

EXECUTIVE Report

Climex World to Make Copper-and-Brass Radiators and Charge Air Coolers

Mexican Company Brings CuproBraze CAC Production to North America

With its low manufacturing costs and proximity to the United States, Mexico has become a key player in the global automotive industry. The automotive segment was the country's largest and fastest-growing manufacturing sector in both 2005 and 2006, according to a report from the U.S. Commercial Service, a branch of the U.S. Department of Commerce. Mexico is currently eleventh in the world in automotive production, says the report, and will rank fifth by 2011.

As worldwide demand for automotive parts heats up, Mexican manufacturers must be ready to deliver. A spinoff of Mexican radiator manufacturer Proveedora de Herramientas y Accesorios para Radiador (PHAR), Climex World is a pioneer in this regard. Since 1999, Climex World has been making steel components including large, heavy-duty radiator frames and tanks for the radiators manufactured by PHAR.

With more than 30 years of combined manufacturing experience and market knowledge, Climex World and PHAR continually seek efficient and innovative production processes. CuproBraze, a breakthrough technology for producing heat exchangers, is one such process.

A Dedicated CuproBraze Plant in North America

Climex World recently completed the new construction of a 53,800-square-foot (5000 m²) facility near Monterrey, Mexico in Escobedo, Nuevo Leon, which will be dedicated solely to the production of CuproBraze radiators and charge air coolers (CACs).

As the company ramps up production, it becomes the first in North America to manufacture brazed copper-and-brass charge air coolers in volume.

Brazed copper-brass CACs are new to the auto industry. Previously most CACs were made from aluminum. This new generation of CAC is made from anneal-resistant CuproBraze alloys, including CuproBraze brass alloys for the tubes and headers and a CuproBraze copper alloy for the internal turbulators and fins. These special alloys remain strong despite being heated to the high temperatures necessary for brazing.

Aftermarket in Volume

The new CuproBraze plant enables Climex World to provide aftermarket customers across the North American continent with CuproBraze products in volume. The company plans to deliver 12,000 CACs and heavy-duty radiators on a monthly basis, with full production starting at the beginning of the second half of 2007. Climex World will produce charge air coolers for heavy-duty trucks, initially with an estimated production rate of 500 CACs per month and increasing production as the year progresses.

Plans for the inaugural year also embrace the production of radiators and oil coolers for the aftermarket, including replacement parts for on-road heavy-duty trucks, industrial and construction vehicles, agricultural equipment, buses and electric power generators. Climex World's prior expertise in manufacturing frames and fittings allows its heat exchanger cores to be matched to a wide variety of original equipment part numbers. For example, it is ready to produce ready-to-install CuproBraze radiators as exact replacements parts, corresponding to specific



part numbers that are used in heavy duty, on-road trucks.

“We can replicate the dimensions of an original, conventional aluminum CAC, replacing it with the benefits of *CuproBraz*e CAC technology,” explains Jorge Warnholtz, who is now the plant manager for Climex World’s *CuproBraz*e plant. “We can do the same for radiators. This gives us a major advantage.”

The Benefits of Using *CuproBraz*e Technology

Climex World was introduced to the *CuproBraz*e technology in mid-2002 in Monterrey, Mexico, at a seminar jointly hosted by Luvata (then Outokumpu Copper Strip) and the International Copper Association. “The advantages of *CuproBraz*e over other heat exchanger technologies were clearly evident from the beginning,” says Warnholtz.

Durability is one key advantage. Brazed copper-brass is superior to soldered copper-brass radiators with respect to fatigue, thermal properties and corrosion resistance and very competitive with brazed aluminum radiators, too. Aluminum, if not grounded

The new dedicated *CuproBraz*e facility includes a high frequency, tube-welding system that will enable Climex World to economically produce *CuproBraz*e charge air coolers.

correctly, is also susceptible to corrosion. The *CuproBraz*e method of brazing copper and brass in a furnace at 650 °C produces much stronger joints. The anneal-resistant alloys ensure that the radiator cores retain their strength and flexibility despite exposure to high brazing temperatures. The high copper content contributes to improved resistance against stress corrosion cracking and dezincification.

“Cores made from copper and brass disperse more heat per unit volume than any other material system,” explains Warnholtz. “Aluminum charge air coolers need to be built with thick-walled tanks and tubes because aluminum is not as strong or tough as brass. Likewise, aluminum fins are not as strong as copper fins so they need to be approximately twice as thick as copper fins.”

Consequently, according to Warnholtz, *CuproBraz*e products can be made with thinner materials, *i.e.*, lighter-gauge metal strips. “More fins and tubes can be accommodated in a given frontal area, which is

exposed to air flowing into the front of the truck,” he says. “This gives the *CuproBraze* product more cooling efficiency for the same dimensions of core and contributes to better performance.”

Technology to Aid in Emissions Reduction

CuproBraze products are also suited to aid engine/vehicle manufacturers in complying with stringent environmental legislation in Europe, Japan and the United States. New laws call for a dramatic reduction in the oxides of nitrogen released from heavy-duty truck engines and off-road diesel engines. Engine technologies that reduce the nitrogen oxides (NOx) released from diesel engines, such as exhaust-gas recirculation, result in significantly higher operating temperatures. *CuproBraze* charge air coolers can cope easily with higher temperatures, and the greater strength of brass can withstand high pressure.

Now with the production capability of the new Climex World plant available, truck owners have a reliable source for aftermarket *CuproBraze* copper and brass CACs. Finally, there is an alternative material system to aluminum. This means that clean diesel engines can be designed to work with *CuproBraze* CACs operating at higher temperatures and pressures than was previously possible.

The Importance of Repairability

Repairability is a major advantage of the *CuproBraze* technology over other material systems. *CuproBraze* products are easily repairable in the field since the application of solder can quickly fix leaks that may develop in heat exchangers. When heavy-duty vehicles are traveling in remote areas over rough roads, owners and operators cannot afford to deal with frequent failures of cooling systems.

Repairability is a big issue in certain applications and more so in combination with rugged

terrains. Canadian end-users are eager to obtain *CuproBraze* products, which will be available by placing orders through Climex World’s distributors. “With *CuproBraze*, we can offer better solutions for severe-duty environments found in such applications,” says Warnholtz.

Continental Reach

Climex World initially will distribute *CuproBraze* products through PHAR’s network of more than 30 distribution centers in major Mexican cities, from Tijuana to Mérida. PHAR owns seven of those warehouse facilities.

Customers within the Canadian and U.S. market will be serviced through the network of knowledgeable distributors located in these countries.

Due to the strategic location of its new plant, the company is well connected to every part of Mexico, the USA, and Canada. The Climex World plant is located outside of Monterrey in the city of Escobedo, situated 220 kilometers (137 miles) from Laredo, Texas, which is the busiest port of entry on the U.S.-Mexico border.

Climex World is the first North American company to produce *CuproBraze* CACs, which will be available as replacements on the aftermarket.



The International Copper Association, Ltd. (ICA)

is the leading organization for the promotion of the use of copper worldwide.

The Association's twenty-nine 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.

For general mailing information about the *CuproBraz*e process or ICA's *CuproBraz*e consulting services, please contact International Copper Association at: mrosario@copper.org.

For technical information contact: cuprobraz@copper.org.

For European inquiries contact: ndc@eurocopper.org.

Above right: Climex World is training its workforce on the assembly and processing of brazed copper-brass heat-exchangers. Its expertise in the manufacture of frames allows it to produce heat exchangers for a large range of truck makes and models.



Building a Competitive Advantage

Warnholtz foresees very positive prospects for the growth of Climex World. "The company continues to invest in cost-effective machinery and skilled labor for the optimization of the production processes," he explains. "A high percentage of the tooling and equipment is specially designed for the products we manufacture. We are developing much of that equipment internally. That will help the company to remain a key competitor in this market for a long time."

For its *CuproBraz*e production, Climex World has invested in a semi-continuous, controlled-atmosphere brazing (CAB) furnace. In addition, Climex World owns a high-frequency (HF) welded tube mill and manufactures its own internal turbulator and external fins, headers and side channels.

Climex World's *CuproBraz*e products are drawing interest. The company displayed the charge air cooler it manufactures for off-road trucks at the National Automotive Radiator Service Association (NARSA) Convention and Trade Show last year and plans to show-

case its *CuproBraz*e products at upcoming industry events.

"As customers visit our exhibit booth and learn about the impressive benefits of *CuproBraz*e, it triggers further interest in the products," says Warnholtz. "With *CuproBraz*e we can demonstrate superior performance and durability."

"Couple that with the favorable economic conditions in Mexico," he adds, "and you have a very positive outlook for the future of Climex World and *CuproBraz*e." ■

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See www.cuprobraz.com for additional materials suppliers, equipment makers and heat-exchanger manufacturers.