

METRO

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CAREL

Success Story

First METRO Transcritical CO₂ store in China

Efficiency and reliability with CAREL Retail sistema

METRO China, FUTE Refrigeration and CAREL China are working in synergy to set up a series of new stores across China, equipped with transcritical CO₂ compressor racks, with the goal of ensuring system efficiency with natural refrigerants. The METRO Lishui bridge store is the first in China to use transcritical CO₂ refrigeration technology. The sales area covers about 4100 m² and the system supplies a cooling capacity of 497 kW to a total of 112 cabinets.

Connected Efficiency



Where

- Metro Lishui bridge store, Beijing city, China

What

- FUTE Design and General contractor company
- SCM compressor rack
- CAREL electronics and EEV
- CAREL supervision

Why

- First transcritical CO₂ system in China
- Natural refrigerant
- Energy savings
- System reliability
- Stable/precise control
- Environmentally friendly

When

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METRO GROUP



Fig. 1.a - LT+MT RACK



Fig. 1.b - HT RACK



Fig. 1.c - CAREL boss

METRO China is part of the METRO GROUP and has been on the market since the 1996, with a total of 92 active stores.

The Chinese market is one of the most important growing markets for the METRO GROUP and an important opportunity for future cooperation.

An important player in this project is FUTE Refrigeration. FUTE was founded in 1999, and is a contractor company that also manufactures compressor racks. It offers a high level of know-how and expertise all over China, with special focus on CO₂-based applications. FUTE Refrigeration stands out by delivering quality refrigeration systems and solutions, while at the same time ensuring environmental sustainability.

The compressor racks are manufactured by SCM Frigo S.p.A. Founded in 1979, SCM Frigo is a leading manufacturer of industrial and commercial refrigeration systems. Since 2011 the company has been part of Swedish multinational Beijer Ref, manufacturing refrigeration systems for the Group under the SCM Frigo brand. In 2004 the company started developing technologies using natural refrigerants, and is today a world leader in the production of carbon dioxide (CO₂) compressor racks.

The METRO Lishui store demonstrates how China is starting to successfully use and deploy transcritical CO₂ systems, with the support of CAREL's technology and experience with natural refrigerants.

Sales area and system description

The hypermarket is situated in Beijing, in northern China. The local climate profile sees average temperatures of around 13°C, with peaks that may exceed 35°C in summer.

The store covers a total surface area of 4100 m² and comprises 84 cabinets and 28 air coolers, divided into low, medium and high temperature applications.

There are 2 compressor racks with a total cooling capacity of 497 kW.

The tables below summarise the sales area information.

Cabinet details:

Application	Cabinets	Air coolers
Medium temperature	31	2
High temperature	-	25
Low temperature	53	1
Tot. no. cabinets	112	

Compressor rack configuration

Low/medium temperature booster compressor rack A:

- Refrigerant: R744 (CO₂)
- Total cooling capacity: 302 kW
- 3 MT compressors (evap. temp. -8°C)
- 3 LT compressors (evap. temp. -28°C)
- 1 parallel compressor
- 1 pRack pR300T for centralised management
- 1 pRack pR300T as backup

High temperature rack B:

- Refrigerant: R744 (CO₂)
- HT cooling capacity: 195 kW
- 3 HT compressors (evap. temp. 0°C)
- 1 parallel compressor
- 1 pRack pR300T for centralised management
- 1 pRack pR300T as backup

Monitoring system

Boss is a complete and reliable solution for the management, monitoring and optimisation of refrigeration systems with up to 300 devices, which stands out for:

- the ability to manage large complex systems via an intuitive web interface (integrated Wi-Fi hotspot)
- alarm management via a powerful engine of rules, conditions and notification channels
- complete logging tool that also produces documents, such as SYSTEM REPORTS

Sales area description

The sales area covers about 4100 m² and the system supplies a cooling capacity of 497 kW to a total of 112 cabinets.

System description

The installation comprises two transcritical CO₂ units, a booster system with MT and LT lines, and a single-line system with HT loads only.

Regarding the booster system, the low temperature compressor flow is first cooled by an intercooler, and then discharged to the medium temperature suction line. The medium temperature discharge line flows into the high pressure line, where the heat recovery system, managed by pRack pR300T, provides hot water for space heating.

The CAREL pRack controller manages temperature control of the gas cooler, featuring EC fans. The control set point is based on outside temperature variations (CAREL floating condensing feature) and may be affected by heat recovery requirements. The HPV valve is controlled based on pressure. The set point is calculated considering the gas cooler outlet temperature, aiming to achieve the optimal pressure to maximise the compressor rack COP in transcritical conditions, or keep the sub-cooling level in subcritical conditions. The minimum HPV set point can be increased automatically when heat recovery is activated. The liquid receiver normally works at around 35 barg (2°C) and the flash valve controls the pressure inside the receiver.

In this booster system, there is also an additional parallel suction line that can manage the flash gas flow rate from the receiver to the high pressure line (gas cooler), increasing system efficiency in mid-high temperature operating conditions. This action can reduce the compression work on the parallel line, increasing energy savings by up to 10%.

From the CO₂ liquid receivers, the lines branch off to the medium, low and high temperature cabinets and air coolers.

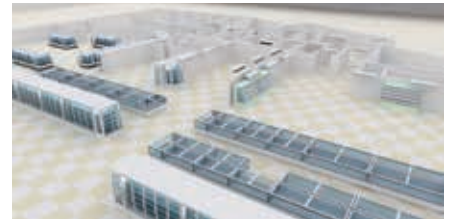


Fig. 1.d - Sales area 3D



Fig. 1.e - Cabinet map on CAREL boss

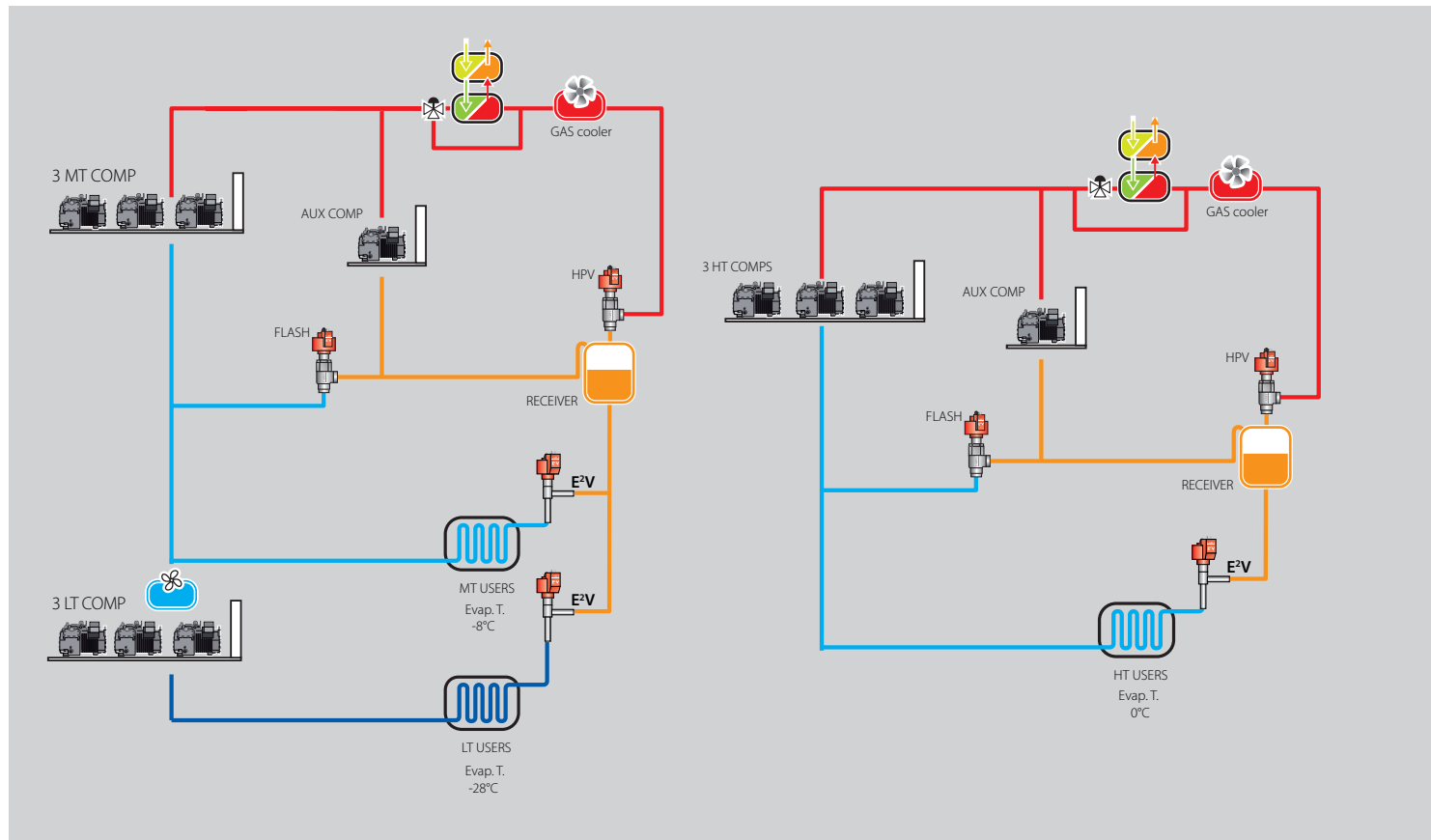


Fig. 1.f - Low and medium temperature compressor rack

Fig. 1.g - High temperature compressor rack

CAREL control system

pRack pR300T

pRack pR300T is the CAREL solution for transcritical CO₂ booster systems. It is the ideal solution to meet market requirements in terms of:

- integrated management of low and medium temperature compressors, parallel compressor and transcritical valves
- dedicated algorithms for CO₂ system management
- integration with heat recovery systems
- innovative management algorithms for energy savings
- ample integration/supervision possibilities

MPXPRO + E2V-Z

MPXPRO is the advanced CAREL Retail system controller for complete and integrated management of multiplexed refrigerated counters. It guarantees superior performance and flexibility, excellent levels of energy savings, with special focus on ease of use and installation, offering:

an integrated driver for the management of E2V electronic expansion valves, top class algorithms for energy savings and optimisation of evaporator efficiency commissioning tools to facilitate operations for installers and maintenance technicians.

The new E2V-Z electronic valves for refrigeration applications guarantee performance and simplicity, without compromise.

The main features are a built-in filter and simplified installation, with just one body for every cartridge size. Furthermore, the new encased stator (IP69K) ensures high resistance and reliability when used in extreme refrigeration applications.

RemotePRO

The enterprise software system used to monitor this installation can retrieve data from thousands of stores. It provides a built-in dashboard suite to ensure the sustainability of each single store in terms of performance and efficiency, helping customers easily identify where they can take action to optimise the system.



Fig. 1.h - Electrical switchboard control



Fig. 1.i - E2V-Z



Fig. 1.j - Energy Dashboards

Conclusions

CAREL, in synergy with FUTE Refrigeration and with the important contribution of SCM Frigo, has demonstrated expertise and knowledge in managing this kind of CO₂ installation, achieving high levels in terms of reliability and support.

The positive experience at the Lishui bridge store in Beijing is the first step in an important process that will soon see transcritical CO₂ systems installed in many stores in China.

CAREL has proven to be the ideal partner for the development of systems featuring high technological innovation, and fundamental in providing specialist support for its partners.

Moreover CAREL, with its complete product range, including rack controllers, expansion valves, cabinet controllers, chillbooster and monitoring systems, has proven that it has the right technology to develop and support these kinds of project across the country.



Fig. 1.k - Service Team at Lishuiqiao METRO store

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