New copper–based heat exchangers for R744
Part II: Systems design and case studies
Y. Shabtay, J.R.H. Black, N.D. Cotton

• Smooth or Inner-grooved tubes made of a high-strength copper alloy (CuFe2P) and suitable for high pressure R744 applications
• Wall diameter 0.25 to 2.0mm
• Brazeable and weldable
• Withstands 2X the pressure of standard copper ACR tube

• Multichannel Copper profile, 1.0-1.3mm channel width
• Precision, thin-wall, 0.2-0.3mm
• Up to 62MPa burst pressure with 0.4mm wall and 1mm channels

Applications

R717/R744 Cascade refrigeration system
For large food freezing and storage warehouses, with R744 in the LT loop - suitable for small diameter copper tube, microchannel and CuFe2P tube (Emerson 2010)


R744 Secondary loop system
Considerable savings can be materialize from the use of small diameter copper tubes in the transmission lines

Hill Phoenix SecondNature ™ Low Temp system

<table>
<thead>
<tr>
<th>System</th>
<th>Length</th>
<th>Diameter (copper tubing)</th>
<th>Insulation</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Expansion</td>
<td>100m</td>
<td>32mm, 10mm</td>
<td>10mm</td>
<td>100%</td>
</tr>
<tr>
<td>Secondary Refrigerant System</td>
<td>200m</td>
<td>32mm, 10mm</td>
<td>30mm</td>
<td>167%</td>
</tr>
<tr>
<td>CO₂ Secondary Refrigerant System</td>
<td>100m</td>
<td>18mm, 6mm</td>
<td>30mm, 10mm</td>
<td>83%</td>
</tr>
<tr>
<td>CO₂ Cascade System</td>
<td>100m</td>
<td>18mm, 6mm</td>
<td>10mm, 5mm</td>
<td>42%</td>
</tr>
</tbody>
</table>

Additional costs not included: fittings, insulation
Additional costs for CO₂: extended pressure range or 2nd defrost system

U. Hesse, “Secondary Refrigerant Systems for Supermarket Application with Brine or Carbon Dioxide,” International Refrigeration and Air Conditioning Conference at Purdue University.

R744 Vending machines
R744 refrigeration cassette with both evaporator and condenser using 5mm inner-grooved copper tube (Sanden Vendo)