



## where

### “RIMI” supermarkets

- Mažeikiai, Lithuania.

## what

### Transcritical CO<sub>2</sub> systems

- REFRA compressor racks
- CAREL control system
- Carel EEV
- CAREL supervision

## why

- Full green solution
- Standardisation of transcritical CO<sub>2</sub> systems
- natural refrigerant
- energy savings
- single-control low temp. and normal temp.

## Deployment of CO<sub>2</sub> transcritical system is a reality with CAREL in Rimi Lithuania

RIMI, REFRA and CAREL INDUSTRIES have joined forces to make it possible to build a series of new supermarkets across Lithuania fitted with all-natural refrigerators that only use carbon dioxide.

The first one to open is called “Mažeikiai” and it is situated in North-West Lithuania. Indeed, since early November last year, the refrigeration plant only uses CO<sub>2</sub> as its refrigerant gas for chilling food.

RIMI Lietuva is part of the RIMI Baltic group and hence the ICA group, one of the largest retailers in Northern Europe. In recent years, it has been engaged in opening new stores across Lithuania that afford high energy efficiency and that are all-green. The main player in this new project is REFRA, which produces compressor racks and air conditioning plants, responding to the growing demand for this type of system in the East European market.

A major partner for installation, BalticMaster, is a highly active contractor in the Baltic countries, specialising in the installation of commercial refrigeration systems.

The construction of this system has demonstrated how:

- the Lithuanian market is ready to use this type of technology, which initially requires more in-depth technological know-how but which promises economic returns on the investment;
- CAREL’s sophisticated and versatile control technology enables optimum control of all the functions required by means of a single electronic device;
- reliability and efficiency of this type of system in CO<sub>2</sub> friendly climates;
- CAREL solutions can also help less experienced users interact with this type of system.



## Description of the Mažeikiai plant

The plant is a supercritical CO<sub>2</sub> booster, distinguished by a low temperature suction line comprising 3 compressors:

- 1 variable frequency compressor for a cooling capacity of 5.46 kW;
- 2 ON/OFF compressors for a cooling capacity of 5.95 kW each.

For an overall cooling capacity of the low suction line totalling a little under 18 kW.

The medium temperature line comprises 4 Bitzer compressors:

- 1 variable frequency compressor for a cooling capacity of 32.38 kW;
- 2 ON/OFF compressors for a cooling capacity of 35.95 kW each.
- 1 ON/OFF compressor for a cooling capacity of 43.64 kW.

For an overall cooling capacity of the medium suction line totalling a little under 150 kW.

### HPVs (High Pressure Valve) and RPRVs (Receiver Pressure Regulating Valve) in the REFRA compressor racks

The CAREL valve range from the E3V-C family is used for the flash gas and back pressure valves.

This is the new platform of steel valves, whose maximum operating pressure (MOP) totals 140 bar (2031 PSI) and whose maximum operating pressure difference (MOPD) reaches 90 bar (1305 PSI), allowing the system to operate with safety pressures in excess of 45 barg.

The calculation for the correct size of the two valves is made using the on-line tool: <https://exvselectiontool.carel.com/ExVLab> and it takes into account:

- the overall cooling capacity
- pressure at the receiver of 35-40 barg
- average saturated suction temperature
- sub-cooling in subcritical conditions



CO<sub>2</sub> Refra pack AS-TR17143F0G

## Description of the system

The plant is a transcritical CO<sub>2</sub> booster, specifically the low temperature compressor flow (-35 °C) is first cooled by an intercooler, comprising two ON/OFF fans, and then discharged by the medium temperature suction line (-10 °C).

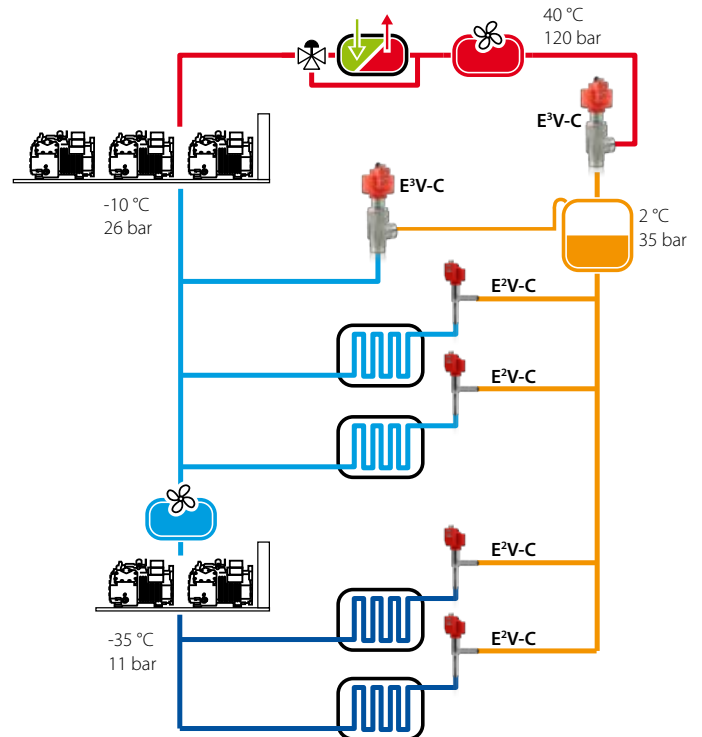
The compressor flows of the two medium lines merge into the high pressure line, where a heat recovery system allows the thermal exchange between the CO<sub>2</sub> gas and water (for domestic hot water use). The pRack pR300T (single board) perfectly manages the heat recovery part, guaranteeing a water outlet temperature at the heat exchanger of 65°C as per the system specifications

The gas cooler comprising EC fans is temperature managed according directly to the value of the heat exchange outlet probe, with the possibility of moving the adjustment set point according to variations in the external temperature (floating condensation).

The adjustment of the HPV valve is on the gas cooler pressure, the set point is calculated according to the gas cooler outlet temperature in pursuit of the optimal pressure for the COP of the plant in transcritical conditions or of the ideal sub-cooling level in subcritical conditions.

The liquid receiver normally operates at around 35 barg (0-2 °C) while the flash valve adjusts the pressure inside the receiver (45 bar safety valves).

The lines towards all the medium and low temperature utilities branch out from the liquid CO<sub>2</sub> receiver.



# CAREL control system

## pRack pR300T

CAREL's compact solution for the CO<sub>2</sub> compressor rack control and management is the ideal solution to meet the market requirements regarding:

- integrated management of low and medium temperature compressors and transcritical valves
- innovative management algorithms for energy savings;
- dedicated algorithms for CO<sub>2</sub> systems management;
- integration with heat recovery systems;
- broad integration/supervision possibilities



## mpxPRO

MPXPRO is a sophisticated CAREL Retail system for the complete and integrated control of ducted refrigerated counters.

It guarantees superior performance and flexibility, excellent levels of energy savings, with a special focus on easy use and installation, offering:

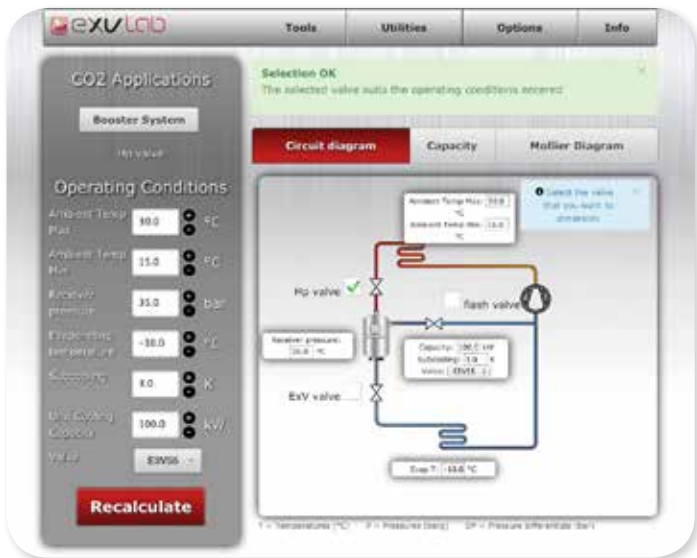
- integrated driver for the management of E2V proportional electronic expansion valves;
- sophisticated algorithms for every savings and the optimisation of evaporator efficiency;
- commissioning tools to facilitate use for installers and maintenance technicians.

## EXV LAB

CAREL EXV Lab is a tool to guide you in your choice and use of CAREL valves.

It is a web environment where both expert designers and novice users can find the tools to select and check valves for all applications and operating environments where an EXV can be used.

<https://exvselectiontool.carel.com/ExVLab/>



## PlantVisorPRO

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

- the ability to manage large complex systems via an intuitive web interface;
- an HVAC-ECO optimisation pack;
- reduced system installation costs;
- alarms management via a powerful engine of rules, conditions and notification channels;
- complete logging tool that also produces documents, such as HACCP and SYSTEM REPORTS.

## E3V for CO<sub>2</sub>

The E3V-C range offers superior performance levels and supervises the commissioning and safety of the entire system, as well as piloting the various electronic valves in the system.

Specifically for the transcritical stage of the unit, where sophisticated control algorithms automatically guarantee the upkeeping of maximum efficiency at any external temperature.

They stand out for their:

- superior reliability
- reduced environmental impact
- high energy savings
- excellent adjustment ability



*pRack pR300T on-board*

## Conclusions

Thanks to the pR300T controller, CAREL is in a position to use a single electronic board to manage fully a transcritical plant with a double suction line, heat recovery, gas cooler, high pressure valves and liquid receiver.

CAREL and RIMI are well-established concerns in Lithuania, where last year alone 7 new Rimi supermarkets opened with CAREL electronics for the management of transcritical CO<sub>2</sub> booster systems.

CAREL and CO<sub>2</sub> are to date a consolidated and well-established system mainly across the whole of Europe but also in the rest of the world, including USA, Brazil, Australia, Japan,...

CAREL demonstrates that it is a sound and reliable business within the CO<sub>2</sub> world thanks to a product such as pR300T which has been on the shelves for a couple of years and is the key feature of CAREL's groundbreaking CO<sub>2</sub> range, comprising valves, plant controllers, drivers, cabinet controllers, chillboosters, leak sensors, local and remote supervisors.

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