

**Air Temperature Specialists**



## Evaporative Cooling - A Brief Introduction

With an estimated 30 million installations worldwide, evaporative cooling is fast becoming the standard method for cooling factories, storage spaces and other commercial premises, and makes working conditions safe and acceptable while protecting stock and processes. With its high efficiency, affordable prices and ability to work without the need to seal your building or change your working practices, there really is no viable alternative for cost conscious businesses who take their environmental responsibilities seriously.

### How it Works

The Evaporative Cooling Process reduces temperature by taking energy, in the form of heat, from air in order to evaporate clean water. As the energy is removed, the temperature of the air is reduced.

### Main Benefits

- Inexpensive to install
- Low running costs
- Low Carbon emissions
- Effective cooling which won't fall away or fail as the outside temperature increases
- Does not require doors and windows to be closed

## Procool's Key Clients

- Gillette UK Ltd
- Eaton Aerospace Ltd
- Fuji Seal Europe Ltd
- Geoff Neal Litho
- De la Rue Holographics
- CTC Aviation
- Microfiltrex Ltd
- British Airways plc
- Salisbury NHS Trust



# About Procool

Procool specialise in providing and supporting affordable cooling for factories, production areas, warehouses and other commercial premises; and without any of the issues that make conventional air conditioning impractical for these spaces. Our systems have many applications, but a “one size fits all” approach is a recipe for trouble. That’s why at Procool we take time to understand your needs, and make the effort to design a system that will truly benefit your business.

With 26 years experience providing temperature control solutions to industry, we have the knowledge to understand how what we do will affect your processes and people, and put that knowledge to practical use every day.

## Design & Installation

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A turnkey service should mean just that, and at Procool we aim to include everything you need, from initial concept right through installation to commissioning of a fully working system and beyond. The idea is that we arrive at your premises as they are today, and leave when you have a fully working installation, without asking you to call in other trades. All of our designs are fully illustrated so that you know exactly what to expect, and our service includes all installation works; both mechanical and electrical. We understand that your production schedule cannot be disrupted, and manage our projects and train our installation teams with that in mind.

## The key stages in our process are:

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- 1) **Initial survey.**  
Designed to collect the information required to move to the next stage, and to make sensible and useful recommendations, the initial survey takes between thirty minutes and one hour, and allows us to understand your needs.
- 2) **Design and Proposal.**  
Following the survey we will prepare a design and fixed price costing. Except for the simplest of systems, all of our proposals are fully illustrated with 3D diagrams that help you to picture the installation.
- 3) **Design Development.**  
Discussion of our design is important to be sure it takes full account of your process, and we are more than happy to develop the design through as many iterations (all fully illustrated) as it takes for everyone involved to be completely happy.



# About Procool Cont.

- 4) **Installation.**  
Once we are instructed to proceed a detail survey will be undertaken to prepare for manufacture, and the work will then be programmed to accommodate the most important factor; avoiding disruption to your business. Installation is carried out by manufacturer-trained teams who are used to working alongside production processes, and who are fully supported by experienced and pro-active contract managers and full documentation
- 5) **Commissioning.**  
Commissioning includes a demonstration of the working system to your staff, and correct setup of the airflow. If required we are always available to fine-tune the system once it's been running for a while and people have become used to its performance.
- 6) **Document Issue.**  
You will be issued with a full document pack, which includes operating and maintenance instructions, fault codes, emergency contact numbers, legionella risk assessment (indicating zero risk, but required none-the-less) and wiring diagrams.
- 7) **Maintenance.**  
Optionally we can make sure you get the maximum benefit from your factory cooling investment through affordable maintenance packages tailored to your needs. We employ only qualified engineers, and offer discounted spare parts and labour rates to contract holders, plus preferential response times.

## Carbon Trust Loans

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The Carbon Trust's "Energy Efficiency Loans" scheme is designed to encourage small and medium sized enterprises (SME's) to invest in energy efficient systems with low carbon emissions, such as evaporative cooling. Depending on the energy and carbon savings achieved each year, qualifying companies may be able to borrow up to 100% of the installed cost, to be repaid over four years, interest free.



# Procool FAQ's

## How does the Procool factory cooling system work ?

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We use a natural process known as evaporative cooling, in which hot dry fresh air is drawn over a wetted transfer pad. Heat is used to evaporate water, and that heat comes from the air, cooling it. If the fresh air is already cool enough, the cooling circuit is turned off, and we achieve free cooling.

## Where is the cooler installed; doesn't it need a lot of ductwork ?

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There are several options, the most common being on the roof with simple "drop ducts" to deliver the air where you need it, or internal units which can be positioned close to the workspace. If roof access is an issue, and internal units are not appropriate, there are a number of other ways we can design the system.

## How much will it reduce the temperature ?

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This is dependent upon the ambient conditions but, in hot weather in the UK, there is typically an 8 to 10° drop in the temperature of the air through the evaporative cooler. Remember too that the cooler uses fresh air, not room air, so if it's already cooler outside than in, you'll get the benefit of that in addition to the cooling effect. We can undertake studies of the existing conditions if required, and from those can predict the effect of an installation.

## I've never heard of Evaporative Cooling. Are you sure it works ?

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There are an estimated 30 million evaporative cooling installations worldwide, although it is relatively new to the UK. But there's no need to take our word for it that it works, as we'll happily arrange to install a demonstration unit so you can see for yourself.

## I've heard that evaporative coolers don't work in humid climates like ours ?

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High humidity and high temperatures hardly ever coincide in the UK, despite our perception of "hot and sticky" summer days. When it's hot it will be dry, and the cooler will work at maximum efficiency. When it's not so hot it may be more humid, but the lower temperature means that we don't need the full effect from the cooler.

## If I have to close all the doors and windows so that the air conditioning will work, how do I continue to operate my factory ?

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While it would be necessary to seal the building for conventional air conditioning to work, it is NOT required for evaporative coolers, which rely on and provide balanced ventilation.



# Procool FAQ's Cont.

What about those exceptionally hot days when I need the system the most; will the coolers be able to cope ?

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Conventional air conditioners give less cooling the hotter it gets, and eventually fail altogether when the temperature is higher than expected. Evaporative coolers give more cooling the hotter it gets, and there is no upper limit – the coolers will not stop working just when you need them most.

It's only hot for a few days a year; do I really need factory cooling?

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In a typical year in the UK, the outside temperature will get above 20 deg C in 7 out of 12 months, and the inside temperature is likely to be 5 to 10 deg C higher than that. Given that studies show that productivity falls by 10% when working temperatures are over 24 deg C (falling more still as it gets even hotter), and that a worker is 23% more likely to make a mistake or have an accident at these temperatures, heat is a bigger problem for businesses in the UK than most people imagine.

If this system uses water, can't you catch Legionnaires' disease from a Procool evaporative cooler ?

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No, because the way the system works is fundamentally different to a cooling tower, and that means that the conditions required for legionella cannot exist. There are also control safeguards built into the system to prevent the unexpected. However, because it is a wet system, a risk assessment is required, and we will prepare one for you.

How much does it cost to run?

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On a hot summer day, a single unit costs about 10p per hour to run, using 2005 UK industry utility costs. A conventional air conditioner of the same capacity would typically cost 40p per hour, more if doors have to be open, AND would not be able to provide free factory cooling in the Spring and Autumn.

Do the coolers clean the air ?

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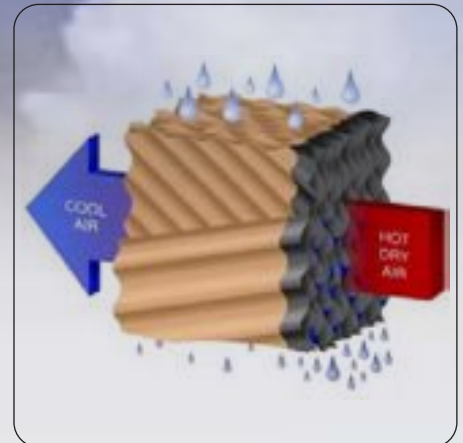
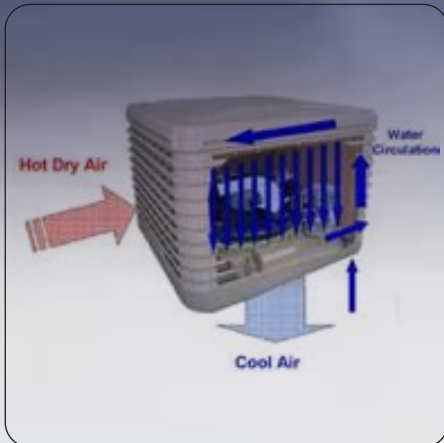
Yes, the pad will filter out larger particles such as dust or pollen, and additional filters can be added if required.

Will I get condensation in my building ?

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No, provided the design is based on a balanced ventilation scheme.

# Process Comparison



## Air Cooling - A Brief History

Civilizations throughout the ages have found ingenious ways to combat the heat in their region. From the Persian 'Wind-catcher,' which channelled air through shafts on the roofs of mud huts, to early forms of Evaporative Cooling where air was vented through wet tent doors or across porous pots, these have formed the base methods of Air Cooling Processes today. There are three main Air Cooling Processes in current use:

## Evaporative Air Cooling

The Evaporative Cooling process reduces temperature by channelling air through damp pads. As the water evaporates from the extended surface of the pads, energy is taken from the air in the form of heat, and the temperature is reduced by 8 deg C or more.

## Air Conditioning

Air Conditioning cools by blowing recirculated air across a refrigerant-filled coil, changing the state of that refrigerant mechanically in a compressor, and then rejecting the heat to outside. Because the compression of the refrigerant requires a lot of energy, electricity costs are on average 4 to 5 times higher than Evaporative Cooling on the hottest summer days. On days when it's hot inside and cooler outside, Air Conditioning still has to compress refrigerant, while Evaporative Cooling can provide free cooling. This increases the running cost difference even more.

## Forced Ventilation

Forced Ventilation moves air around, but doesn't cool it at all (in fact it heats it marginally because of the work done by the fan motor). It can be effective if air is moved from a cool space into a hot one, but on a hot day the absolute best that can be achieved by moving outside air in, or extracting inside air to out, is a room temperature equal to outside, or more likely a few degrees higher than that. Electrical use, carbon emissions and capital cost are all similar to evaporative cooling, but hot weather performance is limited.

## Process Comparison

The chart overleaf compares evaporative cooling with other air-cooling processes, based on a 20m x 20m factory space.



# Process Comparison Cont.

	Permanently Installed Evaporative Cooling	Air Conditioning	Forced Ventilation	Hired Mobile Evaporative Coolers
<b>Energy Costs (hot summer day)</b>	£0.14 per hour	£0.81 per hour	£0.10 per hour	£0.14 per hour, plus ventilation costs
<b>Energy Costs (average summer day)</b>	£0.11 per hour	£0.49 per hour	£0.10 per hour	£0.11 per hour, plus ventilation costs
<b>Carbon Emissions</b>	1.5 tonnes per year	12 tonnes per year	1.5 tonnes per year	1.5 tonnes per year
<b>Average Temperature Drop inside the room</b>	8 deg C at design conditions, more as it gets hotter outside	8 deg C at design conditions, less as it gets hotter outside	Reduces temperature to a few degrees above outside temperature in ideal conditions, never better	8 deg C if placed in a doorway with extract, typically zero or even a temperature increase if placed close to the work area
<b>Air Distribution</b>	Can be the whole room or just problem areas	Whole room. Cold spots can develop close to outlets	Can be the whole room or just problem areas	Very poor –is unlikely to deliver any cooling to the problem area, if placed near a door as required
<b>Effect of exceptionally hot days</b>	More cooling with no limit	Less cooling, and then complete failure	Still very little temperature reduction. Often turned off in the afternoons to stop it blowing hot air over people and processes	More cooling ONLY if placed outside, otherwise zero cooling
<b>Fresh air</b>	100% filtered fresh air	Re-circulated stale air. Fresh air should always be introduced, increasing installation costs and reducing performance	100% fresh air. Can be filtered at extra cost.	Needs fresh air to work, but there is rarely enough available where the cooling is needed
<b>Operating Conditions</b>	Doors and windows can be left open. Through traffic has no effect	Doors and windows must be closed to create an enclosed environment	Doors and windows can be left open	Must be placed close to a source of 100% fresh air.
<b>Effect on humidity</b>	Neutral when properly designed. Can be used to humidify if required without losing the cooling effect	Reduces humidity at the expense of cooling effect	Unpredictable, but never better than ambient	Rapidly humidify the room and stop cooling altogether
<b>Environmental Impact</b>	Low carbon emissions. Low energy use. Zero CFC/HCFC usage. Plain water to drain	High carbon emissions. Requires CFC/HCFC management and possibly monitoring. Compressor contains oil requiring specialist disposal.	Very high carbon emissions and energy usage per °C temperature reduction	Low carbon emissions, but in most applications energy is used for little or no benefit

# Heating & Cooling Case Study



## The Problem

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The engineering workshop at a major food processing company in Bury St Edmunds had a requirement for heating in the winter, ventilation in the spring and autumn, and cooling in the summer. Separate systems were considered, but were expensive and difficult to control coherently, so a combined system was needed

## The Solution

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A combined heating and cooling system was installed based on a single evaporative cooler, with the fan relocated into the ductwork after a recirculation loop.

The roof mounted 'wet box' which results provides either ambient air when it's cool enough to achieve free cooling, or evaporatively cooled air on hotter days.

The recirculation loop operates in winter and, using a steam coil, provides a source for heating.

The five fan speeds available mean that the airflow can be adjusted to suit the conditions, either automatically or manually, and a steam valve controls the heat output.

Change over from winter to summer modes is manual, but could easily be achieved using either a thermostat or a time clock. In the winter mode, the fan speed is held at the minimum, while air distribution is guaranteed by the adjustable outlet louvres.

## The Results

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Comfortable temperatures are now maintained all year round, while using minimum energy because of the efficiency of evaporative cooling in the summer, the free cooling available in Spring and Autumn, and the use of surplus steam for heating in Winter. The controls are very simple, yet make sure that heating and cooling never fight each other.

## Interesting Facts

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In this case, steam was readily available from the clients manufacturing process, but the heat source could just as easily have been water, gas or electricity.