



Data Centre Cooling Solutions





The Data Centre challenge

Driven by several factors, such as the increasing demand for cloud computing services, big data analytics IoT devices and the growing application of AI, the global data centre market is expected to reach **USD 536.28 Billion by 2030** with an electricity use estimated to increase to **848 TWh**.

This rapidly expanding market is increasingly strategic for both companies and society, and it currently faces **4 essential challenges**:



Grant improved energy efficiency: data centres are extremely complex and energy-consuming infrastructures.



Ensure business continuity: it is essential, as their services are critical to many organizations and sectors.



Comply with the new EU Energy Efficiency Directive: starting from May 2024 it will be mandatory for most data centres to report on energy consumption, PUE (power usage effectiveness) and other crucial aspects.



Reduce weight and dimensions of the cooling units: to optimise transport and installation costs, save space and place less strain on the structures.

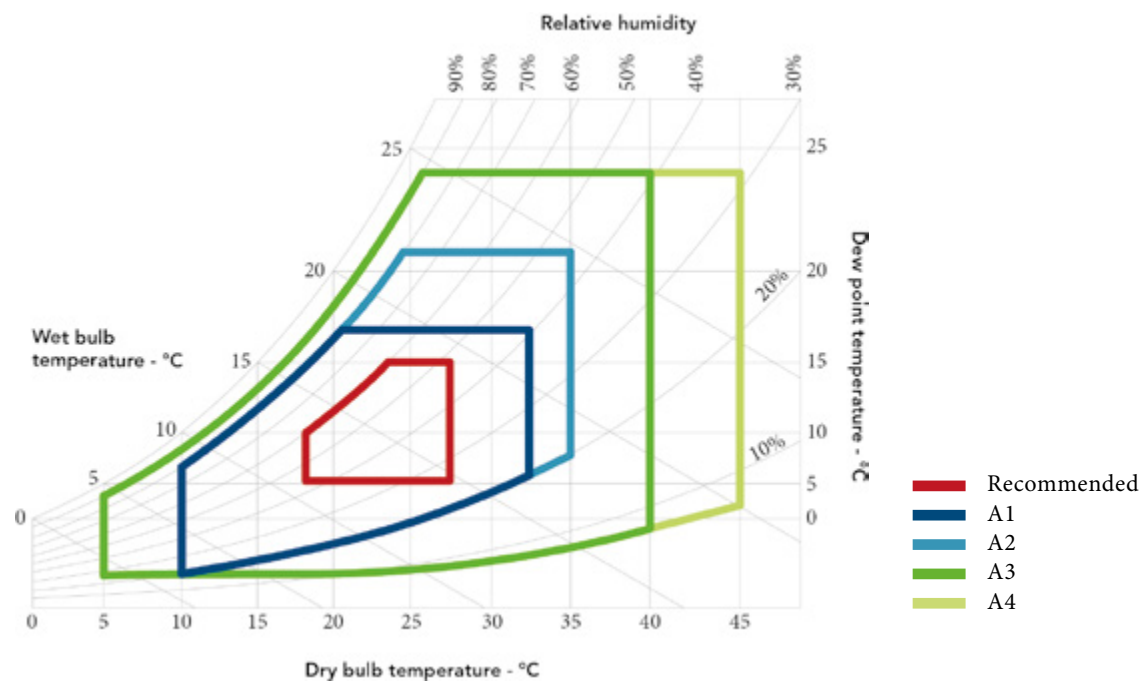
Product features

Data Centres (also referred to as server rooms or IT rooms) and Data Centre Cooling have undergone significant developments since the first introduction of the ASHRAE recommendations and “Thermal Guidelines for Data Processing Environments” in 2004.

The ASHRAE recommendations, are the de-facto standard for thermal management in the Data Centre industry. Evolution of the guidelines aims to **support a more energy efficient cooling of IT equipment, without compromising reliability.**

ASHRAE ideal working condition for any kind of informatics devices

2011 ASHRAE environmental classes for Data Centre applications.

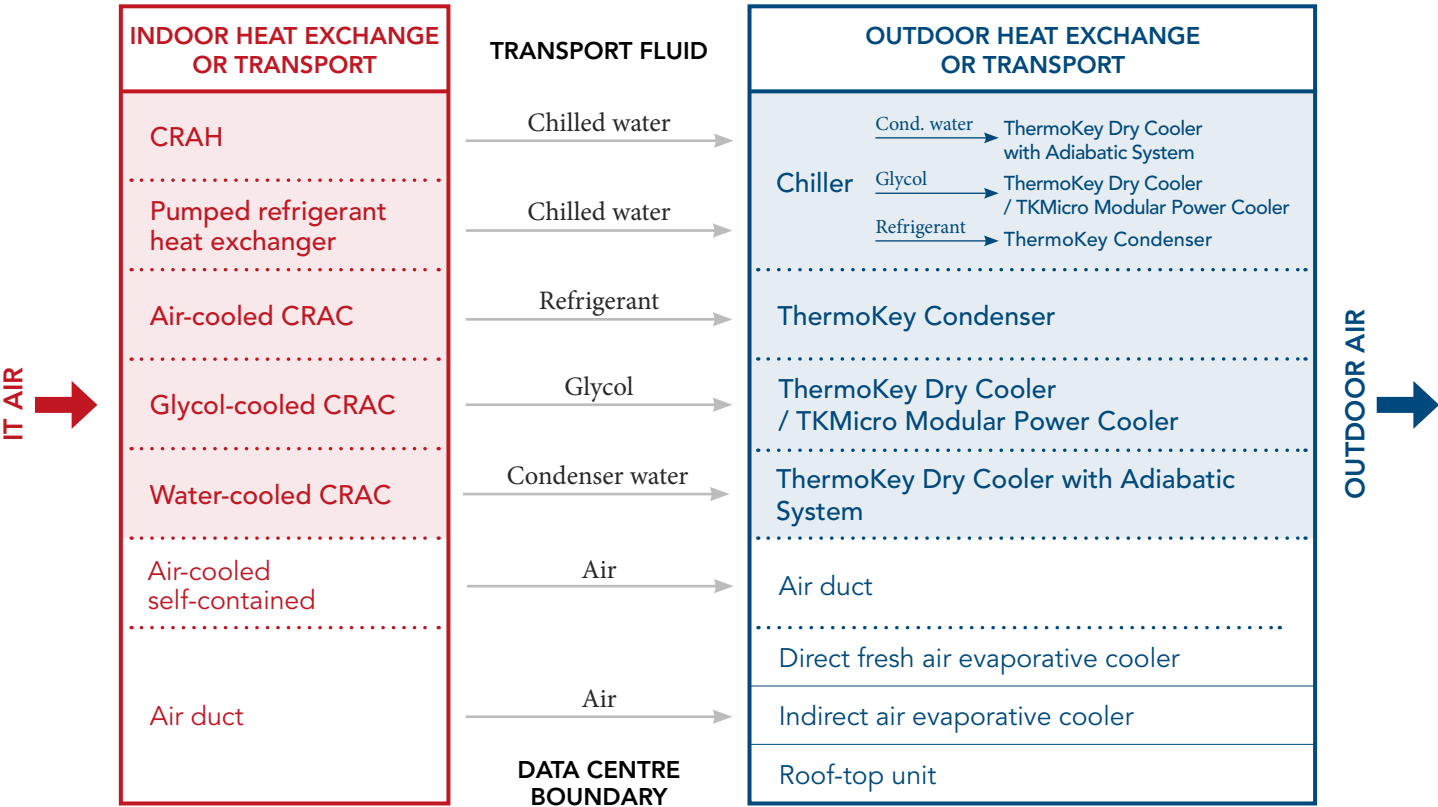


Heat removal methods in Data Centres

Every element of IT equipment that consumes power produces an equivalent amount of heat in return.

The removal of hot air could be as simple as an air duct, but it is generally achieved by using a heat exchanger to transfer heat from one state to another (e.g. from air to water).

One or more methods can be used to cool computer rooms and Data Centres.



ThermoKey Solutions

- Operational Reliability
- Low Noise Emissions
- Energy Cost Savings
- High-Quality Components
- Controlled Unit Operation
- Customized Special Needs



Remote condensers

Example: Air cooled CRAC with integrated compressor.
Heat removal from the server room using a remote condenser installed outside.
Application of use: Medium and small network racks, computer rooms and Data Centre with moderate requirements (lower than 200KW).



MICROCHANNEL CONDENSERS (MPE 25mm, 32mm)

Area of use	Gas condensation
Performance range	Capacity from 5 to 560 kW (R404A, Tc= 40 °C, T1= 25 °C) TKSmart Capacity from 13 to 98 kW (R404A, Tc= 40 °C, T1= 25 °C)
Fans	Diameter Ø 300, 400, 450, 500, 630, 800, 900 mm, AC or EC motor TKSmart Diameter Ø 400, 500, 630 mm, AC or EC motor
Benefits	Innovative high efficiency microchannel heat exchanger +30% capacity vs same foot-print traditional condenser Modular design, 1-8 fans (mpe 32 mm) Reduced dimensions and weight No galvanic corrosion through Long-Life-Alloy Reduced refrigerant charge Low noise and low electrical power consumption Complete range of accessories (mpe 32 mm) TKSmart Modular design, 1-3 fans (mpe 25 mm) TKSmart Accessories: wiring, shock absorber



TURBO-LINE CONDENSERS

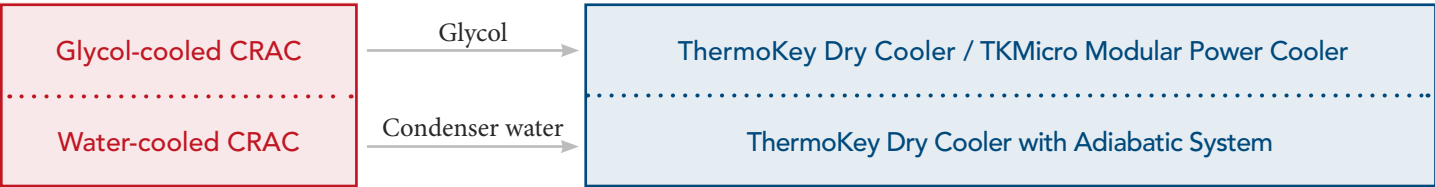
Area of use	Gas condensation
Performance range	Capacity from 10 to 1200 kW (R404A, Tc= 40 °C, T1= 25 °C)
Fans	Diameter Ø 500, 630, 800 mm, AC or EC motor
Benefits	High efficiency geometry Modular design, 1-16 fans Piping in copper or stainless steel AISI 304 Finned pack available in a wide range of materials Complete range of accessories, 8 sound levels Premium series available for fans Ø 500 and 630 mm Casing in galvanized steel, powder painted

TURBO-J CONDENSERS

Area of use	Gas condensation
Performance range	Capacity from 100 to 1915 kW (R404A, Tc= 40 °C, T1= 25 °C)
Fans	Diameter Ø 900 mm, AC or EC motor
Benefits	Maximum performance, minimum footprint High efficiency geometry Modular design, 2-16 fans Piping in copper or stainless steel AISI 304 Finned pack available in a wide range of materials Complete range of accessories, 8 sound levels AFS (Air Fresh System), WFS (Wet Fin System) and EPS (Evaporative Panel System) available upon request Casing in galvanized steel, powder painted

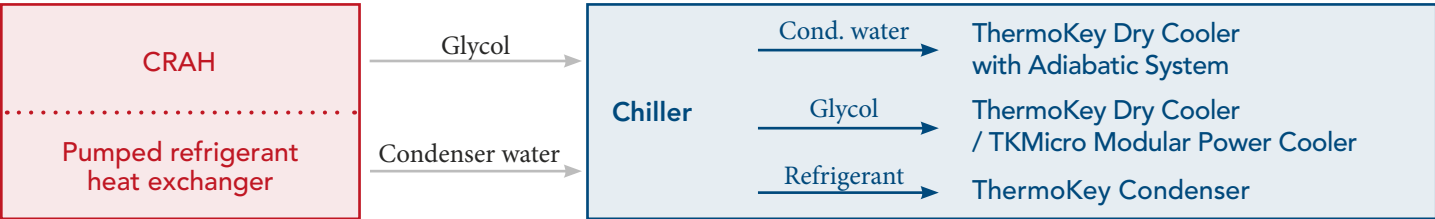


Dry Coolers without chiller



Example: Glycol (or water) cooled CRAC with a pump.
Heat removal from the server room using a drycooler installed outside.
Instead of the drycooler, an adiabatic cooler can be used when the external ambient conditions or efficiency permit it.
Application of use: In computer room and medium Data Centres (30-1000KW).

Dry Coolers with chiller



Example: Computer Air Handling Unit (CRAH) combined with a Chiller Water System that can be accordingly connected to a drycooler or a hybrid cooler or a condenser. Instead of CRAH it is also possible to use a Pumped Refrigerant System with a Cooling Unit installed in the ceiling.
Application of use: In a 200KW or larger Data Centre.



POWER-LINE DRY COOLERS

Area of use	Heat rejection
Performance range	Capacity from 8 to 1100 kW (Ethylene glycol 35%, Tw1= 40 °C, Tw2= 35 °C, T1= 25 °C)
Fans	Diameter Ø 500, 630, 800, 900, 1000 mm, AC or EC motor
Benefits	High efficiency geometry Modular design, 1-16 fans 8 sound levels Piping in copper or stainless steel AISI 304 or AISI 316L Finned pack available in a wide range of materials Complete range of accessories Casing in galvanized steel, powder painted

POWER-J DRY COOLERS



Area of use	Heat rejection
Performance range	Capacity from 70 to 1600 kW (Ethylene glycol 35%, Tw1= 40 °C, Tw2= 35 °C, T1= 25 °C)
Fans	Diameter Ø 800, 900, 1000 mm, AC or EC motor
Benefits	High efficiency geometry Modular design, 2-16 fans 8 sound levels Piping in copper or stainless steel AISI 304 or AISI 316L Finned pack available in a wide range of materials Complete range of accessories AFS (Air Fresh System), WFS (Wet Fin System) and EPS (Evaporative Panel System) available upon request Casing in galvanized steel, powder painted

SUPER POWER-J DRY COOLERS

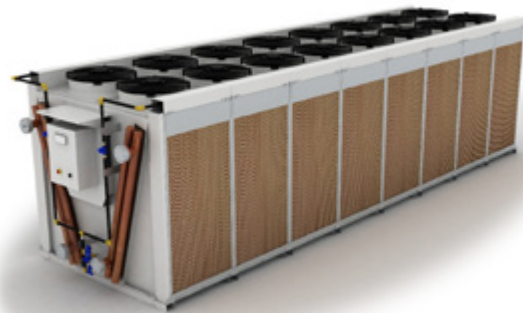


Area of use	Heat rejection
Performance range	Capacity from 290 to 2220 kW (Ethylene glycol 35%, Tw1= 40 °C, Tw2= 35 °C, T1= 25 °C)
Fans	Diameter Ø 800, 900, 1000 mm, AC or EC motor
Benefits	Maximum performance, minimum footprint High efficiency geometry Modular design, 8-20 fans 8 sound levels Piping in copper or stainless steel AISI 304 Finned pack available in a wide range of materials Complete range of accessories AFS (Air Fresh System), WFS (Wet Fin System) and EPS (Evaporative Panel System) available upon request Casing in galvanized steel, powder painted

TKMICRO H₂O MODULAR LIQUID COOLER



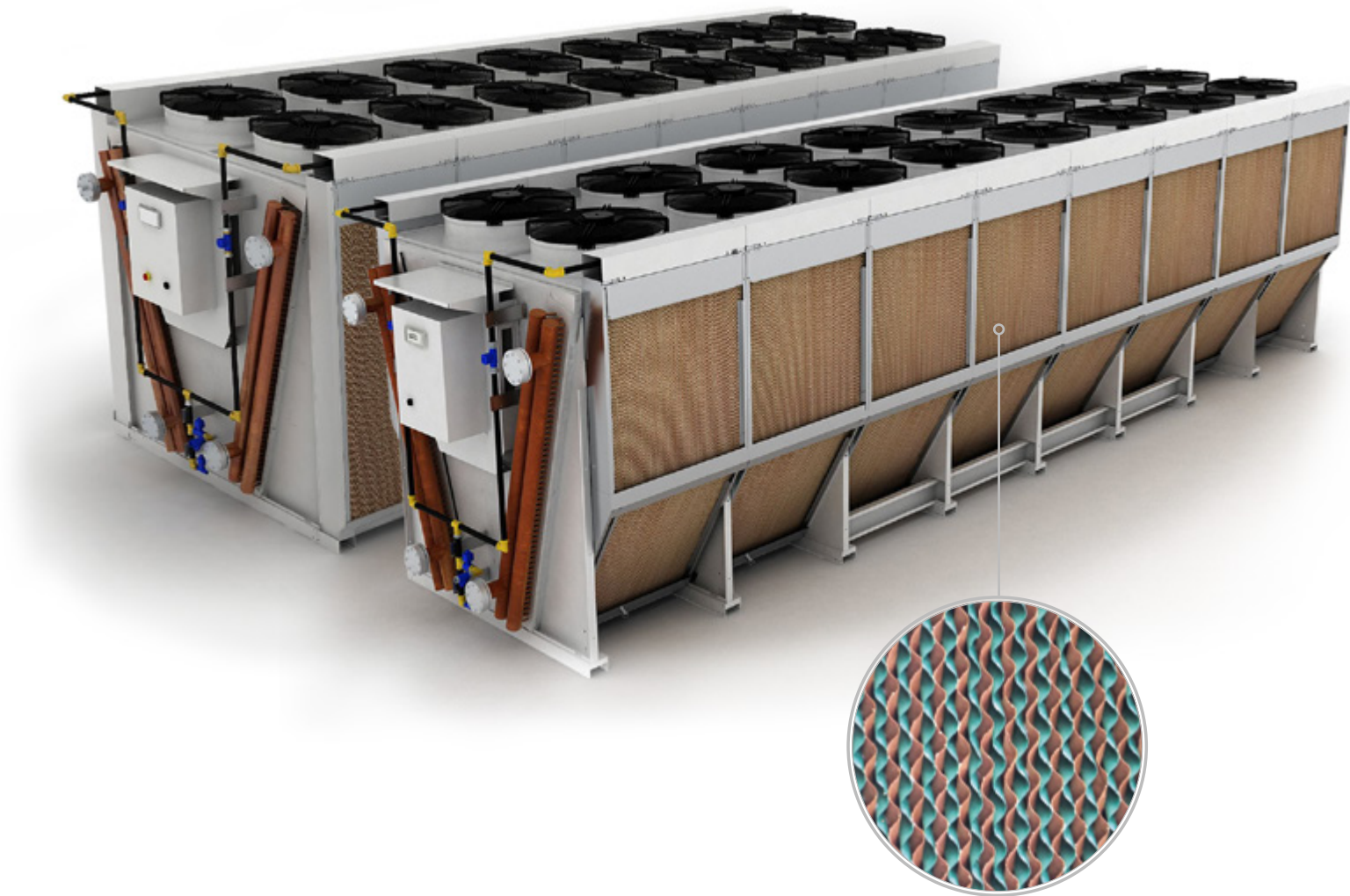
Area of use	Heat rejection
Performance range	Capacity for each module up to 120 kW*
Fans	Diameter Ø 800 mm, AC or EC motor
Modules	From 1 to n
Benefits	Modularity Compactness (maximum length of 2245 mm) Low installation costs Regulation or partialisation of the whole unit Lower enviromental impact Less weight Less fluid use Easy-to-clean microchannel core Core coating possibility in case of aggressive ambient



POWER-J (V-TOWER) DRY COOLER

Performance range	Capacity from 290 to 2219 kW*
Fans	Diameter Ø 800, 900, 1000 mm, AC or EC motor
Modules	From 1 to n
Benefits	EPS (Evaporative Panel System) Maximum performance, minimum footprint High efficiency geometry Modular design, 8-20 fans 8 sound levels Piping in copper or stainless steel AISI 304 or AISI 316L Finned pack available in a wide range of materials Complete range of accessories AFS (Air Fresh System) or WFS (Wet Fin System) available upon request

(*) **Standard conditions** - ethylene glycol 35%, Tw1=40°C, Tw2=35°C, T1=25°C



Exceptional design
increases savings
while minimising
operational costs



No continuous
water usage



No bacterial growth
(Legionella-free)

OTHER BENEFITS

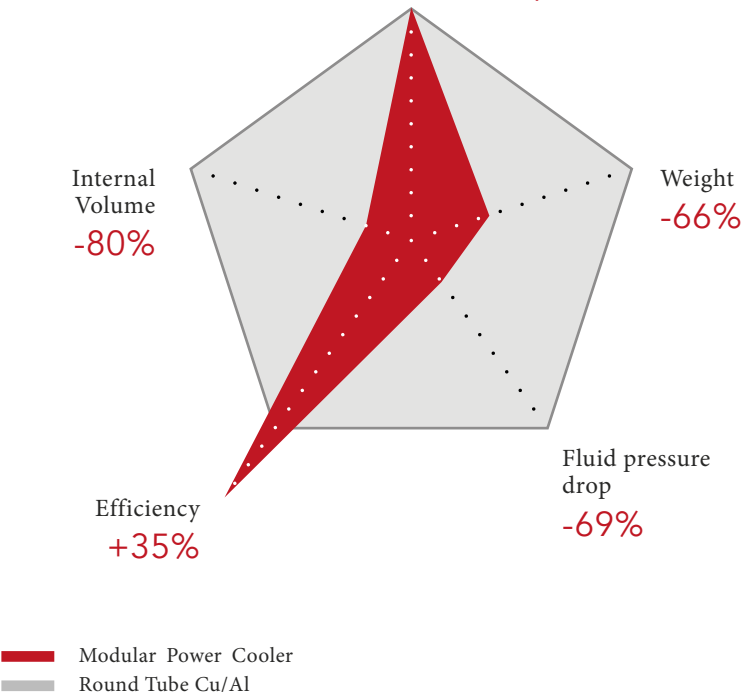
- No corrosion
- No continuous chemical treatment
- No sludge accumulations in piping
- No organic gases
- No fouling nor contamination
- No acids for pH control
- No shut-downs to clean heat exchangers
- No constant maintenance
- No ice formation
- No sewage
- No evaporation of process water
- No process temperature variations
- No fan motor maintenance
- No pulleys & no belts
- No drift eliminator panels



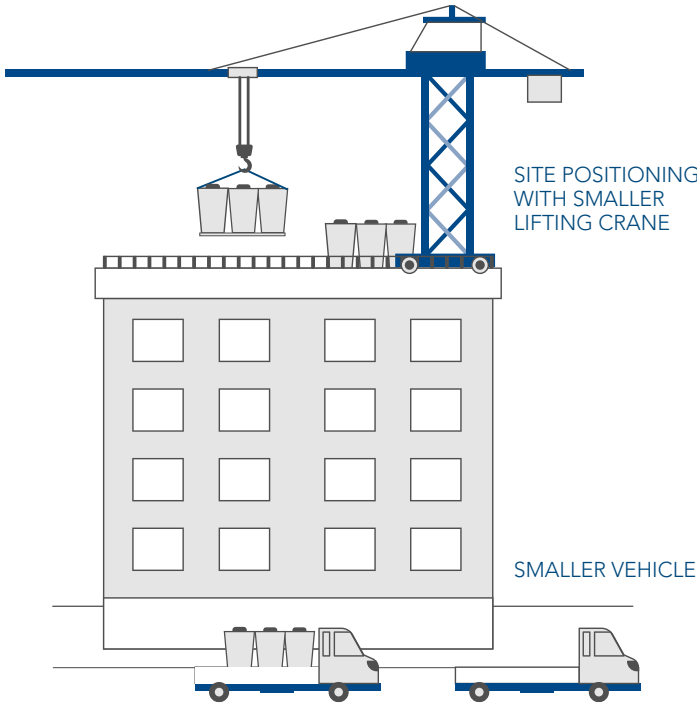
TKMICRO MODULAR POWER COOLER - Patent pending solution

Performance range	Capacity from 200 to 1000 kW*
Fans	Diameter Ø 800, 900 mm, EC motor
Modules	From 1 to 5
Benefits	Modules: 2 fans, 4 vertical microchannel cores High efficiency, minimal footprint 2 inlet, 2 outlet connections Low installation cost Lower environmental impact Lower internal volume Less weight Easy maintenance and core cleaning Core coating possibility in case of aggressive ambient Variable speed EC fans adjust RPM depending on heat load and ambient Individual isolation valves per module on request Maximum reliability with redundancy

Compared to a tube & fin
Fluid Cooler - Same capacity



(*) **Standard conditions** - ethylene glycol 35%, Tw1=40°C, Tw2=35°C, T1=25°C



INSTALLATION

The microchannel solution does not need special transport or high cube/open top containers, therefore it can also be installed in city centres where handling is often more difficult.

Up to 40% less installation costs

reduce overall costs of setup, crane renting and operations.

Up to 40% less load on the roof

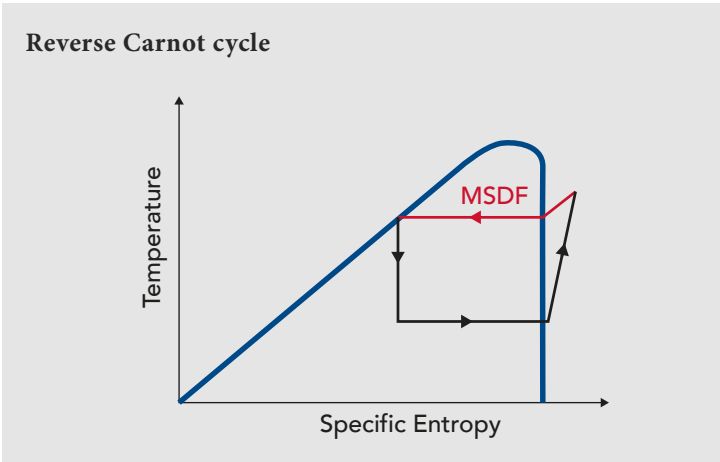
aluminium modules: less wight, less load on the roof (3.500 Kg-8 modules Vs 5.500 Kg-traditional unit).

Easily increase power when needed

in case of capacity request change, the modular system can adapt over time. Identical coils are characterised by same pressure drops, allowing simple modular expansion independently from the size.

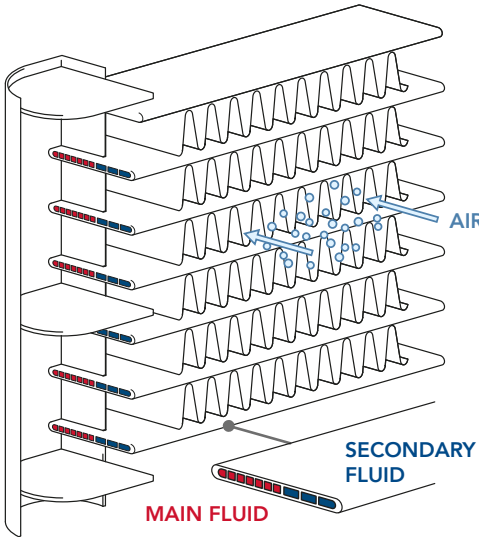
ADVANCED ENGINEERING

Patented solution for heat recovery and adiabatic systems
Closed-loop adiabatic cooling, with zero water consumption.
This technology does not just enhance the performance of coolers and condensers, but also provides a warm source of heat that can be used in many applications.



Multi System Dual Flow

- Option for heat recovery in condensers and coolers.
- Closed-looped booster up to +52% capacity, zero water consumption, no hygenic condition problems.



Multi System Dual Flow working principle

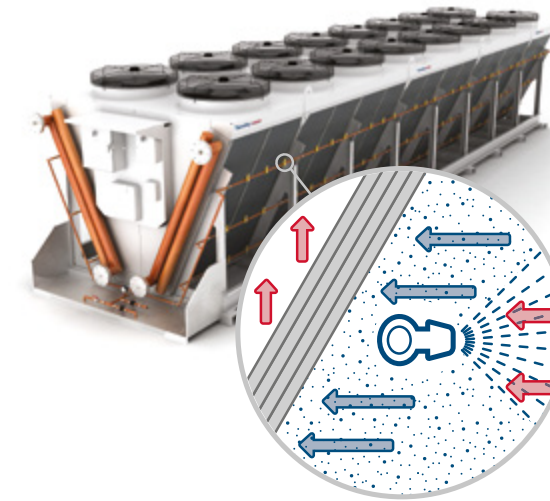
Adiabatic systems

- AFS** Air Fresh System
- WFS** Wet Fin System
- EPS** Evaporative Panel System

The adiabatic system applied to Dry Coolers and large remote condensers are activated in order to increase the air relative humidity that passes through the heat exchanger so as to reduce the temperature and increase the heat exchange.

The physical principle is namely the latent heat evaporation: by evaporating water absorbs heat from the air enters in the heat exchanger and lowers its temperature.

ThermoKey has developed different adiabatic systems to be effective and efficient under certain environmental conditions.



AFS AIR FRESH SYSTEM

ThermoKey adiabatic cooling system equipped with special high-pressure nozzles, which allows to compensate for the peaks of power to be dissipated, with minimum water consumption for a maximum of 500 hours per year.

The combination of high pressure water, the nebulization effect of nozzles (MISTING effect) and a specially designed electronic control system represent the innovative principle of AFS system.

It uses only the quantity of water necessary to obtain the desired adiabatic effect.

Tüv Certified: “No danger in correlation with the risk of legionnaires’ disease”.

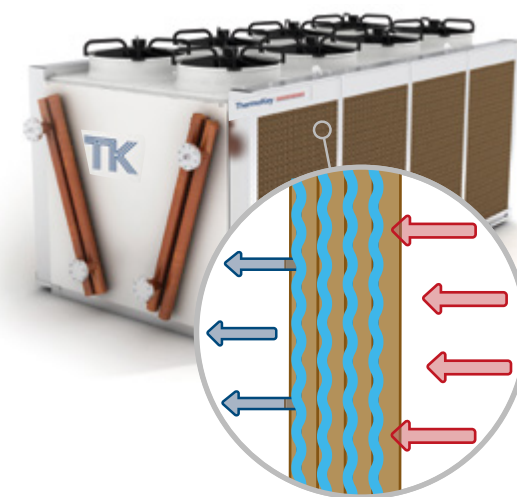
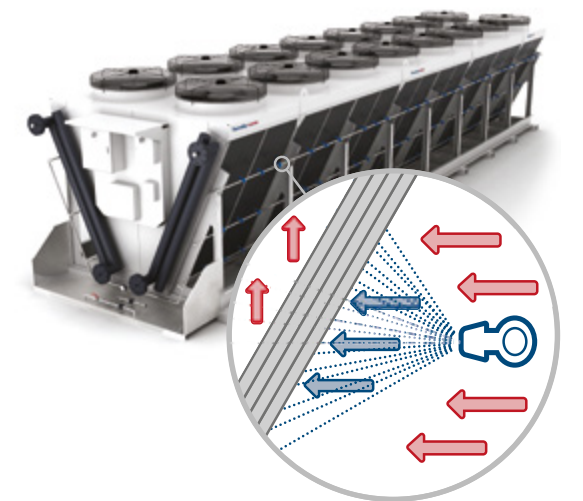
WFS WET FIN SYSTEM

It is ThermoKey hybrid cooling system which allows a complete flexibility of operation, working at low pressure (2-3 bars) and for a very high number of hours per year (up to 1000).

The user can choose whether to prioritize the consumption of water or electricity. Thanks to the misting effect and to the increased exchange efficiency, the WFS system allows to reach higher saturation levels.

Since WFS systems use water for a high number of hours per year, a black double-layer fin is provided in order to improve the protection of the finned pack.

Mainz Universitätsmedizin Laboratory certifies that the WFS meets the standard VDI 2047 part 2 securing hygienically sound operation.



EPS EVAPORATIVE PANEL SYSTEM

The evaporative panel system completes ThermoKey’s offer for adiabatic cooling. Thanks to a homogeneous and adjustable distribution of water on the panels this system allows to reach a high saturation level and therefore an efficient capacity increase with low water consumption (hours per year 8000).

EPS has been designed for seasonal working cycles without any specific time limitation and can be completely disassembled for cleaning and maintenance operations.

Thanks to the evaporation contained in the panel there is no need of any protective treatment for the heat exchanger. It is possible to use the water distributed by the common water supply network.

Mainz Universitätsmedizin Laboratory certifies that the EPS meets the standard VDI 2047 part 2 securing hygienically sound operation.

Energy efficiency of cooling

In order to optimise consumption and efficiency of the Chiller it is possible to adopt different solutions by using an external Dry Cooler.

LOWEST POSSIBLE CONDENSING TEMPERATURE

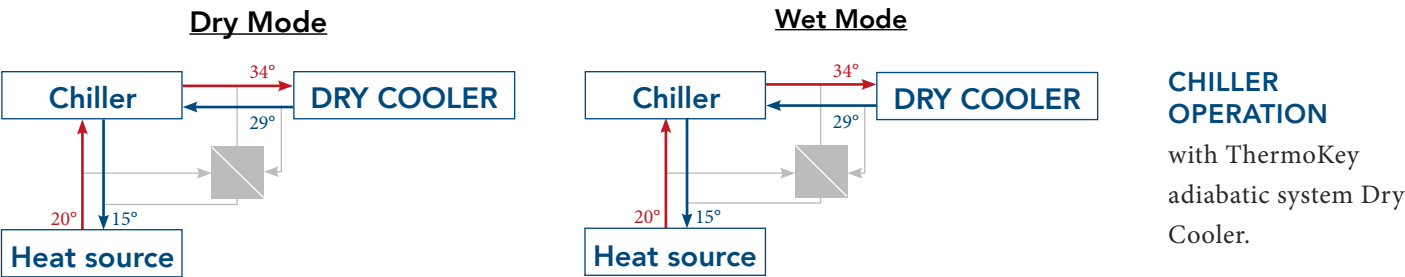
By using a high capacity or efficiency Dry Cooler it is possible to obtain a lower outside fluid temperature.

THE BENEFIT OF AMBIENT TEMPERATURES

Using a Dry Cooler with high capacity or efficiency in order to minimise or even switch off the Chiller during the free cooling mode.

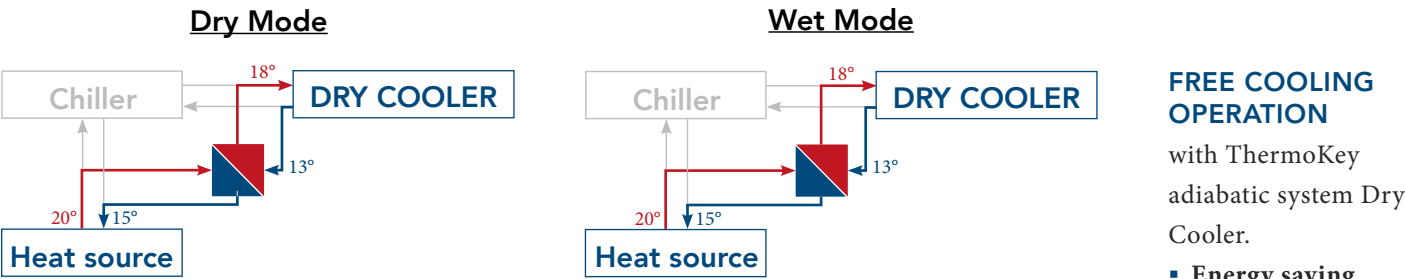
CHILLER OPERATION

When the ambient temperature is high, the refrigeration chiller works in combination with the adiabatic system that works in dry mode.



FREE COOLING MODE

When the ambient temperature is low, the refrigeration Chiller can be switched off and the Dry Cooler will dissipate the entire capacity.



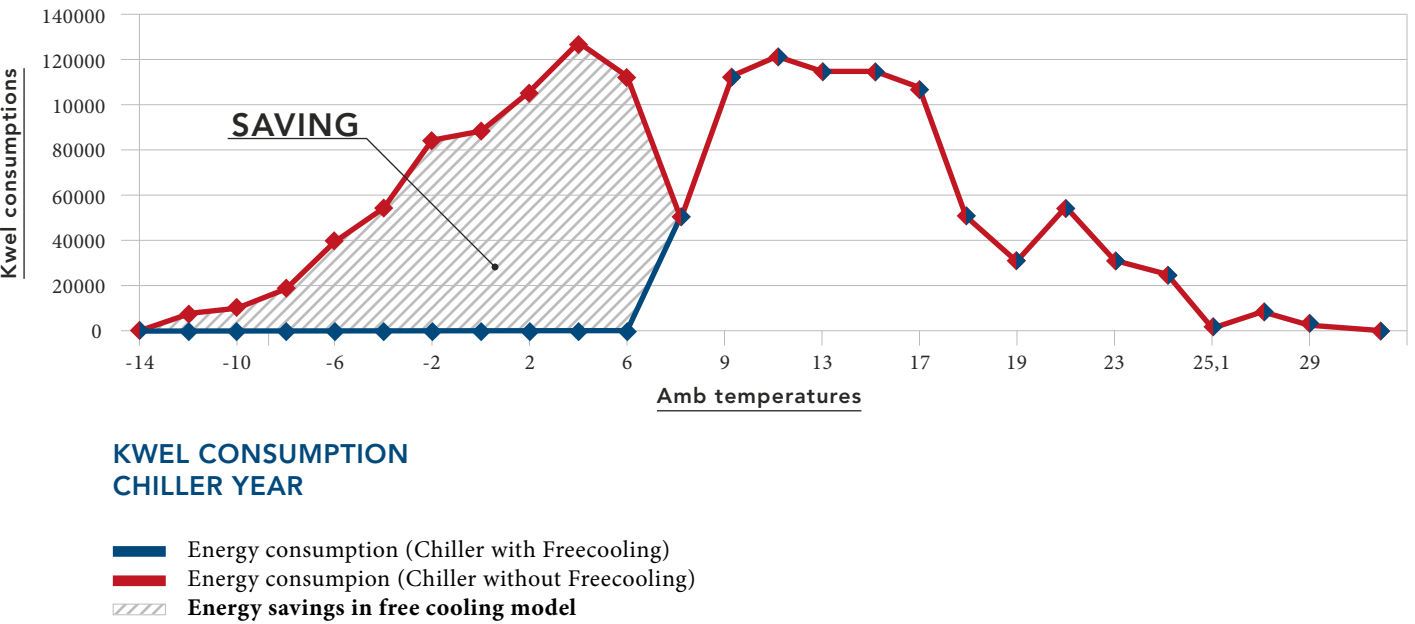
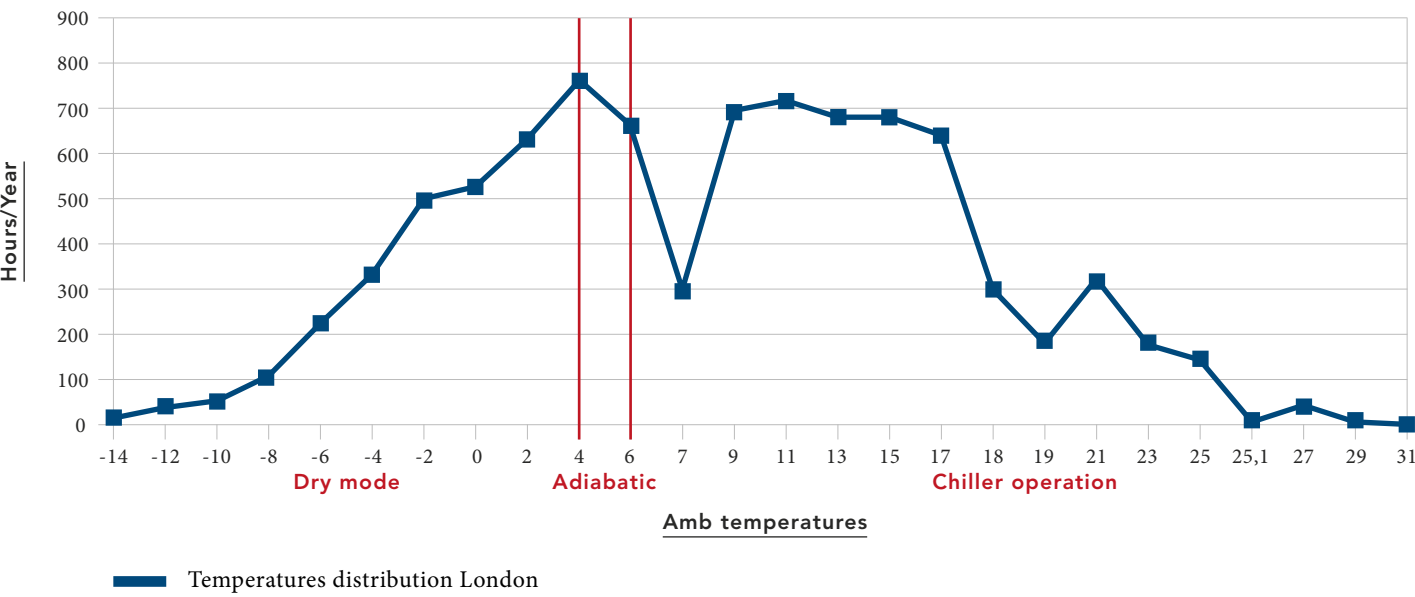
Simulation

Considering a typical range of temperatures at a **Data Centre in London** and combining a 166KW Chiller and a 1000KW Power J. Dry Cooler (our model: JGQ2790B1 with wet fin system), it is possible to distinguish the free cooling mode and chiller mode throughout the year.

					Dry Cooler			Chiller		
Drycooler mode	Ambient condition London	Cooling water in	Cooling water out	Hours/year	Make up water	Fan velocity	Energy consumption	Energy consuption (Chiller with free cooling)	Energy consuption (Chiller without free cooling)	
JGQ2790B1 (EC)(WFS)	°C	°C	°C	h	m3	RPM%	Kwh	Kwh	Kwh	
dry	-14	18	13	14	0	31%	13	0	2324	Winter/Free Cooling period 18-13° C
dry	-12	18	13	39	0	36%	47	0	6474	
dry	-10	18	13	53	0	40%	79	0	8798	
dry	-8	18	13	105	0	44%	194	0	17430	
dry	-6	18	13	227	0	49%	522	0	37682	
dry	-4	18	13	329	0	56%	1151	0	54614	
dry	-2	18	13	500	0	65%	2700	0	83000	
dry	0	18	13	527	0	87%	4796	0	87482	
dry	2	18	13	632	0	98%	10681	0	104912	
wet	4	18	13	764	1960	65%	4126	0	126824	
wet	6	18	13	666	1709	87%	6061	0	110556	Summer/Chiller Operation 34-29° C Dry Cooler
dry	7	34	29	296	0	36%	414	49136	49136	
dry	9	34	29	695	0	42%	1181	115370	115370	
dry	11	34	29	721	0	47%	1529	119686	119686	
dry	13	34	29	682	0	54%	2182	113212	113212	
dry	15	34	29	682	0	63%	3342	113212	113212	
dry	17	34	29	643	0	76%	5337	106738	106738	
dry	18	34	29	297	0	100%	10395	49302	49302	
wet	19	34	29	180	462	40%	270	29880	29880	
wet	21	34	29	323	829	44%	610	53618	53618	
wet	23	34	29	179	459	51%	465	29714	29714	
wet	25	34	29	144	369	58%	562	23904	23904	
wet	25	34	29	4	10	59%	16	664	664	
wet	27	34	29	45	115	69%	288	7470	7470	
wet	29	34	29	10	26	84%	113	1660	1660	
wet	31	34	29	3	8	0%	0	498	498	
Year total consumption				8760	5947		57074	814064	1454160	

-20% cost reduction

Chiller consumptions in free cooling mode at standard London temperatures.



The lower the average annual temperatures are the higher the annual savings can be.

Partial free cooling: depending on plant overall costs, ambient temperatures, desired capacity it is possible to partially use the Chiller system and Free Cooling units and therefore achieve further cost reductions.

TK Accessories

ThermoKey offers various solutions for the electrical and regulation components. Here are some of our main components:



W1E - JUNCTION BOX FOR 400V-3-50HZ EC FANS
Electric box for EC fans with plastic casing.



W2E - JUNCTION BOX FOR 400V-3-50HZ EC FANS
Electric box for EC fans with plastic casing and fan switches (1x2).



W3E - THREE-PHASE ELECTRICAL PANEL FOR 400V-3-50HZ EC FANS
Electrical panel for EC fans with plastic casing, fuse protection for groups of fans and external control 0-10V.



W4E - THREE-PHASE ELECTRICAL PANEL FOR 400V-3-50HZ EC FANS
Electrical panel for EC fans with plastic casing. Protected by automatic switches (circuit breakers) connected to group of fans. External control 0-10V.



Q1E - THREE-PHASE ELECTRICAL PANEL FOR 400V-3-50HZ EC FANS
Electrical panel for EC fans with paint coated metal casing. Protected by automatic switches (circuit breakers) connected to groups of fans, external control 0-10V.



Q2E - THREE-PHASE ELECTRICAL PANEL FOR 400V-3-50HZ EC FANS
Electrical panel for EC fans with paint coated metal casing, controller mounted inside the box, protected by automatic switches (circuit breakers) connected to groups of fans, fan regulation control MODBUS RS485.



Q3E - THREE-PHASE ELECTRICAL PANEL FOR 400V-3-50HZ EC FANS
Electrical panel for EC fans with paint coated metal frame, controller mounted inside the box, protected by automatic switches (circuit breakers) connected to groups of fans, fan regulation control MODBUS RS485, internal anti condensate heating element.



Q4E - THREE-PHASE ELECTRICAL PANEL FOR 400V-3-50HZ EC FANS
Electrical panel for EC fans with paint coated metal casing, controller mounted inside the box, protected by automatic switches (circuit breakers) connected to groups of fans, fan regulation control MODBUS RS485. Panel-mounted switches (1 switch every 2 fans) (1x2).



Electrical panel certified cULus (UL508A - CSA C22.2-14) available on demand

REGULATION FOR DRYCOOLERS AND CONDENSERS EC FANS

EB - EC BASIC SPEED CONTROLLER
The EC BASIC Eb is a multifunction and multiple-input unit for the regulation of speed of three-phase electronically commutated motors installed on axial fans, which is designed to regulate different EC motors, in a simultaneous and coordinated way, using programmable input signals.

UN - UNICON EC SPEED CONTROLLER
Controller Un is a multifunction and multiple-input unit for the regulation of speed of three-phase electronically commutated motors installed on axial fans, which is designed to regulate different EC motors in a simultaneous and coordinated way, using programmable input signals.

EP - EC PLUS SPEED CONTROLLER
The EC PLUS Ep is a multifunction and multiple-input unit for the regulation of speed of three-phase electronically commutated motors installed on axial fans, which is designed to regulate different EC motors, in a simultaneous and coordinated way, using programmable input signals.

FC300 – FC300 EC SPEED CONTROLLER
Controller FC300 is a multifunction and multiple-input unit for the regulation of electronically commutated motors installed on axial fans, which is designed to regulate different EC motors in a simultaneous and coordinated way, using programmable input signals.

- 5 strong points**
User-friendly interface
- Backlit Graphic TFT display with 6 buttons.
 - User-friendly menu navigation.

- Flexibility**
- Set-up and programming of analog and digital I/O from the operator panel.
 - Customization of special applications.

Special functions
Night Limit - Speed Jump - Unlock – Feedback – Threshold – Boost – Cutoff.

Connectivity
Remote access via Bluetooth for tablets and smartphones with the associated HyCo app (iOS and Android).

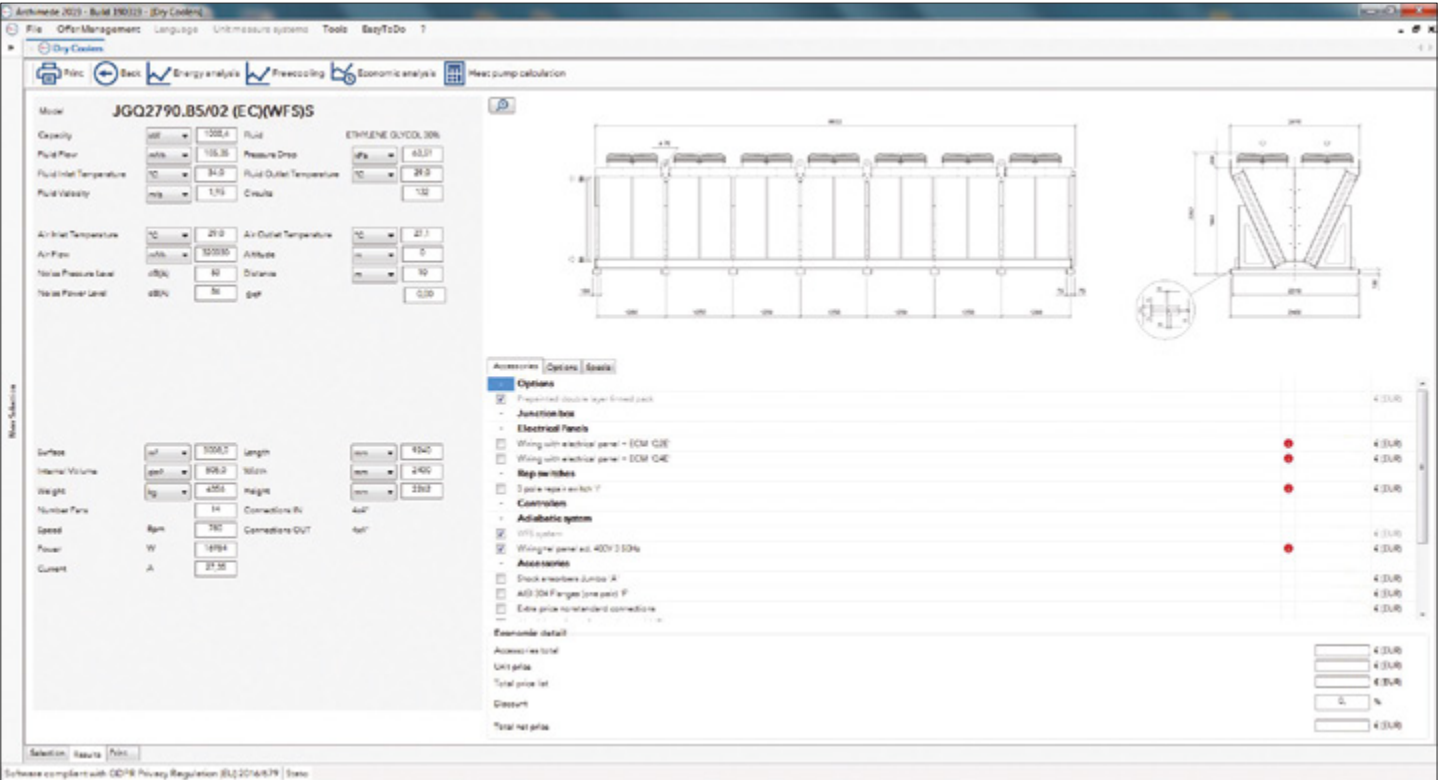
Selectable units of measurement
Temperature °C/°F - Pressure BAR/PSI.

TK

Archimede

With integrated climate data of no less than 537 cities from around the world, ThermoKey software “Archimede” offers:

- **Economic Analysis:** calculates running costs and pay-back time on the investment.
- **Energy Analysis:** verifies Energy consumptions and noise levels.



FREE DOWNLOAD
Scan the QR code or visit the website
www.thermokey.it/download/software



Case studies

Echelon LCY 10 Data Centre in London

- SOLUTION**
- 11 units SJGL2090DN5-02 Q4EAF(EC)(EPSELV)S
 - 2870 kW of heat rejection at 40 deg C ambient design per unit
 - 9 units for duty + 2 for standby
 - Evaporative Panel System with recirculation tanks to minimise water consumption.



Data Centre 6.1 MW

The Dry Coolers have been specifically designed to provide the best and most efficient solution.

NEED

Cooling down one of the biggest Data Centres (6.1 MW) in a particularly aggressive environment like the coastal one.

SOLUTION

16 V-Type Dry Coolers model **JGH2390CZ2/6QIEMAF(EC)(AFS)S** and 2 V-Type Dry Coolers model **JWQ1290A3/8QIEMAF(EC)(AFS)S** with electronic fans, adiabatic and self-cleaning system.



Server in Basel (Switzerland)

ThermoKey Dry Coolers have been produced to ensure durability and reduced energy consumption.

NEED

Cooling down 4.5 MW Total Capacity in a small footprint area.

SOLUTION

3 JGL2790BY AFS, V-Type Dry Coolers with AFS adiabatic system, corrosion protection of finned pack, electronic fans and electrical parts and **1 JGL2790BY**, V-Type Dry Cooler with electronic fans and electrical parts.



Data Centre 5.5 MW

ThermoKey was commissioned to replace 3 existing Dry coolers from another brand to grant the cooling of a Data Center in Amsterdam.

NEED

Removing heat from the server room

SOLUTION

3 table-type Dry coolers equipped with 6 EC fans each – Fin thickness 0.15 mm



Vantage Data Centre in Newport

SOLUTION

- 5 Units **SJGH2090.CN5/02 Q2EIF(EC)S**
- 4 units running + 1 standby
- 1348 kW of heat rejection each at a 35 deg C ambient



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Heat Exchange Solutions

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