

Frankfurt's Exhibition Site Converts from Cooling Towers to LU-VE Dry Coolers with Adiabatic Dry and Spray

Christoph Brauneis is a journalist for the German HVAC magazine *Kälte Klima Aktuell*, or *KKA* (*Cold Climate News*). This article first ran in *KKA* in June 2007.

A LU-VE dry cooler with "Dry and Spray" is being installed in Australia this year and Celsius will report on this installation in a future issue.

Open cooling towers on the exhibition site in Frankfurt are to be gradually converted to closed dry cooler systems.

Messe Frankfurt is the third largest exhibition site in the world covering 578,000 m² of which 321,000 m² is taken up by exhibition halls and 83,000 m² by open air exhibition space.



The LU-VE EHL dry coolers are lifted one by one on to the roof of Hall 4 by crane – in the background modern Hall 3.

Whether it's the IAA, the Book Fair or the ISH – visitors and exhibitors (in 2006 this was 1.8 million visitors and 47,400 exhibitors) expect optimum conditions and functional technology when visiting a particular fair. To ensure this is delivered, the exhibition ground is buzzing with activity throughout the summer when there are no exhibitions. During this period, building construction, extensions and renovations goes on throughout the site to ensure that everything is running smoothly for the start of the busy 'hot' exhibition season.

(In July 2007, there were no less than 68 building sites all of which had to be supervised at the same time by the Department Head for Technical Building Services, Anton Heisler, and Facility Management and his team. As if that was not enough, the first stages of work was starting for the forthcoming International Automobile Exhibition, IAA.)



At exhibitions, such as here at the IAA, enormous heat loads occur which have to be extracted.

The concept of "hot times" can be taken quite literally because heat loads of almost unimaginable magnitude occur in the exhibition halls during an exhibition. Thousands of visitors – each one equivalent to 100 W heating – venue

lighting, spotlights, computers and operating machinery on display, produce enormous amounts of heat which have to be removed to maintain a pleasant atmosphere.

Problems with Open Systems

The management of Messe Frankfurt decided some time ago that all open cooler systems on the exhibition site would have to be replaced gradually by closed dry cooler systems. The reasons given were the risk of Legionnaires disease in open systems, general hygienic aspects, the cost of

maintenance, conservation of resources by greatly reducing water consumption, as well as complaints about fogging by the cooling towers (car owners, parked on the roof of Hall 4 complained about paint damage allegedly caused by fumes from the cooling towers).

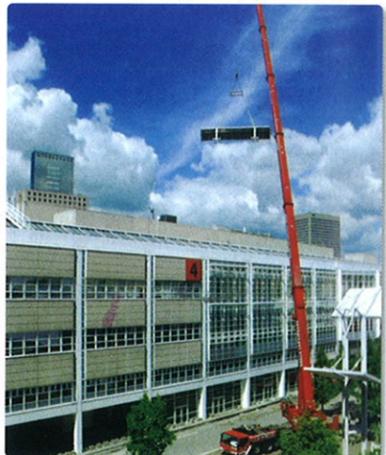
At Hall 4 the replacement of the open cooling towers on the roof of level 4.4 with the dry coolers was planned for July 2007.

The 11 LU-VE Group dry coolers were installed on the roof of Hall 4 on July 25 with a total re-cooling capacity of 13MW. The massive dry coolers with their axial fans were transported on 11 low loaders direct from the production plant in Uboldo near Milan, in Italy, to Frankfurt where they were lifted to Level 4.3 of the exhibition hall roof. The installation had to take place on this level as there was not enough erection space on Level 4.4 where the open cooling towers were located.



Delivery of a dry cooler from the Italian LU-VE Group factory in Uboldo Italy.

The relocation of the system meant that a lot of building work had to be carried out in advance of the installation to provide proper foundations for the dry coolers. In addition, new pipework and



ducting had to be laid out and installed. On the Frankfurt exhibition site by-the-way absorber technology is used for about 80% of refrigeration. At Hall 4 refrigeration is provided by two absorbers (one from York the other from Carrier). Six of the new dry coolers were needed for the York absorber and five for the Carrier absorber

The refrigeration machines have the following capacity data:

Carrier refrigeration machine:
Refrigeration capacity: 2200 kW
Cooling capacity: 5500 kW

Using Glycol/waterside:
Refrigeration capacity: 1540 kW
Cooling capacity: 3119 kW

York (JCI) refrigeration machine:
Refrigeration capacity: 2800 kW
Cooling capacity: 7000 kW

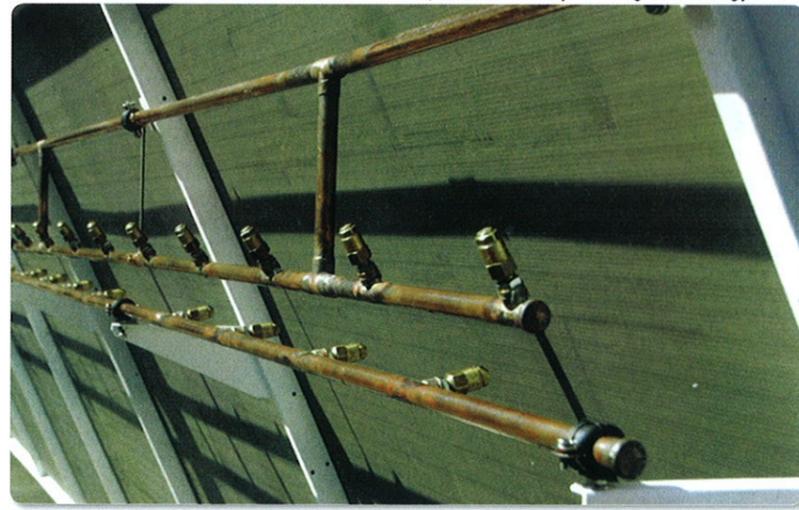
Using Glycol/waterside:
Refrigeration capacity: 2110 kW
Cooling capacity: 5400 kW

The cooling water for the dry cooler is still fed through the existing cooling water pumps which are located in the respective refrigeration centres on Level 4.3. The turbo chillers currently located in the basement will be dismantled and disposed of. They will be replaced by two new air-cooled chillers which will be connected by pipework to the existing cold water system on hall Level 4.3.



New foundations had to be prepared for the new dry cooler on hall Level 4.3

The cold water pumps required for this are installed in the refrigeration centres on Level 4.3. The cold water from the chillers on Level 4.4 is then combined in the cold water distributor and cold water collector in the refrigeration centre on Level 4.3 (York absorber).



"Dry and Spray" system on one of the 11 LU-VE dry coolers.

As exhibitions such as the IAA or the Book Fair just will not stand any experimentation, the old cooling towers remained in operation until the new plant was completely functional. The first successful test operation was in the European autumn of 2007, when the cooling requirements had eased, after which the changeover to the new system was implemented.

The required softened water at 1.6°dH for spraying is prepared in basement area dosing plants with softening equipment and conveyed to Level 4.3 through a network of stainless steel pipes. The dry coolers are only sprayed if the exit temperature from the dry cooler exceeds the set level of 20°C.



View inside the refrigeration centre with a York absorber, which will continue to provide service after the renovation

No great allowances had to be made for sound insulation. The dry cooler as well as the chillers required no additional sound proofing measures, but the individual sub-assemblies are so designed that the sound intensity level at a distance of 10m does not exceed 53dBa.

Messe Frankfurt has been using LU-VE Group products for many years since the renovation of the Torhaus in 2002. The installation space available on the Torhaus would not have been sufficient for a pure dry cooler and those responsible decided on a system with adiabatic cooling. These require less space because the peak loads are taken over by the spray system.

The positive experience with the adiabatic system and the service provided by LU-VE staff led to the provision of dry cooling technology

by the Italian suppliers in Hall 9 and in Hall 4.

Stephan Hahn, Team Leader for Sanitary, Heating and Air Conditioning Engineering at Messe Frankfurt says: "We also have competitors' products with similar technology in use – but we have not had the same positive experience with them. Above all, the technical support from LU-VE has been excellent."

Dry Cooling Technology

The EHL dry coolers installed in Hall 4 are known as adiabatic "dry and spray" units by LU-VE Group. These operate for most of the year as normal dry coolers, as long as the surrounding temperature is low enough to maintain the cooling capacity within the desired conditions (dry operation). At higher air temperatures (project specific) the system automatically comes into operation to spray the necessary amount of water on to the fins on the blocks (spray operation). The evaporation of the water sprayed on the fins increases the capacity of the unit and allows it to maintain the temperature of the cooled liquid within the desired parameters. A control system regulates the fan speed and the amount of water sprayed according to requirements.

This EHL system has the following advantages:

- Water consumption is limited to a few times a year.
- As there are no collecting baths provided under the heat exchanger no hygiene problems arise from stagnant water (which eliminates the problems of Legionnaires' disease).
- "Fogging" from cooling towers is avoided.
- The units need less installation space which is particularly advantageous in cramped situations such as in Hall 4.



Those involved in the project on the roof of Hall 4 in front of one of the new dry coolers: Stephan Zschunke, Sales and Projecting Coldwater Systems, Johnson Controls; Stephn Hahn, Team Leader Sanitary, Heating and Air Conditioning Engineering, Messe Frankfurt; Jürgen Alber, Managing Director LU-VE Contardo Germany; Anton Heisler, Departmental Head Technical Building Equipment Messe Frankfurt; Manfred Krauss, Sales and Projecting Cold Water Systems, Johnson Controls.

Acknowledgement

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