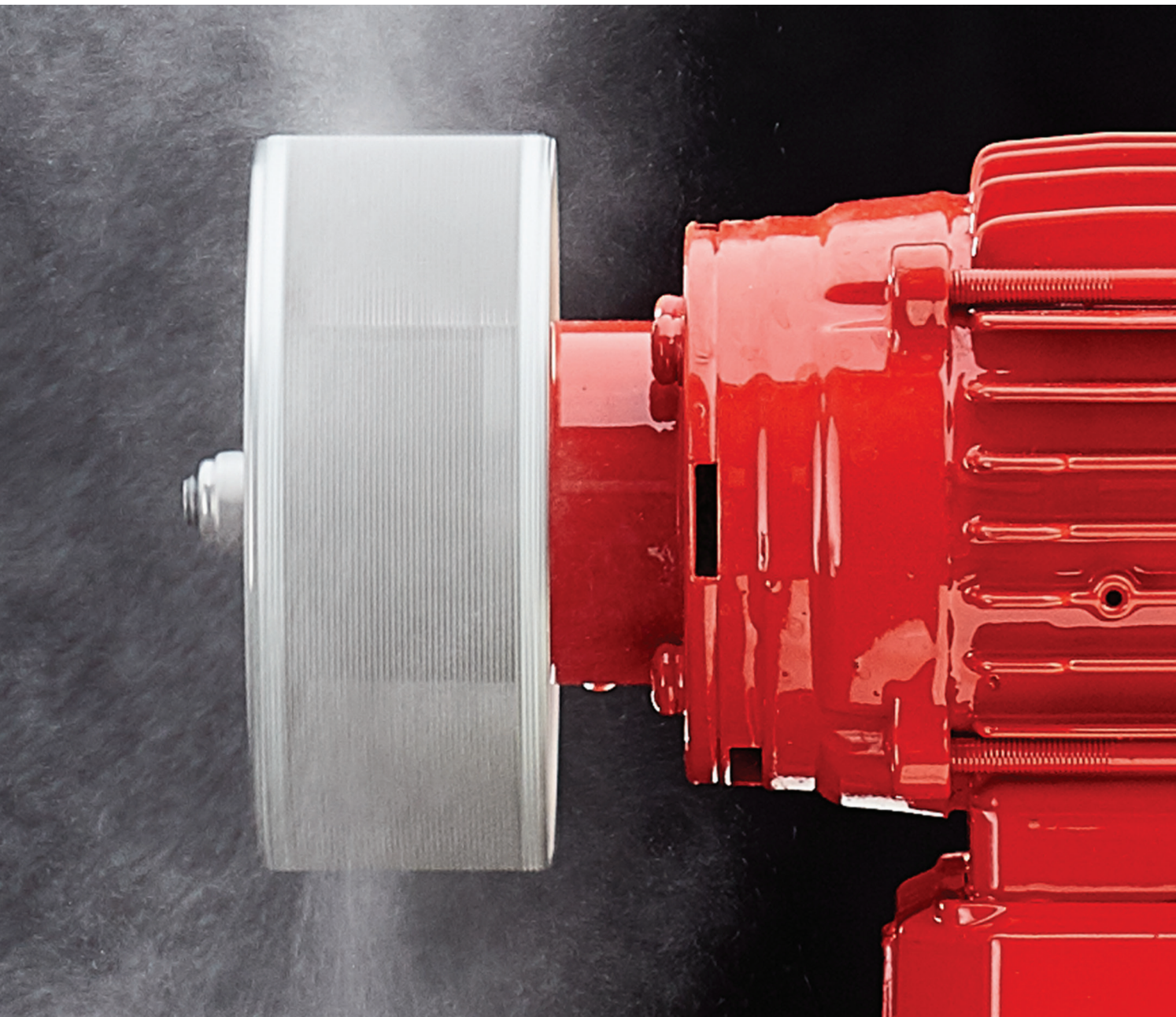




# InstaKool™

Intake cooling with an instant payback



BETTER AIR IS OUR BUSINESS®



GAS TURBINE SOLUTIONS

# The Power of Cooling

Gas turbine inlet cooling reduces the inlet temperature and helps restore lost power output with improved fuel efficiency. Even small increases in ambient temperature above 60 °F can result in significant reductions in power.

Cooling can benefit countless numbers of gas turbine installations around the world. With summer temperatures often well in excess of 60 °F, the additional revenue that can be generated in just one summer could justify the investment.

**60 °F**

even small increases in ambient temperature above 60 °F can result in significant reductions in power

**0.4 %**

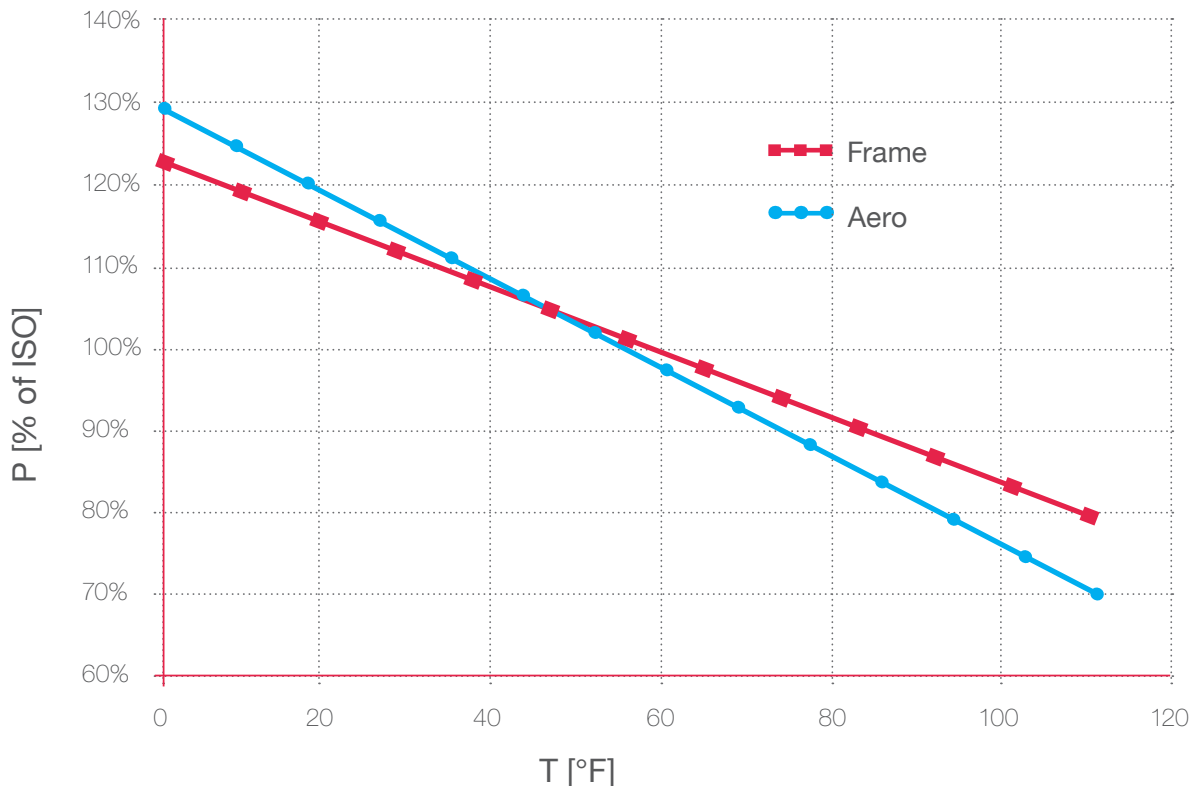
larger gas turbines lose approximately 0.4% power per °F

**0.5 %**

aero gas turbines lose approximately 0.5% power per °F

## Power Loss vs Temperature

As ambient temperature increases power output decreases. The loss in power is a direct correlation with the rise in ambient temperature, and the decrease in the density of the intake air. The lower air density reduces the mass flow through the gas turbine, lowering output. This trend is naturally reversed once the air temperature begins to fall and power output begins to rise again. Gas turbine intake cooling will therefore dramatically reduce power loss, or even eliminate it altogether in some cases.





## Introducing InstaKool™

InstaKool™ is an add-on cooling solution that can be installed and paid back, within the lead time of competing technologies. Installed upstream of the filters, it controls relative humidity with everyday

water quality, maximizing power output with no structural change to the existing gas turbine inlet system and no differential pressure penalty.

| No downtime required for installation

| No demineralized water required

| No structural change to filter house

| No corrosion downstream of filters

| No negative impact on differential pressure

| No risk of foreign object damage





# InstaKool™ Innovation

InstaKool™ is a cooling solution that will increase power output, enhance gas turbine efficiency and reduce CO<sub>2</sub> and NOx emissions. Due to its innovative technology InstaKool™ also has several unique benefits:

## I No downtime required for installation

High capacity atomizers are mounted on a simple frame in front of the filters. There is no requirement to wait for a planned shutdown as there is no need to enter the clean air side. InstaKool™ can be installed well in advance of competing technologies, resulting in instant savings and potential payback before other systems are operational.

## I No structural change to filter house

InstaKool™ is installed in front of the filters, eliminating the need to extend the filter house or make additional structural changes. The system also has a significantly lower weight and size compared to competing solutions, resulting in no structural support changes and a substantial cost saving.

## I No negative impact on differential pressure

Downstream relative humidity is continuously monitored and controlled to ensure there is no negative impact on differential pressure. The InstaKool™ control system continuously adjusts water flow to the atomizers to achieve the lowest possible air temperature at its optimum operating point.

## I No demineralized water required

In most cases competing technologies must use demineralized water. InstaKool™ is not sensitive to water quality, eliminating the need and the expense of installing a demineralized water station and supporting equipment. The simplicity of InstaKool™ drives down the installation and operating costs associated with competing solutions.

## I No corrosion downstream of filters

Alternative gas turbine cooling technologies regularly introduce demineralized water downstream of the filters, increasing the likelihood of downstream corrosion. InstaKool™ is installed in front of the filters so no water is introduced on the clean air side, providing complete peace of mind for customers.

## I No foreign object damage

Competing cooling technologies are situated on the clean air side, increasing the risk of foreign object damage. InstaKool™ is installed upstream of the filters so there is no requirement to enter the clean air side during installation or maintenance.

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## Differentiating Technology

InstaKool™ has been developed after years of research and development, based on the established principle that gas turbine performance is reduced in hot ambient air temperatures.

Research also shows that regions that experience extreme summer climates have lower temperatures during periods of fog, mist, or high humidity. The moisture in the air reduces ambient air temperature and increases gas turbine power output.

The challenge for AAF was to develop a product that could mimic these natural conditions (with no negative impact on filter differential pressure). This has been achieved through the combination of high capacity rotary atomizers with an intelligent control system that monitors relative humidity and controls water flow rate.

### Full control of water flow

AAF's PLC controls downstream relative humidity by adjusting water flow rate with no impact on filter differential pressure. Water flow rate is controllable from 0 to 100 % without affecting droplet size distribution.

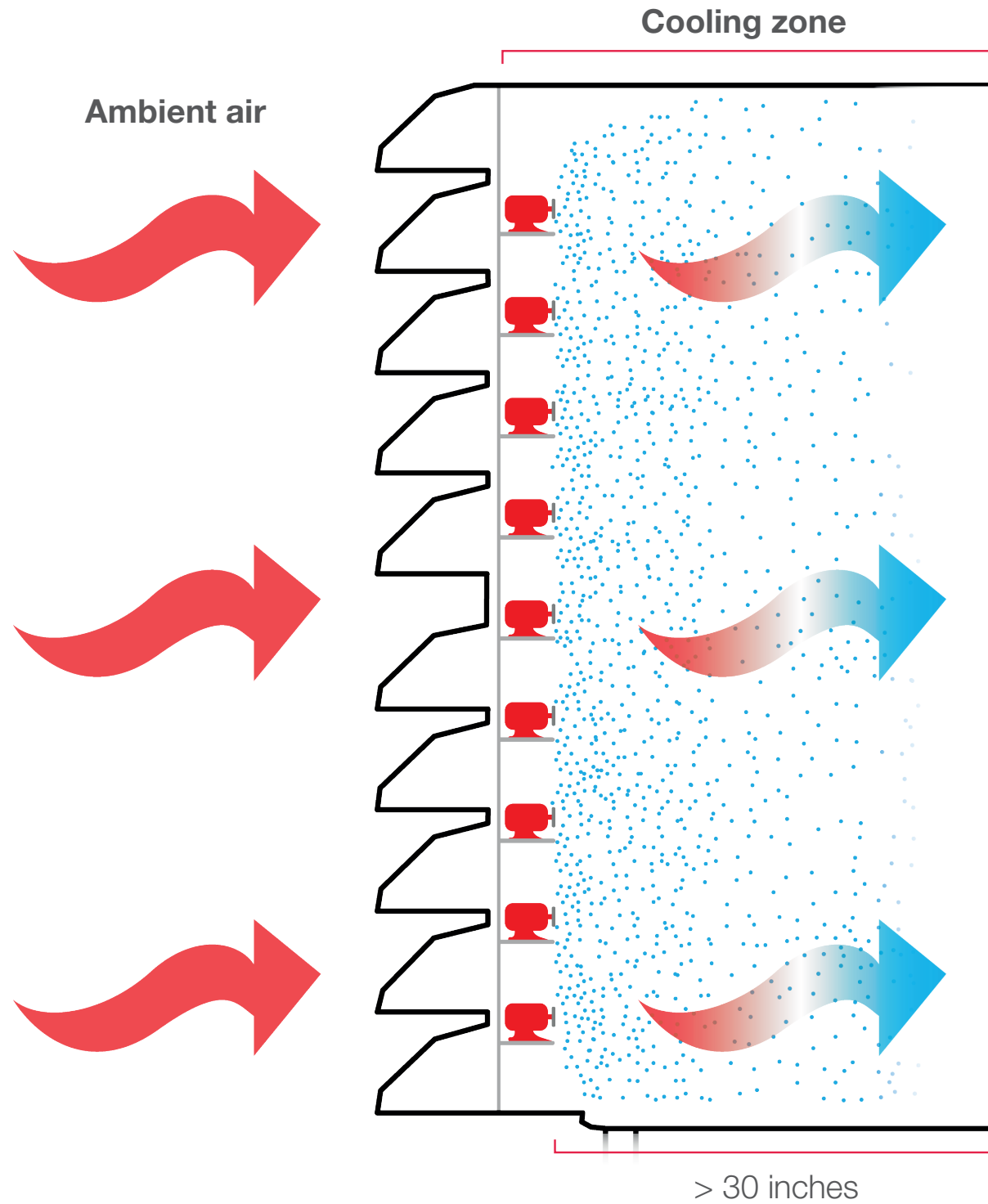
### High capacity rotary atomizers

InstaKool™ is the only gas turbine cooling solution in the world that utilizes high capacity rotary atomizers to create a fine mist. A relatively small number of atomizers are mounted on a simple frame, in front of the filters, to achieve the desired temperature reduction.

The differentiating technology of InstaKool™ is completely unique; a cooling solution in front of filters that incurs no differential pressure penalty.



# How InstaKool™ Works...



Please note: The location of the atomizers, relative humidity probe, and control panel will vary depending on the individual installation. The layout shown is for illustrative purposes only. Speak to your AAF representative for the best advice on options for your individual installation.

# Filtration stages

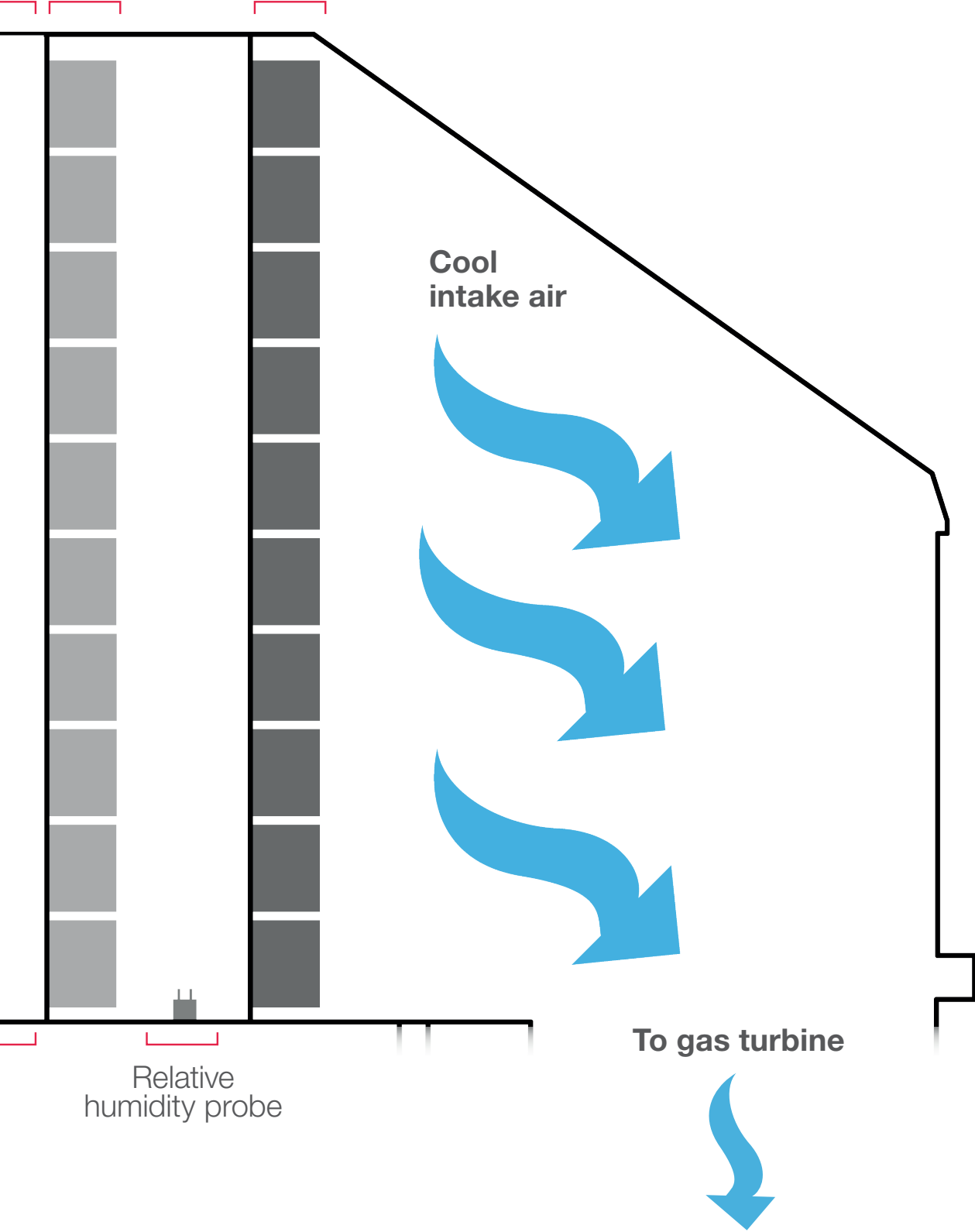
Stage 1

Stage 2

Cool intake air

Relative humidity probe

To gas turbine



# Optimum Operating Point

InstaKool™ is programmed to automatically run at its optimum operating point to maximize power output.

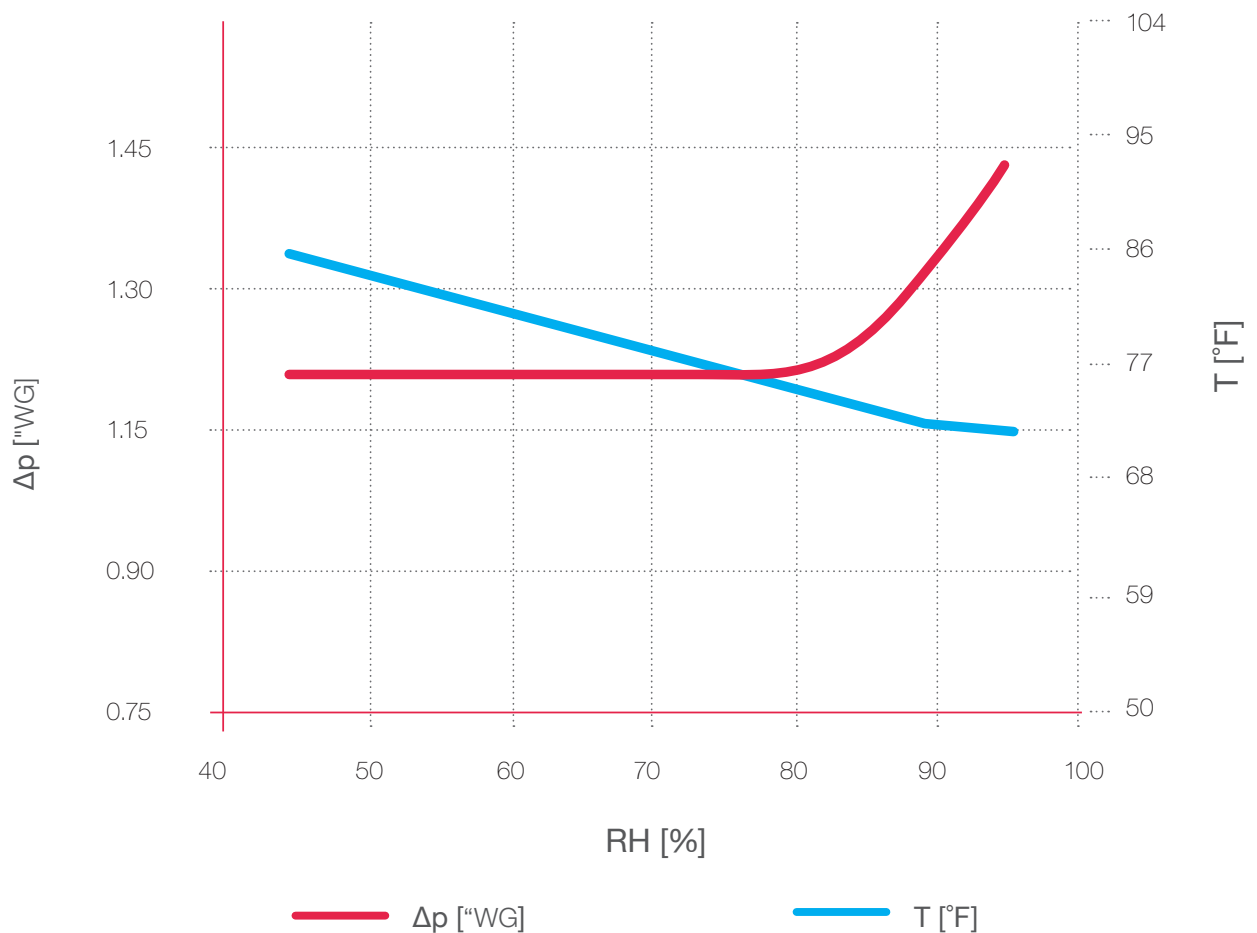
The optimum operating point is when relative humidity is at 80%. This is the point where temperature is at its lowest point without negatively impacting differential pressure.

InstaKool™ continually measures temperature and relative humidity (both upstream and downstream) and differential pressure. Water flow is adjusted accordingly to suit the environmental conditions, with no impact on droplet particle size distribution or filter differential pressure.

## Typical example:

<b>113 °F</b>	Ambient temperature
<b>33 MW</b>	Power output at ambient temperature
<b>75 °F</b>	Temperature downstream of InstaKool™
<b>39.5 MW</b>	Power output after InstaKool™
<b>15 kW</b>	Power consumed by InstaKool™
<b>433:1</b>	Ratio of power gain / power consumed

The relationship between relative humidity, temperature and differential pressure





# InstaKool™ Control

AAF's intelligent PLC control system ensures InstaKool™ reaches its optimum operating point without incurring a differential pressure penalty.

InstaKool™ has a safeguard control system to ensure relative humidity will not exceed 80 % while in operation. This allows installation to be situated in front of the filters, eliminating the risks of any downstream accumulation of water, foreign object damage and corrosion.

InstaKool's™ control system will optimise your operation, while continually adjusting water flow to the atomisers to achieve the lowest possible air temperature to maximise power output.

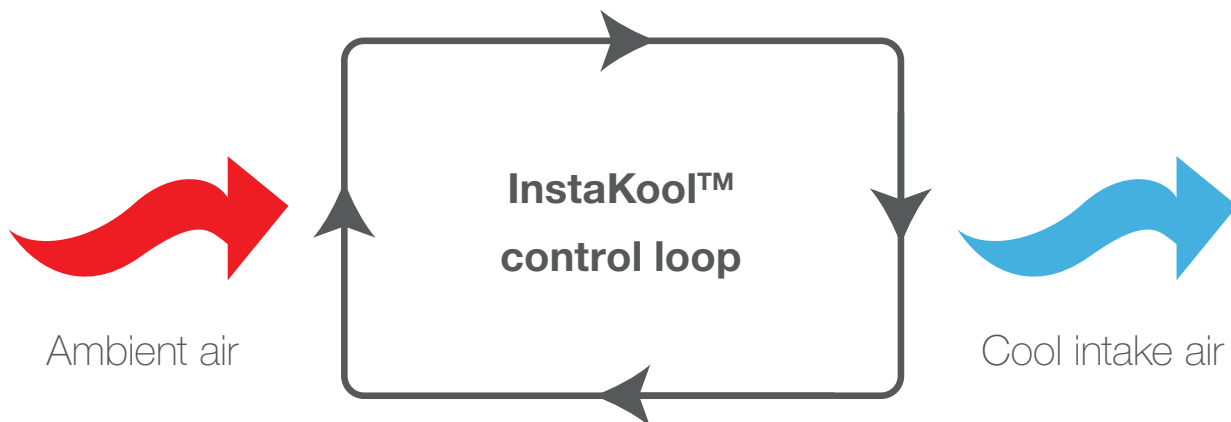
The diagram below highlights how InstaKool™ utilises its safeguard control system to maintain stability within the filter house.

## 1 | Rotary atomizers

introduce a cool fine mist

## 2 | The mist evaporates

and disappears before the first filtration stage



3 | Water flow to atomizers is controlled, maintaining the desired relative humidity

4 | Relative humidity is monitored and will not exceed 80 %

# Comparing Technologies

The innovative InstaKool™ system design offers customers many additional benefits when compared with conventional cooling technologies (high pressure fogging systems and evaporative coolers).

## Comparison table

	InstaKool™	Conventional cooling
<b>Location of technology</b>	Upstream	Downstream
<b>Δp penalty</b>	0 "WG	1 "WG (evaporative cooler)
<b>Lead time</b>	1 week (from inventory)	26 weeks
<b>Pre-installation survey</b>	No shutdown required	At next scheduled shutdown
<b>Installation</b>	No shutdown required	7 to 28 days
<b>Water</b>	Not sensitive to water quality	Demineralized or high quality water
<b>Power Consumption</b>	Low	Low to medium
<b>Foreign object damage</b>	Zero potential	High level of risk

Each InstaKool™ atomizer can be installed, maintained, and checked while the gas turbine is in operation.

In hotter climates, InstaKool™ payback is in the order of 13 weeks (payback is heavily dependent on fuel cost and power price).

With InstaKool™, most customers will have at least 25 weeks of cooling before other systems could be installed, with potentially 28 days extra operation due to no downtime.

AAF offers a comprehensive installation service – speak to your AAF representative for more information.

# Trust the Experts

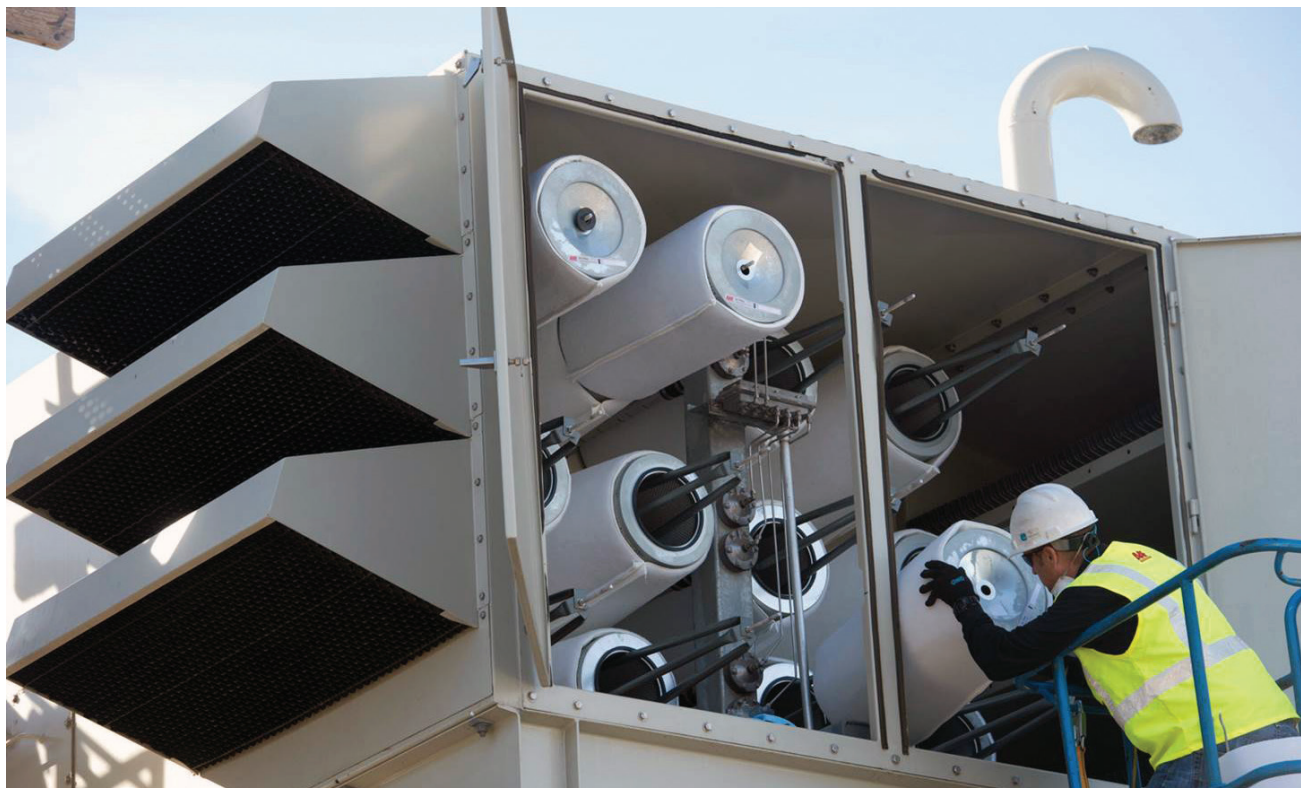
AAF International® is one of the world's leading suppliers of gas turbine solutions, serving all major OEMs and operators, and with over 6,500 installations worldwide.

InstaKool™ extends AAF's growing product portfolio; providing an innovative and unique gas turbine cooling solution.

## Product portfolio

- | Intake filtration systems
- | Cooling and heating solutions
- | Intake ducting and silencer technology
- | Acoustic enclosures and ventilation
- | Hot gas exhausts and silencer technology
- | Exhaust dampers and stack systems

In addition, AAF's Site Services Team provides a reliable and trusted aftersales support service to ensure all auxiliary equipment is correctly maintained.



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