



**ENABLING APPLICATION SPECIFIC HEAT TRANSFER ENHANCEMENT IN**

# Oil and Viscous Fluid Cooling

**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.

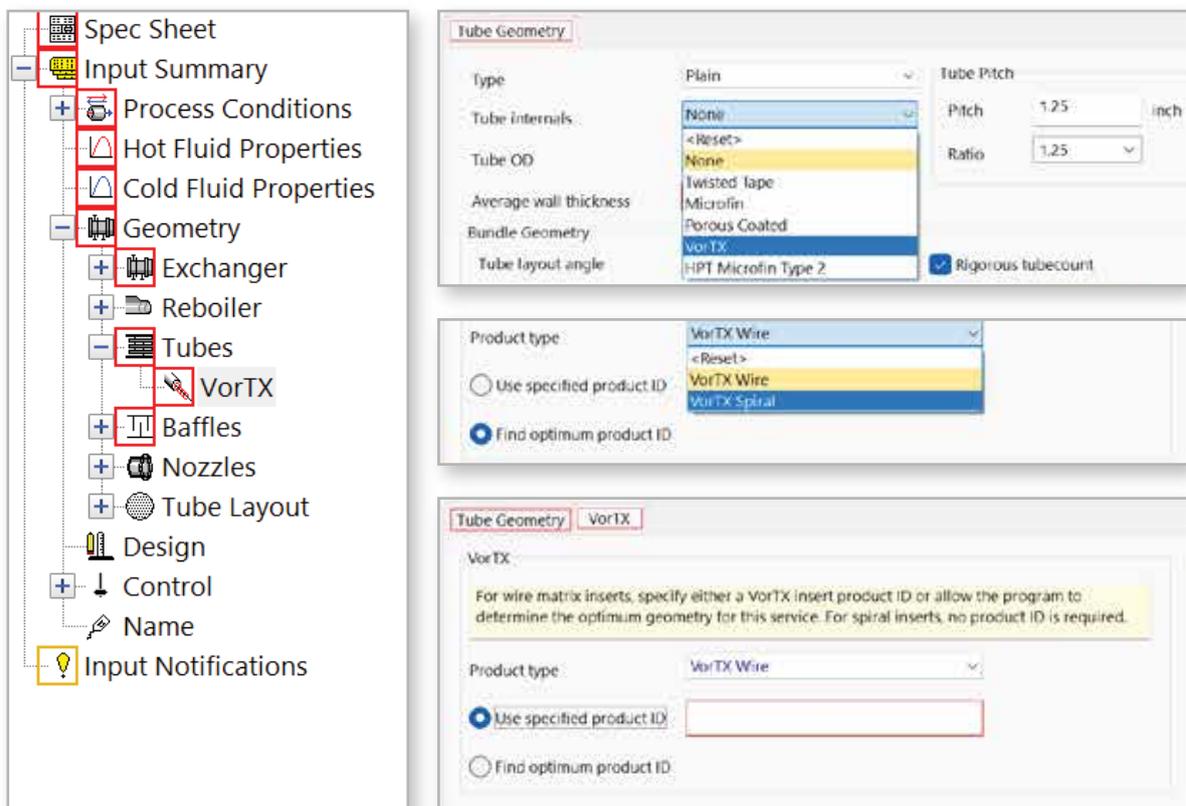
Multiple Concept Engineering International turbulators (wire and spiral tube inserts) were tested at HTRI's Research and Technology Center in Navasota, Texas, USA.

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.

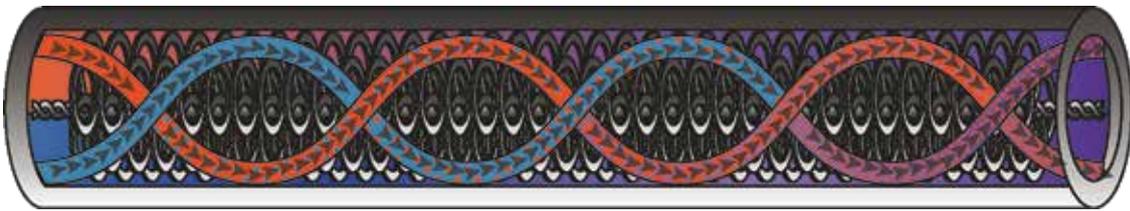
If you're an end-user like a refinery who uses a performance monitoring software, we're also looking at hard coding our mined data in software such as this to see the impact we can have on refinery exchangers to mitigate fouling by looking at shear stress increases and what that will mean for overall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

## High-Performance Heat Transfer: Oil & Viscous Fluid Cooling

Viscous fluids present a unique challenge in heat transfer: the "laminar trap." As viscosity increases, fluid tends to slide through the tube in a thick, insulating layer, leaving the core bypass flow uncooled. At Concept Engineering, we specialize in transforming these inefficient flows into high-performance heat transfer streams through targeted internal enhancement.

### Breaking the Laminar Boundary

In oil cooling, the heat transfer coefficient is typically very low. Our technology focuses on creating radial mixing—forcing the hot core of the oil to the tube wall and stripping away the cooled, stagnant boundary layer.



## Rigid Soldered Turbulators: The Ultimate Oil Cooler



For hydraulic oils, lube oils, and thermal fluids, the rigid soldered turbulator is our highest-performing solution.

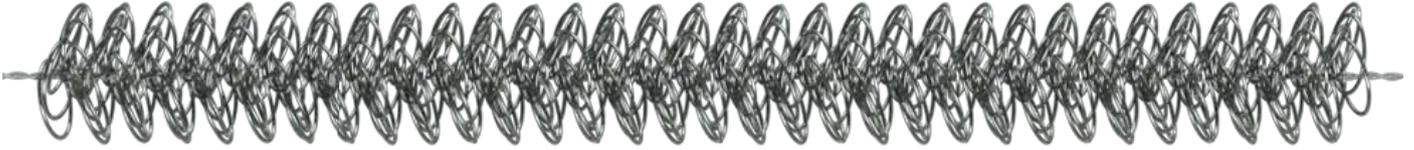
**High-Conductivity Bridge:** The solder bond creates a direct metallic path from the internal fin to the tube wall, turning the entire insert into a high-flux extension of the heat transfer surface.

**Surface Area Multiplier:** Provides 2x to 4x the internal surface area of a bare tube, critical for low-conductivity fluids like mineral oils.

**Pressure Drop Control:** We optimize the internal geometry to provide maximum cooling while staying within the strict Delta P limits of lubrication pumps.

**Target Applications:** Industrial hydraulic systems, plastic injection molding machines, and high-pressure oil-to-water coolers.

# Wire Turbulators: For High-Fouling & Viscous Service



Ideal for heavy oils and process fluids where viscosity changes significantly with temperature.

**Dynamic Boundary Layer Disruption:** The wire loops create a series of vortices that constantly "scrub" the tube wall, preventing the buildup of cold, high-viscosity "skins."

**Self-Cleaning Effect:** Increased wall shear stress helps keep additives and particulates in suspension, extending the time between cleanings.

## Target Applications:

- **Heavy fuel oil (HFO) heaters**
- **Crude oil exchangers**
- **Viscous Chemical Intermediates**
- **Lube Oil Coolers.**

# Spiral & Twisted Tape Turbulators: Economical Flow Management



A robust solution for large-volume oil cooling where energy efficiency and low cost are the primary drivers.

**Helical Mixing:** Induces a swirl flow that improves heat transfer by increasing the effective flow path and promoting secondary circulation.

**Low Fouling:** The simple, open geometry is easy to clean and resistant to plugging from wax or paraffin deposits.

**Target Applications:** Gearbox oil coolers, transformer oil radiators, and large-scale storage tank heaters.

## Specialized Focus: Turbine Oil Cooling

Steam and gas turbines require precision oil temperature control to maintain bearing integrity and prevent varnish formation. Our enhancements are engineered to meet the rigorous demands of power generation:

**Thermal Stability:** By increasing cooling efficiency, we ensure the oil stays within the narrow temperature band required to prevent oxidation.

**Compact Reliability:** Utilizing our rigid soldered inserts allows for significantly smaller shell-and-tube coolers, reducing the overall footprint of the turbine lube oil skid.

**Pulsation Resistance:** Our metallically bonded designs are built to withstand the constant vibrations and flow surges inherent in high-speed rotating equipment.

## Engineering for Cleanliness

Absolute fluid purity is non-negotiable in turbine applications. All of our internal enhancement systems are designed and manufactured to comply with Millipore testing standards for oil flushing, ensuring no manufacturing debris or contaminants enter your lubrication circuit.

# Performance Comparison in Oil Cooling

Feature	Bare Tube	Rigid Soldered	Wire Turbulator
Flow Regime	Laminar	Turbulent/Enhanced	High Shear
Heat Transfer	Baseline	300% – 500% Increase	150% – 250% Increase
Footprint	Large/Bulky	Ultra-Compact	Modular/Versatile
Millipore Compliance	Standard	Certified Compliant	Certified Compliant



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