

- Evaporative Cooling



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**hydor**

# Introduction

Hydor Evaporative Cooling systems are suitable for agricultural, horticultural and a variety of commercial applications.

Originally developed for poultry and cattle, evaporative cooling is a simple but highly effective method of reducing temperature and increasing humidity. The surrounding air is cooled as micron-sized water droplets are emitted from a series of nozzles under high pressure. These are evaporated into the warm environment and air temperature is reduced without causing condensation or damage to any fixtures or fittings.

When encapsulated in an enclosed area such as animal housing, the water droplets are also able to remove small particles from the air, making evaporative cooling systems a very effective method of controlling dust, odour and pollution levels.

Evaporative cooling systems differ from misting systems. Misting or fogging will wet the animal to cool it, which is not suitable for some applications such as poultry. Evaporative cooling systems reduce air temperatures by the process of evaporation. The very fine water droplets change from a liquid to a vapour state reducing the surrounding air temperature in the process.

Further applications where evaporative cooling systems can be used successfully include equine stables and riding arenas, pig housing, store areas, wood, metal and textile manufacturing facilities.



## Cooling

Evaporative cooling systems dissipate heat from the air by the process of the fine mist evaporating; a chemical endothermic process whereby heat energy is taken in during the reaction. Extremely effective at taking heat out of the air, with the end result being evaporated mist and much cooler air, the use of this system allows for greater control over internal climates within animal housing than ventilation alone can provide.

## Humidity Treatment

In addition to providing a cooling effect, the evaporative cooling system can be used to add humidity to dry air, under control, if and when needed in applications where this is important. On any given day, the relative humidity falls as the temperature rises in the middle of the day. When linked to a humidity control system, the evaporative cooling system can be used to effectively maintain a set relative humidity, by adding moisture to the air.

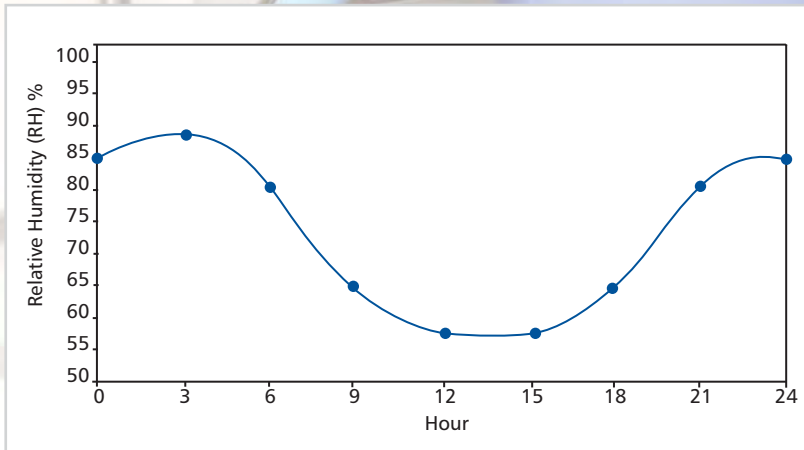


Figure 1

Figure 1 shows the rapid drop in relative humidity throughout the day without any form of evaporative cooling in operation.

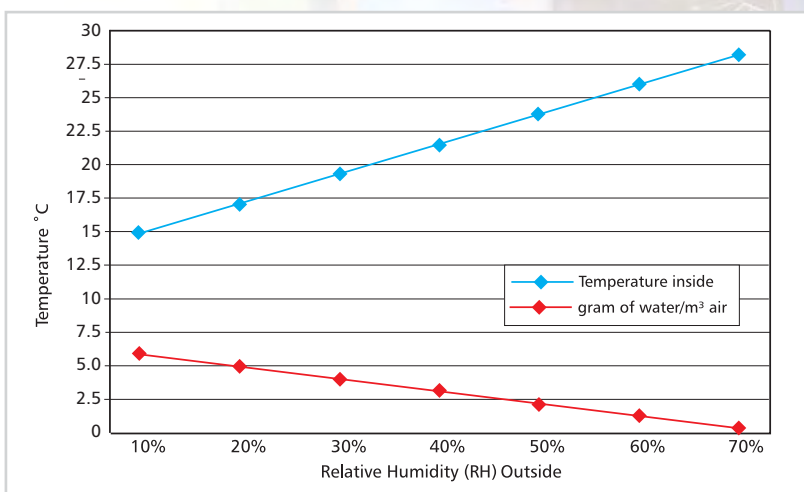


Figure 2

Figure 2 shows the expected temperature drop across various internal temperatures and external relative humidity levels. For example if the internal temperature is 30°C and the external humidity is 50%, by utilising the evaporative cooling system a temperature drop of 5°C could be expected. At 20% external humidity a drop of approximately 10°C, could be expected.

## Soaking & Disinfection

The high pressure system can be used for soaking, of particular use within pig and poultry houses. By switching ventilation systems off inside the empty building, when the system is run continuously it will soak internal surfaces, making cleaning easier and quicker.

## Dust Binding & Odour Suppression

The ultra fine mist effectively collects the dust and odour particles in the air that are too small to be collected by normal water. These are then removed from the building with the aid of the ventilation system. Utilising the system in this capacity is beneficial for the improved respiratory health of both animals and human workers.

## Insect Control

An additional advantage of the evaporative cooling is fly eradication due to the moist air, this is of exceptional benefit in environments such as milking parlours. In poultry housing the system can also be used as an aid to reducing the problem of Red Mite by incorporating appropriate chemicals.

# Specifications

## Nozzles

There are two sizes of the patented nozzle available dependant on the application requirements. Both nozzles disperse super fine mist (10 microns) approximately 5 metres. Nozzles are non-drip in order to prevent any damp patches appearing on the floor areas beneath which could prove detrimental to animals health or pose a safety risk to workers.

**Green** 0.2mm - dispersing 4 litres of water per hour if used constantly.

**Red** 0.3mm - dispersing 6 litres of water per hour if used constantly.

## Pumps

Two pumps are available, the selection of these is dependant on the size of the building which will dictate the number of nozzles required and hence the water-consumption. Both pumps run at high operating pressures of 70-80 Bar. When selecting a pump it is important to consider any additions that may be made to the system at a later date which will increase the levels of water consumption. Pumps are belt driven for ease of service and the speed of the pump can be optimised for the specific application, reducing noise levels and energy consumption.

**Small pump** - 760 litres per hour capacity if used constantly.

**Large pump** - 1260 litres per hour capacity if used constantly.

## Controllers

The system emits the fine mist in short bursts, commonly 30 seconds on and 20 seconds off. This allows time for evaporation to occur and prevents the air becoming oversaturated. These intervals can be adjusted to suit particular requirements on all systems. In addition to this there are three methods of operating the system;

**Timer** - The built in timer can be set to run the system for a dictated period.

**Thermostat** - The system is automated and will switch on when temperatures become too high and will switch off when the optimum is restored, ideal for poultry applications.

**Humidistat** - The system is automated and will switch on when humidity becomes too low, and switch off when the setpoint is reached. Ideal for use in conjunction with a climate computer.

## Water & Energy Consumption

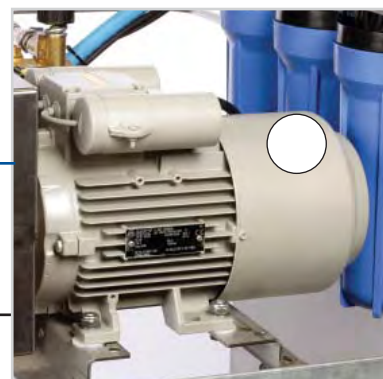
The systems are highly economic with low levels of water and energy consumption which makes them a very cost effective solution for any application. In addition lower temperature levels reduce the energy consumed by fans by running for shorter periods of time or at lower speeds.

## Construction

The durable pipelines are stainless steel to which the nozzles are fixed, normally at 2-4m intervals dependant on the application requirements. Anti-freeze procedures and good maintenance ensure the system remains fully operative all year round when installed in buildings exposed to the elements.

## Flexibility

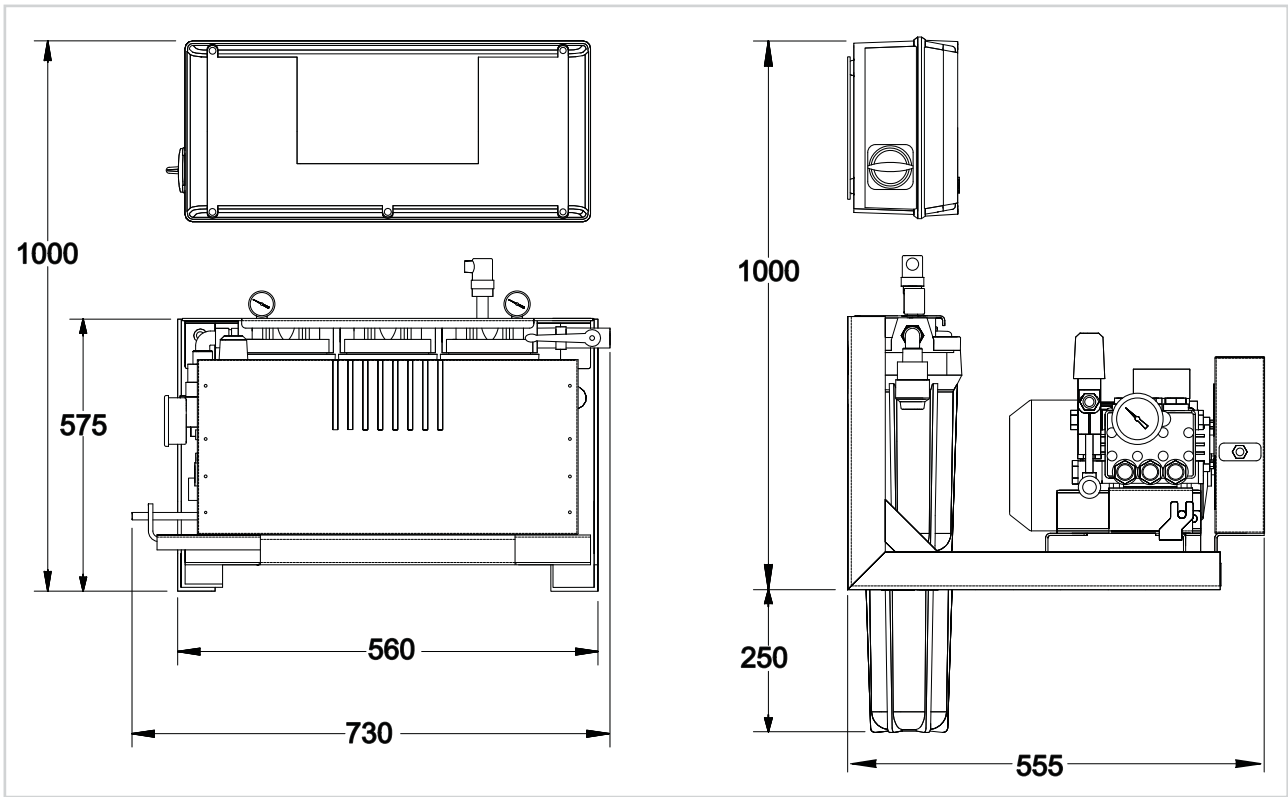
The system is modular and easily adaptable to any size enclosure or building. The quantity of nozzles, length of pipe, and pump size can be specified to suit the particular requirements. In addition installed systems can be increased and added to at later dates as per your building requirements. A single pump is capable of running multiple installations independently via the use of magnetic valves.



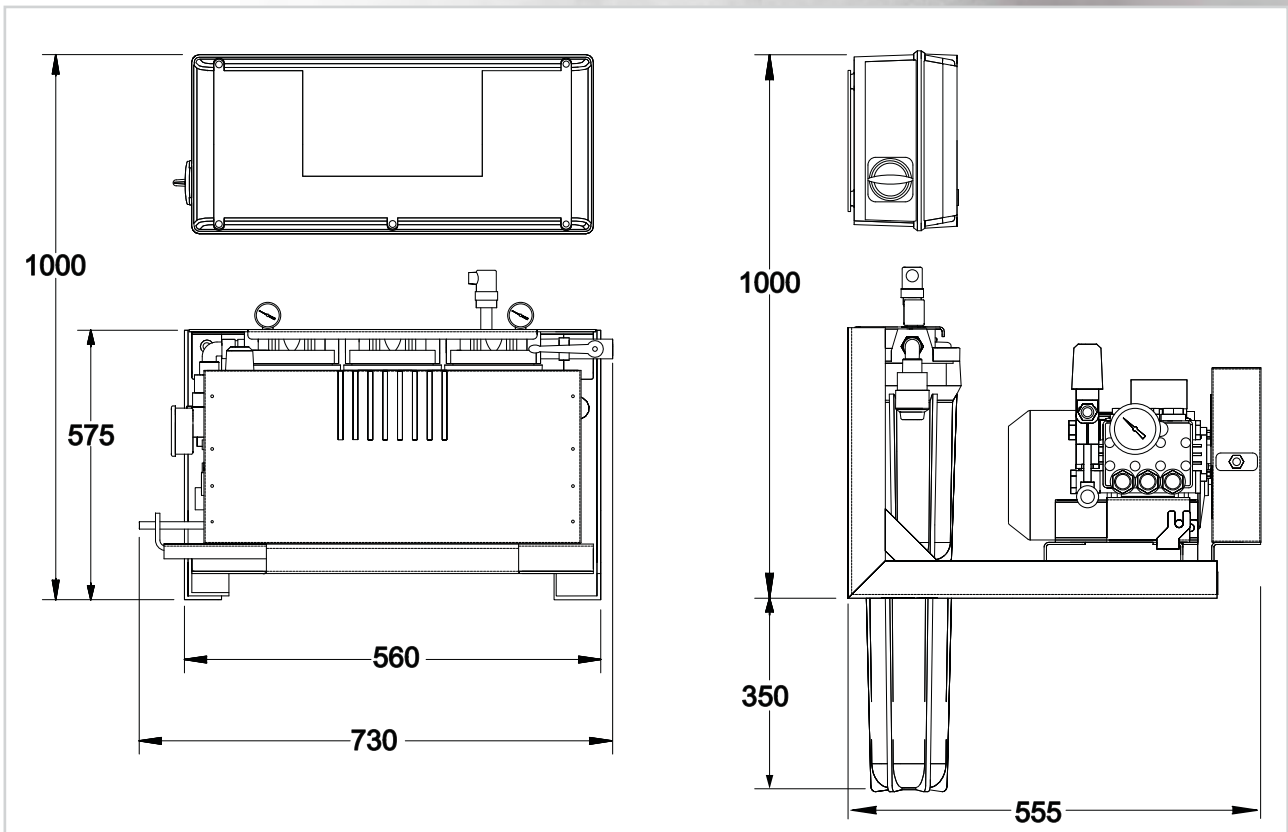
# Dimensions

## ○ Dimensions

### Small Pump



### Large Pump



# Applications



Druids Lodge Dairy Farm, feeding and cubicle housing.

## Dairy Housing

Where additional cooling is required, in excessive heat conditions leading to heat stress in animals, Hydor's Evaporative Cooling System ensures the comfort of your livestock is maintained, thereby retaining normal feed intake patterns.

The system greatly enhances the cooling effect, where work areas, outdoor recreation facilities and animal enclosures can all benefit from the rapid, efficient cooling the system provides, thereby reducing stress and fatigue in animals whilst improving safety and worker productivity.

The added benefit of the fine spray generated by the evaporative cooling system ensures flies and other insects are kept away, an important consideration in milking parlours and the entrance and exit areas of farm buildings. Within holding areas and milking parlours it is imperative cows are kept comfortable in order to achieve the best possible milk yields. Hydor's evaporative cooling system can achieve this with proven success.

Using our high quality, precision misting nozzles, an ultra fine mist is introduced into the environment which interacts with the air to cool, clean and humidify. By using existing climate computers in combination with an evaporative cooling system, this allows humidity to be controlled and optimises the climate.

Cow comfort is imperative for maximising production levels. Lower temperatures and reduced insect infestation improve conditions for the animals, thereby increasing productivity in milk yield and fat percentage. When installed over feeding areas, the animals food intake levels are increased due to more comfortable temperatures, further increasing production levels. An even temperature maintained throughout the building will also reduce bunching and the increased heat levels generated by this.

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## Case Study

Ivy House Dairy Farm, Nottinghamshire, UK

The Hydor evaporative cooling system has been successfully installed at Ivy House farm, who specialise in producing organic milk.

Installed within the innovative 36 bay rotating milking parlour and holding areas, owner Mark Hornbuckle comments "The cooling capacity of the system is excellent. The herd is milking better and is far more comfortable. Moreover, our problem with flies in the parlour has been dramatically reduced."

The system was installed by Hydor as shown in Figure 3, with plans currently in place to extend (as marked in red) to the feeding lines within the cubicle areas as has been done with Druids Lodge Dairy Farm (see opposite photograph).

As well as the Hydor Evaporative Cooling System, the farm has installed eight Hydor 1250mm belt drive air movement fans in the cubicle sheds. These fans are suspended in series along the cubicle shed and their purpose is to blow fresh air through the cubicle shed, capturing any heat and moisture rising from the herd and removing it from the building.

Evaporative Cooling System and Planned Extension.

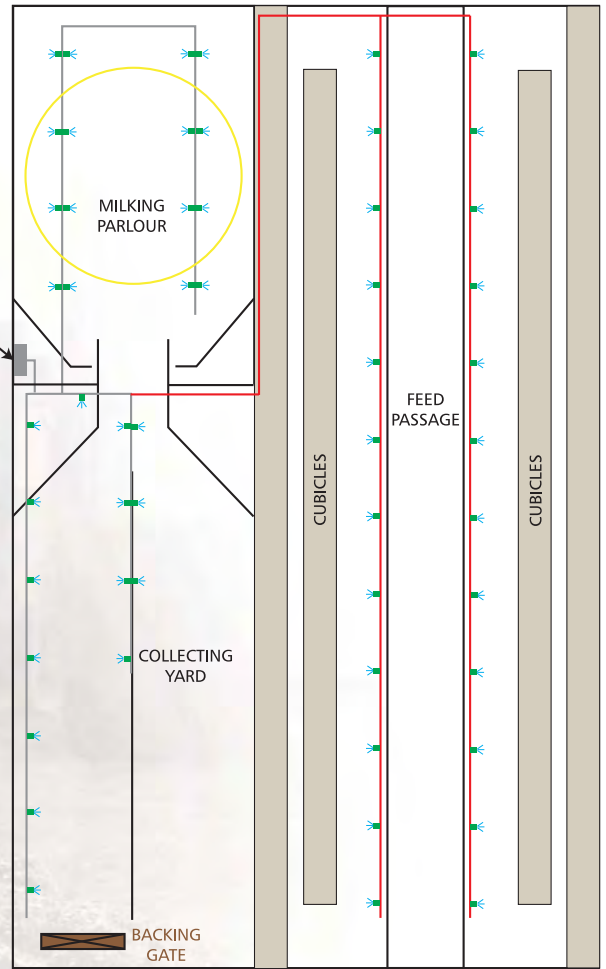


Figure 3.



Ivy House Dairy Farm, Milking Parlour



# Applications

## Poultry Housing

High pressure mist dispersed from a series of nozzles effectively reduces temperatures and controls dust levels. The system can also be run constantly, beneficial for cleaning and disinfection purposes as well as aiding the reduction of Red Mite.

### Summer

During the summer months the heat generated from the birds, in conjunction with the mechanical extract system ensures the mist is evaporated and the air does not become over saturated.

Mechanical forced ventilation will not, and cannot, cool the inside temperature lower than the temperature outside. Therefore on hot summer days with a temperature of 30°C outside, the lowest possible temperature inside your chicken house will be 30°C using only fans to cool. An additional cooling system will be required, in order to lower the temperature further.

The Hydor Evaporative Cooling System has been proven to reduce temperatures by up to 10°C on hot days, potentially reducing mortality rates by up to 25%. Energy usage from fans is also reduced as the temperatures are kept lower, which means the fans run less frequently or at lower speeds. The improved indoor climate also promotes increased feed intake resulting in higher growth rates.

### Winter

During the winter months the system can also be utilised to increase humidity in the air to the desired level, particularly relevant to young birds when the temperature is kept high with the use of heaters. The heating of air dries it and reduces humidity, but with careful control of the system utilising a climate computer, mist can be injected into the shed in 20 second bursts, to restore the humidity levels to the required setting, without reducing the temperature which is maintained by the heaters.

Hydor can supply the controllers which allow the cooling system to be operated by its own unique control panel or as part of a larger building control panel incorporating fans, inlets, winches and heating products.

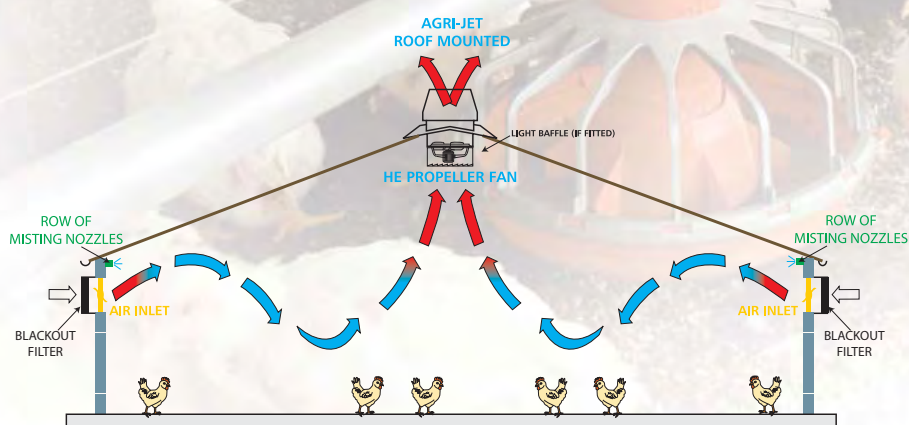


Figure 4.

### Conventional Ventilation incorporating Evaporative Cooling System.

Figure 4 illustrates Hydor Agri-Jet units mounted in the roof with inlets along the two side walls, with misting nozzles positioned internally above each inlet.

Air is drawn in through the inlets, mist from the nozzles cools the air before it falls to the level of the birds, whilst the hot, stale air is extracted via the Agri-Jet roof units.

Air movement generated by both the inlets and the roof mounted fans carry the mist throughout the building, ensuring uniform temperatures are achieved.

# Case Study

## Steanbow Farm, Somerset, UK

Hydor have installed two evaporative cooling systems, one in each of two poultry sheds holding 54,000 birds on Steanbow Farm in Shepton Mallet. The two poultry houses utilise the Hydor 'Pre-Vent' system as illustrated in Figure 5, an additional stage of cooling which is required initially to reduce the higher temperatures the two poultry houses experience during the summer, by being located in a 'sun trap' area of the farm.

In addition to the emergency cooling function; the system has also proven to be extremely useful as a regular stage of cooling by replacing the use of numerous fans, which expend more energy to achieve the same effect. The system is also being put to valuable use to maintain the desired humidity levels in the early part of the crop, when the birds are young.

Owner Mr F Christensen was delighted with the instant results;

"The reduction in excessive temperatures is impressive. Within 5 minutes the temperature had dropped from 30°C to 25°C. We are now able to reduce our energy overheads significantly whilst improving the environment for the birds in high summer."

Hydor 'Pre-Vent' System incorporating Evaporative Cooling System.

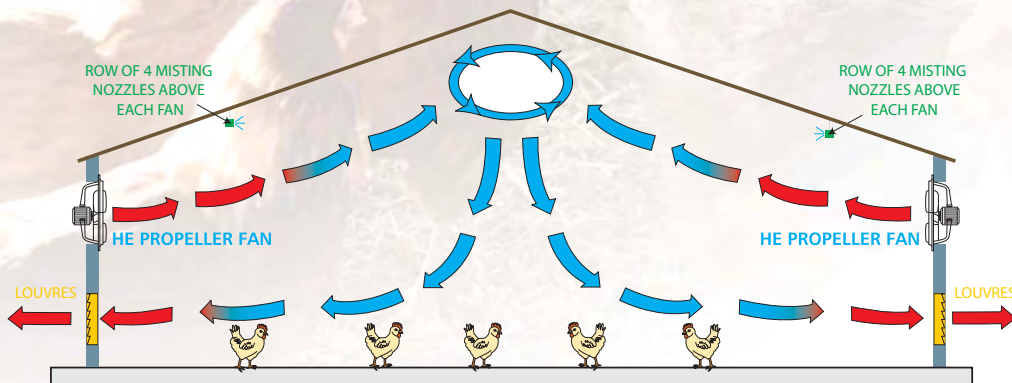


Figure 5.

The Pre-Vent and evaporative cooling system installed at Steanbow Farm (Figure 5) operates slightly differently to conventional ventilation systems as no roof extract units are installed.

Ten fans are installed down each side of the building with louver outlet shutters at low level between each fan. Four nozzles, spaced at 1 metre apart are installed internally from the ceiling above each fan.

Mist is carried with the air from the fans towards the centre of the building, where it meets the heat generated by the birds, evaporates, cooling the air which falls to the level of the birds. The positive pressurisation within the building pushes this across and out through the wall louvres.

Following the success of the evaporative cooling system in these two buildings Mr Christensen is looking to install the system in a further two buildings and is considering the benefits available for dairy housing at Steanbow Farm.

Steanbow Farm Poultry House



# Applications



## Pig Housing

Pigs are sensitive to high temperatures and during summer periods this can have serious consequences for their well-being and productivity.

Whilst most animals sweat to cool themselves, pigs cannot sweat and suffer heat stress at temperatures as low as 23°C. When the temperatures within the building reach 24-26°C the pigs behaviour changes - they take to lying on the cooler floor within their soiling areas as opposed to the straw or sawdust on their laying areas. This behaviour creates added difficulty in mucking out the houses. Temperatures in excess of 27°C carry increased risk of mortality and heat stress in grower / finisher pigs reduces daily feed intake, causing poor feed to gain ratios.

During hot weather, lactating sows eat less causing decreased milk production, lower litter weights, excessive weight loss and breeding problems after weaning. In your breeding herd, heat stress can delay puberty in gilts and reduce fertility in both sows and boars.

By utilising high pressure cooling, the buildings air temperature can be reduced by 5-6°C dependant on the external temperature and relative humidity.

## Dust Binding

In addition to reducing the temperature in summer, the high pressure evaporative cooling system is advantageous in reducing dust levels, particularly at feeding times as well as reducing ammonia fumes and other odours all year round.

## Humidifying

During heating periods or following the arrival of new litters, the system is ideal for achieving and maintaining the optimum humidity levels. Additional applications such as soaking and disinfection of pig housing, reduces cleaning times whilst also creating a safer environment for the pigs.

## Multiple Applications

Highly reliable and flexible for adaption to any pig housing and with construction from stainless steel, the pipes are resistant to acid-corrosion for longevity. The pumps are capable of running various different applications independently, allowing for different pig housing areas to be cooled, moistened or soaked dependant on your requirements.

High pressure evaporative cooling should be regarded as an extra measure to reduce high temperatures and can be implemented alongside various ventilation arrangements successfully. Hydor can supply all fans, inlets, controls and evaporative cooling components to meet your system requirements.



Evaporative Cooling System incorporating Mechanical Roof Extract.

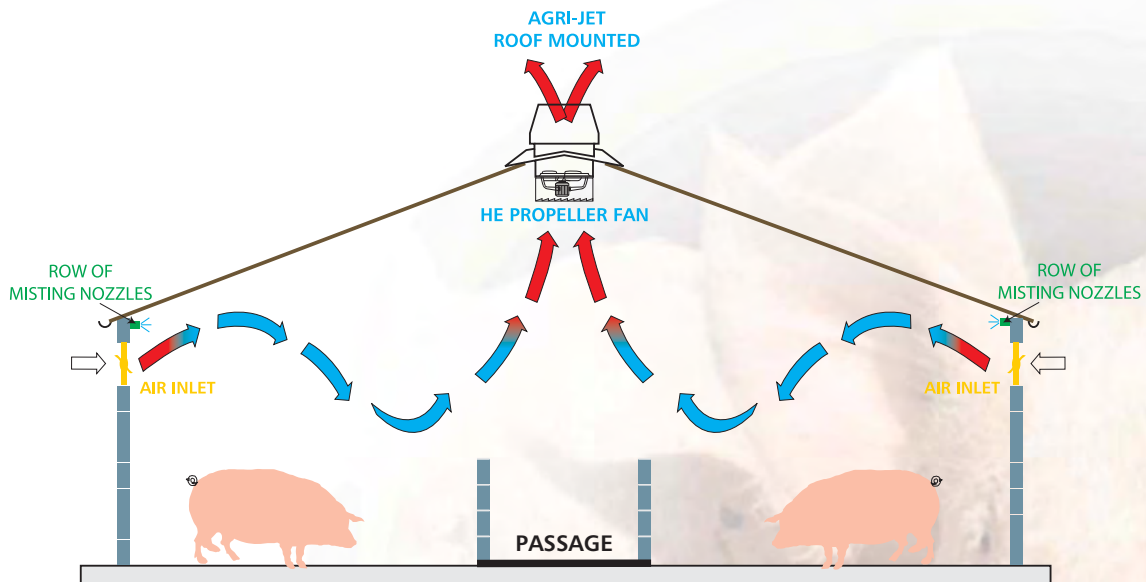


Figure 6.

Figure 6 illustrates Hydor Agri-Jet units mounted in the roof with inlets positioned along the two side walls. Misting nozzles are positioned internally above each inlet.

Air is drawn in through the inlets, mist from the nozzles meets the rising hot air, heated by the warmth generated by the pigs. The mist is evaporated immediately and the internal temperature of the house reduced.

# Applications

## Glasshouses

Utilising an Evaporative Cooling System within glasshouses allows you to obtain additional features to the climate control in the glasshouse by encouraging better growth and cleaner plants.

The system distributes the micron-sized droplets evenly throughout the glasshouse, allowing the humidity in the environment to be easily maintained at the correct level. By using existing climate computers in combination with the evaporative cooling system, the humidity can be controlled to obtain the optimum climate during both day and night.

Alongside controlling humidity, temperature can also be reduced (by cooling) during the day when it may become too hot for the crop in the house. Growth and productivity will benefit from the optimised internal climate.

An evaporative cooling system used within a glasshouse should be combined with osmosis treatment of the water. This will aid reduction of lime content thereby preventing lime deposits appearing on plants and equipment.

Typical Glasshouse Installation Arrangement

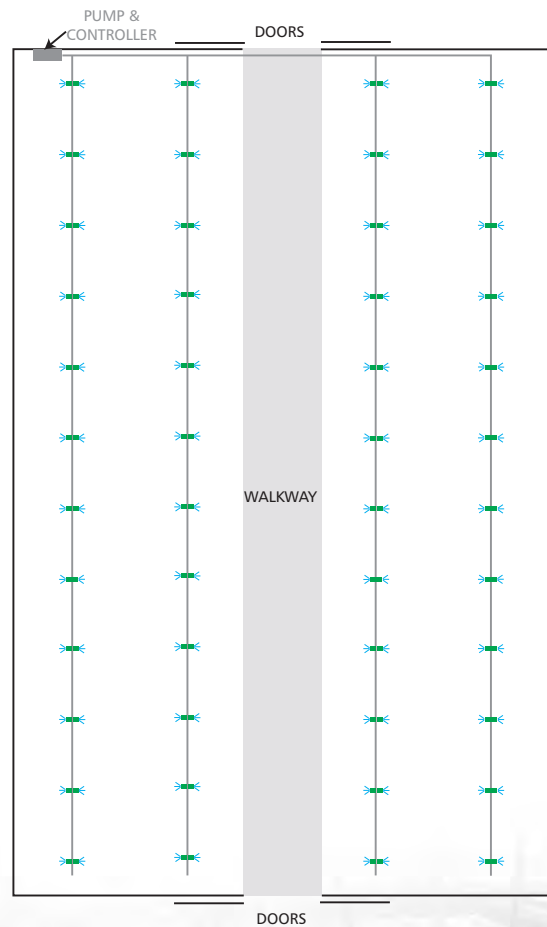


Figure 7.





## Case Study

### Salad Production

Evaporative cooling systems have been installed in four large greenhouses focusing on salad production.

The system in the glasshouses is controlled via a manual timer allowing the 'on' and 'off' time periods to be manually regulated according to the requirements, as dictated by stock levels and age, along with the external environmental climate.

The pipe is mounted directly into the roof construction allowing the fine droplets to be circulated evenly across the building easily by the ventilating fans thereby avoid damp spots (see Figure 7.).

'Back to Back' nozzles are mounted to each length of pipe, this ensures the full width of the glasshouse is covered, (see Figure 8), whilst reducing the amount of piping required and minimising costs.

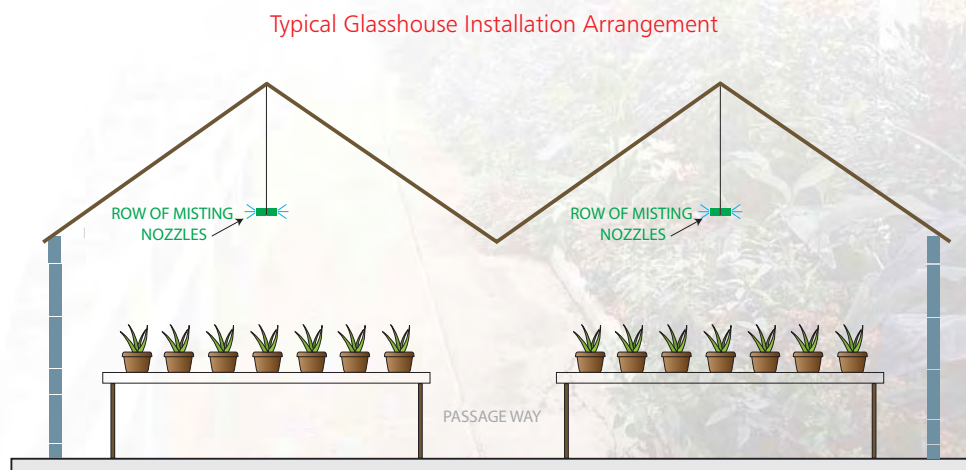


Figure 8.

# Other Applications



## Equine Buildings

Efficient, variable cooling and humidity control whilst controlling dust levels.

The system is capable of reducing temperatures by up to 10°C on hot days. The fine mist dispersed from the series of nozzles effectively reduces ammonia emissions and smells and controls dust levels, of particular benefit in riding arenas. The nozzles are specially designed to be non drip, preventing damp patches on the floor which can cause problems in stable areas where horses rest at ground level.

The heat generated from the horses, in conjunction with the mechanical extract system ensures the mist is evaporated and damp does not evolve.

By using the Hydor evaporative cooling system humidity is reduced and condensation, of particular danger to horses, does not arise.

## Material Recycling Facilities

Dust suppression in such facilities is crucial for both the health and well being of workers and the reduction of fire risk.

The micron-sized droplets attach themselves to dust particles, weighing them down and preventing them from becoming airborne. The Hydor evaporating cooling system achieves this whilst avoiding any damp or moisture which may cause damage to machinery and equipment.

The dust suppression properties of the system are also of significant benefit with saw and paper mills, where large levels of airborne particles can prove detrimental to the health of workers and also carry a high risk of fire.



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## Sewage & Water Treatment Plants

Odour suppression is a fundamental necessity at such sites.

By incorporating appropriate odour neutralisers into the system, the microscopic mist particles provide a safe, economical and effective method of removing odours from manufacturing, industrial and sewage and waste handling sites.

Spread over wide areas, the system can address odours produced at industrial sites such as refineries, rendering plants, waste transfer and recycling stations.



## Storage Facilities

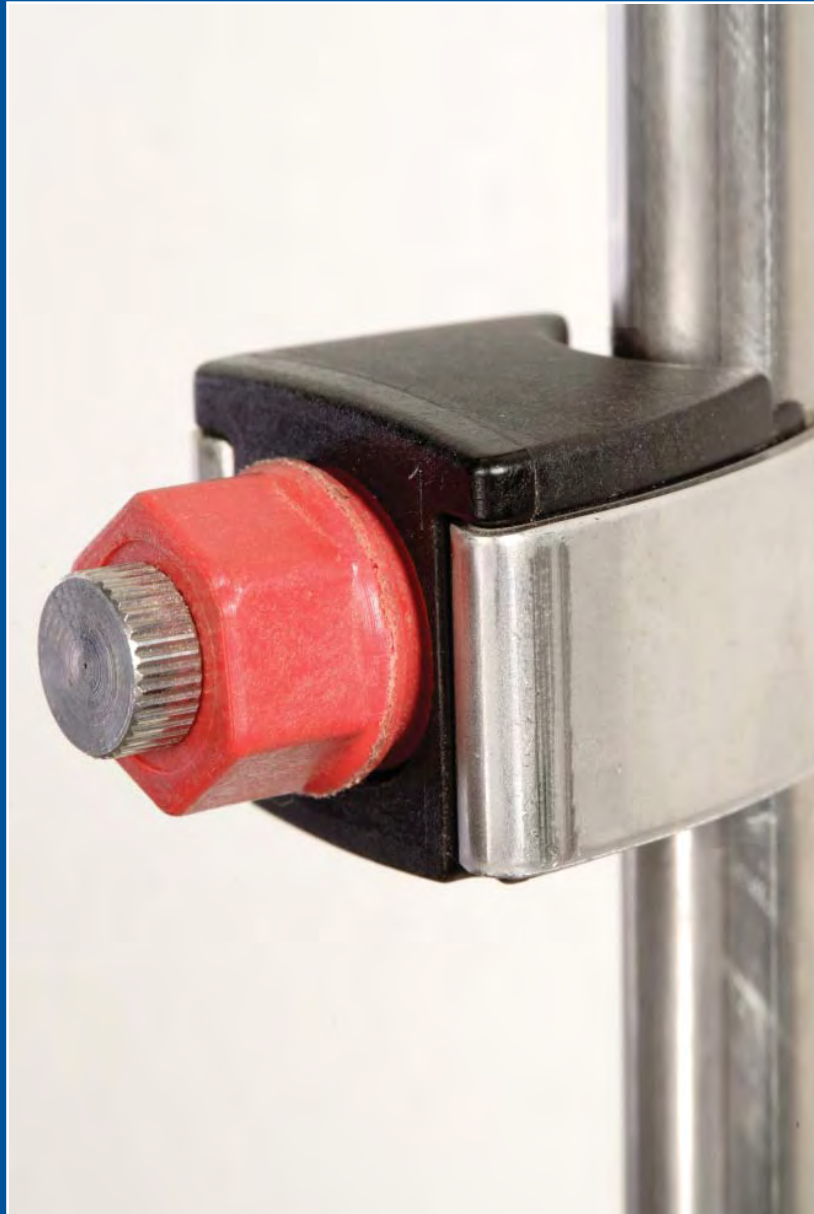
Correct temperature and humidity levels are important in maintaining quality standards of stored products.

Installing conventional air conditioning in warehouses can be expensive, both in equipment and operating costs. Products such as wine and foodstuffs, which are susceptible to temperature and humidity changes, will benefit from the uniform environment the evaporative cooling system can provide.

For storage facilities housing paper and material goods, suppression of static, through the control of humidity levels, is highly beneficial in reducing fire risks.

Within wood storage facilities a maintained level of humidity is essential to prevent problems such as warping and cracking in unprocessed wood which arises where fluctuations in temperature and humidity occur.





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