Design and Controlling of Heat-Exchanger

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Abstract- *The heat exchangers are of various types of which the project is of shell and tube type heat exchanger. The main objective of the heat exchanger is to maintain the temperature of process fluid by using another subordinate fluid. So to achieve complete control over the temperature by giving a particular set-point to the controller one can achieve control over the process fluid. In this project, the heat exchanger is having "Shell and Copper tubes."The control scheme used will be Feedback Control Scheme. The control will be done by using PLC and Windows based ladder programming. Hot water is passed through shell side and cold water is passed through tubes. The objective is to control the temperature of the process fluid (Cold Water).*

Keywords- Heat Exchanger, Feedback Control, PLC (Programming Logic Control), Process fluid.

I. INTRODUCTION

The basic fundamentals of heat exchanger, its construction, working of heat exchanger are few aspects that are taken into consideration in this project. In this project there are two fluids, one is process fluid (fluid whose temperature has to be controlled) and the other fluid is subordinate fluid or the controlling fluid. The applications of the heat exchanger in the process industry are heating, cooling, condensation, evaporation etc.

These kinds of Equipments are based on application of chemical engineering, mechanical engineering, instrumentation engineering, electrical engineering, which are together called as Industrial automation engineering.

II. LITERATURE REVIEW

Modeling and Temperature Control of Heat Exchanger process

The main purpose of a heat exchanger system is to transfer heat from a hot fluid to a cooler fluid, so temperature control of outlet fluid is of prime importance. In this paper, firstly simplified mathematical model for heat exchanger process has been developed and used for the dynamic analysis and control design. Artificial neural networks (ANN) are effective in modeling of non linear multi variables so modeling of heat exchanger process is accomplished using optimized architecture of artificial neural network after that dif erent controllers such as PID controller, feedback plus feed-forward controller and a ratio controller are developed to control the outlet temperature of a shell and tube heat exchanger. The main aim of the proposed controllers is to regulate the temperature of the outgoing fluid to a desired level.

III. PIPING & INSTRUMENTATION DIAGRAM

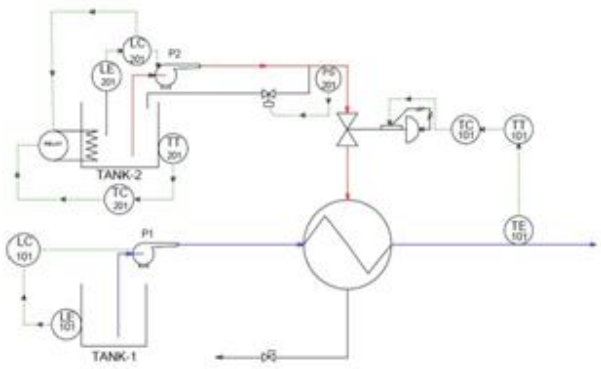

Fig.1 P&ID of Control Strategy of heat ex-changer.

IV. PROSPOSED SYSTEM ARCHITEC-TURE

The main objective of Design and controlling of Heat Exchanger is to provide a service of heat exchange in the fluids with efficient way with the desired Temperature level. The system architecture consists of Heat exchanger vessel, Process fluid pump, Hot water pump, Control Valve, Solenoid valve, Allen Bradley PLC. Power supply and all the required electrical wiring is done at the loop itself. The purpose of the system is to offer heat exchange to Control fluid temperature at certain Set Point and Control the Temperature by manipulating the flow.

V. METHODOLOGY

This is the methodologies for heat exchanger design and control. This system includes following:

- Thermal design.
- Sizing.
- Feedback controller.

- Electrical controls.

1. Thermal design

Thermal design of Heat exchanger proce-dures top in involves heat exchangers quantitative heat transfer rate and pressure drop assessment and heat exchanger size.

2. Sizing

The design of a new heat exchanger means the selection of a heat exchanger construction type, flow arrangement, tube and baffle material, and the size of a heat exchanger to meet the specified heat transfer and pressure drops within all specified constraints. For a Shell and tube heat exchanger a sizing refers to the determination of shell type, diameter and length, tube diameter and number, tube layout, pass arrangement, and so on. Inputs to the sizing are surface geometries including their dimensionless heat transfer and pressure drop characteristics. fluid flow rates, inlet and outlet fluid temperatures, fouling factors, and pressure drops on each fluid side.

3. Feedback controller

In the feedback control scheme, the process variable, T1-OUT, is measured, and applied to a PID (Proportional – Integral – Derivative) based feedback temperature controller. This compares the process variable with the desired temperature set-point, and in turn calculates and generates the required control action, either to open the hot water control valve more or less. The most significant and unique advantage of the feedback control scheme, is that it need not to know what is the source of disturbance, whether it's known or unknown, a corrective action will be taken by the controller.

4. Controls

PLC (Allen Bradley) based controller is pro-vided to control the functions of equipment. Control panel is provided with necessary push buttons for start and stop the Process. Control valve is used to control the fluid flow with Equal percentage characteristics.

VI. RESULT

Hence we have controlled the operation of Temperature controlling in minimum time with required safety parameters.

VII. ADVANTAGES

- Minimum cycle time.
- Provided safety interlocks.
- PLC controlling available.

VIII. CONCLUSION

The system provides design & Control of heat exchanger. The Controlling of process fluids temperature at set point done by the system . The Controlling is done by feedback control scheme with PLC controller. Machine finds application in process industry.

IX. ACKNOWLEGEMENT

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