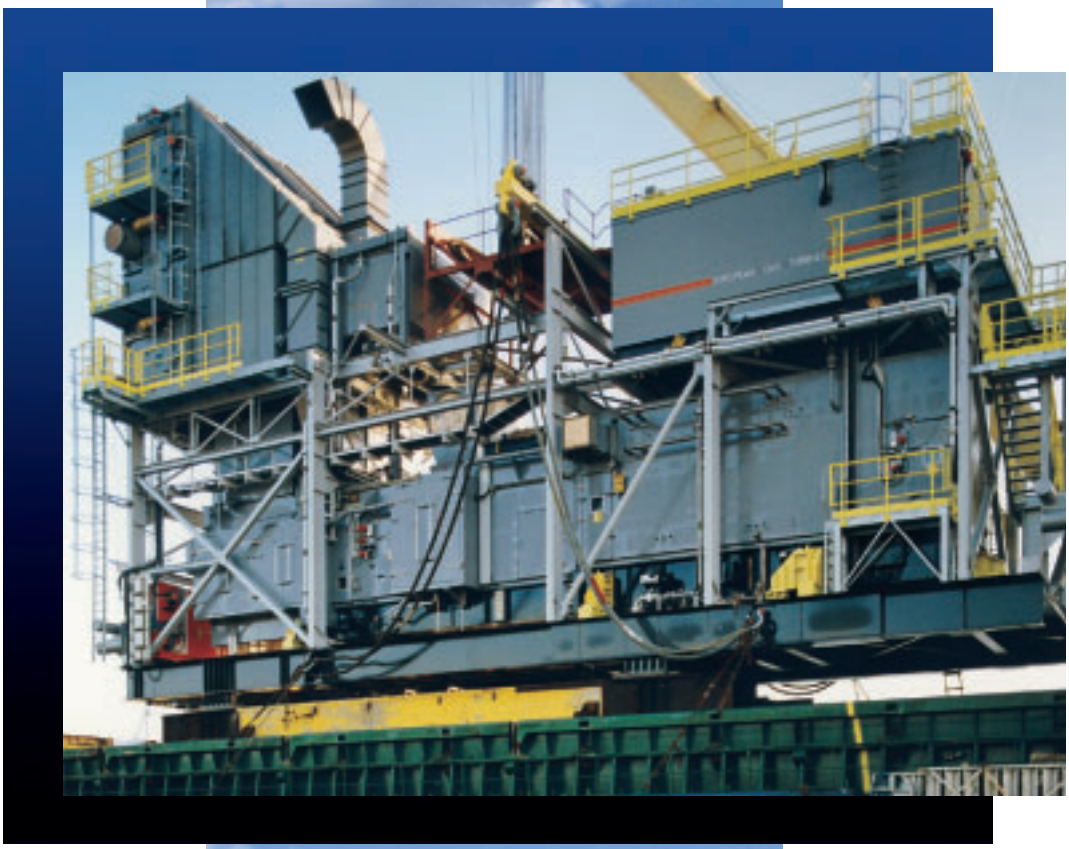
POWER & INDUSTRIAL GAS TURBINE INLET COOLING



BETTER AIR IS OUR BUSINESS®

AAF®
POWER & INDUSTRIAL

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.

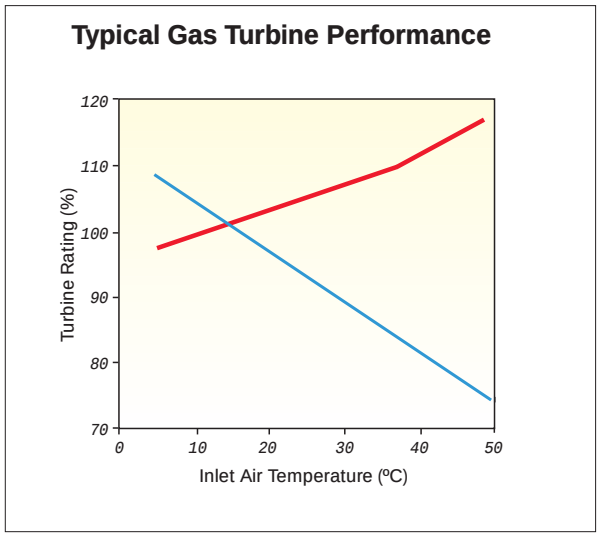
The company provides single source supply of air filtration and acoustic packages as original equipment and as retrofit solutions.

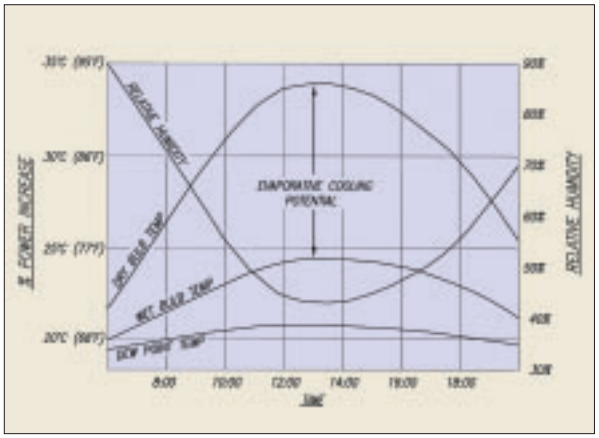
Low cost packaged solutions are sourced internationally using in-house specialist engineering centers in the USA, UK, and France.

AAF Headquarters, Louisville, KY

INLET COOLING

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.



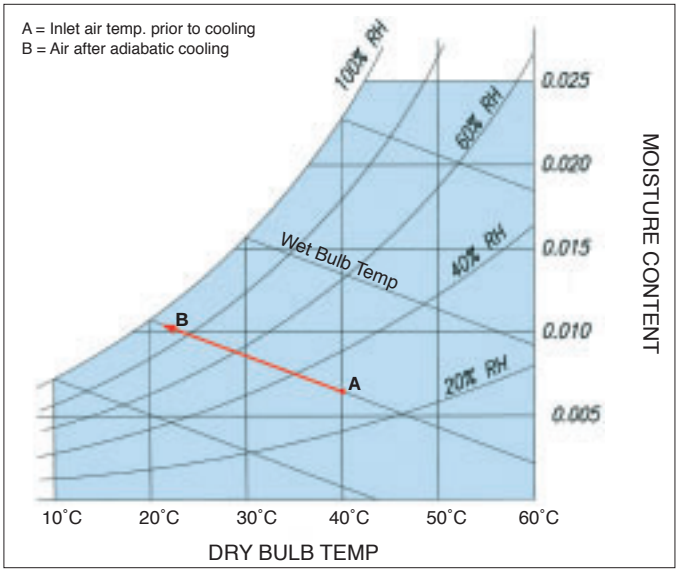


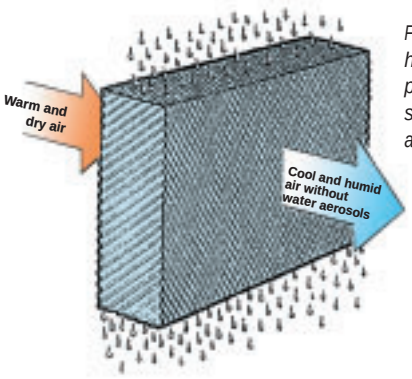
As gas turbines ingest a constant volume of air for a given rotational speed, their power output varies each day as the ambient temperature increases. Typically a 0.5% decrease in power can result from a 1˚F temperature increase, and in hot climates this variation in power output can be significant and 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.

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 fluged 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.





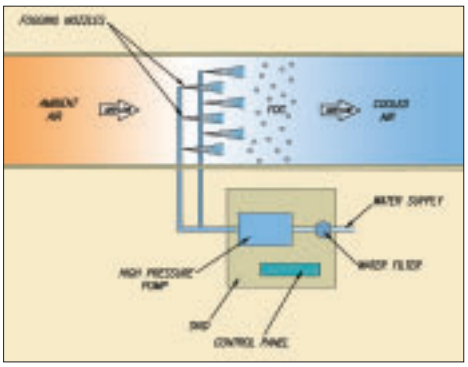
For gas turbine applications, a high velocity mist eliminator is positioned on the downstream side of the media to remove any delinquent water droplets.

EVAPORATIVE COOLING BY FOGGING

- ***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***

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.

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.



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.

Chiller installed in AAF enclosure

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.

AAF POWER & INDUSTRIAL
10300 ORMSBY PARK PL STE 600
LOUISVILLE KY 40223-6169
P O BOX 35690
LOUISVILLE KY 40232-5690
www.aafintl.com

For Additional Information Call
888.AAF.3596
FAX 502.637.0147

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