



where

Metro China

- Weifang City, Shandong province, China.

what

CO2 System

- FUTE compressor rack;
- CAREL electronics;
- CAREL EEV;
- CAREL supervision.

why

- standardisation of a subcritical CO₂ cascade system;
- natural refrigerant;
- energy savings;
- system reliability;
- stable/precise control;
- environmentally-friendly.

First METRO CO₂ store in China

Efficiency and reliability with CAREL Retail system

METRO China, FUTE Refrigeration and CAREL China worked in synergy to build a series of new stores across China, equipped with subcritical CO₂ cascade systems.

Hybrid CO₂/HFC technology, with the goal of ensuring system efficiency, reliability and environment respect.

The first one, up and running since the end of 2014, is situated in the city of Weifang in Shandong province. The system supplies a cooling capacity of 400 kW for a total of 86 cabinets.

The Weifang store is the first by METRO China to implement CO₂ technology.

METRO China is part of the METRO GROUP. It has been on the market since the 1996 with a total of 82 active stores. The Chinese market is one of the most important growth markets for the METRO GROUP.

The main player in these projects is FUTE Refrigeration, which produces compressor racks and provides a high level of know-how and expertise all over China, with special focus on CO₂ based applications.

FUTE Refrigeration differentiates itself by delivering quality refrigeration systems and solutions, at the same time ensuring environmental sustainability.

Another partner in this project is SHANGHAI GENERAL FUSHI Refrigeration Equipment. They specialise in manufacturing cabinets and the installation of commercial refrigeration system. This demonstrates that China is ready to use and deploy these kinds of highly professional systems, and CAREL has the right technological product portfolio and expertise to support local players.

METRO GROUP

Fute 符特制冷
POWER IN TECHNOLOGY

GENERALFUSHI
通用富士

Success Story

Description of the Weifang METRO store

Sales area configuration

	Cabinets	Air cooler
Low temperature	39	2
Medium temperature	6	17
High temperature	---	22
Tot. no. cabinets	86	

Compressor rack configuration

Low temperature rack:

- Refrigerant: CO₂
- Cooling capacity: 80kW
- 4 Bitzer compressors
- 1 pRack for suction line management
- 1 pRack for gas cooler and plate condenser control.

Medium/high temperature rack A

- Refrigerant: 134a
- 4 Bitzer MT compressors
- MT Cooling capacity: 60kW
- 3 Bitzer HT compressors
- HT Cooling capacity: 100kW
- 1 pRack for MT suction line management
- 1 pRack for HT suction line management
- 1 pRack for condenser line control.

Medium/high temperature rack B

- Refrigerant: 134a
- 4 Bitzer MT compressors
- MT Cooling capacity: 60kW
- 3 Bitzer HT compressors
- HT Cooling capacity: 100kW
- 1 pRack for MT suction line management
- 1 pRack for HT suction line management
- 1 pRack for condenser line control.



Electrical switch board control

Description of the system

The system is a subcritical CO₂ cascade in which condensation of the CO₂ is managed using a gas cooler as the first step, cooling the CO₂ down to 20 °C.

As a second step, condensation takes place through a heat plate exchanger system, comprising two heat exchangers and controlled by the CAREL expansion valve (E3V) and driver (EVDEVO). Superheat control in this system prevents liquid return to the medium temperature compressor line and at the same time ensures, on the CO₂ side, a liquid phase at around -5 °C.

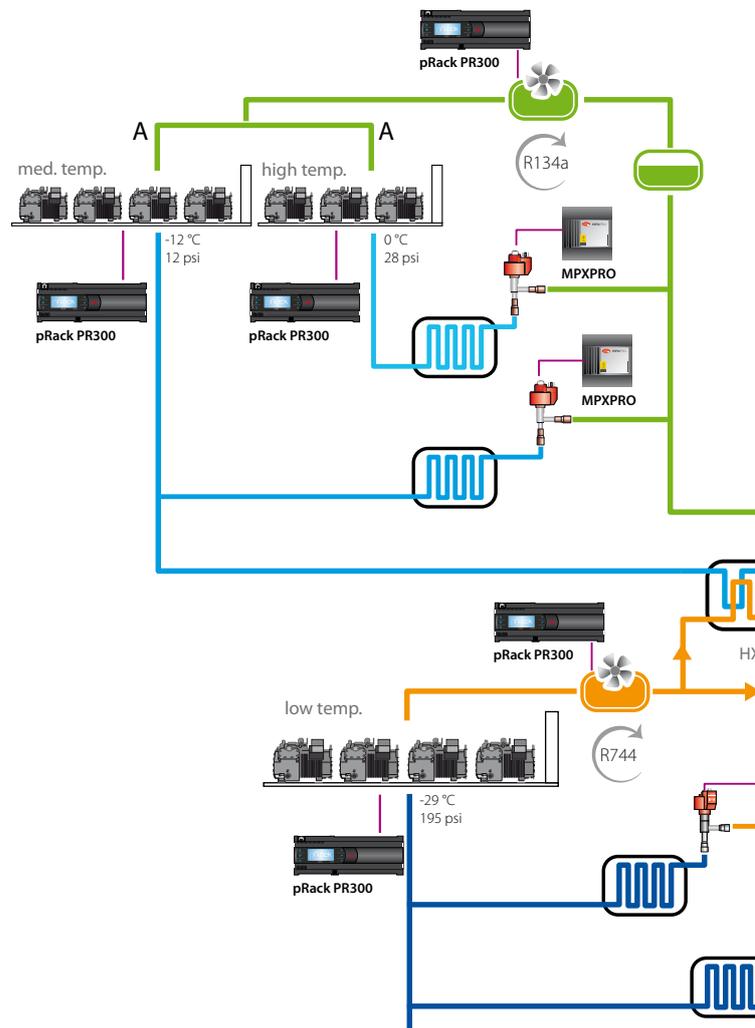
CAREL E3V stepper valves can precisely and continuously modulate refrigerant flow based on the quantity needed by the system at any given time.

An additional CO₂ pressure safety control, managed by the driver, has been implemented on the heat exchanger in order to force the opening of the valve (temporary) if pressure exceeds a limit threshold.

The heart of the system is the compressor rack units supplied by FUTE and equipped with CAREL pRack technology.

In order to provide higher system reliability according to FUTE's requirements, CAREL developed special rack management algorithms. Moreover, in order to increase overall system efficiency, a heat recovery was installed and is controlled directly by the pRack. The main purpose

Control diagram with multiple pRack boards to manage the five compressor lines and the three condenser lines



is to heat the floor of the cold room in order to avoid floor breakage due to low temperature.

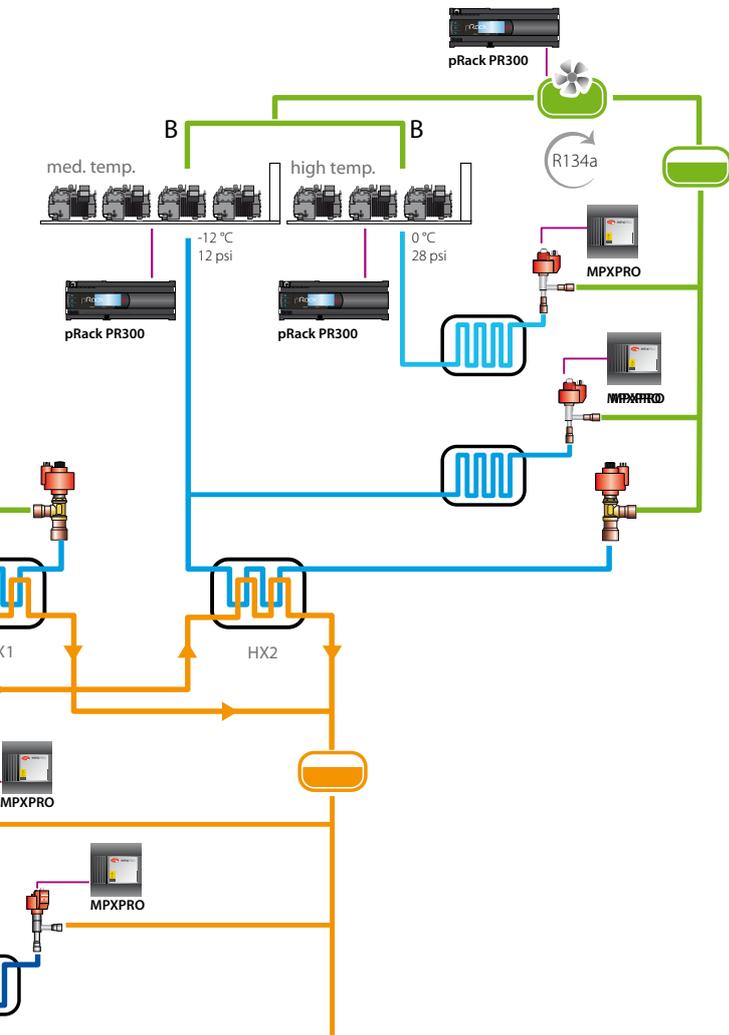
On the cabinets, all the evaporators and air cooler devices are equipped with the latest CAREL technology: MpxPRO & E2V valves in order to provide stable and efficient control for better food quality and safety.



Low temperature CO₂ rack unit



Electronic expansion valve for the evaporator



Monitoring system

PlantVisorPRO

This is a complete and reliable solution for the management, monitoring and optimisation of refrigeration and air conditioning systems with up to 300 units, which stands out for:

- the ability to manage large complex systems via an intuitive web interface;
- reduced system installation costs;
- alarm management via a powerful engine of rules, conditions and notification channels;
- complete logging tool that also produces documents, such as HACCP and system reports;
- increased service maintenance level by ensuring more reliable systems

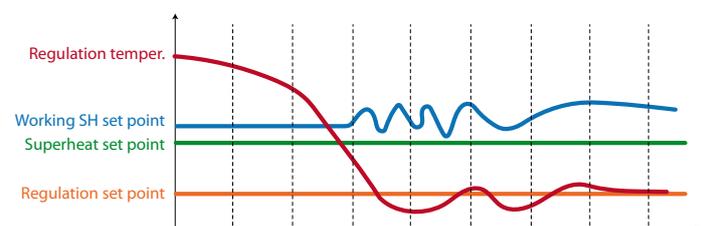


3D site layout for at-a-glance management

All the cabinets adopt smart control that makes the control temperature very stable around the set point.

The superheat set point can be shifted to avoid frequent ON/OFF cycles based on cooling request.

The supervisory system (PlantVisorPRO) in this smart control arrangement can apply an offset to the rack suction pressure set point. Increasing this set point provides extra energy saving in the system, when unit operating conditions are favourable.



Superheat set point increases when the control temperature is reached

pRack300

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

- integrated management of low and medium temperature compressors and transcritical valves with one single device;
- innovative management algorithms for energy saving;
- algorithms dedicated to the management of CO₂ systems;
- possibility of integration/supervision.



E3V

Primary characteristics are in general those of the EXV family:

- external stator that can be replaced without dismantling the valve;
- built-in flow indicator;
- 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;
- control with flow in both directions.



ENERGY METER

Power consumption data are saved for complete and detailed analysis, allowing operators to identify when and where consumption occurs, any inadequate behaviour and incorrect use and evaluate the effects of the energy saving actions implemented.



MpxPRO + E2V

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

- integrated driver for the management of E2V electronic expansion valves;
- sophisticated algorithms for energy savings and the optimisation of evaporator efficiency;
- commissioning tools to facilitate use for installers and maintenance technicians.



Conclusions

The good experience at Weifang in terms of efficiency and reliability have lead METRO China to establish four more stores since the beginning of 2015 with the same system design and configuration.

CAREL China, in synergy with FUTE Refrigeration, demonstrated competencies and knowledge in managing this kind of CO₂ installation with high levels in terms of reliability and support.

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



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