WHAT IS CUPROBRAZE®?

Introduction

CuproBraze® is an official trademark registered by International Copper Association. Under the CuproBraze ™ brand, a heat exchanger manufacturing technology is commercialized. CuproBraze® heat exchangers are made using special anneal-resistant alloys of copper and brass. Tubes are fabricated from brass strip and coated with a brazing filler material. The copper fins, coated tubes, headers and side supports made of brass are fitted together into a core assembly, which is then brazed in a furnace.

The fin copper, tube brass and brazing alloy used in the technology, have been patented by Aurubis (www.aurubis.com). Consequently, consult the owners of the intellectual property rights in case of doubts on infringement of the rights. To be on the safe side both technically and legally, it is advised to follow the guidelines of CuproBraze® Brazing Handbook, Edition #10 or later version (free download on www.cuprobraze.com).

CuproBraze® heat exchangers are today used mainly, but not exclusively, in heavy duty off-road vehicles, like mining vehicles, agricultural vehicles, construction equipment, military vehicles and in locomotives and stationary generators, as well as in heavy-duty highway trucks and buses and in some lighter vehicles.

History

The CuproBraze® mark has been in use since 1999 with many small, mid-size and high-volume production facilities are making CuproBraze® heat exchangers for OEMs and the aftermarket in the years since. So called "one-shot" brazing entered production scale in 2008. During that time CuproBraze® has been promoted through advertising, press, exhibitions, websites and other collateral materials. The *CuproBraze Executive Report* issue Number 61 on twelve CuproBraze milestones titled "CuproBraze® Secrets to Success" http://cuprobraze.com/wp-content/uploads/2015/03/0318-ICA-ER61-Milestones.pdf indicates evidence of historical activities related to the CuproBraze® mark.

An Alliance of supporters formed the CuproBraze Alliance in 2003, in order to promote the brand. Each member has provided economic and intellectual support of the mark. The mark is present in Asia, Europe, Latin America, America, Africa and Australasia.

The Mark

The Mark is a registered service mark owned by the International Copper Association and by agreement used freely by the CuproBrazeAlliance.

The US registration number is 2229409. See here for documents relating specifically to CuproBraze: http://tdr.uspto.gov/search.action?sn=75189874#. The trademark was last renewed in the USA in 2008. The trademark is renewed every ten years.

Registered office: International Copper Association Ltd., 260 Madison Ave 16th Floor, New York, NY 10016-2401

Material

CuproBraze® refers to a manufactured construction that uses copper or copper alloys. CuproBraze® is exclusive to copper base materials. In the section Typical Material Composition (see below), there is a typical but not exclusive list of materials that maybe used in the CuproBraze® Process.

A consequence of this is that any article or product referring to CuproBraze® should at least be made of copper or copper based materials.

Notwithstanding the above CuproBraze® also refers to a process that results in a product of a certain performance that supports the brand. This performance is subject to verification and ultimately the approval of the ICA and the Board of the CuproBraze Alliance. The performance should be in the range described below

Typical Material compositions

Fin copper: Aurubis designation SM0502. Nominal composition CuCr0.2. Patented. Not standardized.

Tube brass: Aurubis designation SM2385. Nominal composition CuZn14Fe0.9. Patented. Standards: ASTM/UNS C66420.

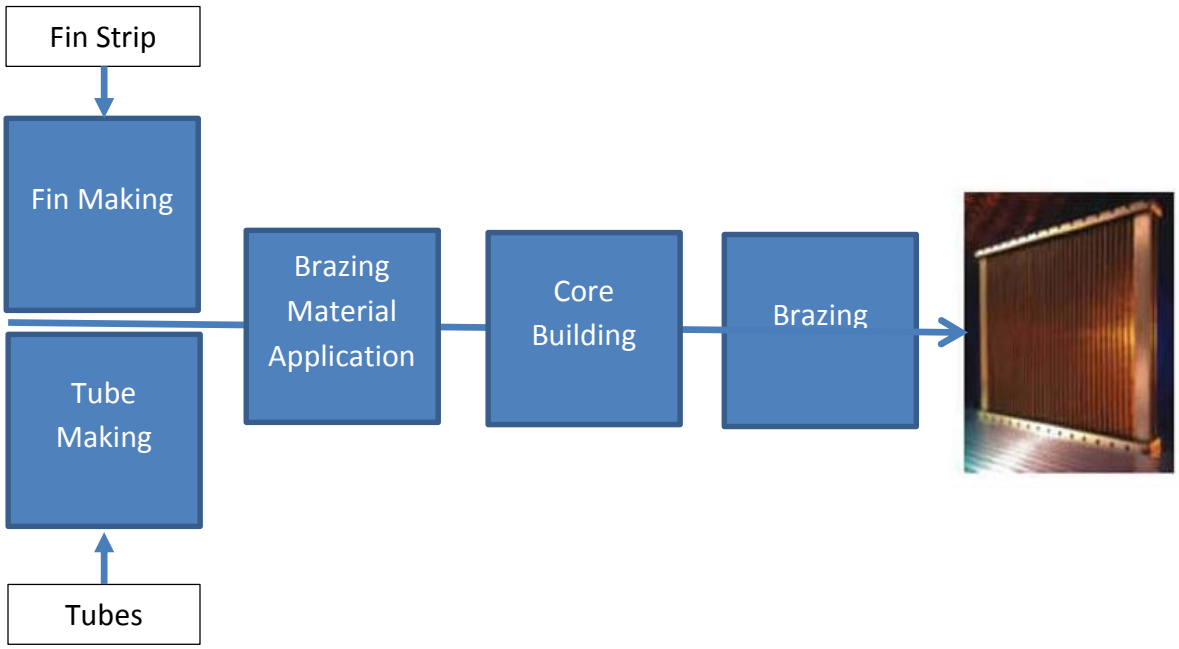
Alloy for header plates, side supports and tanks: Aurubis designation SM2464. Not patented. Standards: ASTM/UNS C74400. This alloy can be replaced with other suitable copper alloys or with steel, when appropriate for the application of the heat exchanger.

Brazing filler alloy powder: Aurubis designation OKC600. Patented. Nominal composition CuNi4.2Sn15.6P5.3. Free licensing to qualified powder manufacturers. This powder is mixed to pastes of different formulas to be used for joints in the CuproBraze® process.

Brazing foil alloy: Vacuumschmelze designation VZ2255. Nominal composition CuNi7.0Zn1.0Sn9.3P6.5. The foil is used as brazing alloy for brazing tube-to-fin joints, and especially for brazing of turbulators to tube inner walls inside the tubes.

Method

The established production method for CuproBraze® heat exchangers is illustrated in the enclosed scheme.



Fin Materials should be- Patented or equivalent performance

Tube Materials should be- Patented or equivalent performance

Brazing materials should be- Patented or in compliance with the details below

In summary:

Only materials described above are allowed to be used. Fins are formed of fin strip in a conventional way. Tubes are typically formed and HF-welded in a conventional way. Tubes are coated by spraying, brushing or rolling with a tube paste to form tube/fin joints; optionally brazing filler foil is inserted between tubes and fins. Heat exchanger cores are built of fins, tubes, header plates and side supports and fixtures for brazing. Header paste (slurry) is applied on the tube-to-header joints, or the header blanks are pasted and brazed prior to punching. After assembly the cores are brazed in brazing furnace in inert nitrogen atmosphere containing maximum 20 ppm oxygen.

In more detail:

The CuproBraze® process is a joining method for heat exchangers of copper based materials at a temperature higher than 600°C. The brazing temperature is typically 650...670 C. please note higher temperatures would cause softening of the fin, tube and header materials. The dwell time at brazing temperature is below 4 minutes. Please note that higher temperatures or longer dwell times would cause a reduced technical performance of the materials.

The joining method is a brazing technique where the object goes through a temperature cycle in a furnace. The furnace could be of a batch, a semi continuous or a continuous type. The atmosphere in the furnace should be of inert or non-oxidizing type during the whole process including the heating, brazing and cooling phases. The brazing powder melts typically at 600...610 C and brazing foil at 600...630 C.

The materials to be joined by the CuproBraze® process should be anneal-resistant materials with the following properties:

The copper material used mainly for fins:
The heat conductivity should equal a minimum of 90%IACS of electrical conductivity.
The tensile and yield strength after 4 minutes holding time at 650°C should be a minimum of 80% of its initial tensile strength.

The brass material for material used mainly for tubes:
The tensile and yield strength after 4 minutes holding time at 650°C should be a minimum of 85% of its initial strength.

The brass material used mainly for header plates and tanks:
The tensile and yield strength after 4 minutes holding time at 650°C should be a minimum of 90% of the initial tensile strength.

The material should be able to be formed and deep drawn.

The braze filler material should be of a type with a solidus temperature of minimum 600°C.

The brazing filler metal can be applied either as a paste or as a rapid solidified foil. The following compositions ensure the quality of a CuproBraze® process:

	Cu [wt.-%]	Sn [wt.-%]	Ni [wt.-%]	Zn [wt.-%]	P [wt.-%]	Melting range [°C]
OKC 600	Balance	15,6	4,2	-	5,3	600-610
VZ2255	Balance	9,3	7,0	1,0	6,5	600-630

Maximum impurity limits are defined in accordance with ISO 17672 for Copper-Phosphorus Alloys (% by mass): Al 0,01, Bi 0,030, Cd 0,010, Pb 0,025, Zn 0,05, Zn + Cd 0,05; total of all impurities = 0,25.

OKC 600 is available as powder and used in various brazing pastes whilst VZ 2255 is available as foil.

The electro chemical potential should be of the same magnitude as the parent materials to be joined to minimize corrosion issues."

A typical cycle times is approximately 20 minutes.

When the thickest part of the core (headers) reaches the brazing temperature (650-670°C) the product should be transferred to the cooling section of the furnace. Oxygen level in the furnace should not exceed 20 PPM.

As part of the process time is allocated to cooling. The conditions under which the cooling takes place is strictly managed and critical to the end use performance.

Typical Equipment

Please refer to CuproBraze.com

New product development “Verification under development”

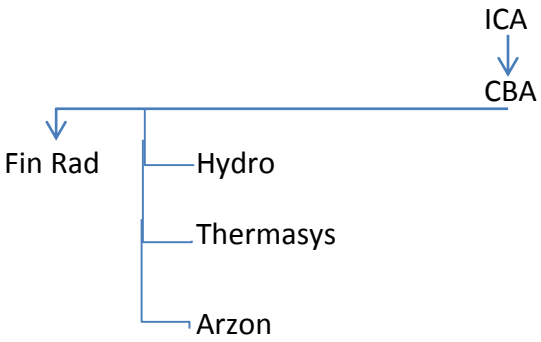
Provisions have been made for products under going product development that may wish to use the term Cuprobraze® in connection to the final output of the development. As a rule, all candidate products should in principle conform to the method and material composition of the CuproBraze® process. Any deviation from the recognized process including material treatment and new processing equipment should be declared to the CuproBraze Alliance before entering the market. Arrangements to submit such projects as early as possible can be made under confidentiality agreements for verification purposes. The CuproBraze alliance can indicate if such a development was submitted for use under the mark if there were any areas of concern.

Benchmark

Please insert an existing FinnRadiator specification

Licensing

A license to use the mark can be obtained through the CuproBraze Alliance by applying in writing to the CuproBraze Alliance secretariat. The written application should declare the intended use of the product, how it will be marketed and its makeup. Fully paid up members of the CuproBraze Alliance can use the mark free of charge. The International Copper Association reserves all rights to the mark.



Violations

Any breach of the recognized practices or materials laid out in this document could result in legal action using the full weight of the law related to service agreements and unfair trading practices.

For example action would be taken in the event of:

Infringments relating to the name of the company i.e. CuproBraze® in company name where the company is not providing 100% goods or products that meet the criteria laid out in this paper.

Infringements related to Materials where products or goods are not consisting of recognized CuproBraze® Materials.

Infringements related to materials which are inferior to recognized CuproBraze® materials that potentially affect the reputation of the Mark

Infringements related to materials that are demonstrably not based on Copper.

Infringements related to Methods/Equipment
Thermal Coating techniques/ furnaces that do not impart the required time and temperature resulting core performance that is weaker or perform badly in testing

Deviation from definitions laid out in the Patent related to CuproBraze®.

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