



The “Cool” Royal Arena in Copenhagen

The new Royal Arena for international music and sporting events in Copenhagen uses the environmentally friendly refrigerant ammonia as refrigerant in its machine room. High-capacity Güntner V-SHAPE Vario GFD units take care of cooling down the glycol for the condensing process in the ammonia chiller, in the most confined of spaces.

Opened on February 2017 with a giant concert performed by the rock band Metallica, following a construction period of around three years and a planning period before this of around two years, the Royal Arena in Copenhagen is a distinguished venue for large national and international events. Extending over an area of 35,000 m², the approx. €135m arena can accommodate both concerts and sporting events. An audience of 15,000 can be catered for at music events while the ground floor of the arena is reserved for the athletes at sporting events. Ice hockey tournaments can thus be followed by an audience of 10,000, while seating for even up to 12,500 can be provided for handball tournaments.

The spacious foyer beneath the main hall is used for markets/trade fairs and exhibitions, with the result that the arena also serves as the city's cultural hub. The Royal Arena is located in the south of Copenhagen in the Ørestad Syd district of the city within the urban development zone and is surrounded by promenade-like green space.



Overview

Business line:	HVAC technology
Application:	Air conditioning and process cooling
Country/Region:	Denmark/Copenhagen
Fluid:	NH ₃ / water glycol mixture
Product:	Güntner Vario V-SHAPE GFD

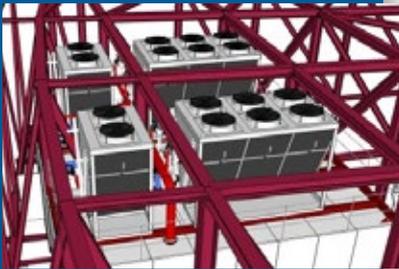
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▲ The maximum tolerance at the flange connections in the prefabricated construction was just 5 mm owing to the confined space conditions.



▲ Güntner dry coolers from the V-SHAPE Vario GFD series precisely fit into the steel construction of the roof.



▲ The Güntner dry coolers V-SHAPE Vario GFD are equipped with energy-efficient ebm Axi-Tops to reduce the sound level. The installed HydroSpray system secures the capacity at very high ambient temperature peaks.

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Challenging building structure

Because of the different sporting events such as table tennis and ice hockey that are held in the arena in addition to concerts, the building engineering is correspondingly sophisticated – though still not visible to the naked eye. High aesthetic standards were set by the Danish architecture firm 3XN, with the engineering offices of ME engineers from Great Britain and Rambøll from Denmark often having to overcome the difficulties presented by the demanding structure in the most confined of spaces.

Key considerations when it came to implementation included high visitor comfort, excellent acoustics and functionality for the artists and athletes and above all the guests. The oval, self-supporting and slightly curved cantilever roof is architecturally striking. Because there are no supporting columns in the central event hall, this construction ensures an unobstructed view from all seats.

The cooling demand at events on ice is more than one third higher

The entire centralised cooling is accommodated directly below the roof construction and posed special challenges for the machine room planners, contractor A-Comfort ApS. A cooling capacity of 2.3 MW is required for normal events, while this figure rises to 3.3 MW for events on ice.

The contractor A-Comfort ApS had decided to build the system including containers, chillers, PHE units and dry cooler in their workshop before the final on-site installation. This was only possible thanks to a detailed 3D representation of the complete system.

Four 1,000 kW screw compressors are responsible for the centralised cooling, which is transferred to glycol cycles that are used to supply 135 coolers. The flow and return temperature in the glycol cycle is 6 °C and 12 °C at normal events, while temperatures at ice events drop to 2.5 °C and 8.5 °C respectively.

The original architect design provided for the compressors being accommodated within the walled machine room in an enclosed container. This container was to be erected on 50 cm high stilts, with the dry coolers in turn being accommodated on the roof of the container. Cooling for the machine room was to be provided in the form of an open space at the side. The clearance of the confined space for the dry coolers was further limited by a steel girder projecting across the roof space.

Special construction necessary

This spatial arrangement did not allow air space for the fans however for the originally envisaged dry coolers. Even though smaller Güntner dry coolers from the V-SHAPE Compact GFW series or Güntner dry coolers from the FLAT Vario GFH series would have had sufficient set-up space, the air volume would not have been sufficient to ensure the required re-cooling power. The flow and return temperature of the dry cooler is 42 °C and 47 °C respectively at an external temperature of 31 °C, with the result that a standard solution would not have been possible in the spatial set-up.

The technical solution involved on one hand relinquishing the 50 cm stilts for the container in the machine room and on the other hand a combination of 4 x 2 differently sized special models of the Güntner dry cooler from the V-SHAPE Vario GFD series in order to take account of the steel girders in the roof construction.

Güntner dry coolers from the V-SHAPE Vario GFD series

The entire prefabricated construction was so precisely planned and constructed owing to the confined space conditions that the maximum deviation at the flange connections was just 5 mm.



▲ The Royal Arena will host the Ice Hockey World Championships in May 2018, one year later it becomes one of the venues of the Men's Handball World Championships.

The four Güntner dry coolers from the V-SHAPE Vario GFD series were interconnected in terms of control technology so as to be considered one unit by the control equipment. What's more, the dry coolers are equipped with energy efficient ebm AxiTops to reduce the sound level. The installed HydroSpray system secures the capacity at very high ambient temperature peaks.

Even today it is clear that Copenhagen attracts top-class events to the city with the new arena: the venue will host the Ice Hockey World Championships in May 2018, one year later it becomes one of the venues of the Men's Handball World Championships.

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