GAS TURBINE
INLET COOLING

GLOBAL COMPANY • WORLD CLASS

With representation in 66 countries worldwide, AAF is a major
global company. The Power & Industrial Division markets the
widest range of air filtration and inlet cooling products utilizing
media manufactured on three continents.

The company provides single source supply of air filtration and
acoustic packages as original equipment and as retrofit solutions.

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

Inlet cooling can provide significant power and thermal efficiency
improvements for original equipment and in retrofit situations.
AAF provides the widest choice of products using the time-tested
techniques of evaporation or the most modern means of
refrigeration.

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 temperature increase, and in hot
climates this variation in power output can be significant and
costly. The wet bulb temperature depression (which is the
difference between the dry bulb and wet bulb temperatures at a
given time) shows how much the ambient air temperature can be
lowered using evaporative cooling.

<table>
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<th>Inlet Air Temperature (°C)</th>
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<tr>
<td>0</td>
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<td>70</td>
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Typical Gas Turbine Performance

AAF Headquarters, Louisville, KY
AMER-Kool III EVAPORATIVE COOLER

When evaporative cooling is applied to combustion air intakes, it serves to lower the heat 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 carryover.

EVAPORATIVE COOLING BY FOGGING

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

In general, a gas turbine operator shall experience most power reduction towards midday and in the early afternoon, 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.

The basic concept of the fogging system is to spray atomized 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.
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 center 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.

**CHILLERS**

**Single Source Supply**

AAF, in conjunction with its sister company McQuay, markets 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 vapor is compressed using a screw, reciprocating, or centrifugal compressor. After compression, the vapor passes through a condenser. The condensed vapor 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 HFC-134a can be used as the refrigerant.

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