

Increase Turbine Output

Gas Turbine Inlet Cooling



AMCO GAS TURBINE DIRECT SPRAY INLET COOLING

AMCO provides extensive engineering, manufacturing, and application knowledge of Inlet direct spray cooling systems for the gas turbine industry.

AMCO has thousands of high-pressure systems in a variety of industrial applications and is a world leader in the industry.

The AMCO Direct Spray Inlet Cooling System consists of one or more positive displacement

pumps that pressurize demineralized water to 3,000 psi. The pressurized water is fed into a series of seamless stainless steel headers connected to stainless steel nozzle manifolds, typically located immediately downstream of the high efficiency filters.

Specialized AMCO nozzles atomize the pressured water into ultra-fine droplets that evaporate quickly and efficiently even in the most humid conditions.

ADVANTAGES OF AMCO DIRECT SPRAY INLET COOLING

100% Evaporation Efficiency

Lowers inlet air to wet bulb temperature - maximizes power output

Easy to Install

Quick to install in existing inlets. Can be installed during an outage.

Low Capital Cost

Capital cost per KW generated is lowest of any power augmentation method on the market.

Low Inlet Pressure Drop

Close to zero as compared to 0.5 inch of water across media coolers and 1.0 inch of water across cooling coils.

Efficient and Durable

System operates at 3,000 psi generating the finest droplets possible. Skid and nozzle arrays made from high performance standards.

Performance

Delivers optimal power gains by tracking gradual changes in ambient temperatures through the use of multiple stages of flow.

It is a fact that turbine output increases when the mass-flow to the compressor increases as shown (Table 1). Since cooler air is denser, it provides more mass-flow.

Turbine output, depending on ambient conditions, can increase up to 20% or more.

AMCO Direct Spray Cooling is a proven, low capital method of cooling gas turbine inlet air that results in lowered operating and maintenance costs.

Quick return on investment.

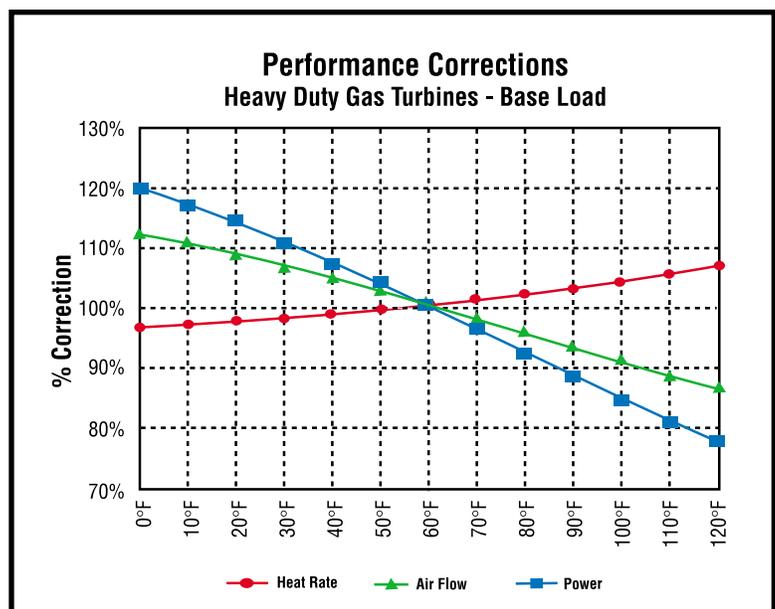


Table 1

AMCO "SWIRL JET" NOZZLE

- Higher nozzle flow - fewer nozzles required
- 90% droplet mass is less than 20 microns (Table 2)
- Smaller droplets - better evaporation
- Durable design - no impaction pin
- Safety lock wired to the manifold using aircraft industry standard locking methods
- Nozzle adapters are attached to seamless 316L SS tubing via a full penetration TIG weld in accordance with ANSI-B31.1 standards



Swirljet Nozzle
Droplet Size Distribution

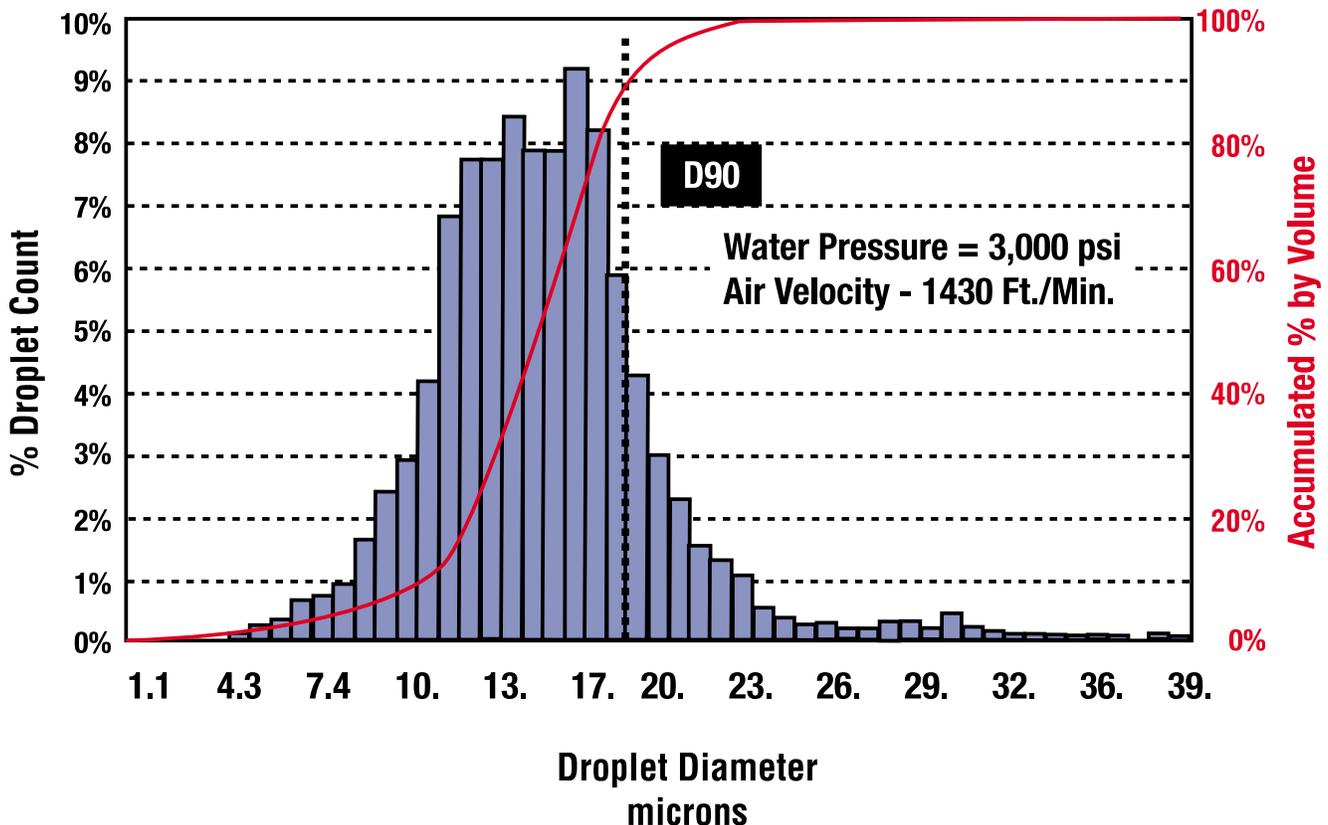


Table 2

AMCO - SIZING YOUR SYSTEM

EXAMPLE: Moisture (GPM) required to lower inlet temperature from:

Temp_{DB}=110°F to Temp_{WB}=70°F with a

Turbine Air Flow=745,388 ft³/min

Formula: See Psychrometrics (Table 3)

$$\text{GPM} = \frac{(745,388 \text{ ft}^3/\text{min})(64 \text{ grains/lb. of dry air})}{(7000 \text{ grains/lb. of water})(13.75 \text{ ft}^3/\text{lb. of dry air})(8.3 \text{ lbs/gallon})}$$

lbs. of moisture/hr required=59.7GPM \approx 60GPM

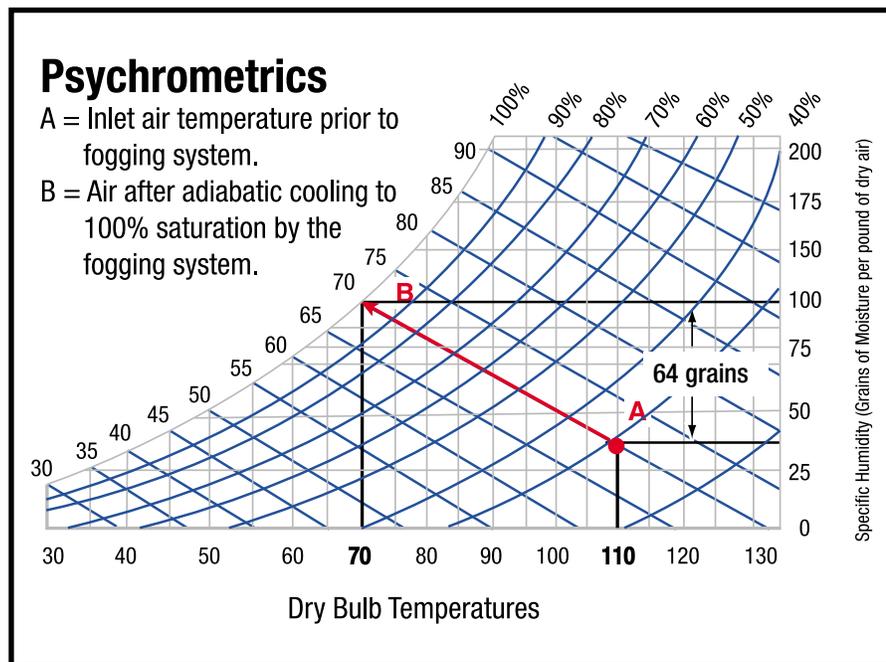


Table 3

Example continued on following page.
See Table 4-Table 5+Figure 1- Figure 2

ACTUAL SYSTEM SIZING IS DEFINED BY SITE -
SPECIFIC CLIMATE CONDITIONS AND GAS TURBINE INLET AIRFLOW

AMCO HIGH PRESSURE SKID AND INLET/NOZZLE ARRAY

The AMCO direct spray inlet cooling system is the pump and control skid, and inlet nozzle array engineered to meet or exceed the highest industry standards. In the example the AMCO skid is providing 60GPM with (6) cooling zones, (32) nozzle lines, allowing (33) separate stages of cooling at increments of 1.3°F (Fig 1- Table 4-Table 5)

High Pressure Skid



Spray Zone Flow Table

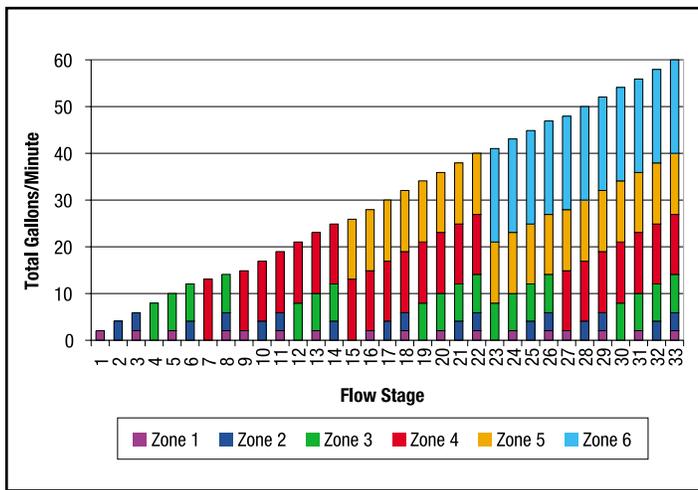
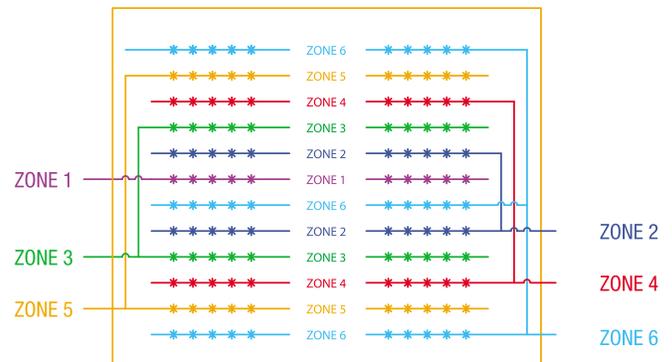


Table 4

Nozzle Array



NOTE: ZONES SHOWN SCHEMATICALLY (ACTUAL NUMBER OF TUBES NOT SHOWN)

Figure 1

Cooling Increment Table

Zone Flow at 110°F, 70°F T _{wb}					
40°F Cooling					
Zone	Lines	Nozzle	%Flow	GPM	Cooling
1	1	29	3.3%	2	1.3°F
2	2	58	6.6%	4	2.6°F
3	4	114	13.3%	8	5.3°F
4	7	186	21.7%	13	8.7°F
5	7	186	21.7%	13	8.7°F
6	11	286	33.4%	20	13.4°F

Flow to be provided in 33 stages, allowing cooling increments of ~1.3°F

Table 5

Inlet Side View

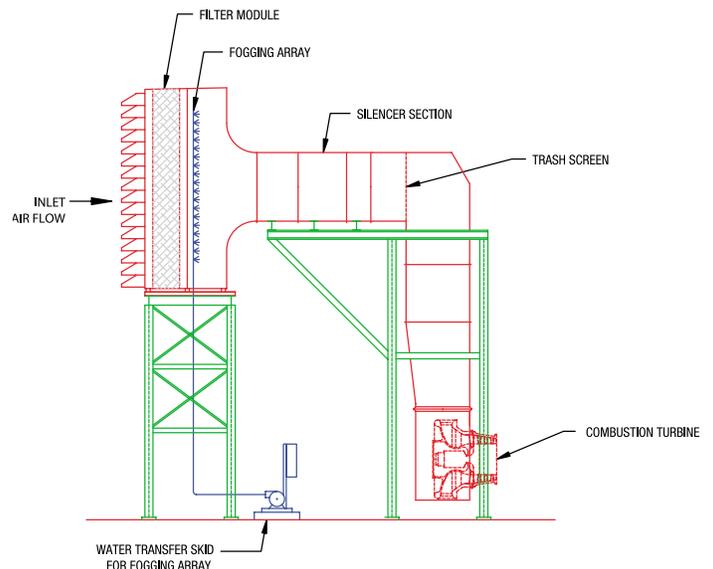


Figure 2

AMCO SYSTEM CONTROLS

Control of the inlet coolers can be accomplished with one of three methods:

- *Personal computer (PC)*
- *Programmable logic controller (PLC)*
- *Direct programming into a plant digital control system (DCS)*

A typical AMCO control system delivers precise cooling control with typical increments of 1°F with PLC logic managing multiple cooling zones.

Each zone consists of one or more nozzle manifold lines being opened. Optimum cooling is achieved with an algorithm that selects the needed flow stage of one or more zones.

Fig 3 and Fig 4 below represent (2) of many screens available on the user-friendly operator interface panels to monitor system performance and perform system diagnostics.

Control - Panel View - Operator Interface Screens

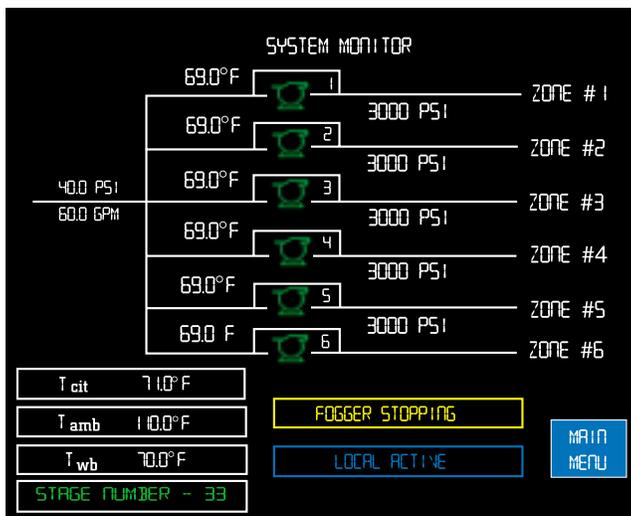


Figure 3

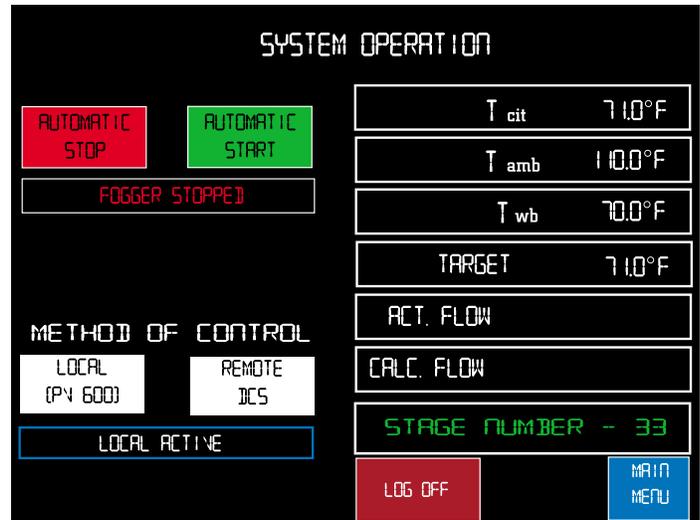
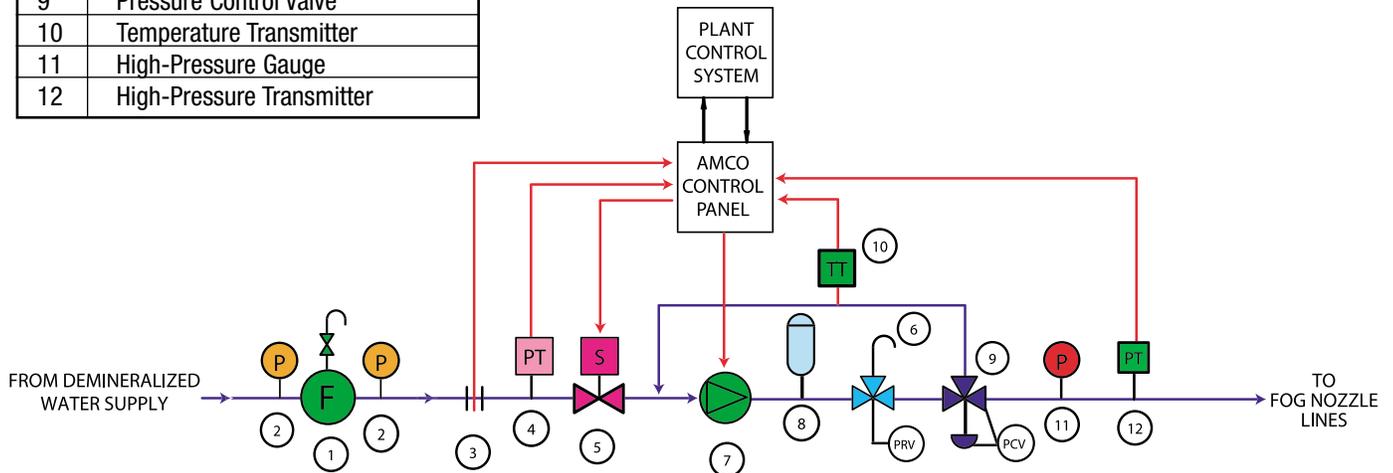


Figure 4

TYPICAL PIPING AND INSTRUMENTATION DIAGRAM

No.	Description
1	Filter
2	Low-Pressure Gauge
3	Flow Meter/Transmitter
4	Low-Pressure Transmitter
5	Low-Pressure Solenoid Valve
6	Pressure Relief Valve
7	High-Pressure Pump
8	Pulsation Dampener
9	Pressure Control Valve
10	Temperature Transmitter
11	High-Pressure Gauge
12	High-Pressure Transmitter



AMCO AUXILIARY PRODUCTS FOR THE GAS TURBINE INDUSTRY

- Enclosures
- Inlet filter houses
- Mist eliminators
- Water forwarding skids
- Water purification systems
- Evaporative coolers
- Water wash systems
- Direct evaporative cooling for heat exchangers
- Control Panels

Contact us for more information regarding the above products.

800.948.5540

ABOUT AMCO

American Moistening Company (AMCO) was founded in 1888 in Providence, Rhode Island, to service the air handling and humidifying needs of the textile industry. In 1929, it relocated to North Carolina to follow the movement of the textile industry to the southeast. In the early years, AMCO served the textile industry using compressed air atomization of water and conventional air washers.

In the 1970's, AMCO expanded to meet the needs of new industries. These markets demanded a more economical means of humidifying process air. In response, American Moistening Company introduced its direct spray, high-pressure water system. Since the introduction of its high-pressure system, AMCO has installed thousands of systems in the textile, woodworking, printing, automotive, and the industrial HVAC markets.

AMCO has applied its knowledge and technical know-how of high-pressure systems to the gas turbine inlet cooling market. AMCO is committed to providing the same high standards of engineering competency and excellence that it has been providing for years.

AMCO is capable and anxious to assist you with your inlet cooling requirements. Let our Sales Engineers show you the economic benefits of AMCO Direct Spray Cooling. Increase your power output by up to 20% or more with minimal outage and low capital cost.



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