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Boiler Automation Using PLC

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Abstract: This paper presents technical communication of automation industry which describes the technical issues of automation control system in operation development, improving management level and high efficiency process in boiler automation plant. In the boiler automation plant sensor need to be controlled and monitored temperature regularly. Thus it becomes tedious job to handle the plant manually. This project outlines the design and development of boiler automation system using PLC and sensors. This paper outlines the various stages of operation involved in the conversion of manually operated boiler towards a fully automated boiler. Over the years the demand for high quality, greater efficiency and automated machines has increased in this globalized world. The initial phase of the paper focuses on passing the inputs to the boiler at a required temperature, so as to constantly maintain a particular temperature in the boiler. The paper gives basic approach to move towards automation at higher level and totally digitize the industry so we can obtain efficient output in less time.

Keywords: *Dc and AC Supply, Relay, Boiler, Temperature Sensor, Analog Module, Programmable Logic Controller*

I. INTRODUCTION

Over the years the demand for high quality, greater efficiency and automated machines has increased in the industrial sector. A boiler is a closed vessel which is used to provide heat. Boilers are made up of different materials change with the passage of time due to demand in increase strength of these pressurized vessels. Historically highest grade of wrought iron was used to make boilers later on steel was used which is stronger and cheaper, with welded construction, which is quicker and requires less labor. Fireboxes of these boilers are made of copper, it was chosen because of its higher thermal conductivity and its better formability.

II. LITERATURE REVIEW

There are many different types of boiler, they are follow

1. Fire-tube boiler
2. Water-tube boiler
3. Superheated steam boiler

A. Fire-tube boiler

Fire tube boiler consists of boiler shell which is filled with water and these tubes are horizontally positioned. Water is partially filled in the water tank and volume is inside the water tank to accommodate the steam. Long horizontal tubes are called flues and these carry the hot combustion gases through the water tank and heating the water. The furnace is situated at the one end of the fire tube which elongates the path of the hot gases. Fire tube boilers are approximately to 360 psig of steam pressure.

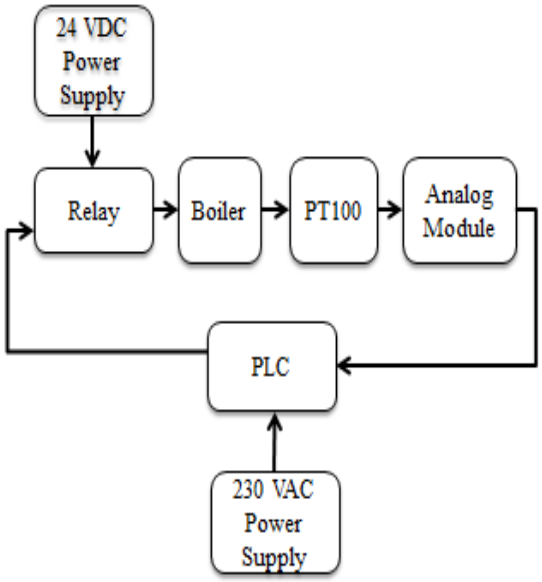
B. Water-tube boiler

In the water tube boilers tubes are positioned vertically in the firebox and through these tubes water flows whish gets heated upon flowing through these tubes, these vertical pipes are called risers and these extends from the water drum which is at the bottom of the boiler to the steam heaters which are at the top of the boilers. Water tube boilers are preferred for the high pressure application because of the high pressure steam/water is contained in smaller diameter pipes which withstand the high pressure.

C. Superheated steam boiler

Reheating a steam which has been produced in the boiler becomes superheated steam, this superheated steam is different from the initial steam which is called as saturated steam because it has water vapor and condense less rapidly as compared to saturated steam. The temperature of steam increases in the super heater section around 370 degree Celsius but its pressure remains same. Superheated steam is mostly used to move turbine as superheating steam removes all the droplets.

III. BLOCK DIAGRAM AND DESCRIPTION



A. PLC

Programmable Logic Controller (PLC) is a digital computer used for the automation of various electromechanical processes in industries [6]. PLC consists

of a microprocessor which is programmed using the computer language. The program is written on a computer and is loaded into the PLC via communication cable. These loaded programs are stored in non volatile memory of the PLC. During the transition of relay control panels to PLC, the hard wired relay logic was exchanged for the program fed by the user. Nexgenie PLC is a compact and genius PLC suitable for small size machine control.

B. Relay

Relay used as switch to operate boiler. We are use 24 VDC relay 655-T7NS5D-24 to operate the boiler. It is Single Pole Double Terminal (SPDT) relay means having both NO (Normally Open) and NC (Normally Close) terminal.

C. Boiler

Boiler is an enclosed vessel in which water is heated and circulated until the water is turned in to steam at the required pressure. The products of combustion are nothing but gases. These gases which are at high temperature vaporize the water inside the boiler to steam.

D. Temperature Sensor

As we have to measure high temperature for steam so we use 3 wire PT100 temperature sensors. The output of sensor is connected to the analog module, because it gives the analog signal.

E. Analog Module

The analog module is used for to convert the analog signal to digital signal, because the output of the PLC is in the digital form. So that purposes we use NE42UX analog module. The analog module is connected at the output of the PT100 because the output of the PT100 is in the analog form. So the output of analog module is in digital form is connected to the PLC.

F. Power Supply

A power supply is a device that supplies electrical energy to one or more electric loads. . The term is most commonly applied to devices that convert one form of electrical energy to another, though it may also refer to devices that convert another form of energy (e.g., mechanical, chemical, solar) to electrical energy. We used 24VAC for PLC and 24VDC for operation of relay.

IV. WORKING

At the initial stage the base plate is at upper most position. The vehicle is at first station from where the object is to be carried. As soon as when an object is placed on the upper plate properly as the upper plate is sliding in nature it starts to travel downward. As the rack is attached to the upper plate it also moves down ward which further rotates to pinion. The pinion and sprocket of chain drive is mounted on the same shaft that is why the sprocket is also rotate at the same speed of pinion. Further motion is transmitted to wheel with the help of chain and sprocket drive. Likewise the vehicle is transports object from one place to another place.

The return motion of the vehicle is achieved by the help of Cross bar tension spring mechanism. When an object is picked up from the upper plate it try to move upward because of tension spring mechanism. The same mechanism will operate in reverse direction i.e., the Rack will move in up word direction that is why the pinion were rotate in opposite direction that motion is further transferred to the wheels with the help of chain drive hence the wheel is rotates in opposite direction and the vehicle comes to its original position.

CONCLUSION

Boiler Automation using PLC was designed and implemented. Sensors are used to measure the temperature and maintained. If the temperature exceeds predefined value then the entire setup will shut down and power supply gets automatically OFF to release the temperature and maintained. If the temperature goes below predefined value then the entire setup will get ON and power supply gets automatically ON to increase the temperature and maintained.

Acknowledgment

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