Intelligent Free Cooling:

Fine-tuning Direct Outside-Air Free Cooling with Two Layers of Environment Protection

Jake Yu, HVAC Applications Engineer

AIRSYS
Balance the Environment

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While free cooling with direct outside air is extremely efficient for cooling remote cell sites and small equipment rooms, care must be taken in locations where air contamination is an issue.

Due to the risk of clogged filters causing diminished cooling capacity and high temperature alarms, free cooling is often entirely disabled for these locations. On an average site with 10kW load, a potential saving on the order of $2,000/yr/site is lost when relying solely on compressors for cooling.

This issue can be resolved by setting up *Intelligent Free Cooling* (*IFC*), a 2 layer approach to maximize energy saving while protecting the building from air contaminates:

Air Filter Protection Device

This AIRSYS patented device is field installed and communicates airborne contaminate density to the AIRSYS Lead/Lag controller. The controller immediately shuts the outdoor air damper when the contaminate density exceeds the predefined threshold.

Air Pressure Switch

The air pressure switch is standard on all AIRSYS units and allows the user to set maximum primary air filter dirtiness. If this threshold is exceeded, Free Cooling (FC) is disabled until the filters are replaced. Even in the worst case scenario, mechanical cooling capacity will be maintained.

***Note:** Software upgrade to AIRSYS Lead/Lag Controller may be required for compatibility. Have your maintenance contractor contact us for more information.*

Benefits of

Intelligent Free Cooling (IFC)

Unlock Energy Savings

When compared to relying solely on mechanical cooling, enabling IFC can easily save $1,000-$2,000/yr for a medium sized (10kW) site. The ROI is less than 6 months from utility cost savings alone.

Reduce Long Term Op-Cost

Depending on the climate, IFC can offset compressor run time and turn-ons by 40-90% throughout the year. This reduces wear on the compressor and related components such as switches, contactors, and condenser fan motors, significantly extending system life expectancy and reducing maintenance costs.

Added Cooling Redundancy

Having another form of cooling provides a safety layer in temperature control of remote sites. IFC can offset the entire heat load during colder months and nights while providing emergency ventilation during the hotter times.

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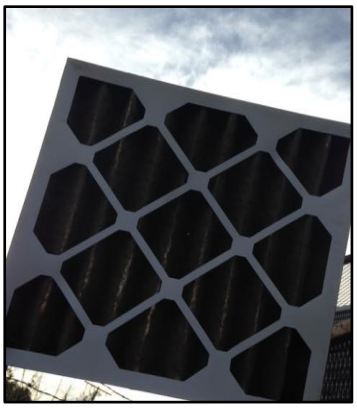
Case Study

Background: This study was conducted at an equipment shelter located in Southern California desert where a small amount of wind can generate a lot of soil, dust and other contaminates. This site has a history of filters clogging quickly with only FC enabled (Figure 2).

Figure 1. Bird's-eye view of Building and Surroundings

Figure 2. Filter Condition: 1 Month, No Protection



Solution: An Air Filter Protection Device (AFPD) was installed on both units. Unit 1 was set to standard sensitivity while unit 2 was set to maximum sensitivity. The Air Pressure Differential Switch was set to trigger at 250 Pa (factory default).

Results: Both units showed significantly better filter condition compared to no filter protection. IFC ran for 1300 hours in 5 months, about 90% of the available free cooling hours. The Air Pressure Differential Switch never triggered during the study despite the harsh environmental conditions.

Figure 3. Filter Condition: 1 Month, Standard Sensitivity

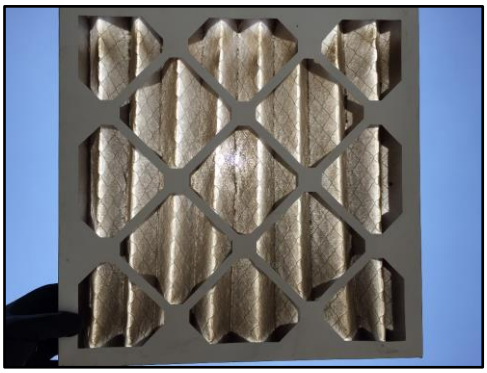
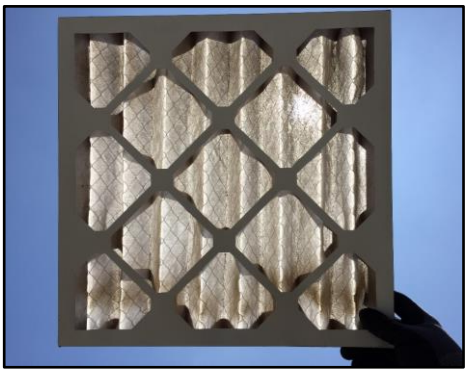


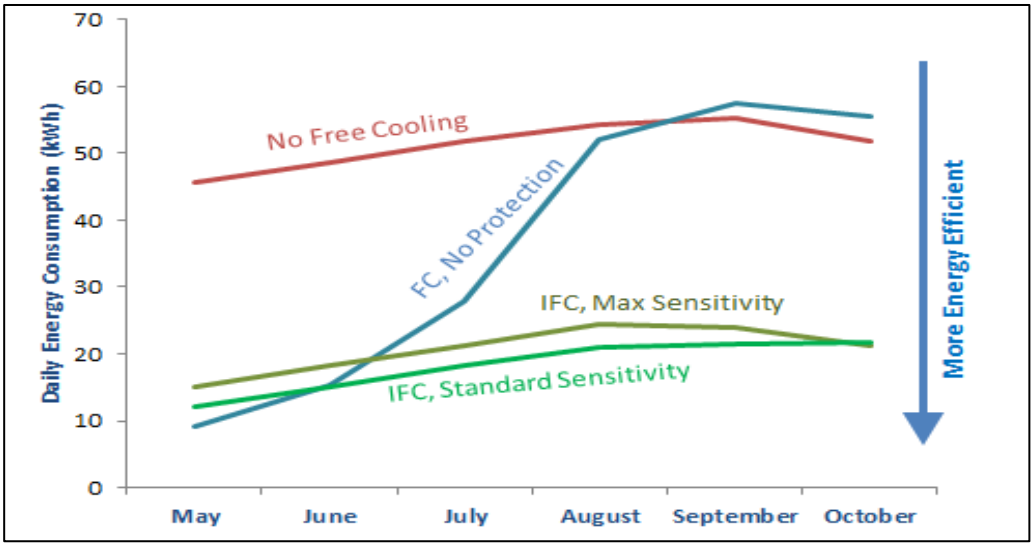
Figure 4. Filter Condition: 1 Month, Maximum Sensitivity



Reasons to Deploy

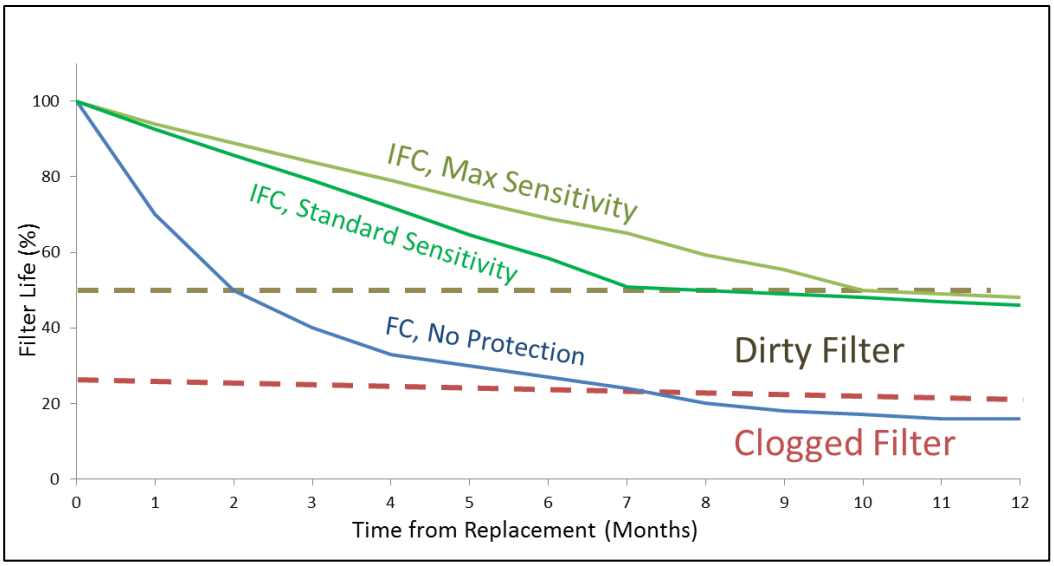
Efficiency: For locations where air contaminates quickly clog the air filters, FC with no protection will initially yield better energy efficiency. However, as the filters clog, the savings quickly diminishes. IFC provides better long-term HVAC system efficiency.

Graph 1. Daily Energy Usage Comparison



Filter Life: The Air Pressure Differential Switch provides a adjustable limit on how dirty the air filter can get before the system automatically disables FC. This helps ensure normal cooling capacity can be maintained under all circumstances. IFC enhances this standard configuration of the AIRSYS HVAC systems by extending air filter life.

Graph 2. Filter Life Comparison



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Return on Investment

The ROI analysis below is based on energy savings alone. Higher utility cost and indoor temperature setpoints will yield better results. Capital cost estimates include cost of material and 3 hours of labor for installation and testing.

10 kW Heat Load

	Baseline, FC Off Due to Environment	IFC, Standard Sensitivity	IFC, Max Sensitivity
Annual Utility Cost	$2300	$600	$700
Annual Utility Saving	Baseline	$1700	$1600
Capital Cost	Baseline	$600	$600
ROI (years)	Baseline	0.35	0.38

3 kW Heat Load

	Baseline, FC Off Due to Environment	IFC, Standard Sensitivity	IFC, Max Sensitivity
Annual Utility Cost	$700	$200	$250
Annual Utility Saving	Baseline	$500	$450
Capital Cost	Baseline	$600	$600
ROI (years)	Baseline	1.20	1.33

Note: Weather data from Cleveland, OH is used along with $0.10/kWh utility cost and 79°F cooling setpoint.

Have a Question?

Please contact us at ASNSupport@air-sys.com for any questions regarding installation, configuration, and testing of Intelligent Free Cooling.

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