iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 2 **Issue:** VIII **Month of publication:** August 2014

DOI:

INTERNATIONAL JOURNAL FOR RESEARCH IN APPLIED SCIENCE AND ENGINEERING TECHNOLOGY (IJRASET)

Heat Transfer Enhancement of Shell and Tube Heat Exchanger

Kirubadurai.B[1], R.Rajasekaran[2], K.Kanagaraj[3], P.Selvan[4]

Assistant Professor In Mechanical Engg [1,3,4]

Sri Shakthi Institute of Engg and Tech[1], Adithya Institute of Tech[3], SNS College of Engg[4]

Coimbatore

Abstract: Heat exchanger is a device which provides a flow of thermal energy between two or more fluids at different temperatures. There are many problems created in the segmental heat exchanger during and after the work. The major causes of this problem is the geometry of heat exchanger, type of fluid used, type of material etc., The purpose of this work is to design the shell and tube heat exchanger which is one among the majority type of liquid –to –liquid heat exchanger. Since the important design parameters such as the pitch ratio, tube length, and tube layer as well as baffle spacing has a direct effect on pressure drop and effectiveness, they are considered to be the key parameters in this work. General design consideration and design procedure are also illustrated in this work. The analysis of orifice baffle and convergent divergent tube in a shell and tube heat exchanger are experimentally carried out. The newly designed heat exchanger obtained a maximum heat transfer coefficient and a lower pressure drop. From the numerical experimentation, the result shows that the performance of heat exchanger increases in modified baffle and tube than the segmental baffle and tube arrangement.

Keywords: modified heat exchanger, pressure drop, bell –Delaware method, modified baffle and tube

I. INTRODUCTION

Heat exchangers are specialized devices that assist in the transfer of heat from one fluid to the other. In some cases, a solid wall may separate the fluids and prevent them from mixing. In other designs, the fluids may be in direct contact with each other. In the most efficient heat exchangers the surface area and to induce turbulence. There are 3 primary flow arrangements with heat exchangers: counter – flow, parallel flow and cross flow. The most common type of heat exchangers used in the process, the shell on the other hand holds the tube bundle and acts as the conduit for the fluid. The shell assembly houses the shell side connections and is the actual structure into which the tube bundle is placed. Shell and tube heat exchangers are used in applications where the pressure and temperature demands are high. They serve a wide range of applications in compressor system, hydraulic system, stationary engines, pain systems, air dryers lube oil consoles and several marine applications.

Factors affecting heat transfer enhancement of shell-and-tube heat exchangers

Every exchangers is subject to mechanical stress from a variety of sources in addition to temperature gradients. There are mechanical stresses which resultfrom the construction techniques used on the exchangers, example, tube and tube sheet stresses resulting from rolling in the tubes.

II. PROVISION OF MECHANICAL STRESS

To protect the exchanger from permanent deformation or weakening from these mechanical stresses, it is necessary to design the exchanger so that any stress that can be reasonably expected to occur will not strain or deform the metal beyond the point where it will spontaneously return to its original condition .And it is necessary to ensure that stresses greater than the design values do not occur.

Vibration problem

A very serious problem in the mechanical design of heat exchangers is flow –induced vibration of the tubes. There are several possible consequences of tube vibration, all of the load. The tubes may vibrate against the baffles which can eventually cut holes in the tubes. Vibration is caused by

ISSN: 2321-9653

INTERNATIONAL JOURNAL FOR RESEARCH IN APPLIED SCIENCE AND ENGINEERING TECHNOLOGY (IJRASET)

repeated unbalanced forces being applied to the tubes. Although progress is being made, the prediction of whether or not a given heat exchangers configuration will adequately resist vibration is not yet a well-developed science. The two best ways to avoid vibration problems are to support the tubes as rigidlyas possible e.g. close baffle spacing and to keep the velocities low.

Erosion

Another essentially mechanical problem in heat exchanger design is that of erosion: the rapid removal of metal due to the friction of the fluid flowing in iron or across the tube. Erosion often occurs with and accelerates the effect of corrosion by stripping of the protective film formed on certain metals. Erosion rate depends upon the metal (the harder the metal the less erosion if other factors are equal), the velocity and density of the fluid and geometry of the system. Thus, erosion is usually more severe at the entrance of the tube or in the bend of a tube, due to the additional shear stress associated with developing the boundary layer or turning the fluid.

Common problems.

Aside from mal distribution 3 possible flow related issues – back flow, instabilities and fouling- must be kept in mind when designing a parallel flow system, be it in a heat exchanger or in any process unit in general. These issues can occur even in very simple systems and complexity of the actual layout is therefore rather irrelevant. More importantly, each of them can lower efficiency cause product degradation due to insufficient heating or over heating of the fluid, or even bring about malfunction of the system.

Backflow

Let us consider simple parallel flow system consisting of a distributor, several branches and a collector with a fluid being fed into the distributor inlet. Flow rate through an individual branch of such a system is governed by the pressure difference between its inlet in the distributor and its outlet in the collector. $p=p_{out},p_{in}$. If $p<0$,then the fluid indeed flows in the expected direction from the distributor into the collector. If $p>0$, the fluid flows in the opposite direction. This behaviour is called backflow and it's generally unfavourable.

Instabilities

Any instability is caused by a random disturbance amplified by a positive feedback while its ultimate consequences are turbulence and random wave's .detailed theoretical information related to flow instabilities can be found in (Sengupta and Poinsot (2010)). Additionally, instabilities specifically related to heat exchangers were studied by Houdek(2007). in this theses,however,we will concern ourselves only with one of the effect of instabilities,namely unsteady flow distribution.as the name suggest ,it means that flow rates through individual channels are not constant in time. This is highly indesirable-especially in high temperature applications since then channels are subjected to (non periodic) variable loading due to changes in their temperatures with a common in result being mechanical failures. We should therefore try to avoid any parallel flow system layout that exhibits such a behaviour.

Fouling

By fouling we mean any accumulation of unwanted material on surfaces of a process equipment hinders the desired operation. This issue is particularly common in food industry, chemical industry and energy industry (including waste-to-energy applications). Overall heat transfer co efficient then falls due to higher thermal resistance of the layer,which implies lower heat exchanger efficiency and in turn , huge economic losses. For example, Hewitt (1998) provided and estimate as large as 1.4 billion USD per year for plants in the United States. It is therefore obvious that fouling must be taken into account when designing any process unit that is expected to work with a fluid having a high fouling propensity. We must eliminate as many stagnation zones with swirling character of flow as possible or atleast minimize formation of eddies. Plan surfaces and suitable materials should be used to further lower fouling rate. Additionally, units should be constructed in such a way that cleaning of heat transfer surfaces and other essential regions is easy.

Fluid settle In between the baffle plate

In generally the shell and tube exchanger having 25%and 50% baffle cut, so the fluid is impact on the baffle then velocity goes too reduced. Working fluid flow rate decreases from one stage to another stage of baffle, so some amount of fluid is settled in bottom of shell.

Vol. 2 Issue VIII, August 2014

ISSN: 2321-9653

INTERNATIONAL JOURNAL FOR RESEARCH IN APPLIED SCIENCE AND ENGINEERING TECHNOLOGY (IJRASET)

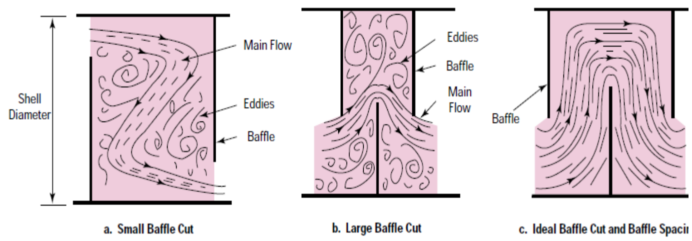


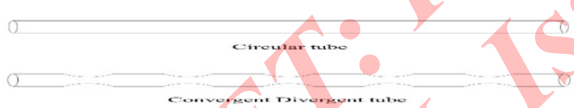
Figure 1: flow pattern of shell side fluid with different baffle cut

Fluid does not flow volume of shell

Due to velocity reduction of shell side fluid at 25% and 50% baffle cut, the height rises on the baffle plate is low comparing with previous stage. So the shell side fluid does not flow entire volume of shell.Low contact time between times between working fluidsThe contact time is important for enhance the heat transfer rate in shell and tube heat exchanger in circular tube heat exchanger the pressure drop is comparing with another type tube heat exchanger. So we need to increase the contact time for enhance heat transfer rate.

Low contact time between the working fluid

Contact time is important for enhances the heat transfer rate in shell and tube heat exchanger. In circular tube heat exchanger the pressure drop is less comparing with another type tube heat exchanger. So we need to increase the contact time for enhance the heat transfer rate.



III. BASIC DESIGN PROCEDURE

1. Define the duty: Heat – transfer rate, fluid flow rates and temperatures.
2. Collect together the fluid physical properties required: density, viscosity, and thermal conductivity.
3. Assume value of overall coefficient μ.
4. Decide number of shell and tube passes, calculate DT_{LMTD}.
5. Determine heat transfer area required:
6. $A_o = q/\mu_o DT_m$
7. Decide type, tube side, material layout assign fluids to shell or tube side.
8. Calculate number of tubes.
9. Calculate shell diameter.
10. Estimate tube-side heat transfer coefficient.
11. Decide baffle spacing and estimate shell-side heat transfer coefficient
12. Estimate tube and shell side pressure drops.
13. Estimate cost of exchanger
14. Accept design and develop software for it.

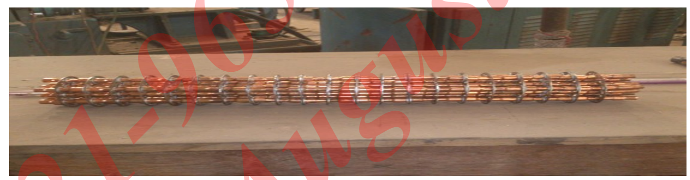


Figure 3:tubes and bafffle construction

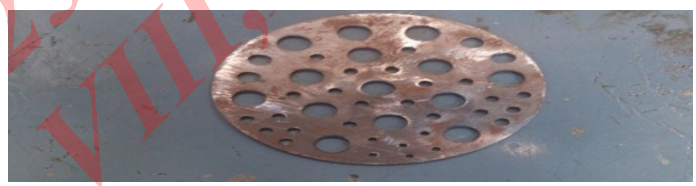


Figure 4: modified baffle construction

Figure 5: existing model and modified model heat exchanger

IV. EXPERIMENTAL SET UP

INTERNATIONAL JOURNAL FOR RESEARCH IN APPLIED SCIENCE AND ENGINEERING TECHNOLOGY (IJRASET)

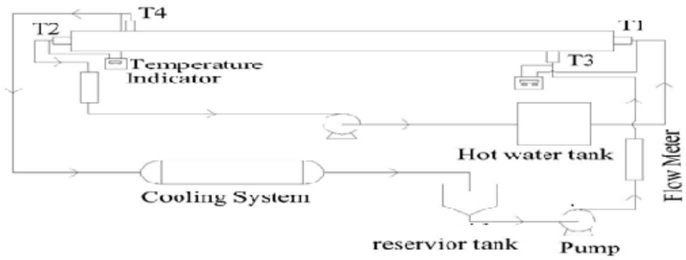


Figure 6: experimental setup

Table 1: Detail of shell and tube heat exchanger (TEMA 1999)

S. No	Parameter	Dimension
1	Type of heat exchanger	1-1 pass shell and tube heat exchanger
2	Shell diameter	0.088m
3	Shell length	0.61m
4	Shell thickness	0.003m
5	Tube diameter	0.013m
6	Tube length	0.61m
7	Tube thickness	0.001m
8	Tube pitch	0.023m
9	Tube pitch type	Triangular pitch
10	Tube clearance	0.01 m
11	Equivalent diameter	0.03189 m
12	Tube diameter ratio	1.08 m
13	Pitch ratio	1.76 m
14	Number of tube required	13 tubes
15	Number of baffle required	25 baffles
16	Baffle spacing	0.023m
17	Shell side Reynolds number	3612 turbulent flow
18	Shell side prandtl number	4.43
19	Heat transfer co efficient of shell	1040 W/m0C
20	Tube side Reynolds number	817 laminar flow
21	Tube side prandtl number	4.43
22	Heat transfer co efficient of tube	466.01 W/m0C
23	Overall heat transfer co efficient	9.56 W/m 0C
24	Number of transfer units	0.2113
25	Overall heat transfer coefficient	0.19048
26	Friction factor tube side	0.0195
27	Friction factor shell side	0.375
28	Pressure drop on shell side	$1.4323*10^{-5}$ Kpa.
29	Tube side pressure drop	9.43*10-7Kpa.

V. RESULT AND DISCUSSION

Experimental results for Segmental model heat exchanger

Time taken for one litter water collection (sec)	Hot water inlet (^0C)	Hot water outlet (^0C)	Cold water Inlet (^0C)	Cold water outlet (^0C)
37	90	65	28	38
40	80	60	28	36
42	70	55	28	35
43	60	52	28	34
44	50	48	28	31

Table: 2

Temperature (^0C)	Mass flow rate (Lit/sec)	Heat transfer Rate (W)	LMDT (^0C)	Overall Heat transfer coefficient ($W/m^{20}C$)	NTU	Effectiveness
90	0.027	2.820825	42.102	0.397381	2.48142	0.480769
80	0.025	2.0895	36.213	0.342226	2.30797	0.454545
70	0.0238	1.491903	29.6521	0.29842	2.11401	0.428571
60	0.0232	0.775622	24.3324	0.189063	1.37397	0.307692
50	0.022	0.183876	19.3926	0.056238	0.43098	0.105263

Table: 3

Temperature (^0C)	Reynolds number (tube)	Reynolds number (shell)	Friction Factor (tube)	Friction Factor (shell)	Pressure Drop (tube) (N/m^2)	Pressure Drop (shell) (N/m^2)
90	313.9535	1451.797	0.050963	0.446058	1.308283	0.152448
80	290.6977	1344.256	0.05504	0.452629	1.20288	0.132624
70	276.7442	1096.913	0.057815	0.470458	1.140291	0.091787
60	269.7674	665.3171	0.05931	0.517343	1.109179	0.037132
50	250.67	315.4521	0.063829	0.596151	1.067129	0.009619

Table: 4

Experimental result for Modified heat exchanger dates:

Table: 5

Time taken for one litter water collection (sec)	Hot water inlet (^0C)	Hot water outlet (^0C)	Cold water Inlet (^0C)	Cold water outlet (^0C)
41	90	47	26	36
44	80	44	26	34
47	70	46	26	33
52	60	46	26	32
54	50	45	26	31

Table: 6

Temperature (^0C)	Mass flow rate (Lit/sec)	Heat transfer Rate (W)	LMTD (^0C)	Overall Heat transfer coefficient ($W/m^{20}C$)	NTU	Effectiveness
90	0.024	4.312728	30.0967	0.849914	5.97064	0.796296
80	0.022	3.309768	26.0911	0.752398	5.76610	0.782609
70	0.02	2.00592	25.4256	0.467933	3.94467	0.648649
60	0.0189	1.105763	20.45	0.320709	2.86092	0.5
50	0.017	0.541	16.23	0.197707	1.96078	0.263158

Table: 7

ISSN: 2321-9653

INTERNATIONAL JOURNAL FOR RESEARCH IN APPLIED SCIENCE AND ENGINEERING TECHNOLOGY (IJRASET)

Temperature (^0C)	Reynolds number (tube)	Reynolds number (shell)	Friction Factor (tube)	Friction Factor (shell)	Pressure Drop (tube) (N/m^2)	Pressure Drop (shell) (N/m^2)
90	363.6364	2219.636	0.044	0.411491	1.538014	0.328731
80	333.3333	2129.302	0.048	0.414752	1.397157	0.304916
70	303.0303	1474.841	0.0528	0.444726	1.258606	0.156856
60	286.3636	948.5071	0.055873	0.483633	1.2	0.070553
50	270	556.8739	0.059259	0.535131	1.176	0.035

Graphical presentation

Mass flow rate of hot water

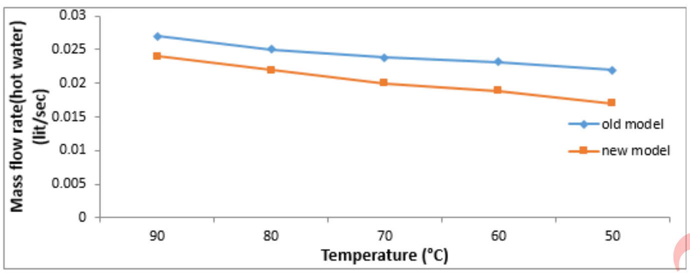


Figure 7: Temperature Vs Mass flow rate

Let's consider the mass flow rate of flowing fluid is directly proportional to the viscosity of fluid and even all flow properties of fluid is depends on the temperature of fluid. In this figure the mass flow rate is decreases with decreases the temperature. Mass flow rate is directly proportional to viscosity of fluid and viscosity of fluid is indirectly proportional to temperature. Here we used the convergent-divergent tube so the flow velocity is very high in convergent part and eventually decreased at divergent part.in this alternate process the mass flow drop in CD tube is low.

Heat transfer rate of hot water

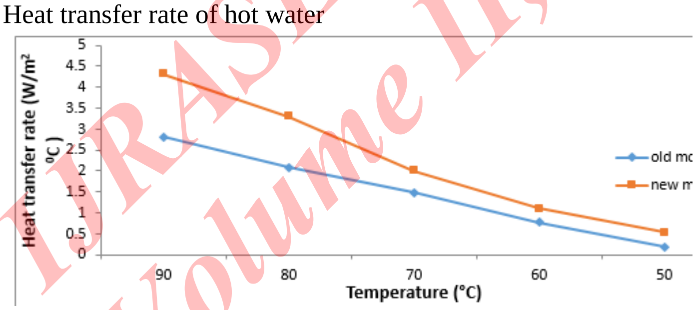


Figure 8: Temperature Vs Heat transfer rate of hot water

Heat transfer rate is depends on many parameters, such as conduct time, temperature, materials etc. here consider the conduct time and heat intensity fluid. In modified heat exchanger having CD tube and orifice baffle are having certain combination, so increase the conduct time of hot and cold fluid. During the flow the heat transfer rate is increased in modified heat exchanger. And even heat intensity of fluid in convergent part is very high, so heat transfer rate is high. Because the heat transfer rate is proposional to heat intensity, so increased the heat transfer rate in the modified heat exchanger.

Logarithmic mean temperature different

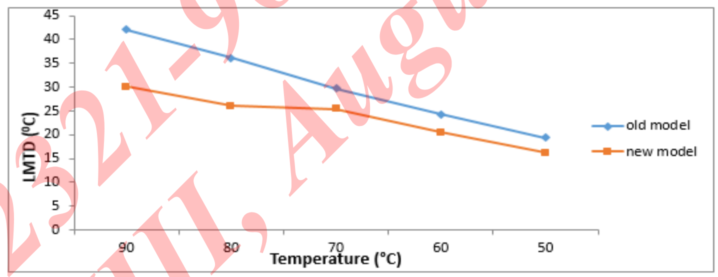


Figure 9: Temperature Vs Logarithmic mean temperature different

LMTD is low in the modified heat exchanger, because of the input and output temperature different of hot fluid is very high.so LMTD is very low at high temperature and gradually decreased from high temperature to low temperature. Because heat transfer rate depends on the temperature of hot fluid.

Overall heat transfer co efficient

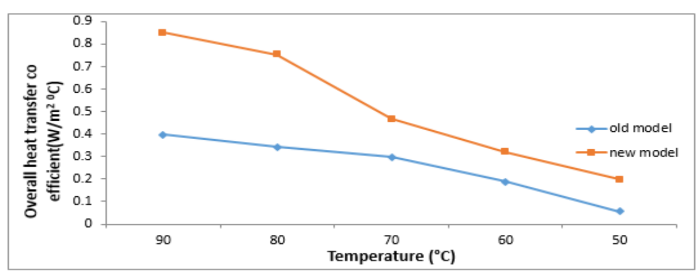


Figure 10: Temperature Vs Overall heat transfer co efficient

Overall heat transfer coefficient is very high in modified heat transfer coefficient, because of the CD tubes and orifice baffle combination. Increase the conduct time and high cold fluid replacement, in modified heat exchanger the mass flow rate of

Vol. 2 Issue VIII, August 2014
ISSN: 2321-9653

INTERNATIONAL JOURNAL FOR RESEARCH IN APPLIED SCIENCE AND ENGINEERING TECHNOLOGY (IJRASET)

shell side fluid is very high. Because of the baffle is designed as the varying mass flow rate from bottom to top, so replaced the cold fluid at heat transferred area of heat exchanger. Increased the mass flow rate of cold water, so increased the overall heat transfer rate of modified heat exchanger.

Number of transfer unit

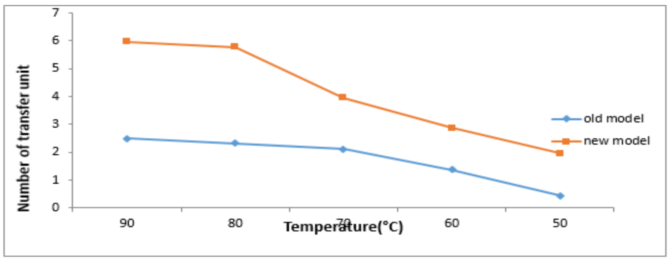


Figure 11: Temperature Vs Number of transfer unit

Number of transfer unit is directly proportional to the heat transfer rate of a heat exchanger. In this modified heat exchanger is having high heat transfer rate, because the number of transfer unit is high.

Effectiveness

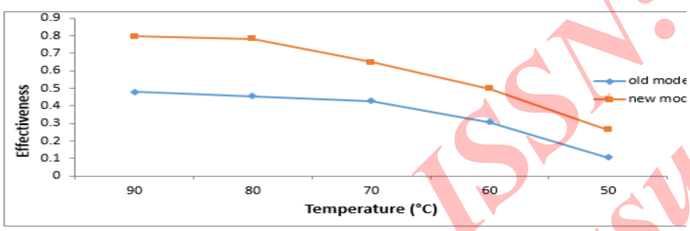


Figure 12: Temperature Vs Effectiveness

Effectiveness is says the overall performance of heat exchanger, the Effectiveness of the modified heat exchanger is high comparing with segmental heat exchanger, because of high heat transfer rate due to CD tube and orifice baffle construction. In this modified heat exchanger effectiveness is increased up to 39% as a compared value.

Reynolds number in shell side fluid

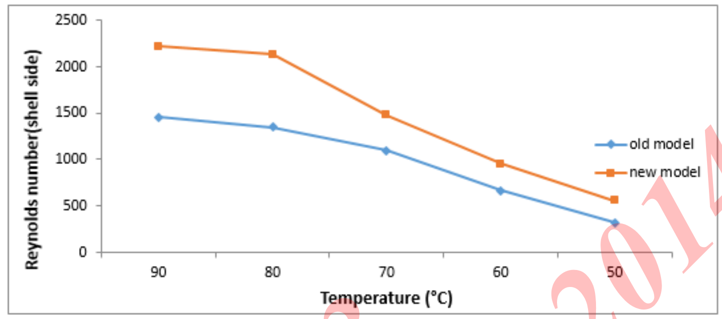


Figure 13: Temperature Vs Reynolds number in shell side fluid

Reynolds number is proportional to velocity and density of fluid and indirectly proportional to viscosity of fluid. In segmental heat exchanger water settled in between the baffle, so Reynolds number is decreased. In this exchanger modified heat exchanger shell side fluid having high heat absorbing capacity due high conduct time, CD tube and even replacement of shell side fluid. So due to the orifice baffle and absorbed high temperature increased the velocity of shell side fluid, due ti increased the velocity inherently increased the Reynolds number of shell side fluid.

Friction factor of shell side fluid

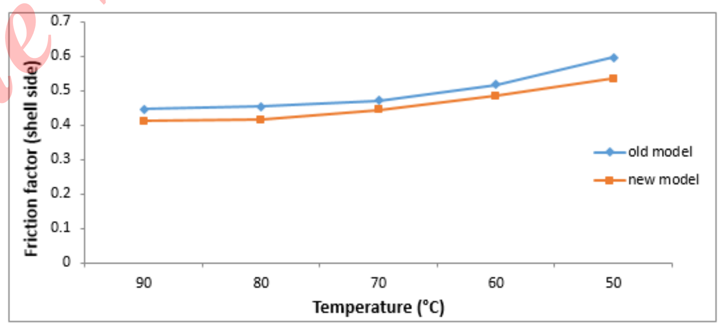


Figure 14: Temperature Vs Friction factor of shell side fluid

Friction factor is a parameter is used to evaluate the flow properties of fluid. Figure shows the friction factor is increased with increasing the temperature. So pressure drop is proportional to the friction factor temperature. By usage of orifice baffle the friction factor is slightly higher than the segmental model.

Reynolds number in tube side fluid

INTERNATIONAL JOURNAL FOR RESEARCH IN APPLIED SCIENCE AND ENGINEERING TECHNOLOGY (IJRASET)

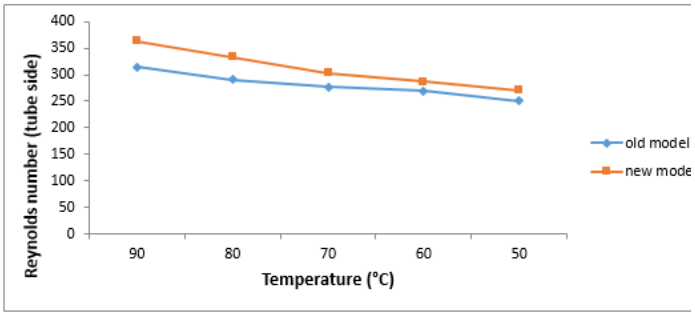


Figure 15: Temperature Vs Reynolds number in tube side fluid

Reynolds number in CD tube is less than the segmental tube in heat exchanger, because the velocity in divergent section is less and even increased the velocity in convergent section so that the velocity reduction compared with concentric tube. Reynolds number proportional to velocity and density of fluid and indirectly proportional to viscosity of fluid. In CD tube heat exchanger water velocity reduced in divergent section, so Reynolds number is decreased in modified heat exchanger.

Friction factor in tube side

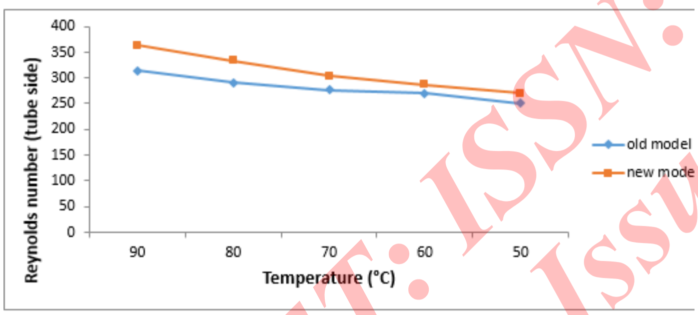


Figure 16: Temperature Vs Friction factor in tube side

Friction factor is a parameter is used to evaluate the flow properties of fluid. Figure shows the friction factor is increased with increasing the temperature. So pressure drop is proportional to the friction factor temperature. By usage of CD nozzle the friction factor is slightly higher than the segmental model.

Pressure drop in tube side

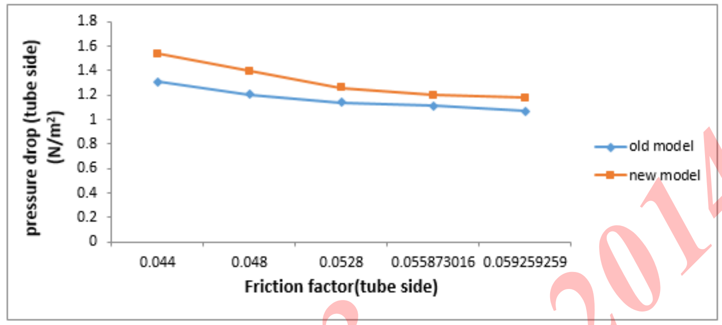


Figure 17: friction factor Vs Pressure drop in tube side

Pressure drop is depends on many factor such as viscosity, geometry etc... In this modified heat exchanger had CD tube in, so the convergent section had the low pressure and divergent section had the high pressure. Due to this pressure variation the pressure drop is occur but this pressure drop is very less compared with segmental heat exchanger.

Pressure drop in shell side

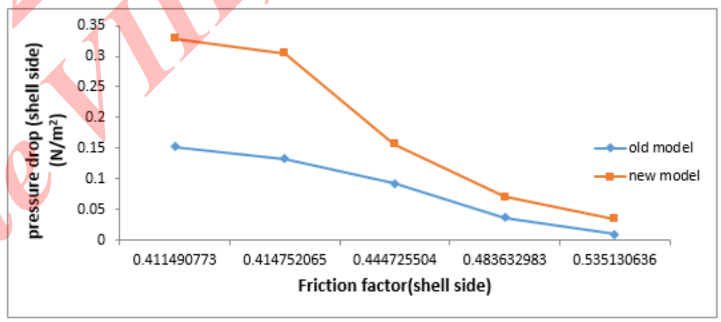


Figure 18: friction factor Vs Pressure drop in shell side

Pressure drop is depends on many factor such as viscosity, geometry etc... In this modified heat exchanger had orifice baffle in shell side, so the orifice baffle is used to reduce the drop of shell side fluid due to mass flow rate variation in baffle bottom to top section. In segmental heat exchanger fluid is settled in between the baffle, so pressure drop is increased.

VI. CONCLUSION

- In this work a model has been developed to evaluate analysis of a new and Segmental Baffle and tube Heat Exchanger as well as the Comparative analysis between the thermal Parameters between the

INTERNATIONAL JOURNAL FOR RESEARCH IN APPLIED SCIENCE AND ENGINEERING TECHNOLOGY (IJRASET)

Segmental and new model heat exchanger has been showed.

- From the Numerical Experimentation Results it is confirmed that the Performance of a Tubular Heat Exchanger can be improved by modified heat exchanger instead of Segmental heat exchanger.
- Use of modified Baffles in Heat Exchanger Reduces Shell side Pressure drop, pumping cost, weight, fouling etc. as compare to Segmental Baffle for a new installation.
- The Ratio of Heat to increase cross flow area resulting in lesser mass flux throughout the shell Transfer Coefficient to Pressure Drop as higher than that of Segmental Baffle.
- The Pressure Drop in modified Baffle heat exchanger is appreciably lesser as Compared to Segmental Baffle heat exchanger.
- Modified Baffle is the much higher than the Segmental baffle because of Reduced by Pass Effect &Reduced shell side Fouling. The modified heat exchanger is twicehigher than the Segmental heat exchanger.

REFERENCES

[1]. Sadikkakac, "Heat Exchangers Selection, Rating and Thermal Design", 2002.

[2]. Ramesh K shah and Dusan P. Sekulic, "Fundamental of heat exchanger design", Rochester Institute of Technology, Rochester New York, 2003.

[3]. Rajeev Mukharji, "Effective design of shell and tube heat exchanger", American Institute of Chemical Engineering, 1988.

[4]. Yusuf Ali Kara, OzbilenGuraras, "A computer program for designing of Shell and tube heat exchanger", Applied Thermal Engineering 24(2004) 1797–1805.

[5]. M.Serna and A.Jimenez, "A compact formulation of the Bell Delaware method for Heat Exchanger design and optimization", Chemical Engineering Research and Design, 83(A5): 539–550.

[6]. Andre L.H. Costa, Eduardo M. Queiroz, "Design optimization of shell-and-tube heat exchangers", Applied Thermal Engineering 28 (2008) 1798–1805.

[7]. Su Thet Mon Than, Khin Aung Lin, MiSandar Mon, "Heat Exchanger design", World Academy of Science, Engineering and Technology 46 2008.

[8]. M. M. El-Fawal, A. A. Fahmy and B. M. Taher, "Modelling of Economical Design of Shell and tube heat exchanger Using Specified Pressure Drop", Journal of American Science.

[9]. Zahid H. Ayub, "A new chart method for evaluating singlephase shell side heat transfer coefficient in a single segmental Shell and tube heat exchanger", Applied Thermal Engineering 25 (2005) 2412–2420.

[10]. R. Hosseini, A. Hosseini-Ghaffar, M. Soltani, "Experimental determination of shell side heat transfer coefficient and pressure drop for an oil cooler shell and tube heat exchanger with three different tube bundles", Applied Thermal Engineering 27 (2007) 1001–1008.

[11]. ResatSelbas, OnderKızılkan, Marcus Reppich, "A new design approach for shell and tube heat exchanger using genetic algorithms from economic point of view", Chemical Engineering and Processing 45 (2006) 268–275.

[12]. G.N. Xie, Q.W. Wang, M. Zeng, L.Q. Luo, "Heat transfer analysis for shell and tube heat exchanger with experimental data by artificial neural networks approach", Applied Thermal Engineering 27 (2007) 1096–1104.

[13]. B.V. Babu, S.A. Munawarb, "Differential evolution strategies for optimal design of shell and tube heat exchanger", Chemical Engineering Science 62 (2007) 3720 – 3739.

[14]. José M. Ponce-Ortega, Medardo Serna-González, Arturo Jiménez-Gutiérrez, "Use of genetic algorithms for the optimal design of shell and tube heat exchanger", Applied Thermal Engineering 29 (2009) 203–209.

[15]. M. Fesanghary, E. Damangir, I. Soleimani, "Design optimization of shell and tube heat exchanger using global sensitivity analysis and harmony search algorithm", Applied Thermal Engineering 29 (2009) 1026–1031.

[16]. JiangfengGuo, Lin Cheng, Mingtian Xu, "Optimization design of shell and tube heat exchanger by entropy generation minimization and genetic algorithm", Applied Thermal Engineering 29 (2009) 2954–2960.

[17]. SepehrSanaye, Hassan Hajabdollahi, "Multi-objective optimization of shell and tube heat exchanger", Applied Thermal Engineering 30 (2010) 1937-1945.

[18]. V.K. Patel, R.V. Rao, "Design optimization of shell and tube heat exchanger using particle swarm optimization

INTERNATIONAL JOURNAL FOR RESEARCH IN APPLIED SCIENCE AND ENGINEERING TECHNOLOGY (IJRASET)

technique", Applied Thermal Engineering 30 (2010) 1417-1425.

[19] M. Thirumarimurugan, T.Kannadasan and E.Ramasamy, Performance Analysis Of Shell And Tube Heat Exchanger Using Miscible System, American Journal Of Applied Sciences 5 (5): 548-552, 2008.

[20] K. Sudhakara Rao, Analysis Of Flow Mal distribution In Tubular Heat Exchangers By Fluent, National Institute Of Technology Rourkela ,2007.

[21] M.R. Salimpour, Heat Transfer Coefficients Of Shell And Coiled Tube Heat Exchangers, Isfahan University Of Technology, Iran, 2008.

[22] Yusuf Ali Kara, OzbilenGurarasa, A Computer Program For Designing Of Shell-And-Tube Heat Exchangers, Applied Thermal Engineering University Of Ataturk, Turkey, 2004.

[23] Usman Ur Rehman, Heat Transfer Optimization of Shell-And-Tube Heat Exchanger through CFD Studies, Chalmers University of Technology, 2011.

[24] Huadong Li And Volker Kottke, Effect Of The Leakage On Pressure Drop And Local Heat Transfer In Shell-And-Tube Heat Exchangers For Staggered Tube Arrangement, Inl. J. Heat Mass Transfer, Elsevier Science Ltd., 1998.

[25] Jian-Fei Zhang, Ya-Ling He, Wen-Quan Tao, A Design And Rating Method For Shell-And-Tube Heat Exchangers With Helical Baffles, Journal Of Heat Transfer, May 2010.

[26] Huadong Li And Volker Kottke, Effect Of Baffle Spacing On Pressure Drop And Local Heat Transfer In Shell-And-Tube Heat Exchangers For Staggered Tube Arrangement, Inl. J. Heat Mass Transfer, Elsevier Science Ltd., 1998.

[27] Muhammad Mahmood AslamBhutta, Nasir Hayat, Muhammad Hassan Bashir, AhmerRais Khan, KanwarNaveed Ahmad, Sarfaraz Khan5, CFD Applications In Various Heat Exchangers Design: A Review, Department Of Mechanical Engineering, University Of Engineering & Technology, Applied Thermal Engineering, 2011.

[28] Philip J Stop ford, Recent Application of CFD Modeling in Power Generation Metal and Process Industries, Second International Conference on CFD in Mineral and Process Industries, CSIRO, Melbourne, Australia, 1999.

[29] KhairunHasmadi Othman, CFD Simulation of Heat Transfer In Shell And Tube Heat Exchanger, University Malaysia Pahang, April 2009.

[30] ZarkoStevanovic, GradimirIlic, Design Of Shell-And-Tube Heat Exchangers By Using CFD Technique, University Of Nis, Fr, 2002.

[31] Ender Ozden, IlkerTari, Shell Side CFD Analysis of A Small Shell And Tube Heat Exchanger, Middle East Technical University, 2010.

[32] Apu Roy, D.H.Das, CFD Analysis Of A Shell And Finned Tube Heat Exchanger For Waste Heat Recovery Applications, National Institute Of Technology, 2011.

KIRUBADURAI BALARAMANreceived the B.E. degree in AERONAUTICAL Engineering from VELTECH Engineering College, Chennai. He got master degree in THERMAL ENGINEERING from GOVERNMENT COLLEGE OF TECHNOLOGY, Coimbatore. Currently working as an Assistant Professor in Mechanical department in SRI SHAKTHI INSTITUTE OF ENGG AND TECH, Coimbatore, India. His Research interest in HEAT TRANSFER.

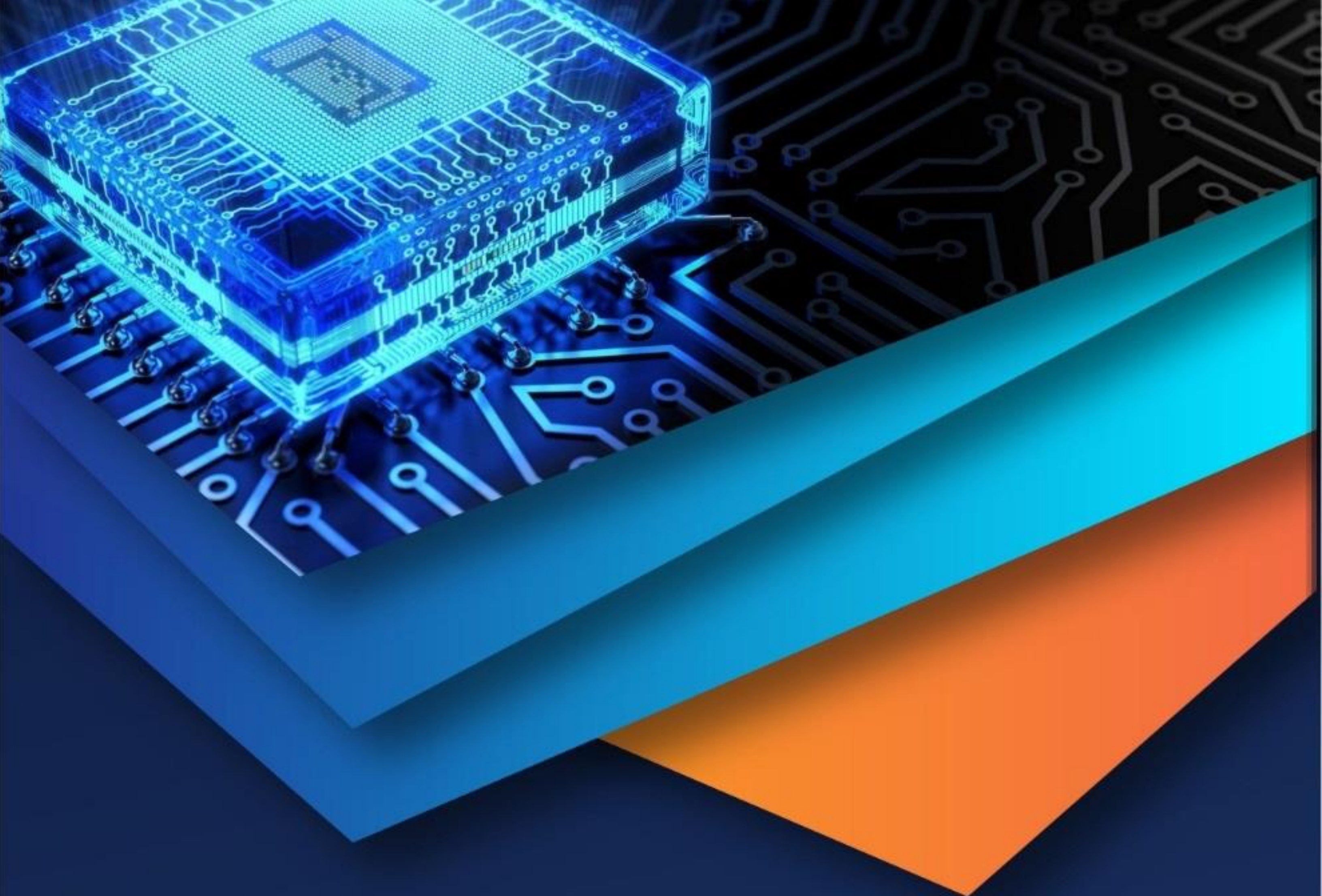
RAJASEKARAN received the B.E. degree in MECHANICAL Engineering from AnjalaiAmmalMahalingam Engineering College, Thiruvarur. He got master degree in THERMAL ENGINEERING from GOVERNMENT COLLEGE OF TECHNOLOGY, Coimbatore. His Research interest in HEAT TRANSFER.

KANAGARAJA KATTURAJAreceived the B.E. degree in AERONAUTICAL Engineering from ANNA UNIVERSITY OF TECHNOLOGY, Coimbatore. He got master degree in THERMAL ENGINEERING from GOVERNMENT COLLEGE OF TECHNOLOGY, Coimbatore. Currently working as an Assistant Professor in Mechanical department

INTERNATIONAL JOURNAL FOR RESEARCH IN APPLIED SCIENCE AND ENGINEERING TECHNOLOGY (IJRASET)

in ADITHYA INSTITUTE OF TECHNOLOGY, COIMBATORE, India. His Research interest in THERMODYNAMICS.

SELVAN PALANISAMYreceived the B.E. degree in MECHANICAL Engineering from KONGU ENGINEERING COLLEGE, Erode. He got master degree in THERMAL ENGINEERING from GOVERNMENT COLLEGE OF TECHNOLOGY, Coimbatore. Currently working as an Assistant Professor in Mechanical department in SNS COLLEGE OF ENGG, COIMBATORE, India. His Research interest in HEAT TRANSFER.



10.22214/IJRASET

INDEX COPERNICUS 45.98

ISRA JIF IMPACT FACTOR: 7.129

TOGETHER WE REACH THE GOAL

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY