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OneShot -Brazing for *CuproBraze* –process "Revolutionizing heat exchanger –manufacturing"

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**Developed in partnership with
*CuproBraze Alliance***





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Customer Driven Development Strategy: OneShot - Brazing

- ✓ **Principles of One Shot Brazing**
- ✓ **Design for *manufacturability***
- ✓ **OneShot –*manufacturing requires***
- ✓ **OneShot –Brazing as Lean philosophy: aiming to optimize added value for customers**
- ✓ **Fiscal benefits for customer**
- ✓ **Technical benefits for customer**



OneShot Brazing

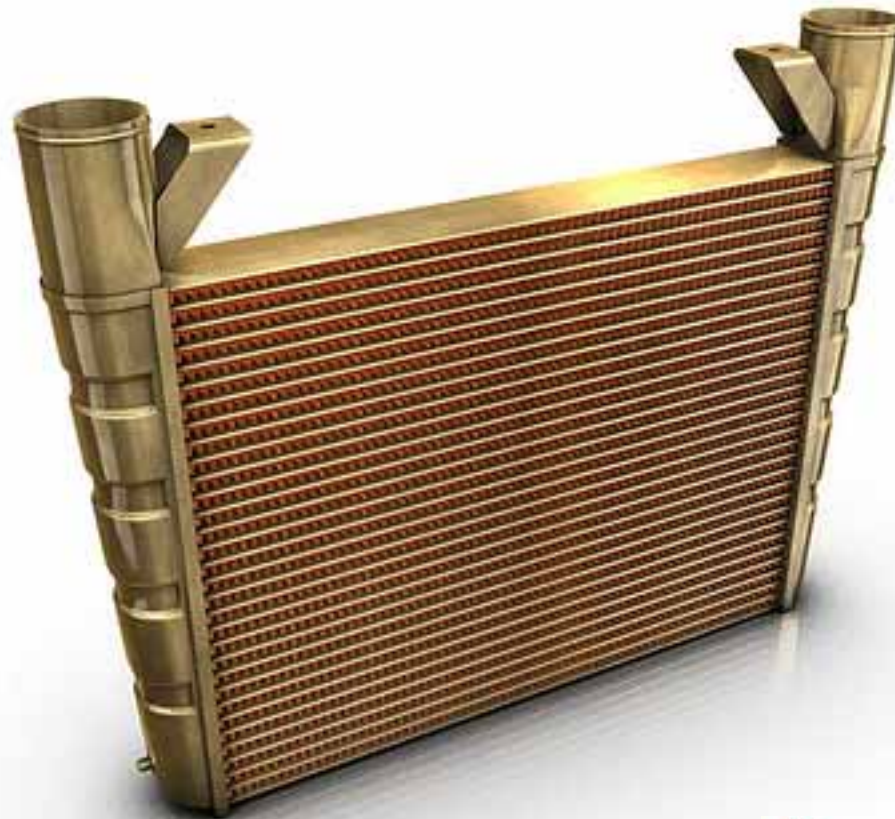
- Copper-Brass radiators compete with their excellent performance and reliability against Aluminium radiators in heavy duty applications like locomotives, trucks, generators and tractors.
- The radiator core is used to be brazed, tested, and then in a second step the tanks are soft-soldered/welded to finalize the radiator.
- Moving the production to zero defect core brazing supports the cost reduction effective by avoiding the welding step and including the tanks in “One Shot Brazing” together with the core.
- Communication, culture, production and design are the main buttons to play.



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"One shot is a triumph of applications engineering!
Now that its benefits are proven by Finnradiator,
CuproBraze is shaping up as a very attractive alternative to existing technologies"

- Nigel Cotton, Automotive Manager of the International Copper Association.



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Design for *manufacturability*

- Know-how of filler behaviour.
- Know-how of thermal expansion properties of fin copper SM0502, tube brass SM2385, header brass SM2464 and stainless steel fixture in relation to each other.
- Component gap-sizes <0.05 mm in order to achieve optimal conditions for capillary force.
- Areas where gaps >0.05 mm, gravitational force's effect during brazing cycle must be understood in design stage (for example component shapes)



OneShot – *manufacturing*

- Adequate application of brazing metal/paste/flux (position, quantity)
- At the brazing temperature, the surfaces of the components to be joined, as well as the brazing powder must be free from any non-metallic films, such as organic residues and metal oxides.
- Homogeneity of the furnace temperature and brazing atmosphere (even flow of nitrogen or other gas) flow: Optimization of temperature-time profile.



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Table 6. The heat expansion and the increase in length (Δl) between 25°C and 650°C for 1 m long object.

| Material | Heat expansion coefficient μ m/m°C | Δl for 25 – 650 °C mm |
|----------------------|---|----------------------------------|
| Copper fin SM 0502 | 17 | 10.6 |
| Tube brass SM 2385 | 19 | 11.9 |
| Header brass SM 2464 | 20 | 12.5 |
| Steel | 11 | 6.7 |
| Stainless steel | 15 | 9.4 |



Fiscal benefits for customer

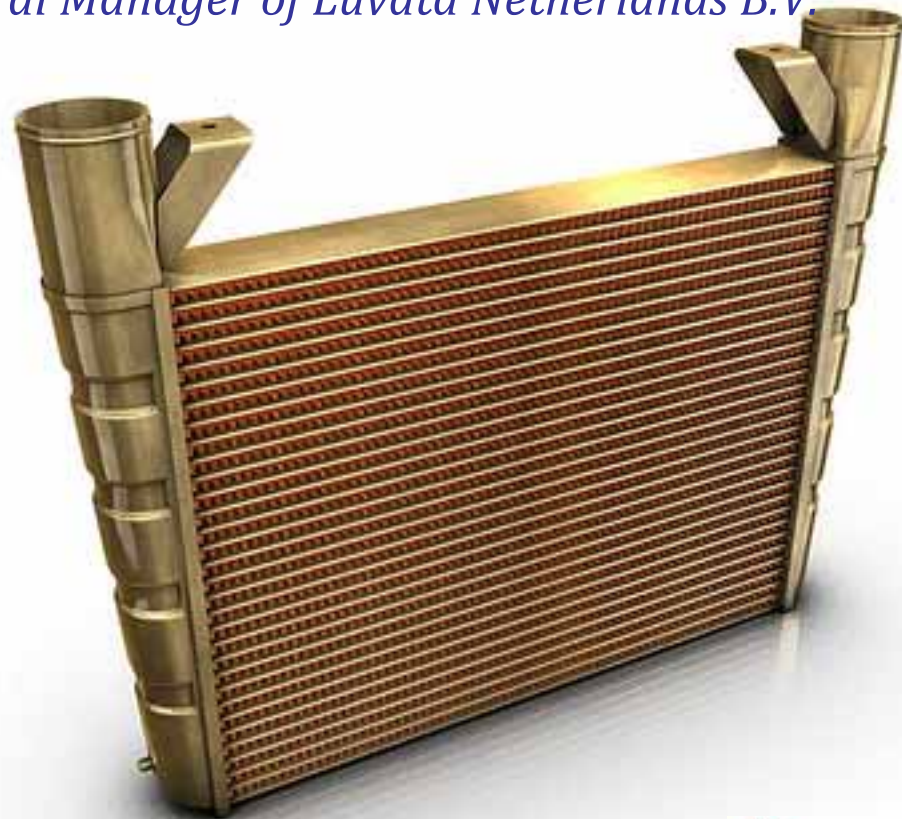
- Up to - 25 % of from labour time of production process.
- One-shot brazing eliminates the need for skilled welders at the post-brazing production stage.
- Reduces significantly need for post-brazing stage inventory and logistics.
- OneShot –brazing enables zero-defect quality in joint-areas, reducing time and resources needed for re-work and amount of scrap compared to soft-soldering and welding (variations caused by manual soft-soldering, welding etc.)



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"One shot brazing is an excellent example of lean manufacturing philosophy: decrease process time and handling improves stability and predictability of the manufacturing process → eliminate waste in the value chain"

- Theo Mimpfen, General Manager of Luvata Netherlands B.V.



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Technical benefits for customer

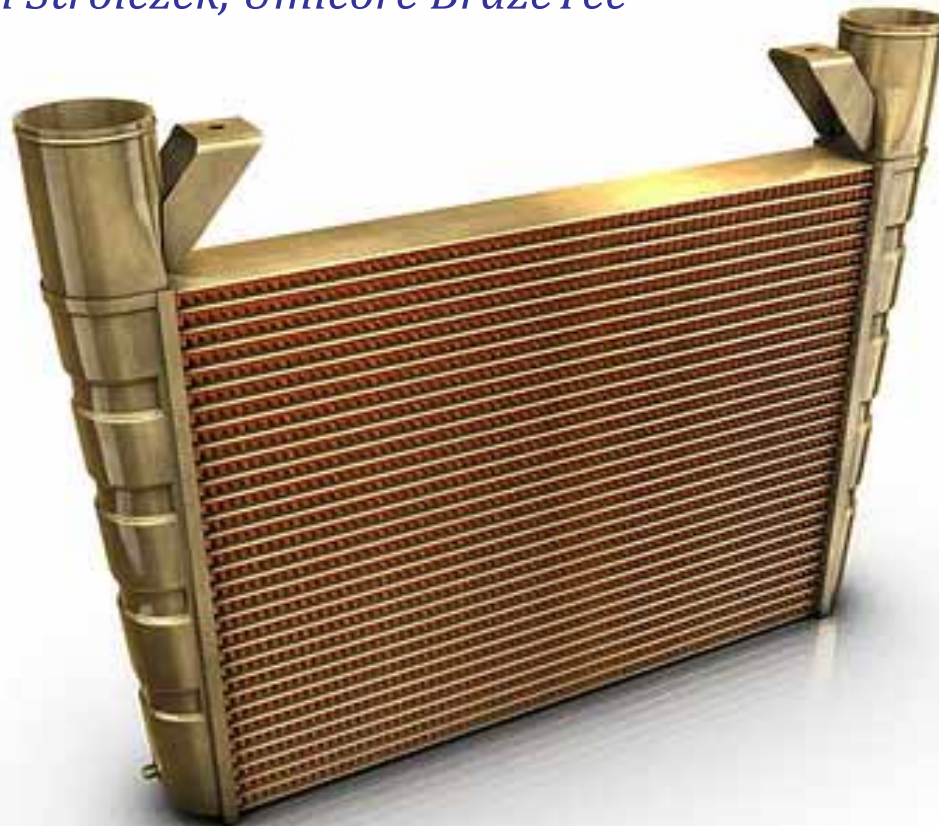
- Stronger joints when compared to soft-soldering. (longer end-product life-span)
- Excellent visual appearance in joint surfaces: no need for post-brazing revision.
- Criticality of dimensional accuracy already at component level (~ 0.05 mm) results very accurate dimensions in final product.



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"One shot brazing combines the advantages of soft soldering and welding without the negatives. The joints are visually pleasing and dimensionally accurate but much stronger than soldered joints and there are no part distortion or heat affected zone like in welding. Besides product superiority the process is efficient and the product is ready to ship inone shot"

- Martin Stroiczek, Umicore BrazeTec



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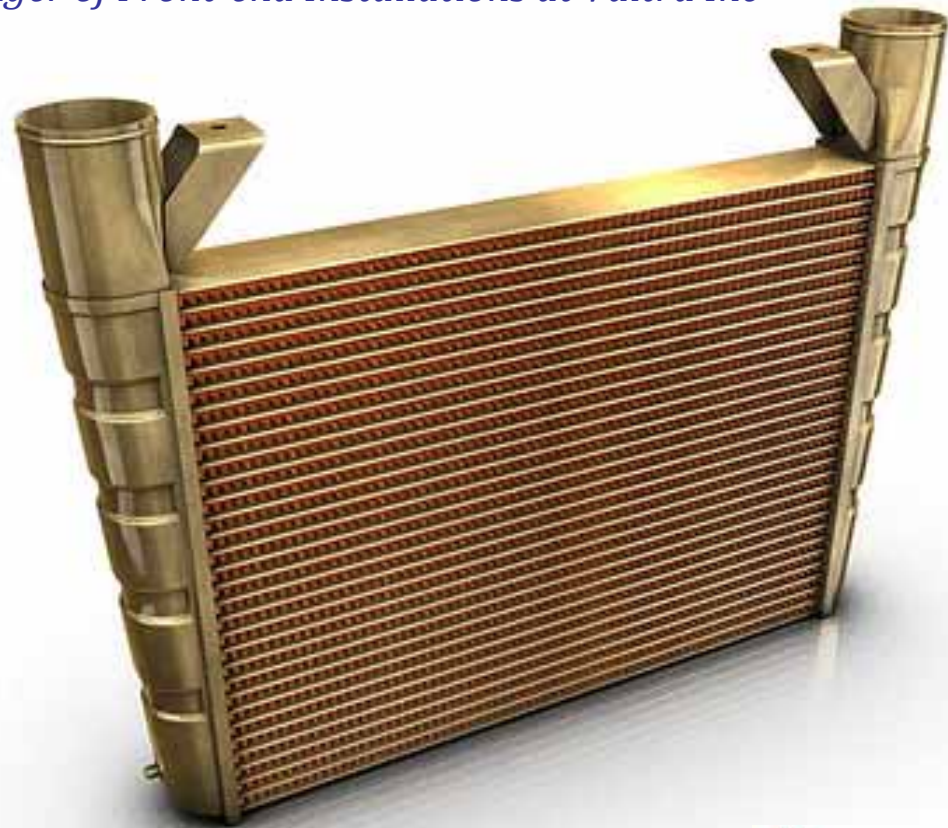
Future perspectives

- From talking to walking moving from company-centerism to networking: Finn radiator's R&D cooperation with Luvata and BrazeTec Umicore was playing a major role during the development of OneShot –process.
- Widening of OneShot –process to whole product portfolio: radiators, CAC's and oilcoolers.
- Increasing the level of automation.



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*“In agricultural and contractor applications, vibration and shock can place fatigue stresses on the CAC joints. The combination of heat and fatigue and increased internal tube pressures does not bode well for aluminum. I believe our customers are getting a better radiator and that the CuproBrazed radiator adds to the value of a Valtra tractor.”
Mr. Ilpo Ahola, Manager of Front-end Installations at Valtra Inc”*



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Thank you for your attention!

