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ENERGY-EFFICIENT CLIMATE CONTROL: "KEEP COOL" IN THE DATA CENTRE

Imagine if the entire IT system at your company were to suddenly fail, and the e-mail-system, Internet, ERP, and perhaps even IP telephony were all to go down simultaneously. This dramatic image underscores the importance of the data centre as the backbone of any company. This is where all the company's applications are made available to users, and all data is stored. Fast, complex computing processes in server racks and data centres can generate serious amounts of heat. To prevent the IT systems from collapsing, the infrastructure needs to grow with these processes, and this is especially true of the climate control system.

In many existing data centres, only around 50 percent of the electricity that is fed into the system actually reaches the servers. The other 50 percent is consumed primarily by cooling systems and uninterruptible power supplies (UPS). Climate control offers the greatest energy saving potential, since it consumes almost as much energy as the servers themselves, accounting for up to 37 percent. When selecting a suitable climate control solution for the data centre, a number of aspects must be taken into account. The most suitable concept for improving energy efficiency in the data centre depends primarily on the performance density of the servers, and the associated heat generation in the server rack or server room.

The PUE value (Power Usage Effectiveness) measures a data centre's energy efficiency by comparing the total amount of energy consumed with the energy used by the IT equipment. Values of 2.0 and above are quite common in many data centres, meaning that the infrastructure consumes just as much energy as the connected servers. In exceptionally energy-efficient data centres, these values can be reduced to between 1.1 and 1.2.

NOTHING BUT COLD AIR

In data centres with heat generation of up to 4 kilowatts per enclosure, efficient cooling is usually achieved by a CRAC system. These systems draw in hot air from the servers, cool it via a heat exchanger, and expel it into the raised floor, from where it re-enters the server racks via slots or perforations in the base plates.

Arranging server enclosures in accordance with the cold and hot aisle principle can help to boost energy efficiency in the data centre. In this layout, rack fronts face one another directly across an aisle.

This simple principle prevents cold air from the cooling system from blending uncontrollably with hot waste air from the computers and storage systems, thereby creating "air short-circuits".

So-called aisle containment takes thermal separation a step further. In such arrangements, the cold aisle at the top and ends of the rack is usually sealed so that cold air cannot escape. This mechanical measure ensures a temperature difference of between 10 and 15 degrees Celsius between the hot and cold aisle. This helps to reduce the system's cooling output – by up to 35 percent.

If the output of the CRAC system is no longer sufficient for adequate cooling of the server rack, we recommend that you install a Rittal TopTherm Liquid Cooling Package (LCP) Inline, which blasts cold air forwards into the cold aisle with a cooling output of up to 60 kilowatts. Incidentally, the LCP Inline can also be retroactively installed, even in heterogeneous environments.

THE ELECTRICITY FED INTO THE DATA CENTRE MUST RE-EMERGE AS HEAT

The higher the computing power, the greater the heat generation. Powerful blade servers for use in cloud computing applications or research institutes generate large quantities of waste heat – up to 25 kilowatts in some cases – which must be dissipated accordingly. The high performance density inside the rack means that so-called "hot spots" can soon develop – for example, if hot air builds up due to densely-packed cabling and is unable to escape. This can soon lead to overheating of the hardware and may eventually culminate in malfunctions and failures. The LCP dissipates high heat loads directly from the rack. Here, the cold air enters the server rack directly at the sides in front of the servers via slotted side panels, and hot air is drawn in again at the rear. The high heat loads are dissipated from the IT and server racks via air/water heat exchangers. Since water has the capacity to transport heat energy almost 4,000 times more efficiently than air, due to its material properties, very small water pipes are sufficient to transport these large quantities of heat.

The highly selective use of cold air in LCPs allows the inlet temperatures in the water circuit to be increased, thereby contributing significantly to more efficient climate control. Whereas a room air-conditioning system with air/water heat exchangers requires water temperatures of 8 to 15 degrees Celsius, if LCPs are used, 21 degrees is often sufficient. The generation of cold water is correspondingly energy-efficient.

A BREATH OF FRESH AIR FOR DATA CENTRES – USING EXTERNAL AIR FOR COOLING

Whichever cooling unit you opt for, at some point in the circuit, cooling will need to be generated in the form of cold air or cold water. One way of achieving this is with chillers. Free cooling offers a very energy-efficient alternative or addition, by using a resource that is available free of charge: cool exterior air. Conventional cooling systems can only guarantee cold water production if the exterior air exceeds a certain external temperature. There is an important distinction between indirect and direct free cooling. With direct free cooling, the Rittal climate control systems cool directly using cold exterior air when the outside temperatures are low. An air vent system regulates the various airflows, and waste air from the data centre is added in order to achieve the desired inlet temperature. With this form of climate control, customers can achieve a PUE value of less than 1.3.

Meanwhile, indirect free cooling is based on a powerful air/water heat exchanger which is located outside of the building and ensures a supply of cold water. This usually requires a temperature

difference of five degrees Celsius between the exterior air and the cold water. Powerful cooling registers help to reduce the temperature difference to 2.5 degrees, which can halve the energy costs for data centre climate control. The cooling circuit remains functional at external temperatures of up to 19 degrees Celsius

ALTERNATIVE COOLING: USING GEOTHERMAL ENERGY AND ADSORPTION COOLING TECHNOLOGY

New technologies are constantly emerging in the climate control of data centres to make generating the required computing power more efficient and environmentally friendly than ever. Geothermal energy is one ingenious alternative for ensuring a cool climate in the data centre. Under this system, after heating up inside the data centre, the cooling medium is subsequently routed into the earth by an underground network of pipes, where it is cooled down and then reused for cooling. Another example of innovative cooling technology is the use of waste heat, for example from a cogeneration plant, to operate the cooling systems. Rittal has showcased a fully autarchic container data centre with a redundant power supply and cooling via two integral CHP plants. Eco-friendly electricity from the CHPs generated from vegetable oil or natural gas is fed directly into the connected data centre, and waste heat from the power plants is used to cool the IT equipment. The cooling units in this system use an adsorption process, i.e. water molecules attach themselves to the surfaces of adsorbent materials. They have a maximum output of 10 kilowatts and continuously supply the liquid cooling LCPs built into the data centre containers with cold water.

TARGETED CONTROL

Operating a climate control system at full capacity day and night is both wasteful and harmful to the environment. For this reason, climate control solutions should always be precisely tailored to individual requirements. As company servers often do not need to operate at full capacity at weekends, for example, it is advisable to use a management software package such as Rittal RiZone to ensure targeted climate control regulation.

SUMMARY

No two data centres are identical, and their climate control requirements are highly individual. Determining factors include the computing power of the individual enclosures, the premises where they are situated, and the availability requirements. As well as fail-safeness and energy efficiency, it is also important to ensure modularity and scalability of the data centre. Manufacturers that offer a complete range of climate control solutions are well-placed to meet individual customer requirements. This in turn saves money and helps to protect the environment.

COMPANY BACKGROUND

World leader in enclosure and IT infrastructure technology, Rittal continues to expand its product offering with the highest quality, German engineering. Since its inception in Germany in 1961, Rittal has grown from a leading supplier of industrial enclosure and climate control technology to be a provider of complete data centre infrastructure. From racks, power, cooling, remote monitoring and physical security, Rittal is paving the way in data centre technology to create the most energy efficient, secure, future proof data centres on the market.

Rittal Australia & New Zealand has over 100 employees with service and delivery centres in all major main land capital cities (excluding Darwin). Our modification capabilities ensure the perfect fit solution no matter what your application. Rittal Australia & New Zealand is backed by a worldwide team of 10,000 committed staff, 10 production facilities and 63 international subsidiaries.

Rittal is your local global provider of market leading technology.

IMAGES

- Available on request.

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