Small Diameter Copper Tube Development Road Map in India

23rd Jan 2018, Gurugram
Challenges for air conditioner industry

- Energy efficiency
- Reliability
- Cost competition
is small diameter inner-grooved copper tube.
is 5mm inner-grooved copper tube.
is an **practical, economical** and **eco-friendly** coil solution for HVAC industry.
**Microgroove™ Advantages**

**Advantages**
- Cost reduction
- Higher energy efficiency
- Less refrigerant
- Small size
- High durability
- Less investment
Microgroove™ Advantages

- **Downsize**: 15%
- **Reduce refrigerant**: 20%
- **High Efficiency**: 10%
- **Cost saving**: 20%

*Comparing with 7mm above heat exchanger.
*Data based on ICA projects in India, the US and China.

Similar processing technology
Microgroove™ coil development-Process

**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
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 conditioning and refrigeration systems.

Using copper, cost-effective copper tubing in 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
International Copper Association India provide support to OEMs to adopt 5 mm copper tube

Microgroove application

- Technology communication platform
- Design guidance
- CFD software
5 mm HEX in India
Use of smaller diameter copper tube heat exchangers

- ICA India worked closely with Indian OEMs to establish advantage of 5 mm
- Optimisation work carried out using R22, R32, and R290
**Test results of 5 mm copper tube using R 22 in India**

<table>
<thead>
<tr>
<th>Condenser type</th>
<th>7 mm copper tube</th>
<th>5 mm copper tube</th>
</tr>
</thead>
<tbody>
<tr>
<td>EER</td>
<td>2.95</td>
<td>3.22</td>
</tr>
<tr>
<td>Capacity</td>
<td>5233 W</td>
<td>5275 W</td>
</tr>
<tr>
<td>Refrigerant</td>
<td>960 g</td>
<td>870 g</td>
</tr>
</tbody>
</table>
## Test results of 5 mm copper tube using R 32 in India

<table>
<thead>
<tr>
<th>Condenser type</th>
<th>7 mm copper tube</th>
<th>5 mm copper tube</th>
</tr>
</thead>
<tbody>
<tr>
<td>EER</td>
<td>3.10</td>
<td>3.28</td>
</tr>
<tr>
<td>Capacity</td>
<td>5000 W</td>
<td>5537 W</td>
</tr>
<tr>
<td>Refrigerant</td>
<td>875 g</td>
<td>700 g</td>
</tr>
</tbody>
</table>
Test results of 5 mm copper tube using R 290 in India

<table>
<thead>
<tr>
<th>Condenser type</th>
<th>7 mm copper tube</th>
<th>5 mm copper tube</th>
</tr>
</thead>
<tbody>
<tr>
<td>EER</td>
<td>3.57</td>
<td></td>
</tr>
<tr>
<td>Capacity</td>
<td>5000 W</td>
<td></td>
</tr>
<tr>
<td>Refrigerant</td>
<td>480 g</td>
<td>375 g</td>
</tr>
</tbody>
</table>
### Cost saving by using 5 mm copper tube Condenser for 1.5 TR RAC

<table>
<thead>
<tr>
<th>Condenser type</th>
<th>7 mm copper tube</th>
<th>5 mm copper tube</th>
<th>%age saving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper Weight</td>
<td>1.328 Kg</td>
<td>1.050 Kg</td>
<td>20.9%</td>
</tr>
<tr>
<td>Aluminium Weight</td>
<td>2.136 Kg</td>
<td>1.168 Kg</td>
<td>45.3%</td>
</tr>
<tr>
<td>Refrigerant R 22</td>
<td>960 g</td>
<td>870 g</td>
<td>9.3%</td>
</tr>
<tr>
<td>Refrigerant R 32</td>
<td>875 g</td>
<td>700 g</td>
<td>20.0%</td>
</tr>
<tr>
<td>Refrigerant R 290</td>
<td>480 g</td>
<td>375 g</td>
<td>21.8%</td>
</tr>
<tr>
<td>Refrigerant R 410A</td>
<td>915 g</td>
<td>836 g</td>
<td>8.6%</td>
</tr>
</tbody>
</table>
ICA India influence

Installed capacity to manufacturer 5 mm in India

Successfully test and validate 5 mm advantage for their system

Orders 5 mm assembly line for their RACs

Orders 5 mm assembly line for their RACs

Adopts 5 mm coils for 1 model by sourcing

5 mm adoption status in India
➢ Think innovation, think copper.

➢ Copper is the best metal for HVAC applications.

➢ Convert the microgroove. advantage into your competitive advantages, and win the market!