CONCEPT

HTRI MEMBER

ENABLING APPLICATION SPECIFIC HEAT TRANSFER ENHANCEMENT IN

Compressed Gas Cooling Solutions

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 turbulation 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 turbulation 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

vortx enabled

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

vortx enabled

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.

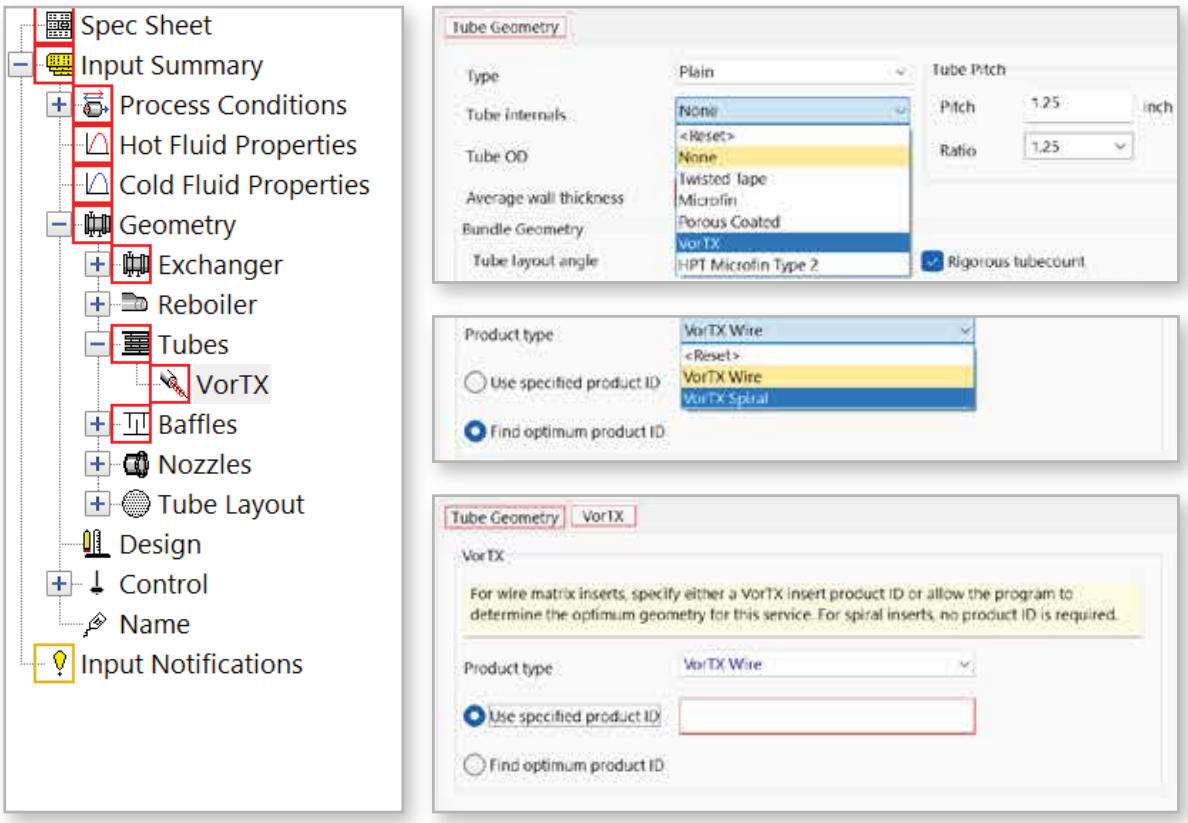
Multiple Concept Engineering International turbulators (wire and spiral tube inserts) were tested at HTRI's Research and Technology Center in Navasota, Texas, USA.

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: Compressed Gas Cooling Solutions

In high-pressure gas compression, thermal management is the key to volumetric efficiency and equipment longevity. Whether in multi-stage reciprocating compressors or high-speed centrifugals, the "gas-side" heat transfer coefficient is almost always the limiting factor. Concept Engineering provides the specialized internal enhancements required to bridge this gap, reducing discharge temperatures and protecting downstream components.

Overcoming the Gas-Side Barrier:

Gases are inherently poor conductors of heat. To achieve efficient intercooling or aftercooling, the internal surface area must be maximized and the insulating boundary layer must be aggressively disrupted. Our technologies transform standard tubing into high-flux heat transfer surfaces, allowing for smaller, more efficient cooler designs.

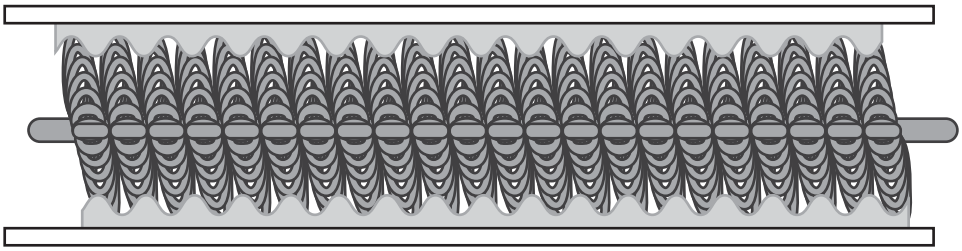
Rigid Soldered Turbulators:

The "Star Performer"

For applications within stable temperature ranges, the rigid soldered turbulator is the definitive industry standard for gas-side enhancement.

Maximum Surface Extension: Increases internal heat transfer area by 200% to 400%, providing the highest thermal density available in the industry.

The Solder Bond Advantage: Our proprietary soldering process eliminates the air gap between the insert and the tube wall. This creates a continuous metallic path, providing a 3x bump in heat transfer coefficients.



Structural Rigidity: The soldered bond prevents "chatter" or vibration-induced wear, even under the heavy pulsations of reciprocating compressors.

Target Applications:

- **High-pressure air aftercoolers**
- **nitrogen compressors**
- **hydrogen cooling loops.**

Application Specifics: Cooling Geometries

1. Air-Cooled Gas Coolers (Fin-Fan Units)

Air-cooled exchangers often suffer from a massive imbalance between the external finned surface and the internal "bare" tube surface.

- **Internal Balancing:** By adding our rigid soldered or wire enhancements, we "balance" the heat transfer resistance, allowing for a much more compact cooler footprint.
- **Throughput Recovery:** Increase the cooling capacity of existing AFCUs by up to 40% without changing the fan motor or structure.

2. Shell & Tube Intercoolers/Aftercoolers

In water-cooled systems, the gas-side (typically tubeside) is the dominant resistance.

- **Thermal Density:** Utilizing rigid soldered inserts allows for a drastic reduction in shell diameter and tube length, saving significant skid space and material cost.
- **Pulsation Resistance:** Our mechanically secured and soldered designs are built to withstand the rigors of high-pressure gas service.

Targeted Industry Applications

Industry	Application	Primary Objective
Oil & Gas	Natural Gas Injection	Reducing gas volume for high-pressure well injection.
Industrial Gases	Air Separation Units (ASU)	Precision intercooling for multi-stage centrifugal compressors.
Power Gen	Hydrogen Cooling Loops	Maximizing thermal density in generator cooling circuits.
Manufacturing	High-Pressure PET Air	Ensuring stable discharge temperatures for bottle molding.

CONCEPT

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