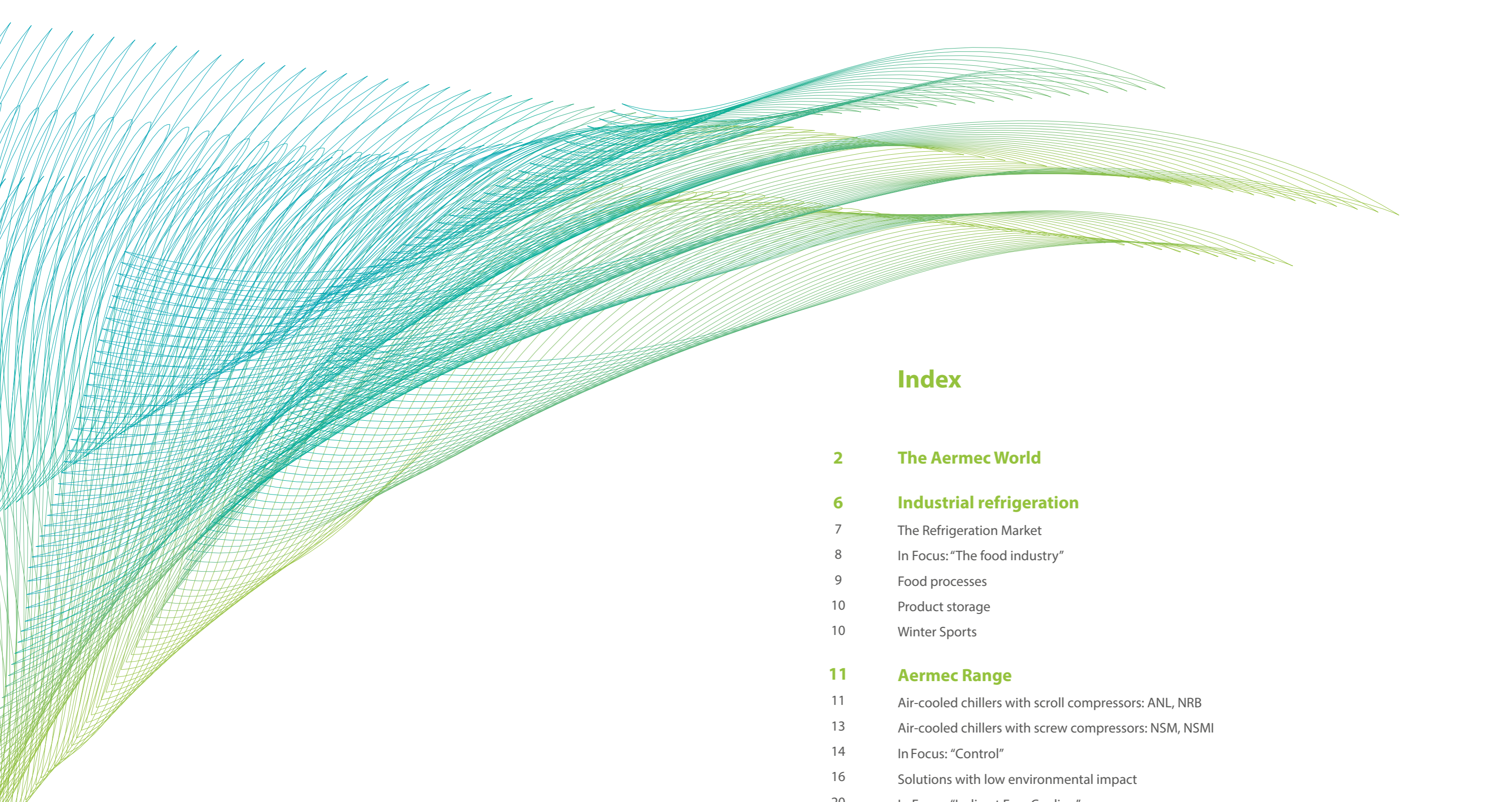


Industrial Refrigeration

AIR CONDITIONING SOLUTIONS

AERMEC

The world of high- and medium-temperature refrigeration encompasses numerous sectors: from the food industry and cut flowers through to the chemical and pharmaceutical industry and winter sports.

To cater to the requirements of these industries, Aermec has designed flexible, reliable, sturdy and highly energy efficient units capable of adapting the equipment's setpoint to suit the particular stage of the process and integrating seamlessly into smart management systems.

Add to this the know-how we have gained over the years and the many projects where we have turned our specific experience into successful applications and it is easy to see why Aermec is recognized as an expert, reliable partner.

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The Aermec World

The Giordano Riello International Group (GRIG), which Aermec is part of, boasts annual sales in excess of € 320m, over 1700 employees, 8 manufacturing facilities and distributes its products through an extensive worldwide sales network. With 6 foreign subsidiaries, with over 60 dealers and 80 after-sales services in Italy and more than 70 international distributors, we can provide global coverage, assisting customers of all kinds with consulting and support services.



Advanced logistics

Highly automated production lines coupled with the most advanced technologies in the logistics field combine to assure short delivery times to meet all customer requirements while delivering high levels of quality. Indeed, before it can be released to market, every single unit undergoes thorough controls to ensure both safety and technical performance meet our exacting standards.

Advocates for efficiency

Aermec is an ISO 14001 certified company and we are strongly committed to minimizing environmental impact in all aspects of our business: not just at our manufacturing sites, but also in the solutions we offer our customers. With ongoing development, technologies allowing us to exploit free cooling and advanced control algorithms, Aermec products deliver the lowest possible consumption and highest possible energy savings at both full load and part load.

Founded in 1961 by Giordano Riello, Aermec is rated one of the leading European manufacturers of air conditioning units. We were quick to extend our know-how to new applications, including wine-making process control, process cooling and industrial refrigeration in general. Today, the unfailing intuition of founder Giordano Riello has established Aermec as a key player on the world stage in medium- and low-temperature applications: leading businesses in the refrigeration industry choose Aermec to meet the demands of a modern hi-tech process. Our challenge has been to develop reliable, innovative, flexible and highly efficient products, integrated in smart management systems, capable of reducing overall energy consumption and catering to the demands of users who are increasingly budget conscious and discerning when it comes to applying the latest technologies.

For Aermec, providing support to customers in all the countries we do business in is a primary concern, as is offering them dedicated technical assistance, with specialist personnel on call 24/7. All authorized support centres - 80 across Italy - and all foreign distributors are kept constantly up to date with the latest solutions and technologies adopted by Aermec. With a widespread local presence and advanced procurement and distribution logistics, Aermec successfully manages and delivers swift customer support and the supply of spare parts worldwide.

The GRIG group

440 Million euros in sales

8 Manufacturing facilities

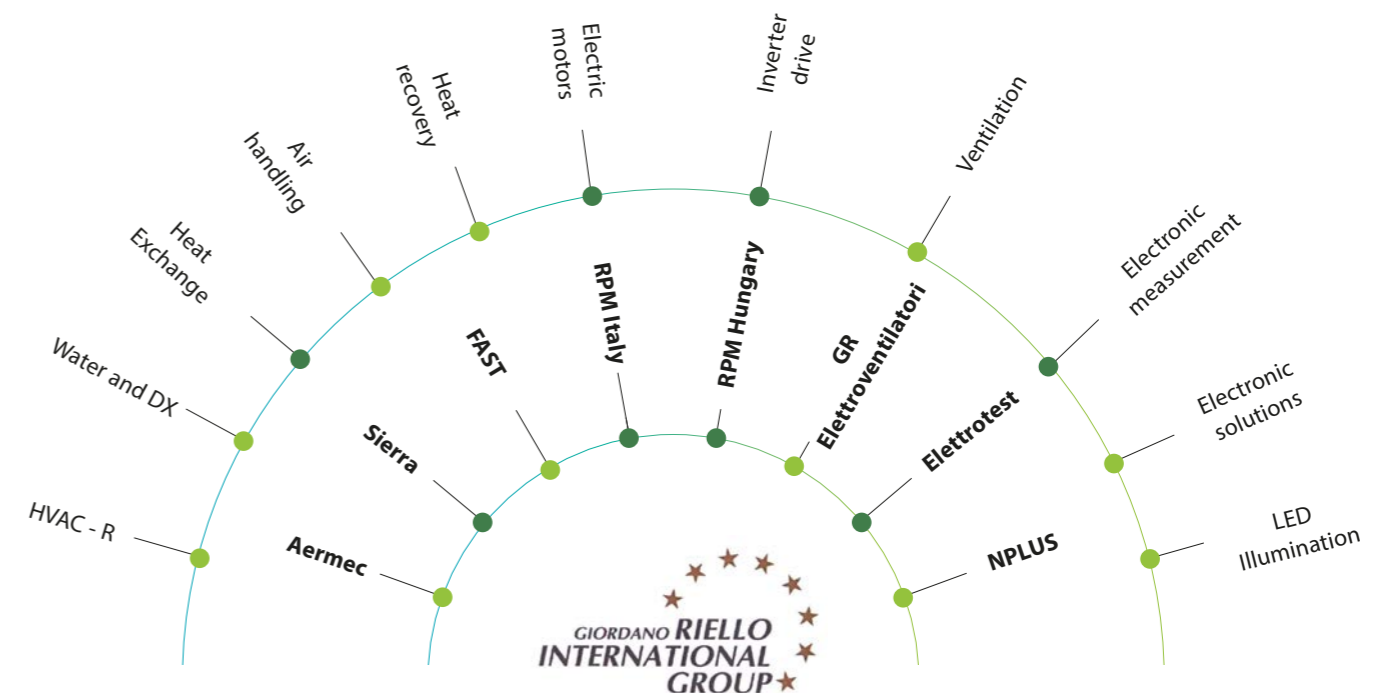
1750 Employees

6 6 foreign subsidiaries

56 60+ Dealers in Italy

81 80+ Technical After-sales Service

70 International distributors





Training center

1+3

Auditorium + Training classrooms

600+

Attendees per year

150

Course days per year

1965

First Aermec training course

2-5

Lesson days per course

25000+

Total number of attendees

Entrance of the new Training centre

The importance of training

Here at Aermec, we have always appreciated the importance of matching the inherent quality of our products with a series of initiatives and services targeting the various categories of operators and users we deal with on a daily basis. Our company headquarters house a new Training Centre with specially appointed rooms for holding courses and meetings.

Each year, the Training centre hosts over 150 training days, with a number of rooms to accommodate a total of around 4000 attendees a year. Over our fifty-plus years in the business, we have helped many engineers in the trade grow their expertise, with more than 25,000 people attending our specific courses.

Calorimetric test chamber used to perform Eurovent tests for the certification



Technology and reliability

Aermec's research centre currently houses the largest climatic test chamber in Europe for system equipment, used to perform testing on chillers and heat pumps up to 1500 kW chosen by Eurovent for the certification, can test units rated as high as 2 MW.

Tests are carried out accurate to ± 0.2 °C, capable of simulating ambient temperature conditions from -20 to +55 °C. In addition, Aermec laboratories are set up to conduct noise and aerodynamic testing and measure changes in enthalpy.

Aermec quality is guaranteed by top certifications, such as Eurovent in Europe and AHRI in North America among others. Every year, a host of customers visit our company headquarters to attend customized tests in these purpose-built laboratories. Thorough procedures at the design stage, careful supplier selection, in-depth prototype testing, numerous checks in the field and vibrational analysis combine to ensure that all Aermec products are built to last and operate perfectly even under the most demanding service conditions.

Industrial refrigeration

Refrigeration is the process whereby the temperature of a given area, machine or product is lowered by means of a system using a glycol solution or direct expansion.

Depending on the required temperature, refrigeration can be classed as:

- High temperature: over 4°C;
- Medium temperature: between 3 and -10 °C;
- Low temperature: down to -50 °C (any lower and we enter the realm of cryogenics).

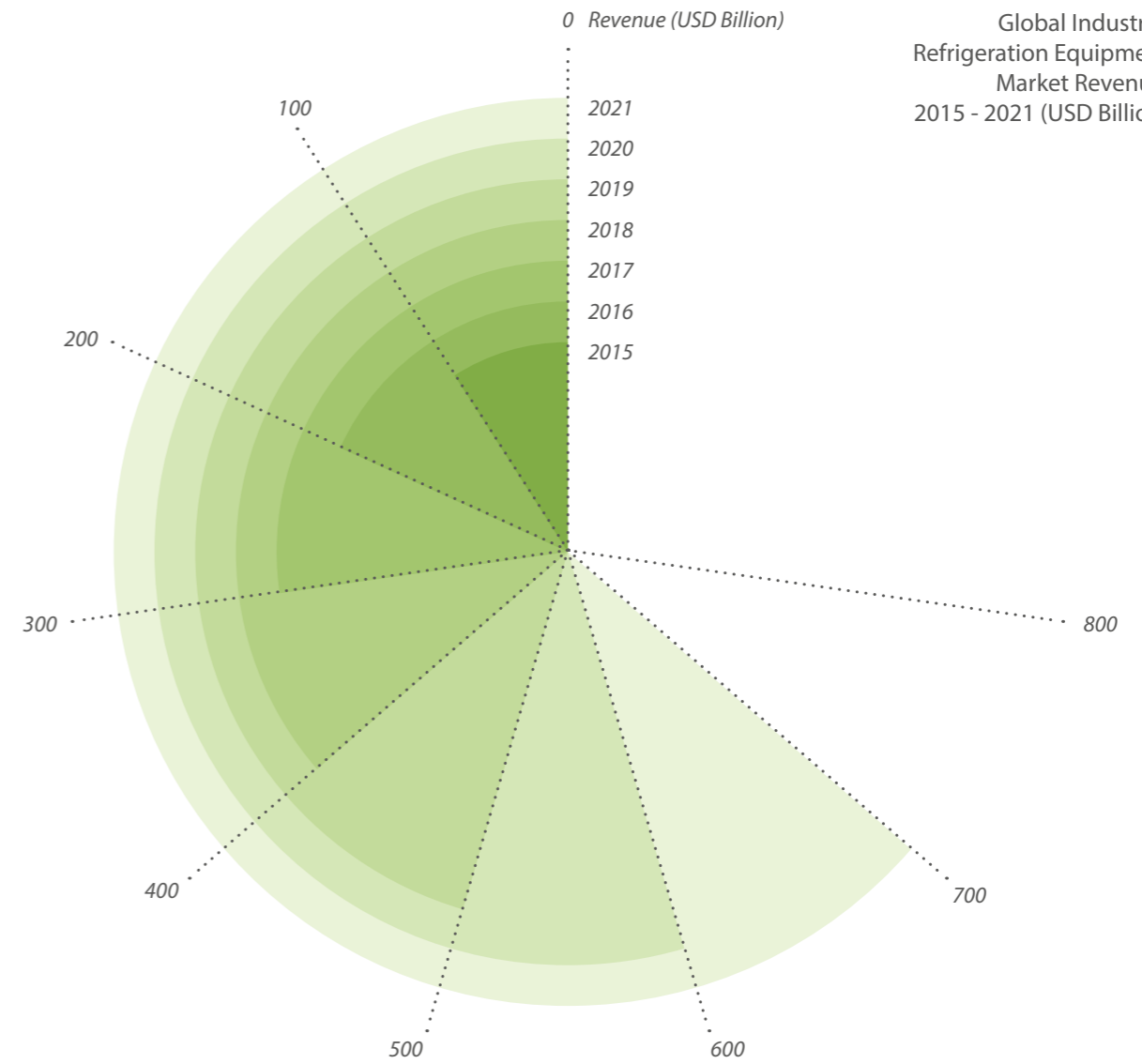
Industrial refrigeration and air conditioning share some common ground, while they differ in other aspects. In both fields, components such as compressors, pumps, heat exchangers and fans are used to control the temperature of a given environment and keep it within a set range.

However, while the purpose of air conditioning is to ensure occupant comfort, industrial refrigeration is often required to ensure that a process works properly or that a product is stored correctly. In addition, given the huge variety of installations and possible plant configurations, implementing industrial refrigeration often entails customizing the system.

With our impressive experience in the industry and extensive range of products and configurations, we can cater to all high- and medium-temperature refrigeration requirements in the various relevant sectors (food and beverage industry, storage of cut flowers, winter sports, chemical and pharmaceutical industry, ...), assist designers and installers during all stages of the system's implementation and provide them with ongoing support for the duration of the equipment's service life.



Global Industrial Refrigeration Equipment Market Revenue, 2015 - 2021 (USD Billion)



The refrigeration market

The global industrial refrigeration market was estimated to be worth 24 billion dollars in 2015 and forecasts point to it topping 36 billion dollars by the end of 2021, with a compound annual growth rate (CAGR) of just over 7 percent between 2016 and 2021.

Industrial refrigeration systems are widely used: in the food and beverage industry, cold rooms, warehouses and in the chemical and pharmaceutical industry, which all require a controlled running temperature for raw materials and in-process materials.

The industrial refrigeration market is divided up into segments according to the various products included in the sector: compressors, evaporators, heat exchangers and so on.

In 2015, the compressor segment was the largest, followed by industrial racks and evaporators. Compressors, refrigerated shelving and evaporators accounted for over 62 percent of the market in 2015.

In terms of market, the application segments for industrial refrigeration equipment include food production and processing, beverage production, chemicals and pharmaceuticals, energy (for producing gas), logistics (storage-warehousing) and petrochemicals. Food production and processing was the number one segment and commanded a market share of over 24 percent in 2015.

FOCUS ON

The food industry

In terms of the agricultural and food industry, the year 2016 can be split into two parts: the first nine months marked by moderate swings and only slight changes, while the last quarter was marked by a significant drive and general uptrend.

Food production was up around 10% on the year 2000, compared to the -20% dip in industrial production as a whole.

When it comes to export markets, the top European performers are Germany (+1.8%), France (+3.2%) and the UK (+0.9%). Another driving market, though steadily slacking off, is Spain, with a progressive value of +5.3%. On other fronts, the US is picking up the pace, improving on last year's +3.6% with a +4.8%, while Canada is showing a steady net recovery with its +7.7%, up on the previous year's +5.6%.

ESSENTIAL ITALIAN FOOD INDUSTRY FIGURES

	2013	2014	2015	2016	2017(*)
Sales	€ 132 bn (+1,5%)	€ 132 bn (+0,0%)	€ 132 bn (+0,0%)	€ 132 bn (+0,0%)	€ 132 bn (+1,5%)
Production (quantity)	-0,7%	-0,6%	-0,6%	1,1%	1,0%
Number of industrial concerns (with over 9 employees)	6.845	6.850	6.850	6.850	6.850
Exports	€ 26,2 bn (+6,1%)	€ 27,1 bn (+3,5%)	€ 29 bn (+6,7%)	€ 30 bn (+3,6%)	€ 31,5 bn (+5,0%)
Imports	€ 19,5 bn (+4,8%)	€ 20,4 bn (+4,8%)	€ 20,8 bn (+2,0%)	€ 20,7 bn (-0,3%)	€ 20,9 bn (+1,0%)
Difference	€ 6,7 bn (+9,8%)	€ 6,8 bn (+0,0%)	€ 8,2 bn (+20,6%)	€ 9,3 bn (+13,4%)	€ 10,6 bn (+14,0%)
Total food consumption	€ 225 bn	€ 227 bn	€ 230 bn	€ 230 bn	€ 231 bn
Ranking within Italian manufacturing industry	2 nd place (13%) after engineering industry	2 nd place (13%) after engineering industry	2 nd place (13%) after engineering industry	2 nd place (13%) after engineering industry	2 nd place (13%) after engineering industry

Data compiled by the Federilimentare (Italian food industry federation) research department based on ISTAT (national statistical institute) data *estimates

When it comes to industries, the most important sectors are: the wine-making industry, with Italy actually being the world's top wine producer, ranked number one for export quantities and third for land area planted with vines; the confectionery and sweet bakery sector in second place with an increase of +12.5%; and the dairy-cheese industry, which has recorded a 5.6% increase on the previous year. Also showing strong growth in double figures are the "sugar" industry (+23.7%) and cereal processing (+18.8%). They are followed by "coffee" (+8.7%) and "oils and fats" (+6.5%). Despite a slight dip (-1.5%), one sector definitely worth

keeping a close eye on is that of the most popular beverage in the world: beer. Indeed, we have been witnessing a shift in the beer market in recent years: on the one hand, large breweries are pursuing internationalization more and more; on the other, micro-breweries are mushrooming, intent on creating quality products for a niche consumer base. Italy - a country where the beer industry contributes around 4 billion euros a year to the government's coffers - boasts the highest growth rate in Europe with a 138% increase in microbreweries going into business over the last five years.



Food processes

To ensure a product retains all its original organoleptic properties, use of the refrigeration system is often required in-process.

Products like cheese, wine, beer, fruit juices and instant coffee need low temperatures during the process of turning the raw material into the finished product.

Depending on the specific stage, the required temperature can vary from 10-15 °C down to -5°C.



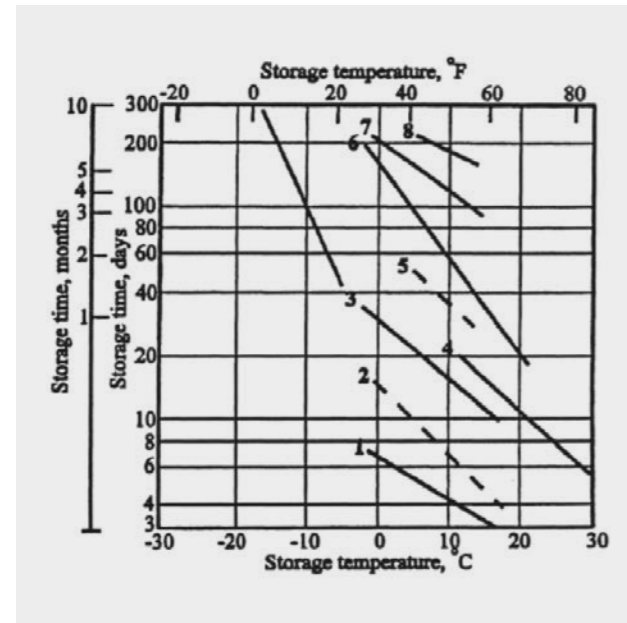
Product storage

A product's shelf life varies depending on the environment in which the product in question is stored.

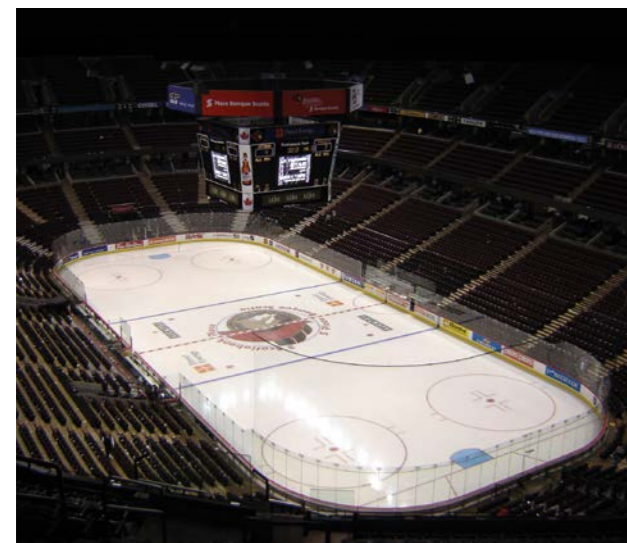
Most products often need to be kept at a temperature that is higher than their freezing temperature so as to retain all their original organoleptic properties.



Shelf life of a number of products versus storage temperature:
1. chicken, 2. lean fish, 3. meat, 4. bananas, 5. oranges,
6. apples, 7. eggs, 8. apples in controlled atmosphere



COLD ROOM TEMPERATURES	
Apples	-1 ÷ 0
Avocados	4 ÷ 13
Bananas	13 ÷ 14
Cabbage	0
Cheese	0 ÷ 1
Lettuce	0 ÷ 1
Pears	-2 ÷ 0
Poultry	-1 ÷ 2
Strawberries	-1 ÷ 0
Tomatoes	3 ÷ 4



Winter sports

Key to most winter sports is keeping the ice rink at the desired conditions. The ice, which is usually 25 mm thick, is kept at optimal conditions using a dense grid of pipes carrying an ice-cold water/glycol fluid. When water is sprayed over the pipes, it forms the top surface for skating or playing sports on.

Temperatures vary depending on the type of sport in question: going from 4°C for an ice hockey rink down to -4°C for an ice skating rink.

Aermec Range

Air-cooled chillers with scroll compressors: ANL, NRB



ANL series

NRB series

ANL series

The ANL series is an R410A outdoor series designed to cater to small- and mid-sized facilities for commercial and industrial purposes. These reliable, sturdy and efficient units feature brazed plate exchangers and scroll compressors, ensuring extremely quiet running. They come in chiller, heat pump and condensing unit versions and with the option of a built-in hydronic kit so as to meet any system requirements and make them easier to service.

NRB 0282-0754 series

The NRB unit are designed to guarantee high efficiencies and low sound emissions. Furthermore, the new geometry of the louver coils allows for a considerable reduction of the refrigerant load. They have an extended operating range and they are equipped with "SEER OPTIMIZED" scroll compressors and braze welded AISI316 stainless steel plate heat exchanger.

NRB series

The NRB series is the new Aermec chiller with V-block micro-channel coils. This configuration, comprising two fans and two coils, has been designed to make maintenance procedures supremely simple by enabling the coils to be taken out from the side. The exchanger on the system side can be a brazed plate model made from AISI 316 or shell and tube version. NRB units are built with a number of circuits and come in three different efficiency levels.

On all units, the equipment's load-bearing frame, made from hot dip galvanized polyester powder coated sheet steel, ensures sturdiness and easy access for maintenance work.

The fan unit comprises statically and dynamically balanced axial-flow fans. The application of multiple scroll compressors ensures reliability and peace of mind and allows for effective stepped capacity control, with reduced consumption at part loads and resulting high values for the seasonal energy efficiency ratio, ESEER. Most models come with the option of compliant solutions, the most advanced technology the market has to offer, delivering high efficiency, quiet running and reliability.

Compliant Scroll technology actually ensures axial and radial adaptability between the two scrolls. The latter increases the component's service life as it allows small solids to pass through it and makes the component more immune to liquid return; while axial compliance minimizes leaks in order to boost the whole unit's overall efficiency.

Depending on the configuration, the unit features safety devices such as: high-and low-pressure pressure switches, high-and low-pressure transducers, sensor for monitoring the unit's inlet or outlet water temperature. NRB models and all heat pumps offer air-side fin and tube exchangers, made with copper pipes and aluminium turbulence-inducing fins. ANL- and NRB-series chillers, on the other hand, have micro-channel exchangers that ensure considerable energy efficiency and lower refrigerant content. The dual thermostatic valve adjusts the gas flow to the evaporator based on the heat load, offering a dual setpoint in cooling mode to cover an extensive operating range from +18 °C to -10 °C for the water produced.

Latest generation fans on an Aermec chiller



Water-cooled chillers with screw compressors: NSM, NSMI

NSM series

The NSM units are chillers with screw compressors, shell and tube heat exchangers and micro-channel coils designed and manufactured to meet the air conditioning needs of commercial complexes and cater to refrigeration requirements in industrial complexes.

Serie NSMI

The NSMI series comes as standard with inverter-controlled compressors so as to enable continuous adjustment of the output and automatic control of the compression ratio.



NSM unit with shell and tube heat exchanger and inline pumps

The base, the frame and the panelling are made from steel treated with corrosion-inhibiting polyester coatings to make the unit sturdy, reliable and suitable for installation even in the harshest of environments.

All units are designed with a number of cooling circuits so as to deliver high performance even at part loads and ensure uninterrupted operation in the event one of the circuits fails.

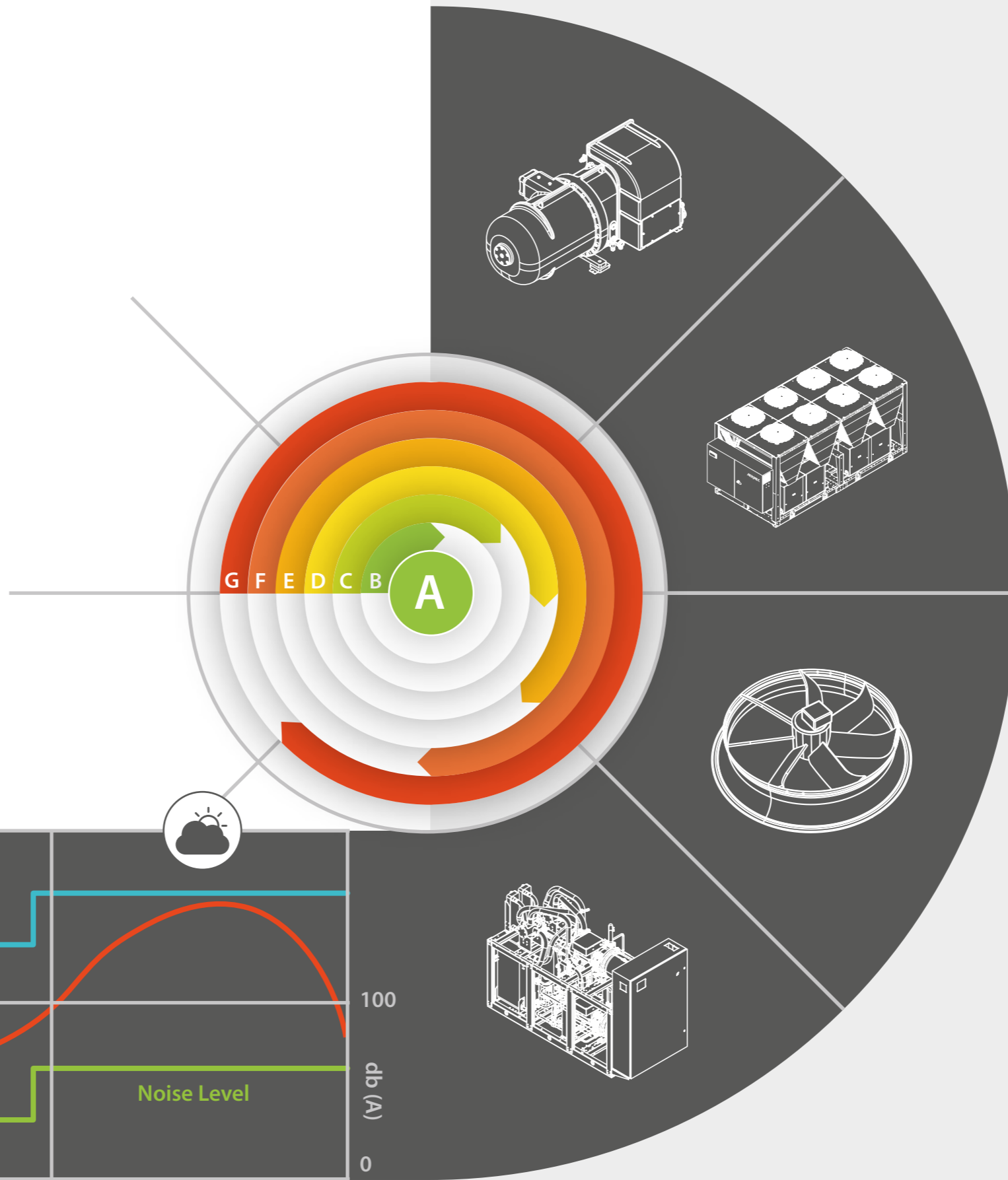
Efficiency levels



As with the scroll units, the NSM-NSMI range also features safety devices, depending on the configuration, such as pressure switches, flow switches and transducers.

For even easier installation and to be able to provide plug&play solutions, you can select the built-in hydronic kit, which comprises all the main water circuit components with one or two inline pumps that adapt to the system's head.

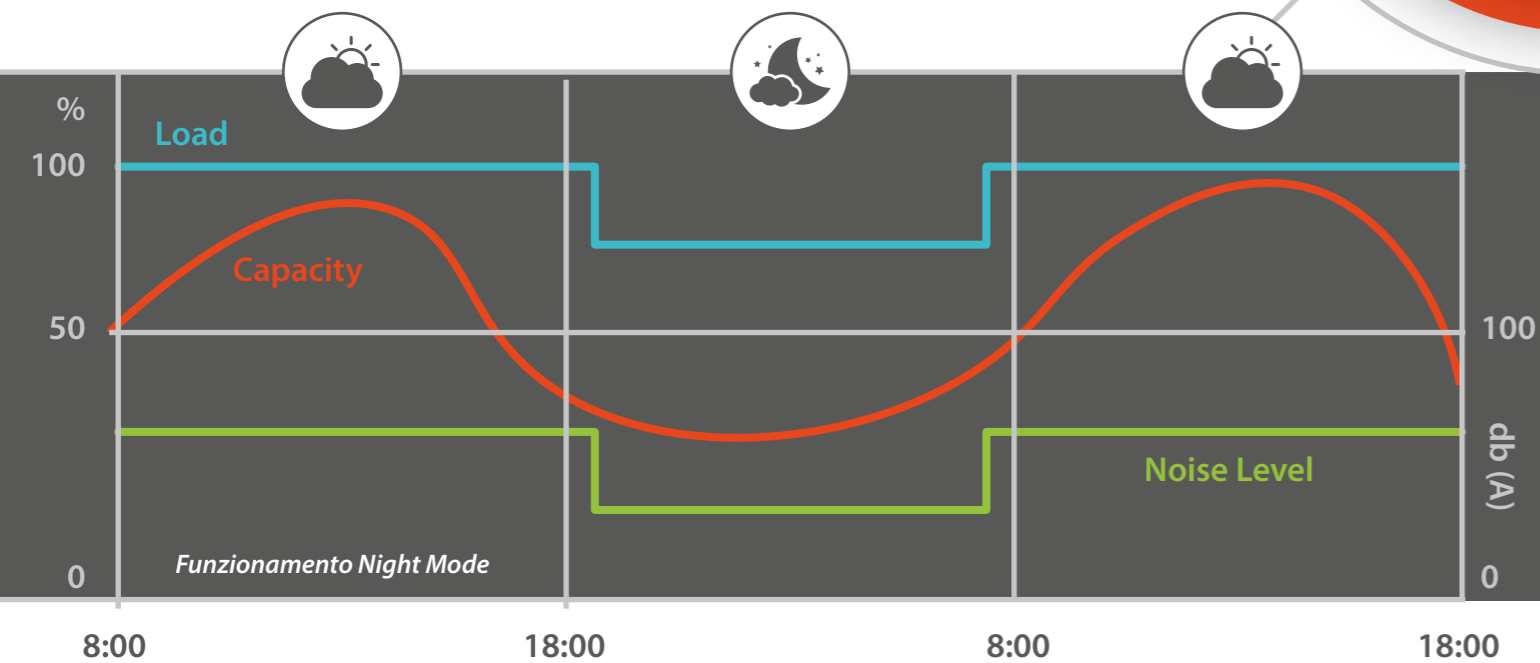
FOCUS ON
Control



Energy efficiency

When it comes to energy efficiency, objectives are increasingly difficult to achieve. Even the commercial and industrial refrigeration industries have become part of a world governed by smart and effective solutions.

Today's most significant challenge is providing a dynamic and flexible response to system demands and to dynamic load variations, at the same time consistently delivering efficiency. All NRB and NSM models with inverter- or DCPX-controlled fans come with the option of **HP floating** (High Pressure floating) control. Aermec has developed an advanced control system for the continuous adjustment of the fans' air flow rate in order to optimize the unit's operation at any work point, ensuring increased **efficiency at part loads with an increase in the ESEER as high as +5% with inverter-controlled fans.**



The timer feature or remote control can be used to set the unit to **Night Mode**. With this special operating mode, when opting for fans equipped with inverters or phase control devices, you can set up a silent running profile for given time intervals, for instance at night-time when the load is lower and greater acoustic comfort is required.

In addition, the NSM and NRB series are designed to be able to reach the outdoor temperature operating limit of -20°C by switching off the fan of one or more V-blocks (XLA kit) and working in variable flow mode on the primary (VPF kit).

Solutions with low environmental impact

NSG-NSGI: unit with R1234ze ecological gas

The innovations in **heat recovery** and the continuous increase in **seasonal energy efficiencies**, along with the systems designed to **minimise the environmental impact**, have always represented and will continue to represent a fundamental business goal for AERMEC.

Over the years the use of refrigerant gases in cooling circuits to obtain cooling has always been the subject of discussion. Only natural gas was used up until the 1930's. Safer gases (CFC) were then introduced gradually until it was discovered that the ozone layer was getting thinner.

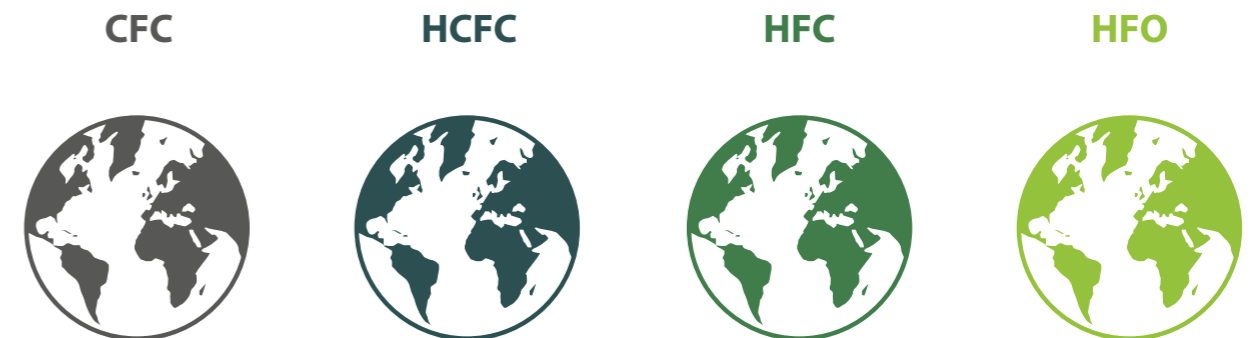
With the Montreal Protocol of 1987, the progressive shift from HCFC fluids (R22) to HFC fluids with nil ozone-harmful effect (ODP = 0) was established. In 1995 global warming started to become a problem and the GWP (Global Warming Potential) parameter became increasingly important.

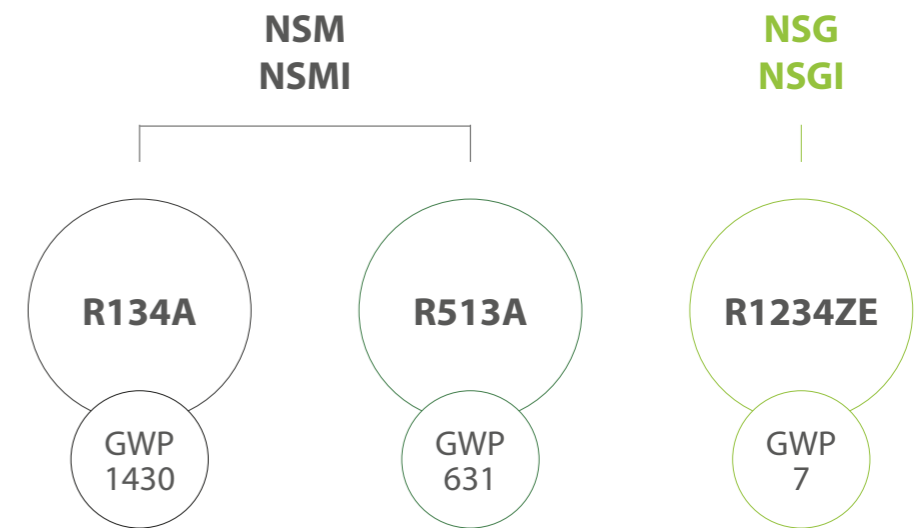
In 2014 **EU Regulation no. 517/2014** marked a real revolution in this field by introducing specific requirements aimed at reducing, step-by-step, tons of CO2 emissions equivalent to fluorinated greenhouse gases (F-gas).



As the graph shows, the phase-down set by the Regulation will lead to an **80% reduction in HFC gas consumption by 2030**. It is important to point out that, at the moment, there is no ban on the current use of the most commonly used HFC refrigerants (R410A, R134a) in the air conditioning sector. Alongside some technical actions implemented to

reduce the kg of refrigerant used (such as the use of micro-channel exchangers or exchangers made with smaller pipe diameter; semi-alloyed shell and tubes with Spray System or Fouling film distribution system), the reduction of the tons of CO2 emitted into the atmosphere is achieved through the **use of low GWP refrigerant gases**.





In this regard, Aermec (ISO 14001 certified company), which has always promoted sustainability and reduced environmental impact, offers **NSG – NSGI** product ranges that are carefully designed to ensure **optimised operation with HFO R1234ze gas with GWP close to 1.**

The **wide operating range** (from -8°C to +18°C of water produced) and the possibility of **total heat recovery even at low system set point temperatures** (thanks to the calibrated injection of hot gas that protects the unit from excessive pressure drops) make these units the perfect solution to fulfil all the requirements of a modern refrigeration process (food industry, product storage in cold rooms, chemical-pharmaceutical industry, winter sports, manufacturing processes in general, large-scale retail trade).



PED unit	2
Safety class	A2L
Formula	CF3CF=CHF
Molar mass [kg/kmol]	114
Practical limit kg/m ³	0,008
Auto-ignition temperature [°C]	368
Lower flammability limit (LFL) [kg/m ³]	0,323
Global warming potential (GWP)	7
Ozone depletion potential (ODP)	0



FOCUS ON

Indirect free cooling

The NRB, NSM and NSMI series units also come in a **free-cooling** version.

In this case, the units come with additional water-cooled coils and 3-way diverter valves as standard: when the air temperature is low enough to cool the water to the desired return temperature, the 3-way valve allows water through to the free-cooling coil and **the solution is cooled for free without using the compressors.**

The use of free-cooling units offers considerable advantages to businesses needing to use cooling all year round, maximizing energy savings while optimizing use of the cooling circuit.

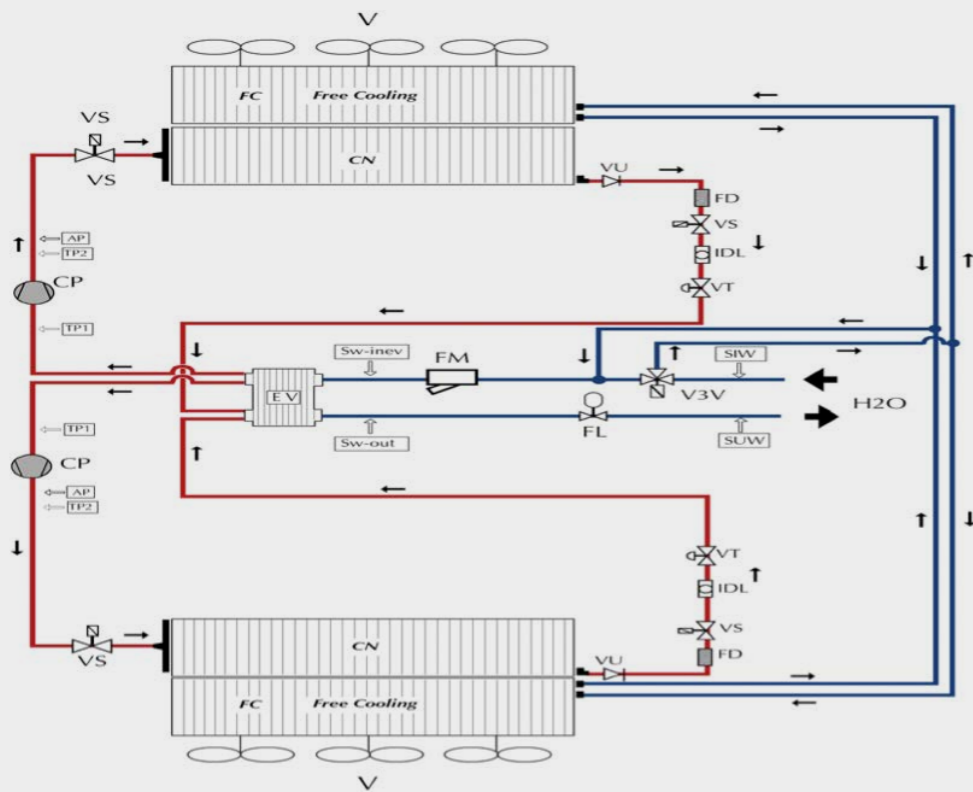
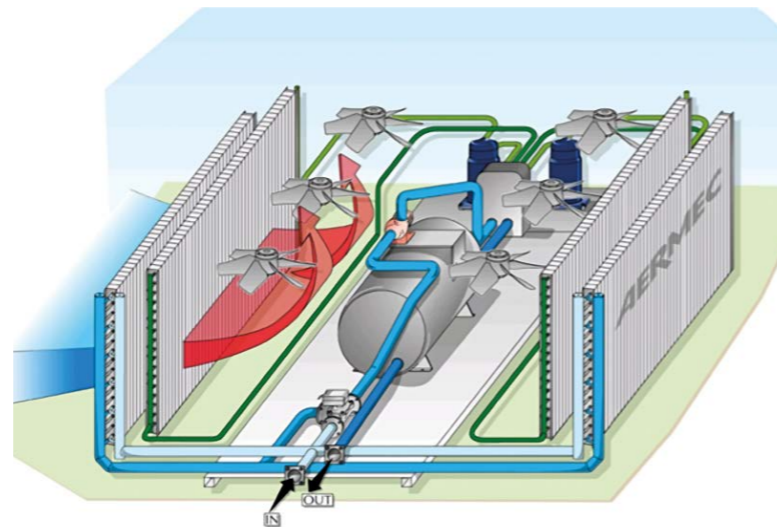
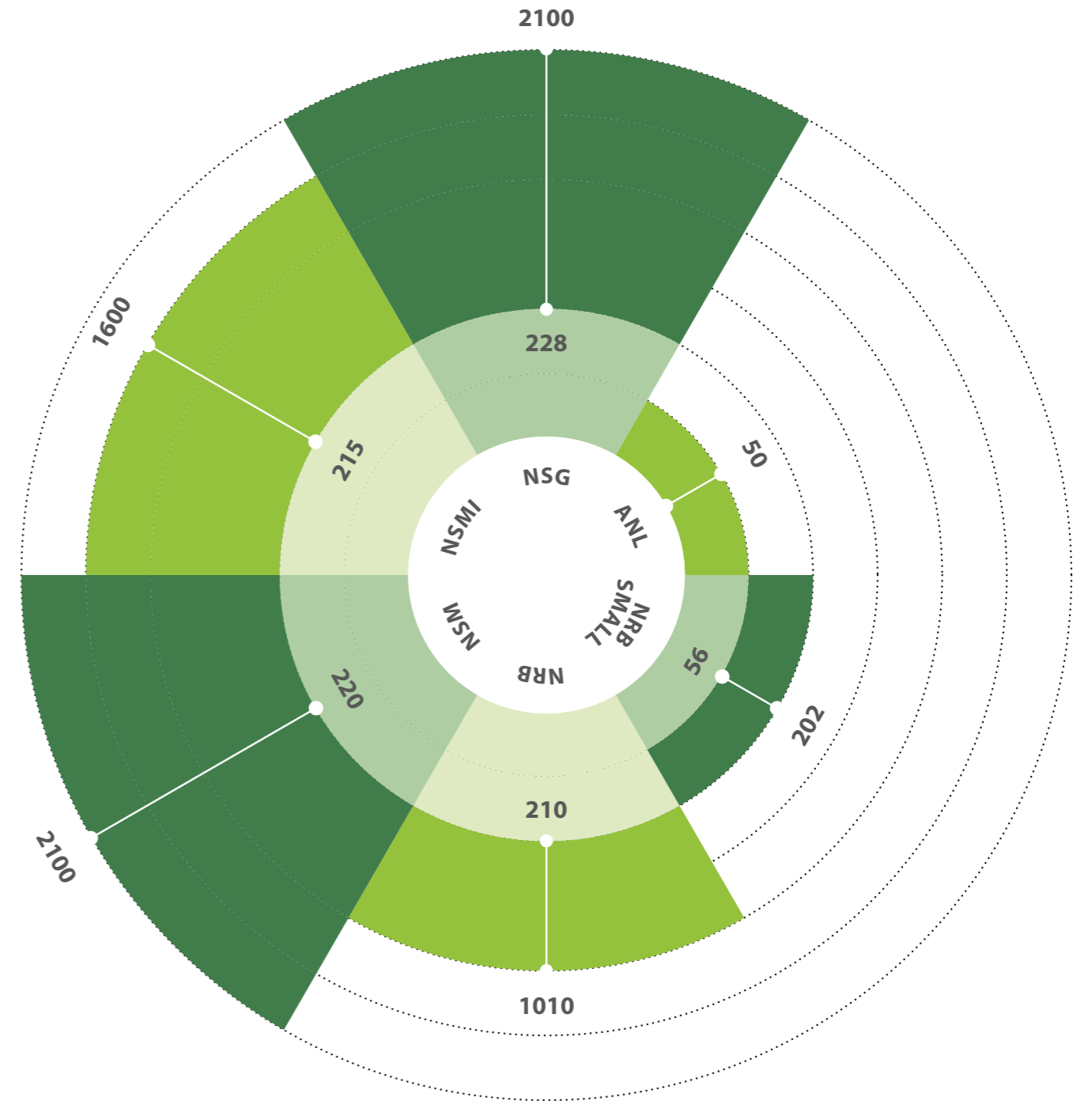


Diagram showing the cooling principle of a free-cooling unit

Technical data [kW]

Data provided under Eurovent standard conditions



Because they have been cleverly designed to ensure a heat exchanger inlet temperature greater than or equal to 35°C, all the units described above allow for heat recovery with the addition of a brazed plate exchanger made from AISI 316L even when producing cold water at very low temperatures.

Water-cooled chillers with scroll compressors: NXW

NXW series

NXW units are water-cooled chillers for producing chilled water (or heated water, with water side reversal) that cater to the safety, efficiency and ease of installation demands typical of the industrial market.

The series features latest generation hermetic scroll compressors fitted, as standard, with an antifreeze heating element that is powered automatically when the unit is idle.



NXW-series water-to-water chiller

The use of scroll compressors allows for effective stepped capacity control so as to adapt efficiently to the load even at part loads. As a result, ESEER values, calculated according to EUROVENT specifications, are very high. Both the evaporator and condenser are brazed plate models made from AISI 316, insulated with suitable

closed-cell material to reduce heat loss and optimize the unit's operation. It comes in two versions: standard and low noise. The latter features a compressor enclosure made from galvanized sheet metal lined with sound-absorbing material capable of reducing noise and ensuring quieter running.

In addition to the various safety and control components, such as high- and low-pressure transducers, pressure switches in versions with plumbing kit and safety valve, the cooling circuit

on the NXW series has valves on both the fluid and delivery line capable of cutting off the refrigerant and sealing the circuit for the purpose of non-routine maintenance and repair work.



Water Station hydronic kit

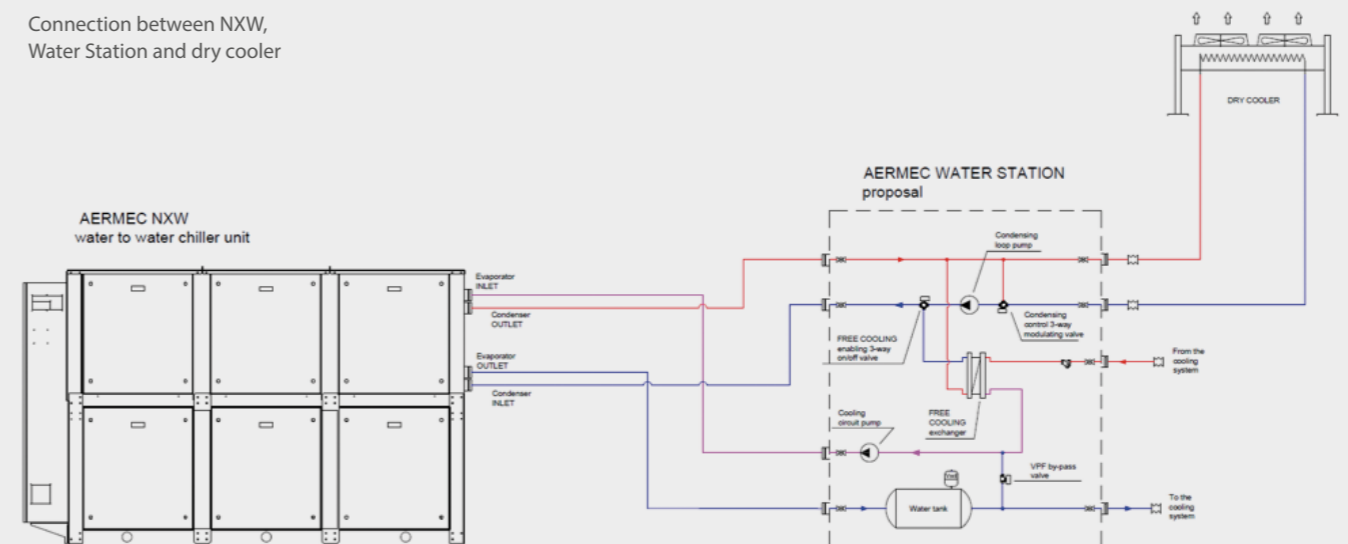
The NXW series can be used in conjunction with the **Water Station**, a plug&play hydronic kit that makes the job of installing the unit easier in systems where the production of chilled water is a year-round requirement.

The WST connects the chiller's water lines to the dry cooler and controls its operation based on outside air

temperature: if the air temperature goes over a certain threshold, the Water Station adjusts the speed of the dry cooler's fans to keep the chiller's condensing pressure under control; if the air temperature is low, the WST switches off the chiller and, thanks to the special free-cooling exchanger, uses the dry cooler's water to supply the system.



Connection between NXW, Water Station and dry cooler



Water-cooled chillers with screw compressors: HWS, HWF

HWS and HWF series

HWS and HWF units are liquid chillers with reversible water side featuring screw compressors and are optimized for high condensing temperatures.

These ranges stand out for their high energy efficiency and low noise emissions due to the unit's option of being fitted with a special enclosure (low-noise version).

The basic difference between the two series lies in the exchangers used: while the HWS units are fitted with AISI 316 brazed plate exchangers, the HWF units feature shell and tube exchangers with a steel casing.

The screw compressors used and the option of having the electronic valve in the cooling circuit mean output can be adjusted in the 25% to 100% range to make

the system flexible and able to adapt to system demands without any drop in efficiency.

Each compressor features a manually reset thermal cutout, heating element, discharge temperature control and nonreturn valve on the discharge line.

The cooling circuit features all relevant control and safety components, such as pressure switches, safety valves and high- and low-pressure transducers, designed to issue pre-alerts in the event the unit experiences operating trouble.



HWS-series chiller



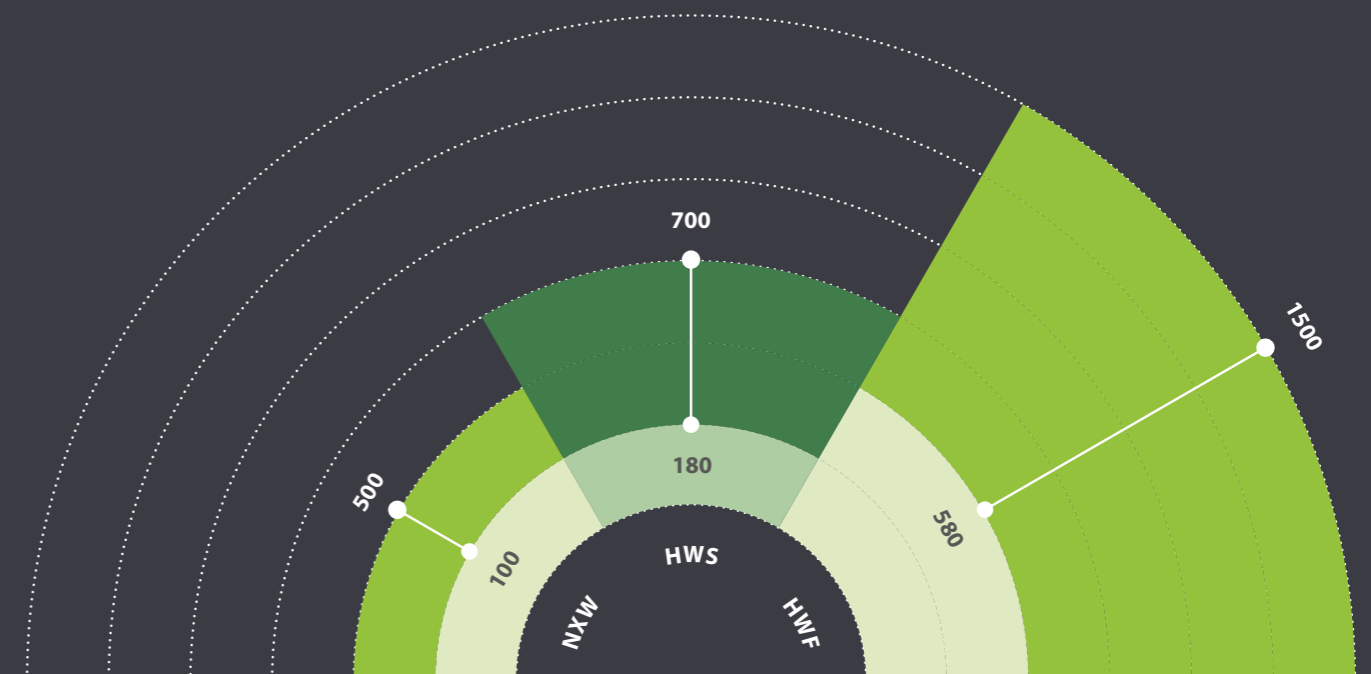
HWF-series chiller



Test chamber for water-cooled units

Technical data [kW]

Data provided under Eurovent standard conditions



Because they have been cleverly designed to ensure a heat exchanger inlet temperature greater than or equal to 35°C, all the units described above allow for heat recovery with the addition of a further exchanger, even when producing cold water at very low temperatures.

Remote condensers and dry coolers

Many applications - especially in environments where it is important not to disrupt the architectural style and keep environmental and acoustic impact under control - call for the installation of remote condensers or dry coolers.

Dry coolers also have the advantage of running without using water, thus eliminating all those issues typically associated with evaporator towers as the system works as a closed loop, as efficiently as indirect cooling towers.

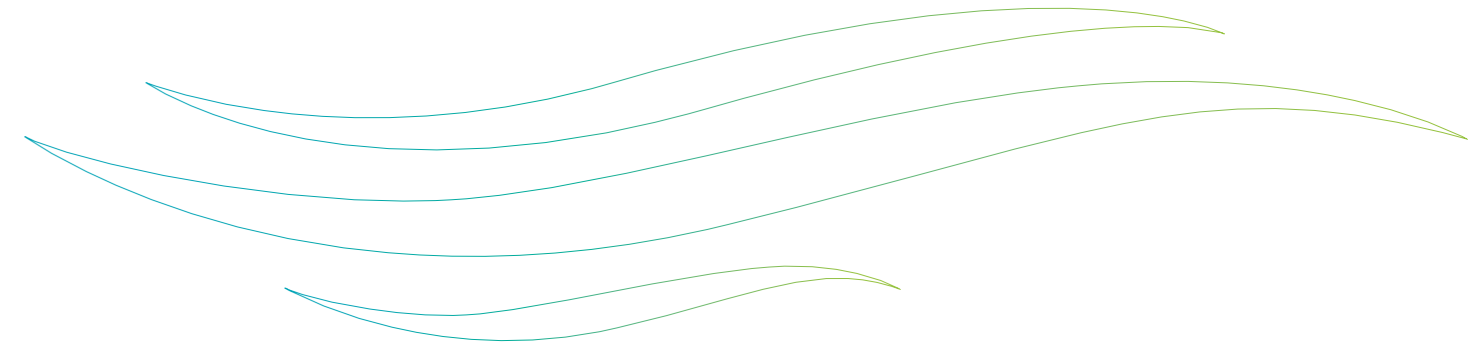
All condenser and dry cooler models in the range we offer are designed for outdoor installations, to deliver reliability and peace of mind and be hard wearing even in harsh environments.

Units are fitted with latest generation axial-flow fans designed to ensure high levels of acoustic and energy efficiency. Depending on the model, there are different versions and noise levels to choose from.

On some units, you have the option of fitting fans with EC motors so as to optimize the component's speed control at part loads.

Some models can be fitted with the latest generation high-efficiency **Spray System** allowing them to work even under extreme weather conditions without a reduction in capacity. As the name suggests, water is sprayed in tiny droplets on the coil, evaporating on contact with the air.

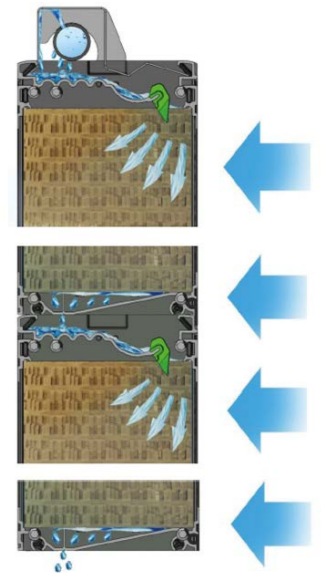
This latent heat exchange lowers the air temperature, improving the heat exchanger's performance and efficiency.



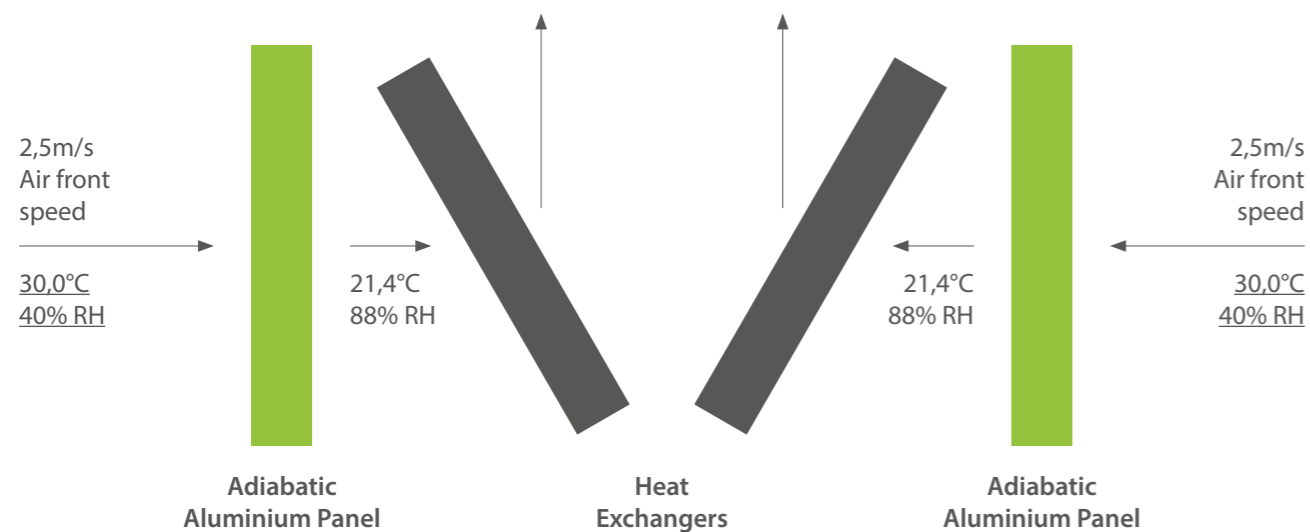
WGA-series dry cooler



Spray System

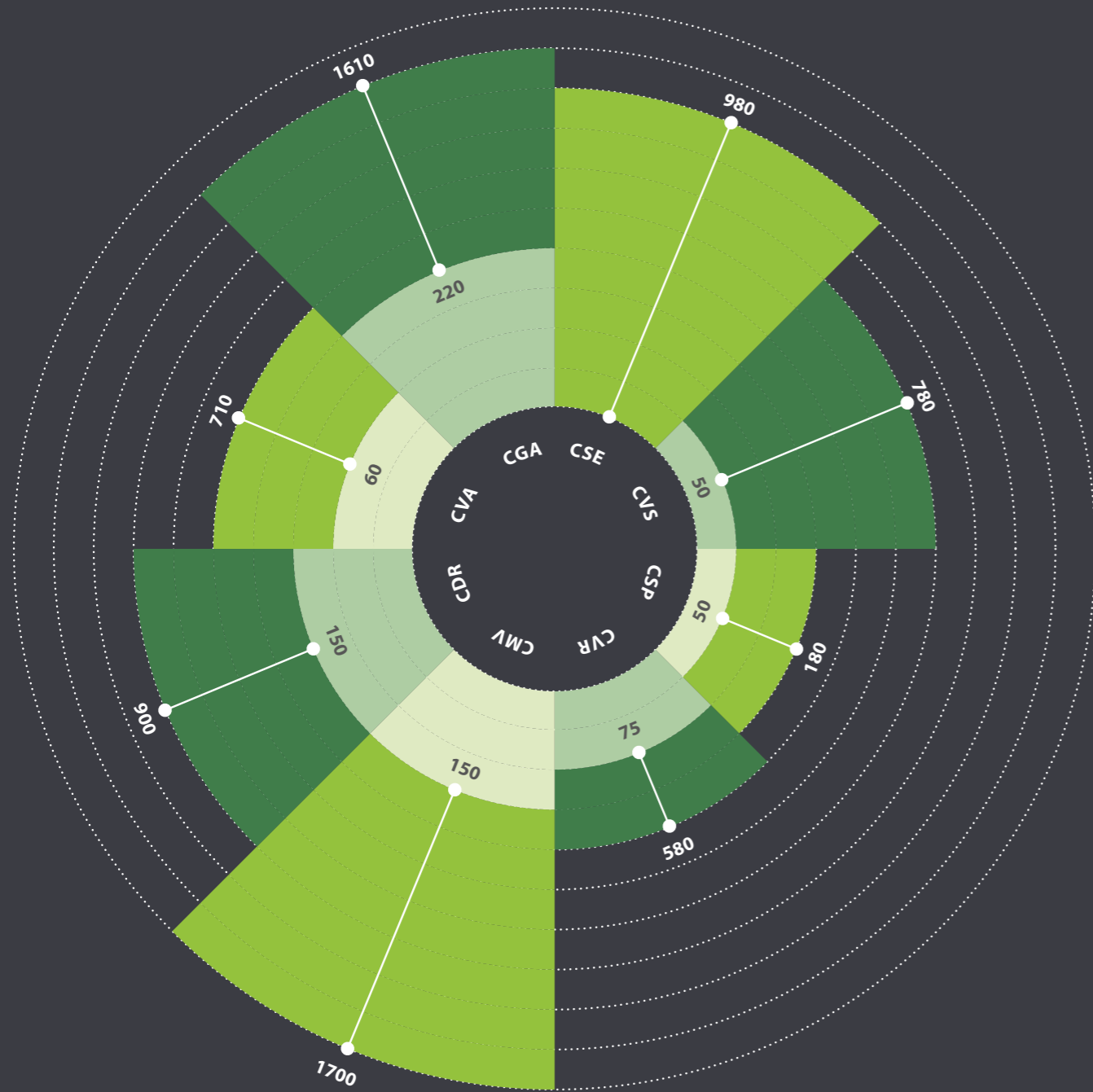


Water circulation in adiabatic cooling with panels



Another system we offer for some of our Aermec condenser and dry cooler models is **adiabatic cooling with panels**. These components comprise aluminium fins into which water is carried from a header positioned on the top of the panel, then evaporating due to an optimized distribution system, cooling the air in contact with the component in the process. The water is then collected in a tray placed at the bottom and recirculated by means of a system of pumps and valves, once a sensor has analysed its hardness (Sump kit). The system is easy to install, modular and does not require any maintenance on the heat exchanger. Flanges are available for dry coolers to make connecting water pipework easier.

Technical data
[kW]



Data provided according to standard EN 327
Heat that can be dissipated with the Aermec Remote Condenser series

Technical data
[kW]



Data provided according to standard EN 1048
Heat that can be dissipated with the Aermec dry cooler series

Air handling

Storing a product requires techniques that slow down the deterioration processes food inevitably undergoes due to effects caused by time and the climatic conditions in the outside environment, at the same time retaining the product's original taste, texture, smell, appearance and nutritional properties.

This is where a modern cooling system comes in and indeed plays a key role. In any designated **food or cut flower storage room, cold rooms and wine maturation and aging rooms**, it is essential that precise temperature and humidity conditions be kept consistent to keep products in optimal condition in terms of weight and quality.



Grape drying room for producing Amarone wine

Temperature and humidity values usually used in refrigerated warehouses

PRODUCTS	t [°C]	UR%
Apples	-1 ÷ 0	85 ÷ 90
Tomatoes	0 ÷ 4	85 ÷ 90
Strawberries	-1 ÷ 0	85 ÷ 90
Apricots	-1 ÷ 0	85 ÷ 90
Cherries	-0,5 ÷ 0	85 ÷ 90
Artichokes	-0,5 ÷ 0	90 ÷ 95
Asparagus	0	90 ÷ 95
Spinach	0	90 ÷ 95
Lettuce	0 ÷ 1	95 ÷ 100
Olives	5 ÷ 10	85 ÷ 90
Grapefruit	10	85 ÷ 90



In addition to consistent temperature, it is very important to control Relative Humidity: if humidity values are too low, they can lead to excessive product evaporation, while a humidity value over the set limit results in mould growth. Temperature control is handled with the aid of high-precision temperature sensors with a trip accuracy of +/- 0.6°C. To be sure to achieve RH values

like those listed in table 1, a range of systems are used, including: self-generating steam humidifier, wet deck humidifier using mains water and spray humidifier. With considerable experience in the design and manufacture of air handling units suited to food applications, we have supplemented the Aermec catalogue with the addition of the **NCD series**.



NCD-series air handling unit

Enclosure

The NCD units' enclosure comprises 50mm-thick sandwich panels with the insulated core made from injected polyurethane or mineral wool in different densities. For greater acoustic comfort, there is the option of using perforated metal sheet on the inside coupled with wrapped mineral wool.

The high standard of hygiene, required in the food storage sector, demands the use of specific materials both on the outside and, above all, in internal parts that the air handling units' air travels through: the materials used in these applications are AISI 304 and AISI 316L stainless steel. Airtightness is ensured with the use of a PVC seal secured in a special slot to reduce air leaking out of the case both under positive pressure and in negative pressure sections, at the same time improving the panel's thermal transmittance.



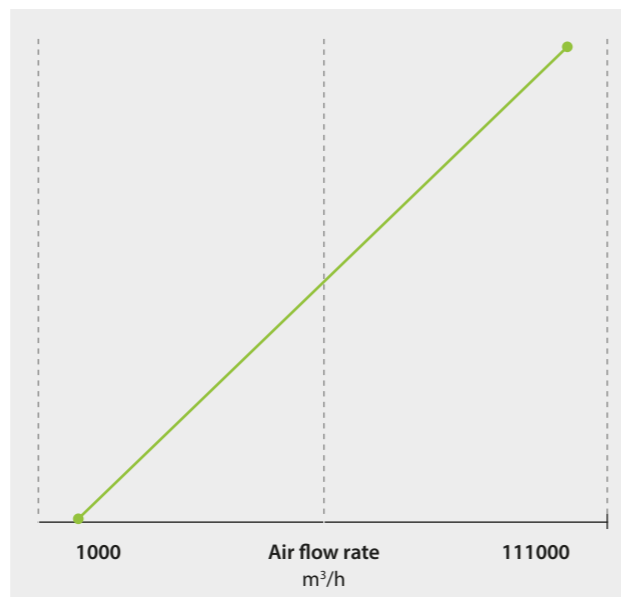
Heat exchange coils

The high-efficiency heat exchangers are housed in such a way as to allow for easy removal and effortless cleaning and maintenance.

Various models are available (water, steam, electric, direct expansion or heat transfer oil) and they can all be produced with different geometries to improve the heat exchange. Depending on the customer's requirements, the condensate tray can be made from aluminium or from AISI 304 or AISI 316 stainless steel. We use dedicated selection software allowing us to optimize heat exchangers with a fin pitch ranging from a minimum of 2mm to a maximum of 10mm, as required in these special applications.

Fan section

The latest generation fans can have forward-inclined, backward-inclined and aerofoil blades. In addition to dual-intake and plug fans, Aermec gives you the option of fitting brushless fans with built-in inverters (EC-motors) for easier installation, lower electricity consumption and fans that automatically adapt to the system's pressure drops. For certain environments, you can choose fans with a corrosion-inhibiting coating or the version with self-cleaning blades providing the extremely high level of hygiene often required in environments such as cleanrooms and cold stores.



Recovery unit

The (EU) regulation 1253/2014 (ErP 2016-2018) requires the manufacturer to use a heat recovery system of some sort for dual-flow AHUs where the fresh air flow rate is more than 10% of the total flow rate. The possible types of recovery system are:

- Cross-flow plate recovery unit, with the option of outside air pre-filtration, installation of a recirculation and bypass damper valve to exploit free cooling where possible;
- Heat recovery wheel, made from hygroscopic material featuring an electronically controlled drive motor;
- Run around coil recovery unit with the water running strictly inside a closed loop, ensuring there is no chance of the air flow being contaminated.

Humidification systems

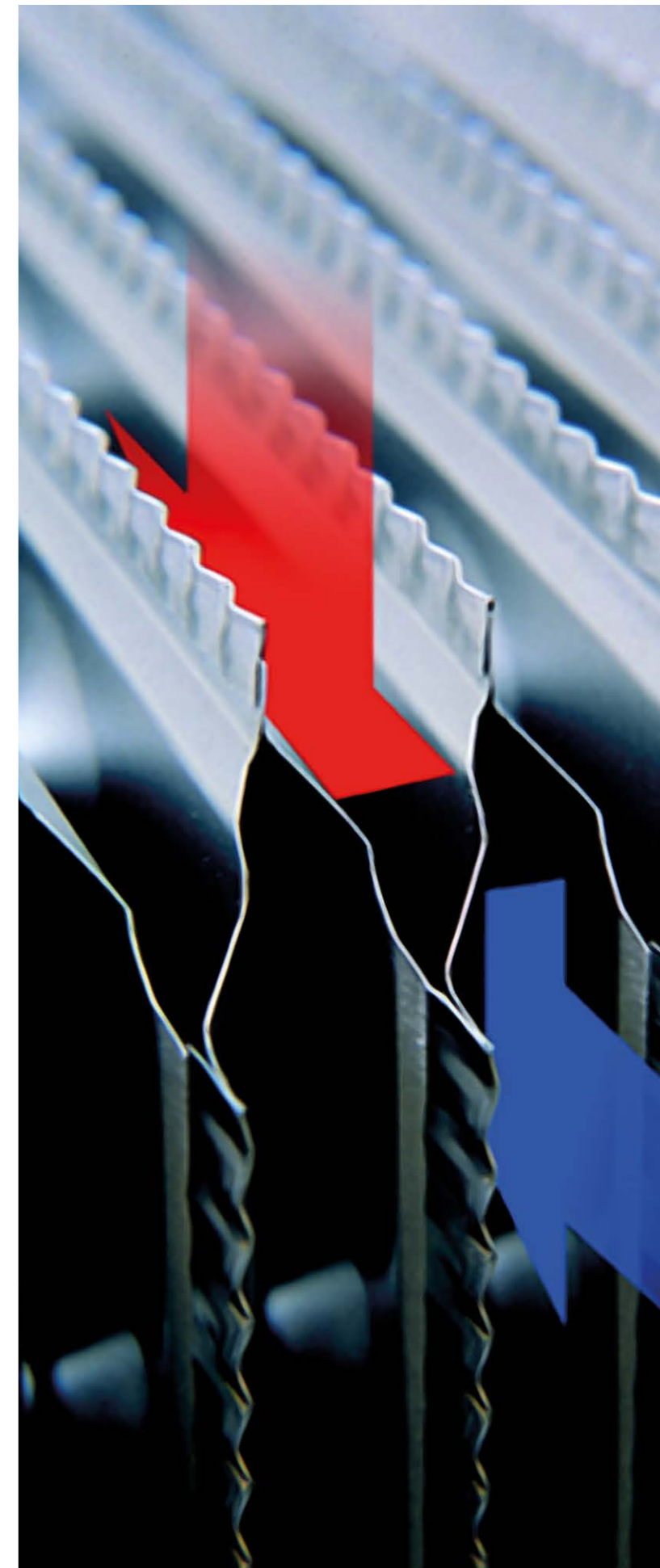
To control and maintain precise temperature and humidity conditions inside a room, the AHU needs to be fitted with an air humidification system. The NCD series offers the following options:

- Adiabatic system, with treated paper or PVC media with or without recirculation pump;
- Isothermal system, with an immersed electrode or resistive element steam generator and relevant steam distributor.

Filters

Depending on requirements, the unit can be fitted with flat or corrugated filters, rotary, bag, EPA or HEPA filters, activated carbon filters, electrostatic filters to achieve filtration efficiencies as high as class H and filters with germicidal lamps for complete sterilization and for stopping bacteria and micro-organism growth.

Cross-flow recovery unit



Completing the air handling unit range are the **TUN, TS, TA and TN** series of air conditioning units that can be ducted and, with the extensive range of available accessories, integrated in complex systems, ensuring flexibility, efficiency and reliability.

TUN

- Air flow rates from 900 to 4,000 m³/h
- 4- and 6-row coils
- Option of fitting inverter-controlled fans
- Wide range of available accessories



TS

- Air flow rates from 900 to 4,500 m³/h
- 3-, 4- and 6-row coils
- Plenum for 2-row coil for post-heating as accessory
- Option of 5-speed motor



TA

- Air flow rates from 900 to 5,000 m³/h
- 4- and 6-row coils
- Enclosure with sandwich panels with polyurethane core
- Option of fitting inverter-controlled fans

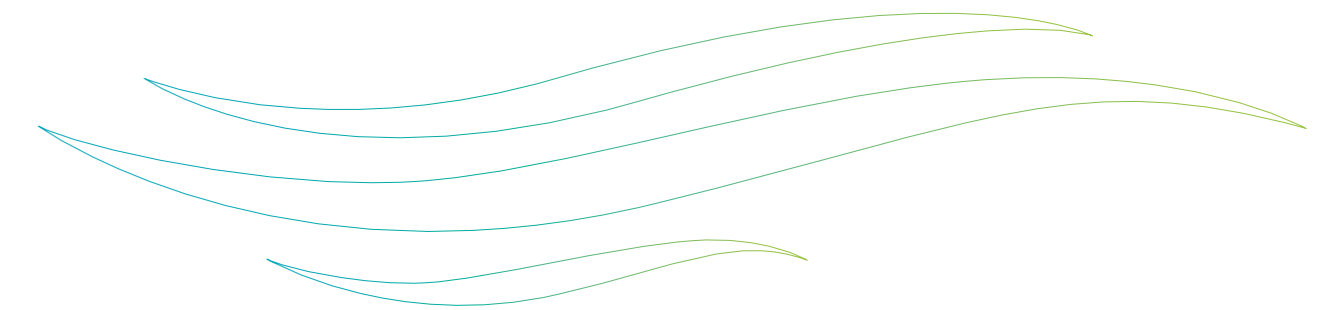


TN

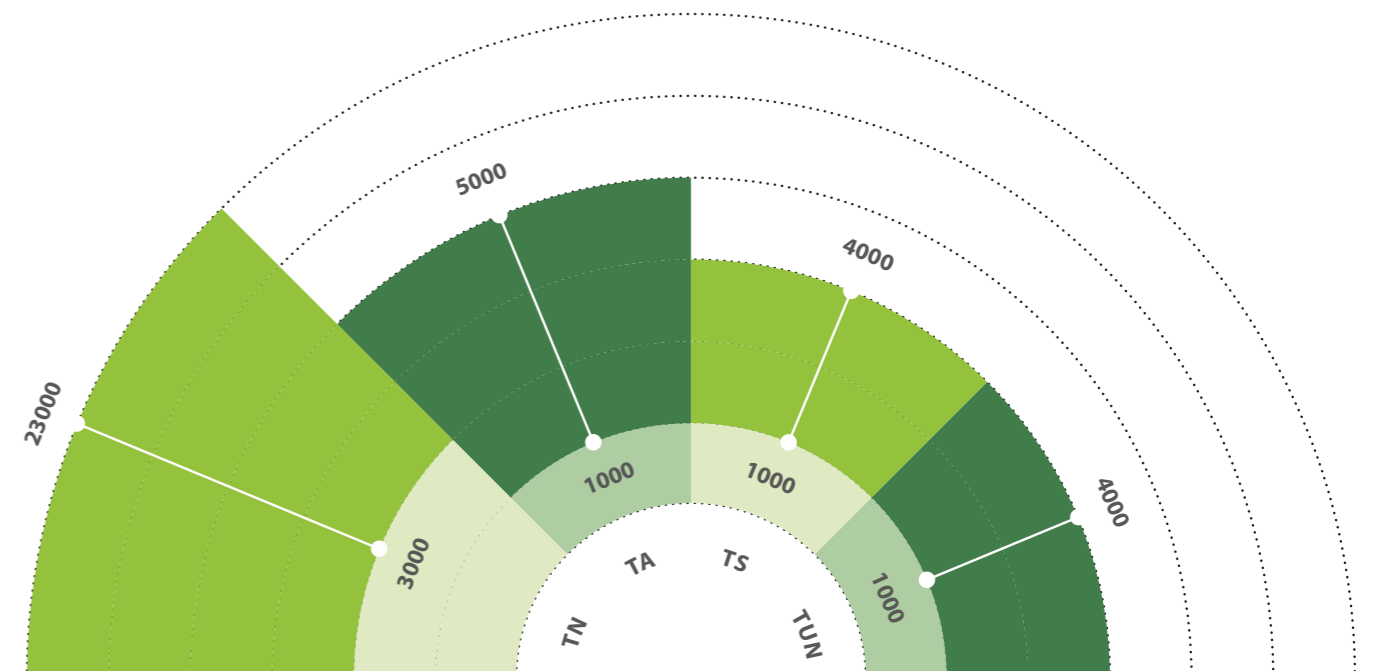
- Air flow rates from 3,000 to 23,000 m³/h
- 4- and 6-row coils
- Statically and dynamically balanced pulleys
- Sandwich panels with 25mm insulation



TUN-series air conditioning unit complete with all accessories



Technical data [m³/h]



CASE HISTORY

Mastri Birrai Umbri brewery

In the hills of Umbria, in the heart of Italy, the “Mastri Birrai Umbri” project was initiated with the aim of creating one-of-a-kind craft beers, the product of over 1000 hectares of diligently and respectfully farmed land. The fruits of the earth are then processed in the malthouse where, following thorough soaking, cleaning and subsequent drying, the malt is ready to be turned into beer. In the brewhouse, the malt, mixed with hot water, becomes wort, which is boiled in special steel tuns. This is where the hops are added to help give the beer its distinctive bitter taste.

Following filtration in the “Whirlpool” and initial fermentation - a stage during which the wort’s temperature is monitored closely - the mixture is cooled rapidly (from a temperature of over 90°C to temperatures in the 16-25°C range), usually using special generously sized heat exchangers.

Following the fermentation stage, the beer undergoes secondary fermentation in the bottle in special temperature- and humidity-controlled rooms. It will be another 4 - 12 weeks before the Mastri Birrai Umbri beer is ready for drinking.



Views of the brewery’s various rooms and the Aermec units used to control the production process



The most significant challenge was to reconcile the need for heat and cooling energy for the production process and the use of high-quality technical solutions with low running costs.

The solution adopted for treating the water used in the production of the beer is a hi-tech system with ultrafiltration and decarbonation for a flow rate of 9000 litres/h. The compressed air system was also carefully designed for a total flow of 3800 litres/min of food-safe air. The bottling room's air handling system is an ISO 6 Cleanroom model with dedicated Air Handling Unit and use of diffusers with absolute filters. Air is distributed with self-cleaning ducting and antimicrobial treatment.

A 10bar steam system has also been installed to aid in the boiling process and for sterilization

in the bottling department. Mechanical systems and building services are supervised by means of a freely programmable DDC system.

The heart of the Brewery system is the cooling plant, which is capable of producing both chilled water for air conditioning and ice-cold water for the production process.

Indeed, the system has been designed with the purpose of:

- Controlling the temperature of the 1 million litres of beer produced during the various stages of the process;
- Maintaining the correct temperature and humidity conditions in the bottling rooms and laboratory (1,200,000 bottles/year);
- Air conditioning the office area and meeting room (Aermec FCL-series fan coils).

For the purpose of office air conditioning, an Aermec fresh air system has also been installed with recovery units from the RPL series.

The ice-cold water circuit required to control and maintain beer temperature prior to bottling is fed by an Aermec NRB-series chiller.

The high-efficiency unit is built with a V-block modular framework and has two independent circuits so as to ensure uninterrupted operation even when one of the compressors is being serviced. The use of more than one scroll compressor allows for effective stepped capacity control, enabling the chiller to adapt output to the system's real demands, thus optimizing the ESEER seasonal energy efficiency ratio, calculated according to Eurovent specifications.

Building Services Engineering:
FLUPROJECT Studio Associato
(province of Perugia) Italy

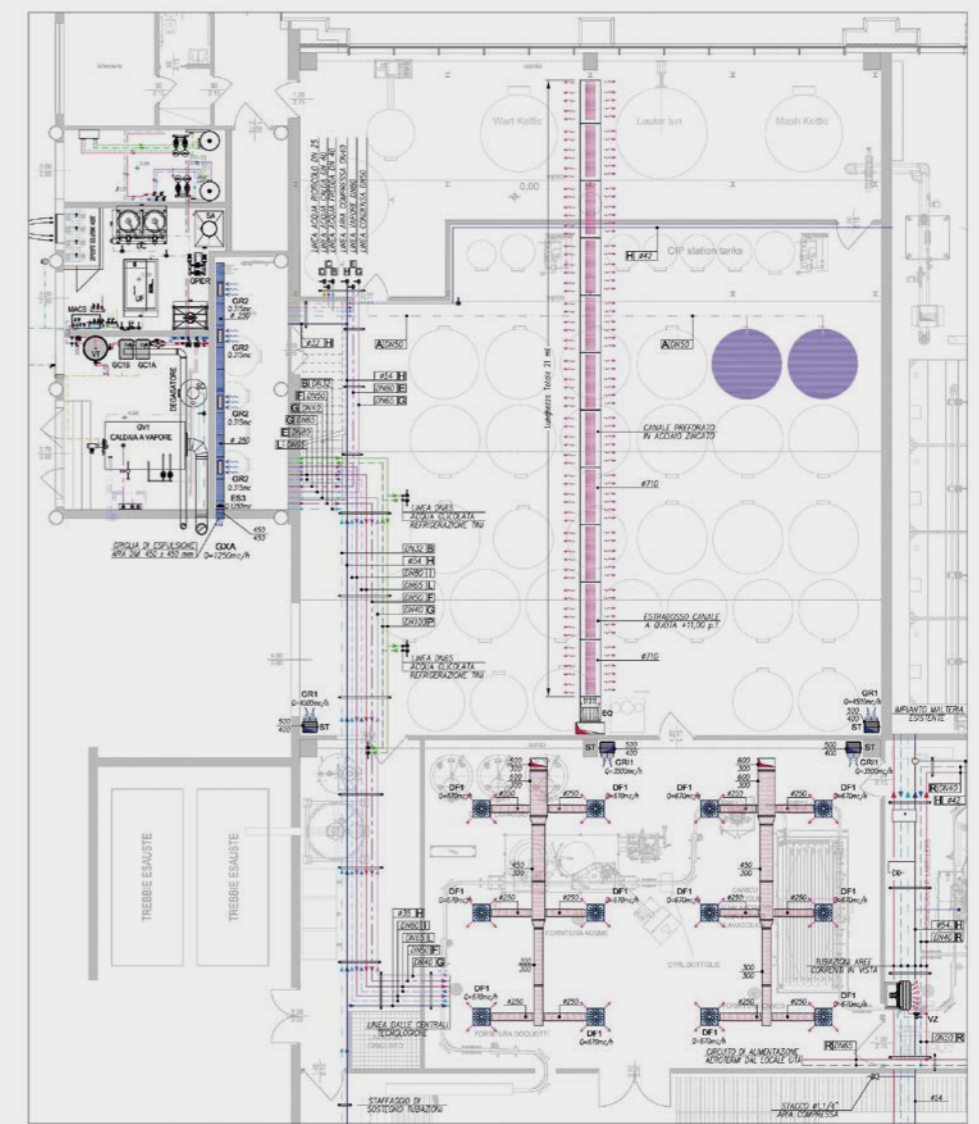
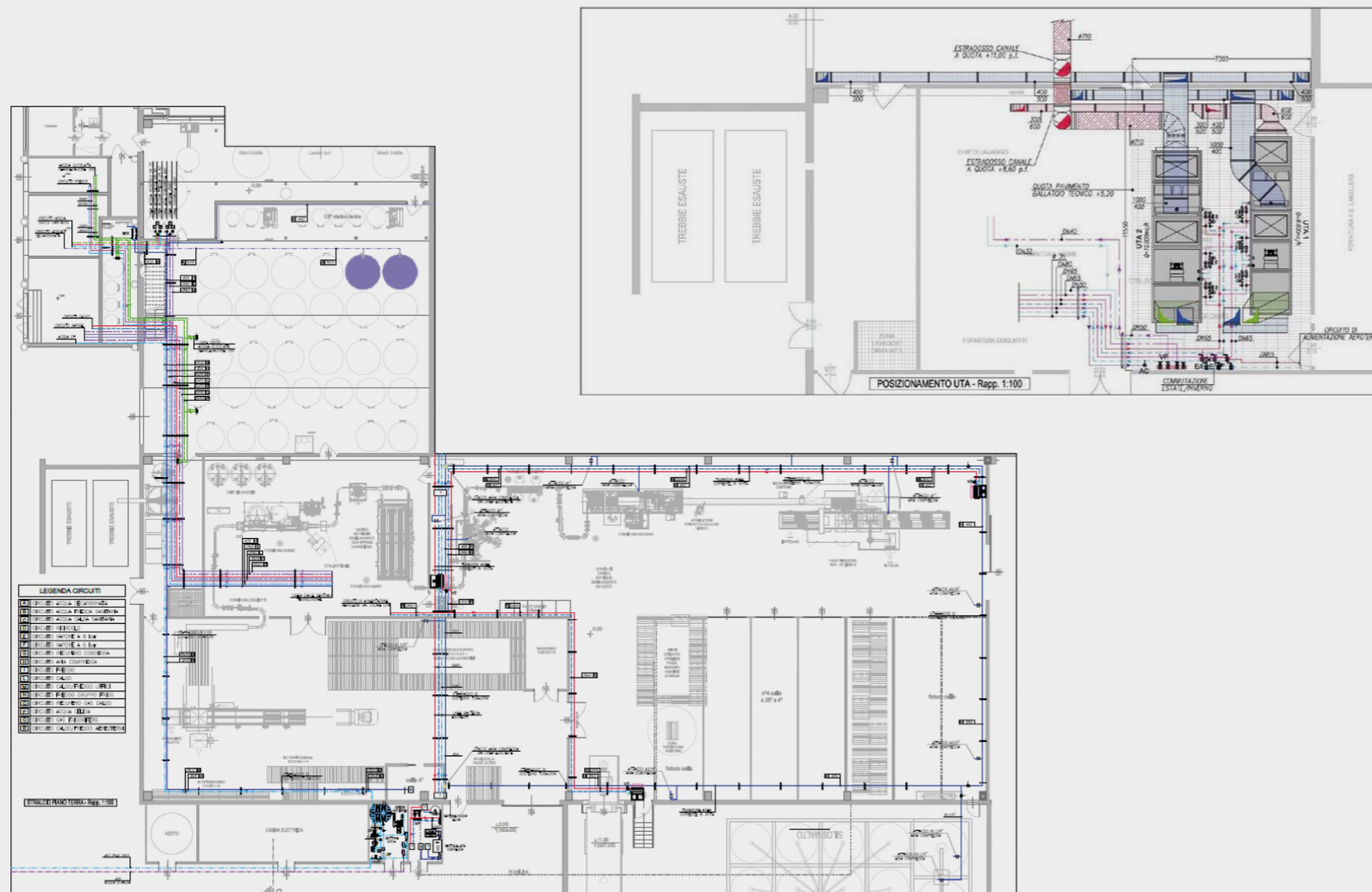
Mechanical Systems:
Marco Braccalenti

Electrical systems:
Marco Valigi

Malthouse/Brewery production plant made by:
Kaspar Schulz Bamberg, Germany

Mechanical systems installed by:
Bartolini Termoidraulica

Electrical systems installed by:
Valeri Lanfranco electricians

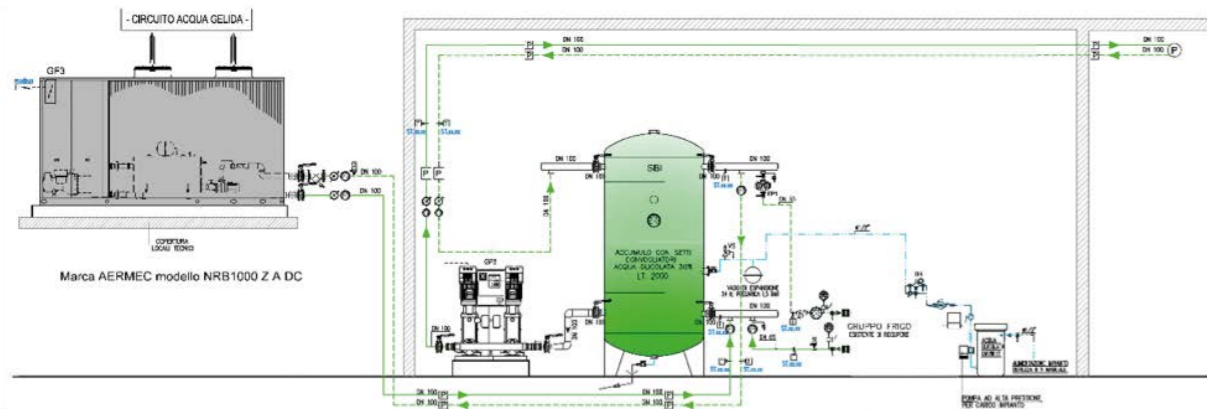


The version chosen is equipped with dual pumps, each as a backup for the other so as to make the system more stable and reliable. In addition, the special control feature means the unit can reduce noise emissions during a certain user-settable time interval.

In terms of the process cooling circuit at slightly higher temperatures, we opted to use an Aermec high-efficiency NRL-series chiller to feed the two 10,000 m³/h and 8,000m³/h AHUs and Aermec FLC-series cassette fan coils for interior air conditioning (bottling room and offices).

The chiller's performance at the required conditions is outlined below:

- **NRB1000 Z A DC** (with electronic valve for water production down to -10°C)
- **Output: 207 kW**
- **Power consumption: 81.95 kW**
- **EER = 2.53**
- **ESEER = 4.27**
- **Outside air temperature: 35°C**
- **Water outlet temperature: -3°C**
- **Water return temperature: +2°C**

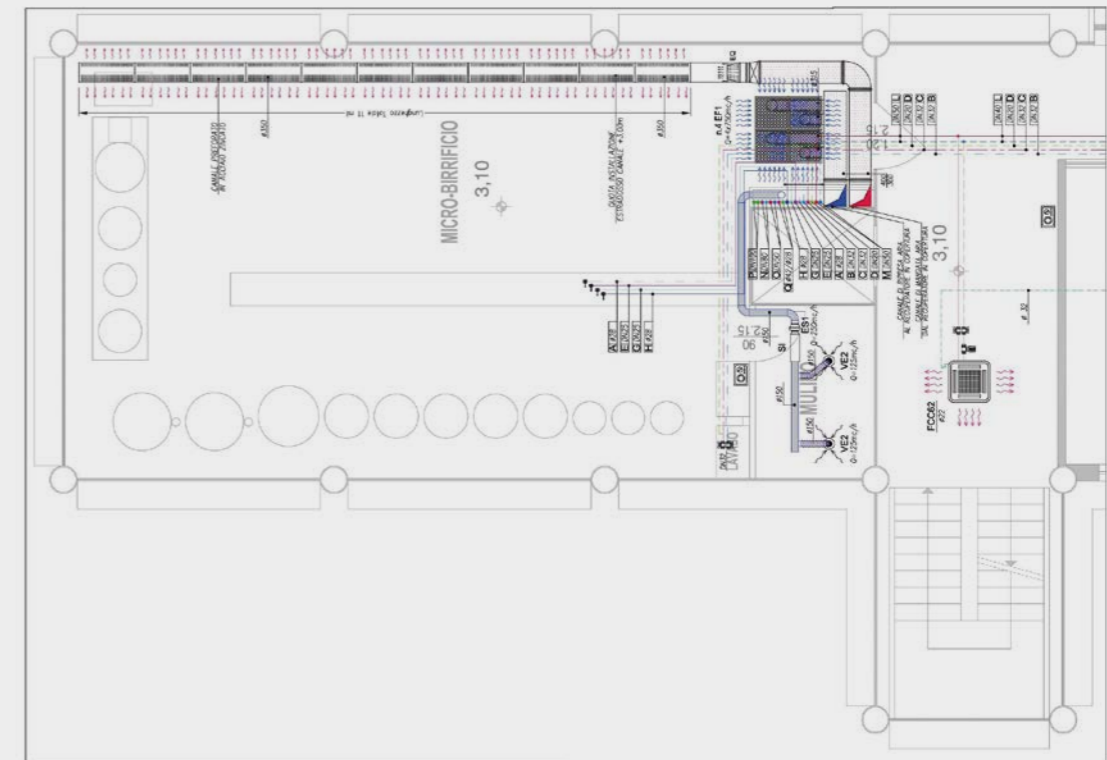
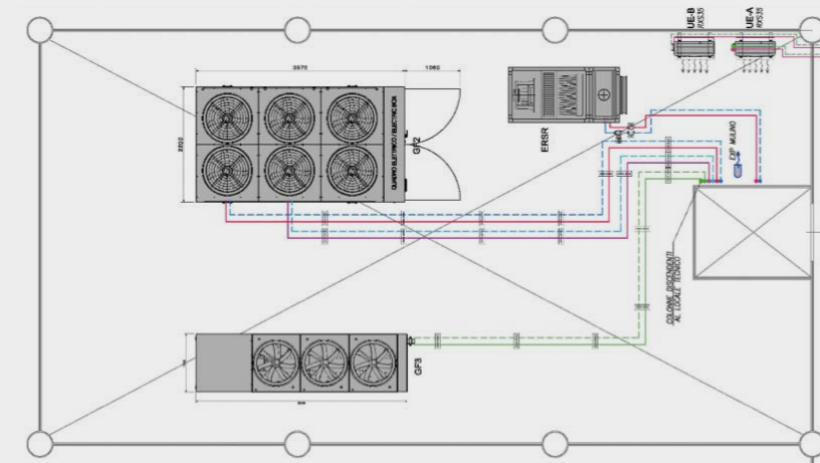
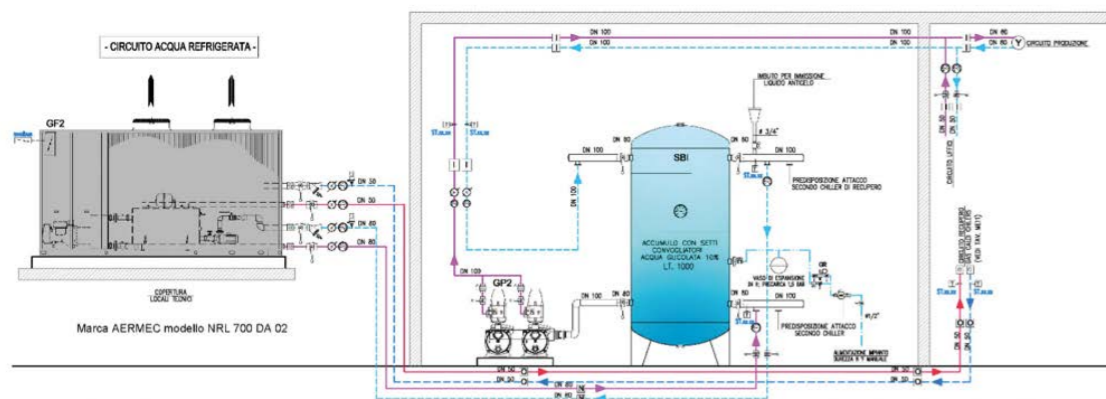


The chiller's performance at the required conditions is outlined below:

- **NRL0700 DA 02**
- **Output: 164.1 kW**
- **Power consumption: 53.6 kW**
- **EER = 3.06**
- **Outside air temperature: 35°C**
- **Water outlet Temperature: +7°C**
- **Water return temperature: +12°C**
- **Recovered Power: 59.8 kW**
- **Leaving water temperature: 50°C**
- **Temperature Difference: 5°C**

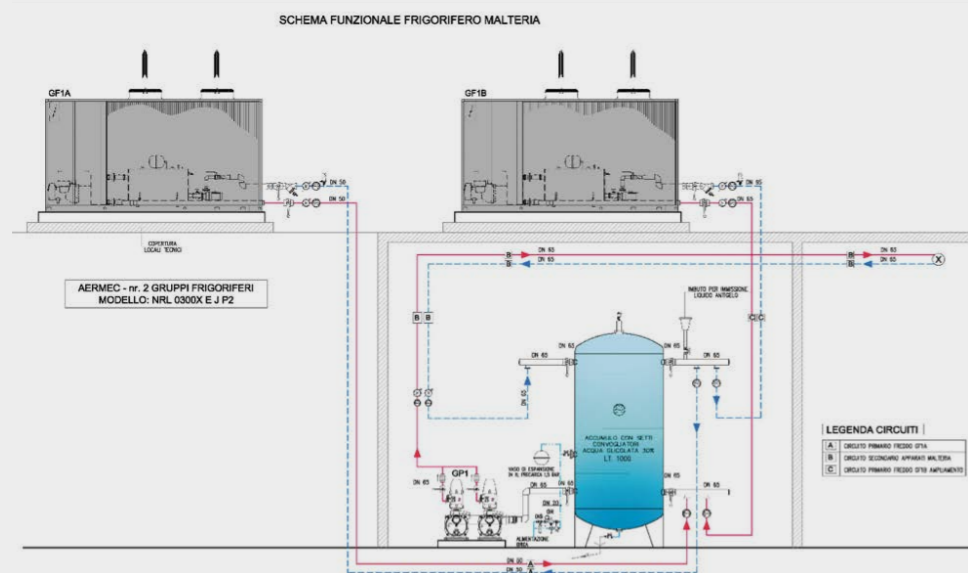
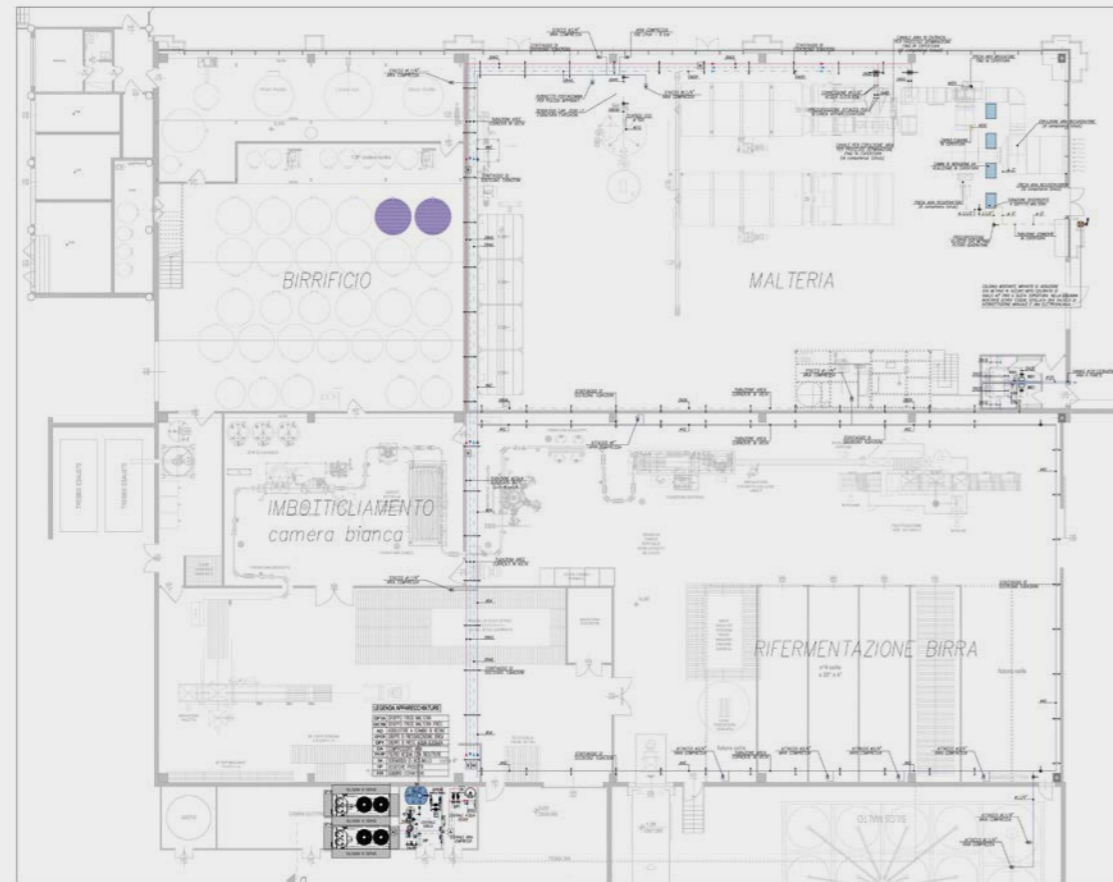
The chiller, in this case, features an additional AISI 316 brazed plate heat exchanger for partial heat recovery so that it can supply both heating and cooling. The heating circuit is integrated with two condensing boilers and a domestic hot water generator.

For improved ease of installation, we have chosen a unit with a built-in hydronic kit: storage with low-head dual pumps whose cyclic rotation is managed automatically by the circuit board to optimize the number of hours they operate.



In addition, there is a heating and cooling plant for the malthouse's air conditioning and production process with two Aermec chillers installed in parallel, model NRL 0300X E J P2.

- **NRL0300X E J P2** (with electronic valve and inverter-controlled fans)
- **Output:** 65.7 kW
- **Power consumption:** 19.7 kW
- **EER = 3.34**
- **Outside air temperature:** 35°C
- **Water outlet temperature:** +1°C
- **Water return temperature:** +6°C



Past projects

When it comes to the wine-making process and interior air conditioning, the reliability of our equipment and our highly qualified personnel constantly on hand to provide assistance make Aermec the supplier of choice for leading businesses in our native Italy and around the globe.

- **Nestlé**

Santa Fe – Argentina
Chiller and Air Handling Unit

- **Conterno Giacomo**

Monforte d'Alba (CN) – Italy
Chillers and air conditioning units

- **Pepsi Cola**

Saint John's – Canada
Chillers

- **Mastri Birrai Umbri brewery**

Gualdo Cattaneo (PG) – Italy
Chillers, fan coils and recovery units

- **Bird farm**

Cheboksary – Russia
Chillers

- **ENI Spa**

San Filippo del Mela (ME) - Sicily, Italy
Chillers

- **Paulig Coffee Factory**

Borovleva – Russia
Chillers and fan coils

- **Loacker wine estate – Corte Pavone**

Montalcino (SI) – Italy
Chiller

- **Ice Rink**

Riga – Latvia
Chiller

- **Cantina Vivallis winery**

Nogaredo (TN) – Italy
Chillers

- **Château Cheval Blanc**

Bordeaux – France
Chillers

- **Cantina Simone Giacomo winery**

Castelvenere (BN) – Italy
Heat pump, fan coils and recovery units

