# An Evaluation on Efficiency Forecast of Helical Coils Heat Exchanger

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**Abstract - This paper deals with the evaluation of efficiency enhancement of the helically coiled tube with similar and reverses circulation settings of various connections with specific data. The numbers of huge circulation rate and the heat range distinction of hot water liquid are documented. Logarithmic Mean Temperature Difference LMTD, potential rate, worldwide heat exchange coefficient, and efficiency are measured and compared for Parallel circulation and Counterflow settings with modifications of rings options. By taking the referrals of developing helical rings tube joints will design the dual tube helical rings and trial set up also has to prepare as per TEMA recommendations. The improved in the concentration of the secondary's circulation developed due to the centrifugal power due to the curve of the tube joints.**

**Keywords - Coil Configurations, Flow configurations, Heat transfer coefficient, Helical coil heat exchanger.**

## 1. Introduction

The important part of this document should describe the characteristics of the problem, past work, objective, and the participation of the document. Each area may get offers to understand easily about the document. The heat exchanger is a system which is used to exchange heat from one method to another method with effective heat exchange amount. The essential of heat exchanger concept is to accomplish an effective heat circulation from the hot liquid to cold liquid. In heat exchanger is a immediate use of the heat range difference between the two liquids, the area where heat is moved, and the conductivity of the liquid and the circulation options. This primary connection of the overall heat exchange coefficient, which given by Equation:

$$Q = U_0 A_{Sr} \Delta T_{LMTD} \quad (1)$$

Some of the researchers' research on the rounded pipes they found that helical coils pipes are having warm exchange amount in comparison to directly pipes heat exchanger. The several research has indicated on the helical pipes are excellent to directly pipes when employed in heat exchange amount. The additional circulation growth due to centrifugal power in the curve of the pipes. Generally, a liquid in the main of the pipe goes towards the external walls, then profits to the inner section of the pipe by streaming back along the walls, as proven in figure-1.

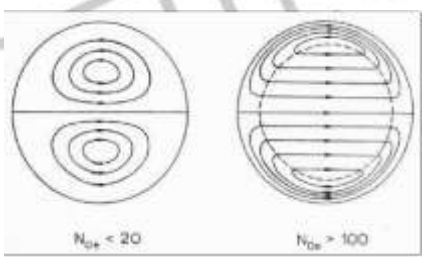


**Figure-1: Additional circulation for low as well as Dean Number**

Additional circulation can be expected to enhance heat exchange between the pipe wall and the streaming liquid. Another advantage to using helical rings over straight pipe joints is that the residence time spread is reduced, allowing helical rings to be used to reduce axial distribution in tubular reactors. Thus, for the style of heat exchangers that contain rounded pipe joints, or helically coiled heat exchangers, heat exchange and hydrodynamic features need to be known for different options of the rings, such as the number of pipe distance to rings distance, pitch, and Reynolds and Prandtl numbers and Dean Number (De). Eustice in 1911 had first seen in the liquid motion in rounded pipe joints. Then after many studies have been worked on the circulation areas that occur in rounded pipe joints (Dean,1927, 1928; White, 1929;

Hawthorne, 1951; Horlock, 1956; Barua, 1962; Austin, tx and Seader, 1973) such as helical rings. The circulation areas of helical rings pipe joints have been noticed experimentally and numerically.

The next logical step in monitoring circulation styles was to study the styles in warm exchange applications. Helical rings warm exchanger style is depending on connections between the Kern technique and Bell- Delaware technique.
• In Bell-Delaware technique is in accordance with the heat- exchange coefficient and pressure fall are estimated from connections for circulation over ideal pipe joints, and the effects of a leak, skipping and circulation of liquid in the pipe zone are allowed for by applying modification factors.
• In Kern's technique is depending on test work on commercial exchangers with conventional specifications and will give a reasonably acceptable forecast of the heat-transfer coefficient for conventional designs. The forecast of stress fall is less acceptable, as pressure fall is more affected by leak and skipping than heat exchange.

**2. Literature Review**

In recent past year, the developments in processing power have raised the interest of technicians and researchers to imitate their problems with computational and mathematical techniques. A lot of computational tools and techniques have been developed in the last decades to studies fluid features, burning, and different ways of heat exchange. Use of heat exchangers in a wide variety of programs draws they and researchers to work in this field. Some of the literary works are as follows;

Rahul Kharat et. al. (2009) has examined the heat exchange coefficient connection for concentric helical rings heat exchanger. Their result is based on a rings settings. It was noticed that the heat exchange coefficient reduces with the growth in a gap. The heat exchange coefficient improves with the growth in pipe size. This is due to a reduction in rings gap with improving pipe size and the consequence of pipe size is not dissociated with the consequence of the rings gap.

Jayakumar and Grover et al. (1997) had examined the performance of the rest of the heat removal program for two-phase natural flow. They had done their tests on helical rings, heat exchanger. They had analyzed the consequence of different process parameter on heat exchange features.

Kapil Dev et al(2014) has carried out a scientific study of helical rings heat exchanger used in fluid water loss and droplet disengagement for a laminar fluid flow. They focused on style factors and heat exchange conditions of generators of a simple gases consumption fridge program with flow condition of refrigerant taken as laminar flow. If the required style factors would be changed, then the efficiency of heat exchanger remains same by improving the area of helical rings. It is also found that the heat exchange coefficient could be improved with the mass flow rate.

Pablo Coronel et al(2008) has performed tests to research heat exchange coefficient in helical heat exchanger under circulation circumstances. His research involved the dedication of the convective heat exchange coefficient in both helical and directly tubular heat exchangers under strong circulation circumstances.

Experiments were performed in helical heat exchangers, with rings of two different curve percentages (d/D = 0.114 and 0.078), and indirectly tubular heat exchangers at various circulation rate (0.000189 - 0.000631 $m^3/s$) and for distinct end-point temperature ranges (92 - 149°C). The outcomes show that the overall heat exchange coefficient (U) in the helical heat exchanger is much more than that indirectly tubular heat exchangers. The interior (hi) and outside (ho) convective heat exchange coefficients were determined based on the overall heat exchange coefficient and a connection to estimate the within convective heat exchange coefficient (hi) as a function of NRe, NPr, and d/D (dean number) was formulated.

Timothy J. Rennie et al(2005) has performed trial studies of a double-pipe helical heat exchanger using two different sizes heat exchanger. It was noticed that there were little variations in the overall heat exchange coefficient between similar and reverse circulation options with two different inner coils diameters. Heat exchange prices were discovered better in counterflow settings than in a similar one. The nusselt variety in the inner pipe was in contrast to literary works principles and discovered to be in good agreement.

B. ChinnaAnkanna et.al.(2014) has performed a performance research of designed helical coils heat exchanger. He examined the effect of various factors that affect the potency of a heat exchanger like the number of rings, circulation amount, and heat range. After performing the tests and evaluating the outcomes obtained on helical (Parallel and reverse flow) and directly (parallel and reverse flow) pipe, the following answers are drawn:

• The helical pipe is having the greater place which allows the liquid to be in contact for an increased interval of the timeframe so that there is an improved heat exchange to this of the direct pipe.
• The overall heat exchange coefficient for helical pipe is approximately 0.35 of that direct pipe joints.
• The heat range of the cold normal water coming from the helical pipe in counterflow agreement is (38°C - 52 °C) i.e. a rise in the climate is between 7°C to 21°C. It means that for the same region the helical pipe consumed is more than that of the direct copper pipe.
• The efficiency of pipe joints either helical or directly in reverse circulation is more than similar settings.
• From the above one can realize the fact that for the same space or volume in the industry the helical heat exchangers are more efficient than normal directly warm exchangers.
• The impacting factors on efficiency and overall heat exchange coefficient in the reducing order are Flow amount, Hot normal water inlet heat range and the number of turns.

Research the circulation and heat exchange features in a spiral-coil tube had done by Naphon (2011). He did both the mathematical and trial study on a horizontal spiral-coil tube to predict the circulation attribute. The standard k–ε two-equation disturbance model was used to imitate the strong circulation and heat exchange features of the liquid. Heat exchange amount or heat change coefficient had affected by the centrifugal power. However, the pressure fall also increases. He discovered that the Nusselt variety and pressure fall obtained from the spiral-coil tube are almost one and a half times more than that of the straight tube due to the centrifugal power.

H. S. Patel et al (2013)carried out a review of the effective assessment and CFD analysis of dual tube heat exchanger. They described the different methods which may help to improve heat exchange amount. Heat exchangers are customized in space of annular, also using Nanoparticle in the water and compared with the traditional heat exchanger. Outcomes show that the heat exchange amount of the customized heat exchanger is more than the traditional heat exchanger. Nanoparticles allocated in the water can significantly improve the heat exchange amount and also heat exchange amount improve with the improvement of mass circulation amount. It may determine that heat exchange enhancement methods are successful to improve heat exchange efficiency of dual tube heat exchanger.

AlokVyas et al (2013) have analyzed the various trial study on the efficiency of tubular heat exchangers. The tubular heat exchanger is used throughout various sectors because of its inexpensive cost and advantage when it comes to maintenance. Their study was focused on tube size, tube length, the variety of pipes, variety of baffles & baffles inclination. They concluded that warm exchange coefficients coming out by use of 30° baffles are more efficient than 0° baffles.

S. Laohalertdechaet al(2012) analyzed the heat exchange efficiency and pressure fall features of the various improved tube. It was discovered that different types of the improved pipes (corrugated tube, ribbed tube, grooved tube, and fluted tube) have great potential for heat-transfer improvement and are highly suited to applications in realistic heat-transfer processes.

Pardeep Kumar et al(2014) performed a trial investigation to analyze the Heat exchange Enhancement of Helix-changer with Grooved Tube. It was discovered that outcomes of heat exchange improvement of helix filter assisted by grooved pipes over simply pipes at same operating conditions, heat exchange improvement by using lines on pipes, which is a passive heat improvement technique, is still far from the program with helix baffle. The pattern on pipes will improve disturbance, the degree of movement of liquid which leads to better heat improvement over the simply tube helix-changer.

**3. Conclusion**

After examining on literary works some of the results are as follows;
1) From the literary works only some adjustment had designed in the coils settings, so can function adjustment on coils settings for improves heat change coefficient.
2) Work on Nanofluid in helical coils heat exchanger with the different solidity of the working liquid.
3) The improve this problem based on the consequence of dean number for all tests and also influence the Nusselt number in both circulation circumstances (parallel circulation and reverse flow) are not discovered out yet.

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