



ENABLING APPLICATION SPECIFIC HEAT TRANSFER ENHANCEMENT IN

Refrigeration & Phase Change Applications

VorTX Wire
Turbulators



VorTX Spiral
Turbulators



Twisted Tape
Turbulators



Rigid Soldered
Turbulators



Wire Wound
Fin Tubes



Finding the right turbulator for an application is an exercise we are equipped to handle.

We make a bunch of different turbulator types and many different geometries within those types.

And it's because we make the entire spectrum of turbulator types and have data on where they stand that we can rank them in order of performance without letting bias creep in.

Rigid Soldered Turbulator



The highest performing turbulator there is as in addition to turbulence it also increases the internal surface area of the tube anywhere between 2x to 4x because of the solder bond effect. It makes drastic size (and cost) reduction in viscous fluid coolers possible.

It is also a gamechanger in gas coolers where the surface area extension is the dominant play other than simply turbulence as gas is naturally turbulent anyway. A 4x increase in internal surface area at 75% bond efficiency would still give a 3x bump in heat transfer coefficient.

Wire Turbulator



Wire turbulators offer the flexibility of easy insertion and the second highest performance profile in our range. Second only to rigid soldered turbulators. Their performance and pressure drop correlations are mapped into our VorTX DLL. Wire Turbulators are ideal for cases where tubeside limitation is severe.

Spiral Turbulator



Spiral Turbulators sit in between the performance of tight L/D Twisted Tape and Low Dense Wire Turbulators. A sweet spot in terms of pressure drop penalties. Spiral Turbulators also have their performance and pressure drop correlations mapped into our VorTX DLL. Spiral Turbulators are ideal for viscous and semi-viscous applications where pressure drop allowance is tight and twisted tapes can't give enough performance.

Twisted Tape



CEI Twisted Tapes have perfect L/D conformance and can be made in a wide range of materials and sizes. Even the L/D range that we can make these in is large giving a lot of flexibility in terms of design choices.

What VorTX is.

VorTX is Concept Engineering International's dynamic link library (DLL) developed by HTRI under proprietary contract with Concept Engineering International.

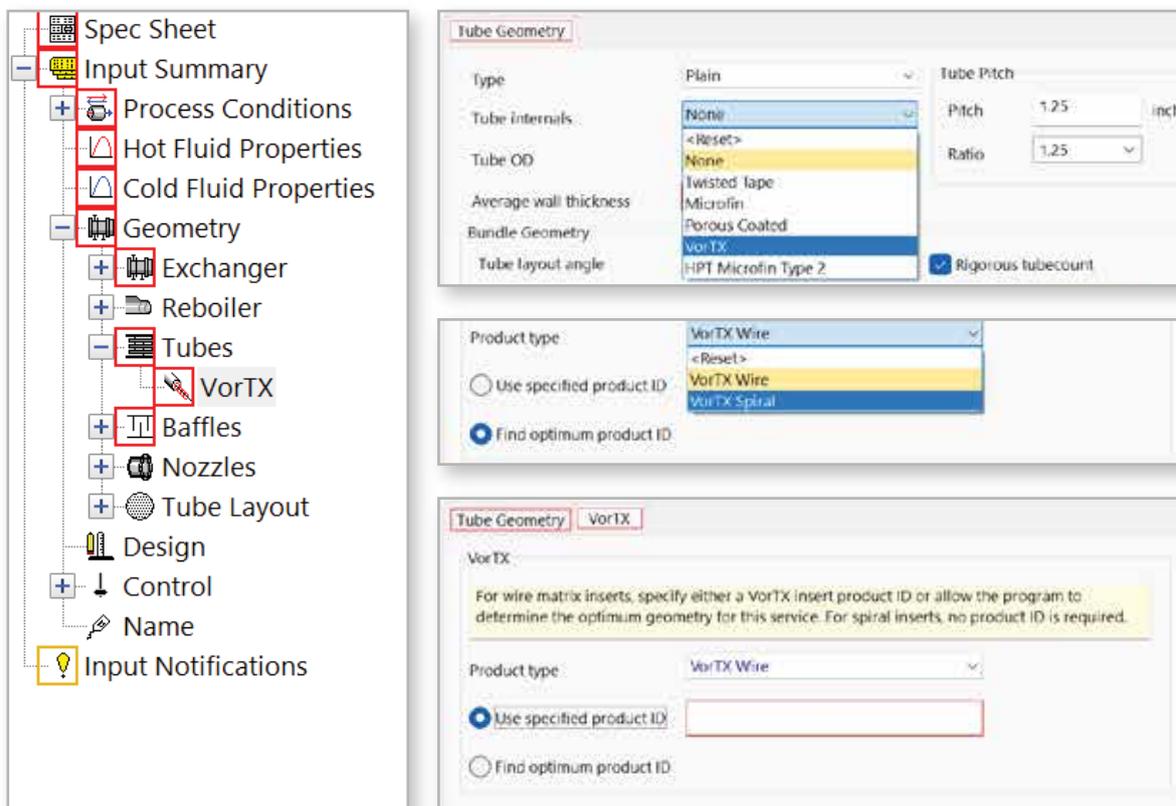
Multiple Concept Engineering International turbulators (wire and spiral tube inserts) were tested at HTRI's Research and Technology Center in Navasota, Texas, USA.

The VorTX DLL contains tube side single phase heat transfer and pressure drop correlations for modeling Concept Engineering International's products which were developed under proprietary contract with HTRI using Concept Engineering International's proprietary data.

HTRI used laminar flow CFD results to supplement empirical testing measurements at Reynolds numbers under 500.

The VorTX DLL can be used with HTRI Software for the following purposes:

1. Identifying an optimal Concept Engineering International product from those supported by the VorTX DLL based on utilizing the maximum amount of pressure drop allowed.
2. Evaluating the performance of a Concept Engineering International product supported by the VorTX DLL that resembles the geometry of those tested by HTRI.



What VorTX enables.

Data really drives every enhancement decision we make.

We're looking for the best operating window for our products from a Reynolds standpoint.

We're diving deep into wall correction factor impact of our geometries in software outputs.

We're looking at the additional hydraulic load of each geometry. Small tweaks in angles of attack.

How much the shear stress is when you pit turbulator vs bare tube.

What the impact on fouling is likely to be because of that additional wall sheer stress.

How we can disrupt film boiling to move over to nucleate boiling, arrest mist flow and reduce bubbles down to size.

These are questions that only data has the answer for.

Our turbulator range (multiple geometries) has been tested for a hard data mining operation.

Post that, the data has been analyzed and curve fitted and then modeled into correlations along with a test report for each insert geometry.

We've also done supplemental CFD work via a proprietary contract to home in on more accuracy.

To completely integrate into software platforms, we've also had developed the **VorTX.DLL** plugin that will hold this data and allow you, the user, to design your exchangers using our products in a matter of seconds if you're using compatible software.

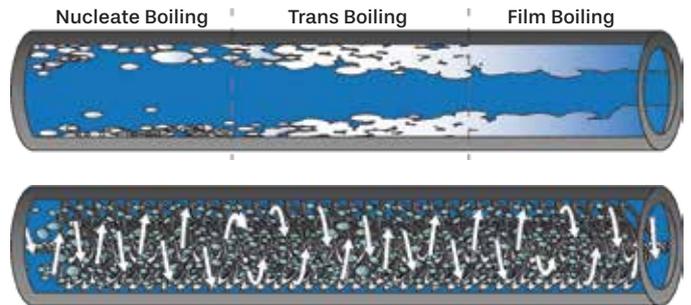
If you're an end-user like a refinery who uses a performance monitoring software, we're also looking at hard coding our mined data in software such as this to see the impact we can have on refinery exchangers to mitigate fouling by looking at shear stress increases and what that will mean for overall CO2 emissions reduction.

High-Performance Heat Transfer Enhancement: Refrigeration & Phase Change Applications

Data drives every enhancement decision we make. In refrigeration systems—where phase change efficiency and oil management are critical—we let the application dictate the geometry. We provide the industry's only unbiased heat transfer advisory because we manufacture the entire spectrum of enhancement technologies, from rigid soldered inserts to flexible wire-wound turbulators.

Engineering the Phase Change

Our range is designed to disrupt film boiling, move systems toward nucleate boiling, and arrest mist flow. By reducing bubble size and increasing wall shear stress, our enhancements ensure your refrigeration exchangers operate at peak thermal efficiency.



Turbulators overcome boundary layer limitations

Rigid Soldered Turbulators: The Gas Cooler Gamechanger



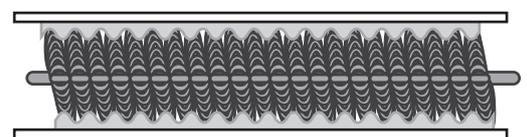
The highest-performing turbulator in the industry. For CO₂ (R744) gas coolers and viscous oil cooling, this is the definitive solution.

Surface Area Extension: Increases internal surface area by 2x to 4x.

The Solder Bond Effect: Achieving up to 75% bond efficiency, providing a 3x bump in heat transfer coefficients.

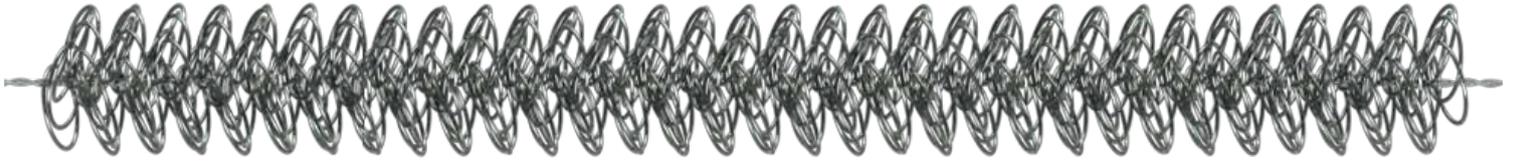
Target Applications:

- **High-pressure CO₂ gas coolers**
- **industrial oil coolers**
- **Ammonia-based systems where thermal density is critical.**



The Solder Bond Effect

Wire Turbulators (VorTX™ Enabled)



Ideal for evaporator and condenser applications where tubeside limitation is severe and oil management is a priority.

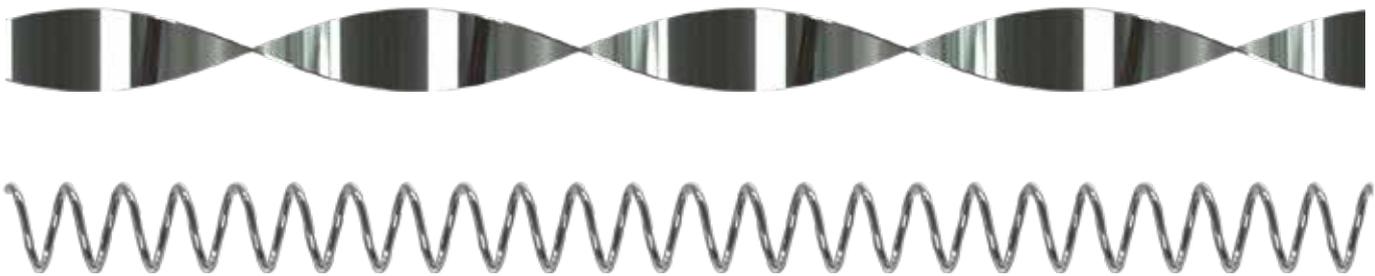
High Shear Stress: Increased wall shear stress helps mitigate oil film buildup, maintaining high heat transfer rates even in oil-rich environments.

Flexibility: Designed for easy insertion into existing heat exchanger designs, allowing for field retrofits or rapid production scaling.

Target Applications:

- DX (Direct Expansion) evaporators
- Liquid chillers
- Marine-grade refrigeration units.

Spiral & Twisted Tape Turbulators



The "sweet spot" for refrigeration systems with tight pressure drop allowances.

Spiral Geometries: Optimized for semi-viscous refrigerants and secondary glycols where standard twisted tapes cannot provide sufficient performance.

L/D Conformance: Perfect conformance ensures predictable performance and prevents bypass flow.

Target Applications:

- Glycol-water chillers
- Process cooling skids
- Shell-and-tube condensers for commercial HVAC.

Targeted Refrigeration Solutions

Our enhancements are specifically engineered to provide maximum ROI in the following systems:

- **Industrial CO2 Gas Coolers:** Utilizing rigid soldered inserts to manage the high thermal loads of transcritical cycles.
- **Ammonia (R717) Systems:** Enhancing tubeside coefficients to allow for more compact, lower-charge plant designs.
- **Process Skids:** Improving heat transfer in secondary loops using glycols or brines where laminar flow would otherwise hinder efficiency.

Design with Certainty: The VorTX™ Advantage

Stop guessing and start modeling. Our proprietary **VorTX™ DLL**, developed by HTRI, allows you to integrate our hard-mined empirical data directly into your design software.

- **Identify Optimal Geometry:** Select the best insert based on your specific Reynolds range and pressure drop budget.
- **Sustainability:** Use our mined data to calculate the impact on CO2 emissions reduction through enhanced thermal performance.



Concept Engineering International,
#2 Krishna Mahal, Ground Floor,
63 Marine Drive,
Mumbai-400020. India
mail@conceptengg.com
+91-22-43533700-99
www.conceptengg.com