



IGTI 2011

June 8th, 2011

EVAPORATIVE COOLING FOGGING TECHNOLOGY

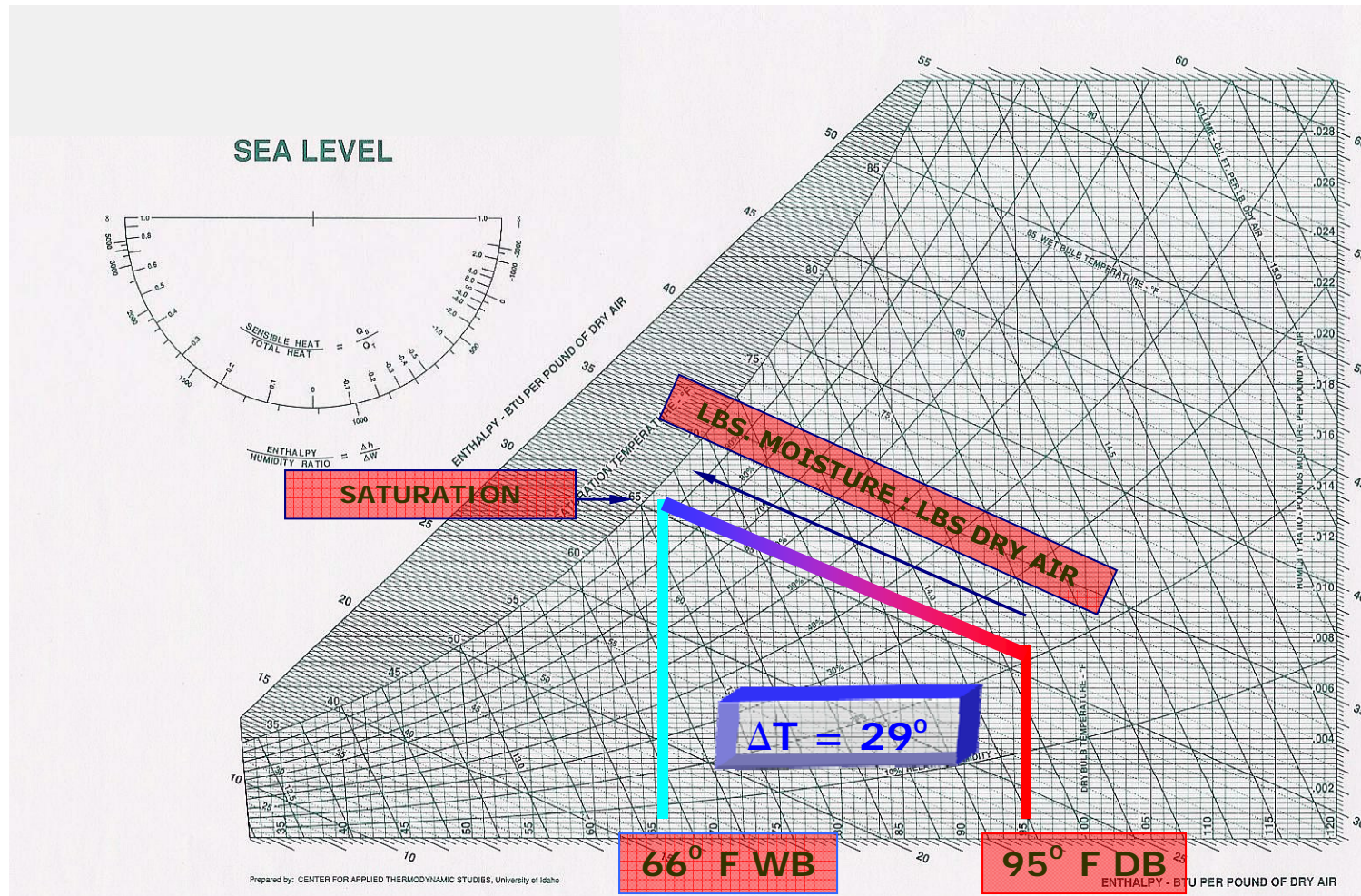
Can cooling compressor inlet air to within 1°
F of ambient wet bulb temperature at wet
bulb temperatures > 50° F.

CT Power Increase 4% to 12%

Lead Time 30 – 45 days

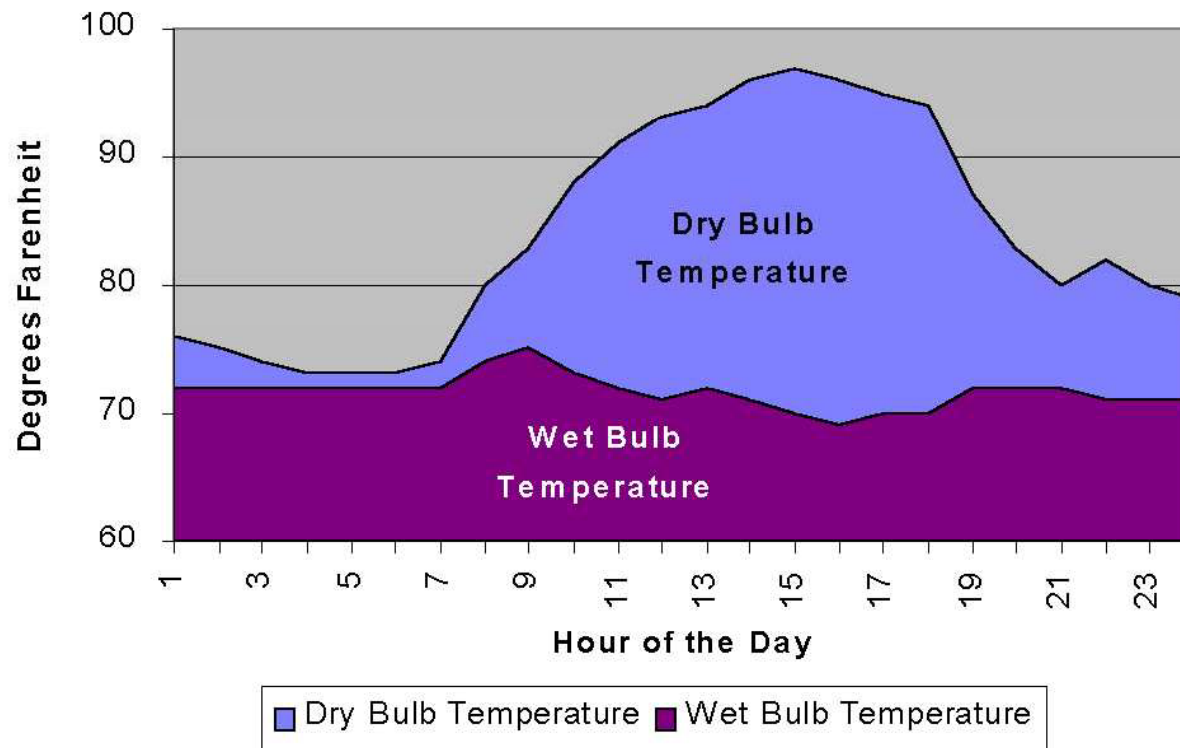
Installed Cost \$20 - \$60 / kW

PSYCHROMETRIC ANALYSIS



TEMPERATURE CHARACTERISTICS

A Hot Day In Houston



Inlet Fogging Systems



Inlet configurations can promote droplet growth

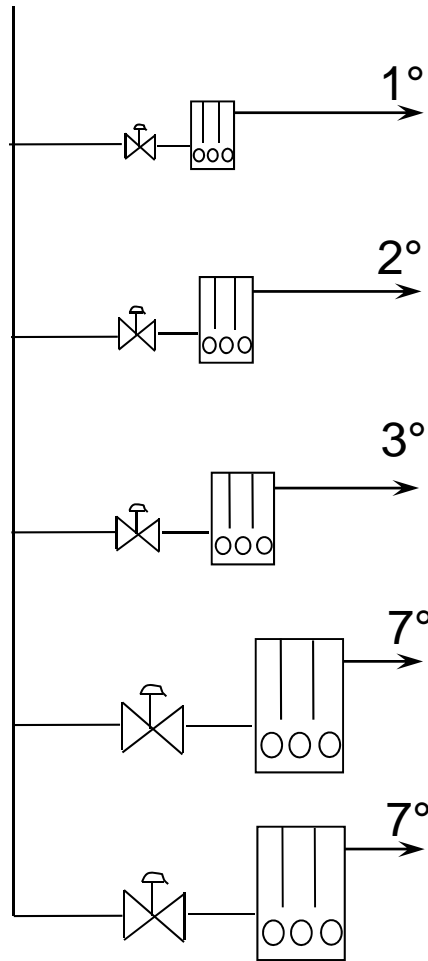
Large droplets have resulted in excessive blade erosion –
greatly exceeding wet compression experience

Fogging systems must be carefully integrated with the inlet
air system

System Requirements

- Fogging Systems use Demin Water
- Foggers use 1.5 kW or less of power per gallon of water used
- A typical 7FA requiring 21F of cooling uses 30 GPM of water
- Droplet sizes of 20 micron for a D90 are desired
- Air side pressure loss less than 0.1 in wc
- The heat rate is improved by about 4% for a 21F system

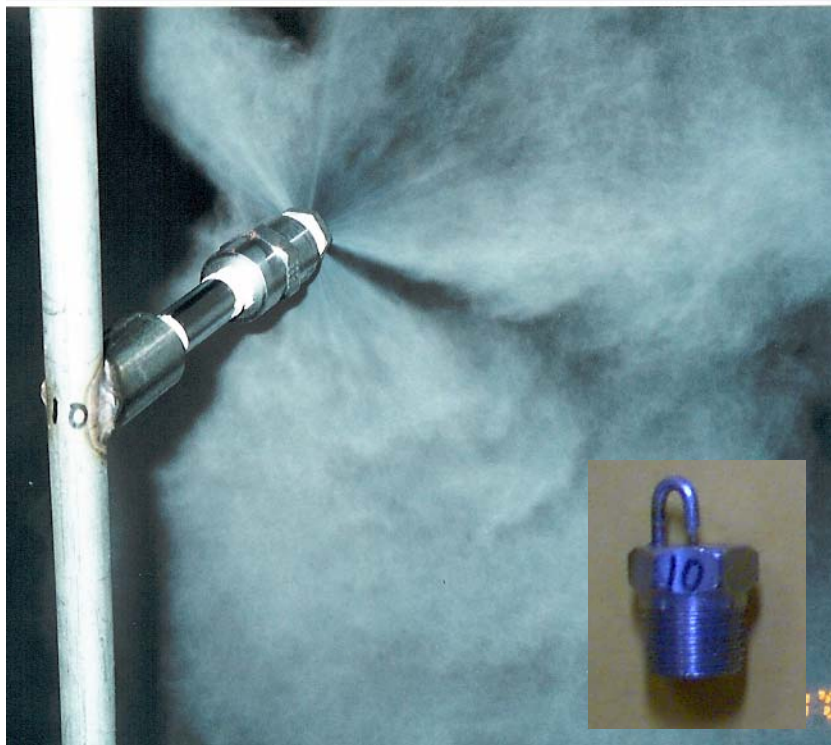
First Generation Fogging Systems



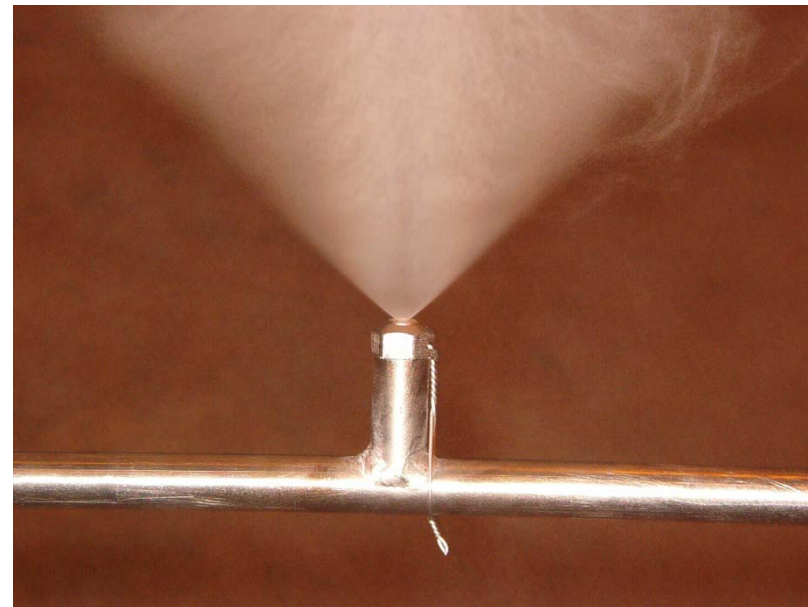
- Pumps dedicated to specific cooling zones –
 - Excessive cycling
 - Loss of cooling increment during pump maintenance
- Pumps operated near design conditions
 - Seal life reduced
- Standard component packaging
 - Excessive vibration
- Impact-pin nozzles
 - Droplet size control & maintenance

Nozzle Development

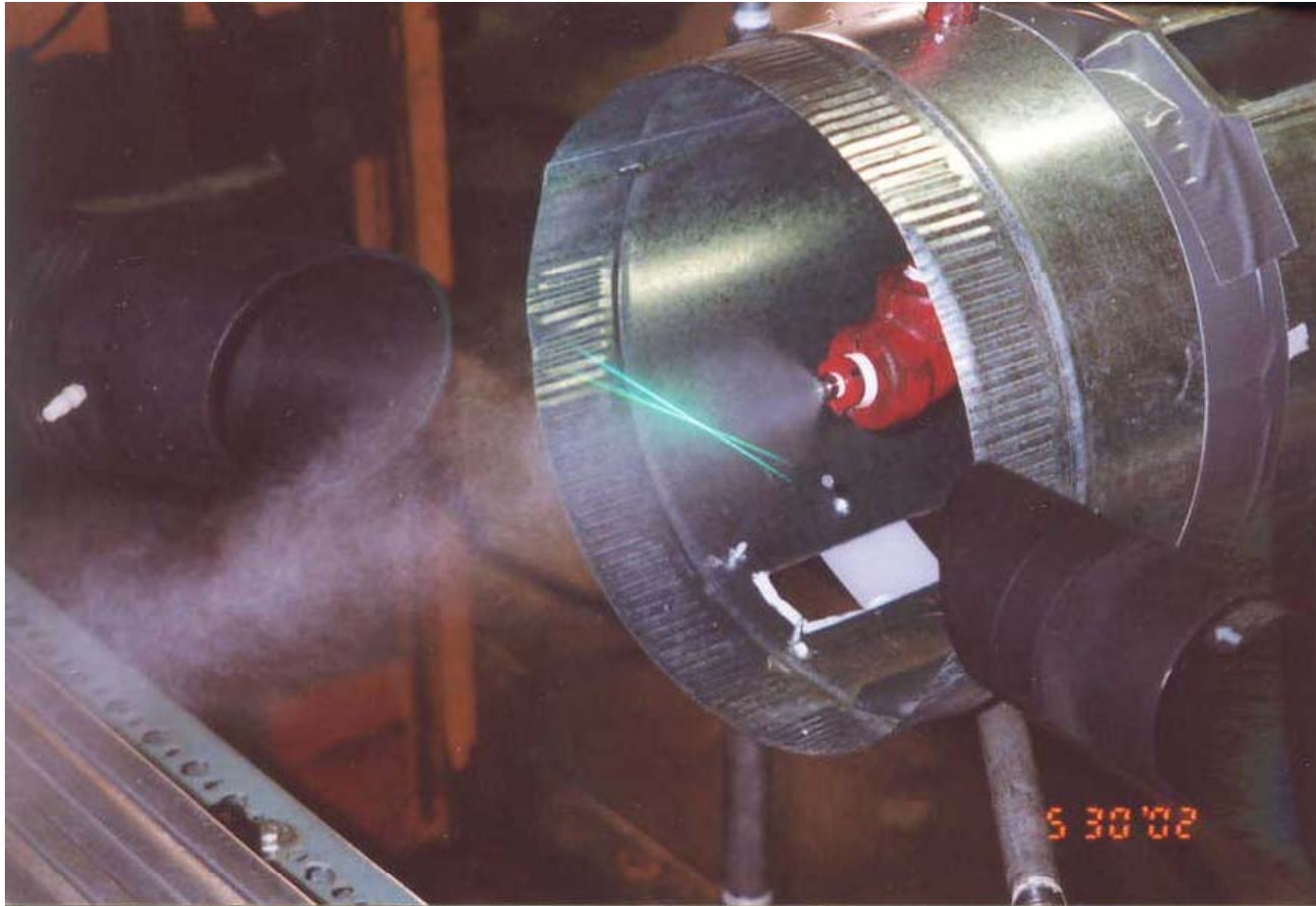
Impact Pin Type Nozzle



Pin-less Nozzle for new and service replacement



Independent PDPA Testing

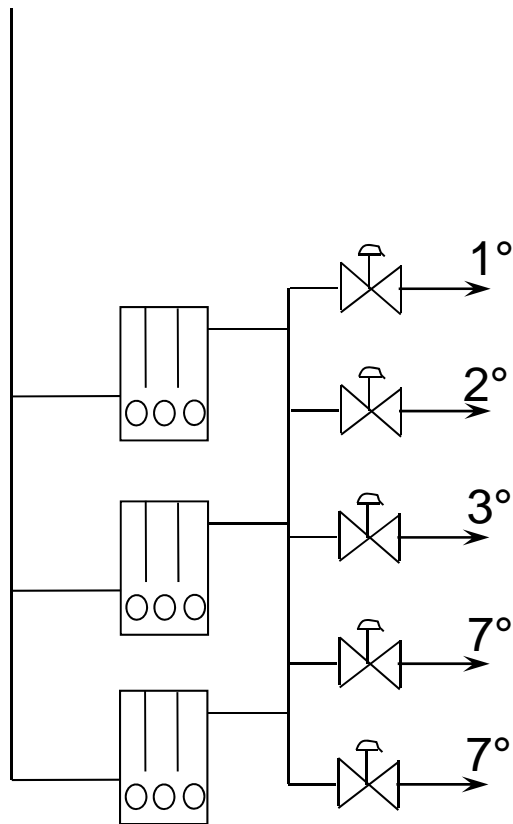


4 Zones of Fogging In Operation

Fog Droplets Light and Uniform



Second Generation Fogging Focus on System Reliability



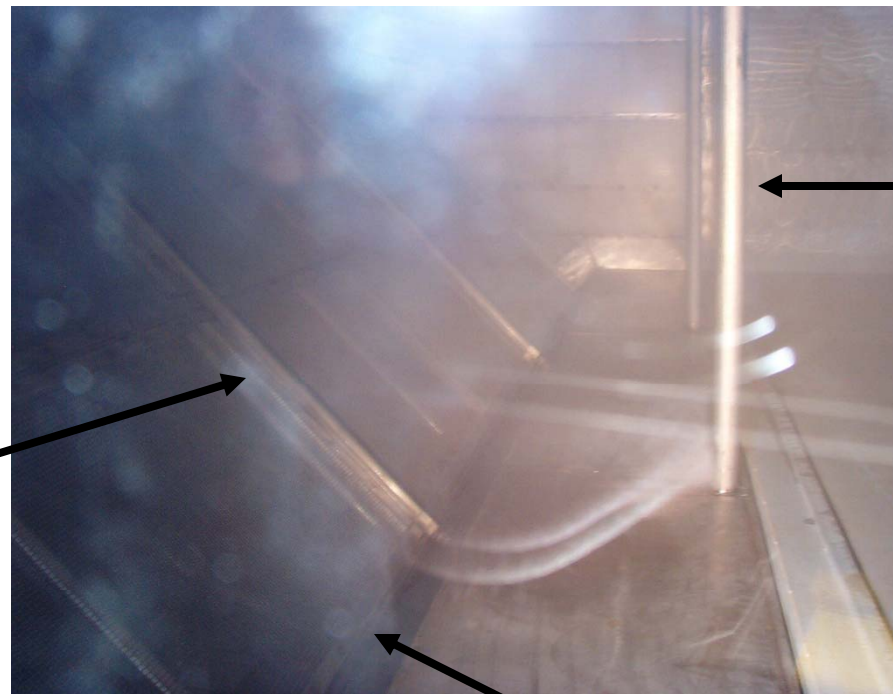
- Common discharge manifold
 - Pump schedule based on hours / starts
 - Pump maintenance reduces max flow capability not zone control
 - Enables redundant pump to be used
- Pump design margin (speed & pressure)
 - Extends seal life
- Components custom packaged
- Pin-less nozzles
 - Smaller droplets
 - Less installation / maintenance risk
- O-ring nozzle seal
 - Reduces replacement time and clogging
- In-line filters – reduces nozzle clogging

Common Manifold Design



Water Agglomeration

Water coalesces on structural steel - shedding large drops into inlet air stream



Water coalescing on vertical structural steel ran to the duct floor.

Water puddles in trough created by duct floor and trash screen structural steel

Fogging System Integration

- Filter house, inlet duct, silencer and compressor manifold treatment (lining, coating, drains)
- New unit inlet duct configuration optimization
- Droplet size control and spacing
- Control logic and integration with Combustion Turbine Control System
- Water quality specification

Third Generation Fogging Evaporation Enhancements

- Enhanced water distribution at design condition
- Enhanced water distribution at off design conditions
- Reduced droplet size
- Water droplet management (patent pending)
- Single VFD Pump Design

VFD Fogger Skid

