



International Copper
Association Asia
Copper Alliance

Small Diameter Copper Tube Development Road Map in India

23rd Jan 2018, Gurugram



Challenges for air conditioner industry

Cu

Energy
efficiency

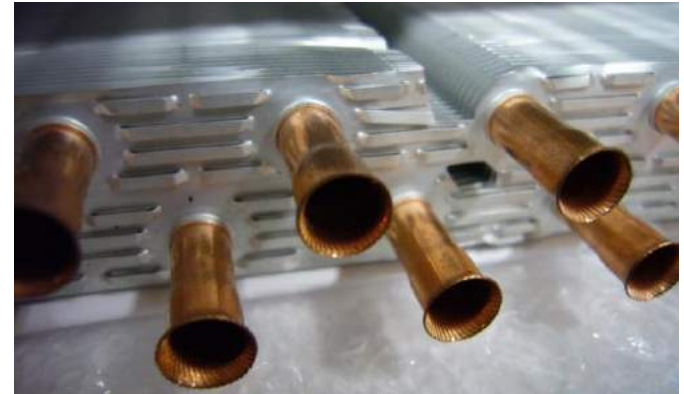


Reliability



Cost
competition

microgroove™

The logo for Microgroove, featuring the word "microgroove" in a blue, lowercase, sans-serif font. The letter "o" in "micro" is replaced by a stylized globe icon. A small trademark symbol (TM) is located at the end of the word.

is small diameter innergrooved copper tube.

is 5mm inner-grooved copper tube.

is an **practical, economical** and **eco-friendly** coil solution for HVAC industry.

Microgroove™ Advantages

Cu

the microgroove™ advantage

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graph TD; A[Smaller diameter Cu tubes] --> B[More Heat Transfer]; C[Inner Grooves] --> B; B --> D[Less Materials]; D --> E[Higher Energy Efficiency]; D --> F[Reduced Refrigerant Volume];
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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 www.microgroove.net.

COPPER
International Copper Association, Ltd.

Advantages

Cost reduction

Higher energy efficiency

Less refrigerant

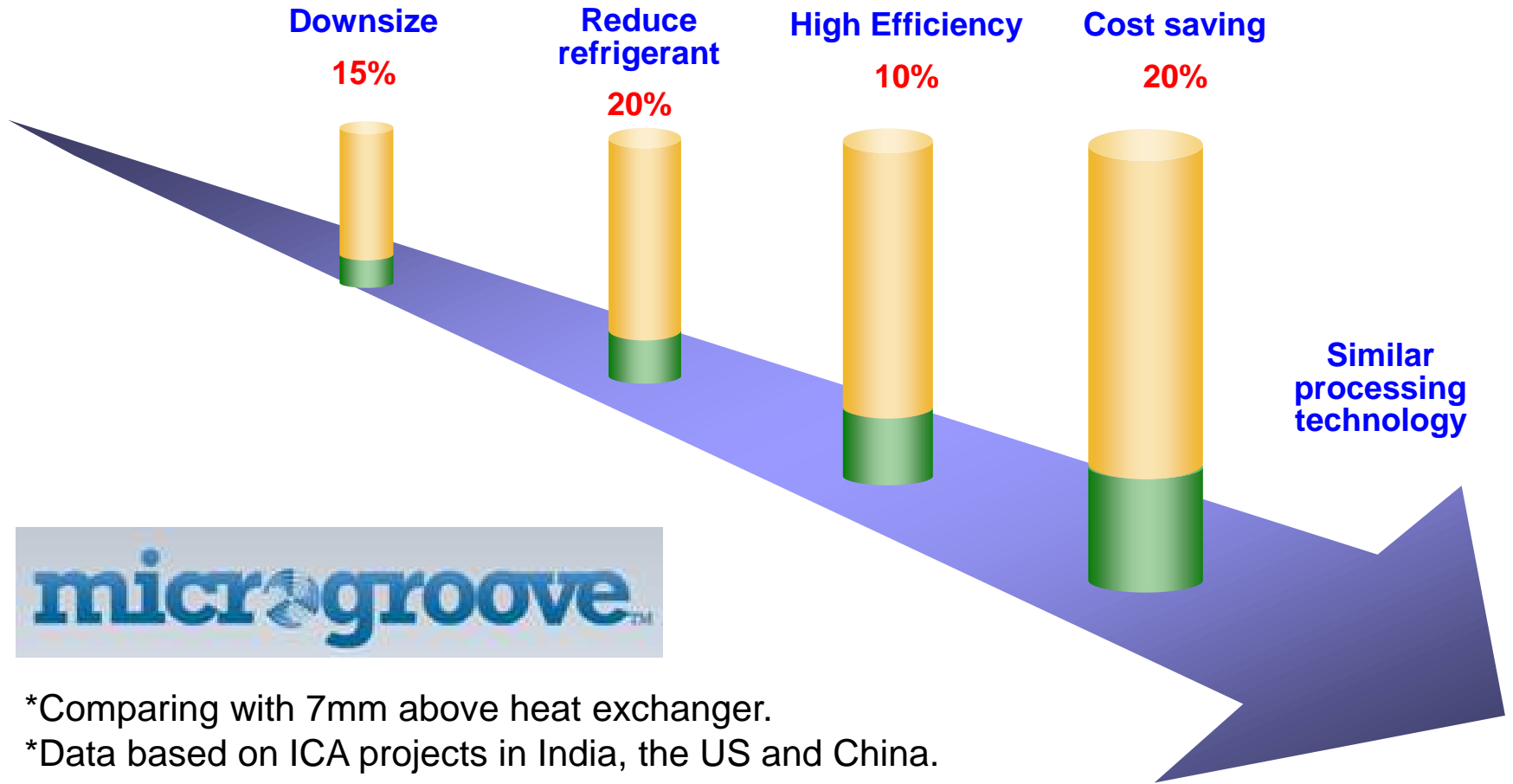
Small size

High durability

Less investment

Microgroove™ Advantages

Cu



Microgroove™ coil development-Process

Cu

R&D Platform Establishment

- Establish project team
- Establish ICA's expert image in room air-con industry and build the technology platform to guide the industrial development

5mm R&D

- Develop high efficient 5mm diameter copper tube
- Develop fin for 5mm diameter copper tube system
- Optimize 5mm diameter copper tube system

Commercial Popularization

- Assure commercial availability of high quality equipment for mechanical tube expansion of 5mm/4mm inner-grooved copper tubes

Simulation Software Development

- Develop and validate software for heat exchanger and system design with 5mm/4mm inner-grooved copper tubes

Smaller tube HX R&D, 4mm/3mm

- Develop smaller tube HX technology

the microgroove™ advantage



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News Releases

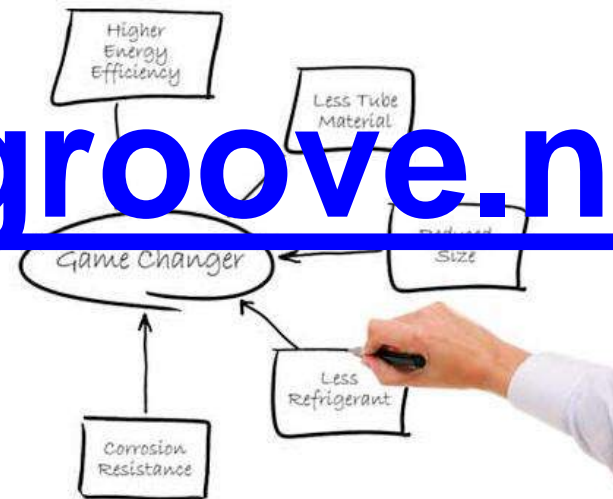
Small Tube Copper Is Economical and Eco-Friendly

It packs all the advantages of copper into more compact, more efficient heat exchanger coils, reducing the cost of high efficiency air conditioners and refrigerators.

Using grooved, double-ported copper fabrication processes and familiar brazing techniques, suppliers and manufacturers are already producing new commercial and residential air conditioning and refrigeration products based on small diameter MicroGroove copper tubing.

Please see "Overview" and "Technical Materials" to learn more about

- Cost-effective fabrication and assembly
- Smaller size, less weight and lower material costs
- Higher heat transfer coefficients
- Well suited for new refrigerants
- Uses less refrigerant
- Overall reduction in system cost



Overview

Technical Materials

Subscribe

www.microgroove.net

Microgroove application

Cu

International Copper Association India provide support to OEMs to adopt 5 mm copper tube



Technology
communication
platform

Design guidance

CFD software

5 mm HEX in India

Use of smaller diameter copper tube heat exchangers

Cu

- ICA India worked closely with Indian OEMs to establish advantage of 5 mm
- Optimisation work carried out using R22, R32, and R290

microgroove™

Test Result of Performance of Outdoor Unit with 5 mm Microgroove Copper Tube Condenser with R22

Condenser Type with R22	7 mm Original Design	5 mm Optimized Design	
Performance Improvement			
EER	2.95	3.22	9% Increase
Capacity	5075	5275	3% Increase
Weight Reduction			
Copper Weight	1.328 kg	1.050 kg	21% Decrease
Aluminium Weight	2.136 kg	1.168 kg	45% Decrease

Test Result of Performance of Outdoor Unit with 5 mm Microgroove Copper Tube Condenser with alternate refrigerant (R290)

Condenser Type with R290	5 mm Optimized Design
EER	3.57
Capacity	5000
Copper Weight	1.050 kg
Aluminium Weight	1.168 kg
Overall Weight Reduction 29%	

Test results of 5 mm copper tube using R 22 in India

Cu

Condenser type	7 mm copper tube	5 mm copper tube
EER	2.95	3.22
Capacity	5233 W	5275 W
Refrigerant	960 g	870 g



Test results of 5 mm copper tube using R 32 in India

Cu

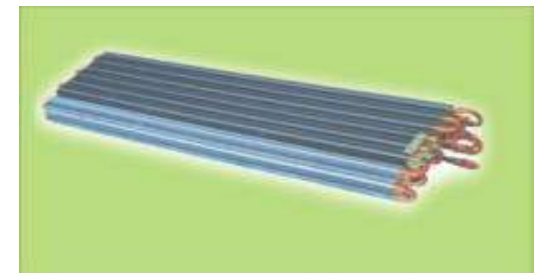
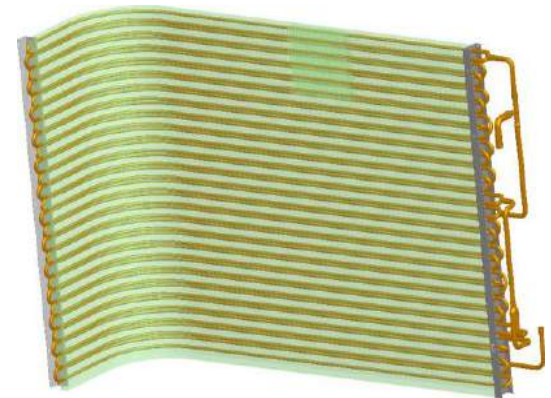
Condenser type	7 mm copper tube	5 mm copper tube
EER	3.10	3.28
Capacity	5000 W	5537 W
Refrigerant	875 g	700 g



Test results of 5 mm copper tube using R 290 in India

Cu

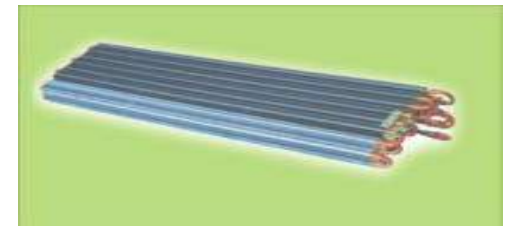
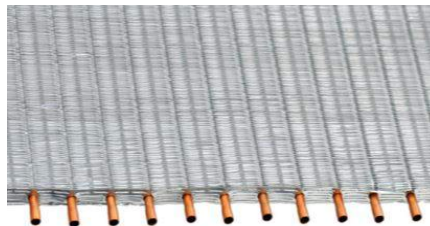
Condenser type	7 mm copper tube	5 mm copper tube
EER		3.57
Capacity		5000 W
Refrigerant	480 g	375 g



Cost saving by using 5 mm copper tube Condenser for 1.5 TR RAC

Cu

Condenser type	7 mm copper tube	5 mm copper tube	%age saving
Copper Weight	1.328 Kg	1.050 Kg	20.9%
Aluminium Weight	2.136 Kg	1.168 Kg	45.3%
Refrigerant R 22	960 g	870 g	9.3%
Refrigerant R 32	875 g	700 g	20.0%
Refrigerant R 290	480 g	375 g	21.8%
Refrigerant R 410A	915 g	836 g	8.6%



5 mm adoption status in India

Cu

ICA India influence

SPIROTECH
HEAT EXCHANGERS PVT. LTD.

Installed capacity to manufacturer 5 mm in India

Godrej

★ **BLUE STAR**

Successfully test and validate 5 mm advantage for their system

★ **BLUE STAR**

Adopts 5 mm coils for 1 model by sourcing

Orders 5 mm assembly line for their RACs

★ **BLUE STAR**

DAIKIN

Midea Carrier

Orders 5 mm assembly line for their RACs

E-D
ENHANCED LIVING

2015

2016

2017

2018

2014

-
- Think innovation, think copper.
 - Copper is the best metal for HVAC applications.
 - Convert **the microgroove advantage** into your competitive advantages, and win the market!



avinash.khemka@copperalliance.asia



国际铜业协会
Copper Alliance