Engineered Surfaces
For Enhanced Heat Transfer
Current energy demands and the desire to increase efficiencies of systems have prompted the development of enhanced heat transfer surfaces.

A new type of enhanced three dimensional heat transfer tube has been created by Vipertex®. This is accomplished through multi-level enhancement that makes the use of a primary surface enhancement and a secondary background pattern. Vipertex® enhanced surfaces have been designed and produced using material surface modifications that optimize fluid flow patterns and increase surface area, resulting in enhanced performance.

Vipertex® enhanced surfaces and tubes offer the following benefits and features:

- Greatly reduced operating cost
- Up to five times the heat transfer of smooth tubes
- More heat transfer and less fouling than other tubes (smooth or enhanced) in high performance applications
- A payback of less than 18 months*
- Smaller installation footprint
- Available in a variety of alloy systems
- Enhancement on one or both sides of the tube
- Enhanced flat sheets available
- More uniform properties than conventional enhanced tubes
- Conducive to high volume manufacturing
- Surface area is increased by up to 25%

* This is a typical time frame for the enhanced tubes.

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Vipertex® Enhanced Surfaces

Vipertex® enhanced surfaces are designed to enhance performance. These engineered surfaces can be welded into tubing or used in a flat configuration. Vipertex® offers enhancements engineered to your specific application. Enhancements can be applied to one or both sides of the surface.

For most applications, the Vipertex® model 1EHT (enhanced heat transfer) surface will provide the best solution. It has been engineered to provide enhanced thermal transfer through increased surface area; additionally, the use of surface enhancements promote turbulence and nucleation sites.

The Vipertex® model 2EHT surface provides a surface absent of dimples to accommodate applications requiring simpler geometry as in the case of very small diameter tubes.

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The Vipertex® model 3EHT surface produces an 8.9% surface area increase when compared to flat surfaces.

The Vipertex® model 4EHT surface produces an impressive 25% increase in surface area when compared to flat surfaces.

The Vipertex® model HB/EHT surface is a microfin surface that can be provided in a helical or herringbone design.
Taking Tube Technology to the Next Level

The Vipertex® Vipertube® line is a family of tubes utilizing the advantages of Vipertex® enhanced surfaces. Produced to ASTM A1098 specifications, Vipertube® is manufactured for the highest level of quality in high-pressured tubing.

Vipertube® is produced using a patented enhancement process, providing a surface that outperforms standard smooth tubes.

Vipertex® Enhanced Heat Transfer Tubes

Optimized heat transfer, using the Vipertex® 1EHT (enhanced heat transfer) tubes, is produced from a combination of secondary flow generation, increased turbulence, boundary layer disruption, increased heat transfer surface area and an increased number of nucleation sites; all leading to an enhanced heat transfer performance for a wide range of conditions.

Under many conditions, the Vipertex® EHT Vipertube® line can recover more energy and provide the opportunity to advance the design of many heat transfer products. Enhanced heat transfer tubes are widely used in order to reduce operating cost and create a smaller installation footprint.

The Vipertex® product line includes:

- Twisted Tape
- Coil
- U-Tube
- Finned Tube

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# Available Materials & Alloys

A summary of typical Vipertex® EHT materials is detailed in the following table.

Welded tubes produced from using Vipertex® EHT enhanced strip will help you optimize the performance of your design.

<table>
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<th>Material</th>
<th>Benefits</th>
<th>Configuration</th>
<th>Enhanced Surface Options</th>
<th>Alloys</th>
<th>Size Range</th>
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</thead>
</table>
| Stainless Steel | • Cost effective alternative for many industrial applications  
• Ideal for the handling of food products or other sanitary conditions | Welded        | 1EHT, 2EHT, 3EHT, 4EHT, HB/EHT | 304(L), 316(L), Other Austenitics: Duplex and Ferritic Alloys | 0.375” - 1.5” (9.5mm - 38mm) OD | ASTM 1098, ASME Code Case          |
| Copper        | • Excellent thermal transfer properties  
• Can stand up to a number of corrosive applications | Welded        | 1EHT, 2EHT, 3EHT, 4EHT, HB/EHT | C122 and others                       | 0.375” - 1.5” (9.5mm - 38mm) OD | In development                      |
| Titanium      | • Ideal where corrosive agents are involved  
• Well suited for high chloride applications                           | Welded        | 1EHT, 2EHT, 3EHT, 4EHT, HB/EHT | Grade 1, Grade 2                      | 0.375” - 1/5” (9.5mm - 38mm) OD |                                    |
| Carbon Steel  | • Provides strength and good thermal transfer properties                | Welded        | 1EHT, 2EHT, 3EHT, 4EHT, HB/EHT | 1008/1010 and others                 | 0.375” - 1.5” (9.5mm - 38mm) OD | ASME Code Case in development       |
| Aluminum      | • Provides good thermal transfer and corrosion resistance              | Welded        | 1EHT, 2EHT, 3EHT, 4EHT, HB/EHT | 3003, 5052 and others                 | 0.375” - 1.5” (9.5mm - 38mm) OD |                                    |

Other alloys are available through special orders.

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Applications

Aerospace  Automotive  Chemical  Desalination

Emerging Technologies  Heavy Machinery & Equipment  Home Appliance  HVAC

Marine  Oil & Gas  Petrochemical  Pharmaceutical

Power Plant  Refrigeration, Food & Beverage

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Design Considerations

Operating Conditions

Heat exchangers using Vipertex® tubes and/or flat goods can be substantially more efficient than those produced with conventional materials. Various operating conditions need to be considered so that the appropriateness of Vipertex® can be determined and optional strategies can be considered before making final design decisions.

Pressure Applications

Vipertex® tubes can be applied to exchangers operating at various pressure levels. Different alloy systems, wall thicknesses and processing specifications contribute to the achievement of various pressure ratings.

Burst and collapse tests of welded Vipertex® tubes confirm higher ratings than their smooth, welded tube counterparts.

Flow Rate

Vipertex® optimal performances produce a more than 500% improvement at Reynolds numbers near 1000. At other flow rates, performance enhancement values of 90-100% are seen. It is very interesting to note that there is an opportunity to reduce pumping power in your design and take advantage of this high-efficiency at the lower flow rate. At other conditions, a nearly 100% increase in heat transfer is produced..

Two Phase Applications

Vipertex® tubes work extraordinarily well in single phase processes, but also enhance two phase applications.

Vipertex® is available in various surface texture options that are good choiced for evaporators or condensers.

Fouling

Vipertex® enhanced surfaces have heat transfer anti-fouling characteristics for many conditions. The design of the Vipertex® surface produces a wall shear that cleans the tube surface, allowing less debris to form on the surface. For many applications involving fouling, Vipertex® designs produce more heat transfer and less fouling than other smooth or enhanced tubes.

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Design Considerations, cont.

Charging Substance
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 in the case of a spill
- Reduce space required

Solving Space Constraints
The highly efficient heat transfer, made possible by Vipertex® enhanced surfaces, allows for more compact heat exchanger designs where space is constrained.
Vipertex® can make the following possible:
- Less tubing
- Less charging fluid
- Smaller overall footprint of the installation
- Tightly-wound enhanced coil sections

Fabricability

Joinery Methods
Vipertex® enhanced surfaces are produced in a variety of alloy systems, which individually lend themselves to processes such as welding, brazing, and soldering, among others.

Fabrication Benefits
- Tightly-wound enhanced coil sections
- Tubes & flat-rolled ship-able in coil form
- More homogeneous properties are present since Vipertex® tubes are annealed after the surface pattern is imparted
- Scalability
- Less wrinkling when bending

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HTRI® Interface Available

HTRI® members can take advantage of a calculation tool that plugs into HTRI® Xchanger Suite software to help them optimize installations using Vipertex® tubing.

Current Vipertex® Standards

- Vipertex® Austenitic steel tubes can be produced using the ASTM A1098 standard. Standards for tubes produced from other alloys are currently being developed.
- ASME Code Case 2877 provides the details for heat exchanger designs that use Vipertex® Austenitic tubes.
- 3A Sanitary Standard

Rigidized® Metals Corporation is an organization that is ISO 9001:2015 Certified. We have implemented the ISO 9001:2015 Quality Management System into every aspect of our operations.

Visit our website at www.vipertex.com to obtain more information, including a library of information topics and articles relating to the extraordinary efficiency of Vipertex® enhanced metal surfaces. Whether you are retrofitting an existing installation or building new, let us help you determine the economic value of using Vipertex®!

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