16 characters. Current consumption is 1mA without backlight. Each character can be built using a 5 \* 8 pixel box.



Fig 5 16\*2 LCD Display

➤ Analysis

For the purpose of analysis two centrifugal pumps of 1 HP and 2 HP respectively were selected. Three readings of current and flow rate were taken for a fixed. Readings were taken at four such voltages 215,220,225,230.when the readings were taken it was seen that for the 1 HP pump the flow rate change was almost negligible but for the second pump it was seen that the variation was greater than the first one.

Table 1 2HP Pump

for 2Hp Pump			
Time elapsed (Min)	Voltage (V)	Current (A)	Flow Rate(LPM)
0 - 5 min	215	6.94	69
6 - 10 min	215	6.94	69
11 - 15 min	215	6.94	69
0 - 5 min	220	6.78	68
6 - 10 min	220	6.78	68
11 - 15 min	220	6.78	68
0 - 5 min	225	6.63	65
6 - 10 min	225	6.63	65
11 - 15 min	225	6.63	65
0 - 5 min	230	6.49	67
6 - 10 min	230	6.49	67
11 - 15 min	230	6.49	67

Table 2 1HP Pump

for 1Hp Pump			
Time elapsed (Min)	Voltage (V)	Current (A)	Flow Rate(LPM)
0 - 5 min	215	3.47	48
6 - 10 min	215	3.47	48
11 - 15 min	215	3.47	48
0 - 5 min	220	3.39	48
6 - 10 min	220	3.39	48
11 - 15 min	220	3.39	48
0 - 5 min	225	3.32	48
6 - 10 min	225	3.32	48
11 - 15 min	225	3.32	48
0 - 5 min	230	3.24	51
6 - 10 min	230	3.24	51
11 - 15 min	230	3.24	51

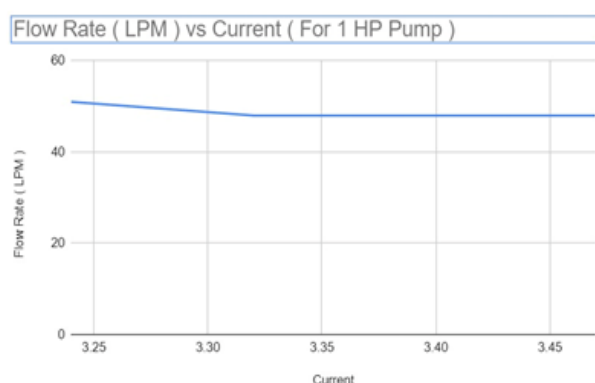


Fig 6 Flow Rate ( LPM ) vs Current (For 1 HP Pump)

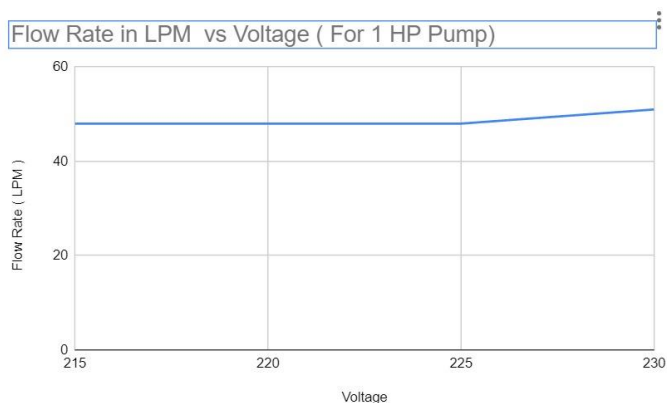


Fig 7 Flow Rate (LPM) vs Voltage (For 1 HP Pump)

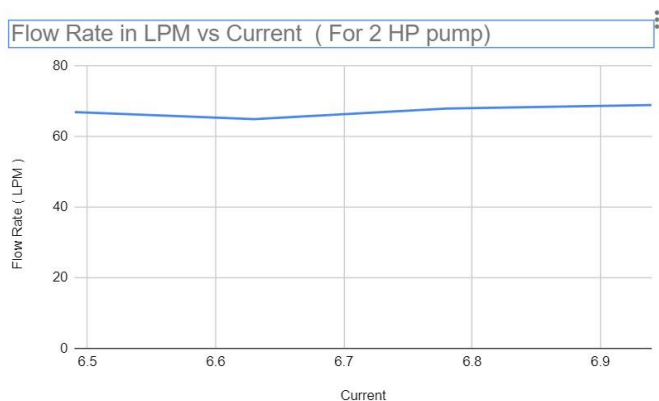


Fig 8 Flow Rate (LPM) vs Current (For 2 HP Pump)

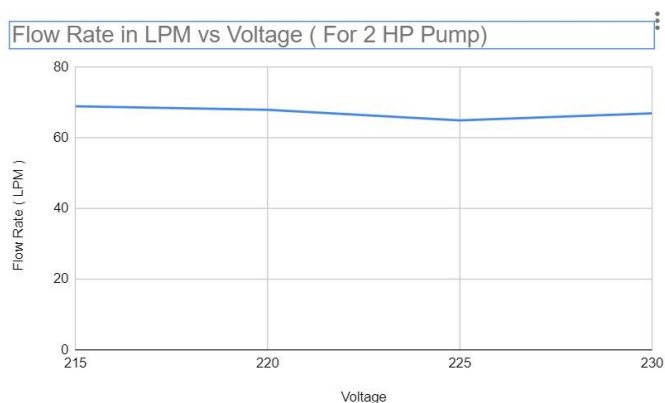


Fig 9 Flow Rate (LPM) vs Voltage (For 2 HP Pump)

So it may concluded that the variation in flow rate was not a great problem at low power pump but as the size and power of the pump is increased there are greater fluctuations for the flow rate which in turn will affect the performance of the pump. So it is necessary to control the voltage fluctuations within a given range.

## II. CONCLUSION

There are a lot of ways in which the faults of a centrifugal pump can be analyzed from vibration monitoring to regression analysis to model making. Each have their own advantages and disadvantages. From our project we can conclude that voltage current analysis is a very handy technique in assessing the health of any device not only a

centrifugal pump because surely the electricity driven devices are going to be affected by the electrical parameters of the driving motor. We have found out in our project that flow rate as a property is greatly affected by the voltage and current fluctuations so we provided a circuit breaker that prevents any harmful effects on the machine at a bay due to the voltage and current fluctuations. These technique is going to be very helpful in the future given the chance of growth in market size. There will be focus on voltage and current control instead of control for voltage and current which is actually a part of our project. Accuracy at low cost is something to look out for in the future.

## REFERENCES

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