Frozen convenience food: and with everything in butter

WOLF BUTTERBACK IS GRADUALLY CONVERTING ITS REFRIGERATION SYSTEMS TO NATURAL REFRIGERANTS. TWO GEA GRASSO CHILLERS USE AMMONIA TO COOL BRINE, WHICH IN TURN DIRECTLY PROVIDES REFRIGERATION TO THE CONSUMERS AND TO A CO_2 CASCADE

++ figure 1

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++ figure 1
Butter in blocks for dough processing

The Wolf ButterBack KG in Fürth, Germany – a member of the Martin Braun Group – opened its Plant 1 in Fürth around 13 years ago. Since this strongly expanding subsidiary of the Martin Braun Group places top priority on sustainable production, company management reached the basic decision two years ago to use natural refrigerants in its refrigeration systems. Management decided to reduce energy consumption to a minimum to ensure that production was as efficient and environmentally compatible as possible.

All Danish and other flaky dough pastries at Wolf ButterBack are produced quick-frozen and ready-to-bake as well as packed in a five-day working week, two shifts a day. Thus production operations alternate between freezer operations – up to 17 h a day, with highly intensive energy requirements – with very energy-quiet intervening periods, especially at weekends. On Saturdays and Sundays, refrigeration requirements are only around 10% of those under full load. Between the phases of actual dough processing, the production process for flaky pastry – with its quickly perishable raw ingredients of eggs, yeast, and butter – is refrigerated throughout, as are the production rooms.

Cost-effective NH_3 refrigeration system

Wolf ButterBack developed the concept for the brine refrigeration system in collaboration with the company WESKA Kälteanlagen GmbH, in Netzschkau, Germany, after Wolf ButterBack had presented the specifications for cooling duty, components to be used, basic models and installation site. The project objective was to replace – successively and without interrupting production – the existing refrigeration system, based on R404 as refrigerant, by ammonia (NH_3) systems. However, the new systems could not be installed in the existing machine room owing to space limitations. In addition, Wolf ButterBack intended to replace its uneconomical existing wet cooling towers by air coolers. As a result, the new GEA Grasso NH_3 facility is installed in a sound-insulated container adjacent to Plant 1, with the air coolers mounted on

++ figure 2
Temper brine valves in the central machine room

++ figure 3
GEA Grasso chiller in spacious container

the container roof. The two-part container, 2.8 m high, was especially designed with floor dimensions of 3 x 14.6 m to allow access to all equipment by one service aisle.

The ammonia is located exclusively inside the two separate chillers in the container and in the condensers, each located on the container roof. The Temper brine heating and cooling circuit serves the refrigeration consumers in Plant 1. This configuration prevents any contact between ammonia and the CO_2 circuit in the freezer cascade in the event of leakage. According to its manufacturer's information, Temper is a synthetic, non-toxic, environmentally compatible secondary refrigerant, without glycol, manufactured on the basis of salts. It possesses outstanding heat conductivity down to –55 °C as well as innovative corrosion protection properties. The system in the container cools the brine to –10 °C and pumps it through the brine heating-cooling circuit, which has a volume of around 12 m^3. Owing to its mass, the brine exclusively serves as temperature "storage" – which accordingly prevents the need for start-stop compressor cycles.

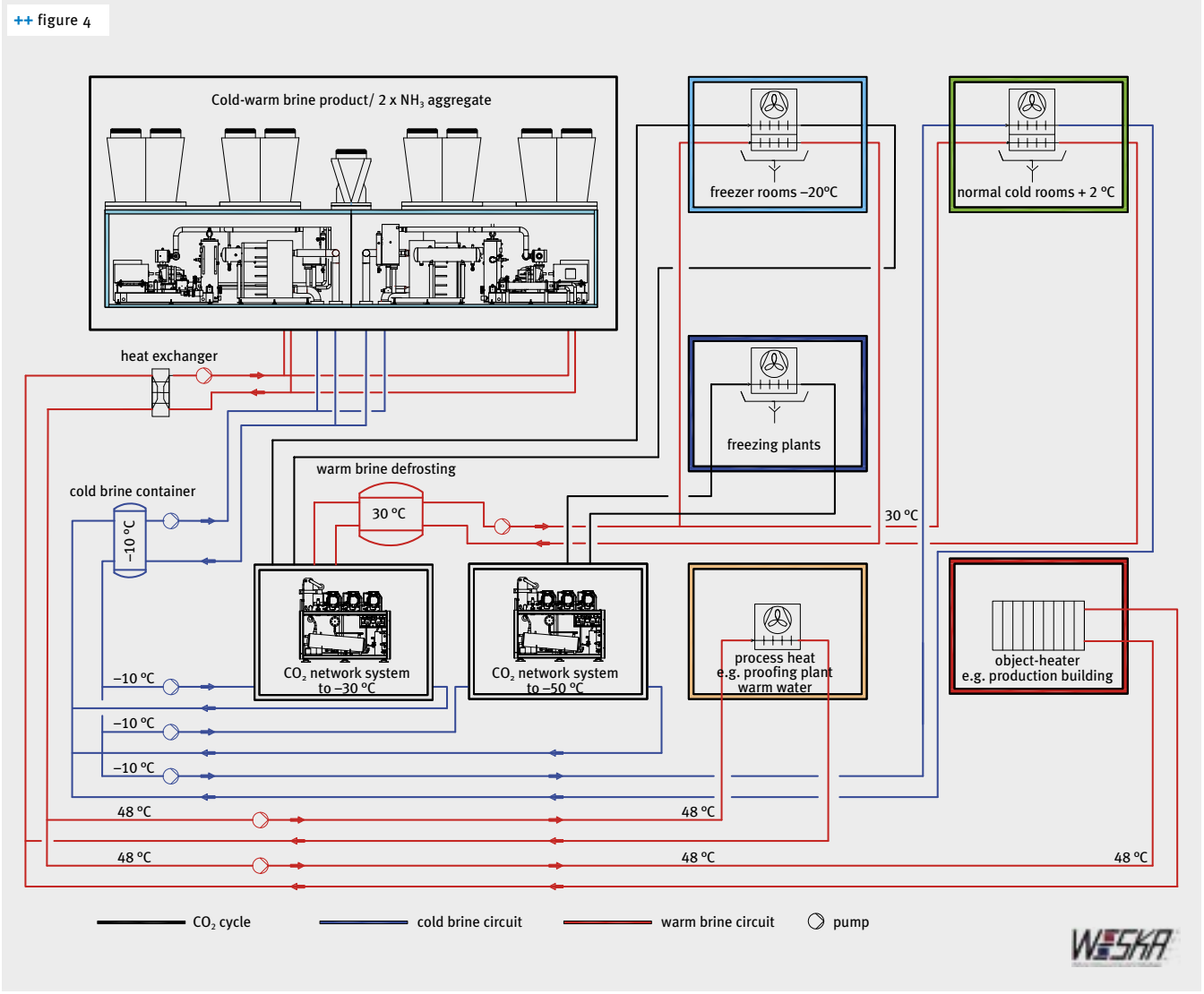
The Temper brine at –10 °C supplies the three CO_2 networked refrigeration systems, as well as the normal cold rooms. The solution recovers part of the waste heat produced by the compressors and oil coolers in the process: around 300 kW, which corresponds to +48 °C as process heat. This energy suffices to heat the partial-baking systems, and to partially heat the production shop floor and the hot water required. Excess heat is removed via the brine heat recovery emergency cooler. A redundant gas heating system serves as backup in case the refrigeration systems don't operate. The microchannel air coolers on the roof of the container extract the surplus heat from the ammonia process.

The deep-freezing process in Plant 1 is based on a refrigeration cascade with natural carbon dioxide (CO_2). The brine supplied from the first Temper circuit at –10 °C is boosted to –30 °C in one of the three CO_2 networked circuits, and supplies the freezer rooms (–20 °C) via an additional deep-freeze brine circuit. The warm side of this CO_2 booster network heats brine to 30 °C to defrost the freezer rooms. Two further CO_2 network systems boost the supply flow of the first temper circuit (at –10 °C) to a temperature of –50 °C for the freezer Temper circuit (see figure 4).

Demand-controlled maintenance from one source

Project director Jens Geyer of Wolf ButterBack decided initially on two single-stage GEA Grasso chillers (with FX LP 800 screw compressors) as key components for the new refrigeration ▶

++ figure 4



++ figure 4
Schematic of the refrigeration process in Plant 1 at Wolf ButterBack

concept. In addition to the choice of refrigerant, it was essential when selecting the compressors that the compressors could effectively cover weekend part-load operations (of around one-tenth of the weekday demand), and that high condensation temperatures would not present problems during summer operation. As a result of solicited bids, the refrigeration company Weska won the order for the entire concept, project engineering, dimensioning of all plant components, and installation of the systems involving the refrigeration container. In addition, this company also supplied the piping for the room and CO_2 refrigeration with Temper. Weska, in collaboration with GEA Refrigeration Technologies, developed the solution implemented in the container.

The container contains two single-stage, technically identical GEA Grasso cooler sets, with a total of 1,200 kW duty. Speed control under part-load operation takes place via energy-saving inverter technology. The chillers run alternately, with similar hours of operational duty, to prevent excessive wear on one unit. The entire infrastructure in the container, including the extract-air system, was pre-installed by GEA Refrigeration Technologies. Weska completed the entire facility onsite: to include the condenser system on the container roof, the emergency heat-recovery cooling unit and the brine system. Operational parameters and times are transmitted via a unit control system via Profibus to the higher-level control system. The control system sends malfunction alerts by e-mail. Remote control of the system is possible via VNC (Virtual Network Computing), which enables control from the outside via a reliable Internet link. If there is a total system failure, leased backup refrigeration systems can be connected at interfaces already provided to the brine system.

Aim: Leading quality in frozen flaky pastry

Owing to its full order books, Wolf ButterBack plans ongoing expansion of its production capacity, and further internationalization of its business. Its management has truly aimed high: Wolf ButterBack intends to achieve quality leadership for frozen premium baked goods, with its core competence in croissants, Danish pastries, and snacks with "Markenbutter". At the same time, it plans to expand its portfolio through innovation. And if its capacity does not suffice – plans have already been drawn up for Plant 3. +++

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