KOCH™
HEAT TRANSFER

TUBE INSERT TECHNOLOGY: RESEARCH & DEVELOPMENT

At Koch Heat Transfer, we pride ourselves on innovation and discovery. With our state of the art R&D facility, we are able to turn ideas into reality.

KHT offers an array of tube insert technology that provides tested and proven enhancement of tube side heat transfer coefficient. This means smaller, more efficient heat exchangers reducing weight and cost. For existing equipment, this is the most cost effective way to improve performance.

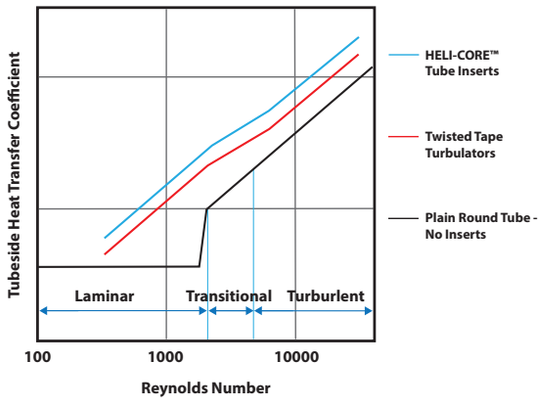
In this case study, we discuss a few applications and the impact that the various inserts have on new and existing equipment.

Research & Development Field Data

The following graphs represent the impact the tube inserts have on the tube side heat transfer coefficient and pressure drop, relative to Reynolds number.

Inserts provide a greater impact on tubeside heat transfer coefficient in the laminar to transitional flow regime while still providing benefit in the turbulent flow regime (figure 1). This translates to either increased duty in a fixed exchanger size or a smaller, more economical new design.

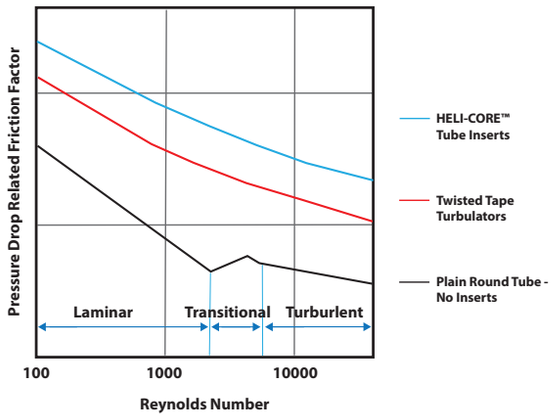
Heat Transfer Tests - Figure 1



Case Study: Low Velocity – Single Phase Fluid

The following is an example of utilizing inserts, compared to a plain tube design (Base Case), in a low tubeside velocity application. The shell size remains the same throughout, only changing nominal tube length and quantity of exchangers, to better compare the impact.

Each insert provides a benefit as compared to a plain tube design. The impact each insert has is due to the type of improvement it brings to the tube side heat transfer coefficient. Twisted tape induces a swirl flow, rather than displacing the fluid. The HELI-CORE™ Tube inserts induce a swirl flow while also displacing fluid to increase velocity. Wire Wrapped Core primarily displaces fluid while slightly inducing a swirl flow.



Hairpin (Table 1)

	Base Case (No Inserts)	With Twisted Tape	With HELI-CORE™ Tube Inserts	With Wire Wrapped Core
Cost	Base	54% of Base	55% of Base	28% of Base
Number of Shells	4	2	2	1
Size	24-inch diameter shell	24-inch diameter shell	24-inch diameter shell	24-inch diameter shell
Nominal Length	20 Ft	18 Ft	16 Ft	15 Ft
Number of Tubes	559	559	559	559
Total Weight	95,100 lbs.	49,500 lbs.	45,200 lbs.	22,000 lbs.
Tube Side dP	1.2 psig	2.0 psig	4.8 psig	2.8 psig

Shell & Tube (Table 2)

	Base Case (No Inserts)	With Twisted Tape	With HELI-CORE™ Tube Inserts	With Wire Wrapped Core
Cost	Base	34% of Base	39% of Base	28% of Base
Number of Shells	4	1	1	1
Size	35x240 TEMA Type BFU	35x300 TEMA Type BFU	35x264 TEMA Type BFU	34x156 TEMA Type BFU
Nominal Length	20 Ft	25 Ft	22 Ft	13 Ft
Number of Tubes	1104	1104	1104	1104
Total Weight	103,500 lbs.	31,000 lbs.	28,000 lbs.	18,000 lbs.
Tube Side dP	1.2 psig	1.5 psig	3.0 psig	2.1 psig

Case Study: Retrofit to Improve Vaporization

The following case explores the benefit the various inserts have, where tube side vaporization occurs. In this application, an insert that induces a swirl flow will have a greater impact on the tube side heat transfer coefficient, rather than one that displaces the fluid by decreasing the tube side flow area.

	Base Case (No Inserts)	With Twisted Tape	With HELI-CORE™ Tube Inserts	With Wire Wrapped Core
Overdesign	-44%	5%	15%	-5%
Pressure Drop	3.0 psig	4.0 psig	4.5 psig	7.0 psig

The existing exchanger was under performing and an insert retrofit was the most economical direction to proceed. Twisted Tape provides more benefit relative to the wire wrapped core due to the minimal impact on pressure drop and inducing greater swirl flow. The swirl flow component forces the liquid to stay in contact with the tube wall ensuring constant vaporization.

Although Twisted Tape is a good choice for many cases, some applications require a more rigid and robust design. HELI-CORE™ Tube Inserts were selected for this application due to their rigid design, durability through maintenance, and improvement in swirl flow.

Summary

Twisted Tape provides a great benefit for vaporizing cases as well as higher velocity / higher viscosity applications. They will usually have the lowest cost on a per length basis relative to the other inserts.

HELI-CORE™ Tube Inserts combine the swirl flow benefits of Twisted Tape and the rigidity and displacement benefits of the Wire Wrapped Core. This insert is also ideal in a vaporizing case, as well as higher velocity / higher viscosity applications. An additional advantage of this insert is the capability to vary thickness and twist pitch that can fit various applications.

Wire Wrapped Core Tube Inserts are primarily intended to be displacement devices that increase the velocity, while also providing a small swirl profile. They may be ideal with low velocity cases in combination with higher allowable pressure drop.

The cases discussed are only a few of many possibilities of the advantage inserts can provide. Koch Heat Transfer will provide a customized solution utilizing expertise and experience that best fits the needs.