

MicroGroove Propels Propane to Success

Copper Tube Heat Exchangers Are Propane Ready

Eco-friendly, economical, high-efficiency appliances for commercial refrigeration benefit from smaller-diameter copper tubes and low-GWP refrigerants.



MicroGroove evaporator and condenser.

Any company that makes or uses bottle coolers, "reach in" cold-food display cases, lidded freezers, or cold-vending machines cannot ignore the transition from F-gases to propane as a refrigerant. Millions of these appliances are manufactured every year and sales are increasing from year to year.

In a short span of time, the favored refrigerant for these refrigeration systems is changing. Since 2011, the regulatory environment has been warming up to the use of propane as a refrigerant while imposing charge limits on this refrigerant because of its flammability. These quantity restrictions as well as other safe-design measures are needed to allay concerns about the flammability of propane.

The renewed interest in propane (a.k.a., R290) as a refrigerant and the parallel development of heat exchangers made with smaller-diameter copper tubes is a fascinating story¹.

Out with F-Gases, In with Propane

The transition to propane has been driven by a tightening of regulations on F-Gases and a loosening of regulations

¹ For a detailed account of this story, see the paper titled "MicroGroove Contributes to the Success of Propane in Refrigeration Appliances" by Nigel Cotton and Yoram Shabtay, published in *International Appliance Manufacturing*, October 2017, pp. 42-50.

on flammable gases such as propane. The U.S. Environmental Protection Agency's Significant New Alternatives Policy (SNAP) program, which is based on the amended Clean Air Act of 1990, listed propane as "acceptable, subject to use conditions" as a substitute for CFC-12, HCFC-22, and R-502 in retail food refrigerators and freezers (standalone units only) in a Final Rule titled "Protection of Stratospheric Ozone: Listing of Substitutes for Ozone Depleting Substances—Hydrocarbon Refrigerants," which was published in December 2011.

One of the "use conditions" limits the refrigerant charge in this end-use to 150 grams (5.3 ounces) or less. The SNAP program generates lists of acceptable and unacceptable substitutes for each of the major industrial use sectors as well as specific products categories.

Just when manufacturers and regulators began signaling that propane would be allowed in light commercial applications, the technology of smaller-diameter copper tubes began maturing.

The Vital Role of Copper

The core benefits of MicroGroove are energy efficiency, less material usage and reduced refrigerant charge. Tube-diameter reduction results in more effective heat transfer and consequently smaller, lighter coils with increased pressure resistance and less refrigerant charge.

Pound for pound, smaller diameter tubes provide much more heat transfer than larger diameter tubes. A dramatic reduction in refrigerant volume is a further benefit of economical, eco-friendly copper tubes. The smaller internal volume of the coils means that less refrigerant is necessary to charge the coil. The need for less refrigerant results in other design advantages including a further reduction in overall system weight.

Especially for propane systems, the smaller refrigerant volume allows for the desired cooling capacities to be reached without exceeding the charge limits


imposed by the regulatory authorities. It could be argued that smaller-diameter MicroGroove copper tubes and heat exchangers contributed to or even were essential to the successful development of a new generation of eco-friendly, energy efficient and economical appliances.

Looking Ahead

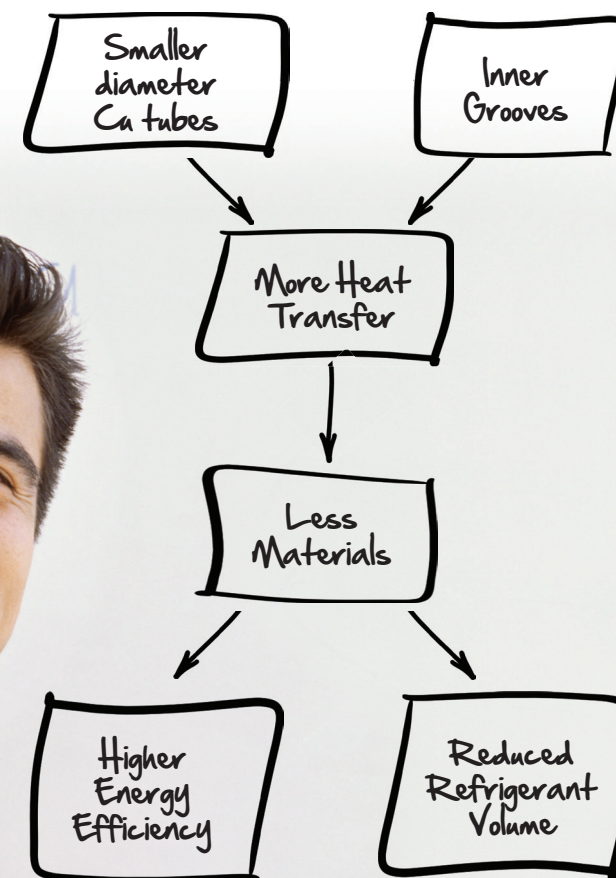
Even with the 150 gram limit in place, propane could be used in a wide range of applications. This amount is sufficient for most of the refrigeration needs in convenience stores, which is a huge market, and many grocery store applications, where individual cabinets each with its own compressor can be installed.

Although propane is classified as an A3 flammable refrigerant, it is safe to use when proper protocols are followed. Propane is not a drop-in replacement. The refrigeration systems must be specifically designed for R290 and comply with the charge limit of 150 grams. The low-charge limit restricts the use of propane to refrigeration systems with fractional horsepower compressors. This is okay for convenience store applications; but multiple independent refrigeration circuits must be used for large applications.

Currently, a working group within the International Electrotechnical Commission (IEC) is developing a standard that would allow for 500 grams of propane to be used in refrigeration systems. If accepted, the new standard could be published in 2018 and as a reference standard it could influence standards issued in the U.S. for example by the EPA and Underwriters Laboratories (UL).

The prospects for the union of propane and MicroGroove in other types of appliances suggest that the propane story will continue for many years. What products are candidates for conversion to ultralow GWP refrigerants? What opportunities exist for the use of propane in other applications such as heat pumps and air conditioners? 

the microgroove™ advantage



IT'S A GAME CHANGER

MicroGroove™ technology is changing the game of air conditioning and refrigeration (ACR) OEM product design.

OEMs are going back to their drawing boards. They are designing ACR products with high energy-efficiency, while minimizing materials usage and reducing refrigerant volume.

The resulting ACR products are smaller and lighter yet can be produced using familiar manufacturing methods.

It's a whole new game!

For more information, or to join a free webinar, visit

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