

DCS Based Emergency Boiler Feed Pump Control

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Abstract : Emergency Boiler feed pump is not necessary in pulverized Fuel boilers since the fire will be cut off if there is no fuel supply, but in CFBC boiler bed material around 300 Tons will be circulating with high temperature. In case of station blackout condition occurs, to safe guard the boiler, Diesel Operated Emergency Boiler feed pump will be started to ensure continuous feed water supply to boiler. Separate PLC (make Allen Bradley, SLC 5) is available to start the EBFP. Start up command will be received from DCS (make maxDNA) only status of the feed pump will be indicated in DCS. Control logics will be taken care by PLC. Since the PLC is obsolete model we are having a proposal to isolate the PLC and shifting the same logic to Distributed Digital Control system (DCS). Therefore in our proposed system, we are reducing the hindrances and disadvantages caused by the PLC.

I. INTRODUCTION

Circulating Fluidized Bed combustion is a comparatively new technology that has given boiler and power plant operators a greater flexibility in burning a wide range of fuels. Most of the coal fired power plants use the Pulverized Coal (PC) firing technology. The technology is proven and is in use for nearly a century. Advances over the years have improved the efficiency of combustion, reliability and reduced emissions. The emerging technology of Circulating Fluidized Bed (CFB) combustion is different in many ways from pc combustion. The circulating fluidized bed (CFB) is a clean process with the ability to achieve lower emission of pollutants. By using this technology, up to 95% of pollutants will be absorbed before being emitted to the atmosphere.

CFB technology burns fuels without fire or burners in the furnace but through a process of fluidization mixes the fuel particles with limestone which captures the sulfur oxides that are formed and the low temperature reduces nitrogen oxide formation. The limestone and fuel are recycles multiples times which increases both the efficiency of producing high quality steam to produce power and also reduces pollution due to its ability to burn

fuel in a clean way than the conventional processes. Circulating fluidized bed technology (CFB) also offers the flexibility of using both coal as well as biomass fuels.

Air supply is from under the bed at high pressure. This lifts the bed material and the coal particles and keeps it in suspension. The coal combustion takes place in this suspended condition. This is the Fluidized bed. Special design of the air nozzles at the bottom of the bed allows air flow without clogging. Primary air fans provide the preheated Fluidizing air. Secondary air fans provide pre-heated Combustion air. Nozzles in the furnace walls at various levels distribute the Combustion air in the furnace.

Fine particles of partly burned coal, ash and bed material are carried along with the flue gases to the upper areas of the furnace and then into a cyclone. In the cyclone the heavier particles separate from the gas and falls to the hopper of the cyclone. This returns to the furnace for recirculation. Hence the name Circulating Fluidized Bed combustion. The hot gases from the cyclone pass to the heat transfer surfaces and go out of the boiler.

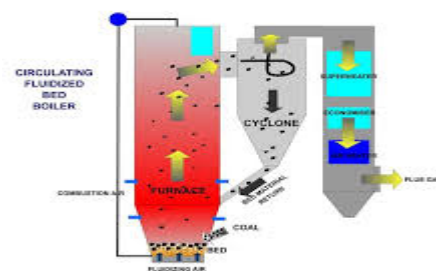


Fig.1 CFBC Boiler

In this above figure, we are having a furnace consisting of refracting bed of sand and limestone. The mixture is ignited with the help of external air supply. The hot gases pass to the super heaters and distribute at various levels. Finally they come out as flue gases.

II. NEED OF EMERGENCY BOILER FEED PUMP IN CFBC

Emergency Boiler feed pump is not necessary in PF boilers since the fire will be cut off if no fuel supply, but in CFBC boiler bed material around 400 tons will be circulating with high temperature. In case of station blackout condition occurs to safe guard the boiler, Diesel Operated Emergency Boiler feed pump will be started to ensure continuous feed water supply to boiler. Separate Allen Bradley, SLC 500 SERIES PLC is available to start the EBFP. Start up command will be received from DCS (make maxDNA) only status of the feed pump will be indicated in DCS. Control logics will be taken care by PLC. Since the PLC is obsolete model NLC is having a proposal to isolate the PLC and shifting the same logic to Distributed Digital Control system (DCS).

III. EXISTED METHOD

The existed system had PLC to control the EBFP. Separate PLC (make Allen Bradley, SLC 5) is available to start the EBFP. Start up command will be received from DCS (make maxDNA) only status of the feed pump will be indicated in DCS. Control logics will be taken care by PLC. The whole set up will be available and can be controlled only in the field level.

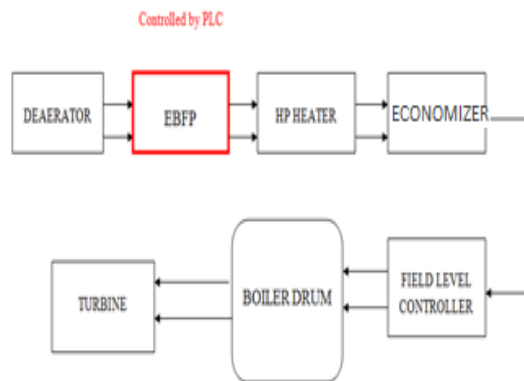


Fig.2 Block Diagram

IV. DISADVANTAGE IN THE EXISTING PLC BASED EBFP SYSTEM

- PLC 5/03 is a discontinued product from Allen Bradley PLC manufacturer. When EBFP is not started Ladder Logic is to be trouble-shooted with the help of Laptop.

- Immediate action has to be taken in troubleshooting the PLC cause delay in the maintenance may cause high level damage to the boiler parts and the feed pump.
- Since the PLC has become obsolete model, many of its spare parts are not available in the market. Also if any problem occurs in the PLC, it has to be solved only by going to the field level
- No SCADA is available to monitor the process.

Hence it is decided to shift the PLC logic to maxDNA DCS system for better monitoring and control of the feed pump.

V. REPLACEMENT OF THE EXISTED METHOD

Since the PLC is obsolete model NLC has isolated the PLC and shifting the same logic to Distributed Digital Control system (DCS).

Now the task will be

- Shift the Input & out signals of EBFP to maxDNA DCS.
- We have to find out spare channels in maxDNA DCS and cabling to be done.
- Development of control Logic and Graphics for DCS and same to be downloaded to DCS processor.
- Annunciation window to be created in DCS.
- EBFP to be commissioned from DCS.

Note: Location DCS control room at turbine hall at 15 Meter level. EBFP location at Ground Level.

CRE 28, CRE29, CRE30 panels are identified as having more spare DI and DO channels and cable laid. Logic and OWS screens are developed in CRE 28 panel DPU and downloaded.

VI. PROPOSED METHOD

A distributed control system (DCS) is a control system for a process or plant, wherein control elements are distributed throughout the system. A DCS typically uses custom designed processors as controllers and uses both proprietary interconnections and standard communications protocol for communication. The whole control logics are shifted to the DCS from PLC. The cables are found and wiring is done. The graphics are created in the annunciation window using the function blocks. By shifting the logics to DCS we are now able to monitor as well as control the

function of EBFP without any hindrances. Hence the proposed system overcomes the disadvantages of the existed system.

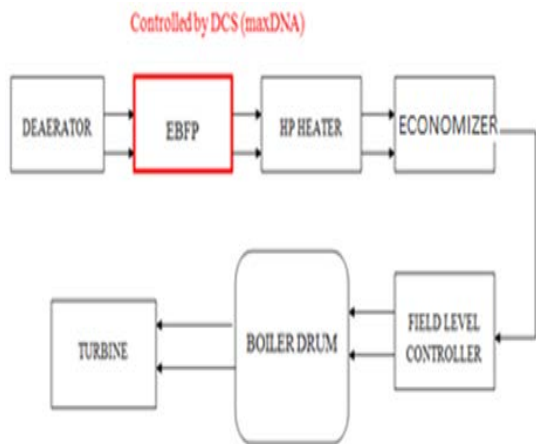


Fig 3. Block Diagram

VII. FUNCTION BLOCK DIAGRAM IN DCS

The Function Block Diagram (FBD) is a graphical language for distributed control system (DCS) that can describe the function between input variables and output variables. A function is described as a set of elementary blocks. Input and output variables are connected to blocks by connection lines. Inputs and outputs of the blocks are wired together with connection lines or links. Single lines may be used to connect two logical points of the diagram. An input

variable and an input of a block, An output of a block and an input of another block. An output of a block and an output variable. The connection is oriented, meaning that the line carries associated data from the left end to the right end. The left and right ends of the connection line must be of the same type. Multiple right connections, also called divergence can be used to broadcast information from its left end to each of its right ends. All ends of the connection must be of the same type. Function Block Diagram is one of five languages for logic or control configuration[2] supported by standard IEC 61131-3 for a control system such as a Programmable Logic Controller (PLC) or a Distributed Control System (DCS). The other supported languages are ladder logic, sequential function chart, structured text and instruction list.

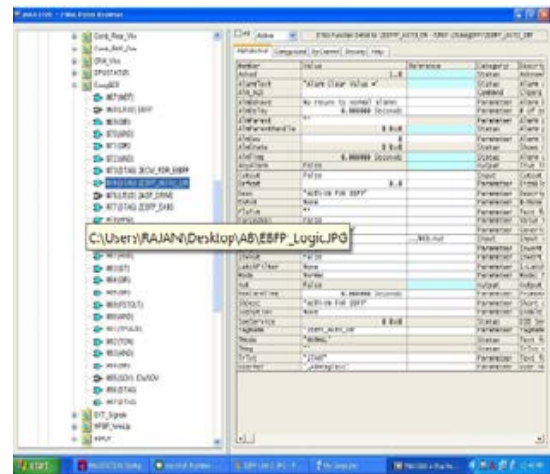


Fig.4 Function Block Used For Developing EBFC Logic

VIII. DEVELOPMENT OF EBFP LOGIC IN DCS

The EBFP logic in maxDNA DCS is developed by the following procedures:

- Shift the Input & out signals of EBFP to maxDNA DCS.
- We have to find out spare channels in maxDNA DCS and cabling to be done.
- Development of control Logic and Graphics for DCS and same to be downloaded to DCS processor.
- Annunciation window to be created in DCS.
- EBFP to be commissioned from DCS

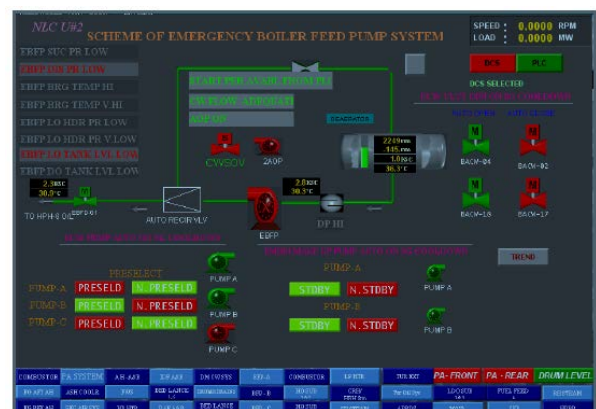


Fig.5 Running Status Of EBFC In DCS Screen

IX. CONCLUSION

DCS are well adapted to a range of automation tasks. The major advantages of functional hardware distribution are flexibility in system design, ease of expansion, reliability, and ease of maintenance. Another obvious advantage of this type of distributed architecture is that complete loss of the data highway will not cause complete loss of system capability. Often local units can continue operation with no significant loss of function over moderate or extended periods of time. Moreover, the DCS network allows different modes of control implementation such as manual/auto/supervisory/computer operation for each local control loop. Hence the problem of going to field level and replacement of spare parts for the function of EBFP are overcome by the advanced technology of DCS.

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