



# Opteon™ XL20: bringing ice-making machines to the next level



## The Company:

The Frigotecnica company has been manufacturing flake ice machines for over 25 years. It was established to meet the needs of the local Sicilian fishing industry and rapidly expanded to become an important player in the domestic and foreign market.

Frigotecnica is a cooperative company established in 1986, specializing in the manufacture of ice flakers. It is located in Mazara del Vallo, an important fishing port with a high concentration of operators in the seafood sector and with demand for flake ice machines growing steadily.

In the seafood industry, flake ice is an indispensable element for the conservation and distribution of high quality seafood, as it melts slowly, it cools and hydrates the product, maintaining its fresh quality and extending its shelf life. Other business sectors also use flake ice for certain processes, in particular for dairy and fruit and vegetables as well as in the food industry for meat processing.

Frigotecnica, thanks to its steady growth, in 2004 acquired the current plant with a production area of 3,000 square meters (32,292 sq. ft.). This has been a strategically important move for the company and, together with new machinery, has enabled it to manufacture new ice-making machines and improve the existing product range performance. Today, Frigotecnica is engaged into the possibility of manufacturing its ice flakers using alternative energy sources and adopting **sustainable refrigerants** to increase efficiency and performance, by at the same time reducing power consumption, certified TUV, RINA and CE.



## Flake ice:

Flake ice offers numerous advantages due to its solid consistency and average thickness of 3 mm (0.12").

- **Adaptation:** Thanks to its physical structure, flake ice does not compact or solidify but adapts to the shape of what it cools without damaging it.
- **Chilling:** The flakes allow the product to instantly benefit from the by the full cooling potential of ice, the latent value of which becomes 100% available.
- **Hydration:** It melts slowly and gradually, providing continuous hydration to the fresh product, preventing it from drying out.
- **Duration:** At a temperature of -18°C (-0.4 °F), flakes resist melting for longer than any other type of ice.
- **Bulk:** Due to its form, the flake ice is less bulky and occupies smaller volumes.



## Utilization sectors:

- **Seafood Sector**
- **Dairy Sector**
- **Fruit and Vegetable Sector**
- **Food and Meat Processing Industry**
- **Catering and Bars**
- **Medical Sector and other uses**

## Case Study Objectives:

With F-Gas Regulation EU 517/2014, the European Union has committed to a process of gradual reduction of the use of refrigerants with high global warming potential (GWP). Due to different operating mechanisms, the HFC refrigerants with high GWP such as R-404A will be limited in new installations and their availability for the maintenance of systems in operation will gradually diminish. This initiative pushes for the use of next generation alternative refrigerants, which are able to replace the previous fluids while maintaining excellent performance, ease of use and minimizing their impact on climate change.

The refrigerants in the Opteon™ range are designed to deliver an optimal balance between performance, safety, ease of use and low global warming potential thanks to the HFO (hydrofluoroolefins) based composition.

In particular, for new equipment, Opteon™ XL20 (R-454C) provides adequate cooling performance with a GWP of less than 150. This is 96% less compared with R-404A and 89% less compared to R-448A.

The aim of the case study was to confirm the performance and develop an optimized design enabling the full potential of next-generation refrigerants like Opteon™ XL20 with a GWP lower than 150:

- Achievement of thermal production targets
- Reduction of 89% of the direct CO<sub>2</sub> emissions compared to R-448A
- Extension of the system's life and long-term operability
- Improvement of the product's environmental credentials

## Flake ice maker:

Frigotecnica ice machines produce flakes with a 3 mm (0.12") average thickness using drinking or sea water. They consist of an evaporator section with a drum specifically designed for the application and an air-cooled condensing unit installed on an AISI 316 stainless steel base. The commercial range is capable of producing 350 to 4,000 kg (772 to 8818 lbs) of ice in 24 hrs. and is characterized by ease and flexibility of installation and low operating costs.



## Model FT 500S:

Refrigerant	Opteon™ XL20 (R-454C)
Daily output	450/580 kg/24h (992/1212 lbs/24h)
Ice thickness	2/3 mm (0.08/0.12")
Ice temperature	-14 °C/-18 °C (6.8 °F/-0.4 °F)
Water consumption	24 l/hr. (5.28 gph)
Cooling capacity (-30 °C/+40 °C   -22 °F/+104 °F)	2.9 kW
Power absorption (-30 °C/+40 °C   -22 °F/+104 °F)	2.3 kW
Dimensions	75 x 46 x 45 cm (29.5 x 18.1 x 17.7 inches)
Weight	70 kg (154.3 lbs)

The 24 hour production index is based on an ambient temperature of 24 °C (75.2 °F) and feed water temperature of 18 °C (64.4 °F) and may vary depending on installation conditions.



## Description of installed devices:

The Leone Condensing Unit by Arci consists of:

- Bitzer 2DES-2Y-40S compressor
- Frigomec liquid receivers
- Castel line components
- Danfoss controls

The evaporator unit is designed and produced by Frigotecnica and consists of:

- Drum evaporator
- Gear motor
- Carel EVD Evolution electronic valve

The condensing unit is certified for the use of R-454C refrigerant, in compliance with the applicable European directives and meets all safety requirements, including the harmonized standard UNI EN 378.

## Comparison with previously used refrigerant:

The performance of the ice-making machine was measured against the previous version that used R-448A refrigerant. The ice flake quality has been evaluated as excellent, with an optimal thickness of 3 mm (0.12") and with a minimum temperature of -18 °C (-0.4 °F). The daily output could be improved, while optimizing absorbed power and refrigeration capacity. Upgraded components were adopted, with A2L safety class certification and the temperature glide of the refrigerant did not present any issue. The refrigerant change has led to an 89% decrease in GWP.

## Discussion and conclusions:

Frigotecnica cares about the environmental impact of its products and their performance and has chosen to use Opteon™ XL20 (R-454C), a HFO blend with <150 GWP . This industrial choice will enable the manufacture and maintenance of new ice-making devices beyond 2030 in compliance with the EU F-gas Regulation 517/2014.

The redesign of the machines has been straightforward and the certified components were found to be readily available on the market. The Leone condensing unit, with Bitzer compressor and Carel controls, offers improved performance for optimal daily output and power consumption.

## The customer's voice:

Baldo Mirabile, partner and technical manager at Frigotecnica who has followed the project from its initial stages commented: *"Using R-454C was easier than we expected. From the first tests, it was clear that performance would meet the requirements of our customers and that the low GWP would enable us to improve our environmental image, ensuring our long-term vision. We are in the process of extending the use of R-454C into our entire range of machines."*

Daniele Pecoraro, sales manager of Frigotecnica, states: *"Thanks to the new refrigerant, sales opportunities and attraction of environmentally conscious customers will grow."*

### COMPANIES THAT CONTRIBUTED TO THE PROJECT

#### **Frigotecnica Soc. Coop.**

Via Rio de Janeiro - 91026 Mazara del Vallo (TP)

#### **Rotocold s.r.l.**

Via Giuseppe Alessi 38 - 90143 Palermo (PA)

#### **Nippon Gases Italia s.r.l.**

Via Benigno Crespi 19 - 20159 Milan (MI)

#### **Chemours Italy s.r.l.**

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