IMPROVEMENT OF RATE OF HEAT TRANSFER IN HEAT EXCHANGER THROUGH TURBULENT FLOW

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KEYWORDS:
Double pipe, Semi circular disc baffles Heat exchanger

INTRODUCTION:

Heat exchangers are equipments that are commonly used to transfer heat between two fluids at different temperatures. They are essential components in engineering systems, ranging from the heavy industries, such as chemical, automotive, power or metallurgy, through the high technique ones such as electronics, to production of every day consumers goods like air conditioning systems, refrigeration, etc. The most popular are those of recuperative type. The fluids are physically separated by heat transfer surface and the heat is transferred from hot to cold agent.

Augmentation techniques usually employ baffles attached to the heated surface so as to provide an additional heat transfer surface area and to promote turbulence. The presence of baffles causes the flow to separate, reattach and create reverse flow. Recently, many investigations have been focused on the baffle-walled channel heat exchangers. Most studies discussed the optimal baffle geometry that enhance heat transfer performance for a given pumping power or flow rate. While the use of solid baffles results in significant heat transfer enhancement, the associated increase in pressure drop and higher local thermal stress at the root of the baffle is of concern. Thus warranting the exploration of the use of perforated baffles to enhance the heat transfer while keeping the pressure drop to a minimum.

Heat exchanger is a device used to transfer heat between one or more fluids. The fluids 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 stations, 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 airflows past the coils, which cools the coolant and heats the incoming air. A heat exchanger is a device that is used to transfer thermal energy (enthalpy) between warmer fluids, between a solid surface and a fluid, or between solid particulates and a fluid, at different temperatures and in thermal contact. In heat exchangers, there are usually no external heat and work interactions. Typical applications involve heating or cooling of a fluid stream of concern and evaporation or condensation of single- or multi component fluid streams.
OBJECTIVES:
From problem statement the objective of work is to increase the efficiency of the heat exchanger. The efficiency of the heat exchanger is basically depends on the geometric parameter tube diameter as well as process parameters (mass flow rate, inlet and outlet temperature of the cooling water etc.) of heat exchangers. So the objective is to optimize some of the parameters tube diameter and flow rate for improve the efficiency of the heat exchanger.

The project aim is to improve the performance and heat transfer coefficient by using baffles for increase area of heat transfer and also applied different material tube with different diameter of tube for analyze performance of heat exchanger
1. To maximize the rate of heat transfer in heat exchanger.
2. To improve the effectiveness
3. Developing a better design of heat exchanger
4. Minimize the cost (assumed to be directly proportional to the dry weight) and size (taken as the largest dimension - length of exchanger from tube end to tube end).

METHODOLOGY:
1. Project selection
2. Concept develop
3. Selection of working procedure
4. Selection of working area
5. [Design]
6. Implementation
7. Result

Turbulent Flow:
Turbulent flow is a type of fluid (gas or liquid) flow in which the fluid undergoes irregular fluctuations, or mixing, in contrast to laminar flow, in which the fluid moves in smooth paths or layers. In turbulent flow the speed of the fluid at a point is continuously undergoing changes in both magnitude and direction. The flow of wind and rivers is generally turbulent in this sense, even if the currents are gentle. The air or water swirls and eddies while its overall bulk moves along a specific direction.

Most kinds of fluid flow are turbulent, except for laminar flow at the leading edge of solids moving relative to fluids or extremely close to solid surfaces, such as the inside wall of a
pipe, or in cases of fluids of high viscosity (relatively great sluggishness) flowing slowly through small channels. Common examples of turbulent flow are blood flow in arteries, oil transport in pipelines, lava flow, atmosphere and ocean currents.

Outcome
1. If tube diameter of tube as well as material of tube changes increases the effectiveness of heat exchanger.
2. To build the better heat exchangers in such a way that it can be used in the industrial fields.
3. Proper design of heat exchanger will result in better performance from all points of view.

Applications
1. Internal Combustion Engines
2. Radiators
3. Air coolers and Refrigeration units
4. In food industry
5. Condensers & Evaporators
6. Air pre-heaters and Cooling Towers

Components Used
1. Hollow shafts
2. Heater
3. Valves
4. Piping Accessories
5. Pump
6. Temperature Sensor

CONCLUSIONS:
Experimental investigations of heat transfer and friction factor characteristics of double pipe heat exchanger fitted with inserted semicircular disc baffles with turbulent flow. The following conclusion could be made:

1. The heat transfer coefficient and friction factor increases with the decrease in baffle spacing compared with smooth tube.
2. Inserted semicircular disc baffle proves the heat transfer rate by 1.9 and 1.3 times that of smooth tube respectively.
3. A good agreement is obtained between the experimental results and the new correlation of Nusselt number and friction factor for inserted semicircular disc baffle.

4. The performance ratio for inserted baffle is greater than unity, therefore improvement in the energy saving lead to validate the capacity of the proposed expressions to predict the behavior for practical applications.

**SCOPE FOR FUTURE WORK:**

Proper design of heat exchanger will result in better performance from all points of view. Double pipe heat exchanger used in industries field as well as if diameter of tube as well as material of tube is changed its effect on heat exchange rate can be studied further. Used in Internal Combustion Engines, Airpreheaters, and Cooling Towers. The performance ratio for inserted baffle is greater than unity, therefore improvement in the energy saving lead to validate the capacity of the proposed expressions to predict the behavior for practical applications. To production of every day consumers goods like air conditioning systems, refrigeration, etc. The most popular are those of recuperative type. The fluids are physically separated by heat transfer surface and the heat is transferred from hot to cold agent.