Programmable Logic Control of Soot Blowers in the Recovery Boilers

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ABSTRACT

A Soot blower is mainly for vanishing the soot which is deposited on tubes of furnace in a boiler during combustion. There are major types of soot blowers such as Wall Blowers, Long Retractable Blowers and Air Heater Blowers were used for the cleaning. Steam is act as a medium for removing the soot away. Soot deposited on the heating surfaces of a boiler acts as a heat insulator. The result is that less amount of heat is transferred to the water to increase the steam and more heat is wasted chimney's Shell. This leads to higher fuel consumption and/or poor steaming. In the conventional model the soot blowing operation has been controlled by relay contactors with manual timers to produce delay time between extension and retraction of the soot blower. But the maximum effective cleaning. This project Programmable Logic Control of Soot Blowers in the Recovery Boiler deals with the cleaning of accumulated soot in the recovery boiler. The convention system uses relay logic for controlling the soot blowing operation. Recently the accumulated soot in the recovery boiler lowers the efficiency of the boiler due to the low time delay between the extension and retraction of the soot blower .Recovery boiler is considered to be the heart of the paper manufacturing process. Hence such a project which increases the effective cleaning area of the recovery boilers by means of soot blowers with the help of PLC. The extensive advantages of PLC make it an effective selection for industrial applications when compared with microcontrollers and contactor relays.

KEY WORDS: PLC, Boilers, Blowers, DCS Control.

1. INTRODUCTION

The aim of the project is to perform the soot blowing operation with increased efficiency with the aid of PLC. For a developing industry the operation performed and the components produced should have it minimum possible production cost and production time. This process can be achieved through PLCs, Computers, PLC Hardware components, Ladder Logic Program. The main advantages of PLC systems are economy, simplicity, reliable and accuracy. Automation plays an important role in industries now-a-days. Charlie Breeding, Ben Zimmerman and Rabon Johnson (2004), told to arrive a new system, which is for optimizing boiler cleanliness using instrumentation and control system. He made a system architecture for a soot blower using smart sensors, smart gauges, boiler parameters, sensors/gauge interface-ISB algorithm, smart convection soot blower, water canon control system (PLC based). Sandeep Shah, Charlie Breeding (2004), conveyed intelligent soot blower system leads better improvement in boiler efficiency, when compared to non-intelligent soot blower system. Heat rate improvement is developed by reducing the flow of at temptation spray, which is mainly for controlling the reheat steam temperature, Jameel (1993), studied and showed the area of front and back tube bundles, after saturated steam used in the soot blower.

Electrical Equipment: Two limit switches were used, which is like one at rest and another at the reverse position. Trip lever bolted be activated by a limit switch on the spindle housing and it is adjustable. Any adjustment position of the forward limit switch will affect the indexing feature of the gearbox. The limit switches and motor power supply can be accessed in an electrical box that is mounted to the side of the soot blower housing.

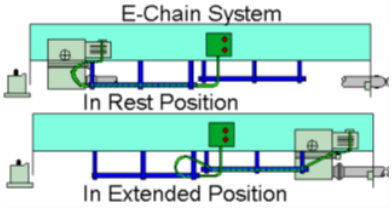

Figure.1. E-Chain System

Existing Model Procedure of Operation: Generally, the RS soot blower is part of a complete cleaning system with several blowers, piping with drain valves, motor starters, and the controls which allow automatic operation of the soot blowers in a sequence, and regulate the valve piping system warm up cycles, and necessary interlocks for safeguarding. The soot blower control system operating manual should be used in conjunction with this manual for operation in automatic.

The following conditions should be met before operation of the soot blower in automatic or at the local start/insert button:

- All maintenance has been properly completed and soot blower inspected to ensure the carriage is at the rest position, valve linkage is properly aligned, valve pressure adjustment nut is in the locked position (externally adjustable valve only), and there are no objects that may block the movement of the carriage.

- Blowing medium must always be available to the soot blower if operating while the boiler is on-line to ensure adequate cooling to the lance as it inserts and retracts from the boiler. Ensure all valves are in the proper position after any maintenance or repairs are completed.
- All condensate is drained and piping is warmed to ensure minimal condensate is passed through the soot blower.

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Existing Boiler Circuit:

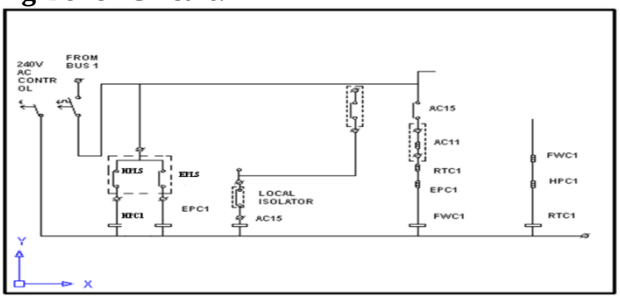

Figure.2. Existing Circuit

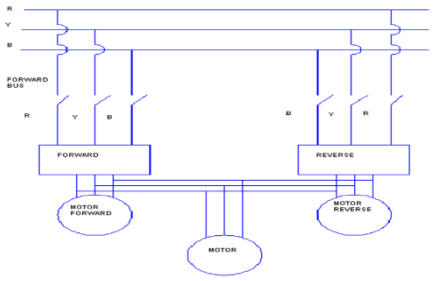

Figure.3. Motor Circuit

Problem Definition: The soot blowers in the recovery boiler operated to blow off accumulated soot along sides of the boiler. The blowers are operated on every 2 hours. Three contactors are available in the existing model. One for forward motion of the soot blower, the second contactor for retraction motion and the third contractor for common. To maintain delay between forward and retraction motion of soot blower is difficult .After long usage, manual timer shows more deviations. The effective cleaning area has been reduced due to less accuracy in the exiting manual control methods. Blow time of soot blower should be controlled precisely for every stage. So, it is to enhance the operation of the soot blowers in the recovery boiler by adopting PLC with the replacement of manual timers. For implementing more soot blowers, the PLC control would be more reliable than manual timers. Controlling the blow-off time precisely, effective area of cleaning is to be achieved

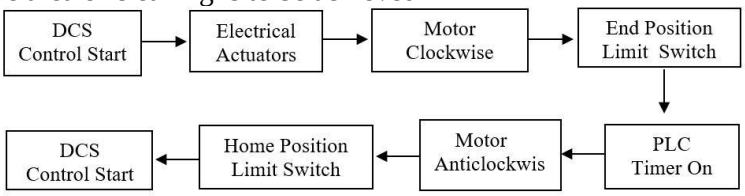

Figure.4. Flow Diagram of Proposed Model

Faster Response Time: In addition to the I/O processing time, there is also an input time delay caused by the scan time. The input time delay is generated because the input status can only be read during the input processing time. If the input status is changed after input processing, the changed contents can only be read during the next scan time.

3. RESULT AND DISCUSSION

Table.1. I/O Description

Category	Catalog Number	Description	Controller Support
Digital I/O	2080Digital I/O	4 to 8 24 VDC Digital I/O with sink or source outputs-IQ4, OB4, OV4, IQ4OV4	Micro810, Micro830, Micro850
	2080-OW4	4-pt 1A Relay Outputs	Micro810, Micro830, Micro850
Analog I/O	2080-IF4	4-ch Analog input,0-20mA,0-10V, non-isolated 12-bit	Micro810, Micro830, Micro850
	2080-IF2	2-ch Analog input,0-20mA,0-10V, non-isolated 12-bit	Micro810, Micro830, Micro850
	2080-OF2	2-ch Analog input, 0-20mA, 0-10V, non-isolated 12-bit	Micro810, Micro830, Micro850
Specialty	2080-RTD2	2-ch RTD, non-isolated, 0.5C	Micro810, Micro830, Micro850
	2080-TC2	2-ch TC, non-isolated, 1C	Micro810, Micro830, Micro850
	2080-TRIMPOT2	2-ch Trimpot ,analog Input	Micro810, Micro830, Micro850

Table.2. Comparison of DCS and PLC

Conventional Method	Proposed Method
The response time is in 8-10 seconds	The response time is 8-10µs
Failure in any of the components cannot be identified	Traceability of components used
Hard wiring increases the maintenance	On line programming is available
Cleaning area is only 2-3m^2	Cleaning area is 4-6m^2
Number of inputs and outputs are limited	Number of inputs and outputs can be increased
Limited memory is available	Memory size can be increased

4. CONCLUSION

Recovery boiler is the heart of the paper pulp manufacturing. Soot blowing operation is a main operation in the recovery boiler cleaning .This project increases the effective area of boiler cleaning than the conventional method. The effective cleaning area in the conventional method is up to 2-3m^2. The effective cleaning area in the proposed method is increased to 4- 6m^2. Response time of conventional relay logic is greater than ladder logic. The installation cost of PLC is higher in range but the memory size and number of I/O s can be increased.

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