



365 days of wintry temperatures in the world's longest ski tunnel thanks to Güntner

There are year-round temperatures of about minus 4 °C in the „Mid-Sweden 365“ ski tunnel. The tunnel system in the Swedish village of Gällö-Viken was once built for military purposes and recently redesigned for about SEK 37 million to house an indoor sports facility for cross-country skiing for everybody that opened its doors in September 2017. Güntner provided air coolers, heat exchanger coils, an ammonia condenser as well as a dry cooler for this ski tunnel.

Gällöberget is located in the heart of Sweden near Trondheim in a national reserve between Sundsvall and Östersund. In this granite mountain, cross-country skiing trails were designed as a circular course with an overall length of 1.4 km, making Mid-Sweden 365 the largest indoor skiing facility in the world. Two trails are prepared for cross-country skiing whereas the third one is designed as ice skating rink. In addition, there are six 50 metre shooting ranges for target practice. The snow for the tunnel is



Overview

Business line:	Industrial
Application:	Sports arenas
Country/Region:	Sweden/Viken, Gällö
Fluid:	Ammonia / water/ethylene glycol mixture
Product:	Güntner air cooler CUBIC Vario, type GGHN (new series: GACV) Güntner heat exchanger coil, type GCO Güntner condenser FLAT Vario, type GCHV-AD Güntner dry cooler FLAT Compact, type GFH (new series: GCHC)

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▲ The waste heat of the secondary circuits is dissipated to the environment via a Güntner dry cooler FLAT Compact GFH (new series: GCHC) equipped with EC fans and GMM.



▲ The cold as well as the supply air is routed via textile socks, resulting in a total length of 2.4 km of air textile socks installed in the mountain. Depending on the distance to the air conditioning unit, the conditioned air is distributed either via ten Güntner CUBIC Vario air coolers type GGHN (new series: GACV) with streamer (at the entry area), or via textile socks (inside the mountain).

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produced in the nearby city of Östersund by a company that has already been globally active in this market since 1974.

The circuit of the MidSweden 365 ski park is everything but flat: The course's maximum difference in height in the tunnel is 13 m. Both amateur and professional cross-country skiers are welcome to make their rounds in Viken year-round between 8 am and 9 pm. You can also find a local service on the spot including reception, café, changing rooms, a ski shop and conference rooms adjacent to the sports facility.

Demanding project

The special technical challenge of this project was to overcome in a first step the thermal forces of the rocks and to compensate the air flow losses resulting from the angular sections in the tunnel. The Swedish refrigeration specialist Francks Kylindustri AB designed and installed the entire HVAC equipment for the demanding tunnel construction MidSweden 365. The company boasts of decades of experience in providing complex industrial solutions with heat recovery. Similar to an industrial plant, a central ammonia refrigeration circuit and secondary glycol circuits are implemented also in this refrigeration circuit.

Speed-controlled ammonia screw compressors provide 800 kW of cold and are thus well equipped also for external summer temperatures. The ammonia refrigerating plant is housed in a container. On its roof, a Güntner axial condenser FLAT Vario, type GCHV AD, with EC fans and Güntner Motor Management is installed. The unit has a condensing capacity of 930 kW.

Güntner dry cooler FLAT Compact

For safety reasons, no ammonia is contained in the part of the refrigerating plant installed in the mountain – a 35 per cent ethylene glycol solution provides the wintry cold for the ski tunnel instead. 32,000 litres of brine are used for the whole cooling system of the ski tunnel whereas about 600 litres of this liquid are kept in a buffer tank. For the air and the ground, there are separate cooling systems, each of which have a flow temperature of -10 °C. The waste heat of the secondary circuits is dissipated to the environment via a Güntner dry cooler FLAT Compact GFH (new series: GCHC) equipped with EC fans and GMM. The dry cooling capacity of the dry cooler is 135 kW (45 °C/35 °C).

The ground below the cross-country skiing trail is cooled by cooling spirals to prevent the snow surface from melting and subsequent frosting caused by the heat input from the rocks and lighting. This installation below the snow surface of the trails can, in principle, be compared with the temperature control of an ice rink.

Air conditioning by Güntner GCO heat exchangers

Providing cold and, at the same time, fresh and oxygen-rich air in the tunnel in line with demand is, by contrast, much more complex. It is not only the waste heat from the athletes but also their breathing air containing carbon dioxide and humidity that needs to be dissipated and replaced by fresh air. The same applies also for the exhaust air of the machines that are in operation to prepare the skiing trails. When there is a large crowd of people in the tunnel, the ventilation system dissipates 5,000 litres of air per second and replaces it by conditioned winter air with a temperature of minus 6 °C and 100 % relative humidity.

The fresh air from the air handling unit installed outside is pre-cooled by the GCO coils of a regenerative cold recovery system and then further cooled down in three steps prior to feeding it into different areas of the tunnel system. The supply air can have a temperature of up to +30 °C and an RH of 60 %. Dehumidification takes place via three Güntner GCO heat exchanger coils with a total heat exchanger surface of

775 m². These coils are connected in series to overcome the temperature difference between outdoor and indoor air. The coils are defrosted every six hours. But as it is necessary to continuously provide fresh supply air, there are two parallel, alternately operated rows of coils. For defrosting, hot ethylene glycol is heated up by the waste heat from the compressors and distributed via a separate system to the heat exchanger coil. This means that always one refrigeration circuit is defrosted while the other generates cold air.

Güntner CUBIC Vario air coolers at the entry area of the tunnel

Ten Güntner CUBIC Vario air coolers GGHN (new series: GACV) with streamers and a refrigerating capacity of each 20 kW are installed at the entry area – in such way that the fresh supply air is distributed evenly. The cold air as well as the supply air are routed via textile socks with a total length of 2.4 km installed in the mountain. The textile socks mounted close to the wall below the ceiling are connected to four air handling units each equipped with two Güntner GCO coils (total heat exchanger surface of 3,536 m²) circulating an air volume of 35,000 l/s in total.

This way, temperatures of -4 to -6 °C are provided for cooling as well as dehumidification that is required as water drips off the walls inside the mountain. The technology of this installation almost fully protects the skiers from draught caused by sinking cold air and, at the same time, cools the walls. This solution saves a huge amount of energy compared to a technical variant with fans providing a great air throw. Another advantage is that the noise level inside the mountain is very low, given the sound pressure level of about 51 dB(A).

Heat recovery

The waste heat from the central ammonia refrigerating plant is transferred to heating circuits. These heat the heating and drinking water for the service centre and also defrost those air coolers and drain pipes in the tunnel that are laid aside the skiing tracks. The ski tunnel opened its doors only recently but the operators have already further plans at hand as there are over 50 other caves and corridors with a total area of about 12,000 m² still available in the mountain.