



EcoCooling
EVAPORATIVE COOLING

Direct Evaporative Cooling and Ventilation Technologies

IT, Data Centre and Telecoms Fresh Air Systems

EcoCooling Energy Efficient Cooling and Ventilation Technologies

- ❖ Established in 2002, EcoCooling is the largest manufacturer and distributor of fresh air direct evaporative coolers in the UK. There are over 3,000 EcoCooler installations worldwide.
- ❖ Based in Suffolk, EcoCooling manufacture the ECT and FA ranges in the UK and have over 1,500m² of warehouse and manufacturing space.
- ❖ EcoCooling are credited with revolutionising the control systems required to use direct evaporative cooling in IT environments. The R&D department drives to incorporate the latest energy efficient technologies into all product ranges, ensuring our clients have some of the most innovative ventilation and cooling systems in the world. This focus on innovation has also resulted in EcoCooling holding a number of patents for fresh air technologies.
- ❖ Our complimentary design advice service capitalises on our vast industry experience and we can work closely with consultants and end-user clients to help optimise EcoCooling technology for their prospective installations.
- ❖ EcoCooling products and control systems are designed to be used across the IT industry. Common applications include the cooling of data halls, UPS rooms and smaller communications rooms.
- ❖ Thinking about an installation? Seminars, case studies and client testimonials are available on the EcoCooling YouTube channel.

Would you like more information? Contact sales@ecocooling.org to discuss your requirements with an application engineer.

How EcoCooling Systems Work

CREC® (Computer Room Evaporative Cooling) control systems operate in different modes depending on the ambient conditions. These modes maximise the EcoCoolers' efficiency and performance:

Ventilation: Energy efficient fans move fresh air through the area being cooled to transport heat away.

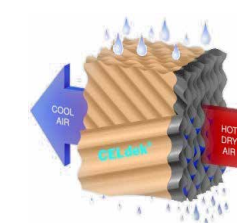
Attemperation: The CREC® control system automatically mixes hot recirculated air with cold external air to supply air at a constant temperature.

Evaporative Cooling: During hot weather air is moved over a wetted cooling pad. The air temperature is reduced as the water evaporates.

Temperature compliance can be achieved with no need for mechanical refrigeration.

Advantages of Using Direct Evaporative Cooling

- ❖ No refrigerants, completely natural cooling process
- ❖ Low running and maintenance costs
- ❖ Low carbon and energy use
- ❖ Exploits the maximum amount of free cooling available
- ❖ Low energy use even at partial population



Advantages of Using EcoCooling Products

- ❖ Experienced innovators in fresh air solutions and controls
- ❖ Free solution consultancy and design assistance
- ❖ Modular systems can reduce capital cost
- ❖ Advanced control systems
- ❖ Patented products and controls
- ❖ Internal and external product ranges
- ❖ UK manufacturers - Critical spares all ex-stock
- ❖ Worldwide remote commissioning
- ❖ Qualify for Salix funding



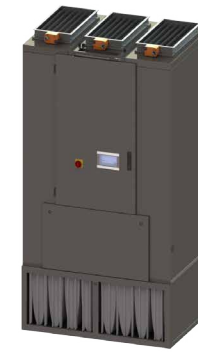
A low cost, energy efficient alternative to refrigeration

"Our PUE has improved from an inefficient 4 to a very competitive 1.08. Usually being environmentally responsible costs more but we secured an interest free loan meaning we could buy and run the system for 50% of our previous electricity costs. It will be paid for in 2 years and then electricity savings rocket to 90%."

Mark Smith - Technical Director, S3.

Reliable Ventilation and Evaporative Cooling Solutions

EcoCooling Cooling and Ventilation Product Ranges



How EcoCooling Systems Work: General Principals

Low energy variable speed EC (Electronically Commutated) fans are specified to supply and extract air.

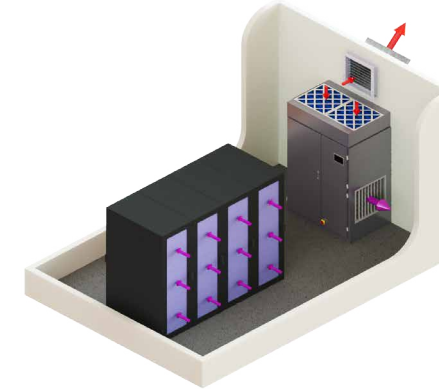
Fresh air is brought into the system through EU4 pre-filters and Munters CELdek® pads.

Evaporative cooling operates during warm periods to cool air.

During winter periods warm exhaust air is mixed with cold fresh air. EcoCooling describe this mixing process as attemperation.

Patented control systems measure and control air flow rate, supply and exhaust temperature.

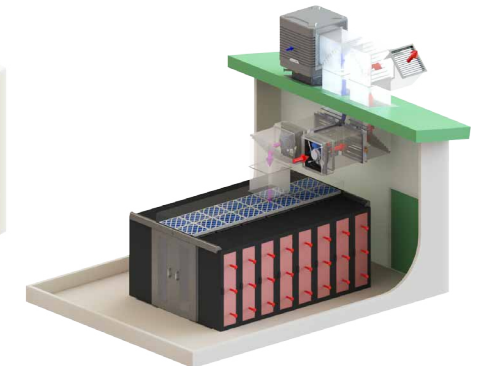
Control systems automatically match air flow to the amount of cooling required.



Internal Product Range (ECT): Compact and Flexible Solutions

The ECT range of coolers are designed to be installed internally. Multiple configuration options allow for air to be supplied either directly, through ductwork or raised floors.

- ♦ Worried about getting the cooler into your room? The ECT5400 can be broken down to fit through a single door.
- ♦ For complete peace of mind a sophisticated leak detection and alarm system has been incorporated into all of our internal products.
- ♦ Humidification: ECT units can be fitted with a humidification option to avoid low relative humidity non-compliance.



External Product Range (ECP): Proven Technology and Results

With over 3000 installations worldwide, the ECP range of coolers can be installed externally or inside a plant room. The standard unit is down flow however top and side discharge configurations are available.

Fresh Air Products (FA):

Fresh air systems without the evaporative cooling option are also available.

Product Range:

See the table below for our full range of products and associated cooling capacities over different ΔT^* .

| Product | Nominal Flow Rate (m³/hr) | Cooling Capacity (kW) | | |
|----------|---------------------------|---|--|---|
| | | $\Delta T=5^{\circ}\text{C}$ (comms) | $\Delta T=10^{\circ}\text{C}$ (servers) | $\Delta T=15^{\circ}\text{C}$ (blades) |
| ECT 5400 | 5,400 | 10 | 19 | 29 |
| ECT10800 | 10,800 | 19 | 38 | 58 |
| ECP | 12,600 | 22 | 45 | 67 |
| ECP - S | 9,600 | 17 | 34 | 50 |
| ECPL | 18,000 | 38 | 64 | 96 |
| ECPL - S | 13,500 | 25 | 47 | 72 |
| FA 2200 | 2,200 | 4 | 8 | 12 |
| FA 18000 | 18,000 | 38 | 64 | 96 |

“The site we are developing has a restriction on total power available. By significantly reducing the electricity demand for cooling this has enabled us to maximize the available power for productive use.”

Jim Nesbitt - Sales Director, Blue Chip

**Release power and save energy
with direct evaporative cooling**

* ΔT (Temperature gain in the room due to the IT equipment) = Temperature of Extract Air - Temperature of Supply Air

Exploiting Energy Efficient Free Cooling

Free cooling is an economical method of using low external air temperatures to reduce the amount of additional cooling required. When the ambient external temperature is below the desired supply set point the CREC® system can run in ventilation and attemperation mode. On warmer days of the year, evaporative cooling is used to cool the supply air.

EcoCooling CREC® control systems and EcoCoolers (direct evaporative cooling) can exploit the full free cooling envelope.



The number of exploitable free cooling days is dependant on your location and desired supply temperature;

- ♦ Cooler climates provide more free cooling potential.
- ♦ Higher supply temperatures increase the available number of free cooling days.

Case Study 1:

Location: London

Desired Supply Temp: 18°C

% time in free cooling mode: 86%

Case Study 2:

Location: Manchester

Desired Supply Temp: 18°C

% time in free cooling mode: 94%

Case Study 3:

Location: Aberdeen

Desired Supply Temp: 18°C

% time in free cooling mode: 97%

IT Industry Cooling Guidelines

ASHRAE: The internationally accepted environmental standards for running data centres are contained in the ASHRAE TC 9.9 guidelines. Temperature, humidity and contamination levels are all identified as important factors when designing a fresh air cooling system for a server room or data centre. EcoCooling solutions optimise the cooling efficiency and provide acceptable conditions for the majority of the time.

Temperature



ASHRAE: While ASHRAE has an allowable range from 15-32°C, care should be taken running at high temperatures as server ventilation has been shown to increase its energy use at temperatures over 25°C.

EcoCooling: Systems can provide supply air temperatures below 25°C all year round in the UK. Control systems provide close control (+/- 1°C) and a large percentage of the year 16°C supply air temperature delivery is achievable.

Humidity



ASHRAE: The ASHRAE allowable range is between 20-80% relative humidity. Low humidity can result in electrostatic discharge. High humidity, in combination with certain contaminants can result in corrosion.

EcoCooling: CREC® control systems can automatically transfer the cooling to 3rd party backup systems if the humidity levels exceed the pre-set parameters.

Contaminants



EcoCooling products are based on direct fresh air cooling. It is strongly recommended that all IT cooling systems using direct evaporative cooling be designed with a minimum of G4/EU4 grade filtration at both the supply and recirculation points.

A range of filtration products up to F7/EU7 grade are available.

“It was never intended that the recommended envelope would be the absolute limits of inlet air temperature and humidity for IT equipment.” - ASHRAE 2011 Guidelines

“The EcoCooling CREC control system gives 100% compliant conditions at less than 10% of the energy usage of a state of the art refrigeration based system.”

Vic Henry - Technical Director, Blue Chip

**Save up to 90% on your cooling costs
and maintain temperatures under 25°C all year round**

Award Winning Data Centres in Energy Efficiency

“We are delighted that our PUE is less than 1.15 during the summer, achieving what we felt was a very ambitious programme of work with a targeted PUE of 1.2.”

Peter Essen - Data Centre Operations Manager, Aberdeen University

Supplementary Products

Filtration

When fresh air is used in a data centre there can be a risk of either particulate or gaseous contamination. The quality of the air in the locality of the data centre can affect the feasibility of the use of fresh air. It is now normal to fit filtration to a minimum of EU4/G4 standards.



Products

The ECT units have in built filtration. The ECP units require filtration to be built into the ventilation system design. EcoCooling stock a variety of filters in different grades up to F7. This range has been specially selected so they are easily incorporated into our systems.

♦ Pre-filter jackets

These fit around the outside of the external coolers, filtering the supply air before it enters the system.

♦ Cartridge filter

These can be fitted as part of the attemperation loop to ensure recirculated air is also filtered.

♦ Filter bags

These are used in the ECT10800 units to filter both supply and recirculated air.

Dual Filtration

Air intake filtration (pre-filter jackets) is designed to eliminate potential contamination from external air. In addition cartridge filters can be used in either ducting or as replacement ceiling tiles to filter the recirculated air.

EC Fans

Electronically commutated (EC) fans are driven by a micro-controller instead of a traditional AC motor. The technology provides the following advantages:

♦ Increased speed control:

EC technology enables continuous adjustment of the fan speed to meet the cooling demands of the data centre. EcoCooling control systems are designed to take advantage of the energy savings which can be gained by reducing fan speeds.

♦ Low power usage at partial loads:

The affect of fan speed on power drain is governed by a cubed relationship, meaning that at half the speed the fan will be using an eighth of the electricity. Operating the EcoCooling system at half speed reduces the fan energy use by over 85%.



Products

All ECT units are supplied with integral EC fans. They are also specified by EcoCooling for any ECP systems as standard.








EC Fans are available in a variety of sizes, ex-stock.

**EcoCooling systems can provide
world class data centre efficiency even at partial loads**

Bespoke Control Systems

Maximise Efficiency

An EcoCooling control panel is integral to the success of a CREC® installation. The standard program has been developed by EcoCooling over the last 10 years to optimise the operation of the CREC® system. Some of the features of the control system are listed below.

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 - ♦ Versatile Communication Options - Modbus TCP/IP allows for easy communication into most major BMS systems. An inbuilt VNC server allows the HMI to be viewed remotely on most mobile phones and tablets. Assistance with converting data and SNMP logging is available on request.
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 - ♦ Resilience - All systems can have a built in 'fail-safe' and incorporate manual control and backup power add-ons to ensure fans will continue running in the event that a control system goes down.
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 - ♦ Redundancy - Key sensors can be duplicated and alternative cooling can be automatically activated as a backup if there is a fault.
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 - ♦ Alarm Notification - The control system can automatically notify the BMS system in the event of an alarm being raised. Email and text notification can also be enabled. Direct links to fire systems are available, which when activated automatically closes fire dampers and switches on any backup systems.
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 - ♦ Historical Data and Event Logging - The HMI can log and present different variables as a trend display. Chosen data can be stored on the HMI for download at a later point via USB. This data can also be emailed after a pre-defined fixed time interval.
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 - ♦ Remote Commissioning - EcoCooling offer a remote commissioning service, saving time and money, particularly in foreign locations.

Savings and Performance

Calculations

EcoCooling developed a calculator to estimate the possible energy savings for all of our systems, inputs include historical weather data and fan data. Cost analysis can be performed for any size data centre or telecoms room in most locations worldwide. Please contact us for more information.

Example Savings Calculator Report

| | |
|----------------------|------------------|
| Cooling Demand (IT): | 100kW |
| Flow Rate Required: | 8.3Kg/s or 7m³/s |
| ΔT | 12°C |

An IT load of 100kW, with a ΔT of 12°C will require a mass flow rate of 8.3Kg/s or air flow rate of 7m³/s. This equates to 25,000m³/hr or 221 million m³/yr of air.

Running Costs and Performance (ECP standard CREC® system)

| Type of System | AC | EcoCooling |
|----------------------------|-----|------------|
| Coefficient of Performance | 2.0 | 27.0 |
| Total Electricity Use (kW) | 50 | 3.7 |
| Effect on PUE | 0.5 | 0.04 |



Annual Usage (IT Environment) = 8760hrs

| Operating Costs | AC | EcoCooling | Savings |
|------------------------|---------|------------|---------|
| Electricity Use (kWhr) | 438,000 | 32,412 | 405,588 |
| Electricity Cost (£) | 43,800 | 3,241 | 40,599 |
| Water Use (m³) | 0 | 145 | - 145 |
| Water Cost (£) | 0 | 145 | - 145 |

| | | | |
|------------------------|------------|-----------|------------|
| Total Cost | £43,800 | £3,386 | £40.414 |
| CO ₂ Impact | 235 tonnes | 17 tonnes | 218 tonnes |

PUE (Power Utilisation Effectiveness)

CREC® systems have assisted both new build and retrofit data centres to achieve PUEs of below 1.1. The fans that drive air flow are the most significant energy consumer in the system, and the use of efficient electronically commutated motors is instrumental in minimising energy use. Exploiting EC fan technology can reduce the power required further, meaning PUEs of 1.05 are now achievable in optimum environments.

“We are extremely happy with the performance of our EcoCoolers, the system consumes 87% less power than the previous DX system did and our data hall is now cooler than it ever was before”.

Mark Jacobs, Facilities Manger, Talk Talk

