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Review: Computational Fluid Dynamics Analysis of Shell and Tube Heat Exchanger with Different Baffles

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ABSTRACT: For many years, large-scale commercial enterprises have been interested in the treatment of waste heat. This recovery not only makes an operation more environmentally friendly, but it also allows for cost savings. Furthermore, it may lower the amount of resources required to power a facility. Many industries have implemented one-of-a-kind waste warmth recovery solutions. A warmness exchanger is a common option. This work describes the investigation of heat transfer in a shell and tube heat exchanger with different types of bafflesby evaluating the results/ researched by various authors.

Key Word:shell and tube heat exchanger, segmental baffle, k-e model

I. INTRODUCTION

Because of its compact construction and excellent heat transfer coefficient, shell and helical coil heat exchangers are widely used in commercial applications such as power generation, nuclear industry, system vegetation, heat recuperation systems, refrigeration, food industry, and so on. Due to their ease of manufacture, helical coils with circular move phases were widely employed in a variety of package styles. Because of the existence of centrifugal forces, floating in a curved tube differs from floating in a straight tube. These centrifugal forces form a secondary flow parallel to the primary direction of flow, with circulatory results that raise both the friction factor and the fee of heat switch.The amount of secondary drift advanced within the tube is proportional to the tube diameter (d) and coil diameter (D). Because of the more desirable warmth switch in shell and helical coiled configurations, the investigation of flow and warmth switch characteristics in the curved tube is critical. Creating fluid-to-fluid helical warmth exchangers (fluid is available on both sides of the tube wall) necessitates a thorough understanding of the warmth switch mechanism on both sides of the tube wall. Despite extensive research on the warmness transmission coefficients within coiled tubes, little work has been documented on the outside warmness transfer coefficients.One of the severe problems is warmth switch fluid, which disrupts the scale and value of warmth exchanger structures.

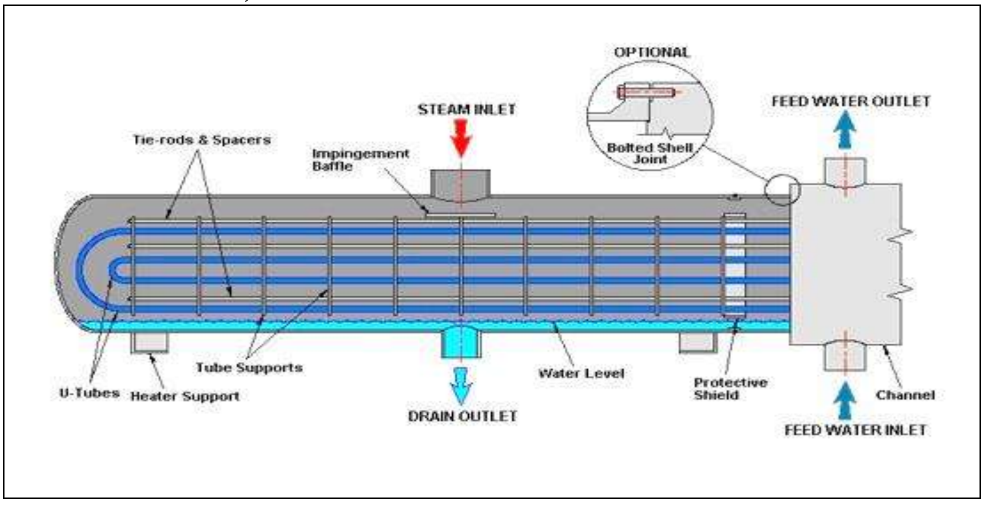

Figure 1Shell and Tube Heat Exchanger

II. LITERATURE REVIEW

GyanPrakash et.al.[1] Shell and coiled coils ar eminent involute tubes which can be employed in variety of solicitations e.g. warmness recuperation, air-conditioning and maintenance schemes, chemical reactors and dairy farm practices. For this, his planned work on CFD to scrutinize the coiled coil by means of victimization ANSYS 15. A 3D fashion of CAD version of coiled coil of tube outer diameter (do) 16 millimetre, inner diameter of coiled coil (di) twelve millimetre, pitch of 26.3mm, pitch coil DIA. 86 mm, tube period of 235 millimetre, shell diameter is 110 millimetre and shell length is 215 millimetre, is generated with the aid of victimization ANSYS fluent fifteen. analytical investigations ar done on the shell and whorled coil device, to see pressure drop and temperature distribution of a water as a base fluid and Fe2O3 as a nanofluid on shell and whorled coil flowing underneath streamline flow conditions. By perceptive the CFD analysis results, the pressure drop is additional in hot fluid of Fe2O3 nanofluid with water as a base fluid in shell and whorled coil device.

PranitaBichkar et.al. [2] doing research on the impact of various types on Shell and Tube Heat Exchangers This research offers numerical simulations of unmarried segmental, double segmental, and vertical arrangements. This implies that the shell has an influence on the pressure drop of the shell and tube warmth exchanger. Unmarried-segmented blocks exhibit the creation of dead zones in which the warmth switch cannot be turned green. When compared to single segment beams, double section beams lessen vibration damage. Because dead zones are eliminated when using a vertical shell, pressure is reduced. Fewer dead zones result in a greater heat switch. Reduced stress results in less pump energy, which boosts system efficiency. The comparison results reveal that the vertical is more beneficial than the horizontal.

Vidula Vishnu Suryawanshi et.al. [3]carried out research on the designing and assessment of helical coil heat exchangers CFD analyses are performed in this work on several compounds with varying sizes. The following tasks must be completed to further develop the helical heat exchanger: wall temperature and consistent wall warmness flux in both laminar and turbulent drift. To maximise the heat transfer coefficient, examine the results and alter the spiral winding pitch.

Vishal Momale et.al. [4] Examine the performance of a conical helical tube warmness exchanger with direct and conical shell cfd usage. Computational fluid dynamics was used to complete the study of a conical helical tube heat exchanger. Heat transmission may evolve significantly when the larger shell fluid comes into contact with the tube fluid when we employ a conical shell rather than a helical shell. With a conical shell configuration, the strain decrease will boom. If we utilise baffles, we can still boost the warmth switch.

R. Patil et.al. [5] A design method for a spiral coil heat exchanger was suggested. The heat transfer coefficient is calculated primarily based on the internal diameter hello of the coil using the Sieder-Tate relationship or the instantly pipe method by plotting the Colburn coefficient JH against Re. External heat transfer coefficients are calculated using correlation for specific stages of Reynolds numbers. Spiral coil warmness exchangers are preferred when space is limited, as well as in low drift or slow flow circumstances.

N. Ghorbani et.al. [6] For the purposes of this paper, an experimental examination of the thermal performance of shell and coil warmth exchangers was carried out. The calculations were done in steady state, and the trials were done in laminar and turbulent glide within the coil. It has been established that the tube aspect to shell mass drift ratio is effective for the heat exchanger's axial temperature profile. He observed that raising the mass flow ratio reduces the logarithmic average temperature difference and decreasing the mass waft rate reduces the adjusted effective temperature distinction.

Sunil Kumar et.al. [7] The first configuration of a helical coil warmth exchanger with fins was explored, as well as stress and temperature comparisons with a standard structure. The end outcome of this investigation is an increase in the overall heat switch coefficient within the domain. Increase the strain decrease within the range. The bloodless water outlet temperature is increased to 320k while the water outlet temperature is dropped to 315k. The total stress decrease increases as the temperature rises. When the CFD numbers were compared to the prior statistics, the entire pressure drop for Case 2 increased to 0.65 bar. The system's overall performance ranges between 5% and 6%.

K. Abdul hamid et.al [8] Pressure decrease in ethylene glycol (EG)-based nanofluids was investigated. Nanofluids are created by diluting TiO2 in a 60:40 volume ratio of mixed water and EG base fluid in three quantity concentrations of 0.5%, 1.0%, and 1.5%. Experiments were carried out in a waft loop with a horizontal tube examination phase at various drift rate values in a variety of Reynolds numbers beneath 30,000. The experimental pressure drop of TiO2 nanofluid results were compared to the Blasius equation for the base fluid. An increase in pressure drop was detected with increasing nanofluid volume attention, and a slight decrease in strain drop was discovered with increasing nanofluid temperature. He discovered that TiO2 did not increase significantly compared to EG liquids. The working temperature of nanofluids reduces the pressure drop due to the reduction of nanofluid viscosity.

Paranisamy et al [9] Warmth switch and strain decrease in a conical spiral tube heat exchanger using MWCNT/water multi-walled carbon nanotubes were determined. Surfactant calculations were performed on MWCNT/water nanofluids with atomic extent absorption of 0.1%, 0.3%, and 0.5% utilising a two-step technique. The study of turbulent drift became revealed inside the range of Din vast variation 2200 De 4200. The volume concentration of nanofluid with assumed Nusselt numbers of 0.1%, 0.3%, and 0.5% became 28%, 52%, and 68% more than water, respectively. The pressure drop of 0.1%, 0.3%, and 0.5% nanofluids is 16%, 30%, and 42% more than that of water, respectively.

Hemasunder Banka et al. [10] carried out a scientific evaluation on shell and tube heat exchangers with pressurised convection heat switch to identify the bodily appearance of nanofluid flows with varying extent fraction and mixing with water. Titanium carbide (TiC) and titanium nitride are two nanofluids (TiC). TiN) and ZnOnanofluids with extremely high concentrations (0.02, 0.04, 0.07, and 0.15%) drift in turbulent circumstances. CFD study of heat exchangers is carried out by using nanofluid houses with certain volume fractions to provide temperature distributions, heat switch coefficients, and heat switch coefficients. He discovered that heat switch coefficients and heat switch coefficients increase as quantity fractions increase.

III. PROBLEM FORMULATION

There is less work has been done on heat transfer rate of shell and tube heat exchanger with different type of baffles. In my work I am trying to showing the CFD analysis of heat transfer by using3 different numbers of baffles are used keeping other parameters and boundary conditions constant, to observe the effect of number of baffles on heat transfer and pressure drop of shell. Constant fluid properties are assumed. After the creation of three geometric models, each model is analyzed with constant velocity and temperature inlet condition. The flow condition is taken as turbulent.

IV CONCLUSION

Pressure drop is an adverse phenomenon which should be taken into consideration while designing the shell and tube heat exchanger. Since the spacing between the baffle is less so the area of recirculation is less and high turbulence is developed

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