

success story



Transcritical CO₂ in Italy with CAREL it is a reality

where

Kanguro supermarket
• Belluno, Italy

what

CO₂ system:

- Epta - Series ECO2-small transcritical
- CAREL remote management
- CAREL electronics

why

- full green solution,
- natural refrigerant,
- energy savings,
- single board control

when

- September 2012

CAREL retail system in CO₂ transcritical installation "Il Kanguro" in Belluno

Thanks to the cooperation between Il Kanguro supermarkets, Epta-Costan and CAREL Industries, the first "full green supermarket" has been created in Belluno. In fact, the refrigeration system uses CO₂ for medium and low temperatures in direct expansion (transcritical cycle). Belluno was strategically chosen as the first Italian city for the installation of the first Epta-CAREL transcritical installation for:

- The consolidated attention of the "il Kanguro" supermarket chain, which is primarily located in the Alpine area and has always been environmentally friendly.
- The Epta Group's absolute mastery and experience in natural technologies and transcritical CO₂ in particular (machines designed and produced in the Limana plant)
- The efficiency, ensured by a climate where the average annual temperature is around 9 °C with rare maximum temperatures of 30 °C

There are numerous objectives in creating this system:

- To demonstrate to the Italian market that we can also use this type of technology in Italy with excellent return on investment
- To keep the cost of the system and space used for the machinery room low, the Epta control unit is considered to be the only one to manage both the TN and LT part and is provided in a plug-in all-in-one version
- To use this system for the direct in-field training of installers and maintenance technicians
- To prove the reliability and efficiency of this type of technology at these environmental temperatures
- To demonstrate how the CAREL solutions simplify the integration of this innovative type of technologies.

The use of specific Epta solutions for transcritical CO₂ operation managed by CAREL electronics makes operation on critical days not only possible but also efficient.



Series ECO2-Small Epta

The so-called TN/BT Booster system means the LT compressors compress the refrigerant from the low temperature evaporation (-35°C) temperature to the pressure of the intake line on the medium temperature compressors (-10°C).

The frame is extremely compact, made of sturdy, painted steel profiles, while the outlet pipes and every other component that can be damaged by vibrations are attached to it using special mounting collars. The thinner size makes it easier to move and install, even in smaller locations.



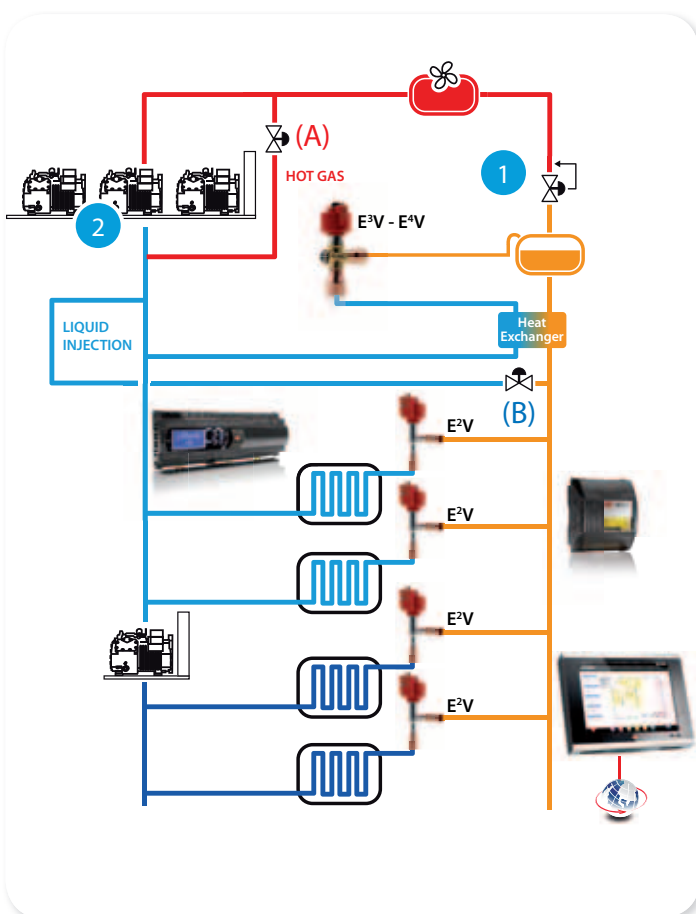
The compactness of the Booster Combi (2380x780x1800mm (LxDxH)) cooling plant, that is the TN and LT all-in-one, supplied ready to be connected to the utilities and gas cooler and tested in Epta's Limana laboratories, along with the choice of size and design, lead to a very small installation in terms of cost and space, very different from similiary machines that are normally in circulation.

Chiller circuit

The controller and remote monitoring, developed with dedicated logic and with CAREL experience, are the heart of the system.

The entire control unit is managed in detail by a single pRack pR200T controller capable of simultaneously managing the low temperature compressors, the medium compressors and the transcritical section. The medium temperature line is made up of 3 compressors, the first of which is modulating with an inverter. The gas cooler is made up of 3 electronic fans, the HPV (High Pressure Valve) is directly managed by the pRack pR200T. It allows the optimization of the gas cooler pressure in transcritical operation and the control of the passage from transcritical to subcritical when environmental conditions allow it. The flash gas by pass valve to control the receiver pressure (RPRV, Regulating Pressure Receiver Valve) is a standard CAREL E³V stepper expansion valve (max 45 barg). The 34 medium temperature cases are controlled by MPXPRO, a standard CAREL solution for the regulation of channelled cold units.

The low temperature circuit, on the other hand, is made up of a single compressor with inverter whose outlet combines with the gas coming from the medium temperature cases and from the flash gas valve to once again be aspirated by the medium compressors. The 4 low temperature food cabinets are also controlled by the MPXPRO.





pR200T:

The compact CAREL solution for the complete control and management of the CO₂ chiller control units is the ideal solution to respond to the numerous market requests for:

- built-in management of low and medium temperature compressors and transcritical valves with a single tool
- innovative management algorithms for energy savings;
- algorithms dedicated to the management of the CO₂ systems;
- full possibility for integration/supervision



E³V

As a flash gas valve, whose primary characteristics are generically those of the E³V family:

- External stator that can be replaced without removing the valve
- Built-in flow indicator light
- Maximum operating pressure 45 barg
- No gears
- Movement on stainless steel ball bearing
- Motor mechanism can be removed to make sealing and any replacement easier without unsealing the valve
- Closed valve seal
- Able to regulation with flow in both directions



MPXPRO

It is the CAREL product for innovative chiller systems since it offers:

- a built-in driver for the management of the proportional electronic expansion valves E³V;
- advanced algorithms for energy savings and optimizing evaporator efficiency;
- commissioning tools to facilitate use by installers and maintenance technicians



PlantVisor PRO

Complete and reliable solution for the management, monitoring and optimization of chiller and air conditioning systems with up to 300 utilities that are characterized by:

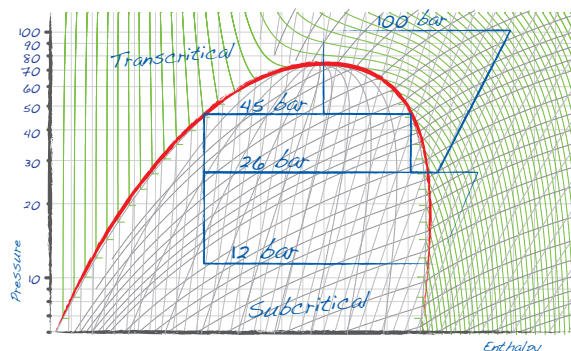
- management of large, complex systems through an intuitive web interface;
- HVAC-ECO optimization package;
- reduction of system installation times;
- alarm management through a powerful set of rules, conditions and notification channels;
- complete reporting and documentation tool such as HACCP and SYSTEM REPORT.

1 Transcritical cycle

In the cycle that is defined as transcritical, the normal condensation, typical of chiller cycles using the most common refrigerants, is replaced by a heat exchange between the refrigerant, which is at a higher pressure than the critical one, and the cooling fluid.

In transcritical operation, there is no phase change from gas to liquid but only the decreasing of the temperature of a gas that is gradually denser.

The maximum operating pressure is no longer linked to the condensation temperature but instead is controlled by means of the assembly comprised of a valve and a liquid receiver



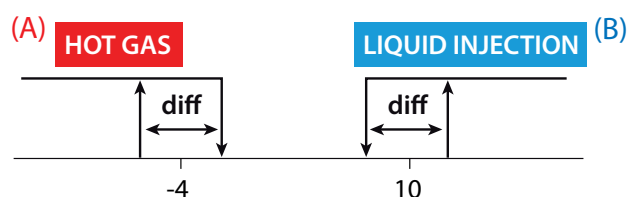
Systems such as this offer maximum efficiency in comparison to similar systems with traditional HFC refrigerant, especially when the outdoor temperature is favourable and if the refrigeration system is optimized as in this case. That is:

- Display case evaporators and cold rooms that are correctly sized for transcritical or subcritical pressures
- Systems in compliance with the PED pressure equipment directive through the use of specifically designed components
- Pipes for transcritical or subcritical pressures in copper or steel depending upon the distribution system
- Safety valves especially chosen to protect the pipes and evaporators in the event of lack of power for a long period of time
- The high quality of the machines supplied and the supplier procurement chain

2 Double superheat control

To control superheating during medium temperature compressor aspiration a double compressor protection mechanism was designed. Built inside the pRack pR200 and based on the medium temperature compressor aspiration superheating value, a hot gas injection system can be activated on the medium temperature discharge line, if the superheating is too low, or a liquid refrigerant injection system can be activated from the receiver, if the superheating is too high.

This system ensure proper compressor operation, sensitive to the aspiration superheating variations and taking advantage of the potential gas mixture at different temperatures.



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