microgroove™ Update

Attain High Energy Efficiency with Less Materials Using Smaller-Diameter, Inner-Grooved Copper Tubes

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# TRENDS IN COOLING TECHNOLOGY AND COIL DESIGN

Nearly 110 years have passed since the first installation of air conditioning in 1902. Although thermodynamics is widely considered a complete science today, new designs of heat pumps, air conditioners and refrigerators are flourishing.

Why has interest in the design of air-conditioning and refrigeration (ACR) products intensified so much in recent years?

## A Climate of Innovation

Many factors are contributing to a climate of innovation in the ACR industry today, including

- Phase out of high-ODP and high-GWP refrigerants
- Use of eco-friendly refrigerants
- Energy efficiency standards
- Sustainable development
- Computer simulation of components and system performance
- Responsiveness to needs and wants in the marketplace

The phasing out of popular CFC and HCFC refrigerants has been a major factor in spurring innovations in cooling technology in the past 20 years. Likewise, energy efficiency and sustainability have necessitated invention. End-users have their eyes on energy efficiency ratings and OEMs are highly motivated to use less material in their products.

Computer modeling is now commonly used to simulate total system design. Decisions about refrigerants, coils and components are now made with the assistance of increasingly accurate performance simulations.

## Advances in Coil Design

Redesign of the coil has seen the use of smaller diameter copper tubes with inner-grooves increasing the internal heat transfer coefficient and raising COPs. Such improvements in coil performance may also be favorable for the use of new refrigerants, less materials, higher operating pressures (due to the smaller diameter tubes) and variable refrigerant flow (due to the increased number of branches).

System design is dramatically changed for the better by using smaller diameter, inner grooved copper tubes in the coil designs.

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## PRESENTATIONS

### WEBINARS

Upcoming MicroGroove Webinar

**The Manufacture of ACR Coils with Smaller Diameter Copper Tubes**

Tuesday, March 27, 2012 at 1:00 pm ET

Presented by *THE NEWS* and *Appliance Design*.

Speaker: John Hipchen, President, Exel Consulting Group

Past MicroGroove Webinars

**View Free Now on YouTube. No Registration Required!**

Boost ACR Energy Efficiency with Copper MicroGroove Tubes (22 June 2011)

Achieving Higher Energy-Efficiency with Smaller-Diameter Copper Tubes (14 June 2011)

Small Tubes of Copper in ACR Applications (15 Dec 2010)

More info on "Webinars" page
www.microgroove.net/webinars

### EXHIBITS

2012 AHR Expo, Booth 2729
January 23 to 25, 2012
Chicago, Illinois

More info on "Events" page
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Or search for "MicroGroove" in the AHR Expo Exhibitor Directory
www.ahrexpo.com

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## Natural Refrigerants

Natural refrigerants such as carbon dioxide and propane are fast becoming more attractive to OEMs and end-users for ACR and heating applications as technology advances.

Also known as R744, carbon dioxide is used as a refrigerant in a growing number of applications ranging from vending machines and refrigerated supermarket display cases to ice-skating rinks.

Another natural refrigerant under consideration for use in air conditioning systems is propane. Known as R290, propane is an eco-friendly hydrocarbon (chemical formula $C_3H_8$) with outstanding thermodynamic properties that make it well suited as a refrigerant for residential air conditioners.

The advantages of copper tubes in these applications include high thermal conductivity, corrosion resistance and strength. Smaller diameter copper tubes have even higher burst strengths and they allow for lower overall refrigerant volumes.

Copper is a proven technology with a well-established supply chain, including a network of trained installers with the know-how to ensure safety and reliability.

## Antimicrobial Materials

Another factor influencing the design of air conditioning and refrigeration systems is new published research on copper's efficacy against the spread of fungi in air conditioning systems.

OEM companies such as the Chinese air-conditioning giant Chigo and Hydronic in France have already developed all-copper products expressly for their antimicrobial properties.

The use of all copper coils is not new but their use expressly to inhibit the growth of fungi and bacteria is a recent development that is expected to be an important factor in the development of innovative air conditioning and refrigeration products.

Bio build up on the coil may be reduced by using all copper coils, helping to maintain high levels of energy efficiency for longer times and avoiding energy efficiency drop off over time.

## The Most Important Factor

Perhaps the most important factor driving the development of new products is a better understanding of attitudes toward comfort and refrigeration in different climates and cultures. ACR product developers are responding better to the real needs and wants of end users in the built environment. They are right-sizing air conditioning and refrigeration products to allow for precise temperature and humidity control in specific zones without waste.

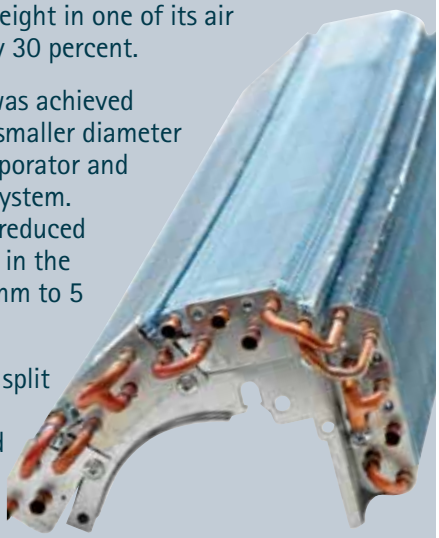
This ground-breaking antimicrobial copper coil air handling unit will harness the antimicrobial properties of copper in hospital applications. It is made in Europe by French manufacturer Hydronic in association with Centre d'Information du Cuivre, Laitons et Alliages (CICLA).

The result is that end-users will enjoy healthy, eco-friendly products that deliver cooling capacity with high energy efficiency when as well as where it is most desirable.

For more information about MicroGroove smaller-diameter, inner grooved copper tubes, visit www.microgroove.net. There you can find technical papers and recently archived webinars as well as a supplier directory.

## IN THE SPOTLIGHT

The air conditioner manufacturing giant Chigo has reduced the tube weight in one of its air conditioning systems by 30 percent.



This weight reduction was achieved simply by switching to smaller diameter copper tubes in the evaporator and condenser coils of the system. The tube diameter was reduced from 9.52 mm to 5 mm in the condenser and from 7 mm to 5 mm in the evaporator.

The air-conditioner is a split system with a cooling capacity of 2500 W and a COP of 3.2, or EER of 10.9. [Note: The energy efficiency ratio (EER) in units of Btu/hr per W is obtained from the coefficient of performance (COP) in units of W/W by multiplying by 3.412 since 1 W = 3.412 Btu/hr.]