the microgroove™ advantage

MicroGroove Technology Reduces Overall Weight of Commercial-Sized R744 Gas Coolers by Reducing Fin-and-Tube Materials Usage, Says the International Copper Association

Case Study Presented at ATMOsphere America Demonstrates Performance Advantages of Smaller-Diameter Copper Tubes using Natural Refrigerants

New York, New York (July 7, 2015) – According to the International Copper Association, heat exchanger coils made with smaller-diameter copper tubes and aluminum fins offer significant performance advantages for applications that use natural refrigerants such as R744 (carbon dioxide) and R290 (propane). These eco-friendly refrigerants have ultra-low indices of Global Warming Potential (GWP) equal to 1 and 3 for R744 and R290, respectively.

High-volume production of MicroGroove coils for R290 and R744 applications has been an accomplished fact for several years now, especially for the refrigeration systems used in cold-vending machines and cold display cases. The smaller-diameter copper tubes allow for reduced refrigerant charge and withstand high pressures.

More recently, MicroGroove smaller-diameter tubes have been used in the manufacture of large gas coolers for R744 applications. The heat exchanger is called a "gas cooler" rather than a "condenser" because CO2 refrigerant in the supercritical state does not "condense" or liquefy.

A supercritical fluid has both gas like and liquid-like properties. In the transcritical refrigeration cycle, the R744 refrigerant is not condensed into a liquid but rather it behaves like a supercritical fluid. Large transcritical refrigeration systems are under development for a growing number of applications, including supermarkets as well as other industrial and commercial applications.

According to Dr. Jian Yu, Director of Product Development at Super Radiator Coils, Richmond Virginia, heat exchanger coils with lengths of 2 to 3 meters can be made using 5-mm copper tubes expanded into aluminum plate fins. Dr. Yu was coauthor of a presentation delivered by Yoram Shabtay of Heat Transfer Technologies at the ATMOsphere America Conference, Atlanta, Georgia on June 25, 2015, titled "New copper-tube technologies for CO2 heat exchangers," which is available online. (Website: www.atmo.org/events.presentations.php?eventid=30 ; Presentation: www.atmo.org/media.presentation.php?id=640.)

Smaller-diameter (5 mm) copper tubes were used rather than conventional-diameter (9.52 mm) copper tubes in heat exchangers designs of similar capacity, design pressure and footprint. (See footnote.) The use of smaller-diameter tubes allows for the reduction of tube weight by 35 percent, the reduction of fin weight by 21 percent, and the reduction of internal volume for refrigerant by 45.5 percent.

[Footnote: The smaller diameter tubes had an outer diameter of 0.197 inches, or 5 mm and wall thickness of 0.040 inch; the conventional-diameter tubes had an OD of 3/8 inch, or 0.375 inches, or 9.52 mm; and wall thickness of 0.049 inch.]

“CO2 in the supercritical state has a very low viscosity even under high pressures,” says Dr. Yu, “so 5-mm tubes can be used with little increase in pressure drop. As a result, the MicroGroove coil is much lighter and will uses less material compared with the conventional [3/8 inch tube] coil.”

“MicroGroove is ideal for CO2 applications,” says Nigel Cotton, MicroGroove Team Leader for the International Copper Association. “Companies such as Super Radiator Coils are successfully building large gas coolers using smaller diameter tubes. They have demonstrated that it can be done and they are filling the demand for these eco-friendly products. Coils for commercial applications typically are not produced in high volumes, so fast yet flexible production is paramount.”

For more information, visit www.microgroove.net. Join the MicroGroove Group on LinkedIn to share your ideas about research directions and product development. www.linkedin.com/groups/Microgroove-4498690.

About ICA

The International Copper Association, Ltd. (ICA) is the leading organization for promoting the use of copper worldwide. ICA’s mission is to promote the use of copper by communicating the unique attributes that make this sustainable element an essential contributor to the formation of life, to advances in science and technology, and to a higher standard of living worldwide. Visit www.copperinfo.com for more information about ICA.

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