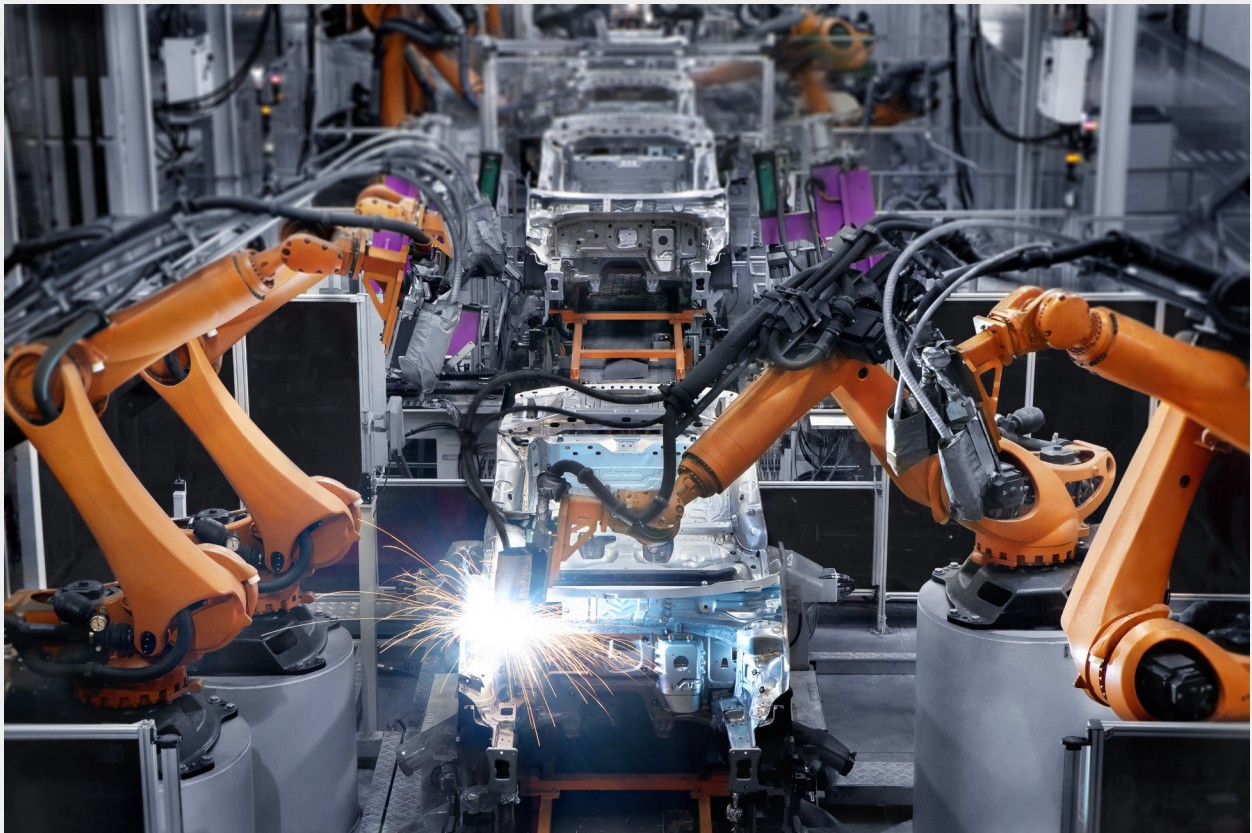


Enhanced Surfaces for Automotive

Automobiles present a number of challenges from a thermal management standpoint. Whether the wheels turn from engines and transmissions or batteries and motors, automotive power train systems run hotter these days and there is pressure to find better ways to deal with all of this heat. Fortunately, heat exchangers made with Vipertex[®] enhanced surface tubing and sheets can be up to five times more efficient than conventional units. Vipertex[®] can allow you to design heat exchangers that can be as efficient as possible so that they can occupy less space, require less charging substance, and facilitate more efficient operation of the vehicle.

Potential benefits of Vipertex[®] in automotive applications include:

- Compact units
- Lightweight units
- Increased power train cooling capacity
- Faster cabin heating and cooling
- Extended range of the vehicle
- Improved vehicle energy efficiency



Vipertex[®] enhanced surfaces are rolled in coil form, promoting repeatability, volume production and cost efficiency. These surfaces can then be transformed into tube or used in a flat configuration to incorporate into heat exchanger designs with greater flexibility and scalability, helping you optimize a solution for your project.

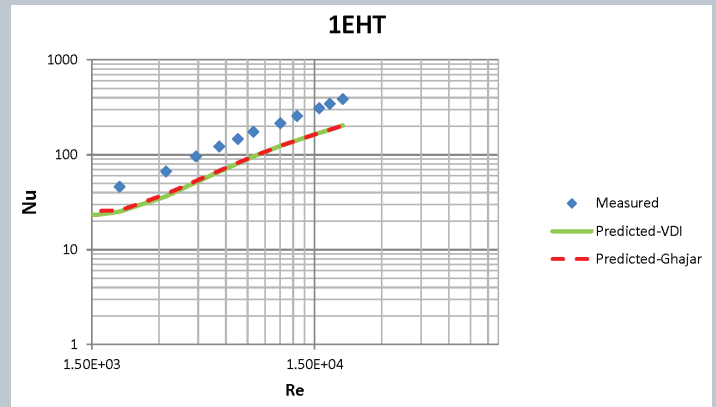
Whether you are retrofitting an existing installation or building new, let us help you determine the economic value of using Vipertex[®].

Pressure Applications

Vipertex® tubes can be used in exchangers operating at most pressure levels. Different alloy systems, wall thicknesses and processing specifications contribute to the ability to produce various pressure ratings.

Burst and collapse tests of welded Vipertex® tubes confirm higher ratings than their smooth, welded tube counterparts. It is apparent that the enhanced surface pattern serves to create a stronger, more rigid tube.

Variation of single phase heat transfer performance (Nu) with flow rate (Re) shows an increase of heat transfer performance of around 100% in Vipertex® tubes when compared to smooth tubes. This evaluation was performed at HTRI®.



Flow Rate

Typical single phase Vipertex® performance enhancement values are near 100%. This produces performance enhancement criteria (PEC) values greater than 1.

Two Phase Applications

Vipertex® tubes work extraordinarily well in single phase processes. Additionally, they enhance two phase applications.

Vipertex® is available in various surface texture options that may, based on other operating conditions, be more appropriate for particular functions, such as evaporators or condensers.

Fouling

Vipertex® enhanced surfaces have heat transfer anti-fouling characteristics for many conditions. Studies have been performed in crude, and once through water. Results show the design of the Vipertex® surface produces a wall shear that cleans the tube surface, allowing less debris to form on the surface.

Charging Substance

Since Vipertex® tubes are produced in a variety of alloy systems, optimization is possible to accommodate a wide variety of charging substances. It is important to consider what substances come in contact with the enhanced surfaces in your heat exchanger. This is helpful in determining a suitable alloy, as well as a suitable enhanced heat transfer pattern.

The increased thermal efficiency of a Vipertex® installation can reduce the amount of charging substance required, which provides the following benefits:

- Charge minimization
- Less environmental liability
- Footprint reduction

Temperature Range

Vipertex® enhanced surfaces can be produced in a number of alloy systems that can be optimized for operating temperatures ranging from high temperature to cryogenic, allowing the use of Vipertex® products in a wide variety of conditions.