MITSUBISHI ELECTRIC

Case Study

Precision cooling for world-leading super computer

Keeping a new DGX-2 supercomputer at an ideal temperature places high demands on I.T. cooling.

Of course, the increased computing power requires correspondingly powerful precision air conditioning, but this also has to be balanced with today's climate protection debate which demands a rational use of energy.

In the case of the current most powerful computing machine in the world for modern AI processes, the ideal solution is delivered by two precision i-NEXT water-cooled climatic cabinets with direct evaporation and full inverter technology as well as free cooling function.

The Deutsches Forschungszentrum für Künstliche Intelligenz (DFKI) is the leading business-related research institution in Germany in the field of innovative software technologies based on methods of artificial intelligence.

Based in Kaiserslautern, the Deep Learning Competence Centre focuses its research on deep learning and machine learning algorithms. In order to further expand the infrastructure from basic research to industrial knowledge transfer, DFKI is the first institution in Europe to receive an NVIDIA DGX-2 supercomputer, which is currently the most powerful computing machine in the world for modern AI processes.

The new supercomputer works on the cluster together with three DGX-1 computers (each with 1 PetaFlop computing power) and currently eighteen other highly integrated GPU computers. It is located in a specially created server room in the basement of the main branch in Kaiserslautern.

A medium-voltage power supply of 0.25 MW is installed for operation, which includes a 1.75-petabyte data memory for this supercomputer, among other things. The use of "normal" computers would also have required many times more space in the server room compared to the new super computer.

Highest efficiency in the smallest space

The extremely high computing power in a very small space leads to a significant growth in thermal loads and to increased demands on I.T. cooling. In order to cool the supercomputers, the DFKI needs intelligent I.T. air conditioning, which ensures the diverse requirements for precise, reliable, energy-saving and noise-reduced cooling of the DGX-2 and the other computers.

The IT cooing plant needs to be energy-saving, among other things, because only limited electricity capacities are available at the location. Attention was also paid to low noise emissions as a residential area is directly adjacent to the DFKI grounds.

Solutions from RC IT Cooling, a Mitsubishi Electric brand, with two precision air conditioning cabinets of the type **i-NEXT FC DW** form an essential part of the solution. The water-cooled climatic cabinets with direct evaporation and full inverter technology as well as free cooling function each have an output of 100 kW. Two ultra-quiet heat exchangers are available for the free cooling function and the re-cooling. The redundant structure of such systems is the usual procedure to ensure operational safety.

The main requirement for air conditioning is a high cooling capacity in a very small space with a comparatively low energy consumption. In addition, cooling accounts for a large proportion of the energy consumption in the new data centre, so the overall concept was designed with a view to permanent, economical operation, with the lowest possible power consumption.

The concept for I.T. cooling was designed by the planning office S2 Sappok & Stutterich GmbH from Pirmasens with the cooperation of Walter Sommer, head of the infrastructure group at the DFKI in Kaiserslautern.

The i-NEXT series from RC I.T. Cooling has been specially developed for the precision air conditioning of servers and I.T. rooms and offers an optimal ratio of performance to stand space. The units enable precise temperature and humidity control as well as humidification and dehumidification.

Energy-saving and noise-optimized EC high-performance fans ensure a regulated air flow. The fans adapt to the thermal load, which is detected by sensors in hot and cold aisles. The evolution+ controller controls the activation times of the compressors with FIFO logic and adjusts the cooling capacity generated to the current heat input.

Intelligent energy management

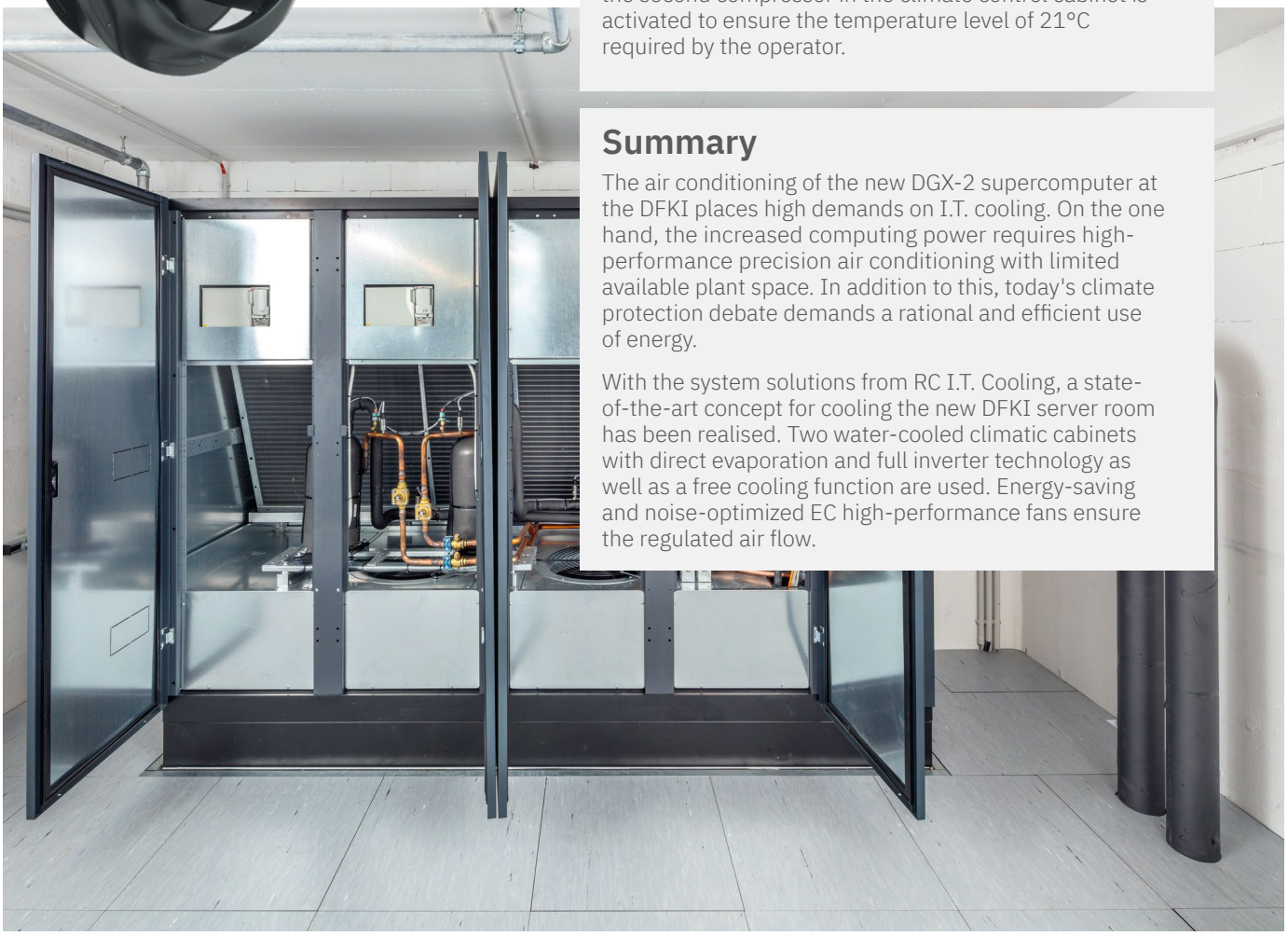
The two climate cabinets are located on the left and right of the server room. In the middle with an all-round aisle there are five racks with the new computer and its peripheral I.T. components. A heat load of approx. 25 kW is carried off per rack.

EC high-performance fan

In order to enable energy-efficient cooling, the server air conditioning is designed according to the down-flow principle. While the air is sucked into the climatic cabinet from above, the air outlet is down into a double floor. A cold aisle is formed on the air intake side of the racks for optimal air distribution through outlet openings in the raised floor, which are located on the front of the racks.

The racks suck in the cold air and blow the warm air into the so-called hot aisle on the back, which is then sucked in and cooled by the climatic chamber in operation. The decision in favour of aisle containment is made over cold aisle containment to enable the precise control of the cold air supplied to the servers. A constant temperature can therefore be guaranteed through the hot and cold aisle and the adapted air flow. Working conditions become more stable and the efficiency of the entire air conditioning increases.

The precision climate chamber works in hybrid or full free cooling mode for a large part of the operating time. In normal operation, cooling with water takes place via the free cooling function. If the heat loads exceed a certain reference point, a compressor is added and additionally cools the intake air using a refrigerant circuit. If the cooling requirements exceed a further temperature reference value, the second compressor in the climate control cabinet is activated to ensure the temperature level of 21°C required by the operator.



Summary

The air conditioning of the new DGX-2 supercomputer at the DFKI places high demands on I.T. cooling. On the one hand, the increased computing power requires high-performance precision air conditioning with limited available plant space. In addition to this, today's climate protection debate demands a rational and efficient use of energy.

With the system solutions from RC I.T. Cooling, a state-of-the-art concept for cooling the new DFKI server room has been realised. Two water-cooled climatic cabinets with direct evaporation and full inverter technology as well as a free cooling function are used. Energy-saving and noise-optimized EC high-performance fans ensure the regulated air flow.

Case Study

DFKI Kaiserslautern, Germay

Installation Summary

Indoor Units:

2 x i-NEXT FC DW
Precision, Water-Cooled Climatic Cabinets

Offering direct evaporation and full inverter technology as well as free cooling function.

Each have an output of 100 kW.

2 x Dry cooler XHL95X 7223 C H 4VENT

MITSUBISHI ELECTRIC
Changes for the Better

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Note: The fuse rating is for guidance only. Please refer to the relevant databook for detailed specification. It is the responsibility of a qualified electrician/electrical engineer to select the correct cable size and fuse rating based on current regulation and site specific conditions. Mitsubishi Electric's air conditioning equipment and heat pump systems contain a fluorinated greenhouse gas, R410A (GWP:2088), R32 (GWP:675), R407C (GWP:1774), R134a (GWP:1430), R513A (GWP:631), R454B (GWP:466), R1234ze (GWP:7) or R1234yf (GWP:4). *These GWP values are based on Regulation (EU) No 517/2014 from IPCC 4th edition. In case of Regulation (EU) No.626/2011 from IPCC 3rd edition, these are as follows. R410A (GWP:1975), R32 (GWP:550), R407C (GWP:1650) or R134a (GWP:1300).

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