Transcritical CO_2 in Climates Above 40°C ? No Problem, Says Epta

The Italian OEM has updated its FTE system and introduced an Extreme Temperature Efficiency (ETE) system that optimizes CO_2 refrigeration in very warm environments.

An Epta FTE installation in Benicassim, Spain.

In March 2017, at the triennial EuroShop trade show in Düsseldorf, Germany, Italian natural refrigerant OEM Epta launched the Full Transcritical Efficiency (FTE) solution for improving the efficiency of CO_2 refrigeration systems in any country with any external temperature.

The patented FTE system, Epta said, was based on a very simple design, whereby a low-pressure liquid receiver is used to flood medium-temperature cabinets with liquid CO_2, eliminating superheat and allowing the evaporation temperature of the cabinets – and, ultimately, the efficiency of the system – to increase.

"Eliminating superheat by flooding the evaporators is the key to increasing efficiency in all climates and during the whole year," Francesco Mastrapasqua, Epta's Advocacy and Regulatory Affairs Manager, said at the time.

Over the past three years, the FTE systems have been widely installed in Europe and the rest of the world, and brought to North America following Epta's acquisition of Kysor Warren last year. (See "Kysor Warren EPTA US takes on North America," *Accelerate Magazine*, June 2019.)

In February of 2020, at the most recent EuroShop in Düsseldorf, Epta was back with an updated version of FTE called FTE 2.0, and an entirely new technology called the Extreme Temperature Efficiency (ETE) system. ETE takes the notion of operating transcritical CO_2 systems in hot climates to the next level.

Following several tests and projects worldwide, including very hot-climate countries like Australia, both FTE 2.0 and ETE are now commercially available.

The two technologies have been developed as part of the Life-C4R project, co-funded by the European Union.

Like the first FTE system, the new FTE 2.0 relies on flooded evaporation technology to achieve its efficiency. But now, Epta has integrated the low-pressure receiver into the power rack, meaning that no extra space is needed in the technical room, which results in reduced installation and start-up time.

The FTE 2.0 also has an Android/IOS app that provides performance updates, diagnostic alarms, and recommendations for optimization of system operations.

FTE 2.0 can be combined with heat reclaim without losing any efficiency. "With a simple additional heat exchanger, we can use the exhaust heat from refrigeration for space heating, which does not affect the performance of the refrigeration equipment," Mastrapasqua explained.

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Like the new FTE 2.0, ETE is a very simple solution, allowing end users to run their CO_2 refrigeration systems in all types of climates, even at temperatures higher than 40°C (104°F), according to Mastrapasqua.

"It is an advanced technology using only an additional compressor with a heat exchanger – no complex control logic or any sophisticated component."

ETE will normally be incorporated into a transcritical CO_2 rack, but can be viewed as an "accessory," Mastrapasqua said. The heat exchanger subcools a portion of the CO_2 coming out of the gas cooler, and delivers the refrigerant expanded to an intermediate pressure level by the EEV (electronic expansion valve) to the high-pressure line. This ensures there is no performance loss in warm and hot climates, and at the same time increasing the total energy efficiency, according to Mastrapasqua.

FTE 2.0 and ETE can be used together and are "complementary technologies," Mastrapasqua stressed, helping each other perform "very efficiently," even at very high temperatures.

The ETE can be used for both commercial and industrial refrigeration, improving the energy efficiency of any transcritical CO_2 rack, said Mastrapasqua

Epta racks with ETE are modular, and scalable, meaning that there's no limit to capacity in larger industrial applications, according to Mastrapasqua.

Epta recommends ETE for areas where the temperature is between 30°C and 40°C (86°F and 104°F) for most of the year, making it suitable for the Mediterranean or the Middle East.

"But if you want to get the best performance from your system above 40°C (104°F) – and up to 50°C -55°C (122°F -131°F), you really need both FTE 2.0 and ETE," Mastrapasqua said.

"Using the ETE gives you an effect like if you are reducing the ambient temperature by 10°C -15°C (18°F -27°F)," he added. "You save 15% to 20% energy in those conditions, with no performance loss."

A key selling point of the FTE and ETE technology, according to Mastrapasqua, is that both are "super simple" to install and operate, compared to competing technologies like ejectors and parallel compression. "Mechanically, the FTE system operates with the same components as a basic CO_2 transcritical system, plus the low-pressure liquid receiver – components that any refrigeration company knows very well."