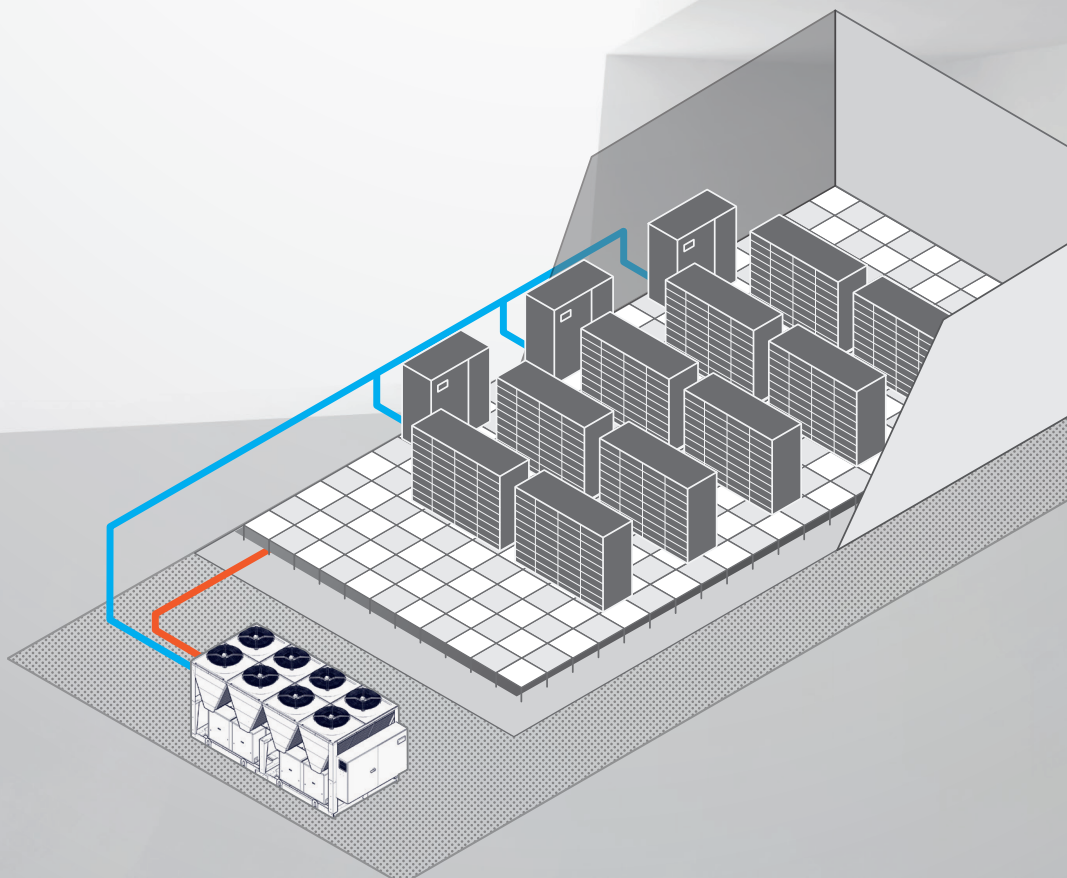
AERMEC DATA CENTRE SOLUTIONS

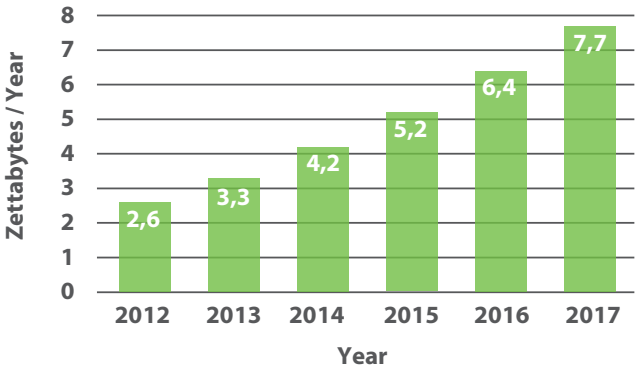
THE COMPLETE RANGE OF AERMEC SOLUTIONS FOR DATA CENTRES



GLOBAL DATA CENTRE IP TRAFFIC WILL TRIPLE WITHIN 5 YEARS

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 requirements.



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.

This notable growth in data centre traffic will also transform into a significant growth in data centre air conditioning needs, which is expected to grow with a CAGR of about 12% till 2018. The market value will grow from the actual $ 4,91billion to $ 8,07 billion in 2018, doubling in size.

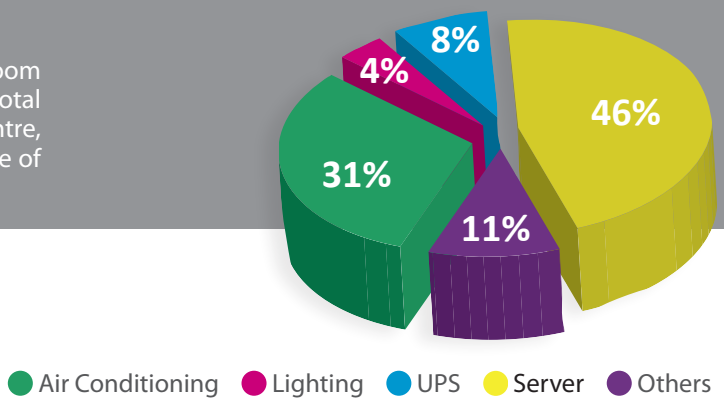
A HIGH ENERGY CONSUMPTION APPLICATION

Data centres represent a high-density building typology, with a consequently very high power density. A data centre requires an average of 10-15 times more energy than a standard office building, at times reaching 40 times. In addition, the field of "Information and Communication Technology (ICT)" is one of the main causes of growth in energy consumptions in Europe. The density of the servers is in fact growing rapidly, and as a consequence so is the power demand of the air conditioning systems dedicated to them.

The air conditioning of a server room represents a significant portion of the total energy consumption of the data centre, representing 31% of the total energy usage of the entire data centre.

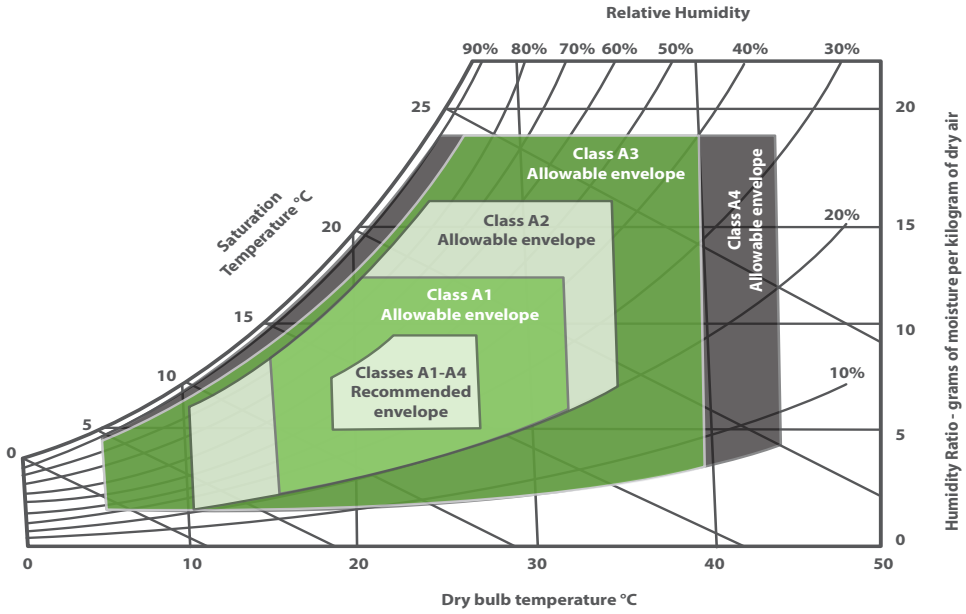
It is thus of paramount importance that the air conditioning system applied within data centres achieves the highest efficiencies and lowest energy consumptions. In fact an optimised data centre air conditioning solution represents a significant cost saving and powerful contribution to global carbon footprint reductions.

Distribution of energy consumptions in a data centre



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 through 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 either directly or via a cooling medium, avoiding the use of mechanical refrigeration whenever possible.



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. The closer to a PUE of 1,0 the more efficient the data centre.
A 2013 independent market survey defined that 41% of data centre CIOs reported their PUE was above or equal to 2,0, whilst the registered average PUE was 2,53. Only 1% of those interviewed reported their PUE was lower than 1,4.

PUE
Power Usage Effectiveness

Current market average PUE = 2,53

PUE achieved by only 1% of market ≤ 1,40

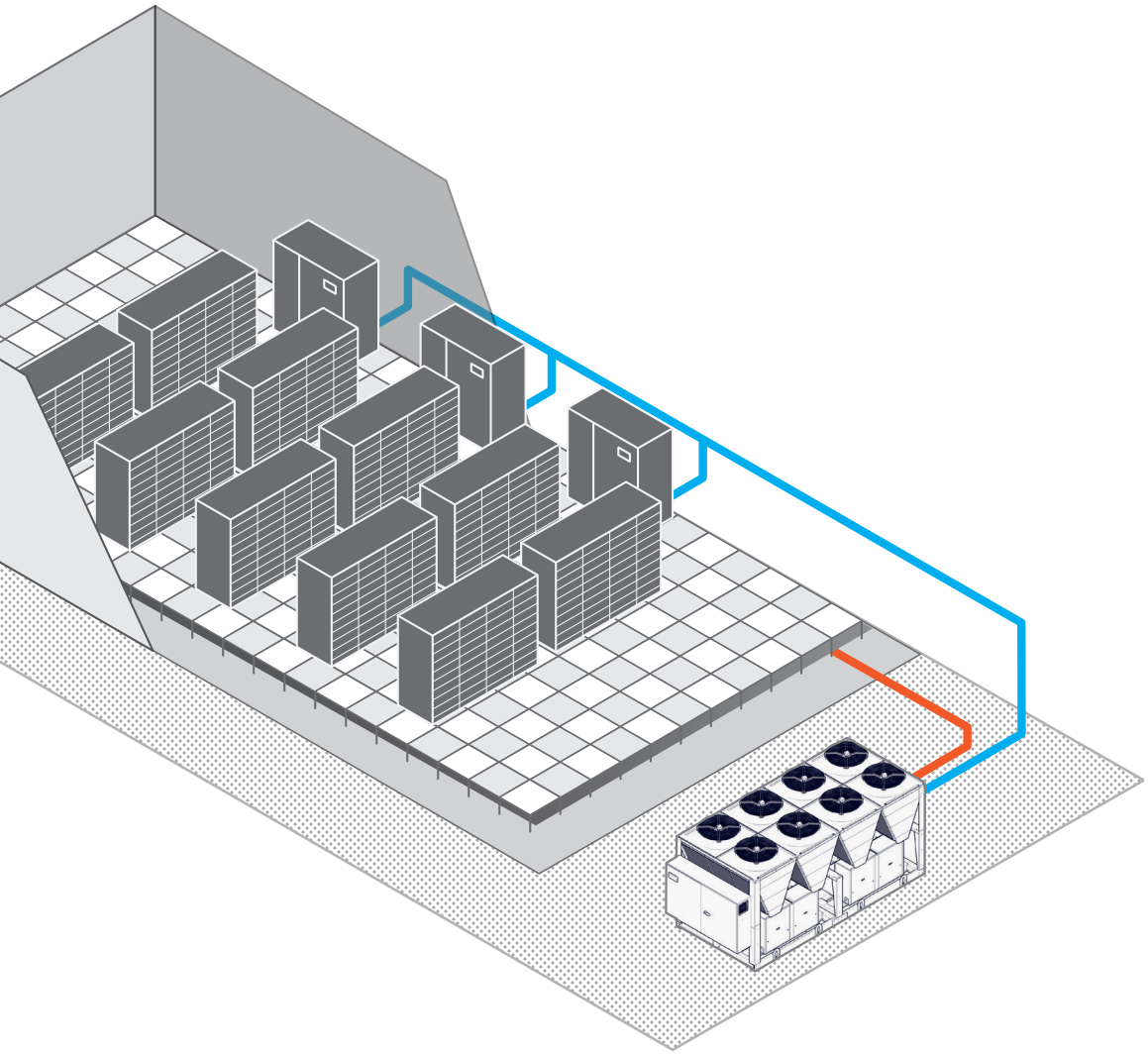
AERMEC: TECHNOLOGY YOU CAN TRUST

Aermec, founded in 1961, counts amongst Europe's longest established Air Conditioning suppliers. A true pioneer, with over 50 years of innovative customer focused 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.

The Aermec Group of companies includes a total of 6 centres of excellence spanning the full air conditioning portfolio, with a turnover in excess of €305m and over 1600 employees. A total of 8 Group manufacturing locations create the advanced product solutions Aermec offers its clientele.

Aermec is well established in the data centre market, with a multiple year experience and prestigious projects aimed at reducing the overall cost of ownership of modern data centres. This process is achieved by applying state-of-the-art product solutions with a strong focus on integrated design and sophisticated analyses of individual data centre customer requirements, with the aim of achieving a personalised and optimised solution for each and every individual installation site.

Product quality is an Aermec hallmark. Premium components are utilised throughout, each unit exiting the Aermec factories undergoes meticulous testing processes, and numerous certifications including Eurovent, MCS, cUL and AHRI testify to Aermec's attention to detail.



Aermec's 2MW testing facilities

2MW TESTING FACILITIES

Aermec's advanced labs extend to 2MW cooling capacity per single unit in what is probably Europe's largest test facility, which will offer Eurovent certification. Specific labs within Aermec also cater for extreme temperature testing, ventilation and heat exchange measurements, noise level verification and vibration testing.
Aermec furthermore utilizes a simulated data centre installation including both a data hall simulator and an ambient air simulator recreating typical ambient temperature and humidity conditions.

AERMEC & DATA CENTRES

Aermec's experience in data centre cooling technologies spans many years and countless individual projects in more than 17 nations.
Aermec's expert professional project approach, combined with system efficiency and reliability, renders Aermec a natural choice in data centre applications.

Aermec's main manufacturing facilities near Verona, Italy

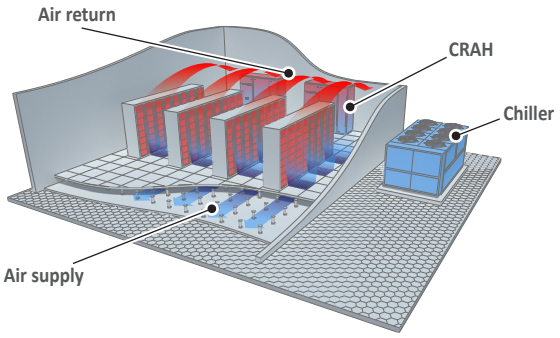
EXPERT SUPPORT AT ALL TIMES

Aermec offers a focused technical support during all stages within the project, accompanying its customers in strategic data centre decisions and providing a full portfolio of services at every stage, including:

- System energy efficiency analysis using innovative energy simulation softwares; Aermec allows customers to evaluate the overall system efficiency in order to obtain the lowest possible PUE.
- Accurate real operation condition witness tests in Aermec's advanced 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 are available at all times for fast and efficient troubleshooting and on-site interventions.

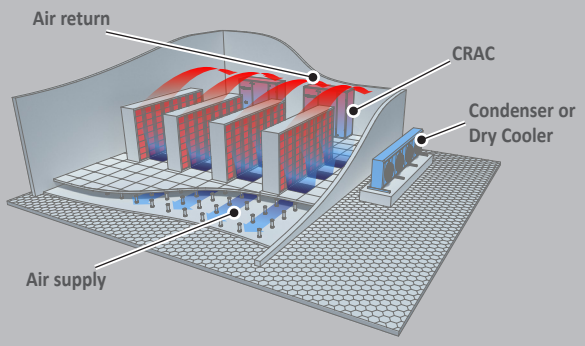
DATA CENTRE DESIGN SOLUTIONS

According to the specific data centre characteristics, the geographical and thus ambient conditions in which the data centre is located, and the individual target requirements of the User, differing data centre cooling typologies can be applied.



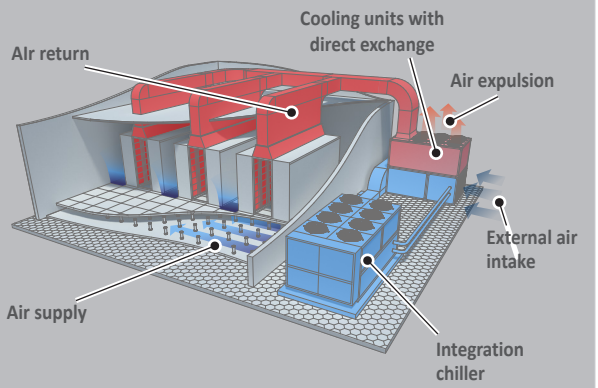
CHILLED WATER SYSTEMS

Precision Air Conditioners featuring one or more chilled water coils (CRAH), operating in combination with one or more external water chillers. The water chiller can be in standard or free-cooling configuration.
In alternative to the CRAH units, which are generally positioned peripherally to the server rack, In-Rack conditioners can be utilised, which supply air conditioning within the server racks themselves.



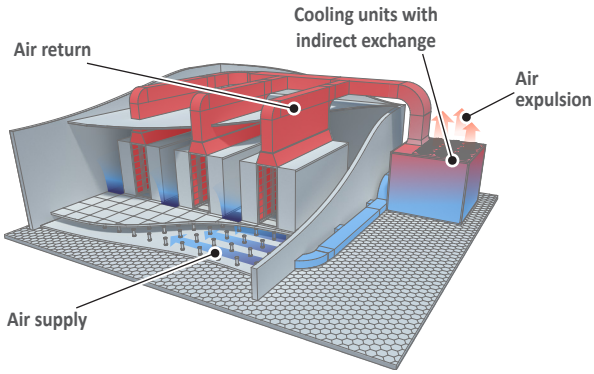
DIRECT EXPANSION SYSTEMS

Precision Air Conditioners featuring one or more direct expansion circuits (CRAC), either in air-cooled configuration with external condensers or in water-cooled configuration with external dry coolers.
In alternative to the CRAC units, which are generally positioned peripherally to the server rack, In-Rack conditioners can be utilised, which supply air conditioning within the server racks themselves.



DIRECT COOLING SYSTEMS

Air Handling Units featuring a cooling circuit which introduces cold air directly into the data centre and expels hot air to ambient. Fresh air is mechanically distributed into the data centre via ducting. Direct cooling systems are integrated with filters and may feature additional forms of adiabatic cooling or dehumidification.



ADIABATIC INDIRECT COOLING SYSTEMS

Packaged units which expel heat from the data centre by passing it through a heat exchanger where it exchanges with ambient air, creating free-cooling. Adiabatic cooling is utilised to support the cooling process at higher ambient temperatures. Mechanical cooling may be supplied as a top-up beyond the standard cooling process.

DESIGNING YOUR OPTIMISED DATA CENTRE

An optimised data centre starts with a clear vision as to the overall project objectives: Aermec's unique ACES energy simulation software supports this process by evaluating the performances of differing data centre solutions.

ACES considers variable loads and all year round operation, evaluating climate profiles and cooling loads. The load demand profile is defined by the specific server requirements, including primary circuit pumping.

The instantaneous efficiencies of each proposed system are calculated using complex algorithms which account for both differing loads and water and ambient temperatures, maximizing efficiency and chiller cycling whilst accounting for the total Precision Air Conditioner (PAC) load needs at specific ambient temperatures and load levels. All factors causing possible efficiency losses are accounted for, including chiller switching sequences, pump input powers and PAC operation.

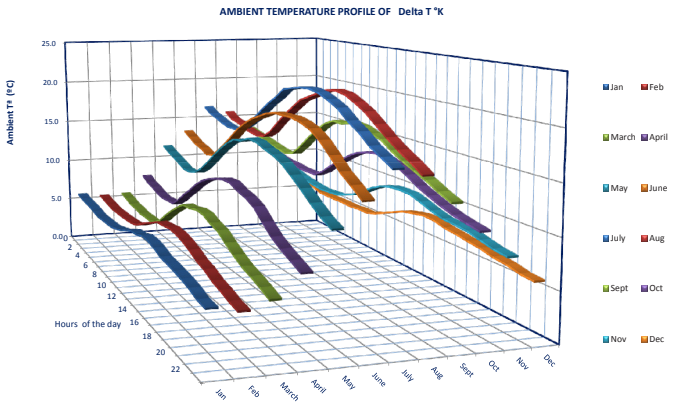
ACES calculates the efficiencies of each individual solution and the resulting efficiency of the whole system.

ACES considers the current and future installation site design, the required cooling load, the climatic profile, the use of the facility, potential renewable energy integrations, the available space, noise constraints, redundancy, maintenance needs and more beyond.

All of these inputs are considered to generate a customized and optimized proposal.

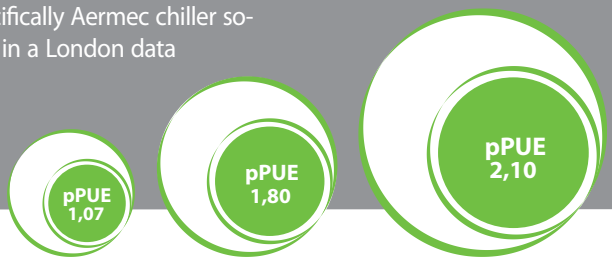
ACES furthermore cross compares the performance of multiple chillers, the PAC system, AHU and server control devices, primary and secondary pumping equipment, system lay out, etc.

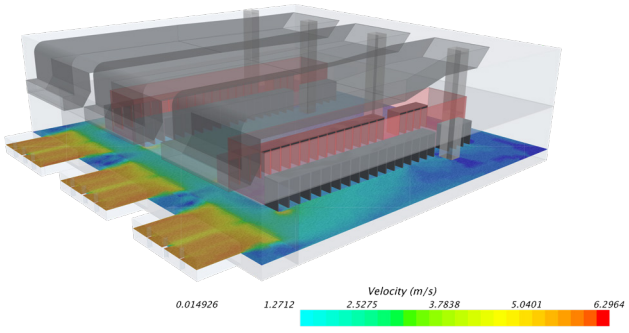
ACES accounts for the complications created by the multiple variables, applying an interactive analysis process which calculates the best possible solution considering all the involved variables.



ACHIEVING THE LOWEST pPUE

Aermec data centre systems are capable of achieving market leading pPUE levels, offering significant reductions in carbon footprints and energy consumptions. More specifically Aermec chiller solutions applying Dynamic Setpoint can achieve a pPUE down to 1,07 in a London data centre. Traditional free cooling chillers by contrast generally achieve pPUE = 1,80, with the market average being 2,10.





DATA CENTRE CFD ANALYSES

Aermec CFD simulations, customized to customers' individual data centre designs, offer an important simulated consultancy which spans beyond the single components.
These allow specific hot spots to be identified, verify the opti mised distribution of air and cooling loads and offer an important contribution within the establishment of the most efficient overall data centre design solution.

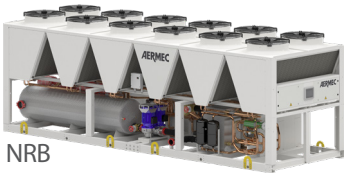
THE AERMEC DATA CENTRE SOLUTIONS

NSM_I

NSM and NSM HWT

TBX

NRV



NRB

NSG

WATER CHILLERS

Aermec water chillers offer a wide range of cooling capacities to meet the needs of small, medium and large data centres. Free-cooling technology exploits the favourable environmental conditions to supply chilled water without the use of mechanical cooling, maximizing efficiencies and energy savings.

NSM_I (285 - 1204kW)
Chillers with inverter screw compressors with shell & tube heat exchangers
Water produced up -6°C to +15°C - Outdoor air temperature up -10°C to +50°C
Standard and free-cooling configurations

NSM (302 - 2100kW)
Chillers with screw compressors with shell & tube heat exchangers
Water produced up -8°C to +15°C - Outdoor air temperature up -20°C to +50°C
Standards, free cooling and glycol free configurations

NSM_HWT (306 - 2001kW)
Chillers with screw compressors with shell & tube heat exchangers
Water produced up -5°C to +30°C - Outdoor air temperature up -20°C to +50°C
Free cooling configurations

TBX (259 - 863kW)
Chillers with Turbocor compressors featuring magnetic levitation
Shell & tube heat exchangers
Water produced up 5°C to +18°C - Outdoor air temperature up -10°C to +42°C

NRV (108kW)
Chiller with scroll compressors and microchannel batteries
Plate heat exchangers
Water produced up 4°C to +15°C - Outdoor air temperature up -10°C to +46°C
Standard and free cooling configurations

NRB (217 - 1049kW)
Chillers with scroll compressors with plate heat exchangers
Water produced up -10°C to + 18°C - Outdoor air temperature up -20° C to +50°C
Standards, free cooling and glycol free configurations

NSG (227 - 1580kW)
Chillers with screw compressors with HFO R1234ze
Shell & tube heat exchangers
Water produced up +4°C to + 15°C - Outdoor air temperature up +10° C a +48°C
Configurazione standard
Outdoor air temperature up -20° C to +50°C
Standard configurations

REMOTE CONDENSERS AND DRY COOLERS

Aermec direct expansion Precision Air Conditioners find their ideal external cooling source when combined with the extensive range of Aermec remote condensers (for air-cooled solutions) and dry coolers (for water-cooled solutions). Horizontal and compact V-coil configurations are available, with a multitude of options and accessories for all individual needs. The dry cooler range with compact V-coil configuration can be equipped also with the adiabatic cooling system. In the Hybrid Dry Coolers , the adiabatic cooling process uses panels with specific aluminium fins, which allow to cool down the air temperature through the water evaporation, so that the free cooling operation mode is extended with significant energy savings. The highly robust design is ideal for year-round data centre operation.

PRECISION AIR CONDITIONERS

Aermec's wide range of Precision Air Conditioners cater for the differing data room conditioning needs. Efficient and flexible product solutions can be applied within numerous differing configurations. A wide range of options and accessories allows perfect alignment according to the needs of individual installations, providing complete and optimised control of the temperature, humidity and indoor air quality within data centres.

AIR-COOLED DIRECT EXPANSION CONFIGURATIONS
Cooling range 7 – 183kW
Down-flow and Up-flow versions
DC inverter compressors, EC fans, electronic expansion valves

WATER-COOLED DIRECT EXPANSION CONFIGURATIONS
Cooling range 7 – 183kW
Down-flow and Up-flow versions
DC inverter compressors, EC fans, electronic expansion valves

CHILLED WATER CONFIGURATIONS
Cooling range 10 – 200kW
Down-flow and Up-flow versions
EC fans

IN - RACK UNITS

Aermec's In-Rack Precision Air Conditioners are positioned within the data hall. In contrast with CRAC and CRAH units, which are generally positioned in peripheral areas within the data hall, In-Rack units are positioned within the server racks themselves, providing a highly effective "localised" cooling right where it is needed.
Both direct expansion and chilled water (20 – 40kW) solutions are offered.

UNDERFLOOR UNITS

UFB offers localised "micro-climate" air conditioning support within critical areas in the data hall. Installed within the raised floor and thus creating no intrusion, it supplies fresh underfloor air into the data hall when needed, as determined by an on-board controller; alternatively UFB recirculates the air within the data hall itself. Integrated filters are standard, with an electrical heater as an option. UFB can be easily repositioned within the data hall, occupying the exact dimensions of a single raised floor panel.

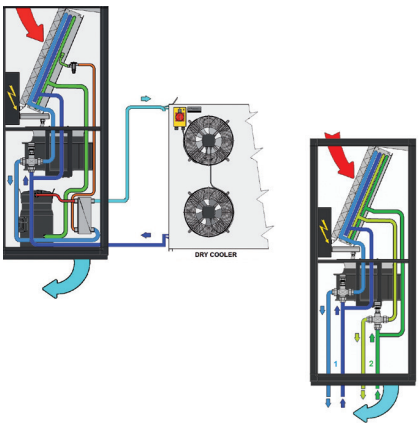
ADVANCED PRECISION AIR CONDITIONERS

Free-cooling operation

Beyond CRAH units combined with free-cooling chillers, direct expansion CRAC units can also operate in either total or partial free-cooling. CRAC free-cooling solutions offer notable energy savings.

Twin source cooling

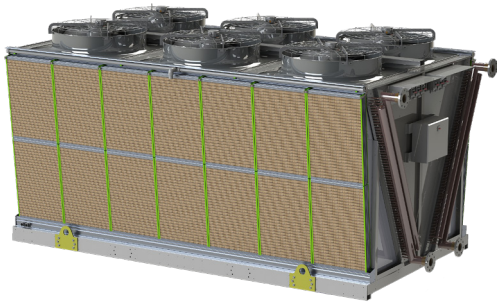
Aermec Precision Air Conditioners are available with twin source operation, either in configurations allowing both direct expansion and chilled water operation using a single unit, or by applying two distinct chilled water sources.



AERMEC CHILLERS ENSURE LOWEST PUE'S

The most evolved free-cooling technologies

Free-cooling translates into cooling for free, the more this can be exploited the higher the energy savings.
Aermec optimises free-cooling, a concept whereby ambient air is used for cooling when the ambient temperature is lower than the data hall air (direct free-cooling) or the chilled water (indirect free-cooling).
In hydronic solutions free-cooling starts when external conditions ensure even a minimum coverage of the thermal load requirements.
Thanks to the application of modulating free-cooling to maximize the free external source, the percentage of free-cooling increases proportionally in relation to the temperature difference between the internal and external environments, thus notably reducing the contribution of mechanical cooling and maximizing overall system efficiency.
Free Cooling is even more effective with high water temperatures, ensuring maximised energy savings.
The ASHRAE standards with the new permitted operating fields make it possible to work within the Data Centre with higher temperatures, so the use of Free Cooling and different cooling technologies compared with the traditional ones becomes even more advantageous.



The Hybrid Dry Coolers

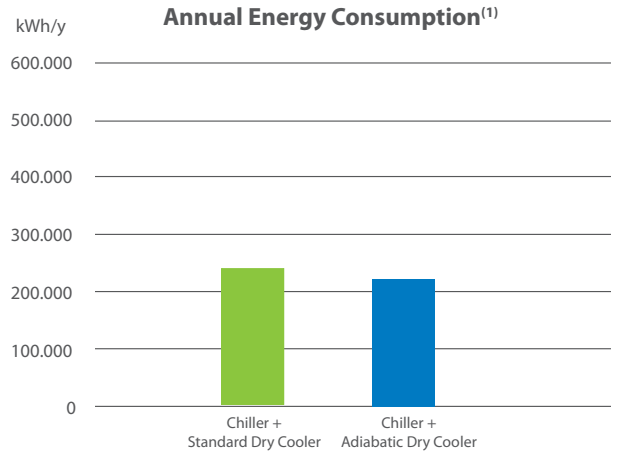
Liquid coolers that use adiabatic cooling technology - already widely adopted and highly effective in high-temperature industrial applications - exploit the adiabatic cooling principle to extend the Free Cooling operating range.
In Hybrid Dry Coolers, adiabatic cooling is made possible by special panels with aluminium fins which, thanks to optimum water distribution, lower the air temperature due to water evaporation. This means additional operating hours in Free Cooling mode.
Given the new ASHRAE ranges permitted, it will undoubtedly be even more advantageous in the future to use Hybrid Dry Coolers in Data Centres in temperate climates and with applications at increasingly high temperatures as a back-up for cooling operations with chillers.

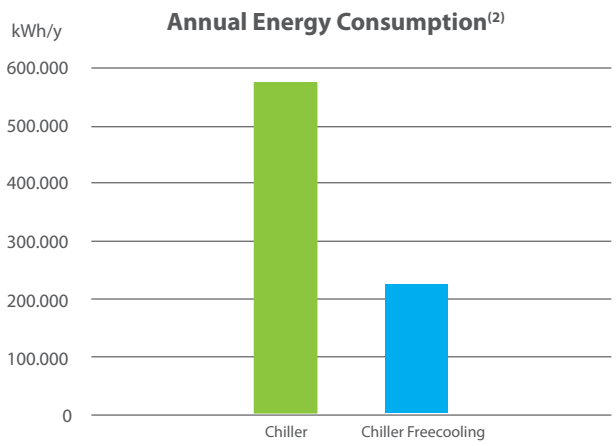
Comparison of the solutions

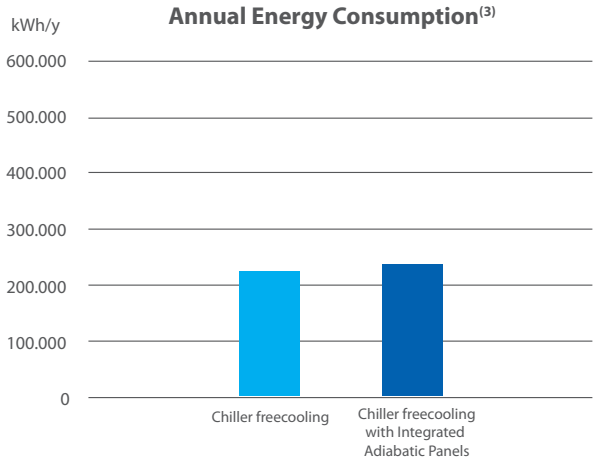
We compared various types of cooling technology applied to a real project involving a Data Centre in London (United Kingdom) with a required cooling load of 500kW; this figure is met by precision air conditioners fed with chilled water at 20/25°C.

The solutions considered were the following:
- Cooling with chillers and standard Dry Cooler
- Cooling with chillers and adiabatic Dry Cooler
- Cooling with standard chillers
- Cooling with Free Cooling chillers
- Cooling with Free Cooling chillers and integrated adiabatic panels.

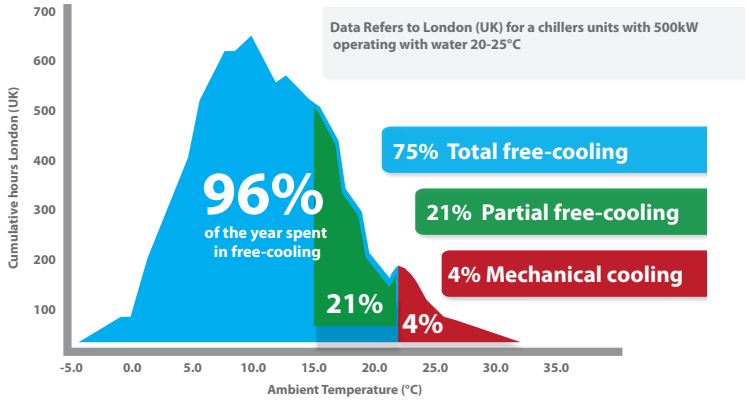
The following charts show the results for the various solutions in terms of annual energy consumption for the examined data centre:







(1) Energy saving with the adiabatic dry cooler would be wider with higher water temperature in the cooling process.
(2) The Free Cooling chiller solution is always the most advantageous, maximising the energy savings in both relative (compared with the other solutions) and absolute terms.
(3) Energy annual consumption includes losses of load on air side due to adiabatic panels.



The percentage of hours over the year in which the load is met purely by mechanical cooling is minimal:
most of the load profile is covered by total Free Cooling.

Dynamic Set Point

DSP DYNAMIC SET POINT

The Free Cooling chiller solution can be optimised with the innovative dynamic set-point (DSP), that provides a further 10% reduction in consumption.
Dynamic Set Point (DSP) automatically and continuously optimises chilled water outlet temperatures as ambient and IT loads vary, ensuring the highest amount of free cooling is achieved all year round.
DSP's control algorithm affords maximum efficiency across the widest operating spectrum. By optimising the efficiency characteristics of single compressor, DSP ensures each compressor works at its peak performance (as opposed to systems where each compressor is loaded up once the full load per circuit is reached). Free-cooling is maximised by allowing chilled water outlet temperatures to rise to 30°C using uniquely developed compressors. Furthermore, specifically redesigned Precision Air Conditioner water coils cater for low load scenarios, overcoming laminar flow issues, with DSP fully exploiting the resilience designed into the system at low load conditions.
DSP noticeably reduces Carbon Footprints whilst allowing flexibility in build programs and load profiles, with a plug and play philosophy allowing modules to be added as and when client IT loads increase. DSP is rapidly proving itself to be the most energy efficient chilled water system available.

Supervision & Connectivity Solutions

Multichiller sequence controlling manages the entire system, evaluating the effective load request to achieve the best overall system efficiency, optimising free-cooling and ensuring tight temperature control. Aermec data centre solutions can furthermore be easily and fully integrated with BMS and Supervisor systems (LONWORKS, BACNET, MODBUS, etc.) to ensure an optimised and simplified system overview.

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