

THE POWER OF COOLING

Expansion into larger coolers for power generation highlight expanded global R&D.

By **Roberta Prandi**

Raise your hands, those who think there is not much work going on behind the development and manufacture of coolers. I am reasonably sure at least a few hands are rising.

A recent visit to the Cooling System division of Hydac proved this belief quite wrong, as there is indeed a lot of analysis, research and testing behind the development and production of coolers.

Hydac Cooling Systems develops cooling systems for industrial, mobile, and power generation applications; for the latter, it is mainly systems for the lubricating oil circuit in gas turbines, and for the thermal management of diesel and gas engines in generator sets.

Over the last two years, Hydac received orders for more than 100 units from a well-known engine manufacturer, consisting of the design and manufacturing of a cooling system suitable for a 3.5 MW diesel generator used for emergency duty in data centers in several locations in Europe and in the U.S. The cooling package has an overall dimension of 10.5 x 10.8 ft. (3.2 x 3.3 m) and fits in the front part of a non-standard container.

Alessandro Ferrario, product manager for the Electric Power Generation market at Hydac, explained that the package is composed of a twin-set of vertical standing stacked coolers for the engine's



After the brazing process of the core element in Hydac's coolers, the components pass through a press to eliminate deformations and are then prepared for welding, an operation carried out with dual-arm welding robots for the largest elements.



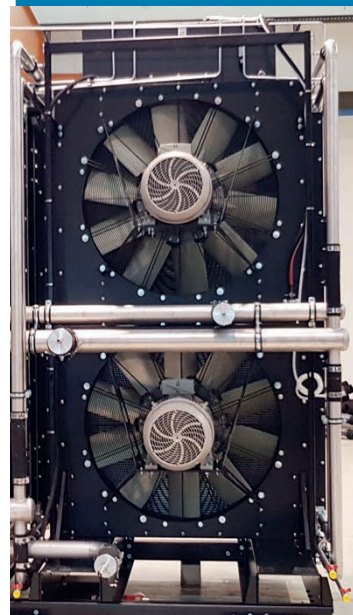
low and high temperature circuits and utilizes a ventilation system made by four fans driven by AC motors in inverter duty.

SAVING SPACE

The package integrates the expansion tanks with level sensors for both circuits, interconnecting pipework and the structural base frame to handle the entire equipment. According to Hydac's customer, this solution has significantly reduced both the space demands for the installation of the cooler and the time to assembly into the container.

While Hydac is a multinational

A Hydac cooling system designed for a 3.5 MW emergency diesel generator used in a data center application. The package features a twin-set of vertical standing stacked coolers with a four-fan ventilation system driven by AC motors.



company mainly active in the production of hydraulic accumulators and fluid filters and headquartered in Germany, a branch of the Cooling System division is located in Tradate, Italy, and Mezzovico, Switzerland, where engineering, assembly, test and R&D departments are located. Testing equipment includes a wind tunnel and test benches for pulsations, thermodynamics performances and thermal shocks.

Cooling systems by Hydac are manufactured from aluminum alloys, using a patented brazing process. The cooler design is based on bar-plate technology, which is particularly

applicable for industrial, power generation and off-highway applications, Hydac said.

The inherent features of this technology allows cooling systems to have a more compact footprint than conventional coolers and is particularly robust against the demanding operation conditions of heavy-duty applications. The radiators can be made using different types of air fins, to match with the conditions of the installation's environment, and can be combined with different types of turbulators suitable for the fluid's physical properties such as viscosity, temperature and density. The thicknesses of the cooling element can vary from 1.77 to 6.3 in. (45 to 160 mm), while the dimensions of the core can reach the limit size of 59 x 94 in. (1500 x 2400 mm) for each element.

"Each application design is tailored and unique, so that Hydac Cooling System can be actually considered an engineering company, which also happens to manufacture radiators," said Giuseppe Candiani, general manager, Hydac Cooling Systems.

GLOBAL MANUFACTURING

The manufacturing of these systems is done in the company's Tradate plant for Europe and in the Hydac's branches in Denver, N.C., and Shanghai, China. Ferrario said the quality and manufacturing standards are the same across the three sites, to guarantee the highest level of consistency of the product wherever it is manufactured.

The manufacturing process starts with the quality inspection of the raw material: aluminum coils and extruded profiles. The quality lab is equipped with tools for metallurgical analysis and laser devices for the analysis of the alloys' chemical composition. Ongoing improvements on the design of the radiator mainly focus on optimizing the geometries of the components and the quality of the brazing process to reduce the level of scraps from production and defective components.

One of the most critical processes in the manufacturing is the brazing of the core of the cooling element. Hydac adopts a Controlled Atmosphere Brazing (CAB)

LOW NOISE

One important feature of these coolers is the low noise emissions, thanks to the use of a ventilation system with electronically-controlled variable speed motors (VSD fans), that makes it possible to automatically adjust the fan speed according to the ambient temperature and fluid conditions. This is beneficial also to the overall efficiency of the cooler and the gen-set. Ferrario pointed out how, particularly for prime power and continuous operation, the amount of energy saved over time is turned into fuel saving and increased power output from the generator, while the engine is maintained its ideal operating temperature range.

In the case of low ambient temperatures, it is also possible to reduce the cooling air flow from each fan, to mitigate the unwanted effect of cold air inside the engine compartment.

Ferrario explained that other configurations of the products are possible, as well as several other options for the fan operation such as hydraulic motors and control equipment, brushless motors and others.

oven in the Tradate and Denver facilities. The components then pass through a press to eliminate deformations and finally through welding preparation. The welding of the tank along the side of the core is carried out with dual-arm robots for the largest elements, or manually by certified welders.

Ferrario said the quality level of the manufacturing process is constantly monitored: all the cooling elements are tested for leakages in a water tank and the complete package passes through a pressure decay test.

"The design of the coolers is very robust and thus ideal for heavy-duty applications in extreme environments," he said. "Our latest developments have moved in the direction of manufacturing larger sizes of coolers which are meant for power generation applications." ■

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