



CAREL

Success story

Avicola Bacco High-performance refrigeration with CO₂

Avicola Bacco has adopted an innovative CO₂ refrigeration system for its duck and goose meat processing, achieving energy efficiency, reducing environmental impact, and optimising product quality.

Where

Avicola Bacco, Codevigo, Padova province.

What

Sustainable CO₂ refrigeration for quality, efficiency, and production reliability.

Why

To reduce environmental impact and ensure quality and sustainability.

MD Service Refrigerazione

Based in Sant'Angelo di Piove di Sacco, Padova province, the company is specialised in the installation of refrigeration, air conditioning, and air handling systems. It offers custom solutions and rapid technical assistance, with scheduled maintenance and on-call service.

Avicola Bacco

renowned duck and goose meat processing company, committed to innovation and sustainability. Founded in 1964, it has a long tradition in the poultry sector and stands out for the quality of its products.

Introduction

Avicola Bacco, located in Padova province, Italy, is a leading poultry processor has been operating on the market since 1964. Specialising in the production of duck and goose meat, the company stands out for the guaranteed quality of its products and its attention to technological innovation.

In the current context, in which environmental sustainability has become a strategic priority for the food industry, the company has recently completed a major project to expand and modernise its production plant, focusing on cutting-edge refrigeration technology using R-744 (CO₂) natural refrigerant in place of synthetic refrigerants with a high environmental impact.

The CAREL solution

To meet these needs, Avicola Bacco chose CAREL's refrigeration solutions, installed by MD Service Refrigerazione. The project involved expanding the processing rooms and installing new cold rooms, bringing the total to 12, with temperatures ranging from -18°C for the low-temperature storage rooms to +15°C for the medium-temperature rooms where initial cooling and processing take place.

The plant is divided into two main sections, each optimised for each specific stage of the production process.

Processing and packaging

This section serves four key areas: cutting room, preparation room, packaging (approximately 12°C) and refrigerated storage (approximately 2°C).

The heart of the system is a transcritical CO₂ system equipped with an EMJ modulating ejector, managed by a pRack p300T HS controller with dual drivers for controlling the ejector and the flash gas valve.

In transcritical systems, the flash gas valve reduces the refrigerant pressure inside the receiver, thus allowing separation of the refrigerant in the gaseous state and improving system efficiency by preventing vapour from entering the evaporator. The ejector, on the other hand, is used as an alternative to the high pressure valve, exploiting the energy of the hot gas to compress part of the refrigerant, thus reducing the work done by the compressor. This ensures better system energy efficiency, especially during the summer and in hot climates in general, recovering energy that would otherwise be lost.

Each cold room is equipped with an evaporator controlled by an EVD EVO driver, which manages an E2V-Z electronic stepper valve. In the event of power failures, the Ultracap system ensures that the valve closes, preventing the migration of liquid refrigerant into the evaporator and a consequent drop in efficiency and reliability. Temperature and defrost control is managed by iJW devices, which activate electric heater defrost cycles based on the temperature, and control cooling precisely and responsively.



Fig. 1.a - stage of meat processing

Storage and blast cooling section

This area of the production plant is divided into two parts: the storage rooms and a cooling tunnel.

The two storage rooms, one at low temperature (-20°C) and one at medium temperature (0-4°C), are served by condensing units controlled by the Hecu CO₂ system, with parallel compressors configured with redundancy logic to ensure the highest reliability over time. The main compressor features permanent magnet technology and is driven by sophisticated power electronics (inverter or drive) that modulate cooling capacity with extreme precision, adapting to both outside temperature conditions and the cold room load. This technology ensures energy efficiency that is incomparably higher than with traditional technologies.

Each cold room is equipped with two air evaporators, managed by universal iJW and IR33 controllers that adjust operation based on the inside temperature.

The cooling tunnel is designed to rapidly lower the temperature of the meat, with a capacity of 1 tonne every 24 hours. The system uses another Hecu two-stage condensing unit with evaporation at -35°C. The unique feature of two-stage systems is that they guarantee energy efficiency even where there is a considerable difference between the ambient temperature at which the condenser/gas cooler operates, and the storage temperature at which the evaporator operates. Two compressors are thus used in series.

Cold room temperature, electronic valve and defrost control are all managed by the UltraCella system, which communicates via serial with the Hecu unit to optimise performance.



Fig. 1.b - cold room for storing processed products

Control, monitoring and supervision

Both systems are equipped with energy meters for the precise monitoring of energy consumption. All the devices are connected to a single serial network supervised by the boss system, capable of managing up to 100 devices via Modbus protocol.

For intuitive and immediate management, an interactive map has been developed that allows users to view the status of the cold rooms in real time, showing both alarms and system operation (monitoring temperatures, active cooling status, defrosting, etc.).



Fig. 1.c - panel on the side of the packaging cold room, with iJW controller



Fig. 1.d - external panel on the condensing unit with pRack and driver for ejector control



Fig. 1.e - Matteo Bacco monitoring the system from his work station

"CAREL technology has allowed us to improve control over the preservation of our poultry products, combining efficiency, energy savings, and sustainability. A result that confirms our commitment to quality and care for the environment."

Matteo Bacco



Conclusions

Thanks to the system designed by MD Service Refrigerazione and the adoption of CAREL solutions, Avicola Bacco has achieved:

- optimal product quality and freshness thanks to precise management of temperature and humidity in ideal storage conditions;
- significant energy savings, accompanied by a reduction in operating costs thanks to the condensing unit and control system technologies, as well as continuous monitoring that has made maintenance response more timely;
- further savings on maintenance costs thanks to the use of a cheaper and easier to source natural refrigerant (CO₂);
- a significant reduction in environmental impact through elimination of fluorinated gases and the adoption of a natural refrigerant that guarantees the long-term sustainability of the refrigeration system.



Fig. 1.f - Davide Marin and Massimo Marin from MD Service Refrigerazione with Matteo Bacco

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