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PLC Based Control System for Steam Boiler

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ABSTRACT: The project is to systematize the steam boiler. The steam boiler is an important factor for various purposes such as water treatment and cooking. Steam boiler is the system that is used in the effluent treatment plant for the separation of water and the total dissolved salts. The boiler is inevitably operated using the control panel. The boiler needs to be guided by the various factors that are against to the normal operation of the whole industry. To overcome this problem, the steam generator is automated using an integrated programmable logic controller (PLC). By automating the boiler, the work of human is reduced and the errors are also deductible. This satisfies high quality and greater efficiency of the PLC controlled steam boiler.

KEYWORDS: ETP, PLC, TDS.

I. INTRODUCTION

Nowadays, every new industry has the demand for high quality, greater efficiency and automated machines has increased in the industrial sector of power plant. The errors that are most occurring is the human errors and these errors also depend on the location and quantity of the resources available. Thus, a sincere attempt is taken to explain the rewards of the companies will face by implementing automation into them. The boiler control which is the most significant part of a power plant, and its automation is the exact effort of the mechanization.

In order to automate a power plant and reduce human made errors, the boiler developed PLC (Programmable Logic Controller) is also used. The boiler produces 600kg of steam when there is a supply of 600 liters of water given as input to the boiler through the feed water pump. To display a controlled system which can be controlled automatically without any human intervention is an essential part of a company's improvement.

II. EXISTING SYSTEM

There are many useful inventions and innovations made by the industry to reduce the human work and set up an interlock to make the system a controlled system. Effluent treatment is a part of the company that separates the salt from the water and is reused. Power plants need constant monitoring and inspection at frequent levels. In the coding process of this application with micro-controller, it needs a fast and operative dispensation which depends on the length and sub-routines of the coding process.

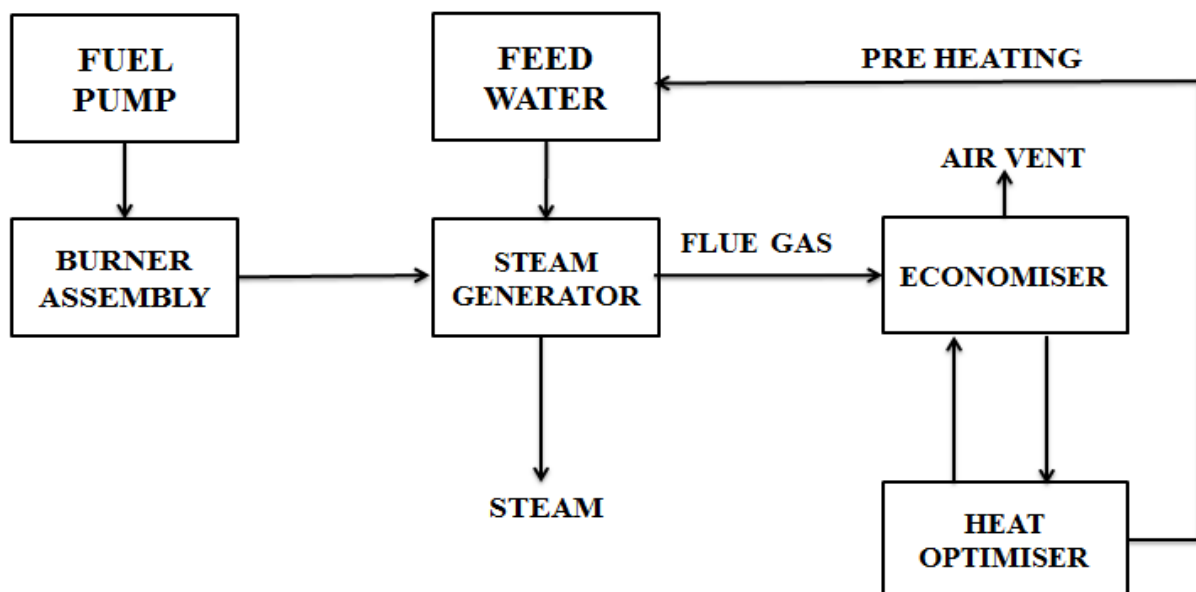
III. PROPOSED SYSTEM

This method is to systematize the physically operated steam boiler. An industry requires an eco-friendly system that not only reduces pollution but also consumes less human work. Steam boiler runs at the pressure of 10Kg/cm² when supplied with 600 litres of water and gives 600kg steam as an output. The main factors that are needed to be considered is that the boiler should be alienated from human and is must be in a suggested location. To overcome the errors and man-made mistakes, the boiler is made automatic using the programmable logic controller (PLC). Frequent inspection of controls by the workers is greatly reduced. This satisfies the high quality and greater efficacy of steam boiler which is vital part of plant functioning.

ADVANTAGES

- Very high accuracy
- High level safety
- Rugged construction
- Easy documentation

IV. BLOCK DIAGRAM



The water is given as the input to steam generator and diesel to the burner section. Where flue gas is collected by economiser and heat optimiser to pre heat the water and it generates the steam. This process is made automatic through the ladder logic programming is to PLC.

V. HARDWARE DETAILS

FEED WATER PUMP: The pump is a reciprocating single acting pump. Three phase power supply is given as input to start the machine. The bolt on the surface is adjusted in order to make the belt tension within a controlled range. The pump has water chamber and crank case. The crank shaft riding on ball bearings drives the pistons. Control valve in the water chamber prevent flow of water from pressure side to suction side. A control valve consists of valve seat, valve disk, spring and valve cage, all held together with the Teflon washers. Control valves are fitted which will require separate type of fitting. The surge suppresser is a pressure vessel mounted on the delivery chamber. It serves to reduce the pressure fluctuation caused by the reciprocating pump.

FUEL PUMP: These are gear type optimistic displacement pumps. The pump is directly coupled and driven with the blower motor. This is driven with separate motor at 3000RPM. The adjustment must be done when the spark is detected by the electrode by the photocell. There is an oil output connection is located to the backwards of the adjustable screw.

BLOWER: The blower is a fan like structure having a shaft that is coupled to the motor. The motor foot mounted type, bolted on the blower casing. The assembly is set so that there are no issues to the other parts of the boiler steam generator. The errors are reduced by the controller logic. The blower is mainly used to supply oxygen in order to burn the diesel fuel. The diesel is burnt when it combines with the specified amount of oxygen.

ECONOMISER: Economiser is a shell that is used for the exchange of heat within the tube. Carbon steel tubes are welded between MS tube plates. The smoke that comes as a result of the burning of the fuel is let out through the economiser valve. The water is again heated to some extent through the economiser chamber.

HEAT OPTIMISER: This is a chamber where the water is preheated and it is made sure that the temperature of the water is made normal. The heat optimiser is the device where the heat is exchanged over the surface of the feed valve. The water is initially heated before it reaches the solenoid coil of the boiler.

VI. SOFTWARE DETAILS

LADDER LOGIC: The ladder logic is the conventional way of representing the operation of the controls in a system. Ladder logic allows a system to be controlled without any usage of wires and cables. The input is given as 24 volts to the siemens PLC which uses simatic software to draw the ladder logic. The ladder logic used inbuilt function such as the function a switch, relay and the output coils.

VII. EXPERIMENTAL RESULTS

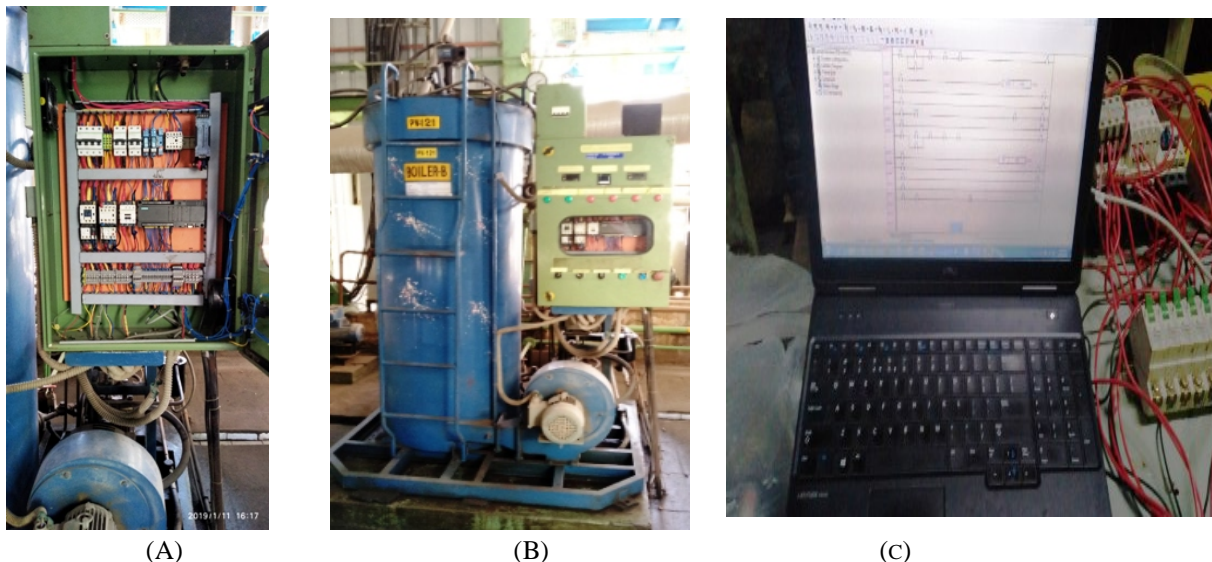


FIG 7.1 – (A) PLC SETUP IN BOILER, (B) BOILER SETUP, (C) OVERALL PLC CONNECTION AND OUTPUT

Steam boiler that is situated in the effluent treatment plant produces 600kg of steam when supplied with 600 liters of water. The steam generated in the boiler is given to the effluent treatment plant (ETP) to extract the total dissolved salts from the water by the use of the steam produced as the result of the operation of the steam boiler generator using programmable logic controller. The man power is reduced and it is various applications.

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