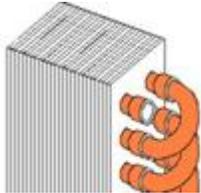
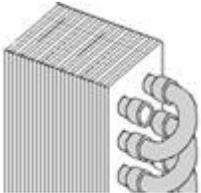


# Table of comparison

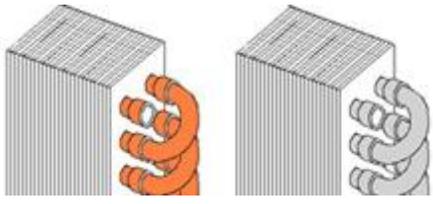
## Why all-Aluminum heat exchangers?

|                                   | Round tube mech. expanded<br>(Cu tube/ Al fin)                                    | Round tube mech. expanded<br>(Al tube/ Al fin)                                    |
|-----------------------------------|---|---|
|                                   |  |  |
| Required space                    | 100%  | 100%  |
| Tube weight                       | 100%  | <b>33% - 66%</b>  |
| Heat exchanger weight             | 100%  | <b>66% - 83%</b>  |
| Tube cost per heat exchanger**    | 100%  | <b>20% - 40%</b>  |
| Burst pressure                    | 100%  | 47% - 100%  |
| Refrigerant charge in condenser   | 100%  | 100% - 86%  |
| Refrigerant side pressure drop*** | 100%  | 100% - 150%   |
| Air side pressure drop            | 100%  | 100%  |
| Lifetime                          | High fin corrosion  | All-Aluminum balanced alloy combination   |
| Recyclability                     | Separation needed   | No need for separation  |

- Data based on properly designed condensers
  - Design conditions:
    - Condensing temperature 40°C
    - Ambient temperature 25 °C
    - Air speed 2.4m/s
1. Compensated for increased tube wall thickness to meet burst pressure
  2. Optimized pressure drop 40kPa (utilize heat exchanger/keep high COP)

# Cost

Even if this parameter is not the key feature, you will manufacture a more cost-effective system when you use aluminum.

|   | Round tube mech.<br>expanded (Cu tube/ Al fin) | Round tube mech.<br>expanded (Al tube/ Al fin) |
|---|--|--|
|  |  |  |
| Required space  | 100%   | 100%   |
| Tube weight   | 100%   | <b>66%</b>                                     |
| Heat exchanger weight   | 100%   | <b>83%</b>                                     |
| <b>Tube cost per heat exchanger**</b>   | <b>100%</b>                                    | <b>30% - 50%</b>                               |
| Burst pressure  | 100%   | 100%   |

\* Compensated for increased tube wall thickness to meet burst pressure

# Weight

If light weight and high performance are your ambitions, then selecting aluminum for your HVACR application will provide you with equipment lighter than devices using copper tubes.

|   | Outside diameter<br>[mm] | Wall thickness<br>[mm] | Weight<br>[kg/m] | Internal volume<br>[cm <sup>3</sup> /m] | Burst pressure<br>[Bar] |
|---|--------------------------|------------------------|------------------|---|-------------------------|
| <br><b>Copper tube</b>   | 9.52                     | 0.28                   | 0.072            | 63                                      | 123                     |
| <br><b>Aluminum tube</b> | 9.52                     | 0.6                    | <b>0.046</b>     | 54                                      | <b>126</b>              |

**Weight saving with aluminum tube for an equivalent burst pressure: 36%**

## Corrosion

- Corrosion test

Why is corrosion an issue with Copper-Al heat exchangers? Why is an all-aluminum design better?

Example of a well designed all-aluminum Heat exchanger

The corrosion rate of aluminum is very low when exposed to most environmental conditions, because aluminum is protected by a stable oxide layer. When corrosion does occur, it is typically due to poor design against corrosion. In a multi-material/alloy system where the materials are in direct contact, such as a heat exchanger or liquid lines, corrosion will take place on the most sacrificial part - the less noble part.

Hence, it becomes essential to consider that the galvanic series become important. It is no surprise to see corrosion developing in a copper tube-aluminum fin heat exchanger, due to high electric potential difference. Aluminum as a stand-alone tube, when selecting the proper alloy, is resistant to even the aggressive environment, like sea water conditions.



Macro photo of conventional copper tube-aluminum fin heat exchanger before and after one year in a coastal environment!

## Heat transfer

Heat transfer was made for aluminum - and vice versa.



**Optimum performance with all-aluminum heat exchanger**

**Using a drop-in aluminum tube in a mechanically expanded tube and fin heat exchanger will enable performance that is fully comparable with a traditional copper tube/aluminum fin heat exchanger.**