

HEAT EXCHANGERS

Who is gearing up with **CuproBraze**® ?



SHAAZ

“As long as the demand is present and our prices competitive, nothing can prevent us from exporting *CuproBraze* heat exchangers anywhere on the globe. We can supply *CuproBraze* charge air coolers to help Western truck and off-road manufacturers to meet their diesel emission requirements.”

- *Mr. Vladimir Kolotushkin,*
General Director of SHAAZ





Introduction

SHAAZ, one of Russia's leading radiator manufacturers, has become the world's largest producer of advanced CuproBraz® heat exchangers. CuproBraz, a technology for the next generation of automotive heat exchangers, is the result of more than 10 years of research and development by the International Copper Association (ICA), Ltd.

SHAAZ's strategic move to adopt CuproBraz gives it a head start in meeting the worldwide demand for more efficient, compact and environmentally-friendly radiators.

This case study examines the factors influencing SHAAZ's decision to make a shift to CuproBraz technology, its transition from old to new technology and the resulting impact on the company's competitiveness.

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THE MAIN PRODUCTION OF JSC "SHADRINSK AUTO AGGREGATE PLANT":

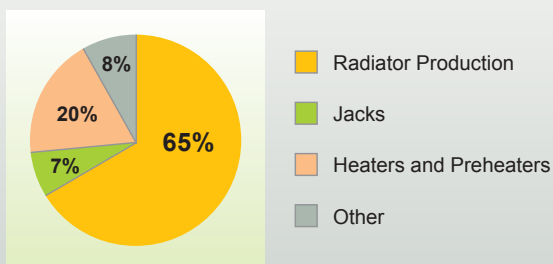


Fig 1: SHAAZ's product profile.

About SHAAZ

SHAAZ was founded as a branch of the Moscow Auto Plant on December 5, 1941. It later became part of the Ural Mining and Metallurgical Company (UMMC) in 1999. Shadrinsk, which is 2000 km (1,200 miles) from Moscow and situated just east of the Ural Mountains in South Western Siberia, is home to SHAAZ.

SHAAZ is certified according to GOST R ISO 9001-2001 (ISO 9001-2000).

SHAAZ produces different types of radiators:

- **Cooling system radiators**
- **Heaters**
- **Water coolers**
- **Oil coolers**
- **Charge air coolers**

Shaaaz also sells HF-welded tubes to other radiator manufacturers.



Applications and customers

SHAAZ radiators are used for the following applications:

- Trucks and buses
- Tractors and farm machines
- Minibuses and light trucks
- Cars

Of the total production, 52% of radiators are supplied to OEMs and 48% cater to the aftermarket (Fig 2).

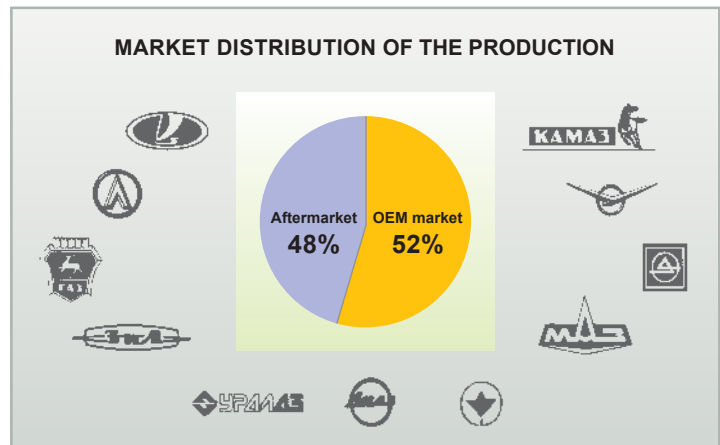
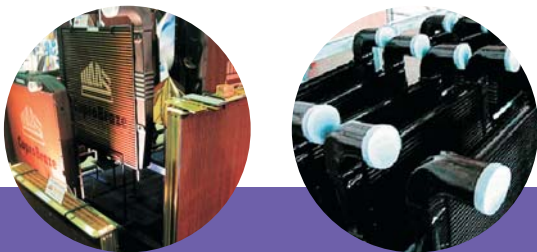


Fig 2

*Still more noteworthy,
SHAAZ is on its way to make inroads into
the western European market with CuproBrazed supplies.*

SHAAZ's customers include major vehicle producers in Russia, such as KAMAZ, GAZ, URALAZ, UAZ and VAZ, and also MAZ in Belarus.

Still more noteworthy, SHAAZ is on its way to make inroads into the western European market with CuproBrazed supplies.



● SHAAZ's Strategic Move to adopt CuproBrazed

The following two factors influenced SHAAZ's move to adopt CuproBrazed:

- Gaining competitive advantage with CuproBrazed technology
- Growing domestic and international demand for superior heat exchangers

Growing demand for superior heat exchangers

Many Russian leaders view the establishment of a globally competitive auto and truck industry as the key to the country's economic growth. As a result, SHAAZ expects a healthy demand for its mobile heat exchangers in its domestic market.

Western vehicle manufacturers in Russia are considering partnership with SHAAZ because of its advanced technology. These partnerships would create additional opportunities for SHAAZ to export its products.

Growing domestic and international demand for superior quality radiators prompted SHAAZ to search for advanced technologies and they identified CuproBrazed after much research and deliberation.



Gaining competitive advantage

The following unique benefits of *CuproBraz*e enable SHAAZ to gain competitive advantage over other manufacturers that are hampered by their commitments to the 30-year-old aluminum-based technologies:

Unique benefits of *CuproBraz*e

- **ENVIRONMENTALLY-FRIENDLY**

*CuproBraz*e is lead-free and truly an environmentally friendly process. In addition, as no rinsing is required, there are no flux residues to worry about.

- **GREATER STRENGTH AT HIGH TEMPERATURE**

The new copper fin and brass tube alloys retain their high strength levels well at elevated temperatures. This feature is a clear advantage versus corresponding aluminum alloys, especially in the future charge air coolers with elevated operating temperatures (Fig 3).

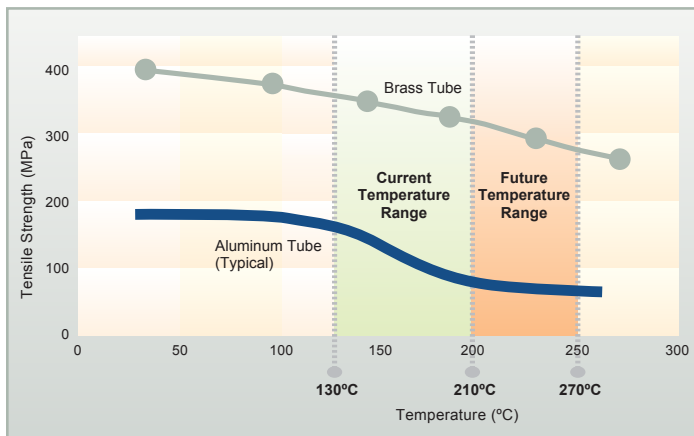


Fig 3

- **THINNER MATERIAL AND MORE COMPACT HEAT EXCHANGERS**

Special copper alloys used in the *CuproBraz*e process allow thinner gauge of material and more compact and efficient designs.

- **FLEXIBILITY**

*CuproBraz*e process is more flexible than an aluminium brazing process. "We like *CuproBraz*e because we can run a variety of products on the same high-volume production line," says Mr. Vladimir Kolotushkin, General Director of SHAAZ.

Establishment of *CuproBraz*e production line

SHAAZ's transition to *CuproBraz*e technology was both smooth and fast. It involved establishing a production line in 12,000 square meters (130,000 square feet) of floor space by installing the following major equipment:

- **Continuous belt furnace**

The heart of the *CuproBraz*e production is a continuous belt furnace for brazing the heat exchanger cores in a nitrogen atmosphere.

- **High frequency tube mill**

The tube mill converts brass strips into tubes. The brass strip is folded and the sides are rapidly welded together in one smooth operation.

- **Corrugated fin machine**

The corrugated fin machine converts copper strip into fins. A variety of fin designs can be fabricated, depending on the application.

Besides the above equipment, the plant includes automated tube spray and header slurry machines and the semi-automated core assembly machine.



SHAAZ's CuproBrazed Production Process

Essentially, a CuproBrazed mobile heat exchanger is made from fins, tubes and headers. The tube mill converts brass strip into tubes. The corrugated fin machine converts copper strip into fins.

The folded fins are inserted between the tubes. A brazing alloy is sprayed onto the external surface of the tubes by a tube spray application machine. Header plates, which include the holes into which the tubes are inserted, are also applied with slurry.

Once the tubes and headers are coated with spray and slurry, a semi-automatic assembly machine assembles the heat exchanger.

Finally, the assemblies are placed on the conveyor belt of the brazing furnace. By the time the heat exchanger leaves the furnace, the core unit is completely brazed.

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Current status and future

SHAAZ is currently producing the following CuproBrazed products:

- Radiators
- Charge Air Coolers
- Oil Coolers

By the end of year 2006, the new CuproBrazed plant will have a manufacturing capacity of 450,000 heat exchangers, including 250,000 charge air coolers per year, making it the largest CuproBrazed production line in the world.

"With the establishment of the capacity to manufacture CuproBrazed heat exchangers in volume, SHAAZ will increase the scope of its market to include OEMs and aftermarket dealers throughout the world," summarises Mr. Vladimir Kolotushkin.

"While we will continue to be a key supplier to the auto and truck industry in Russia, our goal is to export 50 percent of our production capacity. Our global competitiveness will be a key measure of our success, and CuproBrazed technology will be a key ingredient in that success."

The essence of CuproBraz

CuproBraz is the latest technology for the next generation of heat exchangers. It has been developed by the International Copper Association, Ltd (ICA) and is being implemented by members of the CuproBraz Alliance.

Key features that distinguish CuproBraz from other heat exchanger technologies are:

- **Special copper alloys and brazing alloy**

The tube material is 85% Cu brass with about 1% Fe to prevent softening of the material during the brazing operation. The copper fin alloy is of dispersion hardening type (Cr-alloyed).

The new brazing filler metal, called OKC 600, belongs to the CuNiSnP-family with melting temperature of about 600°C.

- **Brazing**

The special materials, with high melting points (Fins: 1083°C, Tubes: 1000°C ~1025°C and Header: 910°C ~930°C), prove suitable for brazing while retaining their strength. Thus, unlike the past when only soldering (<450°C) was feasible for copper heat exchangers, this new technology allows brazing (at about 650°C).



CuproBraz heat exchangers are more efficient, compact and environmentally-friendly. Charge Air Coolers (CACs) can withstand higher temperatures than the conventional equipment, thereby allowing the transportation industry to tackle the twin challenges of reducing emissions and increasing fuel efficiency.

- **Fewer steps in manufacturing process**

CuproBraz does away with many of the steps involved in conventional manufacturing process (see Figs 4 and 5).

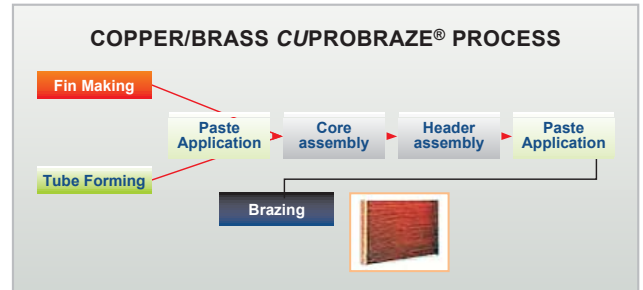


Fig 4

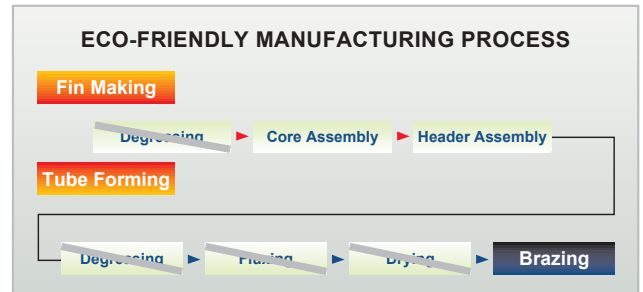


Fig 5

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A publication of the



The CuproBraz Alliance is a strategic industry marketing group of suppliers of machines, parts and raw materials.

Its mission statement is to drive the widespread adoption of the CuproBraz process and to provide services to its member companies.

If you are interested in getting started with CuproBraz or knowing more about it, please visit the web site of the CuproBraz Alliance at:

www.CuproBraz.com

If you have any questions or need more information, please write to:
info@cuprobraz.com

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