ATMO America: Epta's ETE Technology to be Installed in First U.S. Store, Says Kysor Warren

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Ignacio Chaparro, Kysor Warren, at ATMO America 2023.

Commercial refrigeration manufacturer Kysor Warren is introducing Extreme Temperature Efficiency (ETE) technology to the U.S. market, with the first installation scheduled for the coming months.

According to Ignacio Chaparro, Sustainability and New Technologies Manager at Kysor Warren, the U.S. subsidiary of Italy-based Epta Group, Epta's ETE technology will be integrated into a 146.5kW (41.7TR)-capacity transcritical CO_2 (R744) refrigeration system for a commercial application.

Multiple installations are also in the pipeline for the U.S. in 2024, he added.

Chaparro delivered these remarks during his presentation in a Refrigeration Case Studies session at the ATMOsphere (ATMO) America Summit 2023 on natural refrigerants. The conference took place June 12–13 in Washington, D.C., and was organized by ATMOsphere, publisher of R744.com.

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Efficiency improvements

While CO_2-based refrigeration systems work well in mild climates, efforts are needed to improve performance in high-ambient-temperature conditions when they operate in transcritical rather than subcritical mode, Chaparro explained in his presentation.

"In cold-weather conditions, CO_2 systems are efficient, reliable and have good energy consumption," he said. "What we need to do is improve how they operate in transcritical mode."

When ambient temperatures increase, so too does the formation of vapor inside a CO_2 system's flash tank, he noted, adding that this leads to inefficiencies with the system's medium-temperature compressors.

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According to Chaparro there are multiple ways to improve the efficiency of a CO_2 system in hotter climates, and many companies have been developing a range of technologies, including mechanical subcooling, adiabatic cooling, parallel compression and ejectors with parallel compression.

"Each technology has its benefits," he said. However, as they evolve, "we must make sure that they are efficient, cost-effective and simple for end users to adopt."

Extreme Temperature Efficiency

Over the last seven years, Epta has also been developing technologies with the aim of boosting the performance of CO_2 refrigeration systems. Its focus has been on making simple improvements, said Chaparro.

One of the advancements to have come out of Epta's efforts has been its ETE technology, which helps to reduce the formation of flash gas in the flash tank in mild-to-high ambient temperatures. ETE works by adding an extra compressor and some other components to the system after the gas cooler.

"We are cooling the line that comes out of the gas cooler rather than cooling the liquid line, as is common with mechanical cooling in HFC-based systems," he explained.

The approach uses simple components that technicians are familiar with, such as compressors, plate heat exchangers, expansion valves and controls.

"These are components that they normally use; there is nothing new that the technicians have to learn," he said. "They just need to apply them in a different position in the system."

The ETE compressor turns on in higher ambient temperatures and turns off again when temperatures are lower, he added.

According to Chaparro, ETE is more efficient than systems using parallel compression and uses fewer resources like water, which is required when employing adiabatic gas coolers.

Etpa's ETE technology, which was first developed in Europe, is currently used in around 200 food retail stores across the continent. There are also some installations in the Middle East and Australia.

ETE in the U.S.

During his presentation, Chaparro shared a design example for a transcritical CO_2 booster system in Phoenix, Arizona.

The city frequently experiences high ambient temperatures, recently setting a record with 31 consecutive days of temperatures above 110°F (43.3°C).

In this heat, a regular booster system with no additional technologies will produce gas cooler outlet temperatures around 113°F (45°C), producing around 63% vapor and 37% liquid in the flash tank. In turn, this would result in the medium-temperature compressors running inefficiently to recompress the vapor in the system. It would also significantly reduce the system's cooling capacity.

With the addition of ETE technology, the gas cooler outlet temperature is reduced to around 86.3°F (30.2°C), and the amount of vapor in the flash tank is reduced to 29%. This would roughly halve the amount of energy required to recompress the vapor in the system and increase its overall cooling capacity.

Similar results have been seen at a 16,000ft^2 (1,486m^2) supermarket in Ellenbrook, Western Australia, during ambient temperatures of 118°F (47.8°C). Epta's ETE technology reduces flash gas production by 81%, medium-temperature compressor energy use by 35% and overall system energy use by 18%.

Extra Transcritical Efficiency

In addition to its ETE technology, Epta has also developed Full Transcritical Efficiency (FTE) technology, which employs a low-pressure liquid receiver to flood medium-temperature evaporators with liquid CO_2. This eliminates superheat and increases the evaporation temperature in a store's refrigerated cabinets.

This year, Epta introduced on a new technology – Extra Transcritical Efficiency (XTE) – which was announced at the EuroShop trade show in March. The XTE technology includes Energy Recovery's PX G1300 pressure exchanger, which has been found to boost the efficiency of Epta's CO_2 refrigeration systems by more than 30% at ambient temperatures above 104°F (40°C). The pressure exchanger was named Innovation of the Year at the ATMO Awards/North America at ATMO America Summit 2023 in June.