**Simulations Support Eco-Friendly Designs of MicroGroove Heat Exchangers**

*ICA and OTS Collaborate with Friedrich on Drop-in Replacement for Higher SEER Rating*

**New York, New York (6 September 2017)** –The International Copper Association, Inc. (ICA) and Optimized Thermal Systems, Inc. (OTS) are working with OEMs to develop eco-friendly MicroGroove heat exchangers using MicroGroove small diameter copper tubes.

It has been demonstrated time and again that the use of MicroGroove small diameter copper tubes in air conditioning systems results in higher coefficients of performance (COPs), less materials usage and reduced refrigerant volumes. Currently, the supply chain for the manufacture of high efficiency MicroGroove coils is well established. OEMs today have many options available as they strive to make the transition from large diameter copper tubes to smaller diameter copper tubes.

Several years ago, in cooperation with ICA, OTS implemented additional MicroGroove tube correlations into its renowned CoilDesigner® software package. This critical development allowed for the full power of the industry-leading heat exchanger design software to be applied to the design of heat exchangers using smaller diameter copper tubes.

CoilDesigner includes the ability to design with MicroGroove tubes. In other words, the correlations for both the airside and tube side performance have been programmed into the simulation software, allowing for accurate simulations to be performed for a wide range of tube sizes and types as well as for a wide range of fin designs.

Now that ground work is paying off. OEMs are using CoilDesigner to their advantage in designing MicroGroove heat exchangers for use in completely new system designs as well as for drop-in replacements for existing designs.

**Friedrich Leads by Example**

A recent success story involves collaborating with Friedrich in the design of a drop-in replacement for one of its major AC products.

Friedrich engaged Optimized Thermal Systems, Inc. (OTS) to explore the design space for a drop-in replacement coil for an existing 1.5-ton air-conditioning unit. Using the new MicroGroove correlations available for CoilDesigner, they began tackling the problem of how to improve the COP of existing products. A drop-in replacement was desirable so that the system COP could be rapidly improved without redesigning the whole system.

Friedrich wanted to determine which designs made the most sense in terms of lowering materials costs and increasing COP for a drop-in replacement coil. The existing design for the window-type air conditioner used conventional copper tubes with outer diameters (ODs) of 5/16 inch (7.93 mm). Friedrich needed to increase the EER of the baseline unit in order to meet the regulatory requirement for this type of air conditioning system.

Simulations and experiments showed that a quick solution would be to add another row of conventional tubes, which would increase the EER by 3.5 percent. But the mass of copper tubes (excluding u-bends and connecting tubes) would be increased from 3.97 pounds to 5.29 pounds (1.80 kg to 2.40 kg). That’s a 33 percent increase in the amount of copper in the system! The mass of the coil, including copper plus aluminum, was increased from 9.5 pounds to 12.7 pounds (4.3 kg to 5.7 kg, an increase of 34 percent).

As a result, OTS proposed a number of configurations made with 5-mm OD MicroGroove tubes, which were simulated in CoilDesigner. Friedrich had access to suppliers who could make the coils with either slit fins or louver fins. Working with OTS and supported in part by the International Copper Association (ICA), many coils were simulated and several of the best candidates were built to confirm the performance through laboratory testing.

The MicroGroove coils typically had four rows of tubes with 25 tubes per row for a total of 100 tubes. Compared to the baseline design, one configuration reduced the total internal volume of the tubes from 0.041 cubic feet to 0.032 cubic feet (1.16 liters to 0.91 liters) while pushing the COP up by 4 percent; and, at the same time, the total mass of the coil was reduced from 3.97 pounds to 3.21 pounds (reduction of 19 percent). The total mass of the coil (including aluminum plus copper) was reduced from 11.01 pounds to 6.98 pounds (4.50 kg to 3.16 kg, a reduction of 36 percent).

The upshot is that the smaller diameter tubes reached the target COP while decreasing the amount of copper by nearly one-fifth; rather than increasing the amount of copper by one-third. The simulation software also compared louver-fin designs with slit-fin designs and variations of fin pitches. The final choice of fin design will be dictated by manufacturing considerations and discussions with suppliers. Also, the simulations favored circuitry with five circuits rather than four.

The final design choice will be made by Friedrich. Using the CoilDesigner software, this choice can be made with confidence that the final product will meet the desired performance criteria.

“We are seeing more and more manufacturers making the transition to MicroGroove. What is optimal in terms of fin design and circuitry differs from OEM to OEM, depending on the positioning of their products in the marketplace,” says Nigel Cotton, MicroGroove Team Leader for the International Copper Association. “What seems to be universally accepted is that MicroGroove tubes offer compelling advantages both in terms of COP and materials usage.”

**About ICA**

ICA brings together the global copper industry to develop and defend markets for copper and to make a positive contribution to society’s sustainable-development goals. Headquartered in New York, the organization has offices in four primary regions: Asia, Europe and Africa, Latin America and North America. Copper Alliance® programs and initiatives are executed in nearly 60 countries through its regional offices. For additional information please visit copperalliance.org.

**About OTS**

Optimized Thermal Systems, Inc. offers customized software and services for the design and optimization of thermal systems. The OTS mission is to free engineers to do what they do best: create and innovate! It is accomplished by providing advanced software solutions, consulting services, and physical performance measurement and validation for a variety of HVAC&R components, systems and technologies. Visit [www.optimizedthermalsystems.com](http://www.optimizedthermalsystems.com) for additional information.

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