



**SKL**  
**ALUMINIUM**

**How & why,  
Manufacturing Aluminium  
heat transfer technology  
components**

# **SKL** Aluminium Inc / Who we are

- **SKL** is a family owned business
- Operating since 2003 & owned by Ghislain Larouche. The acronym stands for our Ghislain's children **S**teve **K**athleen **L**arouche
- Manufacturing Heavy Duty aluminium cooling components including radiators, oil cooler, charge air coolers, condensers & liquid to liquid / air to liquid exchangers
- 2 Main sectors, SHOP & OEM

# **SKL** Aluminium Inc / Who we are



2 Distinct sectors of activity





Custom core manufacturing per dimensions

2 days shipping (cores)

# Shop

Complete cooling unit replacement & recoring service

Immediate over the phone quote

50 North American distributors (mainly HD radiator shops)

A black metal grate assembly is shown in a factory setting. The grate is composed of several curved, parallel bars. In the background, there are stacks of similar grates and other industrial equipment. The text is overlaid on the image in white.

Custom **turnkey** product development

Full **3D** product validation

**OEM**

Full thermal calculations & **mechanical design**

**200 OE clients** (40 On regular production schedule)

**Mobile & stationnary** applications

# Aluminium & Copper compared... AGAIN!

The debate is old but the main ideas are the following:

## Aluminium

Lesser base metal heat transfer properties

All aluminium brazed construction renders more homogenous heat dissipation & higher assembled unit performance

Stronger & more durable material

Lighter (comparable unit is conservatively estimated to be 30-40% lighter / base material is 2700kg / M<sup>3</sup>)

Better corrosion resistance

Thinner cores for same heat rejection = less forced air power

Repairs are more expensive & complex but less frequent

Longer service life in same environment

## Copper-Brass

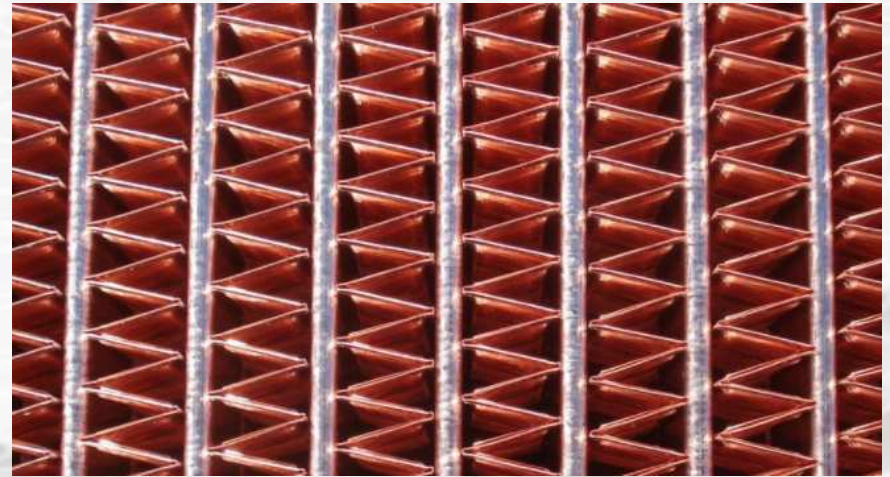
Higher base metal heat transfer properties

Soldered construction renders less homogenous heat dissipation due to dissimilar metals composition

Heavier (Copper-Brass is 8900kg / M<sup>3</sup>)

More prone to corrosion due to dissimilar metals

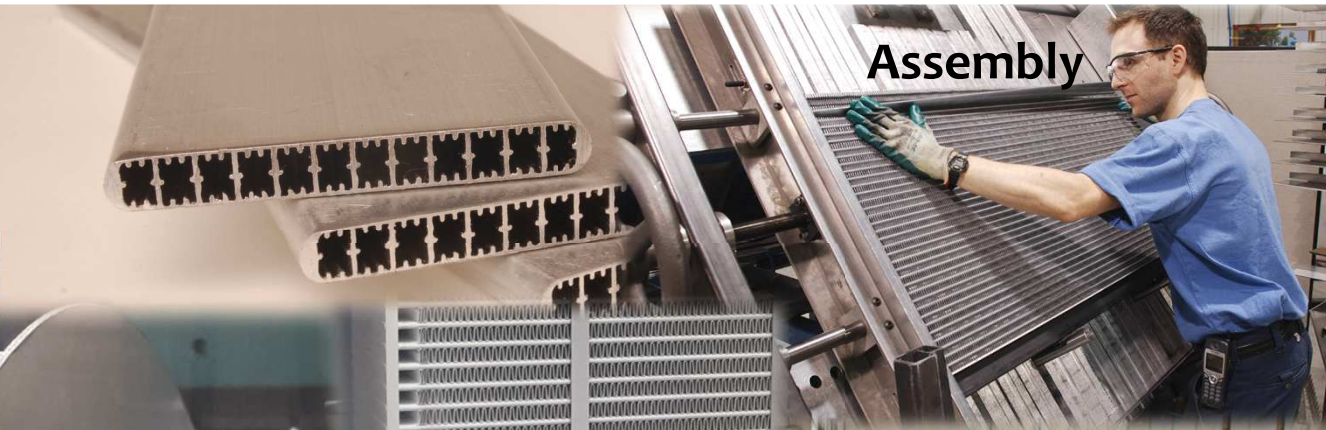
Easier to repair by simple soldering



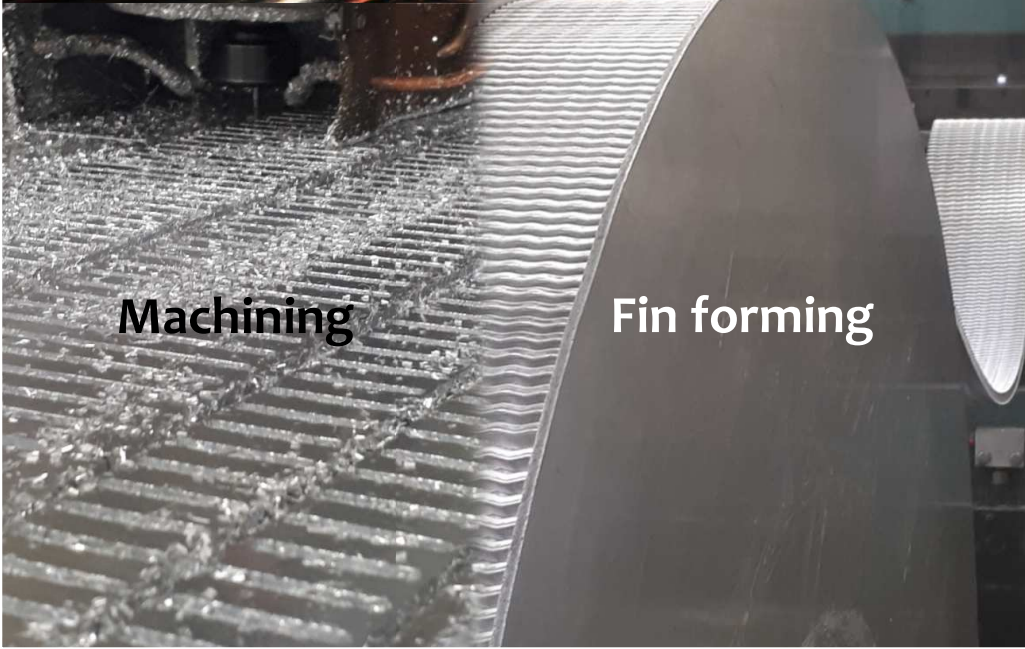
# Assembly & preparation for brazing



Lazer cutting & forming

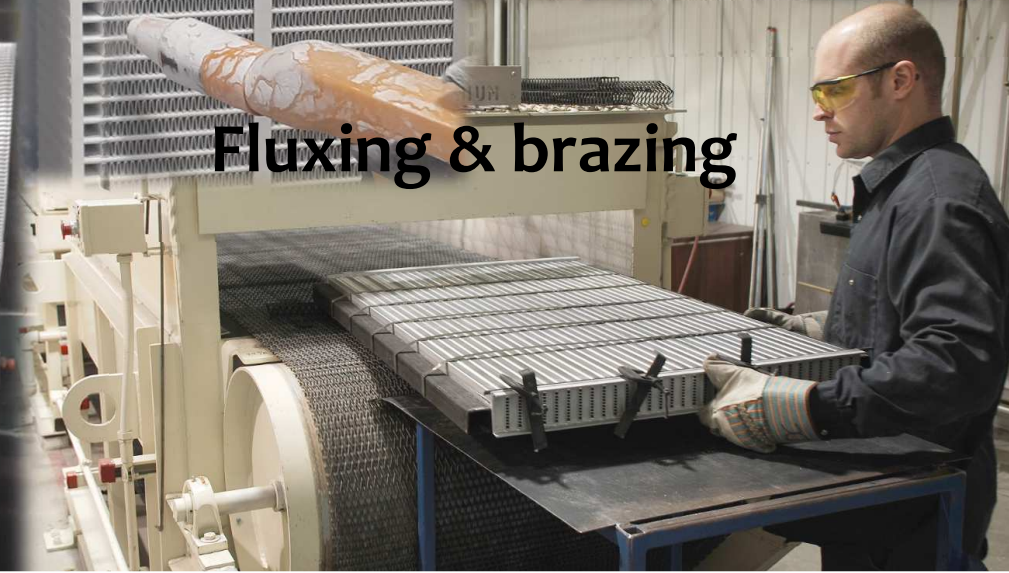


Assembly



Machining

Fin forming

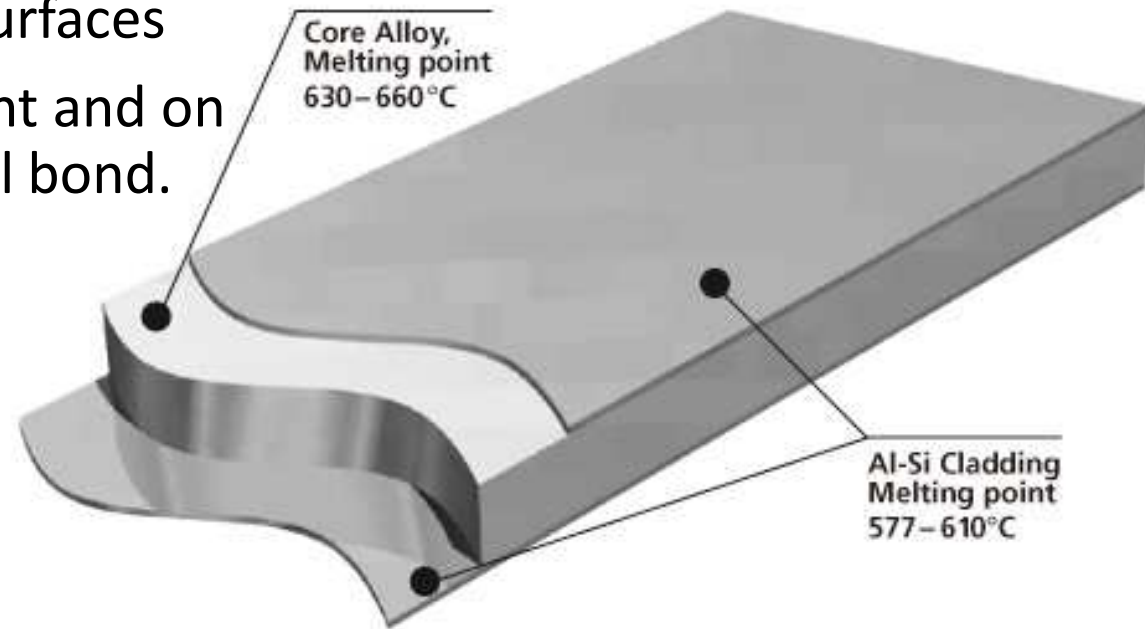
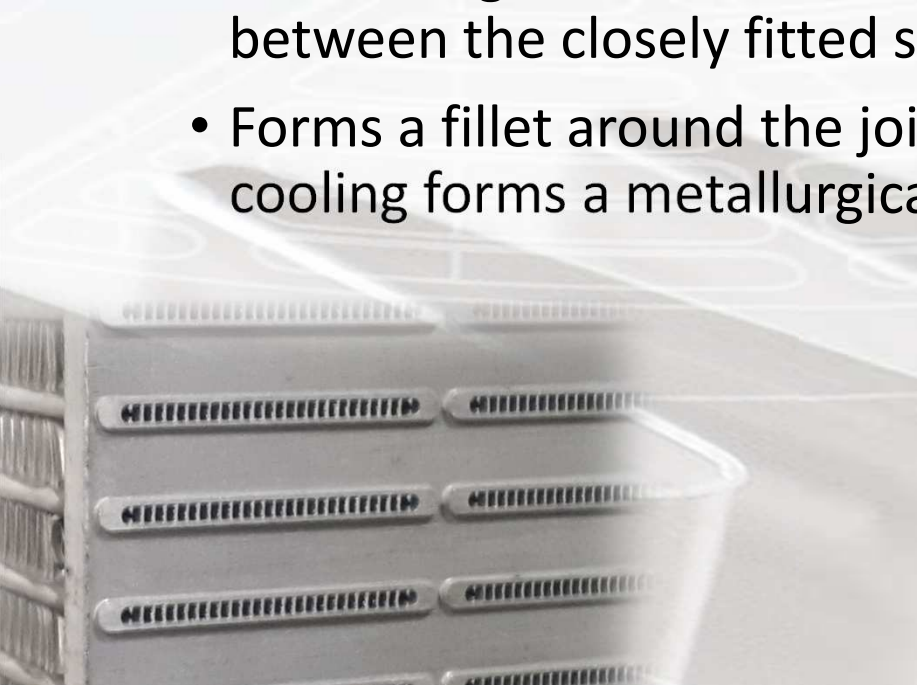


Fluxing & brazing

# Aluminium brazing process basics

## What is brazing?

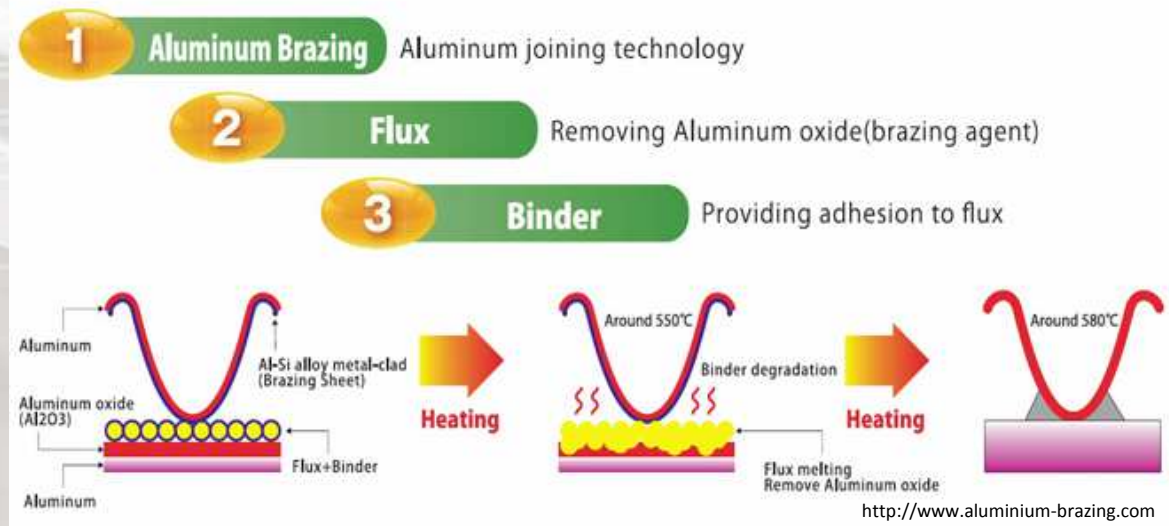
- Brazing is the joining of metals using a molten filler metal.
- On melting, the filler metal spreads between the closely fitted surfaces
- Forms a fillet around the joint and on cooling forms a metallurgical bond.





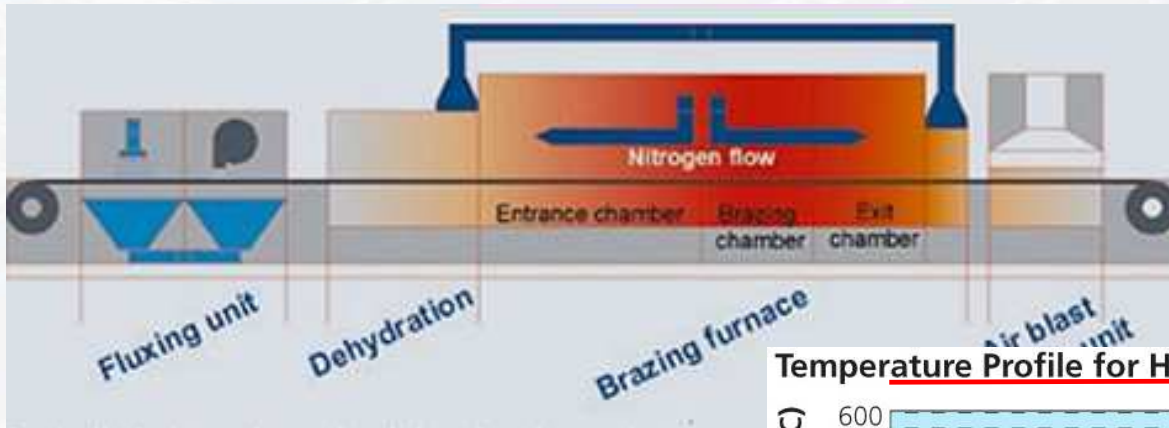
# Aluminium brazing process basics

- An aluminium oxide layer forms instantly on aluminium in presence of oxygen.
- Removal of the oxide layer is imperative & formation of a new oxide layer has to be prevented for the brazing.
- The oxide layer is chemically dissolved by a flux which we apply using a drystatic process.



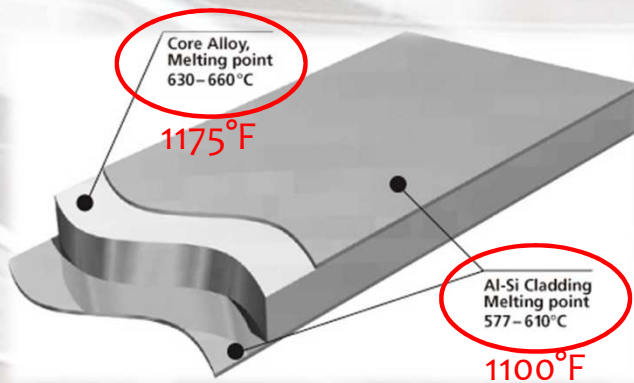
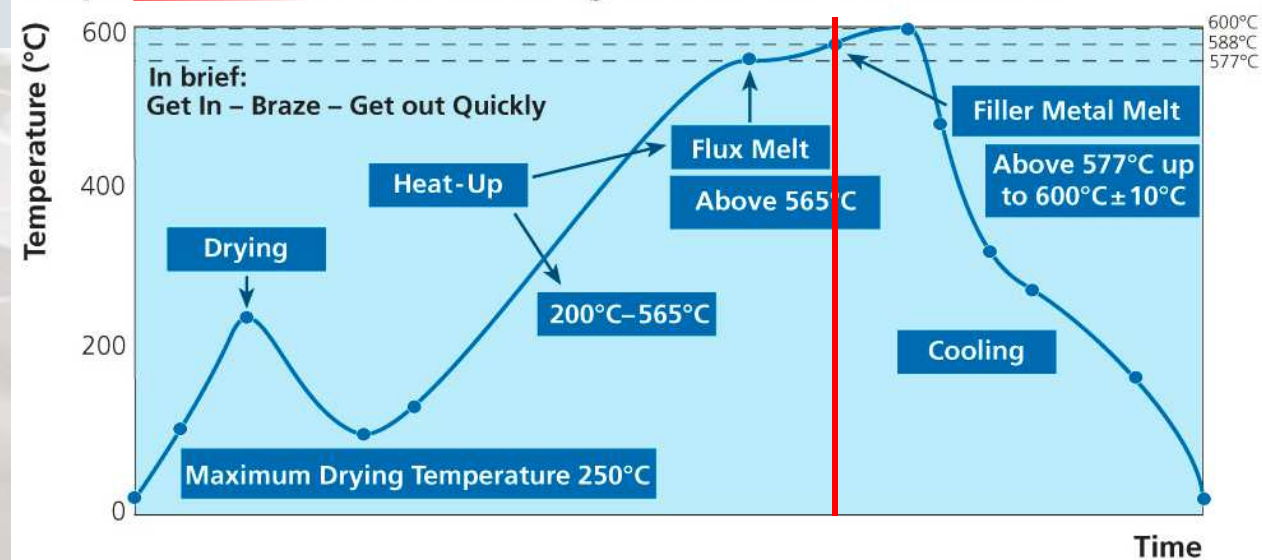
# Aluminium brazing process basics

- Controlled atmosphere aluminium brazing furnace



- Different recipes blend over time, temperatures, air flow, etc.
- Recipes are mainly based on core configuration & batch quantities among other factors

Temperature Profile for Heat Exchanger Brazed in a Tunnel Furnace



# X325 Flat header vs Traditionnal turn-up

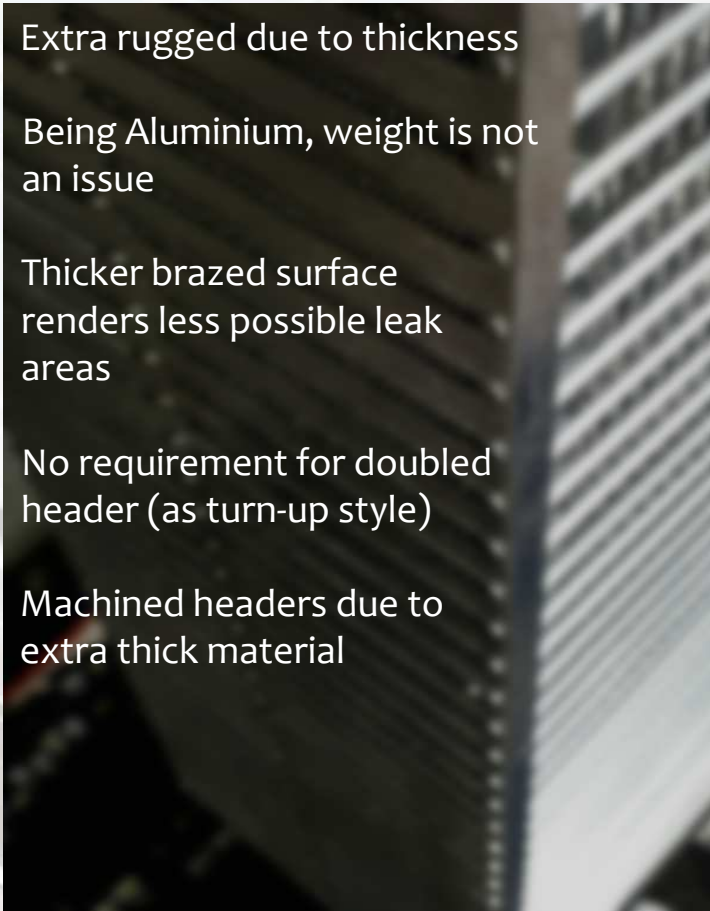
Extra rugged due to thickness

Being Aluminium, weight is not an issue

Thicker brazed surface renders less possible leak areas

No requirement for doubled header (as turn-up style)

Machined headers due to extra thick material



Turn-up style header

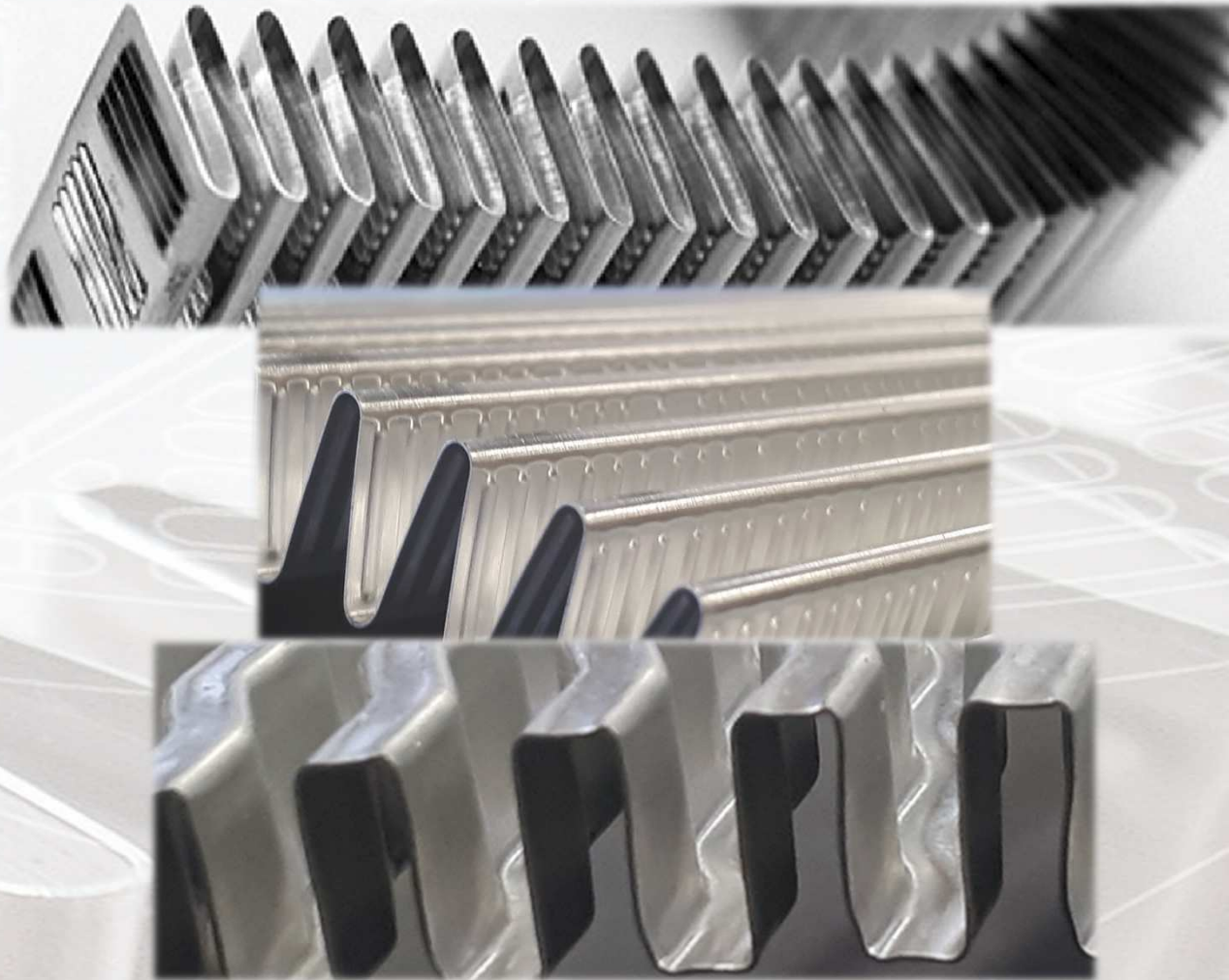
SKL Doubled header

Doubled headers are not typical, we add them for strength

Turn-up headers are now only 25% of our production



# A quick word in regards to aluminium fins & fin selection

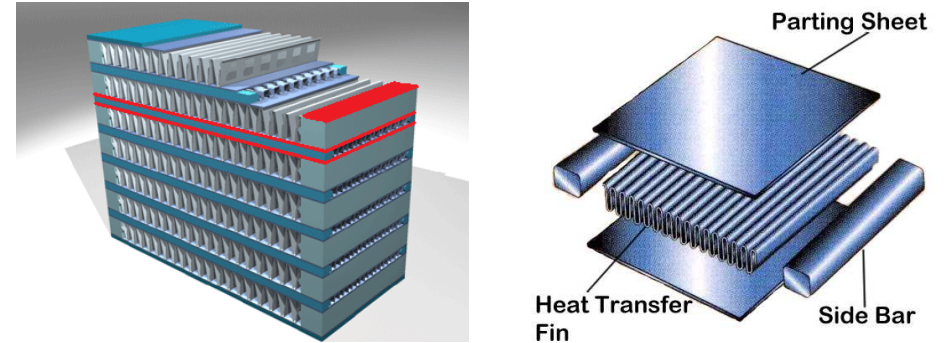


- Double sided cladding material
- Louvered, Dimpled & Square wave
- Minimum 0.006" thick in SKL products
- Variable fin density per original unit (shop production) or per thermal calculations (OEM design)
- Square wave fins are 0.010" for ultra heavy duty. Advantages include
  - Wide brazing surface
  - Improved passage of debris
  - High pressure washable for high debris environments

# Comparing Microchannel to Bar & plate



- SKL uses microchannel extruded tubes
- Very robust / resistant to external damage
  - Generally less expensive
  - Very high heat transfer efficiency
    - Much lighter by design
- Uses a fraction of the brazing surface
- Thickness limitations due to tube width stock/availability



- Channels are the result of the design/construction
  - Very robust / resistant to external damage
    - Generally more expensive
    - Very high heat transfer efficiency
      - Much heavier units
- Brazing involved at every component joint makes quality control very difficult
  - No limitations to thickness and much less inventory required

# SKL aluminium extruded tube construction & why we use them

Tube nose reinforcement for strength & abrasion resistance

Microchannel spacing to optimise heat transfer efficiency vs inner restriction

0,0xx" sidewalls



CAC tubes

- All tubes developed by SKL
- Extruded using our proprietary dies
- Widths in 1 – 6"
- 2000psi+ burst tested

Overkill strong... so we can brag about hardcore heavy duty without remorse 😊

# Gensets & low temp conversions

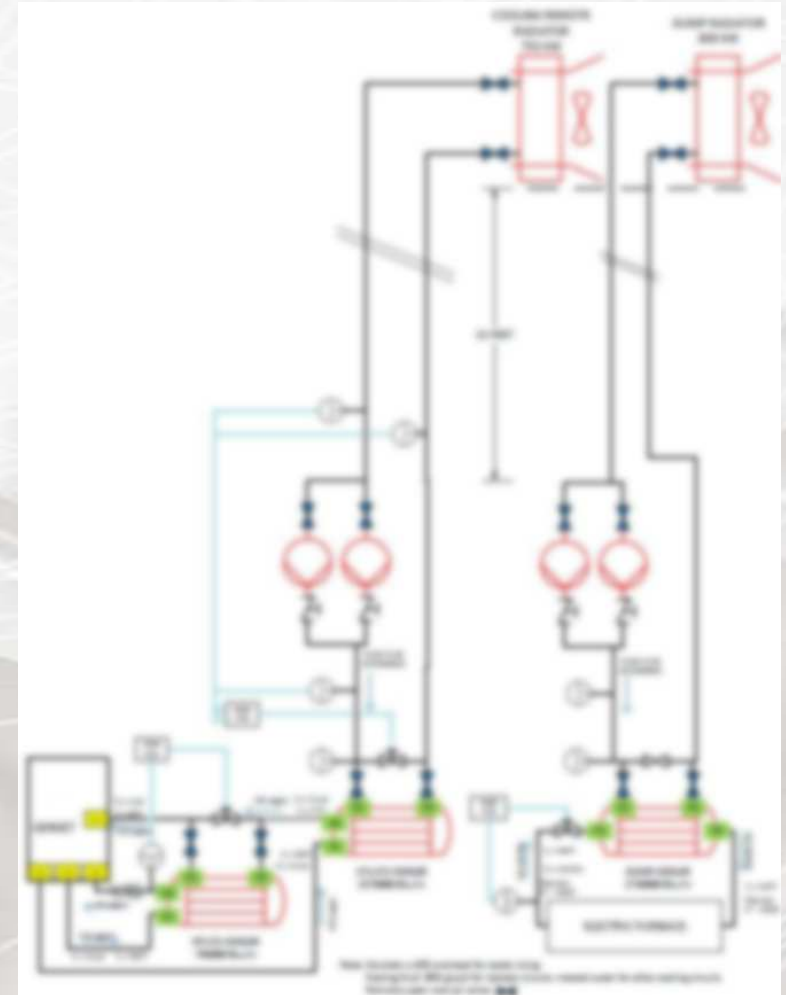


Gensets are a world on their own...

Aluminium cooling components are well suited for gensets applications due to more and more demanding scopes of projects.

Technical requirements can include the following and need to be prioritized to determine the best suited design:

- Sound restriction
- Max deducted forced air HP
- Cost optimisation
- Max dimensions
- Remote conversion exchangers
- Low temp conversion exchangers



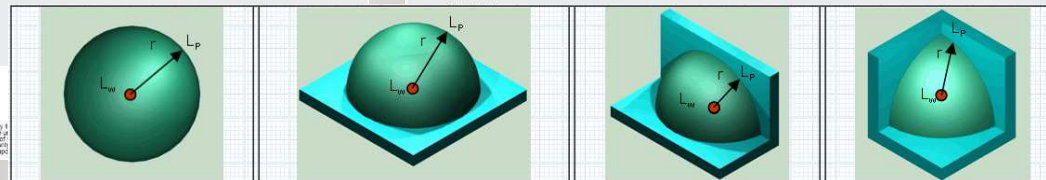
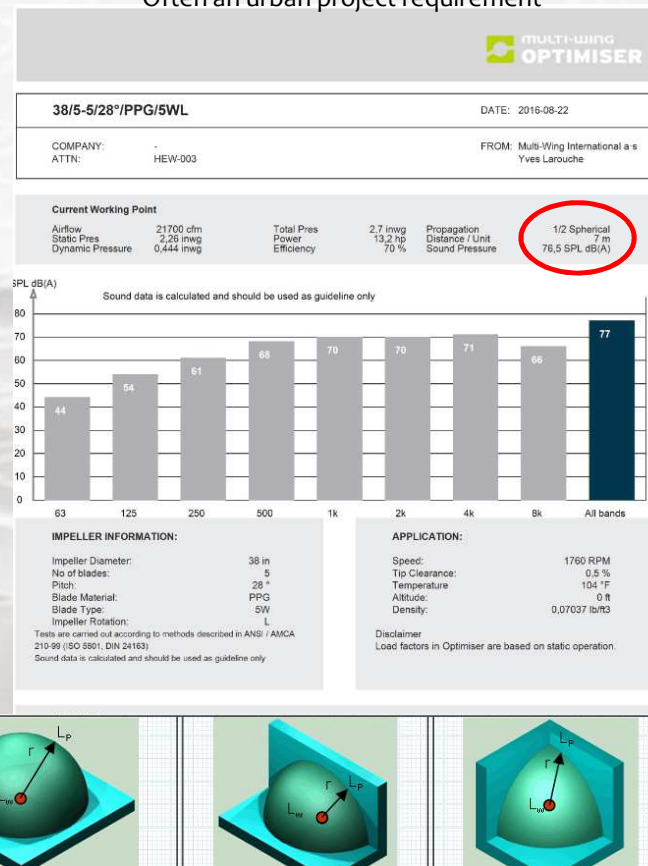
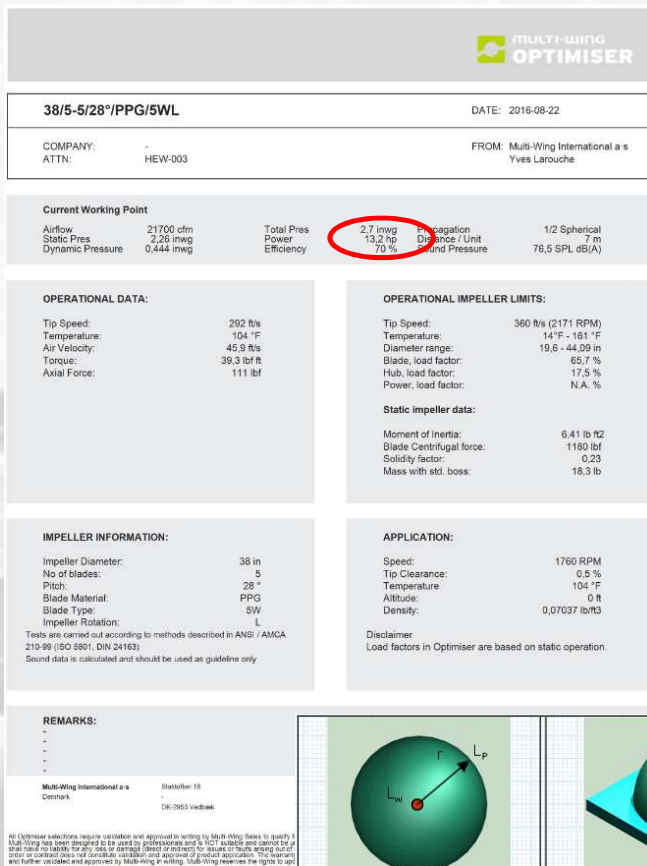
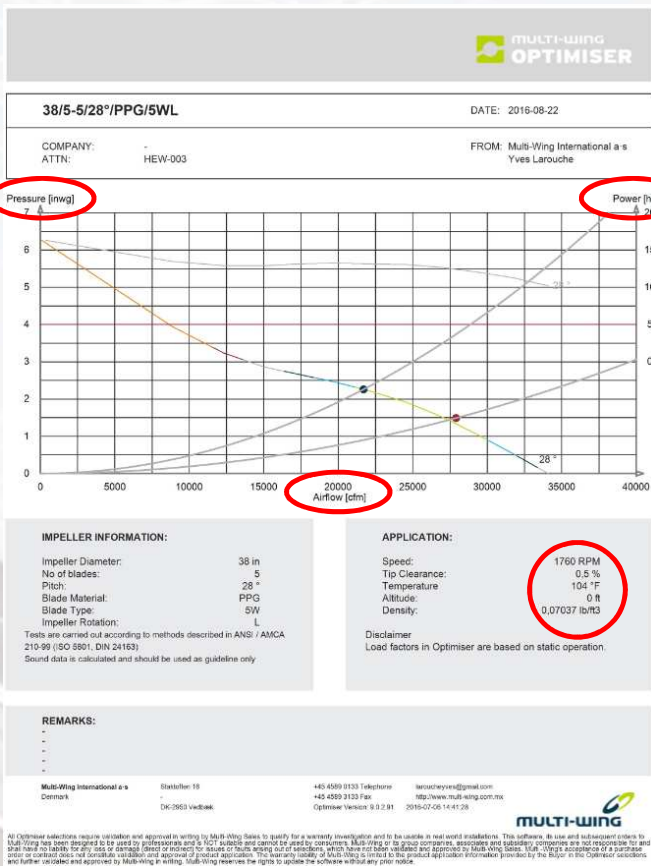
# Gensets & low temp conversions (forced air considerations)

Fan curve per radiator restriction

Max dedicated power

Sound restrictions

Often an urban project requirement



Spherical

Half spherical

1/4 Spherical

1/8 Spherical

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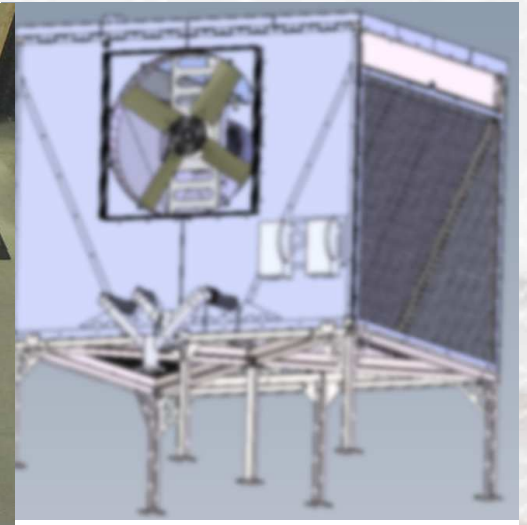
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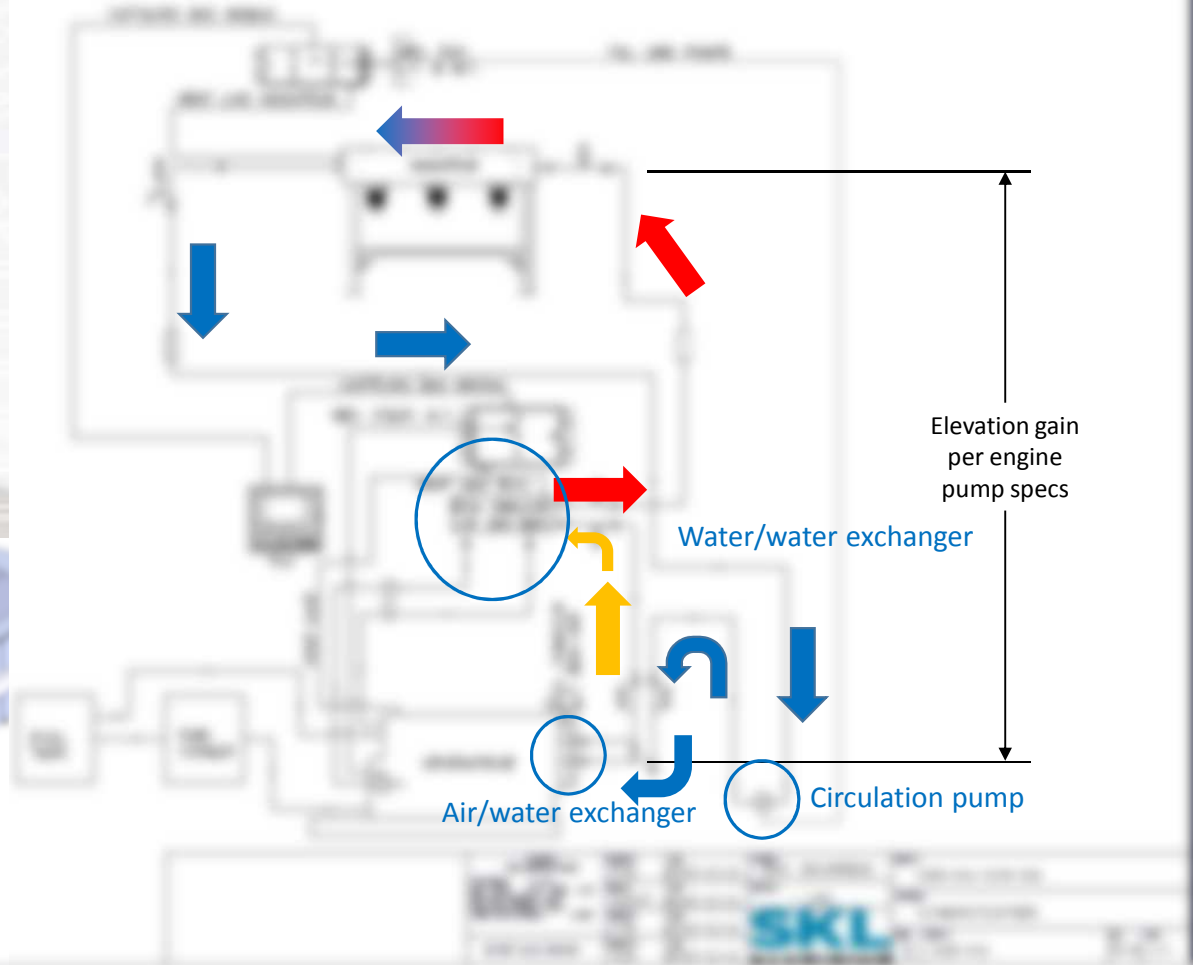
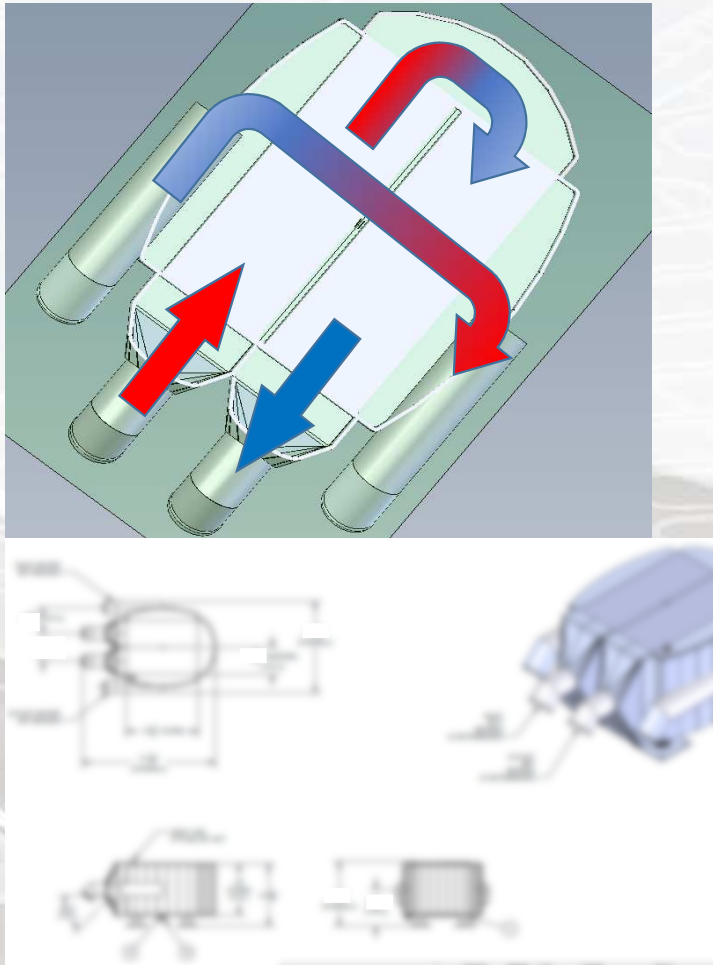


## Gensets & low temp conversions (maximum dimensions)

- Having to design per maximum available space is often a consideration
- Depending the project, the cooling package can be:
  - Freestanding vertical
  - Freestanding horizontal
  - V-Core design
  - Ceiling or roof mounted (containers)



# Gensets & low temp conversions (adapting to remote cooling)



# Recoring & how we do it in short

Recoring replaces the core while reusing existing reservoirs

Often a good value solution for many clients

Many ways to recore an aluminium unit... but the skill saw is without a doubt the weapon of choice



SKL offers specific training for aluminium handling

# Thermal expansion... a requirement?

Thermal expansion is an important consideration

Both Aluminium & Copper thermal expansion should be addressed in regards to cooling component design and the following differences require consideration:

Thermal expansion of aluminium is 35% greater than copper.

Resulting mechanical force due to expansion is 20% stronger for an aluminium component

Aluminium components are homogeneous metals, thus thermal cycling has a lesser effect although not a major concern to soldered copper/brass units

Dissimilar expansion of structural steel & aluminium components (roughly a 2:1 ratio) + amount of exposure to heat is very different



# Lead times are a weapon of choice

In our world of custom manufacturing, inventory is not a realistic option

Rush production is an everyday thing due to equipment down time

Our production schedule includes an important portion of next day or 2 day shipping

Eliminating sub-contracting is a huge objective but allows us to avoid being at the mercy of external suppliers

