

CuproBraz®

EXECUTIVE *Report*

Advanced Brazed Copper-Brass Now In Select Passenger Cars

CuproBraz Favored over Aluminum Heat Exchangers

The newest factor influencing the replacement of aluminum by brazed copper-brass in passenger cars is heat exchanger design. CuproBraz® is a new technology, and the “design space” of new heat exchangers is just beginning to be explored in full. In contrast, designs of aluminum radiators for passenger cars have been refined and improved for nearly three decades, so they are as good as can be.

A well-designed copper-brass radiator offers greater cooling efficiency than an aluminum radiator, which means it can provide the same cooling capacity in a smaller envelope. For this reason, companies like RADAC often receive aftermarket orders for radiators for high-performance racing cars.

For the same reasons, Astro Air makes OEM heat-exchanger cores for Hummer, Ford GT, Lotus and Rover. According to Zach Riddlesperger, Vice

President of Operations for Astro Air, Jacksonville, Texas, “We are doing quite a bit of business and most of it is with passenger vehicles. Copper-brass heat exchanger cores can be made smaller and that is the main reason why our customers keep coming back to us. They are specifying CuproBraz in select passenger vehicle applications, and one gets the idea that the design engineers have in mind applications for high-volume production vehicles.”

The many advantages of brazed copper-brass apply as well to any type of vehicle. Initially, OEM production of CuproBraz heat exchangers was focused on heavy-duty, on-highway diesel truck and off-road diesel equipment applications, where soldered copper-brass was already well established as the preferred technology. In these applications, CuproBraz makes a good product better.

Companies such as Berry Radiateurs in France, SJT in Finland and RADAC in the United States have been filling orders for a variety of heat exchanger

cores for these types of vehicles. In many cases, the orders are for replacement cores for existing OEM products, so little or no design work is required. Some exceptions do occur, however; for example, SJT converts many applications from soldered flat-fin to brazed corrugated-fin radiators, which are less labor-intensive to make. Nonetheless, as far as the end-user is concerned, the only difference is that the new CuproBraz radiators are more durable than the soldered copper-brass or aluminum cores they replace.

Now the situation appears to be changing in the passenger-car parts marketplace, for two reasons. The first is that CuproBraz designs are catching up with aluminum designs for passenger vehicle applications. The second reason is that CuproBraz manufacturers are gaining confidence in the scalability of the process. They are becoming more adept with the new technology, and several high-volume manufacturing plants are now in operation.

High-Volume Production

SHAAZ now has nearly four years of experience in high-volume production. Its integrated charge-air-cooler and radiator package is used in nearly all of the new designs of URAL trucks. Different heat exchanger designs are used by other Russian truck manufacturers. CuproBraz radiators can now be found in IVECO trucks, a well-known brand that is available in Europe as well as Russia. This kind of production and field experience has established the CuproBraz process as a viable technology for the automotive industry.

The latest word from SHAAZ is that its heat exchangers are now being used in Izh passenger vehicles. And why not? All of the benefits of copper-brass over aluminum attach equally well to passenger cars as to heavy-duty trucks.

The only real obstacle to switching from aluminum to copper-brass is to build production facilities large enough to supply passenger car radiators made of copper and brass in high volumes, to meet the demands for hundreds of thousands or even millions of radiators per year.



A CuproBraz radiator can be found under the hood of this passenger car from Izh, the first of possibly many car-makers who will switch from aluminum to copper-brass radiators.

The International Copper Association, Ltd. (ICA)

is the leading organization for the promotion of the use of copper worldwide. The Association's 29 members represent about 80 percent of the world's refined copper output, and its six associate members are among the world's largest copper and copper alloy fabricators. ICA is responsible for guiding policy, strategy and funding of international initiatives and promotional activities.

With headquarters in New York City, ICA operates in 28 worldwide locations through a network of regional offices and copper development associations.

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A pick-up truck is part passenger car and part commercial workhorse. It also represents an intermediate volume of production between heavy-duty trucks and passenger cars. Not surprisingly, CuproBrazef radiator designs are in development for pick-up trucks. Major OEMs are seriously considering scaling up CuproBrazef production for this application. In terms of production volumes, the leap from



These passenger vehicles derive benefit from the space savings advantages of advanced CuproBrazef heating units. See text for manufacturers; images are from websites.

pick-up trucks to passenger cars is not large.

As is well known, any aluminum surface forms a hard layer of aluminum oxide immediately upon exposure to oxygen. This surface is corundum, which is noted for its hardness. (Rubies and sapphires are also made of corundum, with impurities imparting their distinctive colors.) Needless to say, corundum-coated aluminum is nearly impossible to braze or weld. The same surface makes aluminum brazing furnaces much more complicated than CuproBrazef furnaces, because extremely corrosive fluorine-containing chemicals must be used to remove the oxide layer before aluminum can be brazed. For the same reason, the repair of aluminum heat exchangers is impractical.

For manufacturers then, there is considerable motivation to switch to copper-brass production, because the processes are easier to manage, while cooling performance and durability is as good or better. For end-users, among other advantages, if a leak should

develop in a CuproBrazef radiator then, unlike for aluminum radiators, the leak can be easily repaired, resulting in major savings.

Environmental Benefits

Not to be overlooked are the significant environmental benefits accrued by switching from aluminum to copper-brass. First, the production of aluminum from raw materials requires a large input of energy. Unfortunately, the aluminum alloys used in passenger-car radiators do not lend themselves well to recycling, and they cannot be made from recycled aluminum.

The production of a ton of aluminum consumes 75 MWh. Just one megawatt-hour of energy from burning hydrocarbons releases about 1000 kg of greenhouse gases into the atmosphere [1]. The release of millions of tons of greenhouse gases could be avoided by using copper and copper alloys instead of aluminum. Copper is highly recyclable so the use of copper-brass heat exchangers represents a sustainable technology.

Also, as more passenger cars are powered by clean diesel engines, it is possible to reduce energy consumption. Copper-brass is preferred for clean

diesel engines because of the elevated operating temperatures planned for the next generation of these engines [2]. Brazed copper-brass could be an enabling technology for a new generation of energy-efficient passenger vehicles.

Conclusion

The trend today is toward a great variety of passenger vehicles. Given the advantages of copper-brass over aluminum, more and more makes and models are expected to adopt CuproBrazef for heat exchanger cores. As older production facilities are phased out and new facilities built, especially in the emerging automotive industries of Russia and China, automakers and design engineers will consider CuproBrazef instead of aluminum. ■

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