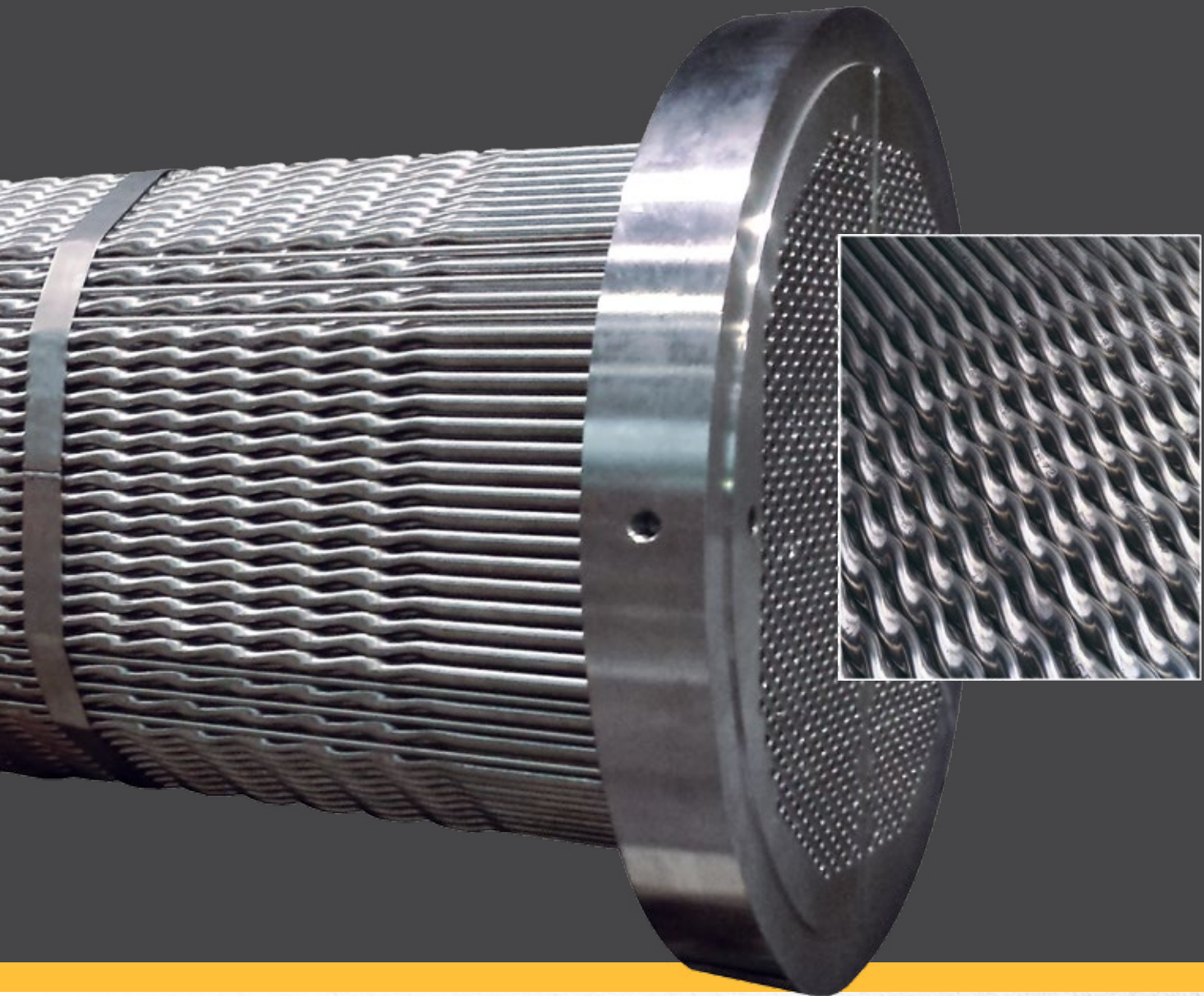


# TWISTED TUBE® Heat Exchangers





## Answering the Need

You do not have to live with traditional heat exchanger problems. It is time to consider a more sensible alternative — the **TWISTED TUBE® Heat Exchanger**.

### **TWISTED TUBE® Bundle technology attributes:**

- Increased heat transfer
- Smaller exchangers or fewer shells
- Elimination of vibration
- Reduced fouling

### **When used as retrofit bundles or exchangers, TWISTED TUBE® Bundle technology also offers:**

- Increased capacity
- Lower install costs
- Lower pressure drop
- Extended run time between cleanings
- Increased surface area

### **Designed to be Different**

We looked at typical problems with shell and tube heat exchangers and solved them with a revolutionary tube shape and bundle construction. The result is better performance than ever before. Hundreds of TWISTED TUBE® Heat Exchangers have been operated under a wide variety of field conditions. Over the years, TWISTED TUBE® Bundle technology has proven to be a more efficient, reliable and trouble-free heat transfer solution.

## Consider the Advantages

TWISTED TUBE®  
Texas Tower



Applications: Reforming & Paraxylene

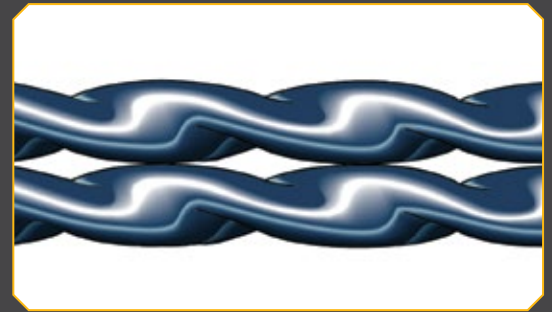
### More Efficient Heat Transfer

TWISTED TUBE® Heat Exchangers can provide a higher heat transfer coefficient than any other type of tubular heat exchanger. Here's why:

- Complex swirl flow on the shellside induces the maximum turbulence to improve heat transfer.
- Powerful tubeside turbulence is achieved even at high viscosities and/or low velocities.
- Uniform flow distribution gives more effective length and surface area than shell and tube exchangers.

Tube-to-tube  
contact points at  
approximately 4"  
eliminate vibration

Each tube is  
"locked" in place  
by at least three  
adjacent tubes



### Applications

- Crude preheat
- Feed/effluent for:
  - Reformer (CCR and semi-regeneration)
  - Hydrotreater
  - Hydrocracker
  - Alkylation
- Overhead condensers
- Reboilers (kettle and J-shell)
- Lean/rich amine
- Compressor interstage coolers

### Baffle-Free Tube Support

The TWISTED TUBE® Bundle design avoids the need for baffles. The unique helix-shaped tubes are arranged in a triangular pattern. Each tube is firmly and frequently supported by adjacent tubes, as illustrated above, yet fluid swirls freely along its length. This support system eliminates tube vibration, which is a common problem in some heat exchanger services. The twist arrangement for baffle-free support provides gaps between the tubes for easier cleaning on the shellside. The TWISTED TUBE® Heat Exchanger tubes are round at each end, allowing the use of conventional tube-to-tubesheet joints.

## TWISTED TUBE® Bundle Replacement

Increased Surface Area for Greater Capacity

### Conventional Bundle

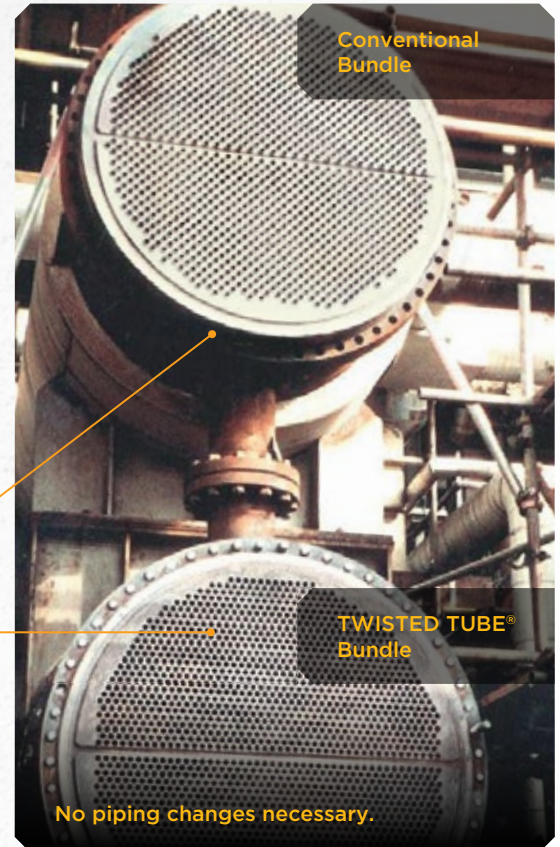
1,278 tubes, 19.05 mm (3/4") OD  
on 25.4 mm (1") rotated square pitch

### TWISTED TUBE® Bundle

1,850 tubes, 19.05 mm (3/4") OD  
on 22.5 mm (8/9") triangular pitch

**+45%**  
Heat Transfer Surface  
Area Increase

Both designs are cleanable. Same shell diameters.



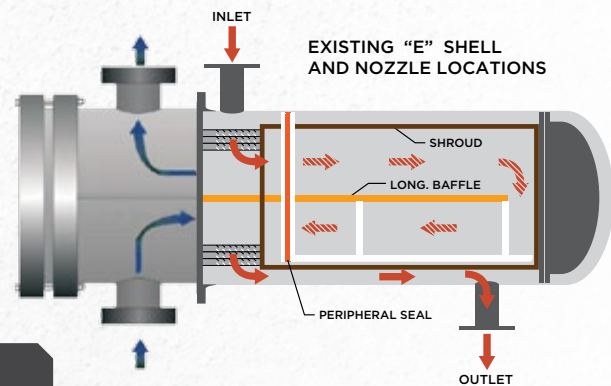
## TWISTED TUBE® Bundle Replacement

Counter Current Flow for Increased Heat Recovery

### "F" bundle in "E" shell

#### Shrouded TWISTED TUBE® Bundle Concept

This technology eliminates the need for a leaf seal down the entire length of the bundle.



### TWISTED TUBE® F Bundle

Only the Small Inlet Flow Area of the Bundle Requires a Seal



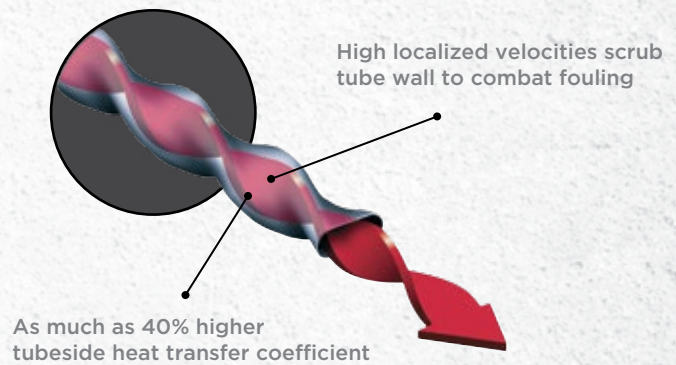
Conventional Bundle

TWISTED TUBE® Bundle



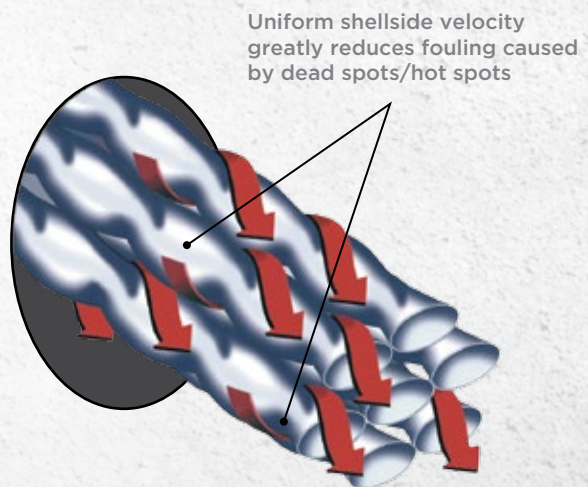
### Improved Tubeside Flow

- TWISTED TUBE® Bundle technology can provide significantly higher heat transfer coefficients in tubular heat exchangers.
- Swirl flow in tubes creates turbulence to improve heat transfer.
- Turbulent flow achieved even at low velocities and/or high viscosities.



### Uniform Shellside Flow

- Complex interrupted swirl flow on shellside maximizes turbulence while minimizing pressure drop.
- Flow distribution and velocity are consistent across the entire bundle.



## Improving Efficiency

### The TWISTED TUBE® Heat Exchanger Bundle Advantage

Improvements over conventional shell and tube heat exchangers:

#### Increased Heat Transfer Coefficient

- Swirl flow creates turbulence resulting in higher tubeside coefficient.
- Uniform fluid distribution combined with interrupted swirl flow results in optimized shellside coefficient.

#### Lower Pressure Drop

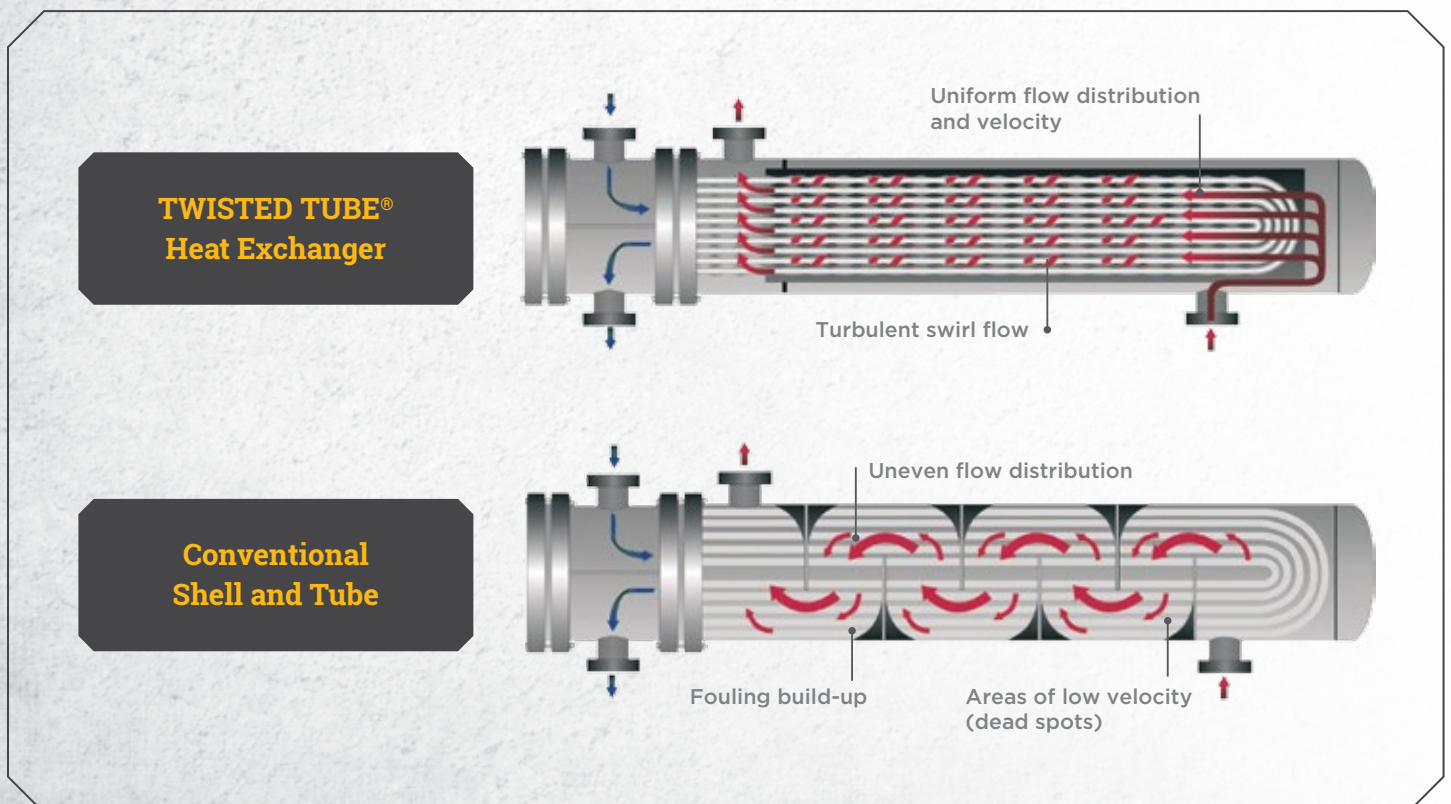
- The longitudinal swirl flow of TWISTED TUBE® Bundle technology reduces the high pressure drop associated with segmental baffles.
- TWISTED TUBE® Heat Exchangers have more tubes and typically require fewer tube passes for equivalent or lower pressure drop on the tubeside.

#### No Vibration

- Baffle-free design directs shellside fluid to true longitudinal flow.
- Each tube using TWISTED TUBE® Bundle technology is extensively supported at multiple contact points along its entire length.
- Tube fretting and failure due to vibration is eliminated.

#### Reduced Fouling

- Baffle-free design eliminates dead spots where fouling can occur.
- Velocity is constant and uniform.
- Constant flow distribution controls tube wall temperature.





**Designed for Efficiency**  
**TWISTED TUBE®** Bundle Cleaning Efficiencies

**Tubeside**

- Tubeside effectively cleaned by hydroblasting.
- Chemical cleaning-in-place is more effective in TWISTED TUBE® Heat Exchangers than conventional shell and tube exchangers, due to swirl flow.
- No special tools required.

**Shellside**

- Cleaning lanes allow complete mechanical cleaning by hydroblasting.
- Chemical cleaning-in-place is more effective in TWISTED TUBE® Heat Exchangers than conventional shell and tube exchangers, due to uniform flow distribution.





**Koch Heat Transfer Company  
R&D Facility in Wichita, Kansas**

## Your source for heat transfer solutions.

Our thermal engineers rely on the Koch Heat Transfer Company state-of-the-art technologies to develop the best possible solutions for our customers' applications. From research and development through thermal and mechanical design, best-in-class manufacturing, technical assistance and aftermarket service, our engineers help you optimize your heat transfer systems to make your operations more efficient and productive. Ongoing research and product development ensure that Koch Heat Transfer Company customers get maximum performance from their TWISTED TUBE® Heat Exchangers.

**BROWN FINTUBE® and ALCO™ Hairpin Exchangers | BOS-HATTEN™ Exchangers  
TWISTED TUBE® Heat Exchangers | HELIXCHANGER® Heat Exchangers | Tubeside Augmentation  
Fintube Technology | TAPER-LOK® Closures | Global Sourcing**

For more information about our products and locations, visit [kochheattransfer.com](http://kochheattransfer.com) or email [info@kochheattransfer.com](mailto:info@kochheattransfer.com).

