AERIS

DATA CENTRE INDIRECT
EVAPORATIVE COOLING SYSTEM
THE GLOBAL DATA CENTRE MARKET

The data centre air conditioning market is expected to grow with a CAGR (compound annual growth rate) of about 12% in the next five years. The market value will grow from the actual $4,91 billion to $8,07 billion in 2018, doubling in size.

GLOBAL DATA CENTRE IP TRAFFIC WILL TRIPLE WITHIN 5 YEARS

The global data centre IP traffic has set a constant growth path, with a CAGR of 25% during the period 2012 - 2017. In particular, the growth will be driven by three main factors:

• The need for bigger online storage resources;
• The new possibility to analyze a bigger amount of data (a phenomenon called “Big data analysis”, applied in the analysis of complex systems such as weather forecasts or social behavior prediction);
• The growing demand for cloud applications.

Cloud data centre traffic will grow with a CAGR of 35% from 2012 to 2017, at a faster rate than the traditional IP traffic, establishing a 4,5-fold growth during this period. Global cloud traffic crossed the zettabyte threshold in 2012, and by 2017 over two-thirds of all data centre traffic will be based in the cloud. Cloud traffic will represent 69% of total data centre traffic by 2017. Significant promoters of cloud traffic growth are the rapid adoption of and migration to cloud architectures, along with the ability cloud data centres offer in handling significantly higher traffic loads.

ENERGY EFFICIENCY & PUE LEVELS: A MARKET SURVEY

PUE (Power Usage Effectiveness) is a measure of how efficiently a computer data centre uses energy. Specifically, it measures how much energy is used by the computing equipment (in contrast to cooling and other overheads). It is defined as the ratio of the total amount of energy used by a data centre facility to the energy delivered to the computing equipment. An optimum PUE would be 1,0. A 2013 independent market survey defined that 41% of data centre CIOs reported their PUE was above or equal to 2,0 while the average PUE was 2,53. Only 1% of those interviewed reported their PUE was lower than 1,4.

Current market average PUE = 2,53
PUE achieved by only 1% of market ≤ 1,40
DATA CENTRE COOLING REQUIREMENTS

Data centre cooling systems represent a significant portion of a facility’s capital expenditure and use a substantial amount of energy. ASHRAE (American Society of Heating, Refrigerating, and Air-conditioning Engineers) publishes specific guidelines for temperature and humidity control within data centres. The 3rd Edition of the Thermal Guidelines for Data Processing Environments defines a recommended operating window and four allowable ranges, designated A1 though A4. The new allowable ranges (A3 and A4) are intended to remove obstacles to new data centre cooling strategies such as free cooling systems. Free cooling takes advantage of a facility’s local climate by using outside air to cool IT equipment directly, without the use of mechanical refrigeration (chillers or air conditioners) whenever possible.

<table>
<thead>
<tr>
<th>Classes A1-A4</th>
<th>Recommended envelope</th>
<th>Allowable envelope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A1</td>
<td></td>
<td></td>
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<td>Class A2</td>
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<tr>
<td>Class A3</td>
<td></td>
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<tr>
<td>Class A4</td>
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**DIRECT AIR OPTIMISATION (DAO)**

Direct Air Optimisation (DAO), employed by several key customers, moves on from closed circuit cooling, drawing in fresh air directly into the data hall and rejecting the warm air to atmosphere.

**CHILLED WATER SYSTEM (CWS)**

This solution comprises water chillers (generally featuring free cooling), a chilled water network and computer room air conditioning units. The chilled water distribution system delivers the required cooling to a number of elements on site. The air conditioning units operate in full recirculation mode inside a sealed environment.

**INDIRECT AIR OPTIMISATION (IAO)**

Indirect Air Optimisation (IAO) removes heat from the data hall return air and rejects this to ambient via a heat exchange process, subsequently returning the suitably cooled air back into the data hall. An adiabatic spray system preceding the heat exchanger intervenes when ambient conditions require it. IAO is ideally suited to the growing number of applications allowing higher temperatures, offering exceptional energy savings.
AERIS OPERATION

AERIS features a unique heat exchange system which removes the heat from the data hall return air and rejects it through to the external ambient. The return air from the data hall is therefore cooled to a suitable temperature for re-delivery into the data hall. The advantage of this layout is that the data hall remains a fully sealed environment, isolated from the external ambient air, consequently there is no moisture or pollutant carry over into the data hall. The air-to-air heat exchanger acts as an intermediary device providing sensible heat transfer between the data hall return air and ambient intake air. The use of adiabatic sprays preceding the heat exchanger, a process applied at higher ambient temperatures only, lowers the dry bulb temperature of the air, thus increasing the effectiveness of the heat exchange process when cooling the warm return air from the data hall to the desired supply temperature which is sent back into the data hall.

On request AERIS can also be supplied with a Mechanical Cooling Module, which offers additional cooling performance at extreme conditions, as well as added system redundancy. The whole system is managed by a plug-and-play controller which defines the various cooling stages, ensuring perfect temperature control combined with minimal running costs.

3 DISTINCT OPERATING RANGES

- **SC**: Range in which only Standard Cooling operates.
- **AC**: Range in which Adiabatic Cooling operates (adiabatic spray assists the cooling).
- **MC**: Range in which Mechanical Cooling is added to top up the Standard + Adiabatic Cooling.

Operating area for a typical Data Centre in Frankfurt (Germany), showing how Mechanical Cooling can be totally avoided in this application.

All values refer to 100% load capacity.

**NB:** For $\leq 23^\circ\text{C}$ WB external temperatures AERIS can guarantee a Data Centre supply air temperature of $\leq 27^\circ\text{C}$ without the need for any Mechanical top-up Cooling.
**STANDARD COOLING**
takes place when the external ambient air temperature lies below the indoor air temperature. The external air is heated by passing through the heat exchange system, thus removing heat from the data centre hall. In this condition no adiabatic cooling or mechanical cooling is required, due to the advantageous external temperature conditions.

**ADIABATIC COOLING**
uses adiabatic water sprays preceding the heat exchange system to pre-cool the external air. When water is introduced into the air flowing into an air-cooled cooling system it evaporates, increasing the humidity and lowering the temperature. Cooler air increases the heat exchanger’s heat rejection capacity, improving system efficiency. Adiabatic cooling operates by boosting the standard cooling process, adding extra performance when required.

**MECHANICAL TOP-UP COOLING (OPTIONAL)**
makes use of a refrigeration circuit to provide additional cooling to the supply air exiting the heat exchange system. Alternatively chilled water can be used as the cooling medium. Mechanical cooling operates only in the rare occasions where external temperatures are too high, and always operates together with both standard and adiabatic cooling, adding a percentage of additional cooling.
AERIS: NEXT GENERATION DATA CENTRE COOLING

HIGHEST EFFICIENCY
AERIS minimizes running costs, and can achieve a data centre supply air temperature which is only 4°C above the ambient wet bulb temperature, this without the use of mechanical cooling. For example, for a data centre in London (UK) and on a day with a 23°C ambient wet bulb temperature, a combined standard + adiabatic cooling operation (ie. without mechanical cooling) offers a 27°C data centre supply air temperature, thus falling within ASHRAE A1 recommended supply air conditions.

MAIN FEATURES
- 4 sizes available.
- Cooling capacity from 84 kW to 336 kW per module.
- Modular design allowing a perfect match to the cooling load.

TECHNOLOGY
- Indirect air utilization to avoid internal air flow contamination.
- Elevated number of hours operating in free cooling, in combination with indirect adiabatic humidification.
- Additional cooling water coil or direct expansion cooling system for peak loads and redundancy.

COMPONENTS
- EC fans with efficiencies of up to 90%.
- Unique aluminium crossflow heat exchanger featuring AERO-SHIELD acrylic protection, exclusive to Aermec, offering minimum pressure drops and long-term fault-free operation.
- Adiabatic cooling system with high pressure atomising jets ensuring the fastest water evaporation levels.

REGULATION & CONTROL
- Fully wired components and electrical controls mounted onboard.
- Integrated programmable logic controller.
- Interface for BMS.
- Remote controller option with possibility for touch screen.
- Plug and play operation.

NO MECHANICAL COOLING
Dependent on external wet bulb temperatures, AERIS can provide full cooling requirements via highly efficient heat transfer processes. Onboard mechanical back up to trim the temperature can be provided where necessary.

INDIRECT AIR SOLUTION
No internal contamination of data centre air from outside. No need for extensive filtration systems, humidification and refrigeration.

CAPITAL AND OPERATIONAL COST REDUCTIONS
Approximately 95% running costs reduction compared with traditional chiller solutions. Infrastructure cost reduction of around 32% versus standard chilled water systems.
ADVANCED FIELD TESTED COMPONENTS

HIGH EFFICIENCY HEAT EXCHANGER
- Crossflow configuration.
- Designed for air-flows up to 100.000 m³/h and performance up to 80%.
- Eurovent certified.
- Low pressure drop.
- Heat recovery in high energy consumption environments.
- Aluminium construction with exclusive AERO-SHIELD acrylic protection.
- Additionally sealed exchanger block.
- Fully removeable.

FANS FEATURING EC TECHNOLOGY
- Efficiencies of up to 90%.
- Extended service life.
- Each individual fan features its own inverter, mounted directly on-board.
- Motor efficiency beyond IE4 efficiency class requirements, without using “rare earth” magnets.
- Backward curved steel blades minimize bearing loads, maximize durability and offer high circumferential velocities.

BYPASS DAMPER SYSTEM
- Modulating damper to bypass air from the hot aisle which mixes with the cold supply air.
- Ensures optimum operation whatever the conditions.

ADIABATIC COOLING SYSTEM
- Creates 10 micron droplets.
- High pressure system for leading performance.
- Total droplets area 3 times higher than standard low pressure systems (increased efficiency, faster evaporation).
- Inverter controlled pumps with integrated timers for optimised spraying cycles.
- Less than 55dB noise level.

MECHANICAL COOLING SYSTEM (OPTIONAL)
- Choice between direct expansion system and cooling water coil.
- Ensures perfect temperature control even in extreme conditions.
- Offers added redundancy.

RESISTANT CONSTRUCTION
- Stainless steel panels and base plates within all sections subjected to humidity.
- Ensures longevity and increased reliability.
EXCEPTIONAL RUNNING COST REDUCTIONS

AERIS, thanks to advanced indirect cooling technology, offers the absolute lowest levels of PUE (Power Usage Effectiveness), and as a consequence allows the data centre user to obtain both significantly reduced annual running costs and a notably reduced carbon footprint.

LOWEST pPUE

pPUE is defined as the ratio between the total amount of energy used by a data centre and the energy delivered to the computing equipment: the closer to 1.0, the more efficient the system. When compared to both average current levels and alternative technologies AERIS offers significantly lower pPUE levels.

MINIMAL RUNNING COSTS

Thanks to a near complete application of free cooling using the external air, AERIS power consumptions are reduced drastically versus alternative technologies. Mechanical cooling is either completely avoided or, in the hottest conditions only, notably reduced, as such the only real energy consumption derives from the advanced fans featuring EC technology and efficiencies of around 90%.

WATER CONSUMPTION

Water is used in the adiabatic cooling phase only. Thanks to Aermec’s 10 micron droplet distribution network and the intrinsic efficiency of the main heat exchanger, which reduces the periods when adiabatic intervention is required, water consumption can be contained to little more than 1.000m³ per annum for a 1MW data centre.

MAINTENANCE

AERIS makes minimal use of moving parts; this not only benefits running costs but also both maintenance needs and system reliability. The air and water filters can be easily cleaned, the heat exchanger is generally self-cleaned thanks to the adiabatic process, the fan motors featuring sealed for life bearings require no programmed maintenance.

# THE AERIS RANGE

<table>
<thead>
<tr>
<th>MODEL</th>
<th>IEC 100</th>
<th>IEC 200</th>
<th>IEC 300</th>
<th>IEC 400</th>
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<tr>
<td>Nominal cooling capacity kW</td>
<td>84</td>
<td>168</td>
<td>252</td>
<td>336</td>
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<tr>
<td>Airflow m³/h</td>
<td>21000</td>
<td>42000</td>
<td>63000</td>
<td>84000</td>
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<tr>
<td>Length mm</td>
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<tr>
<td>Width mm</td>
<td>1534</td>
<td>2334</td>
<td>3868</td>
<td>4668</td>
</tr>
</tbody>
</table>

**Nominal Conditions:**
External air: 23°C (wb) / 35°C (db).
Supply air temperature: 24°C.
Δt: 12K.

Performances at differing conditions available on request.
AERMEC: THE COMPANY

Aermec, founded in 1961, counts amongst Europe’s longest established Air Conditioning suppliers. A true pioneer, with over 50 years of innovative customer focussed solutions, Aermec is present on all continents worldwide and with Subsidiaries and Affiliates in France, Germany, Italy, the Netherlands, Poland, Russia, Spain and the UK.

A GROUP OF EXPERTS

Aermec is the largest partner within Giordano Riello International Group, each company acting as a Centre of Excellence covering the full Air Conditioning portfolio. This includes, amongst others, specific know-how in heat exchanger technology, ventilation and air sourced conditioning applications. Group turnover stands at €305m, with around 1600 employees.

INNOVATION

It is this unique structure and consolidated presence which allows Aermec to implement state of the art innovation, most notably in the field of energy saving and environmental footprint minimization.

QUALITY AND PERFORMANCE

Product quality is an Aermec hallmark. Premium components and meticulous testing of each and every product exiting the factories ensures longevity and trouble free operation. This is coupled with Eurovent certified performance levels, as continuously verified within Aermec’s advanced testing labs, which span up to 1500kW cooling capacity. Specific labs within Aermec also cater for extreme temperature testing, noise level verification and vibration testing.

KNOWLEDGABLE SUPPORT

Aermec offers expert support for every single project, providing honest consultancy and a partnership built upon trust; the result is a tailor made solution optimizing each individual application.
EXTENSIVE DATA CENTRE EXPERIENCE

Aermec’s experience in data centre cooling technologies spans many years, numerous countries and countless individual projects. Aermec’s expert professional project approach, combined with system efficiency and reliability, renders Aermec a natural choice in data centre applications.

CONSULTANCY AND AFTER SALES SUPPORT

Aermec offers data centre users a focused technical support, accompanying its customers in strategic data centre decisions and providing a full portfolio of services, including:

- System energy efficiency analysis using innovative energy simulation softwares; Aermec allows you to evaluate the overall system efficiency in order to obtain the lowest possible PUE.
- Accurate real operation condition witness tests in leading testing laboratories, allowing customers to validate the performance of the units prior to start-up.
- Safety in time: evolved devices supplied with the system allow 24/7 control and supervision of the systems, even remotely, ensuring maximum reliability and peace of mind.
- Aermec service personnel available at all times for fast and efficient troubleshooting and on-site interventions.
All specifications are subject to change without prior notice. Although every effort has been made to ensure accuracy, Aermec does not assume responsibility or liability for eventual errors or omissions.