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MONITORING OF BOILER IN THERMAL POWER PLANT BY USING PLC & SCADA

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Abstract

Boiler is one of the most important equipment in any power plant and which requires continuous monitoring and frequent inspection at particular interval of time. There are many stages involved with in the plant where error occurs at measuring and various stages involved with human workers. The monitoring of temperature of the steam in boiler during steam production process is very complex and difficult to control manually. Many accidents happens that cause injury as a result of human error in the operation of boiler. If the temperature or pressure exceeds the predefined value then the system should be shut down, we will overcome all this problems by using Programmable Logic Controller (PLC) and Supervisory Control And Data Acquisition (SCADA) system. This paper presents Programmable Logic Controller (PL C) and Supervisory Control And Data Acquisition (SCADA) system for conversion of manual operation of boiler to a Atomized Industrial equipment. PLC and SCADA interconnected by communication cables. The paper is outlined in such way that the human error can be avoided like as unreliable reading and poor inspection. This paper focussed on design and development of boiler automation system using PLC-SCADA and sensors so as to maintain the required water level in boiler.

Index Terms: PLC-SCADA, Boiler, temperature sensor, communication cables.

1. INTRODUCTION

As the demand for the high quality, greater efficiency and automates machine has been increasing day by day in the industrial sector of the power plant. Continuous and frequent operations are required with in the power plant to reduce the losses and the error. Mainly the error may occur due to the human work and lack of microcontroller features. In this paper we are going to control the parameters of boiler such as temperature, steam, pressure and water level. By controlling all these parameters we are able to reduce the loss which occurs due to the human error and thus it will be helpful in improving the overall efficiency of the power plant.

Boiler is the one of the most important part of the power plant. In order to monitor the parameter of the boiler we are going to use the PLC and SCADA. PLC is used to store the instruction regarding the instructions of controlling the parameter and SCADA system is use to monitor and reduces the human error.

1.2 Relevant of boiler

A boiler is a power generation device use for generation of the steam. The boiler is tangential fired from four corners creating a fireball in the middle. The ash form settle down at bottom and is collected in crinkle grinder. The burners are tilting type and can be adjusted in vertical direction only. In

the thermal power plant there are total 12 oil guns are provided for starting purpose. Oil burns quickly than coal. The maximum temperature in boiler is 1400° limited by material properties. The boiler is sealed at bottom by using water as it expands in downward direction and cannot be rigid. Boiler expands up to 250mm in downward direction.

The conventional systems are prone to error due to the involvement of the human in the data collection and calculation using the complicated mathematical expression. Thus, we require the system which would be helpful to collect all the data in a proper manner and they can compare available (present) value with reference value.

Electric boilers are specified for being clean, quiet and easy to install, compact. Because, there is no consideration for combustion. And an electric boiler has less complexity and the heating elements can be easily replaceable.

An electric boiler is perfect alternative to supply the low or high pressure steam or hot water where the customer is restricted by emission regulations. The electric boiler is best suited in the area where the cost of electric power is minimum, at that condition the electric boiler would be the best choice. The electric boiler have plus points such as low maintainance, high efficiency, space factor and fuel limitations.

2. WORKING OF BOILER

Water plays a vital role in the generation of the steam. The boiler is a closed vessel inside which water is stored. Fuel is burn the furnace and it produces the hot gases. This hot gases comes in contact with water vessel where the heat of this hot gases transfer to the water consequently steam is produce with in the boiler.

Then this steam is piped to the turbine to the thermal power plant. The percentage of total heat exported by outlet steam in the total heat supplied by the fuel is known as steam boiler efficiency.

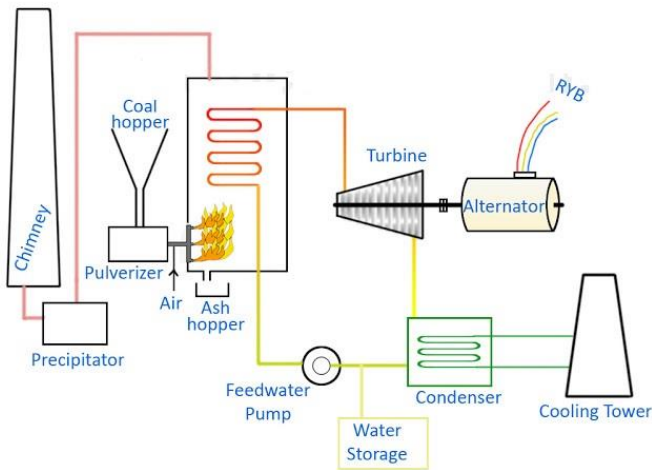


Fig-1: Block diagram of boiler

3. INTEND OF AUTOMATION OF BOILER

The main aim of our paper is to automate the manually operated steam boiler. The steam boiler is one of the most utility factor for all industrial plants. In Titan steam boiler, which is running at the pressure of 10Kg/cm² which is used in effluent treatment plant (ETP) with the capacity of 600Kg. this boiler is operated manually using the control panel. While controlling the boiler manually various factors needs to be considered which are very sensitive to be operated and often leads to serious problems. To avoid this, we propose an automated boiler that is operated and controlled using PLC (Programmable Logic Controller). By automating the boiler operation, we could minimize the human intervention and errors made by them during operation. Frequent examination of controls by the workers is greatly reduced. This satisfies the high quality and greater efficiency of steam boiler which is essential part of plant functioning.

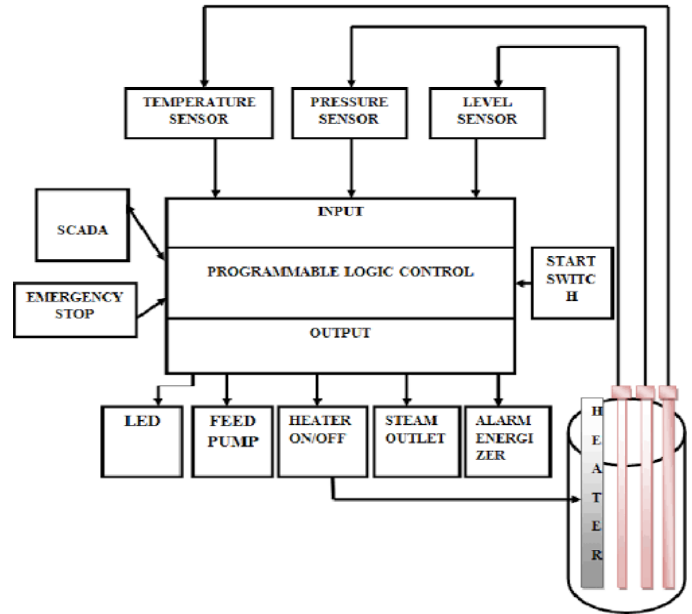


Fig-2 Block Diagram of Automation In Boiler

The feed water pump is switch ON by using feed water pump switch. For sensing the water level the water should maintain at 50 % we use low and high level switch, which is connected to the PLC. When the level reaches 50% lesser than or greater than PLC controller senses the level change and send the appropriate control signal to the feed water valve1.

For sensing the temperature we use laser temperature sensor and which is connected to the PLC. Sensor is used to monitor temperature and pressure signals feed into the PLC and controlling action is taken as per design objective. When desired temperature and pressure gets achieved the steam outlet valve is made ON and flow steam is regulated through that same valve and simultaneously heaters is made OFF.

3.1 Programmable Logic Controller:-

A PLC Allen Bradley SLC 500 is a solid state device designed to perform the logic functions, previously accomplished by components such as electromechanical relays, drum switches, mechanical timers/counters etc, for the control and operation of manufacturing process equipment and machinery. The requirement of highly specialized, high speed manufacturing process created a demand for smaller, faster acting, more reliable, low power consuming, expandable eliminating much of the hard wiring control devices called PLC's.

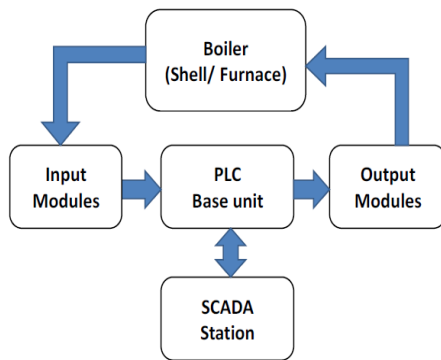


Fig-2 General Interfacing Of System

3.2 SCADA

SCADA INTOUCH is a software application program for process control, collection of data in real time from remote locations in order to control equipment and conditions. SCADA is used in power plants, oil and gas refining, waste control telecommunications and transportation. The hardware collects and feeds the data into a computer that has SCADA software installed. The computer then further processes this data and presents it in a timely manner. By using INTOUCH, we can generate powerful applications, which can deed the key features of Microsoft windows, graphics, networking and more. INTOUCH can also lengthen by adding custom active wizards, generic objects and creating INTOUCH quick script extension.

3.3 Temperature level:-

In System we have maintained the turbine inlet steam temperature at 485°C. If the steam temperature increased above the rated value, PLC gets signal from thermocouple and after Cold water will spray that particular steam pipe line. If the steam temperature decreased that particular level, PLC gets signal from thermo couple Coal Feeding increased.



Fig -3 Infrared Temperature Sensor

3.4 Pressure Control:-

In this system maintain the turbine inlet pressure at 66 Kg/cm². If the pressure level will increase that particular level, PLC gets signal from pressure switch and Coal feeding will reduce. If the pressure Level decreased that particular level, PLC gets signal from pressure switch and Coal Feeding will increase.



Fig-4 Pressure Transmitter

3.5 Water Level:-

In Boiler System water is important for steam generation, if the boiler water is going to below the 60 %, sensor sense the level and gives the signal to PLC. After receiving the signal feed water pump automatically switched on.



Fig-5 Level Indicator

ADVANTAGES

- Higher productivity
- Superior quality of end product
- Efficient usage of raw materials and energy
- Improved safety in working condition

4. CONCLUSION

In this paper, boiler automation by using PLC and SCADA was implemented. Different sensors are used to measure the parameter such as temperature, pressure and water level. SCADA is used to monitor the parameter and PLC is used to control the operation. If the value of temperature and pressure goes above the predefined value then the entire system gets shut down and automatic check valves are opened to realise the steam and pressure. Ladder diagram of delta PLC is stimulated using WPL soft and the SCADA design of boiler automation is stimulated using Intouch wonder war software.

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