thermowave
PHE for process and industry

State-of-the-art refrigeration technology in La Lorraine's deep-freeze bakery storage room

The Belgian family-run company La Lorraine uses Güntner HIGH-STORE coolers and thermowave plate heat exchangers in its new central deep-freeze storage room in the Czech Republic. The industrial bakery which has experienced rapid growth in recent years had the foresight to create impressive infrastructure north-west of Prague which boasts storage space for double the production capacity catered for in 2012. The fully automated high-bay deep-freeze storage room has around 27,300 pallet spaces.

La Lorraine invested large sums in a new high-bay deep-freeze storage room at its production site in the medium-sized town of Kladno in the Central Bohemian Region of the Czech Republic, north-west of Prague. This production site near Prague Airport and the D6 and D7 motorway interchange produces 80,000 tonnes/88,185 short

Overview

Business line:	Food and Beverage
Application:	Food Cooling/Logistics
Country/Region:	Czech Republic
Fluid:	NH_3/CO_2 and propylene glycol/water
Product:	Güntner HIGHSTORE Application air cooler
	AGVH-type Güntner FLAT Vario condenser
	GGHN-type Güntner CUBIC Vario air cooler
	thermowave TL 400 TDFL, TL 200 TDFL, TL 90 HDCL, EL 90 ECCL, TL 150 HDCL

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▲ AGVH-type Güntner FLAT Vario condensers each with 595 kW/2,030 MBTU/h have been designed as special units due to building regulation noise specifications of 50 dB(A)/10 m (33 ft) in order to achieve the specified operating parameters.

▲ Valve station

▲ For fire safety reasons, the oxygen content in the unmanned storage room is reduced to 15 %.

tons of frozen bakery every year. Around 400 different products, both sweet and savoury of "bake-off" quality for supermarkets, hotels, restaurants and cafés (HoReCa), are produced to IFS standard by 700 employees.

From this plant, the products are exported to over 10 European and Eurasian countries, including Russia, Serbia, Romania, Hungary, Bulgaria, Croatia and Turkey, making the company one of the largest Czech producers of bread for retail and wholesale and the catering industry (e.g. restaurant chains and hospitals).

16,000 double-deep Euro and industrial pallet spaces

The site's fully automated high-bay storage room is 41 m/135 ft high and 129 m/423 ft long. The impressively long silo construction with mono-pitch roof has a floor-space measuring approximately 4,000 m^2/43,056 ft^2 and a cubic content of around 169,000 m^3/5,968,179 ft^3. The storage room is equipped with five high-bay rack systems for 16,000 double-deep Euro and industrial pallet spaces. For fire safety reasons, the oxygen content of the air in the unmanned storage room is reduced to 15 %.

The new deep-freeze storage room cools faster than stipulated by the HACCP hygiene standards. In order to ensure that the cold chain remains closed, it is mandatory that the process of order picking is completed within 30 minutes at maximum temperatures of 5 °C/41 °F and that the core temperature of the goods in the storage room is between -15 and -18 °C (5 and -0.4 °F). The average time required for storage, order picking and retrieval from storage in Kladno, however, is just 15 minutes in each case. The air temperature both in the storage room and in the order picking and shipping rooms is -25 °C/-13 °F.

Due to the length of the room, the cold air for the storage room is not supplied along the rack lanes but perpendicular to them. The length of the room was therefore subdivided crossways into nine modules, which are each supplied by one Güntner CO_2 HIGHSTORE air cooler with 100 kW/341 MBTU/h of refrigerating capacity. The wall opposite the air coolers is 34 m/112 ft away in each case.

An annex houses rooms for order picking and preparing the goods for shipping. The machine room is located next to the annex for goods delivery.

NH_3/CO_2 cascade for high-efficiency cold air supply

The deep-freeze storage room is supplied with cold air via a Johnson Controls International NH_3/CO_2 cascade refrigeration system. The CO_2 system works in flooded pump operation. Two frequency-controlled CO_2 screw compressors, each with over 1 MW/3,412 MBTU/h of refrigerating capacity and an evaporation temperature of -35 °C/-31 °F, provide the extreme cold temperatures. The refrigerant is channelled through pumps to the evaporators. The entire CO_2 tubing and the valve stations have been installed on the storage room's roof, enabling easy access for maintenance work.

The two refrigeration circuits are separated from each other via a cascade heat exchanger. This is a shell and tube heat exchanger for condensation and evaporation with double tubing. This safety element prevents substances from mixing in the event of a leak as the refrigerant from the leaky circuit cannot penetrate the other circuit. It can enter only the space between the tubes where it is identified.

The NH_3 refrigeration system consists of three frequency-controlled screw compressors each with over 800 kW/2,730 MBTU/h of refrigerating capacity. The heat is dissipated to the environment via air-cooled AGVH-type Güntner FLAT Vario condensers. A secondary glycol circuit for air-conditioning is also connected to the NH_3 circuit via a thermowave TL 400 TDFL plate heat exchanger with 200 kW/682 MBTU/h. The PHE serves as an evaporator in the NH_3 system. The oil for the compressors is cooled down by a thermowave TL 150 HDCL with 60 kW/205 MBTU/h.

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▲ The waste heat from the NH_3 evaporator is transferred via thermowave plate heat exchangers to glycol circuits. The waste heat is used to heat the offices and the foundations in order to ensure that the ground underneath the storage room always remains frost-free, hence preventing the floor slab from suffering any structural damage.

▲ A powerful thermowave NH_3 plate-type evaporator cools the glycol circuit for the supply of air coolers (back) and another thermowave plate heat exchanger (front) supplies the centralised ventilation system for the offices.

▲ The nine Güntner HIGHSTORE Application air coolers in the deep-freeze storage room sit 36 m/118 ft high, above the top edges of the racks, on a stage.

Güntner and thermowave heat exchangers

The waste heat from the NH_3 evaporator is transferred via two thermowave plate heat exchangers (desuperheaters) to a glycol circuit. The waste heat of the first desuperheater (thermowave TL 200 TDFL, 50 kW/171 MBTU/h) is used to heat the offices. A thermowave TL 90 HDCL (75 kW/256 MBTU/h) heats the foundations to ensure that the ground underneath the deep-freeze storage room always remains frost-free, hence preventing the floor slab from suffering any structural damage.

Four air-cooled AGVH-type Güntner FLAT Vario condensers, each with a capacity of 595 kW/2,030 MBTU/h, dissipate the non-usable heat. Due to building regulation noise specifications, they have been designed as special units, each with a noise level of 50 dB(A)/10 m (33 ft).

Propylene glycol is cooled via a thermowave NH_3 plate-type evaporator for the air-conditioning. This secondary circuit provides cooling for the corridors and the loading docks via GGHN-type Güntner CUBIC Vario air coolers. Another thermowave EL 90 ECCL plate heat exchanger (60 kW/205 MBTU/h) for cold water generation (12/6 °C = 54/43 °F) supplies a centralised ventilation system for the offices.

Güntner HIGHSTORE Application air coolers

The nine Güntner HIGHSTORE Application air coolers in the deep-freeze storage room each have a capacity of 100 kW/341 MBTU/h. They sit 36 m/118 ft high, above the top edges of the racks, on an accessible stage which runs the length of the room. The oxygen content in the storage room is reduced up here to just 13 % for fire safety reasons. Special safety precautions therefore need to be taken if any maintenance work is to be carried out. At least two individuals must be present at all times and the work in the storage room must be paused after 30 minutes. Proper access for maintenance work on both sides of the air cooler is ensured as standard via a maintenance door.

The Güntner HIGHSTORE Application air coolers' defrosting is carried out using CO_2 hot gas which is provided by two small Bitzer CO_2 compressors, one of which is redundant for operational reliability purposes.

Two Güntner HIGHSTORE Application air coolers with 72 kW/246 MBTU/h and 113 kW/386 MBTU/h of refrigerating capacity have also been installed under the ceilings on accessible stages in each case in the order picking and shipping rooms.

The construction of the in-house fully automated deep-freeze storage room has proven a success at La Lorraine. Thanks to the automated process, the handling of the pallets is easier than it was with the five smaller decentralised storage rooms used prior to the commissioning. Thanks to the fully automated material flows in the storage room and the efficient refrigeration technology, the anticipated savings have been achieved and transparency, availability and throughput have all been simultaneously increased.

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