ABOVE THE STANDARD

ABRA

The world depends on data; We power and cool it. From a simple swipe, to life-changing medicines. From push notifications to generative AI.

Where there's data, there's ABRA. Powering its potential. From pioneering precision cooling, to ABRA's leadership in critical infrastructure.

And the more data created, the more ABRA technology is needed. From supercomputers powering artificial intelligence, to modular data centers enabling fast-track deployment.

We're powering the potential for tomorrow's breakthroughs. ABRA's scale and innovation is accelerating the industry. From empowering what data needs now, to cooling where data goes next. As AI heats up, leading chip makers turn to us to keep them cool. What's next?

A sustainable digital future enabled by ABRA. Join us at the edge of innovation, supercharging data's next move.

Because the best way to predict the future, is to power it.

Introduction

Proper cooling is crucial to the operation of IT equipment, including servers, storage, and networking devices. As more companies undergo digital transformation, they need edge data centers that include robust, reliable compute resources located close to where data is being generated and processed. Edge computing is the concept of having compute and storage capacity close to where users are generating, consuming and manipulating data. Internet of Things (IoT) applications, for example, involve devices and sensors generating significant amounts of data at the network edge that must then be processed. Legal requirements, the need for local data consolidation and, above all, the high network costs, latency and network security lead to an enormous growth in decentralized IT, the edge applications. The latency involved in sending it to a centralized or cloud data center is too long, driving the need for localized processing capabilities. Healthcare, factory floor machine control and "smart city" applications including autonomous vehicles are just a few examples of applications driving demand for edge computing and, hence, edge data centers.

Office Environments and Comfort Cooling

The typical office environment uses room-based cooling systems provided by building heating, ventilation and air conditioning (HVAC) systems or de-centralized mini-split cooling systems. In centralized building HVAC systems, the cool air enters the space through vents in the ceiling or floor, while warm air is funneled back to the cooling system through a separate return duct. In de-centralized cooling systems extensive ductwork is not needed because the air conditioner is located in the cooled space on or near an outside wall. While this setup works fine in general, as any office worker knows, some areas may be warmer or cooler than others, especially with the centralized HVAC systems. That's a function of the way such systems work, having a single thermometer setting the desired temperature for what may be a fairly large area, such as an entire floor or multiple rooms. But the building's configuration, and the direction that different windows face, may mean some areas warm up more so than others. These differences, however, are not usually large enough to make for uncomfortable, comfort cooling temperatures one way or the other. Putting IT equipment into such a space can change that equation; looking at cooling requirements for office buildings versus data centers helps illustrate why. Cooling capacity is calculated based on the heat load the cooling system needs to handle, typically measured in watts (W) or kilowatts (kW). A typical office HVAC system should have cooling capacity to deal with a heat load in the range of 50 to 150 W per square meter. But a single rack of IT equipment may produce a heat load of up to 7500 watt per square meter.

That is likely to have several repercussions:

- Employees may be uncomfortable as the system struggles to maintain a target temperature, especially in the areas closest to where the IT rack sits
- IT equipment such as servers often have thermal protection systems that trigger a shutdown if the temperature rises too high, causing disruptive downtime and raising the potential for lost and corrupted data
- Continually taxing the HVAC system to operate above its rated cooling capacity will drive up operating costs, over the long-term

Another issue with typical office buildings is humidity. Office HVAC systems aren't designed to hold a constant level of humidity. With doors and potentially windows opening and closing all the time, humidity levels can constantly change depending on conditions outside. The HVAC system will only keep humidity in check at a general level, as a function of providing comfortable heating and cooling, not at exact levels. That may not be good enough for IT equipment, which is highly susceptible to changes in humidity. High humidity can cause condensation and water droplets to form on metal surfaces, eventually leading to corrosion. On the other hand, low humidity can cause static discharge from IT equipment, which may result in damage to electronics such as hard drives. Similarly, dust is the enemy of IT gear. That's why purpose-built data centers have air filtration systems that remove dust and other particulates from the air. In an office environment, dust will naturally accumulate on any surface that's not at least occasionally cleaned, including inside servers and other IT equipment. Over time, this accumulation could impede proper functioning of the equipment.

IT Cooling Options for Office Environments

Companies have two general options for overcoming these obstacles and providing proper cooling for IT equipment installed in an office environment:

- Dedicated room cooling
- Spot-cooling
- Rack-cooling
- Row-cooling

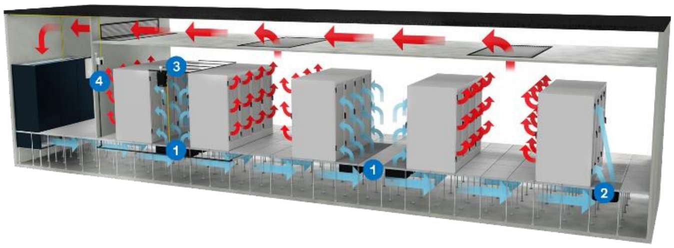
In either case, a key consideration is the equipment footprint.

Companies typically have limited space to dedicate to IT equipment in the first place, often carving it out of space previously dedicated to another purpose. Air cooling systems for such spaces need to be designed to take up as little floor space as possible.

Dedicated Room Cooling

One option is to take a defined amount of space and turn it into a room dedicated to IT equipment, often called a server room. You can then install a cooling system dedicated to the sole purpose of cooling the IT equipment in that room.

Such a system can address the shortcomings of the building HVAC system, including humidity control and particulate filtration. Multiple options exist, enabling companies to choose one that best fits their exact situation.



For cooling the entire room, the two main options are floor-mounted and ceiling-mounted cooling units. In either case, these are typically split systems provided by DX or chilled water that mounted in the IT facility, which are called In-Room systems.

Spot Cooling

However, in edge facilities especially, it's not always possible or practical to create a dedicated server room and some users need to install the IT equipment directly in the office space. In such cases, spot cooling is a good option, with options falling into two general categories: rack- and row-based cooling.

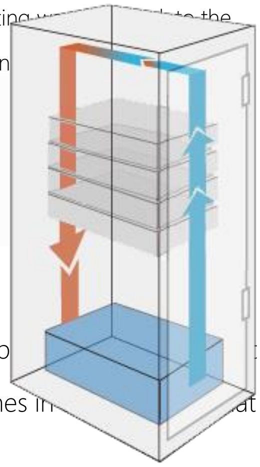
Rack cooling systems can be installed in a perforated door rack or a two-post rack without a door. Such systems also provide some room cooling, making them more suitable for dedicated server rooms or network closets. The systems typically have cooling capacity of about 2-4 kW per rack.

Rack-based Cooling

Rack-based cooling is good for smaller installations of just one or two racks of IT equipment. It involves a cooling system that's integrated directly into the rack and cools only that rack.

The racks can be enclosed, or contained, such that the cool air doesn't get dispersed into the room. This is a good option in office installations because it separates IT cooling from office cooling, so they do not impact each other. IT cooling won't make it uncomfortably cool for people in the office, and the warmer office air won't hinder the effectiveness of the IT cooling system.

A rack-based system has a self-contained unit that disperses cool air to the IT load, then circulates the resulting … to the cooling unit. Enclosed Rack Cooling Does not require dedicated server room. It can be installed in office or in

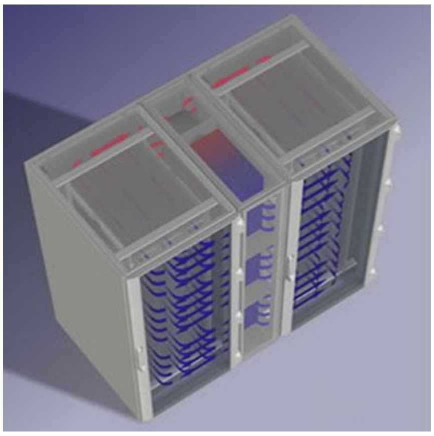


Row-based Cooling

For applications with more than one rack, another option is row-based cooling. These are typ… use an outdoor condenser unit and an indoor evaporating unit. The indoor component comes in … at enables it to fit seamlessly into an IT rack, with the ability to cool several racks in the row.

Row systems can also be contained, similar to enclosed rack systems so that the IT cooling air is circulated only inside of the racks and not discharged into the room. This configuration is ideal for users that don't have a dedicated server room but need to have more than two racks installed in an office space.

Here again, an open version with perforated rack doors is available as well and is used mainly in dedicated server rooms.



Row-based systems disperse cool air through the front of server rows and send warm air out the back, typically to an outdoor condenser unit where it is cooled again. They can be configured as fully contained systems or with perforated doors for room cooling.

One of the benefits of row-based cooling is it's installed close to the IT equipment, which allows for short air paths and quick system reactions to changing heat loads. The system continuously adjusts its cooling capacity and airflow to match the actual server load at any given time. This helps to keep operating costs low by giving the IT equipment only the cooling capacity it needs. Some systems can monitor temperatures of up to 10 different racks and adjust their cooling performance to make sure each rack is getting enough cold air. Such a capability makes these systems a good fit for applications with varying levels of server density.

Heat Rejection Options

As the cooling system cools the room, it removes the heat from that space, and this heat has to go somewhere. There are several options available for how the heat can be rejected, and each application may require different heat rejection types, like the popular methods of air, water, and refrigerant. This may dictate which cooling system is the best match for a given space.

One simple way of heat rejection is through the existing duct system in a building. This is a viable option for smaller rack-based cooling systems that generally produce a relatively small amount of warm air if a building duct system is available and suitable for it. Unfortunately, in many situations this is not the case.

Row- and room-based systems require a different approach since their cooling capacities are bigger, and consequently, they also remove more heat from the room. The existing building duct system would not have the capacity to absorb all this rejected heat. Therefore, these systems always consist of an indoor and outdoor unit connected with two pipes. Depending on heat rejection type, there can be either refrigerant or water flowing in these pipes between indoor and outdoor units.

Direct expansion (DX) systems use refrigerant to transport the heat removed by the indoor unit into the outdoor unit called the condenser, where it is rejected into the ambient air. A DX System is a practice used most commonly with home air conditioning systems.

Chilled water systems use water to transport the heat removed by the indoor unit. The chilled water type of indoor unit is connected to an outdoor chiller plant. The Chiller plant removes the heat from the water, cools it, and sends it back into the indoor unit, which uses it to cool the room. Chilled water systems are typically used in applications with higher heat loads because a single chilled water row-based indoor unit can provide from 30 to 60kW of cooling capacity. In practice, most companies would not build a chiller plant for small sites since it's quite expensive. Therefore, for smaller locations, DX systems are typically preferred.

Uncontrolled Environments

Aside from office environments, many companies need to install edge data centers on factory floors, in manufacturing facilities, and in warehouses that have widely varying environmental characteristics.

Any warehouse faces challenges in maintaining a constant temperature since they aren't usually well-insulated. Depending on geographic region, that can lead to excessive heat or cold inside the facility. Facilities located in regions with changing seasons will see wide fluctuations in terms of temperature from hot to cold and back again. Humidity is likewise an issue for all the same reasons, especially in facilities with no ambient air control system in place.

Uncontrolled environments are also likely to be far dustier than offices, and less likely to have any particulate filtration system in place. Dust combined with high humidity can be quite harmful to IT equipment, as the humidity will make particles stick to IT equipment and potentially clog up the filters meant to protect gear such as servers and data storage systems.

Cooling Options

Theoretically, all the same cooling systems that apply in an office environment can also be used in uncontrolled environments, but most customers favor an approach that involves a sealed rack, which means rack- or row-based cooling.

The reason is simple: such self-contained systems essentially seal off the IT equipment from the outside air. That protects the equipment from dust and humidity, while enabling the company to tightly control the temperature of the racks.

The key is to look for a system with a high Ingress Protection (IP) rating as defined in the International Electrotechnical Commission (IEC) 60529 specification, which covers mechanical and electrical enclosures intended to protect against intrusion, dust and water. An IP54 rating, for example, means an enclosure offers strong protection against dirt, dust, oil, and splashing water, all enemies of IT equipment.

With such an enclosure, the IT equipment is isolated from the environment in which it’s installed. Combined with a rack- or row-based cooling system, companies can tightly control the temperature of the IT equipment while also protecting it from its potentially harsh surroundings.

Such a setup can also be highly efficient since IT equipment can withstand far higher temperatures than what is comfortable for humans. For example, the latest guidance from the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) says 87 percent of server models are safe to operate at 35 degrees Celsius (95 degree Fahrenheit). Operating the IT cooling system at or near that level would save significant sums on cooling costs versus using a temperature closer to the comfort level for humans.

Features

- Advanced power quality monitoring and metrics, ±1% metering accuracy
- C13 and C19 combined in any order, auto-locked outlets, outlet's power status LED indicate
- Individual outlet control, power sequencing on/off, timed on/off control
- LCD display with touchable screen, LCD orientation rotatable, metering information real-time display
- Ethernet 10M/100M, USB, CAN, I/O, IIC (sensor), RS485 (sensor)
- Protocols: HTTP/HTTPS (HTML5, REST, JSON), SSH, IoT (MQTT), SNMP (V1, 2c, 3), SMTP
- User configurable threshold alarms for sensors reported over SNMP, SMTP, and HTTP POST to customizable URL
- Access control through user accounts with passwords and X.509 (PKI) certificates, Cloud Access (AWS and Google)
- Signed and encrypted firmware upgrades (network, USB) to ensure authenticity and integrity
- Circuit breaker(s) and surge protection,
- Industrial grade mechanical design, Slot assembly mode and screwless on panel
- Temperature, humidity, power consumption monitoring; digital binary state signal sensor; supports third party external sensor with power supply (5V)

The IMP Series PDU is an intelligent modular power distribution with high accuracy energy measurement and reliable outlets controls. It offers industrial-grade reliability, complete power management, user-configurable firmware, and hot-swappable capability for maintenance. Its futureproof design helps manage operations more efficiently and greener.

The IMP series PDU incorporates Center Controller Module, Phase/Total Meter Module, Circuit Breaker Module and Relay/Outlet Module

The Center Controller Module

The intelligent control center of PDU, that houses high compute power, display screen, and multiple connectivity ports.

- LCD with touched display provides information on power usage, outlet status and critical alerts.
- Touchable LCD also provides an easy way to check and control PDU's status on site

In-Room Cooling System

Benefit

- Extended chilled water coil to deliver high specific cooling capacity with maximum efficiency in limited footprint
- Design based on economization with direct and indirect free-cooling operation
- Smart airflow and thermal load management for energy efficiency
- Highest reliability to safeguard business
- Modular and tailored configuration for many applications
- User friendly touch screen display for easy access to all parameters
- Easy maintenance and full-frontal access

Boosted capacity to save white space occupancy

While data center loads are increasing, there is less space available for cooling equipment that must therefore provide the required cooling capacity with a minimum white space occupancy.

The TDCC series is designed to provide the highest cooling capacity in the linear occupancy compared with traditional units. This means:

- Maximum space available for the IT equipment
- Resized electrical infrastructure

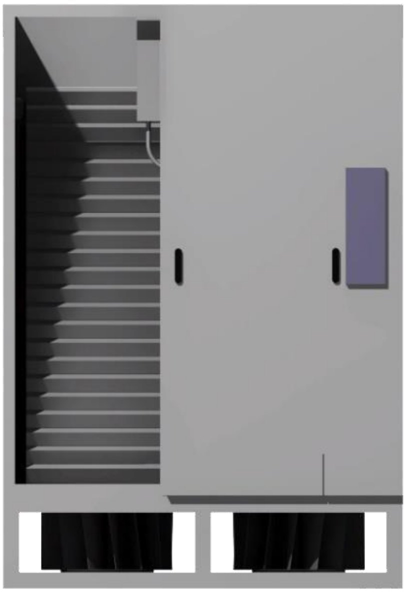
* Traditional design units with fans inside unit cabinet

Large chilled water coil and high specific capacity

TDCC fans are located underneath the floor, enabling more coil surface in the unit and less internal air-side pressure drop.

More heat exchanger coil and less pressure drop equals less power consumption and more capacity inside a compact footprint.

Water circuits design is optimized to have low water pressure drop even with high water flow rate and tight water DT.



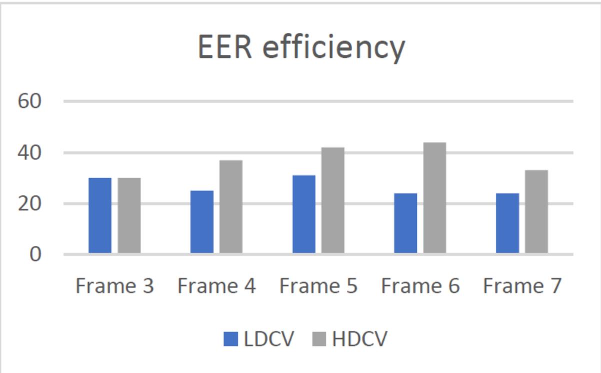


Figure 1. Comparison LDCV*-HDCV -same capacity -Air 35'C/30% -Water 1 6-24'C

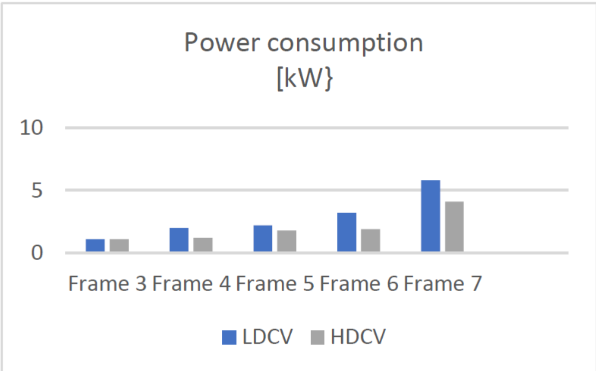


Figure 2. Comparison LDCV*-HDCV -same capacity -Air 35'C/30% -Water 1 6-24'C

Direct free cooling

Under certain climate and air quality conditions, the optional Free Cooling plenum enables the direct use of external air to cool the Data Center with enormous energy savings.

According to the site conditions the unit can be configured with specific free-cooling control logics to maximize the free cooling hours.

Room humidity is continuously monitored with the ability to disable free cooling in case of high room humidity. maximum and minimum humidity levels are monitored.

Indirect free cooling

When combined with a free-cooling chiller, chilled water systems can leverage on the outdoor temperature to reduce the energy consumption throughout the year. In this case the free cooling effect is provided by the free-cooling coils of chillers.

If properly designed, this system can provide outstanding energy savings and can be applied regardless the outdoor air quality and humidity.

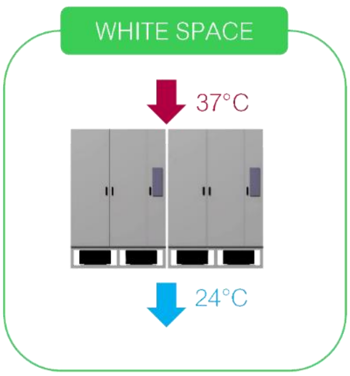
Indirect free cooling and design on optimum temperatures

To further maximize energy efficiency, the TDCC series is available in a High Temperature version (20-250kW).

- Designed to maximize the efficiency of the thermal exchange and provide precise supply air temperature to the servers.

- Optimized for a water regime of 20 °C / 30 °C, with airflow of 37 °C on the return side and a supply air temperature between 24 - 25 °C.

- Wide water DT to reduce water speed in the coil and improve thermal exchange efficiency.



Smart airflow management

The Data Center is a dynamic working environment where required airflow can fluctuate considerably. If this is not correctly considered the cooling system will use more cold air than the actually needed. TDCC units manage the airflow to adjust the cooling system power consumption according to changes in IT load.

Cooling capacity regulation with fixed or variable airflow

Latest Generation composite EC & VFD Fans provide fan speed adjustment via the microprocessor control while the unit is running with the ability to regulate airflow depending on the actual thermal load. This means lower power consumption on the fan side and high part-load efficiency.

Automatic Floor Pressurization System

Fan speed changes to maintain a constant set point of pressure under the raised floor. The change in airflow is based on the pressure differential between the air under the floor and the air above the floor. Automatic Floor Pressurization System (AFPS) adapts the power consumption to IT Room load changes over the time, minimizing energy consumption in all operating conditions.

Active stand-by management

Up to 15 units can be linked to each other through the local LAN network to perform grouping logic. Units are rotated on a time basis to optimize operation. The stand by units integrated with AFPS can be switched on to maximize system efficiency.

Easy maintenance

Ease of maintenance is key to reduce operating costs and avoiding downtime.

Regular maintenance can be carried out while the unit is in operation and without airflow disruption. Full frontal access for regular maintenance. Easy maintenance and component replacement. User friendly electrical connections. The front panels can be opened without the need for special tools. Easy removal of fans from front of the unit.

Continuous availability: dual power source

TDCC units are available in single and dual power supply with automatic electromechanical change over for complete redundancy without single point of failure, as Per TIER recommendations.

The ultracapacitor is included in the dual power supply version and is optional in the single power supply version. It keeps the microprocessor powered during the switching of the lines to save time for reboot of hardware and firmware and a ow a quick restart.

High redundancy: dual cooling source

TDCC units are available in Dual Coil (DC) version. These units have two separate hydraulic circuits that can be connected to separate cooling sources, providing redundancy and an emergency cooling source.

Different cooling strategies (tandem, redundant, dual input, single input) allow HXCV DC units to maximize the cooling capacity per linear occupancy.

Cybersecure your data

ABRA HVAC protects customer's security and privacy. TDCC units ensure:

protection against cyber-attacks according to latest standards (TLS 1.2).

the possibility to implement the unit in networks requiring HTTPS certificate.

a three-tier user access with trusted password management.

Continuous monitoring and WEB integration

Metering and continuous monitoring of the operating parameters are key for a precise control of the cooling system operation to prevent system failures.

TDCC units can measure operating conditions as well as cooling capacity and power consumption.

All data can be easily shared with any building management System as units come with a complete set of integrated cards that ensure wide and secure connectivity.

Advanced Control

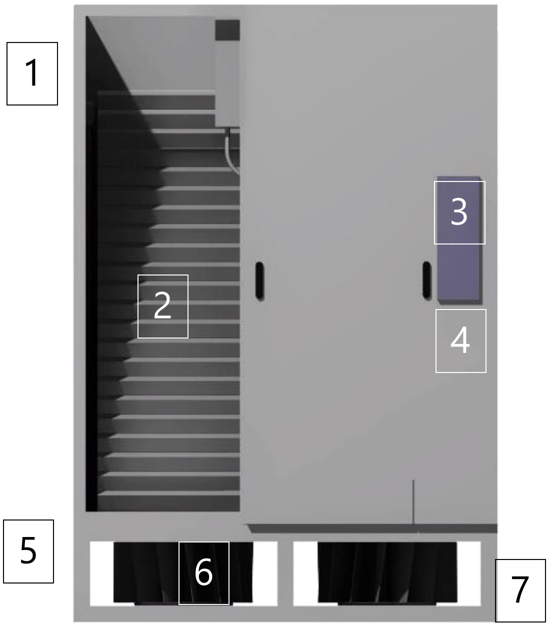
Advanced control logics ensure an intelligent operation of TDCC units to meet the cooling and airflow needs without wasting energy. Air flow control adapts to specific data center air distribution strategies (hot or cold aisle) and ensures efficient air flow management.

Advanced microprocessor control system UG50 enables direct communication between multiple TDCC units enabling precise cooling.

7 inch

Touch Screen Color LCD

TDCC series main features



1. Coil module

- For installation above the raised floor.

- Large surface copper and aluminum cooling coil.

- Designed for mid-low water temperatures and HT version for high water temperatures (20'C up to 32'C).

- Internal aeraulic layout designed to optimize airflow and maximize fan efficiency

2. Air filters

- High efficiency EU4 or EU5.

- Surface maximization for low air pressure drops

3. Integrated user interface

- 7" touchscreen display.

- Native integration with ECOSTRUXURE IT Platform via SNMP

4. Power supply

- Single and double power supply.

- Ultracapacitor

5. Underfloor fan module

- Optimum air distribution.

- Avoid turbulence to increase fan efficiency

6. Electronically Commuted Fans

- Latest generation Radical composite EC & VFD fans.

- New impeller design maximizing efficiency.

- Microprocessor continuous fan speed regulation

7. Adjustable legs

- Easier installation on raised floor

A wide choice of air flow configurations for any site layout

- Fan module open on all sides
- Fan module with frontal air discharge
- Fan module with frontal and lateral air discharge
- Fan module with all sides closed for installation above the floor
- Back discharge for installations in technical corridors out of the IT space

Technical Data Table

DX VERSION										
TDCCD MODEL		F34SSD	F54SSD	F78SSD	F86SSD	F99SSD	F136SSD	F156SSD	F173SSD	F181SSD
Fan type	-	VFD & EC								
Power supply	V/Ph/Hz	400/3/50								
Number of fans	-	1	1	2	2	2	3	3	4	4
Airflow	m^3/h	10000	13000	19000	24000	24000	31000	35000	40000	42000
Net sensible cooling capacity	KW	34	54	78	86	99	136	156	173	181
DIMENSIONS										
Height	mm	2510								
Length	mm	1010	1310	1720	2170	2170	2570	3100	3100	3405
Depth	mm	865								
ODU DIMENSIONS										
Height	mm	2000					2205			
Length	mm	860					1100			
Depth	mm	2200								

CHILLED WATER VERSION								
TDCCLW MODEL		A28SDD	A42SDD	A57SDD	A82SDD	A108SDD	A125SDD	A151SDD
Fan type	-	VFD & EC						
Power supply	V/Ph/Hz	400/3/50						
Number of fan	-	1	1	2	2	3	4	4
Airflow	m^3/h	7900	13000	17500	24000	32000	35000	42000
Net sensible cooling capacity	KW	28	42	57	82	108	125	151
DIMENSIONS								
Height	mm	2510						
Length	mm	1010	1310	1720	2170	2570	3100	3405
Depth	mm	865						

1 - Data refer to nominal conditions: Room at 35 °C - 30% RH water temperature 18/24 °C, fan module installed under a 900 mm raised floor, and glycol 10%.

2 - Includes fan module.

3 - Cooling performance refers to one running CW circuit.

4 - Data refer to nominal conditions: Room at 36 °C - 30% RH water temperature 20/30 °C, fan module installed under a 900 mm raised floor, and glycol 20%.

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