A

Seminar report

on

Heat Exchangers

Submitted in partial fulfillment of the requirement for the award of degree
Of Mechanical

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Preface

I have made this report file on the topic **Heat Exchangers;** I have tried my best to elucidate all the relevant detail to the topic to be included in the report. While in the beginning I have tried to give a general view about this topic.

My efforts and wholehearted co-corporation of each and everyone has ended on a successful note. I express my sincere gratitude to ……..who assisting me throughout the prepration of this topic. I thank him for providing me the reinforcement, confidence and most importantly the track for the topic whenever I needed it.

Content

Introduction

In a heat exchanger, heat energy is transferred from one body or fluid stream to another. In the design of heat exchange equipment, heat transfer equations are applied to calculate this transfer of energy so as to carry it out efficiently and under controlled conditions.

The equipment goes under many names, such as boilers, pasteurizers, jacketed pans, freezers, air heaters, cookers, ovens and so on. The range is too great to list completely. Heat exchangers are found widely scattered throughout the food process industry.

What is a Heat Exchanger?

A heat exchanger is a device that is used to transfer thermal energy (enthalpy) between two or more fluids, between a solid surface and a fluid, or between solid particulates and a fluid, at different temperatures and in thermal contact.

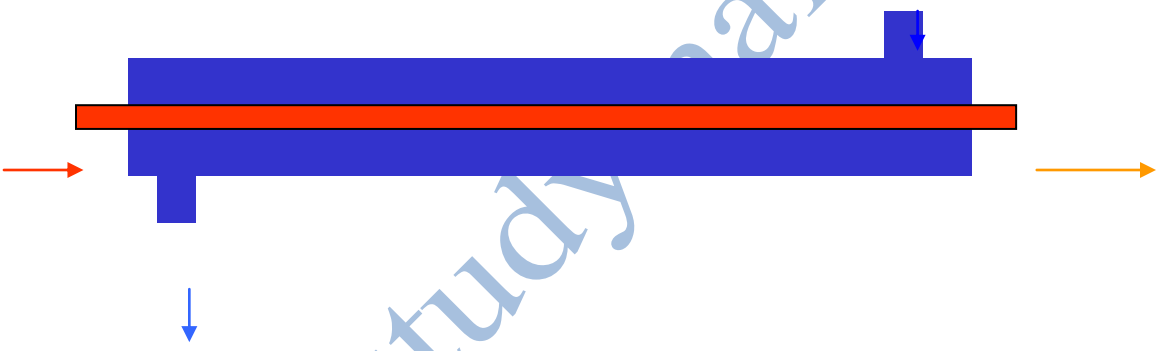
Objectives

- Recognize numerous types of heat exchangers, and classify them
- Develop an awareness of fouling on surfaces, and determine the overall heat transfer coefficient for a heat exchanger
- Perform a general energy analysis on heat exchangers
- Obtain a relation for the logarithmic mean temperature difference for use in the LMTD method, and modify it for different types of heat exchangers using the correction factor
- Develop relations for effectiveness, and analyze heat exchangers when outlet temperatures are not known using the effectiveness-NTU method

Know the primary considerations in the selection of heat exchangers.

Applications of Heat Exchangers

- Heat Exchangers prevent car engine overheating and increase efficiency
- Heat exchangers are used in Industry for heat transfer
- Heat exchangers are used in AC and furnaces
- The closed-type exchanger is the most popular one.
- One example of this type is the Double pipe exchanger.

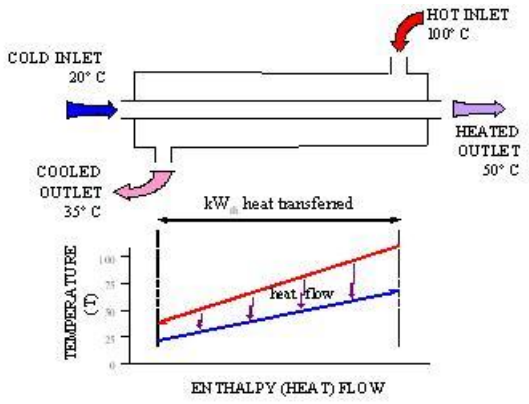


- In this type, the hot and cold fluid streams do not come into direct contact with each other. They are separated by a tube wall or flat plate

Principles of heat exchangers

Simplified heat exchanger concepts

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 means (DTLM)

Thus total heat transferred Q = UADTLM

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

Types of Heat Exchangers

Shell and Tube Heat Exchanger

Shell and tube heat exchangers are comprised of multiple tubes through which liquid flows. The tubes are divided into two sets: the first set contains the liquid to be heated or cooled. The second set contains the liquid responsible for triggering the heat exchange, and either removes heat from the first set of tubes by absorbing and transmitting heat away—in essence, cooling the liquid—or warms the set by transmitting its own heat to the liquid inside. When designing this type of exchanger, care must be taken in determining the correct tube wall thickness as well as tube diameter, to allow optimum heat exchange. In terms of flow, shell and tube heat exchangers can assume any of three flow path patterns.

Plate Heat Exchanger

Plate heat exchangers consist of thin plates joined together, with a small amount of space between each plate, typically maintained by a small rubber gasket. The surface area is large, and the corners of each rectangular plate feature an opening through which fluid can flow between plates, extracting heat from the plates as it flows.

The fluid channels themselves alternate hot and cold fluids, meaning that heat exchangers can effectively cool as well as heat fluid—they are often used in refrigeration applications. Because plate heat exchangers have such a large surface area, they are often more effective than shell and tube heat exchangers.

Regenerative Heat Exchanger

In a regenerative heat exchanger, the same fluid is passed along both sides of the exchanger, which can be either a plate heat exchanger or a shell and tube heat exchanger. Because the fluid can get very hot, the exiting fluid is used to warm the incoming fluid, maintaining a near constant temperature.

A large amount of energy is saved in a regenerative heat exchanger because the process is cyclical, with almost all relative heat being transferred from the exiting fluid to the incoming fluid. To maintain a constant temperature, only a little extra energy is need to raise and lower the overall fluid temperature.

Adiabatic Wheel Heat Exchanger

In this type of heat exchanger, an intermediate fluid is used to store heat, which is then transferred to the opposite side of the exchanger unit. An adiabatic wheel consists of a large wheel with threads that rotate through the fluids—both hot and cold—to extract or transfer heat.

GOALS

a. Role of heat exchangers in chemical processing

b. Basic concepts and terminology

c. Types of heat exchangers

d. Design methodology

- Sizing
- Design
- Rating

References

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