Güntner heat exchangers chosen for TÜV SÜD test chambers

TÜV SÜD's new testing laboratory on Geiselbullacher Strasse in Olching, Germany, boasts the largest range of refrigeration and air conditioning testing capabilities anywhere in Europe. This includes Germany's most powerful CO_2 test rig for refrigeration heat exchangers to date. Powerful and accurate GFN-type Güntner Application BLAST air coolers with impressive air throw ensure constant test conditions in the test chambers whilst assessments are being carried out.

Once the volume of orders flooding into the headquarters on Ridlerstrasse in Munich finally meant that there was insufficient testing capacity there to cope and since increasing the test capacity in Munich wasn't an option, the international independent testing and certification service provider TÜV SÜD decided to construct the new TÜV SÜD Center of Competence for Refrigeration and Air Conditioning "in the green countryside".

At the same time, the range of services on offer was also expanded. The 8,500 m^2 premises now boast 16 different-sized test chambers featuring different equipment which can be used to test ventilation and refrigeration/air conditioning prototypes and products as well as those for refrigerated temperature-controlled transportation. Johnson Controls' site in Mannheim supplied the test chambers for the testing laboratory, and ska Industriekälte, based in Vöhringen, planned, delivered and installed the refrigeration system.

Overview

Business line:	Industrial refrigeration
Application:	Laboratory
Country/Region:	Germany/Olching
Fluid:	NH_3, Hycool
Product:	GFN-type Güntner Application BLAST air cooler

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▲ ATP climatic chamber for testing refrigerated vehicles

▲ Room temperatures of between -40 °C and +50 °C can be set in the test chambers at relative humidity levels of between 20 % and 95 %.

▲ 198 kW of refrigerating capacity and an air volume flow of 90,000 m²/h are installed in the large ATP test chamber. The fans have been optimised for use at between -40 °C and +50 °C.

The test centre is equipped for testing refrigeration and air conditioning equipment with traditional (synthetic) and natural refrigerants (NH_3, CO_2, hydrocarbons). Head of the Department and Laboratory, Andreas Klotz, says: "The number of units using natural refrigerants is rising on account of the F-Gas Regulation and hence opening up new lines of business for us. As part of concerted efforts, the industry is also optimising the primary energy consumption of its products. What's more, food refrigeration chains continue to be a hot topic. As a service provider, we are naturally keen to be able to meet all these increasing market requirements."

TÜV SÜD works for Eurovent Certita Certification and the EHPA as a testing institute. The service provider has been accredited by the German national accreditation body DAkkS as a testing laboratory in accordance with DIN EN ISO/IEC 17025 and as an inspection body in accordance with DIN EN ISO/IEC 17020. TÜV SÜD is also an approved ATP test station and pressure and temperature calibration laboratory.

Wide range of tests on offer

The modern test centre's services also include technical acoustics and the certification of CO_2 refrigeration technology, e.g. in accordance with Eurovent's test criteria. In addition to two ATP chambers and six climatic chambers, there is a 588 m³ sound chamber and a heat recovery double chamber (e.g. for testing ventilation and air conditioning units with heat recovery), a testing room for low air velocities and a large measuring area for determining air volume flows.

One of the key focus areas of the new refrigeration and air conditioning test centre in Olching is the testing of refrigerated equipment used throughout the entire value chain in the production of food and pharmaceutical products and related logistics. This includes equipment for refrigerated temperature-controlled transport as well as components and assembly groups for cold rooms.

The tests offered range from the calibration of thermometers and temperature monitoring devices right through to the type testing of entire refrigerated vehicles (in two 650 m³ and 530 m³ test chambers with exhaust gas extraction) in accordance with the "ATP Agreement on the International Carriage of Perishable Foodstuffs".

The 25 employees at the Olching-based testing laboratory also test refrigeration and air conditioning systems and components such as heat exchangers, compressors, fans, fittings and entire refrigerating systems, e.g. refrigerated display counters and heat pumps.

Precise room temperatures of between -40 °C and +50 °C can be set in the test chambers at relative humidity levels of between 20 % and 95 %. In order to keep the test parameters in the test chambers constant, i.e. ensure a maximum deviation of just 0.2 K, the plant contractor separated the central production and distribution of cold from each other and installed three secondary refrigeration circuits and one heating circuit in the test centre.

Space-saving central refrigeration technology

The central ammonia refrigeration system is housed on the test centre's roof. Each of the three levels of the space-saving booster system boasting 1,720 kW of refrigerating capacity consists of seven identically constructed screw compressors. All of the compressors are connected to a large multi-chamber system separator (medium, low and ultra-low pressure separator) meaning that the entire central cooling supply could be set up on a roof space measuring approx. 115 m² with, nevertheless, all assembly groups being easy to access in the event of maintenance work.

The first level of the central cooling facility uses three 420 kW compressors to reach a flow temperature of -8 °C. The second booster level consists of two compressors, each 160 kW, and ensures a flow temperature of -30 °C. The third level uses two 140 kW compressors to reach a flow temperature of -46 °C.

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▲ Each ATP climatic chamber is assigned an air conditioning unit which is mounted in an intermediate storey above the test chambers.

▲ ska Industriekälte planned, delivered and installed the refrigeration system.

▲ The air coolers are defrosted using warm brine and the process can be enhanced with electric defrosting; as such, the trays are also designed to be heated. As the air coolers have a modular design, both the floor-mounted and ceiling-mounted units were quickly and easily assembled.

Cooling using groundwater

The compressors have speed-controlled motors and are regulated to ensure that they always operate with the lowest energy input possible and when working in conjunction the unit with the lowest number of operating hours switches on and in partial load operation the unit with the highest number of operating hours switches off.

The non-usable waste heat from the compressors is dissipated in an environmentally friendly way with 12 °C cold groundwater which can thereby be warmed to 18 °C. This water-cooled condensation of the ammonia is, in this case, particularly economical because the water table at the site is on average only around three metres below ground level and therefore the development costs and required pump capacity are comparatively low. Drainage wells reabsorb the warmed groundwater.

Hycool as coolant and heat carrier

The environmentally friendly refrigerant ammonia is found only in the machine room as the distribution of heat (from district heating) and cold (three secondary circuits) is undertaken by the fluid Hycool in both cases. Using secondary circuits, which directly supply the GFN-type Güntner Application BLAST air coolers, it is possible to limit the temperature fluctuations in the climatic chambers to a maximum of 0.2 K and, together with the air conditioning units above the test chambers, ensure standardised test conditions. Heat is transferred from the primary circuit to the secondary circuits in each case on the cold side via plate heat exchangers.

The fluid Hycool is a potassium formate-based brine with a high specific thermal capacity c (2.5 - 3.0 kJ x kg^{-1} x K^{-1}) (compared to $c_{20\,°C\ warm\ water}$: 4.182 kJ x kg^{-1} x K^{-1}). As such, this brine can be used just as effectively in cold and/or heat transfer at both extremely high and low temperatures – tailored to meet the specific needs of the test centre with regard to flexibility. The required temperature levels in the supply circuits ultimately range from -46 °C to +75 °C.

A total of approx. 50 m^3 of brine is contained in the entire tube system and the three Hycool buffer tanks. A variety of frequency-controlled pumps in the brine circuits are magnetically coupled in order to prevent any corrosion-induced restricted functionality from the outset.

Güntner heat exchangers ensure stable test temperatures

The rooms' test conditions are subject to strict requirements as a TÜV SÜD test report is drawn up at the end of each laboratory test. For example, a heat pump, which is to be tested, will be installed between two "climate zones" – room temperature is simulated on one side and the annual cycle with negative and positive temperatures is simulated on the other side for the internal unit of the device.

The GFN-type Güntner Application BLAST air coolers installed in Olching are based on the operating principle of a powerful blast freezer. Their design was optimised in accordance with the dimensions of the chambers and the required range of temperatures to be used in each case.

Refrigerating capacity of between 30.5 kW and 198 kW and an air volume flow of between 13,000 m^2/h and 90,000 m^2/h were installed depending on the size of the chamber and its specific set of requirements. The fans have each been optimised for use at between either -40 °C or -25 °C and +50 °C, depending on the test room.

The air coolers are defrosted using warm brine and the process can be enhanced with electric defrosting; as such, the trays are also designed to be heated. As the air coolers have a modular design, both the floor-mounted and ceiling-mounted units could be quickly and easily assembled.

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▲ The forced draught fans of the GFN-type Güntner Application BLAST air coolers are mounted behind the climatic chamber.

▲ TÜV SÜD's powerful CO_2 test rig in Olching delivers clear performance data, e.g. for condensing units and refrigerated display units.

Smart control

A smart control monitors the test environment in the individual chambers and ensures that the required test conditions and hydraulic or electrical test loads are adjusted in each case so that the environmental parameters are fulfilled. In addition, the test set-ups can be put into operation by means of a local control or alternatively can run automatically via the measurement control system and the measurement data can be recorded independently for subsequent analysis.

The process control system (PCS) regulates the entire plant. A measurement control system (MCS) in turn captures the test data. Both systems communicate via ProfiNet but work independently of each other. Where necessary, the MCS can, for example, send a required temperature or relative humidity level from measurement programmes to the PCS via ProfiNet and hence either readjust the conditions in the chambers or define other test conditions.

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