



## **FREECOOL-AD**

Adiabatic Evaporation Cooling Unit

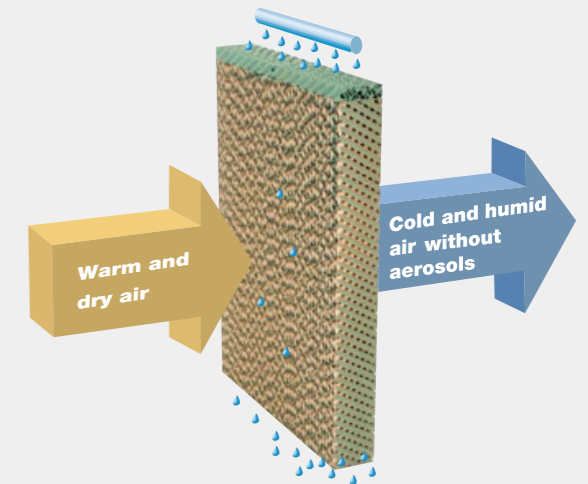
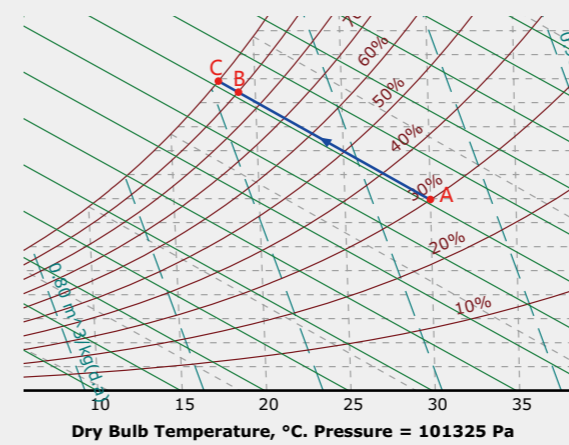
Cooling capacity: 34kW

Air volume: 18000m<sup>3</sup>/h

# How it works?

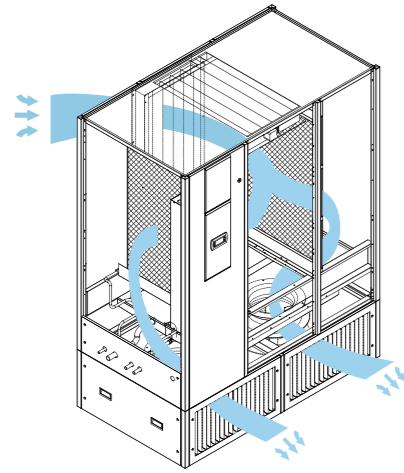
## Adiabatic Evaporation Cooling

In the adiabatic evaporative cooling process, warm and dry air enters the unit at an unsaturated condition (Point A) and is saturated adiabatically as it travels to Point C (wet bulb temperature) as it passes through the water-moistened pad. The Relative Humidity within the pad is approximately 100%, however, no equipment is perfect leading to certain losses in the cooler; if we consider a cooler 90% efficient, we can then reach Point B and obtain the supply air conditions for IT environments.



Adiabatic evaporation cooling is fast becoming the most efficient option for more and more data centers, particularly with the recent focus on technological advancement in the field. Without compressors and refrigerant, Adiabatic Evaporation Cooling can reduce energy consumption by up to 90% when compared to a conventional air conditioning approach.

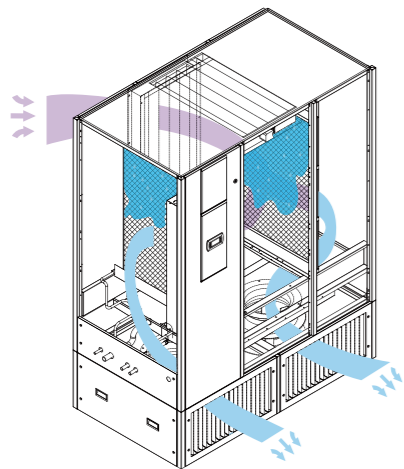
## Working Flow Schematic Diagram



Free Cooling

### Winter Operation

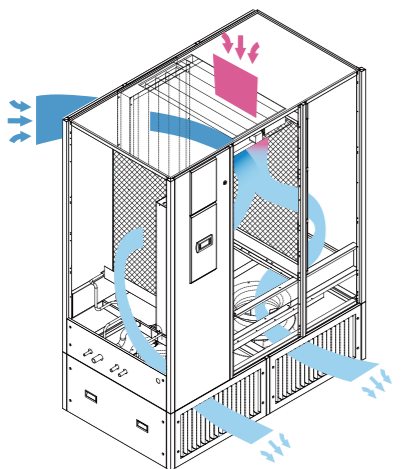
For most places, ambient temperature in winter is low enough to achieve free cooling.  
In winter, cool outdoor air is drawn by AIRSYS FREECOOL-AD'S EC fan to indoor and absorb the heat load.



Direct Adiabatic Evaporation Cooling

### Summer Operation

Ambient temperature is too high to achieve free cooling, so Adiabatic Evaporation Cooling is needed to achieved cool supply air.  
Hot outdoor air is drawn by AIRSYS FREECOOL-AD'S EC fan through spraying water pad to indoor and absorb the heat load.

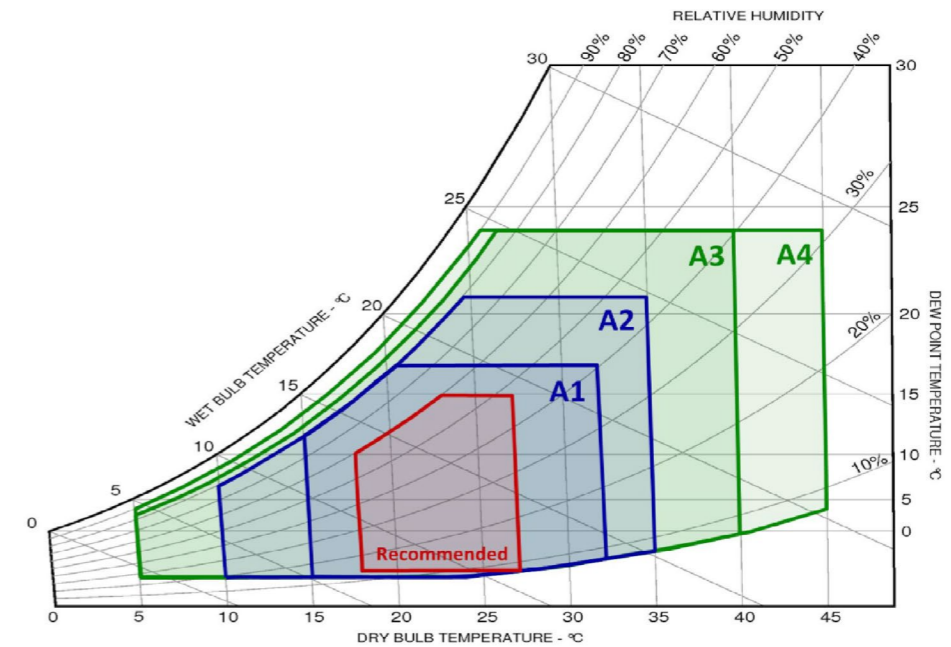


Free Cooling at extreme low outdoor temperature

### Extreme Cold Environment

For extreme cold regions, ambient temperature is extremely low. Even mixed with hot return air, the supply air temperature can meet IT environment requirements.  
In extreme cold regions, extreme cool outdoor air is drawn by AIRSYS FREECOOL-AD'S EC fan to indoor after mixed with hot return air and absorb the heat load.

## Application



ASHRAE (The American Society of Heating, Refrigerating and Air-Conditioning Engineers – the industry body who set the environmental recommendations for the IT industry) have continued to broaden the environmental envelope in which modern IT equipment can operate. The ASHRAE TC 9.9 Thermal Guidelines for Data Centers, 4th Ed. (2015) advise a wider operating range for data centers (refer to the above psychrometric chart envelope). The guidelines also advise an expanded allowable dry bulb temperature range of 15–32°C for A1 class data centers, with most manufacturers confirming allowable conditions greater than these recommendations.

Broadening this operational envelope has opened the door to other more cost effective and environmentally sustainable forms of cooling. One of the most efficient solutions to have recently been introduced is adiabatic evaporative cooling.



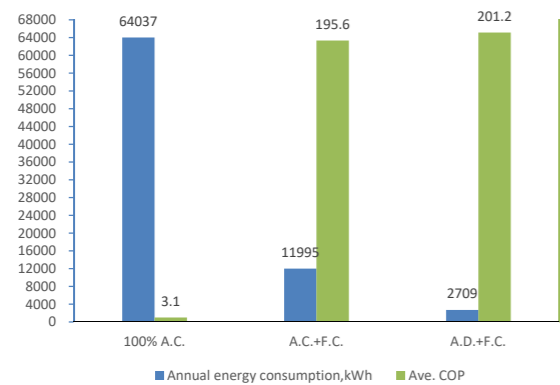
# Why AIRSYS?

AIRSYS FREECOOL-AD adiabatic evaporation cooling units can provide the most energy efficient and environmentally responsible cooling solution for a large variety of IT cooling needs. FREECOOL-AD can work in three modes: Free Cooling Mode, Direct Adiabatic Evaporation Cooling Mode & Free Cooling at Extreme Low Outdoor Temperature Mode. They are able to efficiently operate throughout a diverse range of climate conditions and, as such, are well suited to most IT cooling applications across the globe.

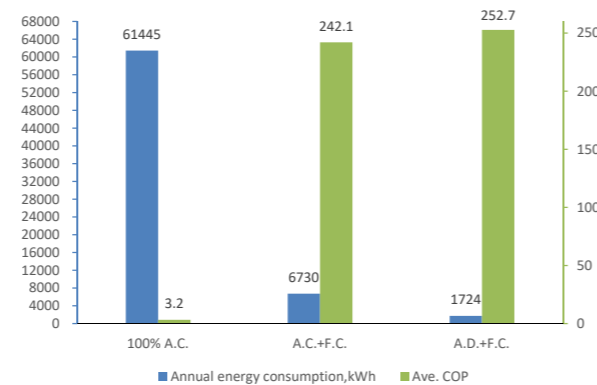
The following charts provide a comparison between AIRSYS FREECOOL-AD adiabatic cooling units and traditional air conditioning equipment (both with and without free cooling), based on the annual energy consumption and average COP.

The calculations are based on a 40m<sup>2</sup> IT space with 23kW stable equipment load and unstable building load which differs by ambient environment in the following different locations worldwide.

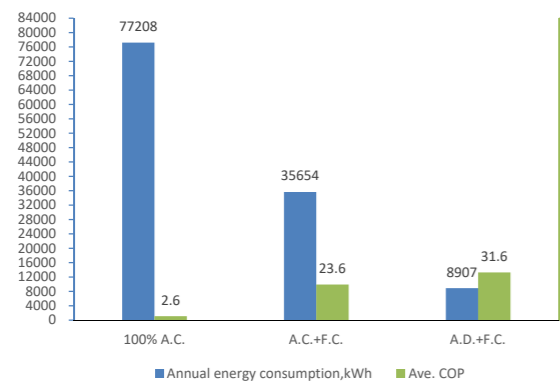
Daytona beach international airport, FL, US



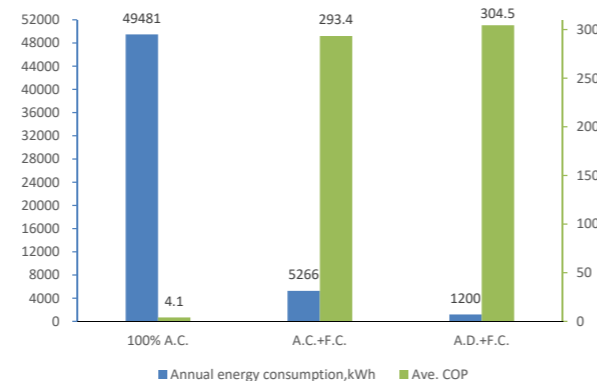
SaoPaulo, Brazil



Singapore



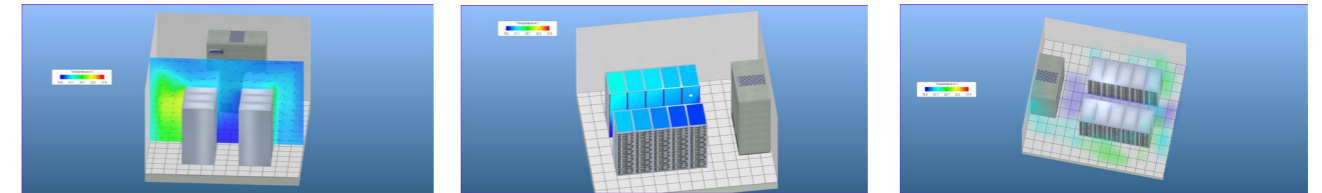
Ningxia, China



From the above graphs we can see that AIRSYS FREECOOL-AD adiabatic evaporation cooling unit can cover different climatic regions in the world. It's no exaggeration to say that no matter where your data center is located on the planet, you can choose AIRSYS FREECOOL-AD adiabatic evaporation cooling unit; both in terms of annual power consumption and average energy consumption, AIRSYS FREECOOL-AD adiabatic evaporation cooling units can achieve huge energy savings compared to the conventional air conditioning; even compared to air conditioner with free cooling, the energy savings can reach nearly 80%.

# How AIRSYS Provide the Right Solution?

AIRSYS has nearly 20 years' experience in designing high efficiency IT and precision cooling solutions. Through continuous development AIRSYS has applied the latest and most powerful innovative tools to ensure our products can deliver the greatest energy savings.

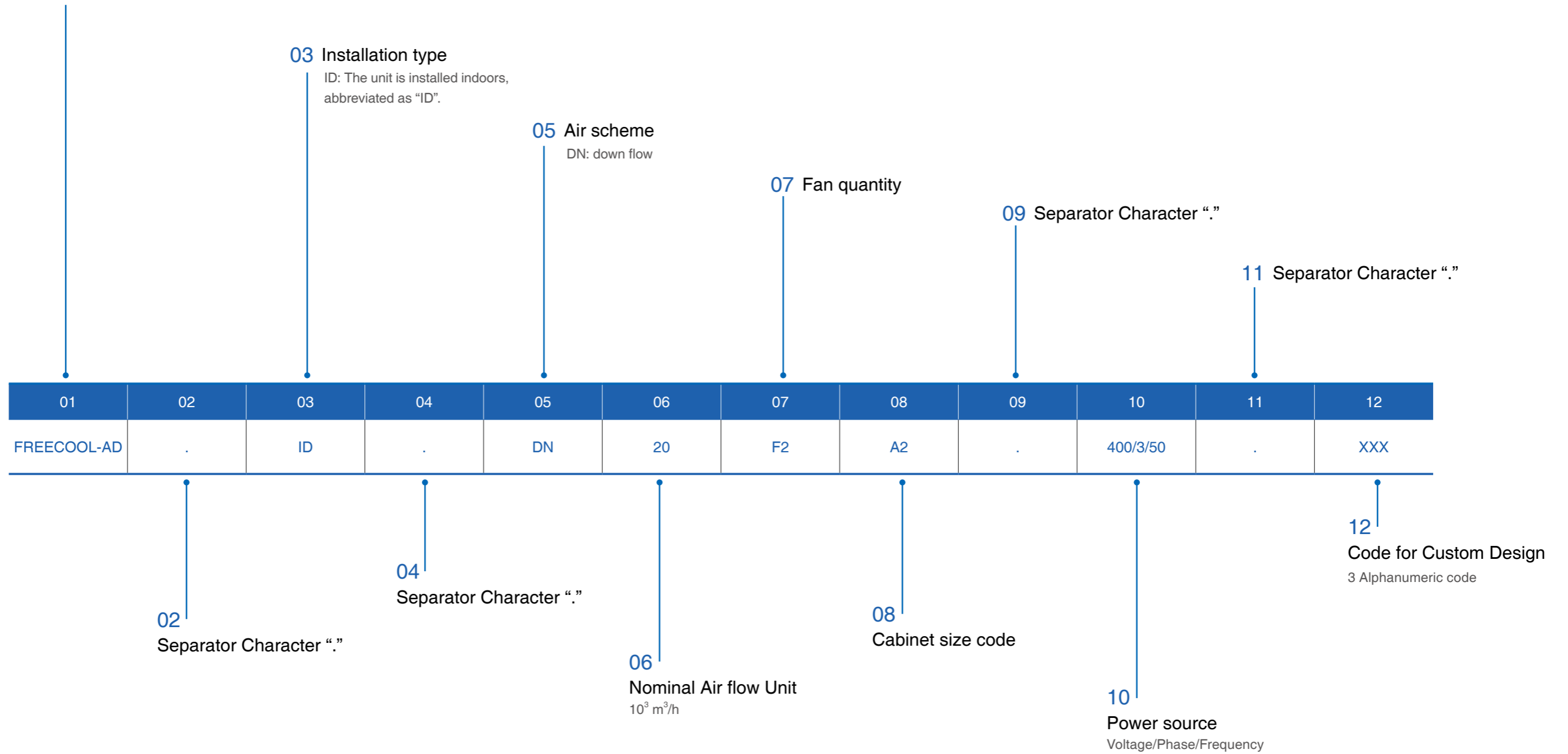


AIRSYS can also offer flexible and customized systems, specifically designed to meet the needs of any installation and resulting in the greatest energy savings. An engineered-to-order design approach allows solutions to be customized to fit any specific application.

# Unit Identification

## 01 Product series name

FREECOOL-AD : Intelligent control adiabatic evaporation cooling unit, can be abbreviated as "FCA".



# Product Features

## High energy efficiency

Using adiabatic evaporation pads to cool fresh outdoor air, the run hours of other conventional air conditioning equipment can be significantly reduced.

## Good structural design for easy maintenance

The main components such as fans, motor, damper, controller and other items are all easily accessible and maintained from the front of the unit.

## Easy installation, supply air arrangement flexibly

FREECOOL-AD units are modular in design, ensuring simplified transportation and ease of installation on site. The supply air box is separate from the main unit, allowing flexibility to choose up flow or down flow arrangement, according to the need of each individual site installation.

## Corrosion-proof

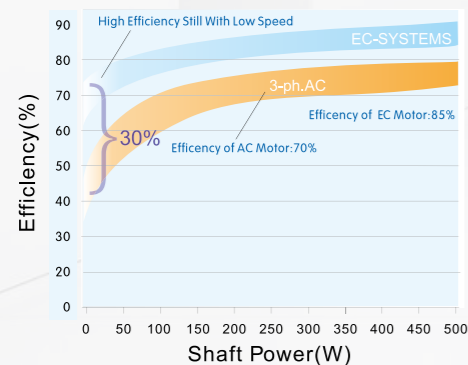
The standard unit framework is supplied with corrosion protection treatment. The treatment is sufficient to provide protection for 15 years life cycle for inland installation. If necessary, the treatment for sea air environment can be supplied as an option.

## EC fan

The fan is a core component of the FREECOOL-AD unit; an oversized EC fan allows the maximum speed to be kept under 80% of maximum, to reduce both the generated noise and energy consumption.

Other benefits of the EC centrifugal fan include:

- High efficiency motor
- Infinitely adjustable speed; energy consumption at low speeds is significantly lower than at high speeds
- Increased and more consistent airflow volume, when compared to axial-style fans



A comparison between EC motor and other motors

## Strong structure

The unit has passed a transportation test to confirm the structure is strong enough to be able to transport on low grade roadways.

## Pressure transducer

The pressure difference between either side of the filter can be checked any time, to easily deduce the state of the filter and prepare maintenance in advance.

## Intelligent control

FREECOOL-AD units are fully controlled by microprocessor; all components operate automatically to achieve maximum energy savings without manual monitoring and input. Similarly, all alarms and protective measures are automated

## Random restart when power recovered

Once the power has been restored (following an outage), the unit will restart automatically with a random time delay between 1 to 60 seconds to avoid multiple items of equipment starting at the same time.

## Control of other air conditioners (Option)

FREECOOL-AD units can control other air conditioners for increased energy efficiency. For example, when the FREECOOL-AD unit can fully meet the cooling demand of the base station, the controller can send a signal to stop other air conditioners serving the same site.

## Complete automatic protection

The main components such as fans, motor, damper, controller and other items are all easily accessible and maintained from the front of the unit.

## Data log

The controller has a large internal memory to log up to 100 historic alarms.

## Remote control and monitoring (Option)

The unit can be installed with a RS232 or RS485 communication card to enable remote control and monitoring by a BMS with open communication protocol.

## pCOWeb internet communication (Option)

The unit can be equipped with a pCOWeb internet communication card with TCP/IP protocol and Ethernet to enable remote control and monitoring. Each computer can be connected to the web server by Ethernet network to view the working status and control the unit remotely.

## Water level sensor

Equipped with a two-level float switch and a four-level float switch to properly control the water level in water sump, the unit will avoid water sump overflow and prevent the pump idling.

## Supply air humidity control

A humidity sensor can prevent high-humidity conditions from occurring within the IT room. With the humidity sensor, free cooling mode will turn off when the humidity of the outdoor air is higher than the indoor humidity limitation to avoid the BTS equipment working at high humidity levels, which may cause failures and damages to the electronic devices.



# Legionella Control

It was named after an outbreak of severe pneumonia which affected a meeting of the American Legion in 1976.

It is an uncommon but serious disease.

It is not caught from other people, but by breathing in tiny droplets of contaminated water.

The most common sources of legionella are in man-made water systems including cooling towers and evaporative condensers, hot and cold water systems, spa pools etc.

There is a reasonably foreseeable legionella risk when the water system has a water temperature between 20~45°C .

## Preventing Legionnaires' disease

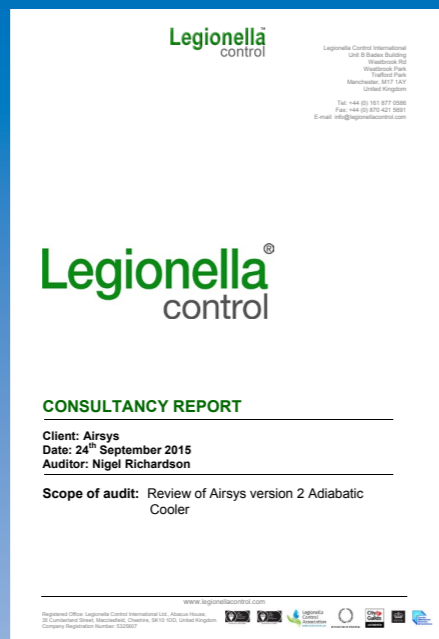
The primary measures in preventing Legionnaires' disease include:

- ⊙ Water is drained at regular intervals to stagnation;
- ⊙ Air flow rate is lower than 2.4m<sup>3</sup>/s in order to reduce the release of aerosols from adiabatic evaporation pad;
- ⊙ Water operating temperature is lower than 20°C (initial setting, adjustable);
- ⊙ Water scale (caused by increased water volume) is monitored and the water tray emptied and rinsed once the set value has been reached;
- ⊙ All surfaces in contact with water (except the adiabatic evaporation pad) are plastic or stainless steel to avoid corrosion;
- ⊙ Adiabatic evaporation pad dry mode ensures the pad surface is completely dry, reducing the risk of breeding bacteria;
- ⊙ Maintenance intervals are dictated by the local water quality. E.g. in regions with a high water hardness, empty after each filling;

In regions with a medium water hardness, empty after every second filling;

In regions with a low water hardness, empty after every third filling.

Legionella Control International is a world-leading legionella risk management company. AIRSYS has received the evaluation report for FREECOOL-AD units from LCI.



# Unit Configuration

## Standard Components

### Unit base and frame

- ⊙ Unit base is made of folded sheet steel coated with grey epoxy resin powder.
- ⊙ Unit frame is made of folded sheet steel and assembled with bolts or rivets. The surface of unit frame is coated with grey epoxy resin powder.

### Backward curved, centrifugal fan directly coupled with 400 VAC motor

### Adiabatic evaporation pad

### Primary water sump

### Secondary water tray

### Water pump

### Pocket filter

### Return air filter

### Control box (includes controller, contactor, relay, ircuit breaker etc.)

### Micro control system, include

- ⊙ Micro-processor
- ⊙ PGD user terminal
- ⊙ Indoor temperature sensor
- ⊙ Outdoor temperature sensor
- ⊙ Fresh air humidity sensor
- ⊙ Supply air temperature and humidity sensor
- ⊙ Exhaust air temperature and humidity sensor
- ⊙ Water tray temperature sensor
- ⊙ Pressure transducer
- ⊙ Four level float switch
- ⊙ Two level float switch
- ⊙ Water leakage alarm
- ⊙ Power sensor

## Optional Components

### Exhaust fan

### Gravitational pressure relief valve (air discharge)

### Air inlet louver

### Mounting plinth

### RS232 communication interface card

### RS485 communication interface card

### pCOWeb card

### External water leakage alarm

### Smoke and fire alarm

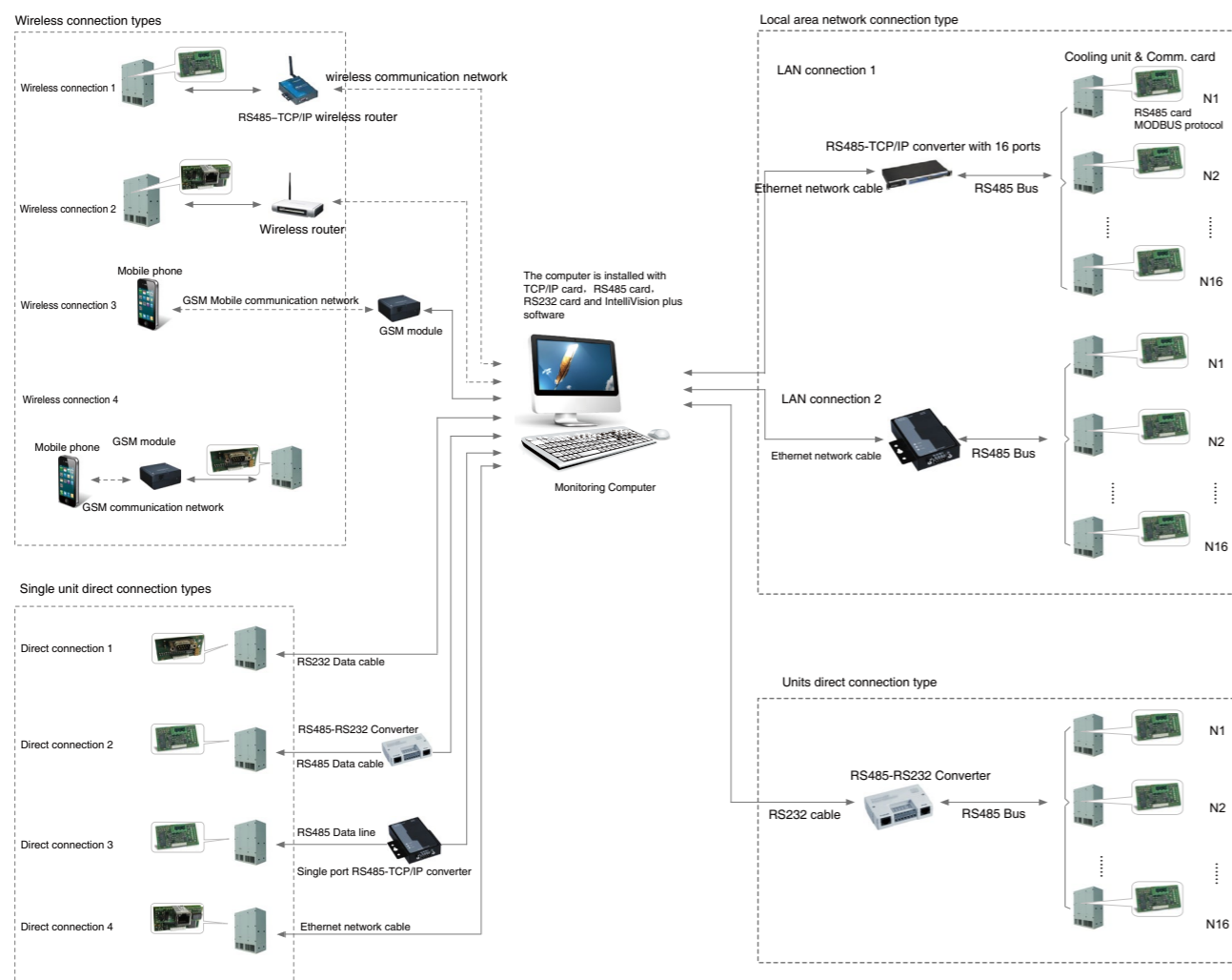
# Remote Control & Network Monitoring

Networking and Monitoring of air conditioning equipment is typically a subsystem of a Building Management System (BMS) and provides centralized monitoring and management of all the air-conditioning equipment.

Thanks to years of experience in the production and application of precision air conditioning equipment, AIRSYS is able to provide a variety of monitoring systems ranging from simple SMS alarm monitoring to the most sophisticated tERA cloud based GPRS wireless centralized monitoring system. There is a solution available to suit all sites and installations.

A given unit can be remote controlled or monitored via several means:

- 3 kinds of local direct cable connection
- 3 kinds of LAN network connection
- 4 kinds of wireless network connection



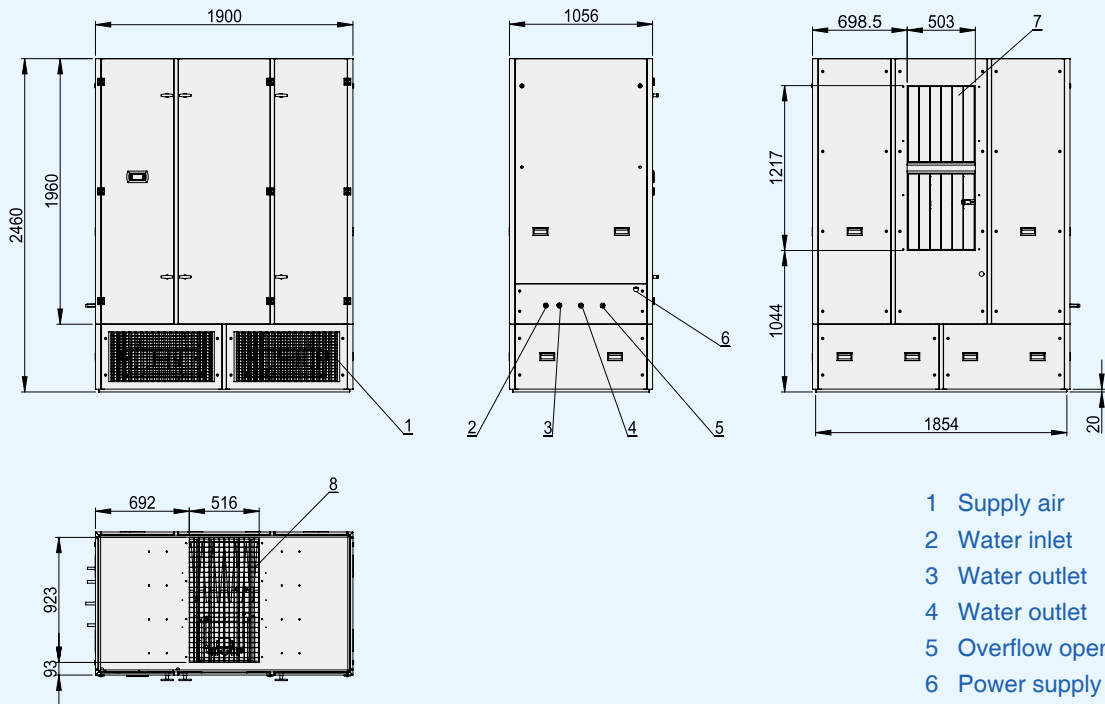
# Technical Parameters

Model	20F2A2	
Air supply arrangement(1)		DN
Cooling capacity(2)	kW	34
Free cooling capacity(3)	kW	32.2
Supply fan		EC Centrifugal fan
Type		
Qty.	n.	2
Air volume	m <sup>3</sup> /h	18000
Input power	kW	2.8
Current	A	4.5
Water consumption	kg/h	90.9
Water pump		DC Diaphragm Pump
Type		
Water flow	kg/h	1500
Input power	kW	0.12
Current	A	4.8
Power supply		400V/3Ph/50Hz
Power source		
Unit max. operating power input	kW	4.8
Unit max. operating current	A	7.7
Overall unit dimensions and weight(4)		
Width	mm	1900
Depth	mm	1056
Height	mm	2460
Weight	kg	575
Main unit dimensions and weight		
Width	mm	1900
Depth	mm	1056
Height	mm	1980
Weight	kg	385.5
Packaged main unit dimensions and weight		
Width	mm	2170
Depth	mm	1300
Height	mm	2150
Weight	kg	514
Fan section dimensions and weight		
Width	mm	1900
Depth	mm	1050
Height	mm	500
Weight	kg	189.5
Packaged fan section dimensions and weight		
Width	mm	2060
Depth	mm	1210
Height	mm	660
Weight	kg	226

(1) DN: down flow;  
 (2) The cooling capacity is closely related to temperature and humidity of inlet air. Cooling capacity at standard operating(@ Tindoor 25°C, @outside air dry bulb temperature 30°C, RH30%, adiabatic cooling mode);  
 (3) Indoor temperature and outdoor temperature difference(ΔT) is 5°C;  
 (4) Dimensions after main unit and fan section installed on site.



# Unit Dimension Drawing



- 1 Supply air
- 2 Water inlet
- 3 Water outlet
- 4 Water outlet
- 5 Overflow opening
- 6 Power supply
- 7 Outdoor fresh air
- 8 Return air



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