

## Heat exchangers: Copper or aluminium?

When dealing with thermal transfer performance, it is normal to use the conductivity table to make the choice of material. From this point of view copper seems to be a better choice than aluminium since copper has a higher thermal conductivity. Yet, since the 90's, the industry has been leaning more and more towards aluminium. Why do you think that is?

To understand this tendency, it is necessary to know how heat exchangers are manufactured. The tubes and the fins of copper exchangers are joined together usually by tinning with lead or tin. However, these metals have a lower thermal conductivity. Therefore, they are more prone to (galvanic) corrosion, and more sensitive to breakage under vibration.

Other types of copper heat exchangers, such as the TIF (Tube in Fins), have junctions only by mechanical contacts under pressure. However, it is known that the surface of real contact between two juxtaposed solids is only 2-4% of the apparent surface of contact. The thermal transfer is thus stopped to the junction of the tubes and the fins. This phenomenon is called "thermal contact resistance".

Aluminium heat exchangers are brazed. Brazing is a welding process which makes the exchanger a single piece, entirely in aluminium. There is no thermal contact resistance, and no transition materials.

As final result, the aluminium heat exchangers are often only two thirds of the volume of those made of copper, for the same performance. This space saving has a second advantage: the heat exchanger requires less energy to use because the power required by the fan is lower when the exchanger is thinner (because of a lower air restriction). Another advantage in favour of aluminium is that its price per pound is currently approximately half the price of copper. Mostly, aluminium heat exchangers are 100% recyclable, lead free.

These are the reasons why aluminium is a much better choice than copper for heat exchangers; it is also the reason why most original equipment manufacturers in the industry (cars, trucking & heavy machinery etc applications) choose aluminium.

### Tips & Advice

All SKL heat exchangers are delivered with joints of expansion on the side-plates. These joints are in fact grooves that are used to reduce the mechanical constraints following sudden changes of temperature.

In order to preserve this advantage (and thus to increase the lifespan of the heat exchangers), when additional side-plate must be added from the part of origin it is important not to weld it in a manner that will prevent the expansion. Also, while installing the unit, allow enough space for the tubes to dilate freely.

Furthermore, damaging the joints of expansion could cancel the manufacturer's warranty.

