Dantherm®
CLIMATE SOLUTIONS

SELECTION GUIDE

FREE COOLING TECHNOLOGY

FOR SHELTERS IN THE TELECOMS, POWER DISTRIBUTION, RAILWAYS, OPTOFIBRE AND BATTERY STORAGE INDUSTRIES

DANTHERMGROUP

INDEX

WHY IS FREE COOLING IMPORTANT?

In today's world, there is an increasing demand for reliable, efficient, and cost-effective cooling solutions for shelters and enclosures that house critical electronic equipment in e.g. the telecom, power distribution, data centre, railway, optofibre or battery storage industries. Free cooling technology is gaining popularity due to its high efficiency, low energy consumption, and environmental sustainability.

Drive down costs, maximise uptime

Ideally suited for a wide range of sectors and uses, our free cooling solutions provide reliable, energy-efficient heat removal and temperature control for sensitive electronic equipment and technology in for instance shelters, cabinets, enclosures or rooms.

As a company, we are committed to finding new ways of meeting your cooling requirements while lowering energy consumption and maximising reliability. Our team of cooling specialists constantly challenge the status quo and identify innovative solutions aiming to deliver greater value to you every day.

Having developed and delivered more than 1 million free cooling units, we know the challenges encountered by the sectors wanting to protect sensitive equipment from overheating.

The aim of this selection guide is to help you find the cooling solution that is the best match for your project.

Enjoy reading!

Free cooling is a method of using naturally occurring cool outdoor air to cool the indoor space of a building or industrial process without the use of mechanical refrigeration systems.

It is a cost-effective and environmentally friendly way to cool a shelter or building.

Simple, yet incredibly efficient

Free cooling works by taking advantage of the difference in temperature between the outdoor air and the indoor air. In a typical setup, a free cooling system consists of an outdoor air intake, a fan unit, and a system of dampers and a controller. During cooler times of the day or year, the systeem draws cool outdoor air into the building. The free cooling unit cools the indoor air by transferring heat from the warm indoor air to the cool outdoor air. The cooled air is then circulated throughout the building and exhausted through the outlet damper.

The effectiveness of free cooling depends on the local temperature conditions and location of the building. In some climate zones, the outdoor air may not be cool enough to provide sufficient cooling, or the humidity levels may be too high. In such cases, a hybrid system that combines free cooling with mechanical cooling may be used. Additionally, the design and layout of the building can affect the efficiency of the free cooling system. Proper insulation, building structure, and air distribution are important factors to consider.

WHAT ARE THE BENEFITS OF FREE COOLING?

Traditional ventilation/fans vs. free cooling

Dantherm Group's free cooling systems for technical buildings and shelters constitute a top-tier choice, offering a number of advantages over traditional ventilation and fan solutions. These benefits extend across various facets, making it a comprehensive and efficient solution for environments with sensitive equipment.

Complete systems built for purpose, tested and approved

What distinguishes Dantherm's approach is the commitment to delivering fully assembled, tested and type-approved systems. Unlike one-off projects assembled from disparate components, Dantherm's solutions are compact, energy-efficient, and encompass various elements such as duct or box fans, filter boxes, duct systems, and more. This means that our offerings are CE marked and adhere to standards such as REACH, ROHS, WEES, and others.

Flexible, silent and compact

Dantherm Group' s free cooling systems also excel by ensuring minimal noise levels thereby making the environment quieter and more comfortable.

Beyond performance, the system accommodates special building requirements, including fire classification and IP classification, with the option to incorporate an extensive range of additional accessories if necessary.

Installation is streamlined, thanks to a standardised and packaged solution that significantly reduces the time and space required during setup.

Clever control system adapts to real-time needs

The intuitive CC 3000 control unit is a user-friendly interface designed for easy commissioning, customisation, connectivity and troubleshooting. Its accessibility allows virtually anyone, even without prior knowledge, to handle the system effectively. Optionally, it can be locked for unauthorized changes, adding an extra layer of security.

The smart control logic embedded in the CC 3000 unit, working in tandem with the fan, significantly reduces energy consumption. This dynamic communication optimises the fan's speed based on real-time needs, a notable departure from traditional systems that rely on preset curves. This not only ensures energy efficiency but also minimises noise levels.

Custom-built solutions = high service costs

Service and aftermarket management are streamlined with a factory-built and tested system, facilitating cost-effective support and spare parts. This stands in contrast to the challenges and increased costs associated with managing individualised, one-off solutions.

From a Life Cycle Cost (LCC) perspective, considering the aforementioned advantages, Dantherm's free cooling system emerges as the most cost-effective solution for cooling technical buildings. Its integration, commitment to quality, noise reduction, compliance with standards, and smart control logic collectively position it as a standout choice in the realm of cooling solutions.

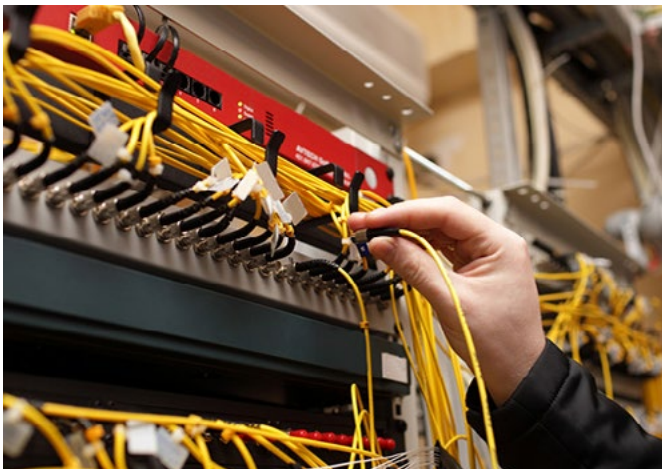
WHERE CAN FREE COOLING BE USED?

BATTERY STORAGE

Battery storage systems are increasingly being used to store renewable energy and provide backup power for critical infrastructure. These systems often generate heat during operation, which can negatively impact their performance and lifespan og even cause blackouts. Therefore, efficient cooling is essential to maintain the optimal temperature range for these systems.

Free cooling constitutes a viable solution for cooling battery storage infrastructure, especially in locations where the outside air temperature is lower than the desired temperature for the batteries. Free cooling can be combined with existing cooling installations to make them more efficient.

The main benefit of using free cooling for battery storage applications is a significantly reduced energy consumption and uncomplicated maintenance.



OPTOFIBRE

Optical fiber communication systems are widely used in telecommunication networks and data centers for high-speed data transmission. These systems often generate heat during operation, which can negatively impact their performance and lifespan. Therefore, efficient cooling is essential to maintain the optimal temperature range for these systems.

Free cooling can be a viable solution for cooling optofiber infrastructure, especially in locations where the outside air temperature is lower than the desired temperature for the equipment. One important consideration for implementing free cooling in optofiber applications is the potential impact of environmental factors, such as dust, dirt, and other contaminants that can affect the performance of cooling systems. It is important to ensure that the cooling systems are properly designed and maintained to prevent contamination and ensure reliable operation.

WHERE CAN FREE COOLING BE USED?

POWER DISTRIBUTION

In power distribution applications, free cooling can be used to reduce the temperature of electrical equipment and components, such as transformers, switchgear, and control panels. High temperatures can have a negative impact on the performance and lifespan of these components, so maintaining an appropriate temperature range is important for ensuring reliable operation.

The effectiveness of free cooling depends on various factors, including the geographical location, climate conditions, and design of the cooling system. In regions with cooler climates or during certain seasons, free cooling can be particularly advantageous, as the ambient air temperature is naturally lower. However, even in warmer climates, free cooling can still contribute to energy savings by reducing the load on mechanical cooling systems or operating them only when absolutely necessary.

RAILWAY

Railway applications often involve the use of electrical equipment, such as signaling and control systems, which generate heat during operation. High temperatures can negatively impact the performance and lifespan of these systems, so it is important to maintain an appropriate temperature range.

Free cooling can be a viable solution for cooling railway infrastructure, especially in locations where the outside air temperature is lower than the desired temperature for the equipment.

One important consideration for implementing free cooling in railway applications is the potential impact of dust, dirt, and other contaminants that can affect the performance of cooling systems. It is important to ensure that the cooling systems are properly designed and maintained to prevent contamination and ensure reliable operation.

TELECOM & DATA CENTRES

In telecom and data center applications, cooling is essential to maintain optimal operating temperatures for servers, networking equipment, and other critical infrastructure. However, traditional cooling methods can consume a significant amount of energy and contribute to high operational costs. Free cooling addresses these challenges by leveraging external environmental conditions to cool the equipment.

The implementation of free cooling in telecom and data centre applications offers several benefits. These include reduced energy consumption, lower carbon footprint, and cost savings in terms of electricity bills and maintenance. However, it is important to consider factors such as humidity control, air quality, and system design to ensure efficient and reliable operation.

FACTORS THAT INFLUENCE COOLING REQUIREMENTS

Climate and geography

It is important to take geographical and surrounding factors into account when determining the cooling strategy and choice of cooling technologies and methods.

Urban areas

- Where traffic is forecasted to increase and sites may be filled with more transmitting equipment, factor in the possibility of expanding the cooling. Even if the space remains the same, as the concentration of transmitting and supporting equipment is getting denser, the cooling needs will increase.
- Where sites are placed near noise-sensitive residential areas, you want to choose solutions that can be sound-reduced site by site.
- Where construction is ongoing and sand may be an issue, factor in solutions that can run closed-loop or can incorporate sand traps.

Desert

- With risk of sand drift and sandstorms that can either be blown into the site or cover parts of the site, factor in efficient sand traps and the possibility of closed-loop units.

FACTORS THAT INFLUENCE COOLING REQUIREMENTS

Humidity

- When there is risk of high humidity levels, free cooling can be used alone as the temperature of the air is rising when entering the site, thereby decreasing the relative humidity. If you want to combine free cooling with air-conditioning, choose air-conditioners for electronic cooling that supply the cooling at higher temperatures and with higher airflows than commercial comfort units in order to avoid condensing.

Snow risk areas

- When there is a risk of snow and ice, the shelter solutions could be raised slightly from the ground. This is preferred from a cooling perspective. The reason is that in these areas it is often cold, and the optimum energy-efficient cooling system is usually free cooling. When choosing a unit that takes the air from the bottom of the shelter (through the floor) the air path should thus be clear as there most often will be one side of the shelter that allows air in from under the shelter.

Warm areas

- Use existing air-conditioners. Install DC free cooling to be used as emergency cooling to prevent meltdown. Combine with free cooling during cold hours (evening/night)

Fluctuating temperatures

- Install DC-free cooling as addition to the existing air-conditioners – to optimise energy savings and also as emergency cooling to prevent meltdown.

Cold areas

- Use the air-conditioners and heaters you already have to implement a free cooling unit for total heat management (i.e. it controls all components). Depending on site configuration (e.g. placement high above ground, or on the ground), the free cooling unit can either take the air from through the floor to provide cooling even during snowfall or, if the shelter is placed on the ground, the free cooling unit that can be placed with air intake high above the ground.

INDOOR LOCATIONS

Most electronic equipment placed indoors can withstand 40-45°C. But batteries and some routers are not designed for such high temperatures. Batteries, for instance, often need temperatures no higher than 25°C and 30°C for specific routers.

Therefore, it is a challenge to find the most suitable temperature that requires the least possible energy.

General rules of thumb

Generally, we recommend first examining whether a low temperature is required due to just one piece of equipment that could be replaced by a more temperature-resistant unit. This may well pay off in the long run.

For sites where people are also working, we recommend choosing a control solution which can be set to a comfort mode when staff is present and then subsequently changes back to normal operation automatically. In our experience, this will enable you to ensure optimal working conditions while avoiding the risk of somone forgetting to manually set the temperature back to the energy-efficient temperatures once they leave.

Combining DC-powered passive cooling solutions with new or existing air-conditioners gives you the additional advantage of emergency cooling in case of a power outage or an air-conditioner breakdown. It also extends life expectancy of your air-conditioners as they will no longer be running all the time.

Overall, combined solutions ensure site uptime and earnings while eliminating the potential massive cost if a site melts down due to overheating.

Shelter or room with no batteries on stable grid sites

For sites with no batteries, temperature-sensitive routers or equipment, we recommend raising the set temperature to 38-40°C for normal operation.

You can utilise passive cooling strategies (for instance free cooling) to remove the excess heat from the site, and for warm climates you can combine passive and active cooling technology by applying air-conditioners for the warm periods/peaks.

INDOOR LOCATIONS

Shelter or room with batteries – where batteries can be placed in separate compartments or cabinets

For sites where the battery bank determines the overall temperature requirements, we recommend creating a separate compartment inside the shelter/room for batteries and other temperature-sensitive equipment to allow for dual-zone cooling. If this is not possible, we recommend establishing a separate cabinet which will also allow for dual-zone cooling. The setup for both would be as follows:

- In the separate battery compartment or cabinet, the temperature is kept at 25°C by utilising active cooling technology such as DC air-conditioning.
- The rest of the site that contains temperature-resistant equipment can then be cooled using passive cooling equipment such as free cooling, and, in very warm climates, using air-conditioning in combination to tackle high-temperature periods/peaks.

The climate controller should include a comfort switch for the site staff allowing them to carry out work in comfortable temperatures. The climate controller should automatically switch back to normal energy-saving mode after a preset period of time.

Shelter or room with batteries – where batteries cannot be placed in separate compartments or cabinets

For sites where batteries cannot be placed separately, they will determine the temperature requirements of the site. We still recommend establishing passive and active cooling. Free cooling for the periods with ambient temperatures below 20°C and air-conditioning for the periods with ambient temperatures above 20°C. Even if temperatures are never below 20°C, this system can be used because the passive cooling system will then provide emergency cooling and prevent site meltdowns when running on batteries.

OUTDOOR LOCATIONS

Most electronic equipment used for outdoor sites can withstand 50-55°C – sometimes even more. Due to the ambient temperatures in the EMEA region, the need for air-conditioners is therefore minimal.

Sites without batteries and fitted with temperature-resistant equipment

For sites like these, passive cooling technologies such as free cooling are typically sufficient to keep the equipment at a desired working temperature.

Sites with batteries that can be placed in inside compartments or separate cabinets/enclosures

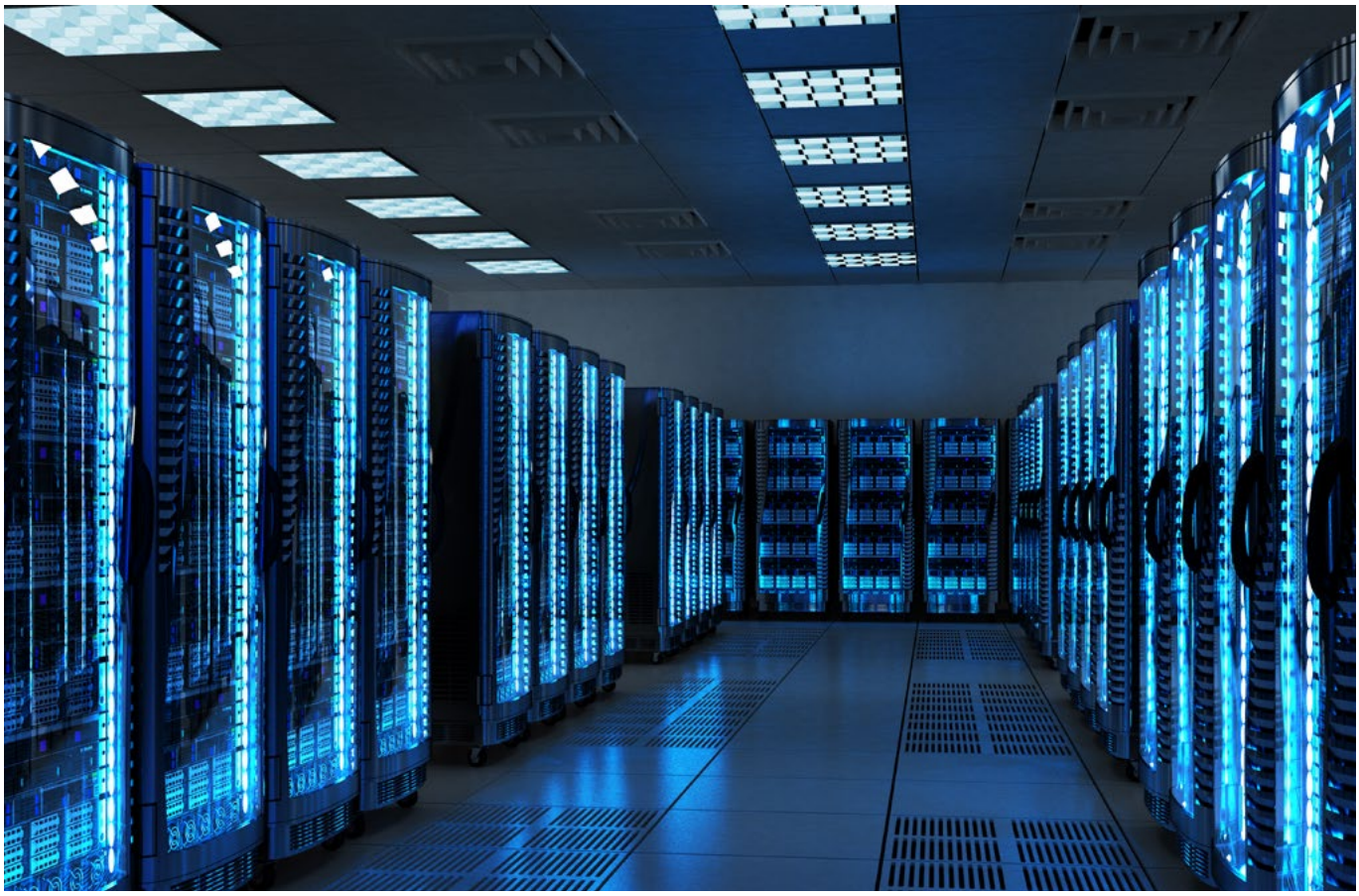
For sites with batteries, we recommend creating a separate compartment inside the shelter for batteries and other temperature-sensitive equipment to allow for dual-zone cooling. If this is not possible, we recommend establishing a separate cabinet or enclosure which will also allow for dual-zone cooling: The cooling strategy for both would be as follows:

- The compartment with the batteries is kept at 25°C utilising a small active cooling technology such as DC air-conditioning.
- The rest of the site that contains temperature-resistant equipment can be cooled using passive cooling equipment such as free cooling, and, in very warm climates, using air-conditioning to handle high-temperature peaks.

Cabinet sites with no compartment or separate cabinet/ enclosure for batteries

For sites where batteries cannot be placed separately, they will determine the temperature requirements of the site. We still recommend establishing a cooling strategy based on passive and active cooling. Free cooling for the periods with ambient temperatures below 20°C and air-conditioning for the periods with ambient temperatures above 20°C.

COOLING TECHNOLOGY AND STRATEGIES



Free-cooling technology works by using the ambient air outside the shelter or enclosure to cool the inside. This is achieved through a heat exchange process, where the warm air inside the enclosure is drawn out and replaced with cool outside air.

This process can be achieved through a variety of methods, such as direct air cooling, indirect air cooling, and adiabatic (evaporative) cooling. These cooling methods utilise different techniques, such as air-to-air heat exchange, air-to-water heat exchange, or evaporative cooling, to achieve the desired temperature.

One of the main advantages of free-cooling technology is its energy efficiency, as it can significantly reduce the energy consumption and carbon footprint of the cooling system. This is because it relies on the natural cooling properties of the outside air, rather than energy-intensive refrigeration circuits. In addition, free-cooling technology can also be more reliable and cost-effective than traditional cooling methods, as it requires fewer mechanical components and can operate at higher temperatures.

Overall, free-cooling technology is an innovative and sustainable cooling strategy that offers many benefits for shelters and enclosures. By utilising this technology, you can reduce your energy consumption, lower your operating costs, and achieve a more reliable and efficient cooling solution for your critical equipment.

FREE-COOLING TECHNOLOGY

Free cooling is cost-effective controlled ventilation – the telecom shelter or enclosure is cooled by means of ambient air without a compressor. Dantherm free cooling solutions operate with an overpressure, delivering filtered air into the room, thereby ensuring a clean environment for the electronic equipment. Our Flexibox units generate documented energy cost savings of up to 90% on cooling at Telecom sites hosting GSM, UMTS, or LTE networks.

Installing a Flexibox free cooling unit at an existing site will:

- Lower maintenance costs for the complete cooling system as the Flexibox will be relieving existing air-conditioning systems thereby reducing tear and wear of this expensive technology
- Decrease the number of emergency trips to sites due to air-conditioner breakdowns
- Limit site breakdowns as the Flexibox will also deliver emergency cooling in case of air-conditioner breakdown or power outage, secure a longer "up-time" in case of overheating – and allow for technicians to arrive on site before the site comes to a complete hault.

In this way, a free cooling solution results in securing customer' perception of telecom network as a high-quality network, decreasing maintenance cost thanks to lowered risk of site breakdowns, and achieving prolonged air-conditioner life time.

Case study

3GIS RNC CORE NETWORK SITES

The entire Swedish 3G network is based on Dantherm free cooling. The solution has also been implemented at 11 RNC core network sites to generate significant savings.

Running cost reductions on cooling

3G Infrastructure Services AB builds and runs infrastructures that enables the owners –Telenor Sweden and 3 – to offer their customers mobile telecom and services using the 3G/4G mobile telecom technology. 3GIS has used free cooling solutions from Dantherm to build the most cost-effective 3G network in the world. By using free cooling rather than active cooling on 11 RNC core network sites, the general reduction in energy consumption for the large RNC sites was 25,000 kWh/year compared to the originally installed cooling solution.

Low installation costs and high reliability

Shortly after the project initiation, the focus was extended to include minimising installation costs, which also reinforced the advantages of choosing a Dantherm solution – the double cube and the flexibox free cooling solution. Thanks to the solutions' low power consumption, emergency cooling in case of AC mains failure, built-in alarms and factory-installed cabling, the installation time was minimised and the realiability of site uptime was secured.

Fast and reliable rollout

Dantherm was the turn-key entrepreneur on the project and thus took full control of everything including supervising suppliers. Because of the extreme importance of delivering constant network access, performance is of the utmost importance for 3GIS. Dantherm was tested continuously and scored 100% on delivery performance during the entire project.

DISPLACEMENT-FREE COOLING

Displacement free cooling is a type of free cooling that uses a displacement ventilation system to provide cooling to a building. Displacement ventilation systems work by supplying air at low velocity through diffusers located near the floor. The cool air then displaces the warm air, which rises and is exhausted through high-level vents or windows.

In displacement free cooling, the cool outdoor air is drawn into the building through a free cooling unit and distributed via the displacement ventilation system. The cool air is distributed at low velocity, which helps maintain a consistent temperature throughout the space while also reducing the amount of energy required for the fans to circulate the air.

Displacement free cooling is particularly effective in buildings with high ceilings or areas where the air can stratify, such as atriums or lobbies. By using the displacement ventilation system, cool air can be supplied directly to the occupied zone, which can result in significant energy savings compared to traditional cooling systems.

However, as with all free cooling systems, displacement free cooling is dependent on external weather conditions and may not be effective in all climates or during certain times of the day. Additionally, proper design and installation are necessary to ensure that the system is optimised for the specific building and its intended use.

Dantherm's DCF units are less cost-intensive and more silent than traditional free cooling solutions, because they operate with lower air flows and fan speed. Furthermore, the DFCs are small in size, taking up a very limited space in the room. The 6th generation version also features the Dantherm CC3000 controller, which includes dual-zone cooling, night mode, and browser-based remote control.

Case study

DISPLACEMENT FREE-COOLING

The efficiency of any cooling solution depends on the conditions at your site. This is why Dantherm met with a large Telecom operator, who was convinced that displacement free cooling was the best choice for all rooms and containers in their entire network.

A hands-on meeting with Dantherm

How do you explain when and where to apply traditional free cooling, displacement free cooling or air-conditioning without getting lost in manuals? Well, it is not easy, so Dantherm engineers arranged for a hands-on meeting with a big telecom operator in Europe. This opened the operator's eyes to the technologies behind all three cooling solutions and why knowing your site conditions is critical to the cost-efficiency of your solution.

Displacement free cooling – ideal conditions

Displacement free cooling by Dantherm (DFC) is most efficient under the following conditions:

- In rooms up to 12m2
- When the internal air is stagnant

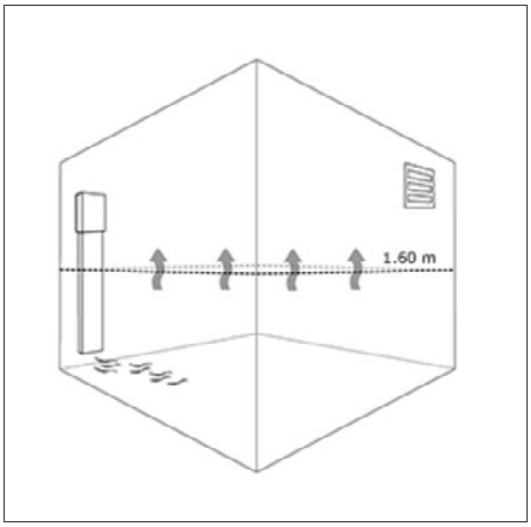
This is because cool outdoor air is supplied at the bottom of the room through a bag filter, and a cushion of cool air builds up at the bottom of the room, forcing the warmer air to move up.

Specific strengths of the DFC solution

The Dantherm DFC units are less cost-intensive and more silent than traditional free cooling solutions, because they operate with lower air flows and fan speed. Furthermore, the units are small in size, taking up a minimum of space inside the room.

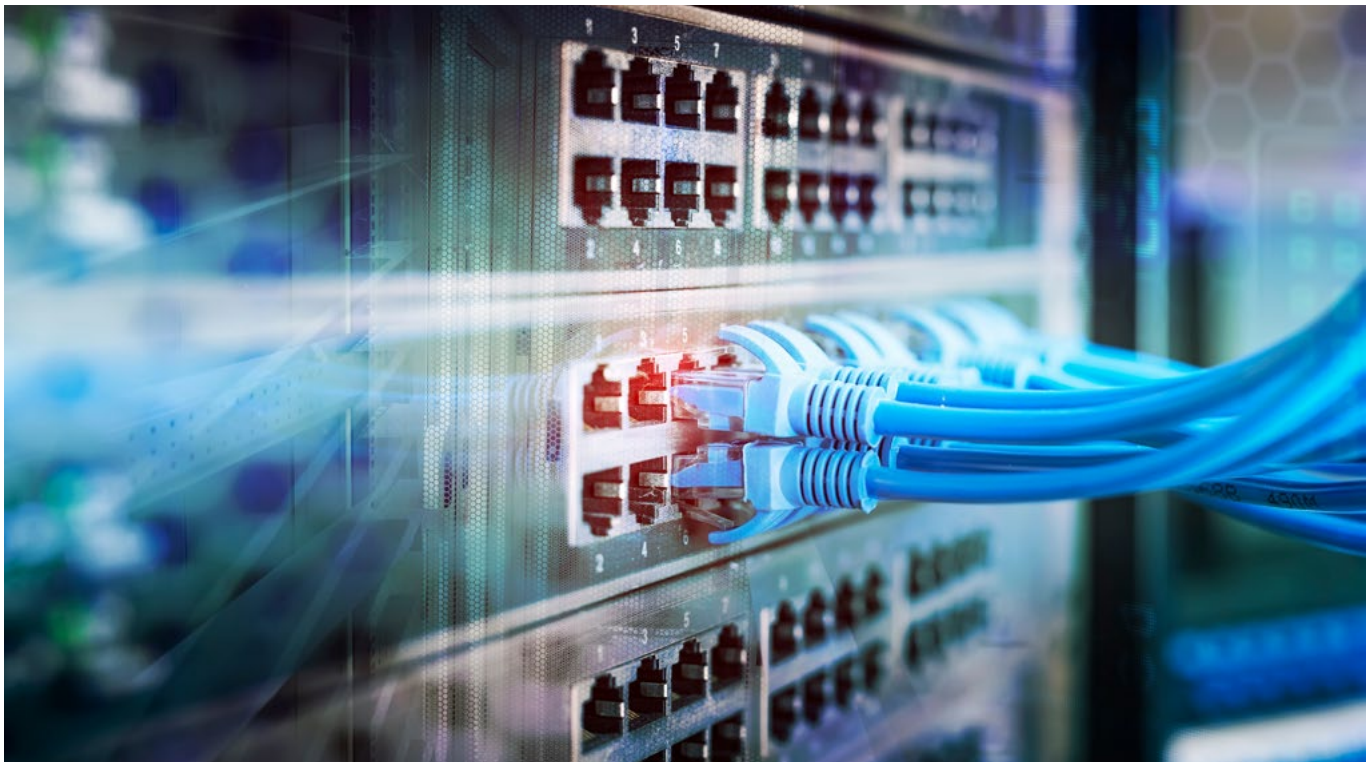
Shared knowledge, different strategies

By sharing technical knowledge and strengths and weaknesses about different cooling methods available, the client was equipped for making decisions about differentiated cooling strategies, thus ensuring the highest possible savings across their network. Displacement free cooling turned out to be the ideal solution for the operator's sites in the Czech Republic. For the remaining sites in Europe, the operator chose to approve two Dantherm solutions: the combo cooling, a unit operating with free cooling and air-conditioning, and the flexibox, a unit operating just with free cooling.



DFC installation sketch

DISPLACEMENT-FREE COOLING



Dual-zone cooling

Dual-zone free cooling is a type of free cooling system that provides separate cooling zones within a building, each with its own temperature control. The system works by taking advantage of the temperature difference between the outdoor air and the indoor air to provide cooling to the zones that require it, while allowing other zones to operate at a higher temperature.

In a dual-zone free cooling system, the building is divided into two or more zones, each with its own air handling unit (AHU) and ductwork. One zone is designated as the "cool" zone, while the other zone is designated as the "neutral" or "warm" zone. During cooler times of the day or year, the AHUs draw in cool outdoor air and supply it to the cool zone, while the neutral or warm zone receives a mixture of outdoor and recirculated air.

The temperature in each zone is controlled by a thermostat, which modulates the amount of cool or neutral air supplied to the zone. The system can also be designed to include variable air volume (VAV) dampers, which adjust the airflow to each zone based on cooling demand.

Dual-zone free cooling can be an effective way to reduce energy consumption and operating costs in buildings that have different cooling requirements in different zones. However, the effectiveness of the system depends on factors such as the location and orientation of the building, the climate, and the building's occupancy patterns. Proper design and installation are also critical to ensure that the system is optimised for the specific building and its intended use.

Case study

HOW TO SAVE WITH DUAL-ZONE FREE-COOLING

By using a dual-zone climate control solution, Dantherm helped a large telecom operator in southern Europe reduce energy consumption by 70% for site cooling.

Dantherm was contacted by a large southern European telecom operator with thousands of sites around the world. They were using traditional air-conditioning to cool their indoor sites, but wanted a more energy-efficient solution.

Each of the sites contained up to 16 batteries, which meant that a great deal of energy was needed simply to maintain the set temperature.

The operator was looking for a new way to cool the sites, in order to save as much energy as possible and to cut the operational costs of the sites.

The operator brought Dantherm in as a technology advisor on the project to help improve energy efficiency.

Tested cooling methods to find the best solution

Dantherm's team approached the task by setting up four various test sites, as well as one reference site to benchmark, and set out to determine which solution provided the best savings in terms of energy consumption.

After testing the different solutions, the operator decided to use dual-zone climate control – a strategy that divides the site into different temperature zones in order to regulate and differentiate the cooling.

Battery compartment cooling and raised shelter temperature

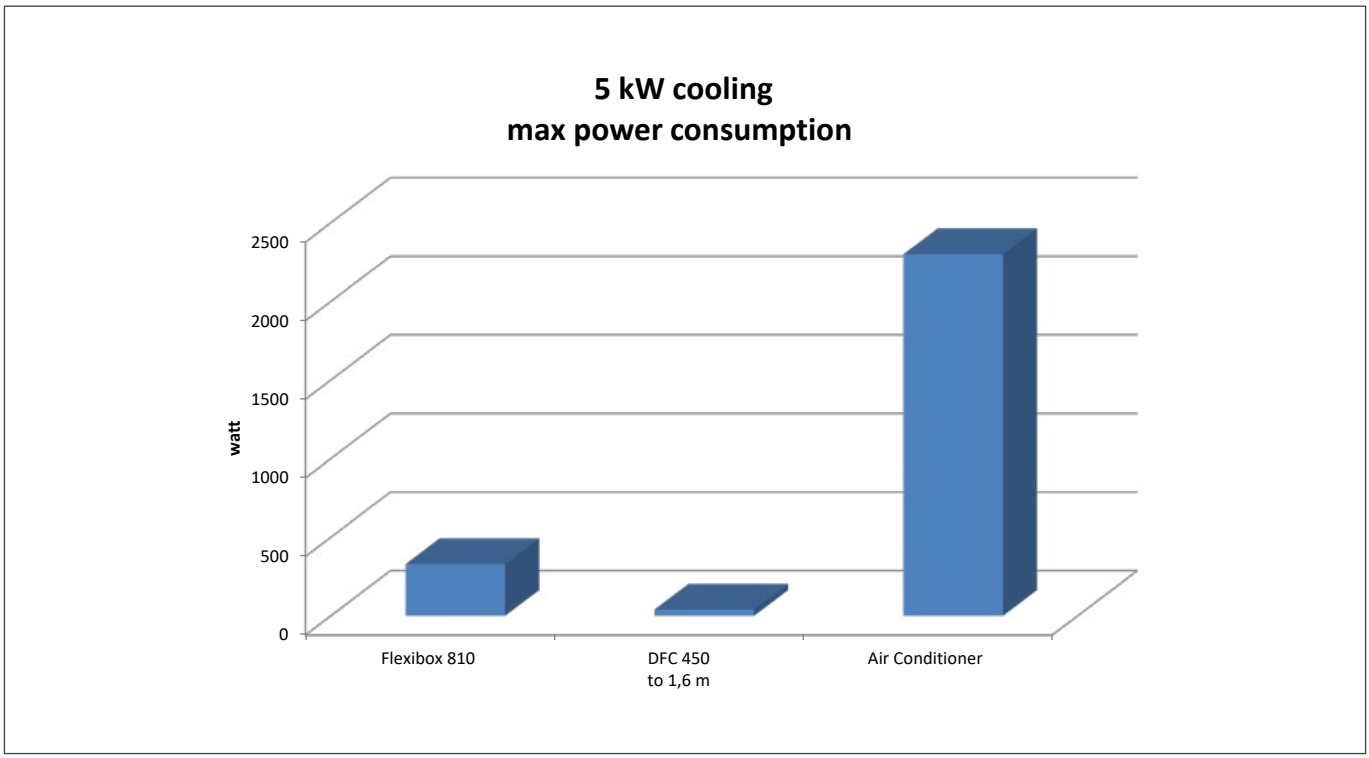
The dual-zone climate control solution uses the Dantherm Flexibox 810, which is a 48V DC free cooling solution that maintains a target temperature of 35°C in zone 1.

This means that the Flexibox simply removes excess heat when the temperature exceeds 35°C.

Turbulent or displacement free cooling

The technologies used in our flexibox and displacement free cooling technology solutions are inherently different and are therefore suitable for different types of installations. For instance, Flexibox solutions offer very good temperature distribution securing an equal temperature in the entire shelter, whereas displacement free cooling cools a limited part of it with the upper section having a higher temperature.

For further installation examples and details, please refer to our product quick installation guides which are freely available for download on our website danthermgroup.com.



Flexibox free cooling is ideal for:

- Large and/or crowded shelters
- Shelters with equipment that has internal fans
- Shelters with difficult air paths
- High density installations

Displacement free cooling is ideal for:

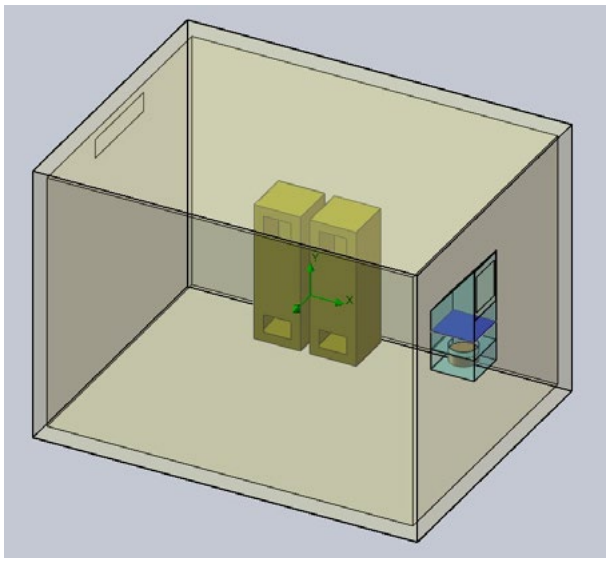
- Small shelters
- Shelters where temperature layering is acceptable
- Shelters with stagnant air
- Shelters that require low sound levels

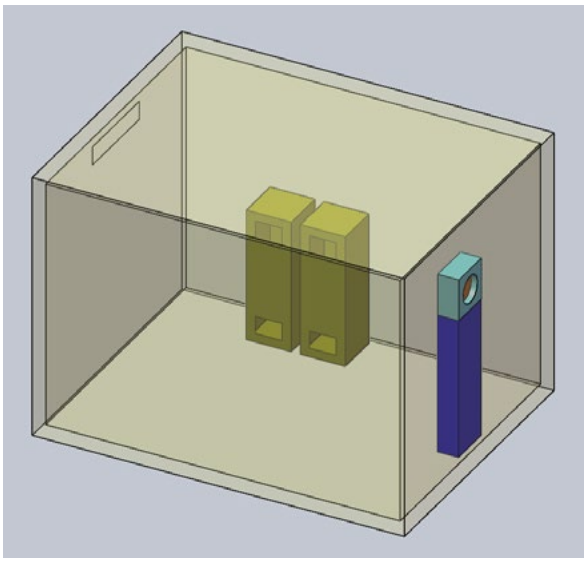
Specifications	Flexibox free cooling	Displacement free cooling
Air velocity	High	Low
Filter	Filter before the fan	Diffusor filter in the room
Installation	Flexible	Fixed
Sound	Low	Extremely low
Power consumption	Low	Extremely low
Cooling capacity	Entire room	Up to 1.6 m above floor

Flexibox free cooling (turbulent)

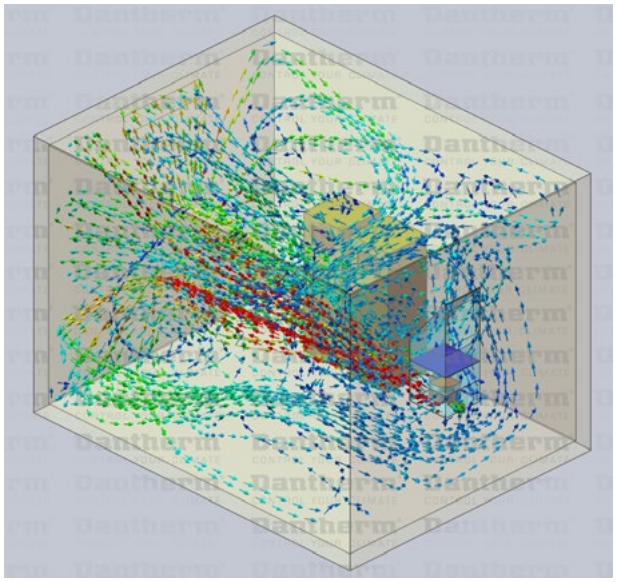
Displacement free cooling

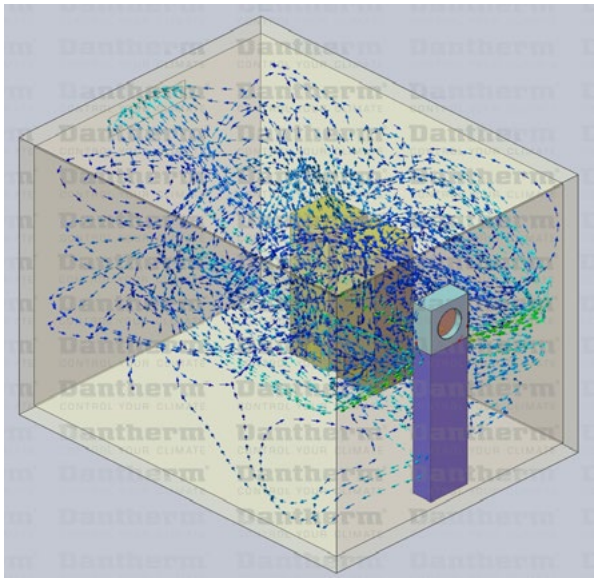
Installation



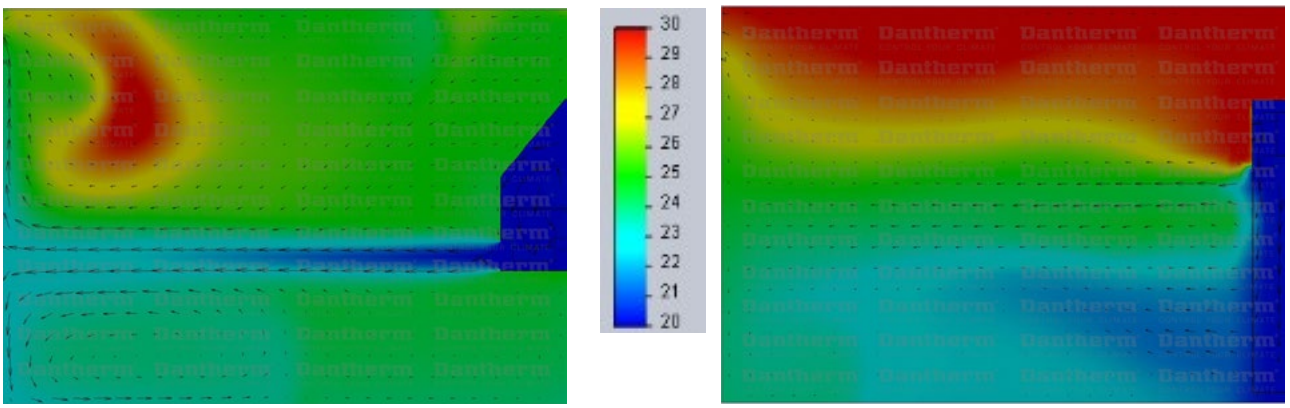


Air velocity





Temperature distribution



FLEXIBOX 900

FB 900

The Flexibox 900 offers cost-effective and controlled free-cooling ventilation. The solution cools by means of ambient air without using a compressor, generating significant savings in all climates.

The unit comes standard with the Dantherm-developed CC 3000 cooling controller, which allows for settings configuration and live operation monitoring on any standard browser.

The Flexibox 900 can be used as a stand-alone unit or in combination with e.g. existing air-conditioning. This ensures maximum use of passive cooling, prolongs the air-conditioner service life and generates significant OPEX savings.

These units are very suitable for retrofitting into existing systems. The return on investment for the retrofit is achieved especially quickly in base stations, where comfort air-conditioning units run 24/7.

- Extremely energy-efficient – savings in all types of climates
- Total heat management – control of multiple external units
- Stable operation – stepless fan speed control
- Clean internal environment – overpressure system
- Extended air path protection – Dantherm AirMaze
- Flexible installation – with variants for indoor and out-door use
- Low maintenance costs – long-life compact filter
- Maximum security – remote monitoring and configuration
- Integrated CC 3000 control system

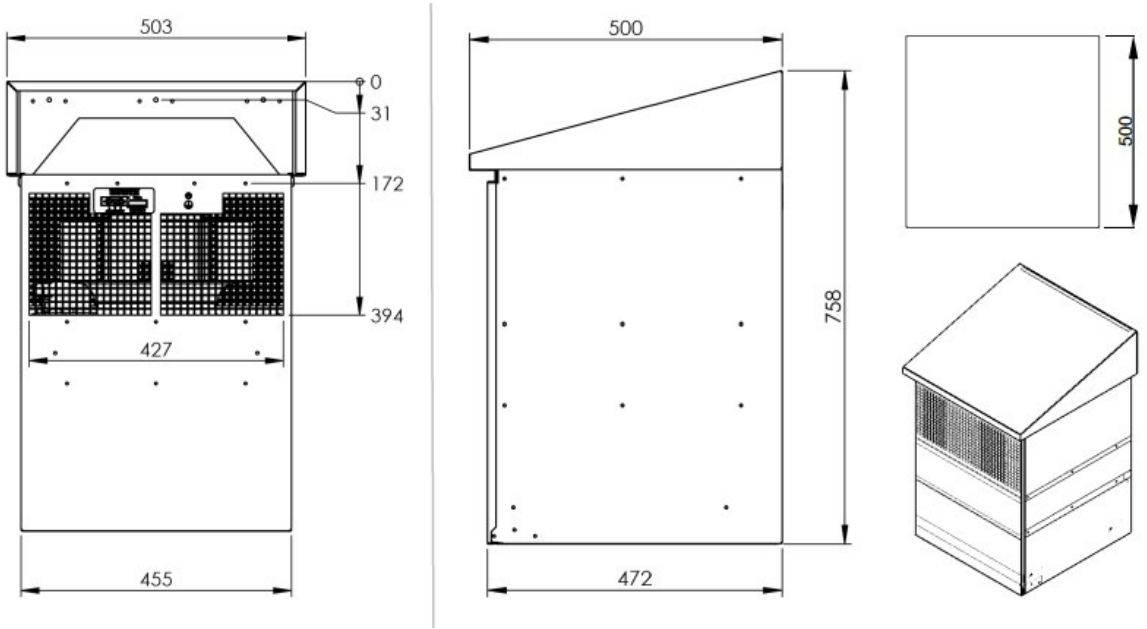
Installation and controller features	Description
Installation and operation	
Flexible installation	Plug-and-play, new and legacy sites
Minimum installation costs	No need for cooling technician
Controller	High-quality components
Solution-specific controller	Dantherm-developed, wall-mounted
Flexible configuration	Live monitoring and configuration on any standard browser
Energy-saving strategy	Max. use of controlled ventilation
Intelligent climate control	Automated change of cooling mode
Stable operation	Stepless fan speed control
User-friendly configuration	Built-in SD card reader and digital colour display
Service minimisation	Digital filter status detector
Strategy evaluation/planning	Complete data logging

FLEXIBOX 900

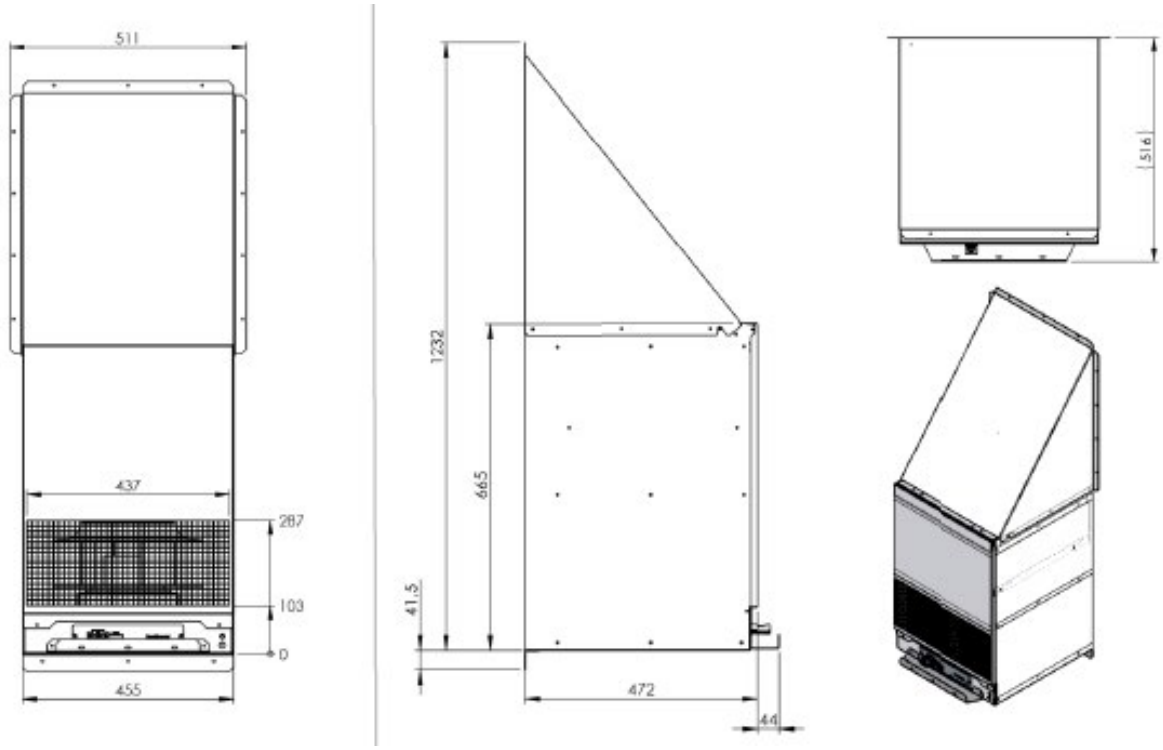
Specifications	Units	FB 900-48V	FB 900-230V
Capacity and performance			
Operational temperature range, min./max.	°C	- 25 to + 55	- 25 to + 45
Cooling capacity at Δt=10°C, 50/80%	W	4950 / 7210	5370 / 8340
Maximum cooling capacity at Δt=10°C, 100%	W	8140	8610
Airflow, maximum	m^3/h	2450	2590
Electrical connection	Type	Phoenix PC 4/2-STF-7.62	Ensto NAC32S.W
Input voltage range	VDC	48VDC (42-57VDC)	230V AC (200 to 277)
Power consumption 50/80/100%	W	78/239/366	71/284/400
Sound level, 50/80%, 3m distance*	dB(A)	47/56	49/59
Expected operation life	Min. years	10	10
*Sound power 50/80%	dB(A)	62/71	64/74
Shipment, Storage & Mounting			
Unit dimensions (height×width×depth)	mm	758 x 503 x 500	758 x 503 x 500
Net weight	kg	25	25
Single package weight incl. unit	kg	28.1	28.1
Multi package weight incl. unit (standard pallet, 6 units)	kg	192	192
Single packing dimensions (height×width×depth)	mm	790 x 530 x 530	790 x 530 x 530
Multi packing dimensions (height×width×depth)	mm	1725 x 800 x 1200	1725 x 800 x 1200
Storage relative humidity, min./max.	RH %	0 to 95	0 to 95
Storage temperature, min./max.	°C	-40 to +80	-40 to +80
Mounting method	Type	Wall-mounted	Wall-mounted
Service area dimensions	mm	500 x 666	500 x 666
Filter	Item no.	077164	077164
Filter type	Class	Compact G4	Compact G4
Filter area	m2	0.75	0.75
Controller details			
Dantherm Cooling Controller CC3000	Item no.	091210	091210
Communication interface	Type	Ethernet SNMP	Ethernet SNMP
Mounting method	Type	Wall-mounted	Wall-mounted
Certifications			
Protection according to EN 60529	IP class no.	X5	X5
Complies with standards	Code	EN 60950	EN 60950
Colour	RAL	AlZn coated steel ¬¬¬plate	AlZn coated steel ¬¬¬plate

FLEXIBOX 900

Flexibox 900 outdoor dimensions

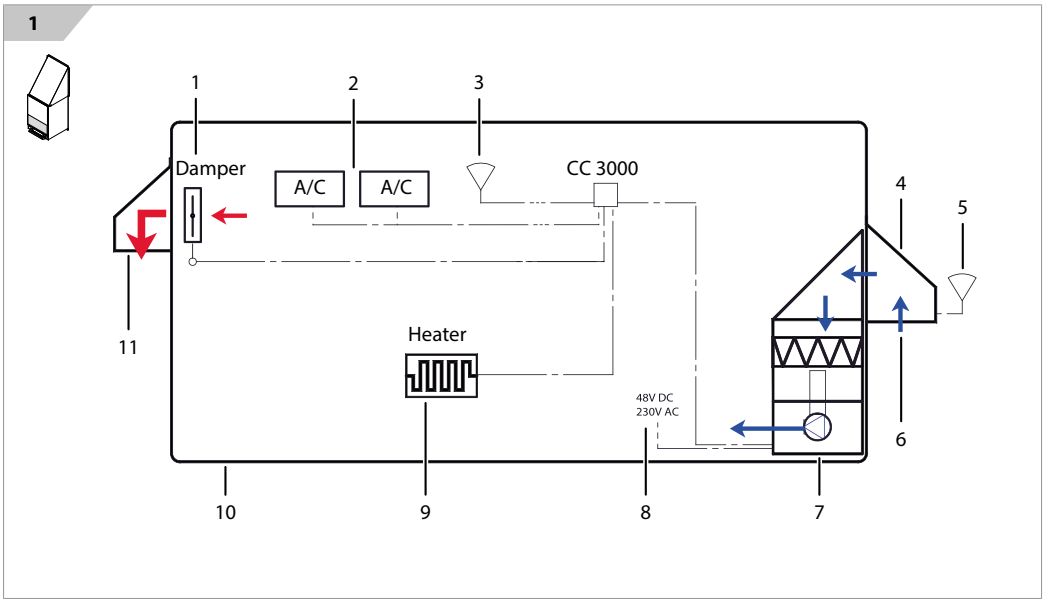


Flexibox 900 indoor dimensions

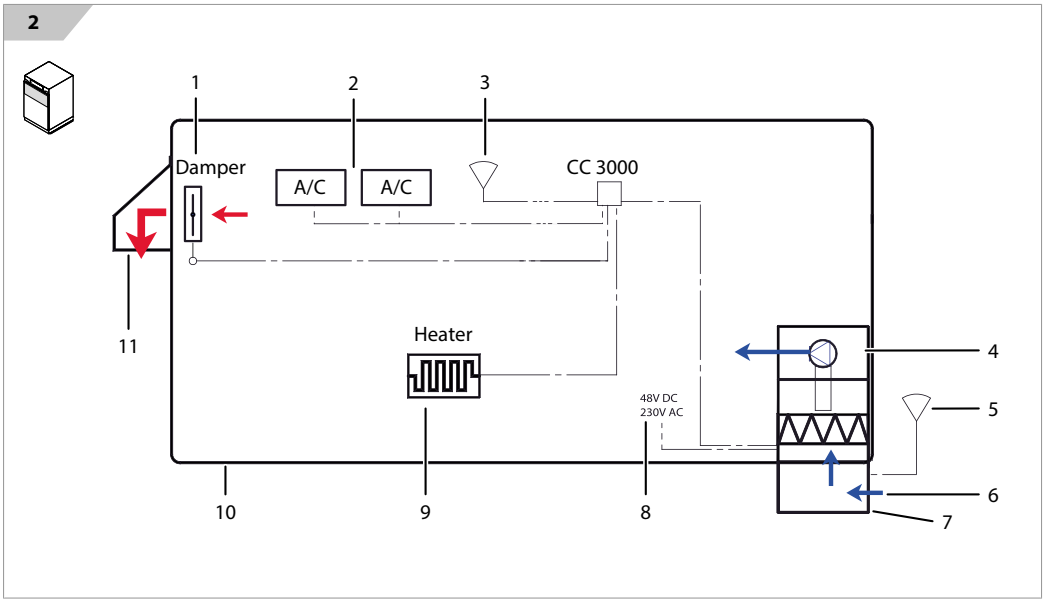


Installation options – indoors

Wall-mounted indoor unit



Floor-standing indoor unit

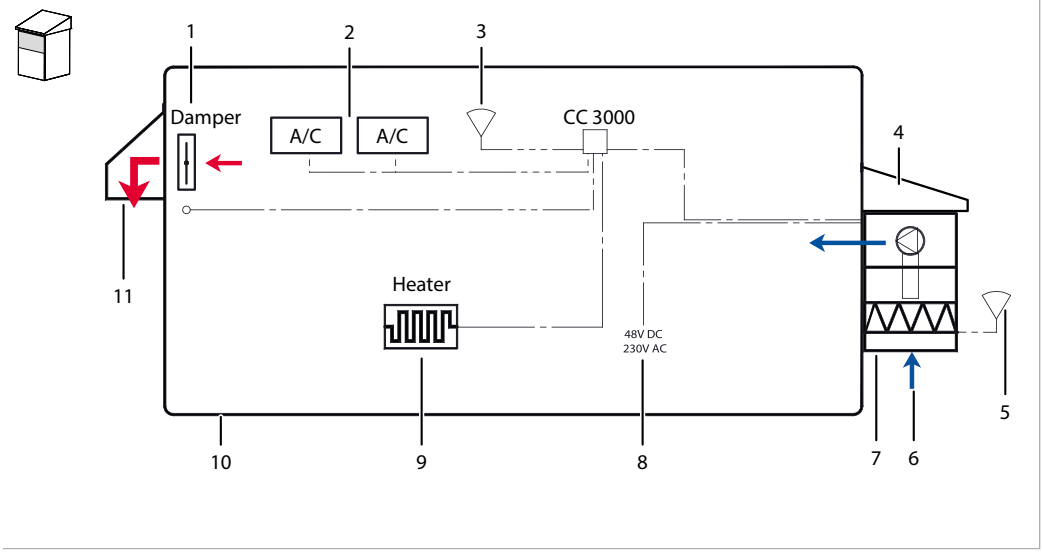


1. Motorized air damper
2. Air conditioners
3. Room temperature sensor
4. Rain hood
5. Outdoor sensor
6. Airflow, outside air inlet
7. Indoor unit
8. Power connection
9. Heating unit
10. Room/dwelling
11. Exhaust air

Installation options – outdoors

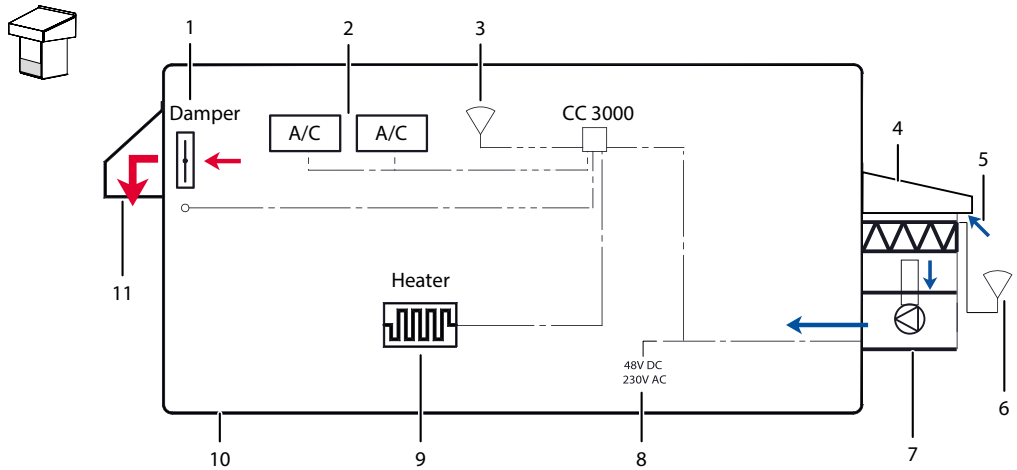
Air flow, ourdoor unit

3



Airflow down, outdoor unit

4



1. Motorized air damper
2. Air conditioners
3. Room temperature sensor
4. Rain hood
5. Outdoor sensor
6. Airflow, outside air inlet
7. Indoor unit
8. Power connection
9. Heating unit
10. Room/dwelling
11. Exhaust air

FLEXIBOX 900 WITH BAG FILTER

FB 900 WITH BAG FILTER

The Flexibox 900 with bag filter offers cost-effective and controlled free-cooling ventilation. The solution cools by means of ambient air without using a compressor, generating significant savings in all climates. The unit comes standard with the Dantherm-developed CC 3000 cooling controller, which allows for settings configuration and live operation monitoring on any standard browser.

The Flexibox 900 can be used stand-alone or combined with e.g. existing air-conditioning. This ensures maximum use of passive cooling, prolongs the air-conditioner service life and generates significant OPEX savings.

Fitted with a large bag filter this unit offers extended life time of the filter, thereby prolonging the intervals between filter changes.

These units are very suitable for retrofitting into existing systems. The return on investment for the retrofit is achieved especially quickly in base stations, where comfort air-conditioning units run 24/7.

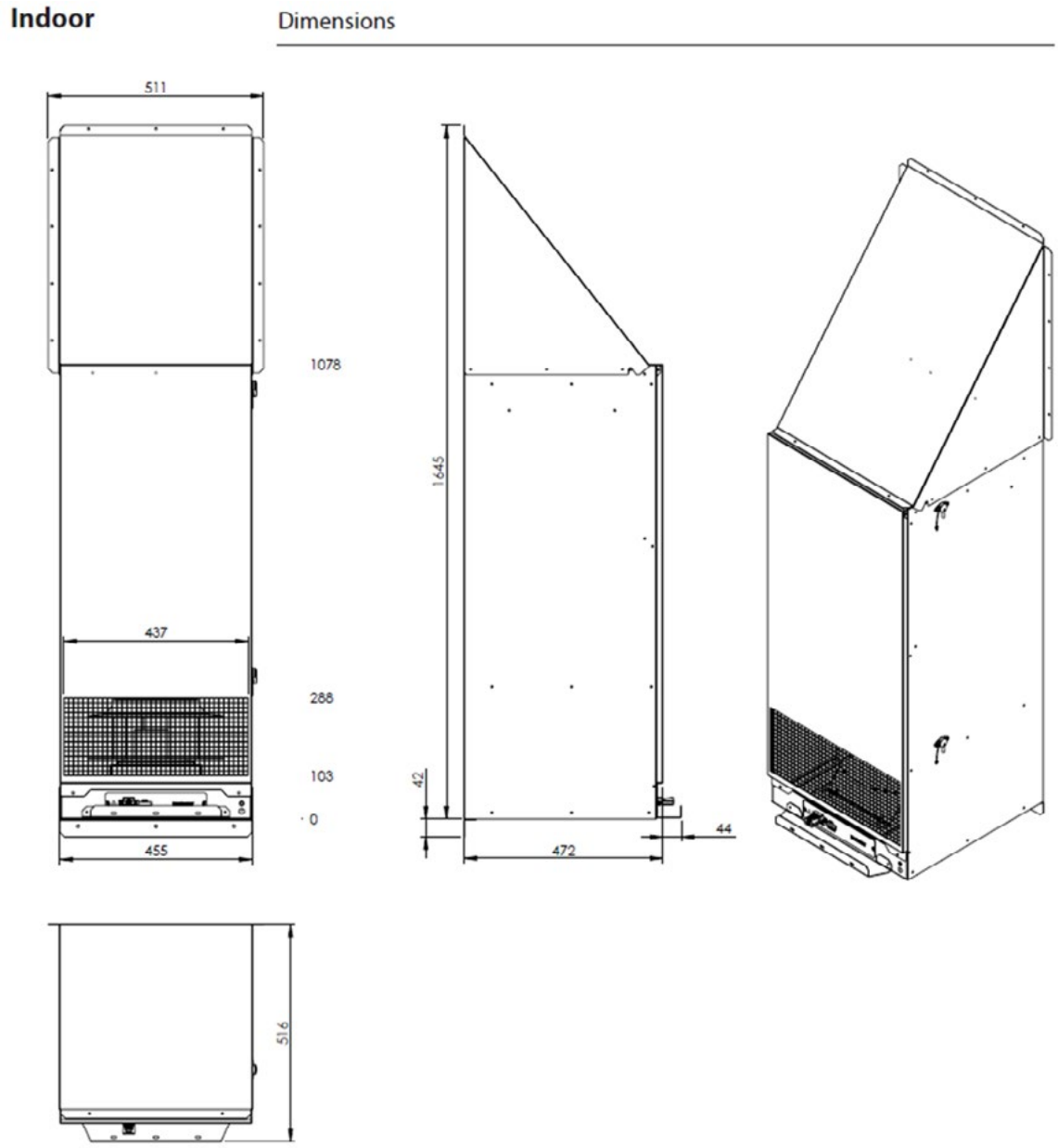
- Extremely energy-efficient – savings in all types of climates
- Total heat management – control of multiple external units
- Stable operation – stepless fan speed control
- Clean internal environment – overpressure system
- Extended air path protection – Dantherm AirMaze
- Flexible installation – with variants for indoor and outdoor use
- Low maintenance costs
- Fitted with long-life bag filter for harsh environments
- Maximum security – remote monitoring and configuration
- Integrated CC 3000 control system

Specifications	Units	FB 900-230V
Operational temperature range	°C	-40*/-25 to +45
Maximum cooling capacity at 25°C ambient, Δt = 10°C, 100%	W	8610
Air flow – maximum	m^3/h	2590
Filter class		ISO ePM10 60% (F6)
Input voltage range	VDC	230V AC (200 to 277)
Power consumption 50/80/100%	W	71/284/400
Sound level, 50/80% @ 3m	dB(A)	49/59
Communication interface	Type	Ethernet SNMP
Controller		CC 3000
Product size indoor (h x w x d)	mm	1078 x 455 x 472
Net weight	kg	28

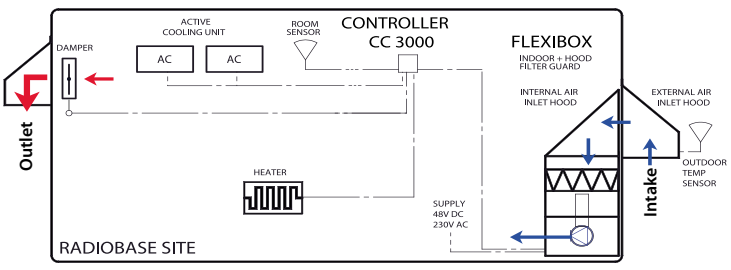
* Lowest operational temperature depends on installation

FLEXIBOX 900 WITH BAG FILTER

Flexibox 900 indoor dimensions



Installation (indoors only)



DFC 350-450

DFC 350

The Dantherm DFC 350 and 450 are slim passive cooling units utilising the displacement-free air cooling technology. The units are designed to remove excess heat from small rooms with electronic equipment where the air is stagnant.

- Extremely energy-efficient – savings in all types of climates
- Total heat management – control of multiple external units
- Stable operation – stepless fan speed control
- Clean internal environment – overpressure system
- Extended air path protection – Dantherm AirMaze
- Flexible installation – with variants for indoor and out-door use
- Low maintenance costs
- Fitted with long-life bag filter for harsh environments
- Maximum security – remote monitoring and configuration
- Integrated CC 3000 control system

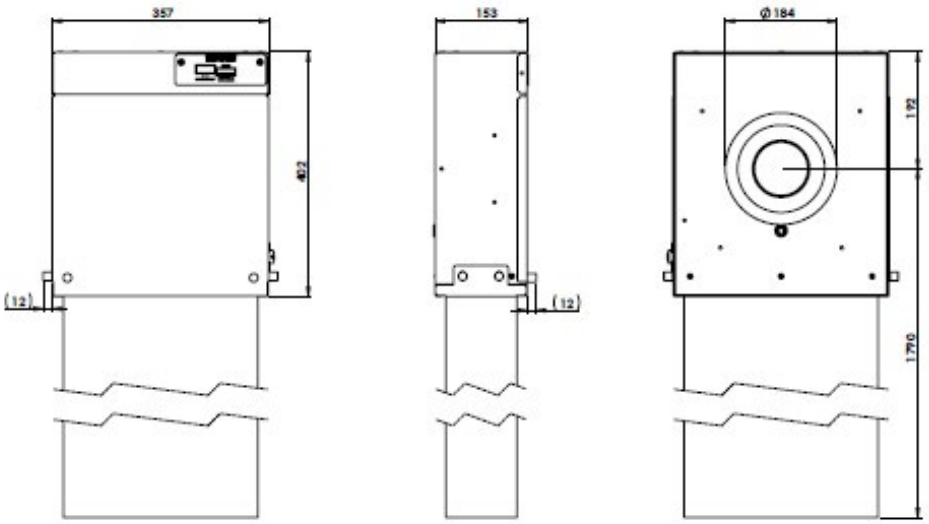
Installation and controller features	Description
Installation and operation	
For small, indoor applications	Rooms up to 12 m2 with stagnant air
Minimum installation costs	No need for cooling technician
Controller	
Solution-specific controller	Dantherm-developed, wall-mounted
Flexible configuration	Live monitoring and configuration on any standard browser
Energy-saving strategy	Max use of controlled ventilation
Intelligent climate control	Automated change of cooling mode
Stable operation	Stepless fan speed control
User-friendly configuration	Built-in SD card reader and digital colour display
Intelligent monitoring	Ehternet SNMP
Service minimisation	Digital filter status detector
Strategy evaluation/planning	Complete data logging

DFC 350-450

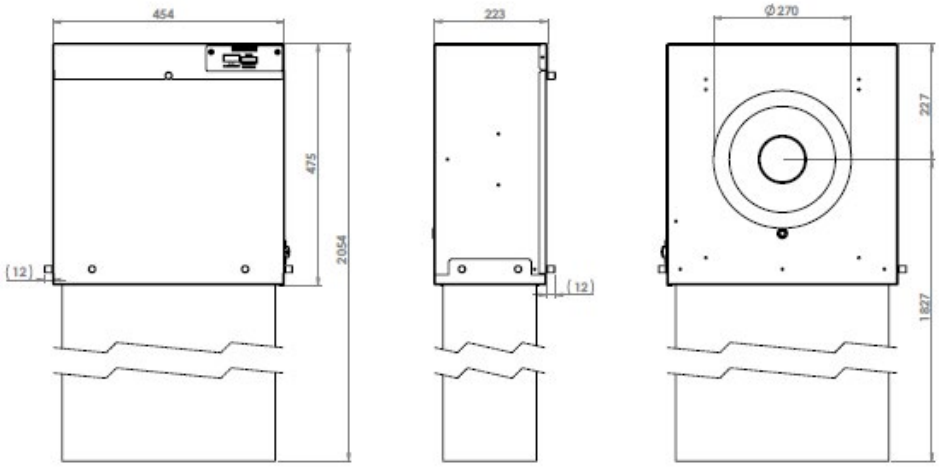
Capacity & Performance	Units	48V DC, DC fan	230V DC, EC fan
Operational temperature range, min./max.	°C	-25 - (+55)	-25 - (+55)
Cooling capacity up to 1,6 m above floor, Δt=5°C, 50/80 %	W	1200/2350	1200/2350
Max. cooling capacity up to 1,6 m above floor, Δt=5°C, 100 %	W	3000	3000
Airflow, max.	m^3/h	514	514
Electrical connection	Type	Phoenix PC 4/2-STF-7.62	Ensto NAC32S.W
Input voltage range	VDC	48VDC (42-57VDC)	230VAC (200 to 277)
Power consumption 50/80/100 %	W	11 / 23 / 40	8 / 20 / 35
Max. current	A	2,5	1,0
Sound level, 100 % (3 m distance)	dB(A)	43	44
Sound power 100 %	dB(A)	61	62
Expected service life	Years	10	10
Shipment, storage & mounting			
Product dimensions (H × W × D)	mm	1982 x 385 x 166	1982 x 385 x 166
Net weight	kg	10	10
Single package weight incl. unit	kg	12	12
Single packing dimensions (H × W × D)	mm	280 x 410 x 430	280 x 410 x 430
Multi packing dimensions (H × W × D) (10 units)	mm	1825 x 800 x 1200	1825 x 800 x 1200
Storage relative humidity, min./max.	RH%	0 to 95	0 to 95
Storage temperature, min./max.	°C	-40 - (+80)	-40 - (+80)
Mounting method	Type	Wall-mounted	Wall-mounted
Service area dimensions (H × W × D)	mm	400 x 350 x 150	400 x 350 x 150
Filter	Item no.	299821	299821
Filter type	Class	ePM10 55 % Bag (F5)	ePM10 55 % Bag (F5)
Filter size	mm	1600 x 352 x 149	1600 x 352 x 149

DFC 350-450

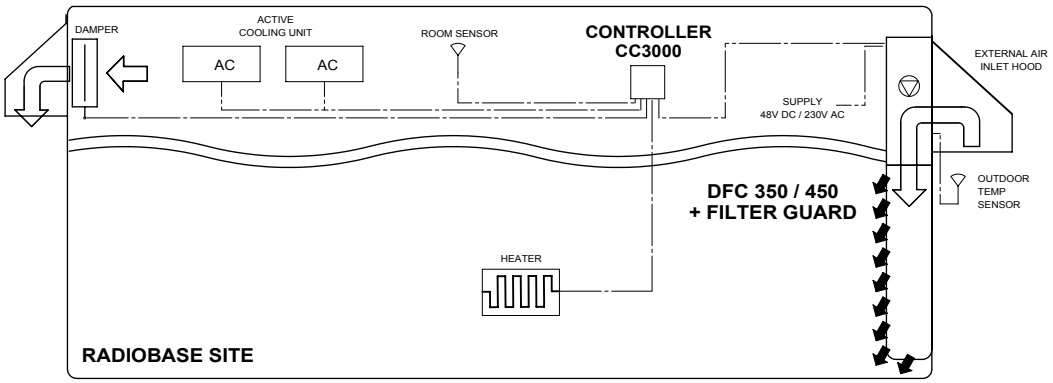
DFC 350 dimensions



DFC 450 dimensions



Installation

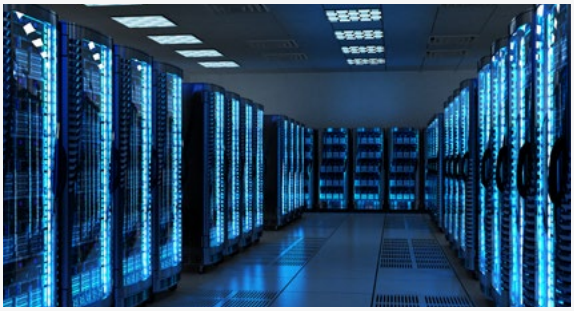


TKS 60

TKS 60

TKS 60 is high-capacity free air cooling designed to control the internal environment of communication shelters using a minimum of energy.

By means of ventilation in an overpressure system, the TKS 60 efficiently removes excess heat from the temperature-sensitive equipment – maintaining the internal temperature within defined limits.



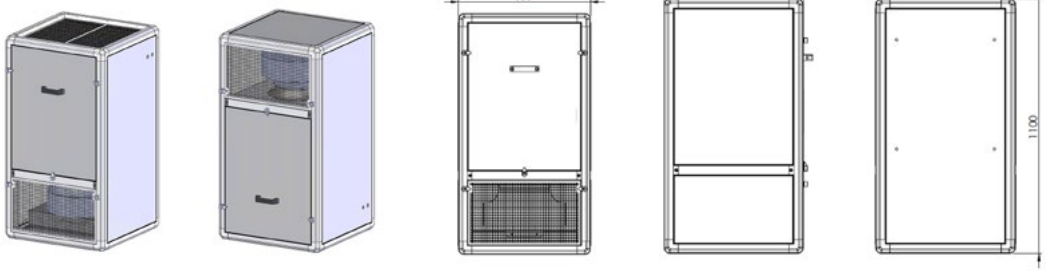
- Total heat management – designed for energy-efficiency with maximum use of controlled ventilation
- Energy-efficient cooling strategy – automatic change between cooling modes
- Protect your equipment – standard M5 fine bag filter and optional AirMaze (patent pending)
- Avoid unscheduled service visits – plan service with built-in filter monitor
- Wide geographical usage – ambient temperature operating range from -25 to 55°C
- User-friendly display for climate control and ethernet and SNMP for remote control
- Integrated CC 3000 control system

Installation and controller features	Description
Installation and operation	
Flexible installation	Plug-and-play, new and legacy sites
Minimum installation costs	No need for cooling technician
Anti-theft security	No accessible screws, nuts or bolts
Controller	
Solution-specific controller	Dantherm-developed, wall-mounted
Flexible configuration	Live monitoring and configuration on any standard browser
Energy-saving strategy	Max. use of controlled ventilation
Intelligent climate control	Automated change of cooling mode
Stable operation	Stepless fan speed control
User-friendly configuration	Built-in SD card reader and digital colour display
Service minimization	Digital filter status detector
Strategy evaluation/planning	Complete data logging

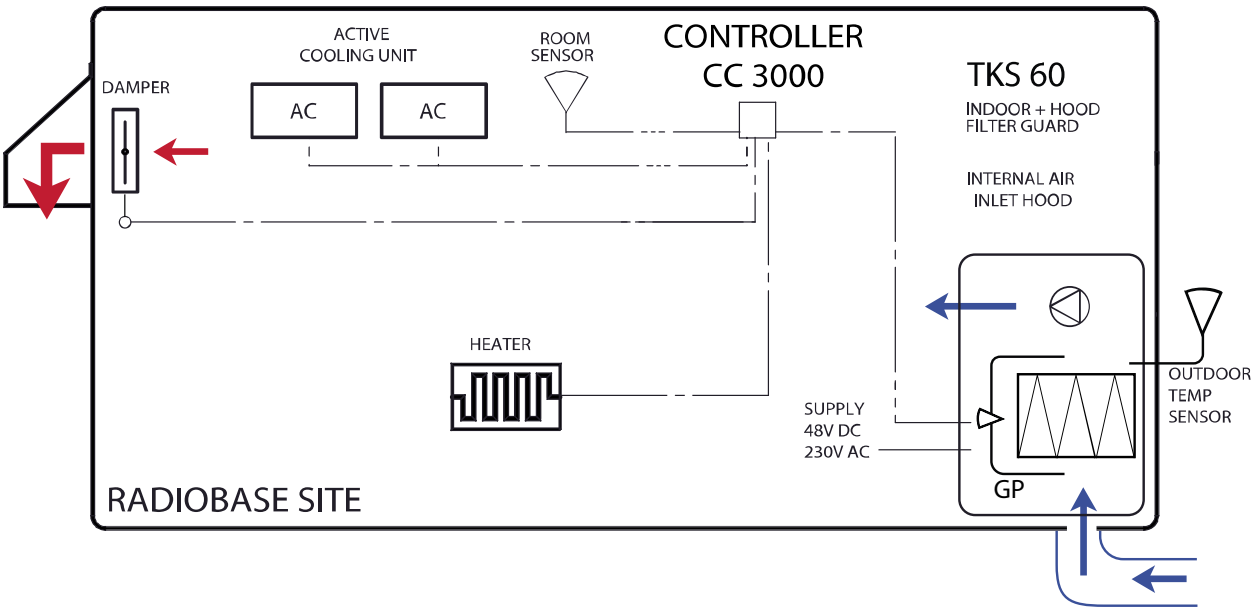
TKS 60

Version	Unit	48V DC (EC-fan)	230V AC (EC-fan)
Model		n/a	B
Capacity & Performance			
Operational temperature range, min./max.	°C	-25 to + 50	- 25 to + 55
Maximum cooling capacity, Δt=1°C, 100%	W/°K	1050	1400
Airflow, nominel	m^3/h	3200	4200
Electrical connection	Type	Flying leads	Flying leads
Input voltage range	VDC	48VDC (42-57VDC)	230V AC (200 to 277)
Power consumption, nominel	W	374	782
Max current	A	7.8	3.4
Expected operation life. Min. years		10	10
Sound pressure 1m distance	dB(A)	~64	~67
Shipment, Storage & Mounting			
Unit dimensions (height x width x depth)	mm	1100 x 600 x 600	1100 x 600 x 600
Net weight	kg	56	59
Single package weight incl. unit	kg	62	65
Single packing dimensions (height x width x depth)	mm	1300 x 700 x 700	1300 x 700 x 700
Storage relative humidity, min./max.	RH %	0 to 95	0 to 95
Storage temperature, min./max.	°C	-40 to +80	-40 to +80
Mounting method	Type	Wall-mounted or floor mounted	Wall-mounted or floor mounted
Service area dimensions	mm	600 x 500	600 x 500
Bag filter EN779 / ISO16890	Class	Bag filter M5 / ePM10 50%	Bag filter M5 / ePM10 50%
Filter area	m^2	2.2	2.2
Controller details			
Communication interface	Type	Ethernet SNMP	Ethernet SNMP
Communication bus	Type	Modbus over TCP/IP	Modbus over TCP/IP
Mounting method	Type	Wall-mounted	Wall-mounted
Certifications			
Protection according to EN 60529	IP class	X5	X5
Complies with standards	Code	EN 60950	EN 60950
Approvals		CE, RoHS, REACH	CE, RoHS, REACH
Colour	RAL	9002	9002

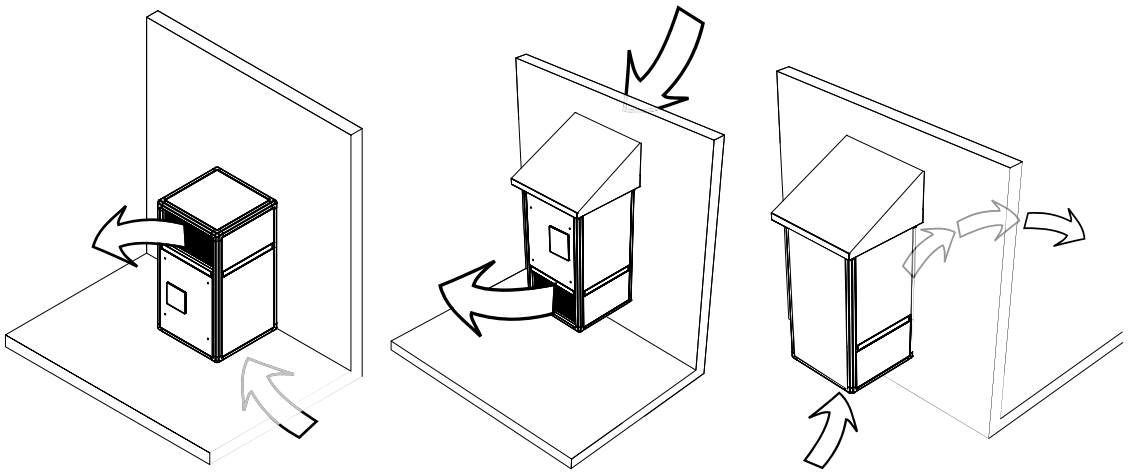
Dimensions



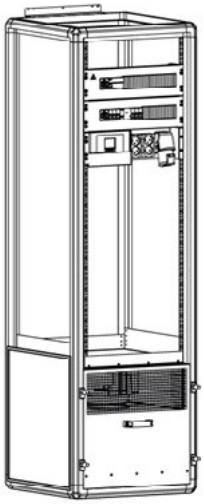
Installation



Airflow options



COOLRACK



- Contains the complete electrical panel including circuitbreaker 3 x 400V 16A and RCCB (Residual Current Circuit Breaker)
- 1 pcs. 3x400V 16A for rectifier
- 1 pcs. 16A CEE outlet (3x400V)
- 4 pcs. Schuko outlet 230V 10A
- 1 pcs. heating cable 230V 10A
- Battery shelf
- 17 rack units (19") free for customer equipment
- Free-cooling units with integrated F5 filter
- Climate controller CC 3000 for securing the climate inside the technical room

COOLRACK

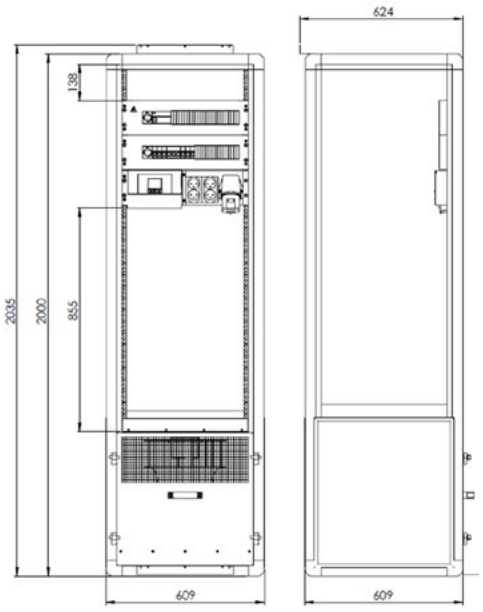
Coolrack is a combined cooling and rack unit specially designed for railway signal systems. Coolrack is in principle a free-cooling unit that takes air in through the floor and filters it before letting it enter the room. Coolrack works together with a damper, by gravity or as a motorised unit.

Dantherm's unique CC 3000 control system comes standard with Coolrack. The system handles the climate control inside the shelter or technical room. External heaters, air-conditioners, dampers and fans can be connected to and controlled by the Coolrack unit.

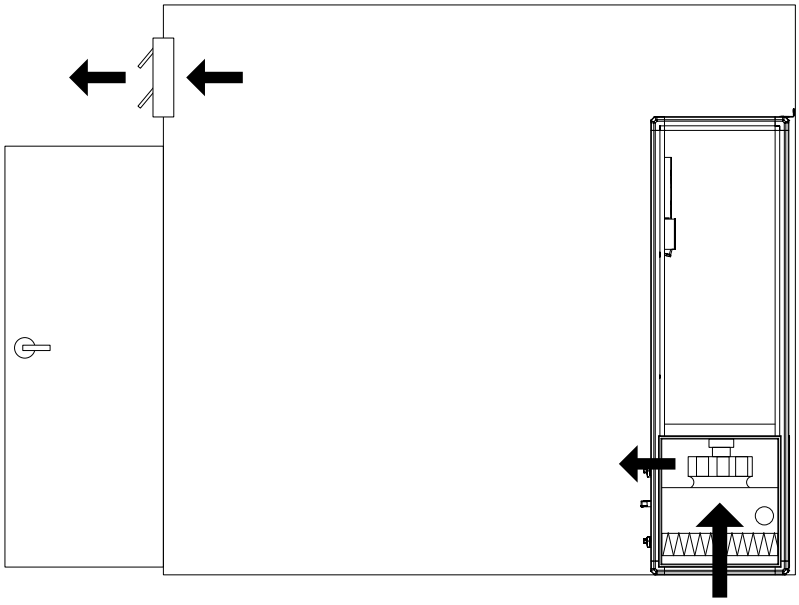
Coolrack has 17 rack units (19") all free and reserved for customer equipment.

Specifications	Units	COOLRACK
Air flow (at 53VDC)	m^3/h	1,440
Cooling capacity at ΔT = 7°C	kW	3.4
Rated Voltage	VDC	48
Rated amps	A	2.8
Max power consumption	W	140
Max rpm	rpm	2,500
Filter class		ePM10 55% (F5)
Filter area	m^2	9,4
Pressure drop through clean filter	Pa	30
19" Rack units for customer equipment		17
Dimension (w x d x h)	mm	603 x 603 x 2000
Weight including frame and excluding batteries	kg	83
AC Voltage outlet		
3 x 400V, 16A CEE	pcs	1
1 x230V, 10A CEE 7/3 (Schuko)	pcs	4

Dimensions



Installation



CC 3000

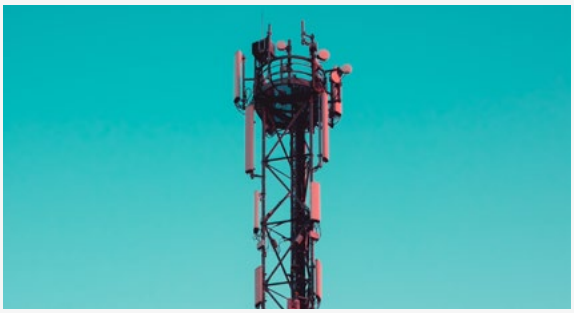
CC 3000

The Dantherm CC 3000 Cooling Controller for Telecom is designed for control and monitoring of free-cooling systems.

The controller has connections for up to two free-cooling units, e.g. Flexibox Free-cooling 900 series, TKS 60 and DFC products with or without motorised dampers.

In addition to controlling two free-cooling units, the CC 3000 can control a heater unit and two air conditioners.

CC 3000 includes graphic user interface (GUI) and WEB interface, WEB GUI and SNMP for access via any standard browser. The Dantherm CC 3000 optimises cooling performance with the lowest possible energy consumption.



- Automatic restart after power failure
- Energy-saving mode that auto-reduces fan speed by measuring both room and outdoor temperature to secure the lowest fan speed and energy consumption
- Advanced night mode, where fan speed and noise level can be reduced during night time. It is also possibly to change from air-conditioning to free-cooling operation
- Multi-lingual display
- Monitoring and alarm relaying (SNMP, Modbus, via dry contact (10 available)
- Self-test mode for easy installation
- Data-logging every 10 minutes
- Password protection
- Four different modes of operation possible:
  - Free-cooling mode (default)
  - Standard mode
  - Energy-saving mode
  - Air-conditioning mode

Specifications	Units	CC 3000
Operational temperature range	°C	-30 to 85
Input voltage range	V	40 to 60
Product size	mm	200 x 215 x 90

REDUCE YOUR COSTS

The Dantherm CC 3000 control and monitoring unit for free-cooling applications is the key to truly intelligent handling of your entire climate control setup no matter where you are. With its browser-based remote control capabilities, the CC 3000 is capable of controlling two free-cooling units, a heater unit and two air conditioners. The free-cooling units may be with or without motorised dampers.

Reduced energy consumption

Based on years of development, the intelligent software enables the controller to optimise cooling performance in a way that reduces energy consumption to an absolute minimum. Creating a cooling solution dedicated to your site is the first step towards reduced energy consumption. Combining that with the CC 3000 intelligent control solution from Dantherm, which is tailored to fit the conditions of your project, protects your equipment while fully utilising your energy savings potential.

The CC 3000 controls fan motors, dampers, compressors, air-conditioning systems, heaters, redundancy cooling, emergency cooling and much, much more.

Remote and real-time control

You can access and configure all features of the controller remotely through a standard web browser. These include real-time system monitoring, configuration of digital inputs/outputs, firmware upgrades, backup/restore sessions and customised data collection.

Other clever features of the CC 3000 include dual-zone cooling, night mode, dual slope fan control, duration counters, integrated SD card for setup and logging, clock, calendar and much much more.

Complete climate control

- Customise controllers designed for total site energy efficiency
- Energy-optimised control strategies
- Remote access anywhere
- Maximum site uptime

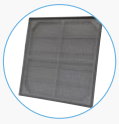
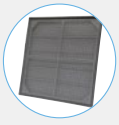
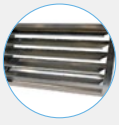
Multiple application options

- All types of climates
- Challenging environments
- On-grid and off-grid
- New and legacy sites
- Remote sites

CONTROLLER ACCESSORIES

Illustration	Accessory	Description	FB 810	FB 900	DFC 350-450	TKS 60	DC 450	DC 3500	Code
	**Humidity controller**	Operation temperatures: -20°C to +50°C @ < 90%RH. The Humidity sensor has a cable length of 480mm and can be connected directly to CC 3000 controller, and the %RH is then shown in the CC 3000 display.	●	●	●	●			094166
	**Heater relay**	Relay for operating the electrical heater. Relay built in Box and including PG grommets. Max fuse: 10 Amps. 230V/50Hz. Dimensions: H x W x D: 130 x 130 x 99mm.	●	●	●	●		●	095842
	**Air-con relay**	Plastic box with relay and terminals. Relays for start and stop two external air-conditioners. Up to 16A. 1 phase system. 3 phase system.	●	●	●	●			089990
	**Hot spot sensor with 8000mm cord**		●	●	●	●		●	096873
	**Dantherm RS485 display unit**		●					●	075210
	**SD card 2 GB for logging data**		●	●	●	●		●	077213
	**CC 3000 upgrade kit DC**	The kit contains CC 3000, SD card with firmware and config files, room and outdoor temperature sensor. satellite PCB, communication cable between CC 3000 and satellite PCB.			●	●			094838

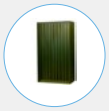
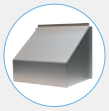
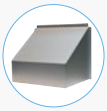
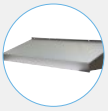
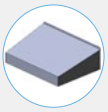
DAMPERS

Illustration	Accessory	Description	FB 810	FB 900	DFC 350	DFC 450	TKS 60	DC 450	DC 3500	Code
	**TC damper**	Damper for re-circulation. Measurements: H x W x D: 487 x 455 x 150mm. To be installed between the wall and the unit.		●		●				091346
	**Gravity damper (ABS plastic)**	Opening: [407 x 407mm] Measurements: [456 x 456 x 27mm]	●	●			●			086964
	**Gravity damper (Aluminium)**	Opening: [400 x 400mm] Measurements: [442 x 442 x 50mm]	●	●			●			299943
	**Gravity damper (Aluminum)**	Inside measurements: 800 x 180mm Dimensions: H x W x D: 219 x 837 x 73mm	●	●	●	●	●			299945
	**Gravity damper (ABS plastic)**	Including bird net and mosquito net. Inside measurements: 310 x 310mm. Dimensions: H x W x D: 360 x 360 x 27mm.			●	●				098178
	**Damper, motorised**	Inside measurement: 300 x 311mm. Dimensions: H x W x D: 361 x 432 x 125mm.			●	●				074600
	**Damper, motorised**	Inside measurement: 400 x 411mm. Dimensions: H x W x D: 461 x 532 x 125mm.		●	●	●	●			074603
	**Damper, motorized**	Inside measurements: 800 x 211mm. Dimensions: H x W x D: 272 x 921 x 125mm.		●	●	●	●			074609
	**Gravity damper (Aluminum)**	Inside measurement: 600 x 400mm Dimension: H x W x D: 442 x 642 x 100mm		●						299944

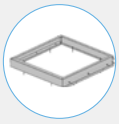
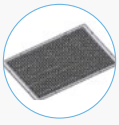
FILTERS

Illustration	Accessory	Description	FB 810	FB 900	DFC 350	DFC 450	TKS 60	DC 450	DC 3500	Code
	**Bag filter, ePM10 55% Bag (M5)**	352 x 149 x 1600mm.								299821
	**Bag filter, ePM2.5 50% Bag (F6)**	352 x 149 x 1600mm.			●					067335
	**Bag filter, ePM2.5 65% Bag (F7)**	352 x 149 x 1600mm.			●					052319
	**Bag filter, ePM10 55% Bag (M5)**	450 x 215 x 1600mm.				●				299749
	**Bag filter, ePM2.5 50% Bag (F6)**	450 x 215 x 1600mm.				●				840058
	**Bag filter, ePM2.5 65% Bag (F7)**	450 x 215 x 1600mm.				●				054773
	**Bag filter ePM10 50%, (M5)**						●			087363
	**Panel filter coarse 50% (G3)**	450 x 450 x 130mm.		●						109264
	**Panel filter coarse 60% (G4)**	450 x 450 x 130mm.		●						075071
	**Panel filter EPM10 55% (M5)**	450 x 450 x 130mm.		●						299926
	**Panel filter EPM2.5 65% (F7)**	450 x 450 x 130mm.		●						840081
	**Panel filter Coarse 60% [G4] for Combo cooler units**	460 x 795 x 44mm.		●						217655

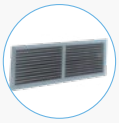
WEATHER PROTECTION

Illustration	Accessory	Description	FB 810	FB 900 indoor	FB 900 outdoor	DFC 350	DFC 450	TKS 60	DC 450	DC 3500	Dampers	Code
	**AirMaze panel unpainted**	Unpainted, measurements: [1149 x 735 x 120mm].	●	●	●			●			●	075575
	**AirMaze panel painted**	Painted, (not standard colour) with bug screen, measurements: [1160 x 703 x 137mm].	●	●	●			●			●	086924
	**AirMaze panel**	AirMaze for DFC 350/450. Measurements: H x W x D: 744 x 472 x 137mm. The AirMaze gives weather protection for all DFC inlets and for damper outlets.				●	●					091265
	**External rain hood**	Opening: 513 x 607mm. Dimensions: H x W x D: 578 x 672 x 442mm. The rainhood gives weather protection for all DFC inlets and for damper outlets.	●	●	●	●	●	●			●	299653
	**AirMaze panel unpainted**	Dual AirMaze. Unpainted, measurements: [1149 x 735 x 200mm].	●	●								109267
	**AirMaze cube for outdoor Flexibox**	Unpainted, measurements: [500 x 450 x 450mm].	●		●							081993
	**External rain hood**	Opening: 440 x 440mm. Dimensions: H x W x D: 472 x 500 x 300mm. The rainhood gives weather protection for damper outlet art. No: 074600 and 098178.	●			●	●				●	090768
	**External rain hood**	Opening: 800 x 200mm. Dimensions: H x W x D: 280 x 961 x 450mm. The rainhood gives weather protection for damper Art. No 299945, 074609 and 074611.									●	299942
	**Damper rain/snow protection**	Dimensions: H x W x D: 500 x 600 x 151mm. (Exhaust air only).									●	087317
	**External rain hood**	Opening 450 x 525mm. Dimension: 615 x 456 x 525mm. The rain hood can be used sound reduction.			●							095410
	**External rain hood with sound insulation**	Opening: 552 x 490mm. 30mm insulation foam. Dimensions: H x W x D: 889 x 673 x 455mm. The rain hood gives weather protection for damper Art. No 299945, 074609 and 074611.		●							●	095845

INSTALLATION EQUIPMENT

Illustration	Accessory	Description	FB 810	FB 900 indoor	FB 900 outdoor	DFC 350	DFC 450	TKS 60	DC 450	DC 3500	Code
	**Adapter for ducting**	Measurements: [450 x 450 x 70mm].	●	●							299648
	**Duct mounting bracket**	Measurements: [275 x 50 x 40mm].	●	●							299673
	**Wall bracket for Flexibox**	Measurements: [202 x 452 x 40mm].	●	●							299650
	**Wall ducting**	Adapter for installation of Ø400mm spiro duct.	●	●	●	●	●	●			299698
	**Frame for air inlet from floor**	Floor frame 450 x 450 x 50mm.	●	●							096733
	**Grille for air inlet from floor**	Grille air intake from floor, 450 x 450 x 0.8mm.	●	●							299647

INSTALLATION EQUIPMENT

Illustration	Accessory	Description	FB 810	FB 900 indoor	FB 900 outdoor	DF 350	DFC 450	TKS 60	DC 450	DC 3500	Dampers	Code
	**Wall grille**	Wall grille type V - 400 x 400mm. Exterior installation with insect net.	●	●	●			●			●	299947
	**Wall grill**	Wall grille type V - 300 x 300 mm Exterior installation with insect net				●	●			●	●	299956
	**Supply grill**	Supply grille 400x200 (C-grillee) Adjustable slats	●		●							071679

OTHER ACCESSORIES

Illustration	Accessory	Description	FB 810	FB 900 indoor	FB 900 outdoor	DF 350	DFC 450	TKS 60	DC 450	DC 3500	Code
	**Internal air hood (Aluzinc AZ150)**	Dimension: H x W x D (w. mounting flanges): 580 x 560 x 580 mm.						●			091436

QUESTIONNAIRE

This questionnaire aims to facilitate information gathering in connection with the request for solutions for cooling and ventilation of technology shelters for telecom, railway, power etc. The more questions that can be answered in an early stage, the better basis we have for proposing a good and cost-effective solution.

1. Size of building (internal)
   a. Surface: _____ m^2
   b. Height: _____ m
2. Type of building. Freestanding shelter or other facilities, new or existing.
   Please describe: _____
3. Total number of buildings that the project contains: _____ pcs.
4. Main purpose of building: _____
   (telecom, power, optofibre, railway, energy, pump station etc.)
5. Geographical position of building: _____
   For instance which country, area, climate zone etc. It is important to make the right choice with regards to the impact from the climate and weather conditions, make visible any local authority requirements and regulations regarding installation, transport etc.
6. Displacement or turbulent air distribution (if there are preferences): _____
   Depends on position and type of equipment. Displacement is often preferred due to. lower energy consumption, but places greater demands on the location of the equipment. If known, please also specify which type of equipment that will be installed.
7. Desired position of freecooling unit indoor/outdoor: _____
   a. If indoor: will air inlet be placed on wall, high or low, or through floor: _____
   b. If outdoor: will air inlet be by the bottom or top of unit: _____
8. Desired position of air outlet: _____
   a. Wall (square)
   b. Wall above door (rectangular)
   c. Roof (chimney, hood)
9. Please specify any eventual physical limitations on the exterior or interior of the building that has impact on choice or position of cooling equipment. If possible, provide drawing: _____
10. Desired power supply: 48 VDC/ 230VAC: _____
11. Desired filter type: G4 (std), M5, F6, F7, other: _____
12. Type of damper: Gravity type, plastic or aluminum, aluminum motorized open/ close or aluminum motorized with spring return.

a. Desired type of damper inlet: _____

b. Desired type of damper outlet: _____

13. Fire classification (building): YES/NO. If yes, what are the requirements?

_____

QUESTIONNAIRE

14. Damper gas tightness required?: _____

15. Building tightness required? (IP class): _____

16. Hood inlet (YES or NO): _____ With respect to position and weather conditions.

17. Hood outlet (YES or NO): _____ With respect to position and weather conditions.

18. Bug screen for hood(s) (YES or NO): _____

19. Total internal heat load including transmissions/ desired cooling power: _____ kW

20. Indoor design temperature min (winter): _____°C

21. Indoor design temperature max (summer): _____°C

22. Outdoor design temperature min (winter): _____°C

23. Outdoor design temperature max (summer): _____°C

24. Is top up (lex. active A/C) cooling required as complementary cooling source (depending on the equipment temperature limitations, iex batteries) (YES or NO): _____

25. Is any heat source required (radiator, el. fan heater):_____

26. Noise restrictions: YES/NO. If yes, what are the requirements and noise level? :_____ dB(A)
Please specify as detailed as possible any standard, distances, sound pressure or sound power etc.

27. Other desired accessories: Smoke detector, humidity probe etc: _____

28. Other requirements, desires or information of value: _____

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