# Gas Turbine Inlet Cooling

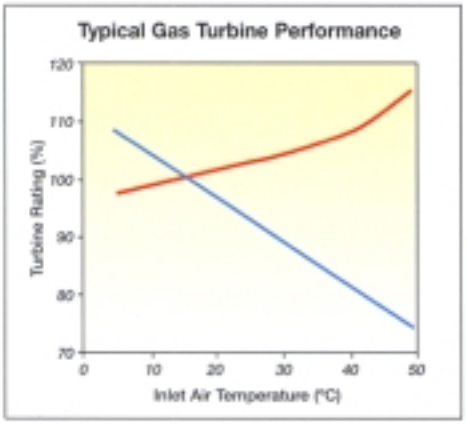
AAF
POWER & INDUSTRIAL

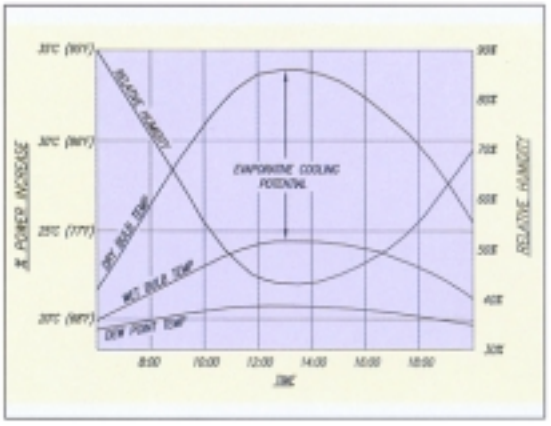
# Global Company · World Class

**With representation in 66 countries World wide, AAF is a major Global Company. The Power & Industrial (π) Division markets the widest range of Air Filtration and Inlet Cooling Products utilising media manufactured on 3 continents.**

The company provides Single Source Supply of Air Filtration and Acoustic Packages as original equipment and as Refit solutions.

Low cost packaged solutions are sourced internationally using in-house specialist engineering centres in the USA, UK and France.



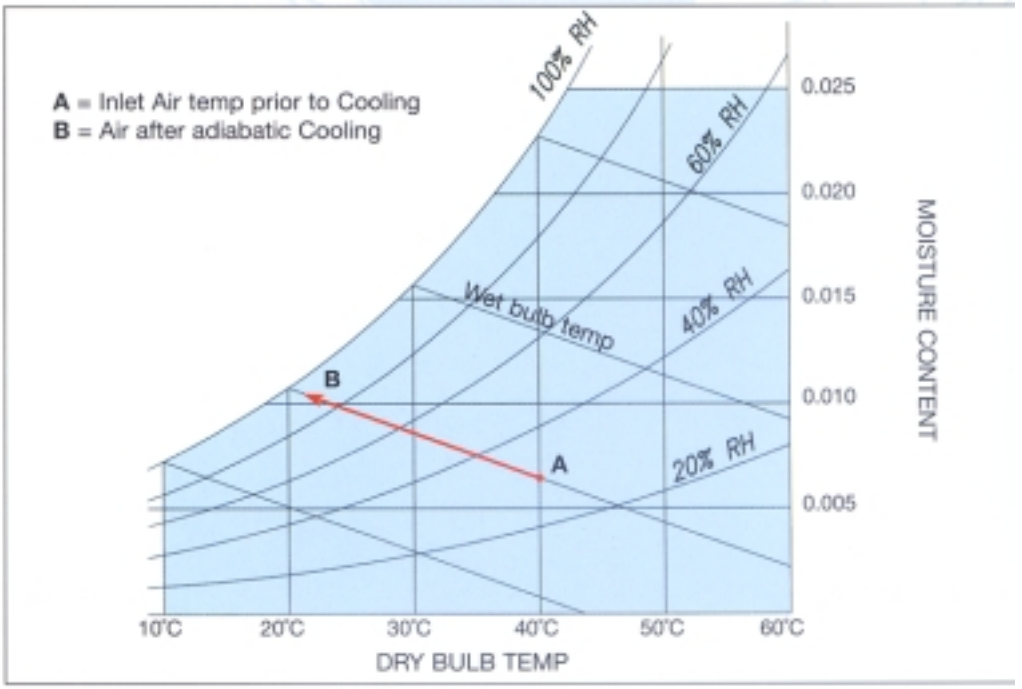

As Gas Turbines ingest a constant volume of air for a given rotational speed, their power output varies each day as the ambient temperature increases. Typically a 0.5% decrease in power can result from a 1° F temp increase and so in hot climates this variation in power output can be significant and costly. The wet bulb temp depression, (which is the difference between the dry bulb and wet bulb temperatures at a given time), shows how much the ambient air temp can be lowered using Evaporative Cooling.

**Inlet Cooling** can provide significant power and thermal efficiency improvements for original equipment and in refit situations. AAF provide the widest choice of products using the ancient techniques of Evaporation or the most modern means of refrigeration. The choice is yours....

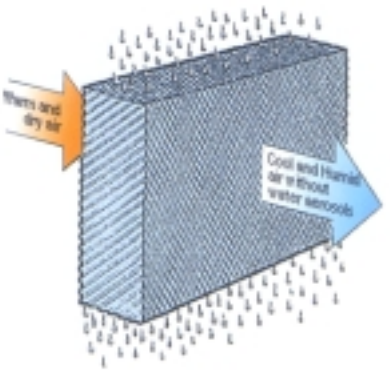
# **Amer-Kool III** Evaporative cooler

When evaporative cooling is applied to combustion air intakes it serves to lower the heat rate and enhance engine efficiency by increasing the air density. Increased air density has the effect of raising specific mass flow rate through the engine, improving output and fuel efficiency. A further effect is the reduction of emissions of oxides of nitrogen. Evaporative coolers are normally mounted downstream of the filter system where the media is protected from the ambient contaminant load resulting in long life and stable pressure loss.

The AMER-Kool III unit has been designed to provide maximum performance with minimum pressure loss. Air to water contact is achieved in a fluted media. The large fluted openings are positioned to create the maximum evaporating interface between the air and wetted surfaces. This permits the AMER-Kool III to operate with minimal pressure loss and negligible water carry-over.




For gas turbine applications, a high velocity mist eliminator is positioned on the downstream side of the media to remove any delinquent water droplets.

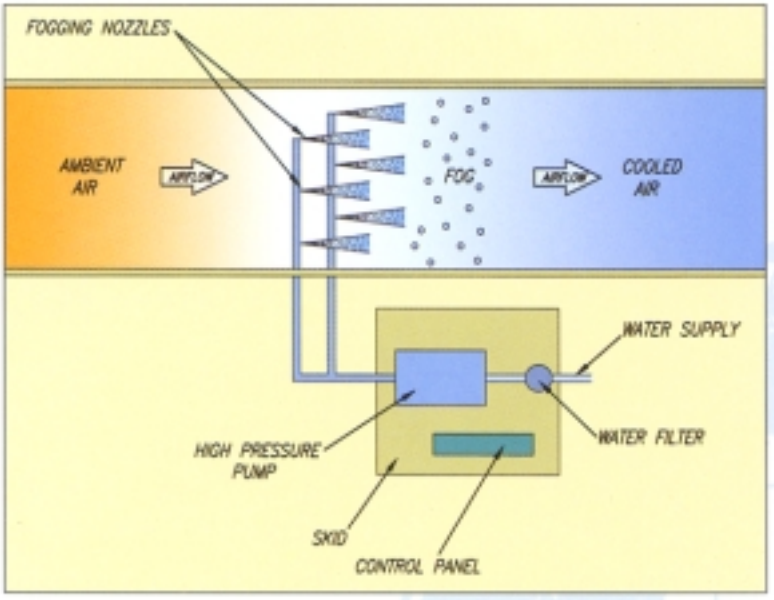


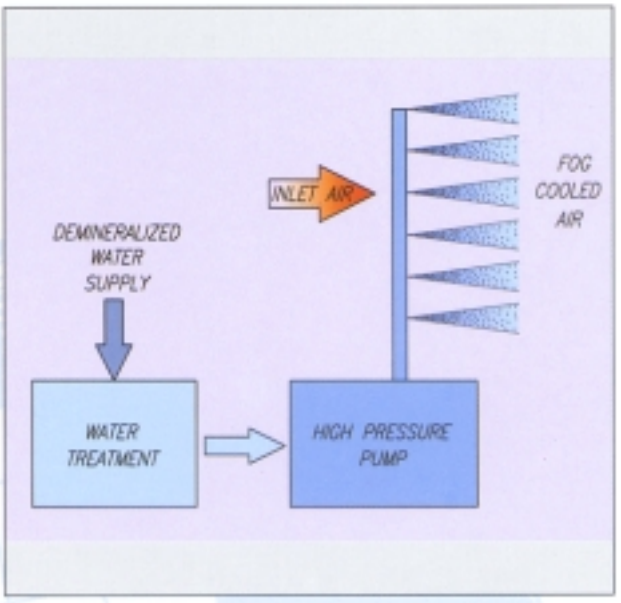
# **Evaporative Cooling** by Fogging

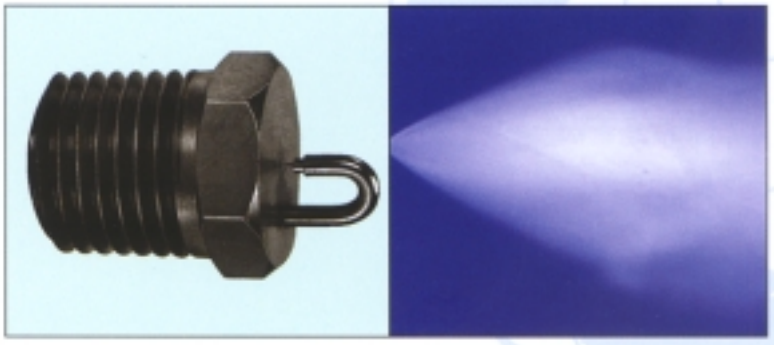
The basic Concept of the fogging system is to spray atomised water under high pressure (70 to 200 bar) into an airstream. The AAF high pressure spray nozzles are designed to generate very small fog droplets. Droplets of approximately 10 microns (µm) diameter are desired as they have a faster evaporation rate than larger sizes.

In general, a Gas Turbine operator shall experience most power reduction towards midday and in the early afternoon (as shown graphically) although the actual situation is that the power fall off will be gradual through each day. Fogging systems can be provided with modulated control systems so that the water spray is introduced in stages. The modulation is achieved completely automatically with the ambient temperature and relative humidity continuously assessed and the pump and valve actuators controlled by this continuous measurement process.

- Fog cooling can achieve 100% of adiabatic cooling.
- Overspray inter-cooling can achieve significant additional power increase
- Ideal Refit potential with minimal impact on existing structure/arrangement
- Minimal installation downtime
- Low capital cost and fast payback time
- Minimal parasitic losses
- Insignificant pressure drop



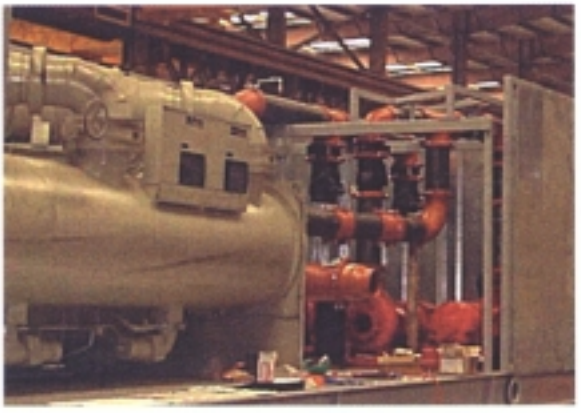



Fogging systems offer a very small pressure drop to the Gas Turbine. The nozzle array and manifold is easily installed as a refit with the water control and weather centre generally located adjacent to the air filter package. The AAF high-pressure system employs Stainless Steel throughout for long life and minimum maintenance. This includes spray nozzles, pumps, pipe-work and fittings.

# Mechanical Chillers by AAF INTERNATIONAL | McQuay Air Conditioning

## Single Source Supply

AAF in conjunction with its sister company McQuay, market a full range of Refrigeration systems including Mechanical and Absorption Chillers. Inlet air is normally cooled by passing it through a finned coil (of tubes) and the air temperature must not be less than 5°C (41°F) to avoid ice formation on the coil. Refrigeration will always provide the design inlet temperature regardless of the ambient conditions, unlike the Evaporative systems which lose effectiveness in high humidity conditions.



**Mechanical Chillers**

Refrigerant vapour is compressed using a screw, reciprocating or centrifugal compressor and after compression, the vapour passes through a condenser. The condensed vapour is then expanded to provide the cooling effect. The evaporator chills the cooling water which is circulated to the Gas Turbine inlet cooling coils.

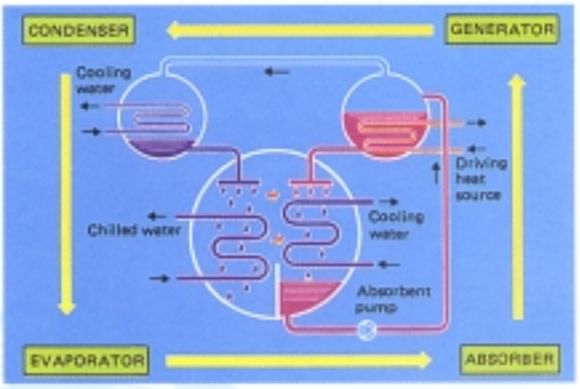
Either Ammonia or Chlorofluorocarbons (CFC) can be used as the refrigerant.

AAF-McQuay market an Ammonia Chiller with direct chilling of the air without the chilled water circuit and the company also supplies an HFC-134a product which has a chilled water secondary circuit.

## Absorption Chillers

Absorption systems typically use lithium-bromide (Li-Br) as the absorber with water acting as the refrigerant. They can be single or double effect and can be mechanically or thermally driven.

The basic principle is that water (refrigerant) is passed over a chilled water coil in a vessel at low pressure (6.5mmHg). As the Li-Br chillers operate at sub-atmospheric pressure the Evaporator cannot be placed directly in the GT air path.




The evaporation of the refrigerant water at 5°C (41°F) removes heat from the water in the coil and Li-Br is introduced to absorb the vaporised refrigerant. The resultant diluted Li-Br solution is drawn from the vessel and heated by the Gas Turbine hot gas exhaust. As a result of heating, the absorbed refrigerant is released as a vapour and Li-Br is re-concentrated for further use. The vaporised refrigerant is then cooled in a condenser and reused as the liquid refrigerant

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**AAF also represented in 66 countries globally.**