International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 04 | Apr 2021 www.irjet.net p-ISSN: 2395-0072

DESIGN AND FABRICATION OF TUBE IN TUBE HEAT EXCHANGER

Udit Hansalia[1], Manan Modi[2], Rahul Patel[3], Raj Patel[4], Krunal Parikh[5]

[1,2,3,4]UG-Students, Dept. of Mechanical Engineering, Indus Institute of Technology and Engineering, Gujarat, India
[5]Asst.Prof, Dept. of Mechanical Engineering, Indus Institute of Technology and Engineering, Gujarat, India

---

Abstract - *A heat exchanger is a system used to transfer heat between two or more fluids. Heat exchangers are used in both cooling and heating process. Tube in tube heat exchanger is one of the simplest types of heat exchangers. Tube in tube heat exchanger is simple in design and comes with ease of maintenance. Hence it is used widely in small and medium scale industries. Heat exchanger has widespread industrial applications for the recovery of the heat. They are widely used in refrigeration, air conditioning, power stations, chemical plants, petrochemical plants, petroleum refineries, natural-gas processing and for different industrial uses. While fabrication tube in tube heat exchanger the operations are enhanced by equipments like valves, pump, thermocouples, geyser, digital screens, etc...Here we have fabricated the tube in tube heat exchanger with selecting the materials with the aim of enhancing the effectiveness of heat transfer.*

***Key Words*: Keywords: Heat Exchanger, Tube, Heat transfer, Counter flow, Effectiveness**

1. INTRODUCTION

In tube in tube heat exchanger there are two pipes, in one pipe lower temperature fluid is passed and in another pipe higher temperature fluid is passed. It is done in concentric tube construction, which can have parallel or counter flow configuration. Parallel flow is when the flow of fluids is in same direction and in counter flow the flow of fluids is in opposite direction. The counter flow is more effective than parallel flow. The reason behind counter flow being most suitable in tube in tube heat exchanger is because it gives maximum rate of heat transfer for a given surface area. The design and fabrication of this tube in tube heat exchanger is done in such a way which can work in parallel as well as counter flow configuration. The heat transfer occurs from high temperature fluid to low temperature fluid and in order to make this happen the tube material should be thin and made of conductive material.

2. MATERIAL SELECTION

Inner tube (copper tube): The inner tube is used of copper material because it has higher conductivity and higher heat transfer rate compared to aluminium and MS. Hence effectiveness of copper is high. Copper is corrosion resistant and can retain its mechanical and electrical properties at high temperatures. Outer tube (MS tube): The outer tube has to be selected in such a way that minimum heat loss occurs. So MS tube having less heat transfer rate, the heat loss is minimum. MS material is also very easy for welding and fabrication.

3. COMPONENTS REQUIRED

Table -1: Components Required

Components	***Specifications/Purpose***
Inner tube	*Material: Copper, Diameter: 76mm, Length: 800mm*
Outer tube	*Material: M.S., Diameter: 160mm, Length: 640mm*
Geyser	*3 L , for supply at hot inlet.*
Thermocouples (4)	*At both inlet and both outlet for temperature sensing.*
Digital screen (4)	*For display of temperature.*
Tanks	*For storage of water.*
Pump	*HP 0.5/KW 0.37, RPM: 2800*
Other components	*Valves, Fittings, etc...*

4. DESIGN AND FABRICATION METHODOLOGY (ORDER)

1. Choosing the field of project.
2. Referring of research papers.
3. 2D&3D modeling with dimensioning.
4. Material selection and calculations.
5. Welding and machining processes.

6. Assembling.
7. Results and observations.

5. FABRICATION

After the all the required components were purchased, as per the design dimensions of the heat exchanger the copper sheet was converted into tube and M.S. sheet was also transformed into the required size tube. To overcome the challenge of leakage while joining the ends of copper and ms tubes TIG welding was done. Holes were made for inlet and outlet on both tubes and valve fittings were welded. For inlet and outlet in both tubes valves are placed for control of flow. Geyser is also used for raising the temperature of hot inlet. Pump is used for supply of water. Very sensitive thermocouples are used at both inlet and both outlet for accurate temperature sensing. Digital screens are used to display accurate temperature sensed from these thermocouples. The above described heat exchanger system is placed on a fabricated stand.

6. DESIGN

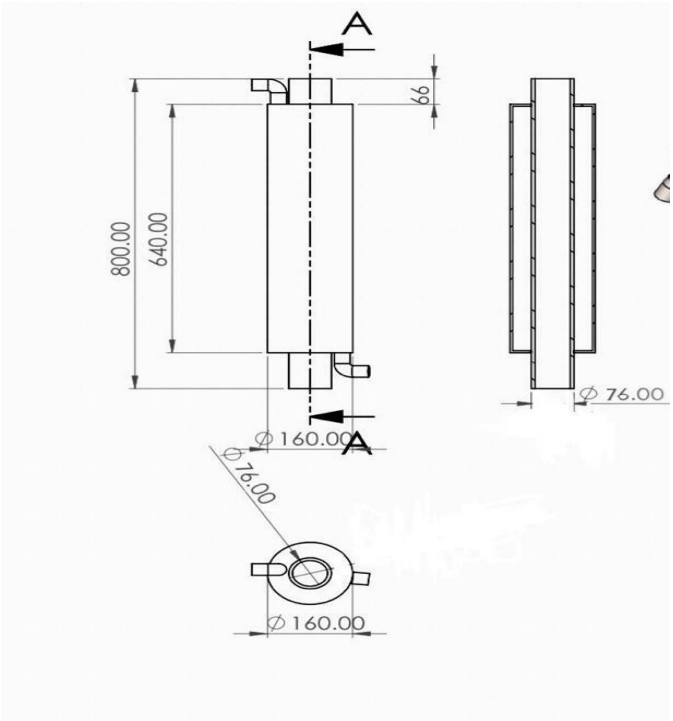

Figure -1: Design of tube in tube heat exchanger

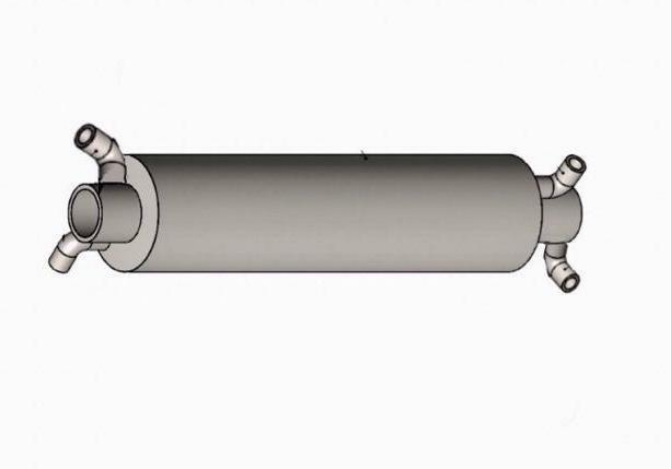

Figure -2: 3D Model of tube in tube heat exchanger

7. RESULT AND DISCUSSION

Table -2: Experimental Temperature Readings

Sr.no	*Time (sec)*	*Cold water inlet temp (°C)*	*Cold water outlet temp (°C)*	*Hot water inlet temp (°C)*	*Hot water outlet temp (°C)*
1	*30*	*33*	*35*	*36*	*34*
2	*60*	*32*	*36*	*48*	*39*
3	*90*	*34*	*40*	*57*	*44*
4	*120*	*33*	*44*	*65*	*46*
Average	-	*33*	*38.75*	*51.5*	*40.75*

An experimental investigation was carried out mainly for measuring heat transfer rate using various Conditions as mentioned above. An average of 5.75 °C of change in temperature is seen between cold water inlet and cold water outlet temperature. An average of 10.75 °C of change in temperature is seen between hot water inlet and hot water outlet temperature. From this experimental data we can see that there is increase in heat exchange as the time interval increases.

8. CONCLUSIONS

In this study, a double pipe heat exchanger was designed, manufactured and integrated with the whole mechanism. The double pipe heat exchanger is the most simple in design and very effective mode for heat transfer. The performance

of the heat exchanger was measured and we found very small difference in the experiential value of heat transfer and the theoretically calculated values. For manufacturing a double pipe heat exchanger, there are many factors to be considered. The two major factors among them are selection of material of the both the inner and outer pipe and the selection of the overall dimensions of the pipes, as per the application. The selection has to be done in such a way that we get optimum mechanical and economical advantages. With ease of manufacturing and having compact structure, they have wider application in industries such as textiles, pharmaceuticals and chemical industries.

REFERENCES

[1] Mrs. Kirti B.Zare , Ms. Dipika Kanchan , Ms. Nupur Patel," DESIGN OF DOUBLE PIPE HEAT EXCHANGER" Vol. No.5, Issue No. 12, December 2016.

[2] Anand Babu K, Naveena H S, Nagesh R, Prabhakar C G," EXPERIMENTAL INVESTI HEAT TRANSFER OF A DOUBLE PIPE HEAT EXCHANGER" Volume 8, Issue 8, August 2017, pp.203-210.

[3] Idongesit Effiong Sampson," Design and Operation of Double Pipe Heat Exchanger" Vol. 3. 2017.

[4] Patrick Mukumba, KeChrist Obileke," Thermal Performance Evaluation of a Double Pipe Heat Exchanger Installed in a Biomass Gasification System" Volume 2020 |Article ID 6762489 .