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## TITLE: AUTOMATION IN OIL PUMPING

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**Abstract**

Today electrical energy is the most important need for the development of country. In India there are 90 thermal power station is available, and Maharashtra has 20 thermal power plant. The generating station has been constantly struggling with the energy problems, which are (1) heat energy losses and (2) electrical power losses. But these electrical power losses rise in electrical machine, controller, drives, transducer, actuator and oil (fuel) pump. In the present condition of thermal power plant to run the oil pump, used motor are continuously run at full speed due to this large amount of electrical power losses occur. These power losses can be overcome by using PLC control method. This PLC control the VFD of oil pump. In which VFD and PLC provides the required power to pump so that it can be maintain the pressure and force of fuel. So, we can try to save the wasted electrical power in oil pump. Pumping systems account for nearly 20% of the world's electrical energy demand and range from 25 to 50% of the energy uses in certain industrial plant operations. Pumping systems consume a significant portion of the electricity, VFD's are often recommended in such a way to save pumping energy. This paper provides technique for conservation of the energy by using the VFD. Recently, the use of the VFD in controlling the speed of the induction motor in the industrial sector has been used because they are easy to install and flexible in operation.

**Index Terms:** Power plant, variable frequency drive (VFD), Programmable logic control (PLC), Supervisory control and data acquisition system (SCADA), Three phase induction motor.

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## 1. INTRODUCTION

Over the years the demand for high quality, greater efficiency and automated machines has increased in the industrial sector of power plants. Power plant requires continues monitoring an inspection at frequent intervals. There are number of power plant present in our country. These are coal, hydro and nuclear power plant. The thermal power plant is coal fired power plant and million tons of coal is required for the generation of the power. Coal is most common fuel used in India for power station due to its abundant availability and low cost. Coal used in Indian thermal power station is bituminous coal. The quality of coal is decided based on its carbon content and other composition. In present scenario of thermal power plant, the efficiency of coal is not enough to maintain the boiler temperature. Simultaneously, we use another fuel (oil) to maintain the boiler's temperature.

Because of low efficiency of coal, we are facing the problem regarding the efficiency of boiler, excess of ash content depending on grading of coal. In order to overcome

these problems, oil is used as another simultaneous source. Circulation of oil is done by oil pump which provides oil in the furnace. Here, the three-phase induction motor is used

While circulating the oil within the furnace, motor runs continuously at full speed. Due to the continuous running of motor, the rate of energy consumption is high.
Variable frequency drive provides controlling over the speed of running motor. Therefore, the high rate of energy consumption gets reduce. Which is helpful to improve the overall efficiency of thermal power plant. These power losses can be overcome by using PLC control method which maintain the pressure and force of fuel by VFD controlled motor. In this way, the wasted power can be saved in oil pump.

### 1.1 OHP in thermal power plant

The oil(fuel) handling plant and storage system in a thermal power station covers unloading of the fuel oil, it's storage and transfer to the day oil tanks. Heavy fuel oil (FO/LSHS/HPS) are generally used for the initial start of the boiler and load up

to the load of 30% of maximum continuous rated (MCR). Fuel(oil) is also used for the coal flame stabilization nearly 40-50% MCR of the steam generator. In addition to all the above content, light diesel oil (LDO) system, of 7.5% MCR capacity, is also used to initiate the unit from cold condition when the steam is not present for heavy furnace oil (HFO) heating. Light diesel oil (LDO) is also been used for the auxiliary boiler (if envisaged).The fuel (oil) with in the thermal power plant has been received by the by railways, roadways or by the ships for coastal plant depending upon the logistics.

## 1.2 Fuel oil unloading system

The heavy fuel oil used with in the power plant such as HFO/LSHS/HPS is generally unloaded by the railway tankers. Till dated, oil rack contains the 80 wagons which are of TOH/TORX type which has the capacity of 22.3 kL each. Presently each rack contains the 48 wagons and BTPN type of wagon is used which can receive the oil up to the 58 kL .This system. This system also involves the heating of high viscosity fuels such as furnace oil, LSHS & HPS. The heating is normally carried out by the steam tapped off from the auxiliary steam holder.

Generally, the unloading of the oil is done in about 8 hours which involves the placement of the wagon, heating and pumping.in case of the where the transportation by the railway is not possible then the fuel unloading by road is preferred to eliminate the need of lying a railway track and associated marshalling facilities. The unloading is done by the road only.

## 2. Existing system in OHP.

Over the year, the demand for the high quality, greater efficiency and automated machines has been increased in the industrial sector of power plants. Power plant requires continues monitoring and inspection at frequent interval. There are possibilities of error at measuring and various stages involved with human worker and also the lack of few features of microcontroller. So, a reliable monitoring system is necessary to avoid the catastrophic failure, which is achieved by PLC and SCADA. Initially, we focused on passing the input to the oil(fuel) pump at the required temperature, so as to maintain the particular temperature in the furnace. SCADA is used to monitor the oil(fuel) level, pressure by using different sensors.

In the present scenario of the Indian thermal power plant the efficiency of the pulverised coal is not sufficient for the burning of the coal due to the presence of the moisture and due to the ash contents. Within the existing system of the oil handling plant the heavy oil is used with in the oil tank, pumps are connected to the oil (fuel) tank which are connected to the three phase induction motor of 22HP. Oil (fuel) in the oil tank is circulated by using the motor pump which are at always full speed irrespective of calorific value of coal. Due to the continuous running oh high HP motors it consumes more energy and going to waste lots of energy in circulation in oil.
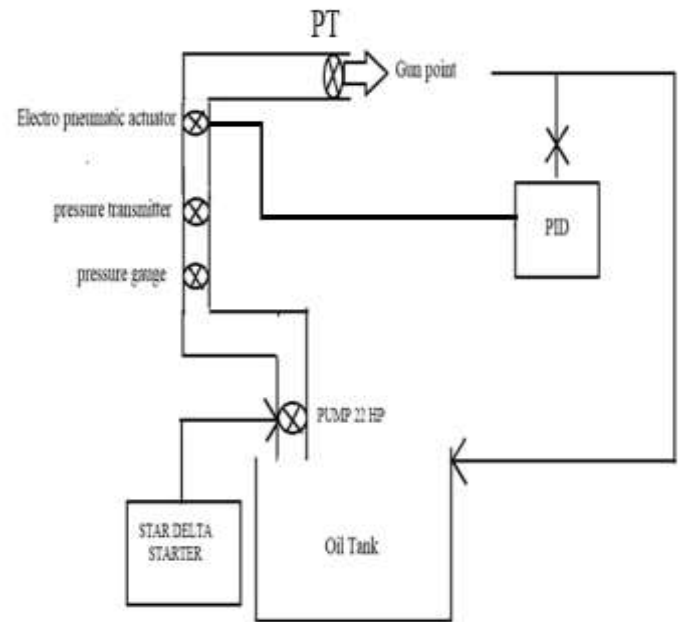


**Fig-1: Existing system in OHP**

The existing system comprises of pressure transmitter, actuator, motor, pressure gauge and PID controller

- Pressure gauge: it use to convert mechanical pressure value into proportional electrical signal.
- Pressure transmitter: it use to give the signal in the form of current and voltage.
- PID controller: it measures the unbalance signal.
- Motor: the motor runs continuously high speed which consumes the more energy.

The output of the pressure gauge is given to the pressure transmitter. The range of PT is 0-15 bar. Actuator is the type of valve, output of actuator is given to the gunpoint, and it spread high-pressure oil to catch the fire. The actuator will reduce the error signals if pressure is maintain then system will run and the remaining oil(fuel) goes back to the oil tank..

As the high power pumps (22 HP) are operated at full rated speed, therefore oil pipeline is under constant full pressure if not operated at full speed then pressure will be low and energy get wasted.

In order to overcome this entire drawback we are going propose the system in which all the equipment such as pressure transmitter, actuator and PID controller are replaced by the VFD, PLC, and SCADA.VFD is connected to the motor and it is used to control the speed of the motor which is continuously running at the high speed. By using the PLC/SCADA and VFD, oil is properly injected with in the furnace without any losses and accordingly speed of the motor varies automatically at the set level.

The proposed system overcome the drawbacks of the existing system which is mainly arise due to the moisture content with in the coal which reduces the calorific value of the coal. And drawback continuously running of the motor at high speed which is going control by using the VFD.

All variable frequency drives maintain the output voltage to frequency ratio constant at all the speeds for the reason that has been followed. The phase voltage V, frequency f and the magnetic flux $\phi$ of motor which is given by the equation

$$V=4.44\ f\ N\ \phi$$
$$\text{Or } V/f=4.44\times N\times\phi$$

Where N= number of turns per phase.

The advantages of using the VFD are

1. Bearing and winding life to the equipment increases.
2. Smooth control over the parameters such as temperature, pressure and speed can be achieved.
3. Break down and maintenance time decreases.
4. It provides the significant energy saving.

**Energy consumption formulae**

- Flow $\propto$ Speed
- Torque $\propto$ Square of speed ( $T\propto N^2$)
- $N \times T\propto N^2 \times N$
- Power $\propto$ nCube of Speed ( $P\propto N^3$)
- 10% Reduction of speed gives 25% Power saving.

## CONCLUSION

Thus, we conclude that when the motor runs at normal speed, then the motor will consume the more amount of energy. So the significant amount of energy gets conserved by using the variable frequency drive (VFD). The speed of the induction can be controlled by changing the frequency and the supply voltage of the induction motor.

As we know that the energy conservation is one of the most important need in all over the world. By using the automation, we are able to reduce the losses, which occurs human error.

By using VFD the use of starter is eliminated and it contains the capacitor and due to the presence of capacitor the power factor increases. By the use of VFD the wear and tear of the machine gets reduce. The installation of the VFD is easy, which helps to improve the overall efficiency of the plant. And thus the energy gets conserved.

## REFERENCES

[1]. Reference3

[2]. Reference4 etc.