



Green building thanks to integrated planning

The REWE supermarket in the Norderstedt district of Schleswig-Holstein operates as a CO₂ neutral store. The building was awarded the DGNB platinum prize in the 'retail building' category in recognition of this high standard of building and sustainable use of material and energy resources. The transcritical CO₂ cooling system from the company Epta uses a Güntner FLAT Vario gas cooler from the S-GVH series.

The REWE Group implements sustainable and energy-efficient supermarket concepts in Germany. At the end of 2016 the company has established more than 50 green building supermarkets in accordance with DGNB (German Association for Sustainable Building) standards, and there are even more in the pipeline. The REWE green building concept for the sustainable construction and operation of commercial real estate is based on the integrated planning of all trades. In terms of building services, the latest cooling and air conditioning, heating, ventilation and lighting technology was installed.

The around five million euro supermarket building in Norderstedt has a sales floor area of 1,300 m², made from environmentally friendly building materials. It is particularly



Overview

Business line:	Commercial
Application:	Supermarket Cooling
Country/City:	Germany/Norderstedt
Refrigerant:	CO ₂ /Water
Product:	Güntner gas cooler S-GVH

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▲ Güntner Vario FLAT S-GVH gas coolers use small-diameter core tubes made of high-strength copper alloy. This substantially reduces the necessary tube volume to about 40 percent of that in typical stainless steel core tubes.



▲ CO₂ multi-compressor rack from the company Epta with heat recovery in the plant room.

well insulated, and the pioneering building engineering dispenses fully with the need for fossil fuels. Further features that contribute to the positive energy footprint include the daylight architecture and the use of locally sourced, renewable energy (heat recovery, heat pumps and photovoltaics).

The solar system on the roof of the supermarket is designed to fully cover own electricity consumption needs on Sundays. During opening hours, the solar collectors cover some 40 to 55 percent (distributed throughout the day) of the demand. Around 70 percent of the heat energy is derived from waste heat from the central commercial refrigeration, while the heat pump covers peak heat loads.

Transcritical CO₂ cycle

Because the cooling and lighting systems are the largest energy consumers in supermarkets – together accounting for some three quarters of the entire energy requirement – special attention was paid to energy-efficient operation and environmentally friendly refrigerants when it came to the refrigeration in Norderstedt.

The innovative cooling concept is based on a central transcritical CO₂ process which, in turn, supplies decentralised refrigerant cycles in the individual cooling units by means of circulating water. A Güntner S-GVH FLAT Vario gas cooler with a capacity of 119 kW transports the unusable heat from the transcritical CO₂ cycle to the ambient air.

CO₂ evaporator integrated in the buffer tank

A further special structural feature of the transcritical CO₂ system in Norderstedt is that the evaporator used in the transcritical CO₂ process is surrounded by a cold water buffer tank. When the CO₂ evaporates, the cold transmits directly to the water in the buffer tank without the CO₂ entering the water.

Because this cold water from the buffer tank supplies cooling/cold water to the condenser of the connected “Epta Blue” refrigerated cabinets and is thus available in a sufficient or redundant quantity, the supermarket’s entire cooling technology can be supplied from this buffer tank without loss in the event of a fault in the CO₂ cycle – allowing an adequate grace period, if needed, for service call-outs.

Güntner gas cooler – technical background

To ensure that transcritically operated CO₂ refrigeration systems achieve optimal COP ratings, there must be a control valve to regulate the pressure in the gas cooler to a constant value that is a function of its outlet temperature. Owing to the high operating pressure under which CO₂ systems operate, the gas cooler is designed for a maximum operating pressure of 120 bar as standard.

To enable it to withstand these high pressures, Güntner has been using small-diameter core tubes made of high-strength copper alloy since 2015. This substantially reduces the necessary tube volume to about 40 percent of that in typical stainless steel core tubes.

On one hand, this helps to significantly reduce the refrigerant charge needed in the plant, but it also speeds up the process of switching between subcritical and transcritical operation, because less CO₂ has to be displaced into the gas cooler. One positive side effect is that a smaller intermediate pressure vessel can potentially be used, because less refrigerant needs to be provided for this process.

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▲ The CO₂ cycle operates exclusively between the technology room and components installed outdoors such as the Güntner gas cooler.

The evaporator in the transcritical CO₂ multi-compressor cycle is used primarily as a heat pump. This means that the condensing temperature of the connected refrigerated cabinets and condensing units in the cold rooms can be kept low to increase efficiency.

Heat recovery for heating and raw water

The usable heat on the high pressure side downstream of the compressors is directed in heat pump mode via a plate heat exchanger which is connected to the heating network. Raw water can therefore also be heated efficiently owing to the high discharge gas temperature.

In addition to the heat pump, the waste heat from the refrigerated cabinets serves as the main energy source for heating the supermarket. The Epta refrigerated cabinets used are fitted with “blue boxes” for this reason. The entire waste heat is delivered to a central cooling water system and can be used in this way for the heating.

Energy-saving refrigerated cabinets

The refrigerated cabinets on the operator side were also optimised to ensure the lowest possible energy consumption. All refrigerated cabinets (normal and deep freezing) are thus enclosed by glass doors in chest or shelf form in the REWE green building so as to avoid cooling losses from the outset.

The anti-glare glazing of the deep freezers is additionally fitted with anti-fog coating, which prevents the panes fogging up when the doors are opened, thus in turn eliminating the need for an electrical window heater.

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