Energy Analysis on Shell & Tube Type Heat Exchanger

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Abstract—Energy consumption is the most important problem in the present day. The energy analysis gives only energy consumption and energy losses of systems. It does not provide information about internal inefficiency of equipment. The energy analysis, when applied to process or a whole plant tells us how much is the usable work potential or energy supplied as input to the system & consumed by process or plant. Unequal duration of the active and passive phases of the heat source, and consequently of the heat storage and discharge, is allowed. After energy analysis of shell and tube type heat exchanger there are losses of energy of all part we can try to minimize energy loses and improvement in energy. We are to follow standard procedure for measuring energy which I can get from reference paper or some text book related to energy. Secondly, when I learn the standard procedure I will learn where to measure and what to measure to analyze energy of heat exchanger. After getting all data in the heat exchanger I will able to tell what is an improvement.

Key words: Energy Analysis, Heat Exchanger, Tube Type Heat Exchanger

I. INTRODUCTION

A heat exchanger is a piece of equipment built for efficient heat transfer from one medium to another. The media may be separated by a solid wall to prevent mixing or they may be in direct contact. They are widely used in space heating, refrigeration, air conditioning, power plants, chemical plants, petrochemical plants, petroleum refineries, natural gas processing, and sewage treatment. The classic example of a heat exchanger is found in an internal combustion engine in which a circulating fluid known as engine coolant flows through radiator coils and air flows past the coils, which cools the coolant and heats the incoming air. The energy analysis, when applied to process or a whole plant tell us how much is the usable work potential or energy supplied as input to the system & consumed by the process or plant. Our project is IDP level which we can get data from the organization which name Ambica boiler. After taking all data from the company now can calculate how much losses and how much getting work after the calculation we calculate all data some of method which getting from reference paper or book and compare both data to each other in last desiccation we can try minimize the losses and improve in energy.

A. Shell and Tube Type of Heat Exchanger

A shell and tube heat exchanger is a class of heat exchanger designs. It is the most common type of heat exchanger in oil refineries and other large chemical processes, and is suited for higher pressure. As its name implies, this type of heat exchanger consists of a shell (a large pressure vessel) with a bundle of tubes inside it as its name implies, this type of heat exchanger consists of a shell (a large pressure vessel) with a bundle of tubes inside it. One fluid runs through the tubes, and another fluid flows over the tubes (through the shell) to transfer heat between the two fluids. The set of tubes is called a tube bundle, and may be composed of several types of tubes: plain, longitudinally finned, etc. The maximum useful work that can be obtained from a system at a given state in a given environment; in other words, the most work you can get out of a system.

II. WORKING PRINCIPLE

Heat exchangers work because heat naturally flows from higher temperature to lower temperatures. Therefore if a hot fluid and a cold fluid are separated by a heat conducting surface heat can be transferred from the hot fluid to the cold fluid. The rate of heat flow at any point (kW/m2 of transfer surface) depends on:

- Heat transfer coefficient (U), itself a function of the properties of the fluids involved, fluid velocity, materials of construction, geometry and cleanliness of the exchanger. Temperature difference between hot and cold streams Total heat transferred (Q) depends on: Heat transfer surface area (A) Heat transfer coefficient. Average temperature difference between the streams, strictly the log mean (DTLm) But the larger the area the greater the cost of the exchanger Therefore there is a trade-off between the amount of heat transferred and the exchanger cost

- Thus total heat transferred Q = UADTLm

III. LITERATURE REVIEW

1) Energy and Energy analysis on Shell and tube type heat exchanger by Patel Rakesh Suggested in this paper Energy consumption is the most important problem in the present day. The energy analysis gives only energy consumption and energy losses of systems. It does not provide information about internal inefficiency of equipment. The energy analysis, when applied to process or a whole plant tells us how much is the usable work potential or energy supplied as input to the system & consumed by process or plant. The loss of energy provides quantitative measure of process inefficiency. Based on energy analysis &energy analysis sankey diagram shows energy &energy distribution and losses. Energy analysis of heat exchanger as a boiler the
efficiency of boiler is calculated after finding out the various losses, which takes place in the boiler. First law analysis shows the efficiency of boiler to be of 81.67%. This causes loss of 18.33% of energy. This loss is reduced by operating boiler at appropriate air fuel ratio & use of suitable particle size of coal. The piping and ejector losses reduced by selection of appropriate size & better insulation of pipe. The condenser, piping and ejector losses are found to be quite high and any reduction in this would result in better overall performance. The energy and energy are due to unaccounted and leakage loss is of the order of 1.5%. In order to reduce the steam loss, gland leakage, steam traps and miscellaneous leakages should be stopped.

2) Energy and Energy analysis on steam power plant in Egypt by A. Rashad work on In this study, the energy and energy analysis of Shobra El-Khima power plant in Cairo, Egypt is presented. The primary objectives of this paper are to analyze the system components separately and to identify and quantify the sites having largest energy and energy losses at different load wise modelling and a detailed break-up of energy and energy losses for the considered plant has been presented at different loads (Maximum load, 75% load and, 50 % load). Energy losses mainly occurred in the condenser where (404.653 MW at Max load, 306.747 MW at 75% load and 278.849 MW at 50% load) is lost to the environment. The percentage ratio of the energy destruction to the total energy destruction was found to be maximum in the Turbine system (42% at Max load, 59% at 75% load and 46.1 at 50% load) followed by the condenser (28% at Max load, 20.3% at 75% load) while at 50% load the feed water heaters showed more energy destruction (27.7%) than condenser (23.8%) and then the feed water heaters (20.8% at max load, 12.1 at 75% load). In addition, the calculated thermal efficiency based on the specific heat input to the steam was 43% while the energy efficiency of the power cycle was (44% - 48%). The energy analysis of the plant showed that lost energy in the condenser is thermodynamically insignificant due to its low quality. In terms of energy destruction, the major loss was found in the turbine where 46.1%, 59.6% and 42% of the fuel energy input to the cycle was destroyed at 50%, 75%, and full load respectively. The percent energy destruction in the condenser was 23.8%, 20.3% and 28% at 50%, 75%, and full load while all heaters and pumps destroyed less than 30.2%, 32.4%, and 30% at 50%, 75%, and full load respectively.

3) Energoeconomic analysis on condenser type heat exchanger by Ahmet Can work on In this study, an energo economic analysis of condenser type parallel flow heat exchangers is presented. Energy losses of the heat exchanger and investment and operation expenses related to this are determined with functions of steam mass flow rate and water exit temperature at constant values of thermal power of the heat exchanger at 75240 W, cold water mass flow rate and temperature. The inlet temperature of water is 18 °C and exit temperatures of water are varied from 25 °C to 36°C. The values of temperature and pressure of saturated steam in the condenser are given to be Tcond = 47 °C and Pcond = 10.53 kPa. Constant environment conditions are assumed. Annual operation hour and unit price of electrical energy are taken into account for determination of the annual operation expenses. Investment expenses are obtained according to the variation of heat capacity rate and logarithmic mean temperature difference and also heat exchanger dimension determined for each situation. The present analysis is hoped to be useful in determining the effective parameters for the most appropriate energy loses together with operating conditions and in finding the optimum working points for the condenser type heat exchangers.

4) Energetic Optimization on shell and tube type heat exchanger used genetic based algorithm by Yavu Ozkelic work on In the computer-based optimization, many thousands of alternative shell and tube heat exchangers may be examined by varying the high number of exchanger parameters such as tube length, tube outer diameter, pitch size, layout angle, baffle space ratio, number of tube side passes. In the present study, a genetic based algorithm was developed, programmed, and applied to estimate the optimum values of discrete and continuous variables of the MINLP (mixed integer nonlinear programming) test problems. The results of the test problems show that the genetic based algorithm programmed can estimate the acceptable values of continuous variables and optimum values of integer variables. Finally the genetic based algorithm was extended to make parametric studies and to find optimum configuration of heat exchangers by minimizing the sum of the annual capital cost and energetic cost of the shell and tube heat exchangers. The results of the example problems show that the proposed algorithm is applicable to find optimum and near optimum alternatives of the shell and tube heat exchanger configurations. Shell and tube heat exchangers are crucial components of energy systems and in this study, a computer program that can estimate the optimum values of the discrete and continuous variables of the energetic optimization of the STHE’s problem was proposed. The acceptable deviations from the global optimum values of the objective functions in the test problems showed that the genetic based algorithm can be used to estimate continuous variables and exact optimum values of integer variables of MINLP problems water.

5) Energy and energy analysis on ground couple heat exchanger with horizontal heat exchanger by Mustufa...
inli suggestive working on The use of ground-coupled heat pumps (GCHPs) in commercial and residential facilities is a remarkable example. GCHP systems exchange heat with the ground, and maintain a high level of performance even in colder climates. This results in more efficient use of energy, for this reason many society utilities support the use of GCHP systems. In this paper we investigate of energetic and energetic efficiencies of ground-coupled heat pump (GCHP) system as a function of depth trenches for heating season. The horizontal ground heat exchangers (HGHEs) were used and it were buried within 1m (HGHE1) and 2m (HGHE2) depth trenches. The energy efficiency of GCHP systems are obtained to 2.5 and 2.8, respectively, while the energetic efficiencies of the overall system are found to be 53.1% and 56.3%, respectively, for HGHE1 and HGHE2. The irreversibility of HGHE2 is less than of the HGHE1 as about the results show that the energetic and energetic efficiencies of the system increase when increasing the heat source (ground) temperature for heating season. The results show that increasing reference environment temperature decreases the energy efficiency in both HGHE1 and HGHE2. In this paper the energy analysis and experimental study of a GCHP system for heating application is performed and energy loss of each component is calculated. The first and second law efficiencies of the system working under varying operating conditions (HGHE1 and HGHE2) are investigated and compared. The results show that, as expected, the heating COP overall of the system increase slightly when increasing the heat source ground temperature.

IV. CONCLUSION

The energy analysis gives only energy consumption and energy losses of systems. It does not provide information about internal inefficiency of equipment. The energy analysis, when applied to process or a whole plant tells us how much is the usable work potential or energy supplied as input to the system & consumed by process or plant. Unequal duration of the active and passive phases of the heat source, and consequently of the heat storage and discharge, is allowed. After energy analysis of shell and tube type heat exchanger there are loses of energy of all part we can try to minimize energy loses and improvement in energy.

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