Opteon™

Sustainable Refrigeration Solutions

"Cultivos Araba reap the rewards of an innovative application using **Opteon™ XL20** (R-454C)"

Cultivos Araba, a company that belongs to ***Cultivos Hispalus (Almería)***, one of the Spanish leaders in tomato production, is creating a big project in ***Valdegobía (Araba)*** with the construction of a large greenhouse structure with an adjacent refrigerated area. To guarantee the freshness and conservation of the final product, they have proceeded to build a state-of-the-art refrigeration system with **Opteon™ XL20 (R-454C)**

Chemours™

CULTIVOS ARABA®

GRUPOFREIRE REFRIGERACIÓN

Introduction

The European Regulation 517/2014 F-Gas came into force to reduce the use of high GWP HFC gases that generate emissions that contribute to the greenhouse effect and requires systems that use gases with low-GWP.
Refrigerant gases are among the many application areas that the industry considers when evaluating environmental impact and cost/benefits. The current trend is to ensure that the gases incorporated into the system design meet high standards and long-term environmental protection regulations.

The current generation of low GWP refrigerants have been designed to be versatile between applications, offering the greatest synergy between technologies. This means that specific types of installations are not bound to use one type of refrigerant. And now there is greater potential to use a refrigerant with different types of equipment and components, to **achieve the lowest possible Total Equivalent Warming Impact (TEWI)**.

We know that, when dealing with new generation refrigerants, with low Global Warming Potential, the indirect emissions resulting from the electricity consumption of the refrigeration systems are a much greater contributor to climate change than the GWP of the refrigerant itself, making the energy efficiency a vital factor when selecting a low-GWP solution. **Energy Efficiency** is a term that is gaining more and more importance, especially in the context of global carbon reduction targets to fight climate change.

Reducing the environmental impact and carbon footprint are becoming increasingly important. In a sector as essential as food production and distribution, energy efficiency and the reduction of emissions, both direct and indirect, are very important factor when planning companies' environmental and sustainable development strategies.

Opteon™ XL20 (R-454C) is an HFO blend that provides excellent performance and complies with current and future regulations regarding emissions, safety, and energy efficiency.

Project Overview

Frío Araba, part of Grupo Freire Refrigeración, were asked to develop an efficient cooling solution to one storage chamber and one refrigerated handling area using a modern, energy-efficient and reliable refrigerant.

In this case, the chosen solution was a ground installation using ***150 kg of Opteon™ XL20 (R-454C)*** for over three separate systems. This installation was part of an extensive project from ***Araba Cultivos in Valdegobía*** to cultivate tomatoes, prepare and deliver them to the market.

This case study demonstrates the practical application and solution of applying large charge sizes of A2L refrigerants XL20 (such as R-454C) to large industrial cold storage installations, whilst maintaining compliance with Spanish Safety Regulations and PED.

Following the Safety Regulations for Refrigeration Installations in force in Spain, given that the project refers to an installation for industrial use, accessibility C, location of systems 2, and occupancy of less than one person per 10 m², the installation has no load limit restrictions for the ***Opteon™ XL20*** refrigerant. The only considerations we had to take into account were making sure the components were adapted for A2L refrigerants and to follow the indications in the refrigerated rooms for the respective products.

Site details and description of the new system

The installation consists of the refrigeration of one storage chamber and a big handling area for product preparation and packaging.

The total volume for refrigeration has been more than

7000 m³

and for this purpose a refrigeration capacity of

250 kW

has been installed.

To meet all the service

150 kg

of Opteon™ XL20 (R-454C)

supplied by ***KIMIKAL, S.L.*** have been used.

Technical solution: super inverter system

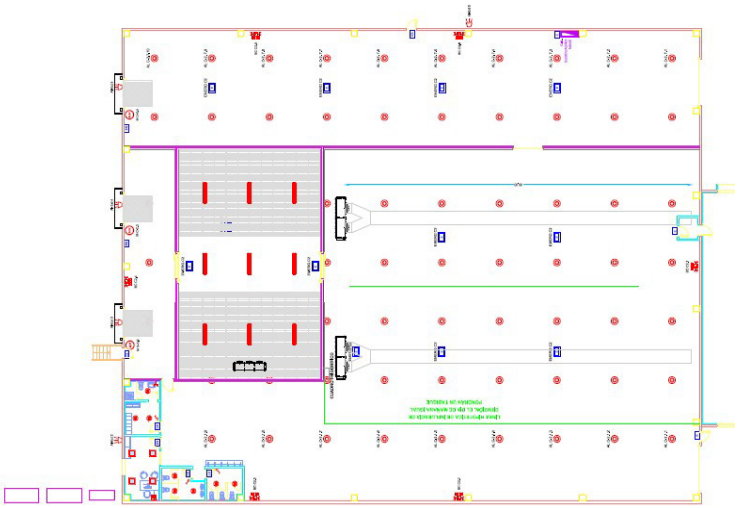
We are going to opt for three independent ***SUPER INVERTER*** systems, with ventilated defrost in the refrigeration chamber. This gives us the following advantages:

- Energy savings: Up to 30% compared to conventional units, using variable speed drives, and carrying out floating condensation.
- Robust semi-hermetic compressors.
- Soft starts by means of a Voltage-frequency inverter, which reduces consumption to a minimum at start-ups.
- Useful life: The groups with ***SUPER INVERTER FREIRE*** technology, reduce the continuous starts and stops of the compressors that compose it, reducing electrical consumption, and extending the useful life with respect to conventional equipment.
- High stability.
- Largely sized condenser with EC fans to increase the efficiency of the refrigeration installation, for ambient temperatures up to +46 ºC.
- Replacement of thermostatic expansion valves with **Carel EV2-3** type electronic stepper valves, which keep the flooding of the evaporators more stable. They increase efficiency between 2-3 %.
- The lowest possible load for each circuit, placing the evaporators as close as possible to the condensing units.

Floor plan

Using textile sleeve ducts in packaging areas, which gives great uniformity throughout the air diffusion room, protecting workers from feeling any intense drafts.

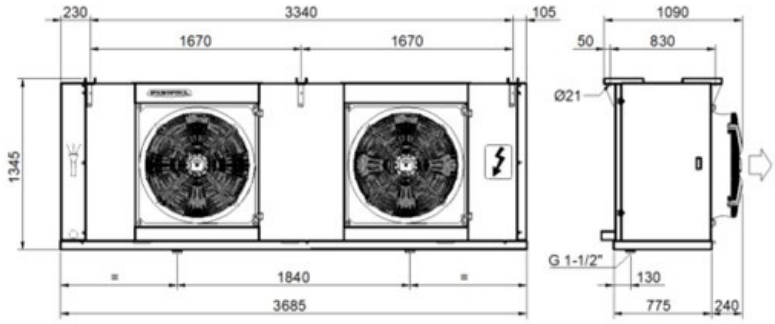
The evaporators have a G3 filter that prevents soiling of the refrigerating battery and the textile sleeve on the inside.



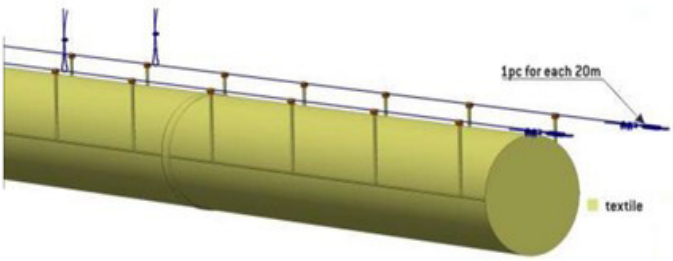
Description of the new devices

Refrigerated handling Area

- **2 SILENT** condensing units. With **BITZER** semi-hermetic piston compressor model 4FE 35Y of 35 CV of power that evaporates at 0 ºC with **Opteon™ XL20 (R454C)** with a condensation temperature of +40 ºC give us a refrigeration performance at 68 Hz of 2 x 102.2 kW approx.
- Refrigerant load: **55 kg of Opteon™ XL20 (R-454C)** by circuit.
- **2 INDUSTRIAL** Cubic evaporators units. Fin spacing 12 mm. It does not require defrost.



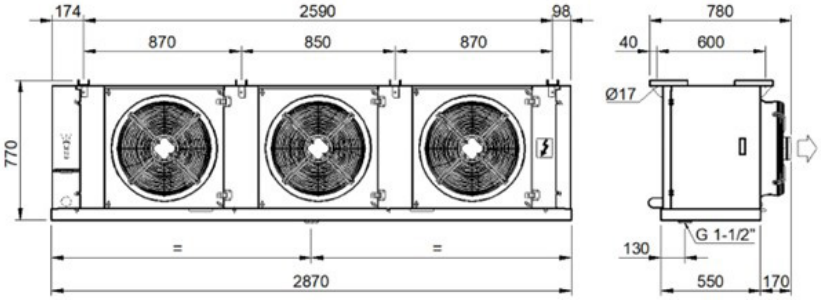
- 2 Units Carel EV3 stepper electronic expansion valve.
- 2 Electronic valve control sub-panel with EVD controller.
- 2 NTC overheating probe.
- Radiometric pressure probe.
- Liquid solenoid valve.
- Leak detector for each evaporator.
- 2 Textile sleeves.



- Electrical panel for each condensing unit with an evaporates with 2 three-phase fans. With personalized synoptic with **Eliwell** refrigerator microprocessor. With magneto thermic protections for the condensing unit, operation with fans of each evaporator.

Refrigerated chamber

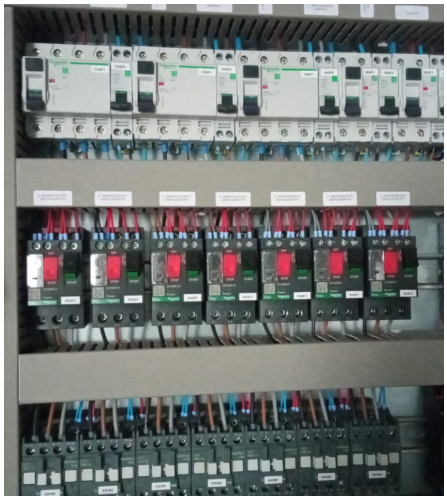
- **1 SILENT** condensing unit. With **BITZER** semi-hermetic piston compressor model 4PES 15Y of 15 CV of power that evaporating at -2 ºC with **Opteon™ XL20 (R454C)** with a condensation temperature of +40 ºC gives us a refrigeration performance at 68 Hz of approximately 45.5 kW.
- **INDUSTRIAL** cubic evaporators. With 3 three-phase 500 mm blade fans. With 7 mm separation of fins. Ventilated defrost.
- Refrigerant load: **45 kg of Opteon™ XL20 (R-454C)**



- **For every evaporation unit:**
  - **Carel** EV3 stepper electronic expansion valves.
  - Electronic valve control sub-panel with EVD controller.
  - NTC overheating probe.
  - Radiometric pressure probe.
  - Liquid solenoid valve.
  - Leak detector for each evaporator.

Eletric panel

- With personalized synoptic with **Eliwell** refrigerator microprocessor.
- With magnetothermal protections for condensing unit, maneuver.
- Circuit breaker for each three-phase fan of each evaporator.



Remote management system

For installation control, the system has:

- Remote control from mobile phone or other electronic devices.
- Leak alarms, general equipment breakdowns and temperatures.
- Record of temperatures.
- Control of electronic expansion valves and temperatures.

Summary of requirements

Refrigeration service	Volume (m^3)	Consignment Temp. (°C)	Required performance (W)
Handling area	6090	+12 °C	204.400
Storage chamber	1060	+8 °C	45.500

Compliance with safety regulations

Following the specifications of the Refrigeration Installations Safety Regulation (RSIF, RD 553/2019) for refrigeration installations with A2L refrigerants, the installation is equipped with appropriate A2L leak detectors.
All components are approved to work with A2L refrigerants, complying with the most demanding environmental and safety regulations.
The location of all the units abroad means that additional security measures for machine room are not necessary.

Client Feedback

Informed and advised by ***Frio Araba (Grupo Freire Refrigeración)***, the management of ***Cultivos Araba*** made a strategic choice for their project by selecting the ***Opteon™ XL20 (R-454C)*** refrigerant. Notably, this refrigerant boasts a low Global Warming Potential (GWP) of less than 150, aligning perfectly with environmental considerations. Its attributes include ease of installation, safety, and a noteworthy exemption from the Spanish fluorinated gas tax. This decision was reached following a comprehensive evaluation of diverse technological alternatives during a series of meetings, where a paramount focus was placed on sustainability and energy conservation.

Frío Araba® GRUPO FREIRE REFRIGERACIÓN

In the opinion of ***Mr. Fco. Javier Sierra, representative of Frio Araba***, „we opted by ***Opteon™ XL20*** because is the best option due the characteristics of the system. It brings us the simplicity of the use and the technology in it, with safe applications; it offers an important reduction of emissions, direct and indirect, that allows the customer a reduction in the carbon footprint; it brings a superior energy efficiency, with less energy consumption; and also very important, not being subject to the Fluorinated Gas Tax“, in addition, „it is a refrigerant for long term, due to its very low GWP value, complies with current and future regulations”.

According to ***Mr. Matías Brunet, representative of Cultivos Araba*** in Valdegobía, „we are very satisfied with this installation. This is an important project, and we need a reliable refrigeration system that can cover us for the next years. The safety and ease with which the work has been carried out gives us great confidence, and it is a more energy-efficient solution, which will allow us interesting savings in costs and a significant reduction in our emissions."

Opteon™ Efficient Economy

Beyond their low-GWP credentials, **Opteon™ XL A2L** refrigerants, as long-term solutions, are being developed to move towards increasingly stringent emissions targets and deliver clear system efficiency advantages. The versatility and thermodynamic properties of these new generation refrigerants ensure that they can significantly reduce life cycle costs and emissions in commercial and industrial refrigeration applications, all without compromising refrigeration performance or safety.