DFC 350 and 450

Service manual

EN

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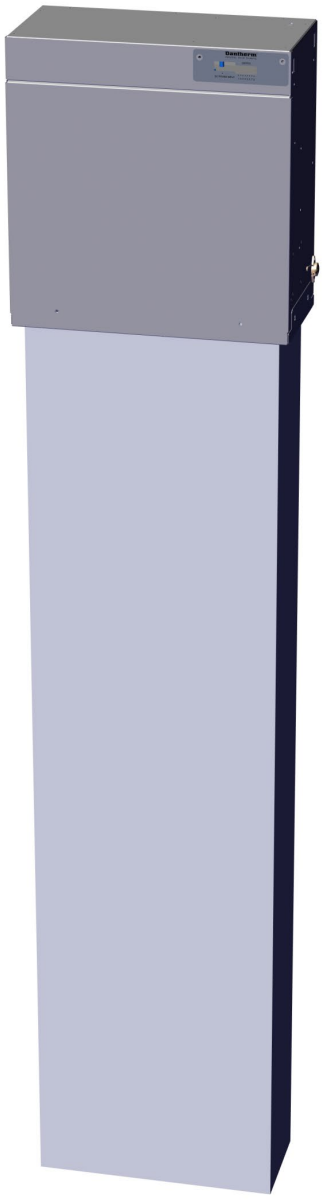


Overview

Introduction

This is the service manual for the Displacement Free Cooling unit DFC 350 & 450.

The DCF 350-450 unit is usually shipped including a control unit. This control unit, CC3000 is covered in a separate service manual.

Table of content

The Service Manual covers the following main topics:

General information

Introduction

This section provides general information about the unit and this Service Manual.

Target group

The target group for this Service Manual is the technicians who install, maintain and repair the unit.

Warning

It is the responsibility of the operator to read and understand this service manual and other information provided and to use the correct operating procedures.

The product should only be operated by qualified (trained) personnel. Failure to do so can result in personal injury or equipment damage.

Read the entire manual before the initial start-up of the product. It is important to know the correct operating procedures for the product and all safety precautions to prevent the possibility of property damage and/or personal injury.

Products

The Service Manual cover the following products:

Name	Type No.
DFC 350	299763
DFC 450	299745

Copyright

Reservations

The service manual is subject to changes without notice.

CE-Declaration of Conformity

CE

Dantherm Air Handling A/S, Marienlystvej 65, DK7800 Skive hereby declare that the DFC unit is in conformity with the following directives:

2006/42/EC	Directory on the safety of machines
2014/35/EU	Low voltage directive
2014/30/EU	EMC directive

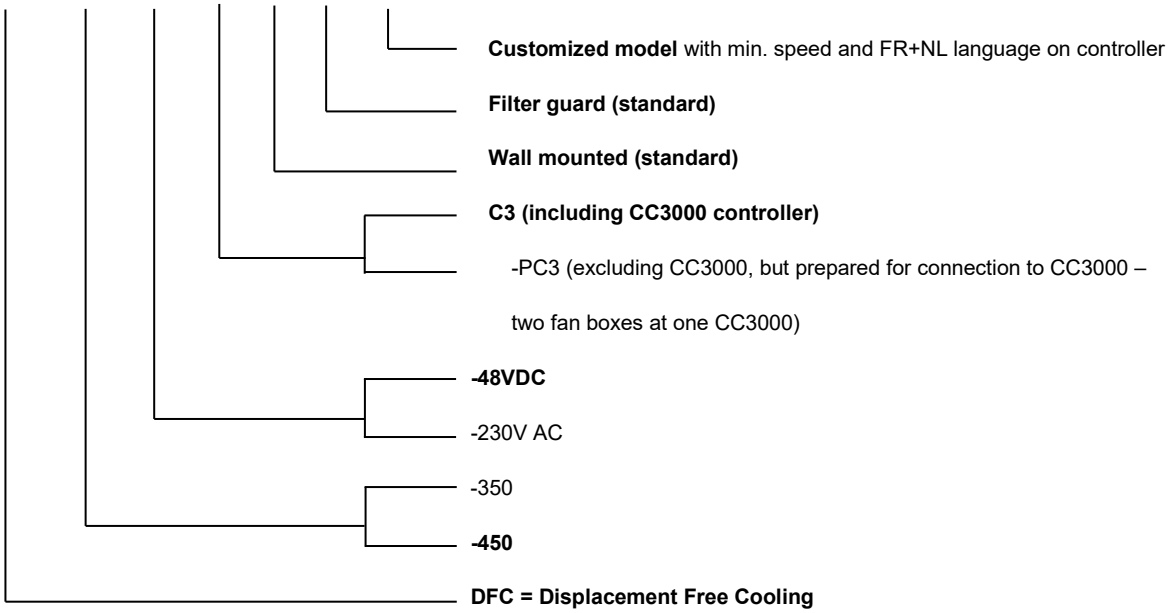
The product is manufactured with components which follow the application standards for Low Voltage Directive and in case of norms for EMC in EU countries.

Recycling

The DFC unit is designed to last for many years. When the time comes for the unit to be recycled, the unit should be recycled according to national rules and procedures to protect the environment.

Variant syntax for DFC 350 and DFC 450

DFC -450 -48V -C3- W- FG- X10



Example

DFC 450 – 48V DC – CC 3000 – Wall – Filter guard

Please note that a bag filter is not included but must be ordered separately

Art. No: 299749, F5 bag filter 450 x 215 x 1600mm

Art. No: 840058, F6 bag filter 450 x 215 x 1600mm

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General principle for DFC units

General

A DFC (Displacement Free Cooling) unit supplies the cold outdoor air through a diffusor filter with very low velocity. This will make a dune of cold air at the floor and up to a height of 1,6 meter in the shelter. The temperature at the ceiling will be relatively high.

The idea is to remove more heat with lower air volume in order to save power consumption of the fan.

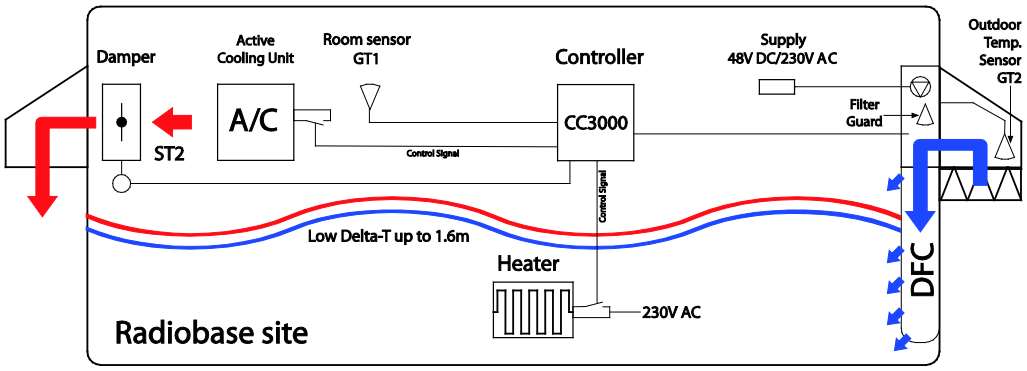
This is only possible if a large temperature difference between supply air and air out of the shelter can be achieved.

Efficiency

The efficiency of the DFC unit depends very much on the circulation of the internal air circulation in the telecom equipment and in the shelter. It is therefore very necessary to do a thorough test of the airflows in the shelter before initiating a bigger roll out.

Illustration

The illustration below shows the DFC and some external parts unit mounted in a container:



Parts

This table describes the different part (from right to left) in the illustration above:

Part	Description
Outdoor Temp sensor	Measures the outdoor temperature (NTC resistor)
DFC unit	The unit including bag filter and air inlet hood with compact filter
Controller	Climate unit controller CC3000 or other
Heater	External electrical heater
Supply 48V DC/230 V AC	Supply to the DFC
Room sensor GT1	Measures the indoor temperature (NTC resistor)
Active cooling unit	Existing airconditioner (often split unit)
Damper	Electrical damper allowing warm air to leave the shelter

Continued overleaf

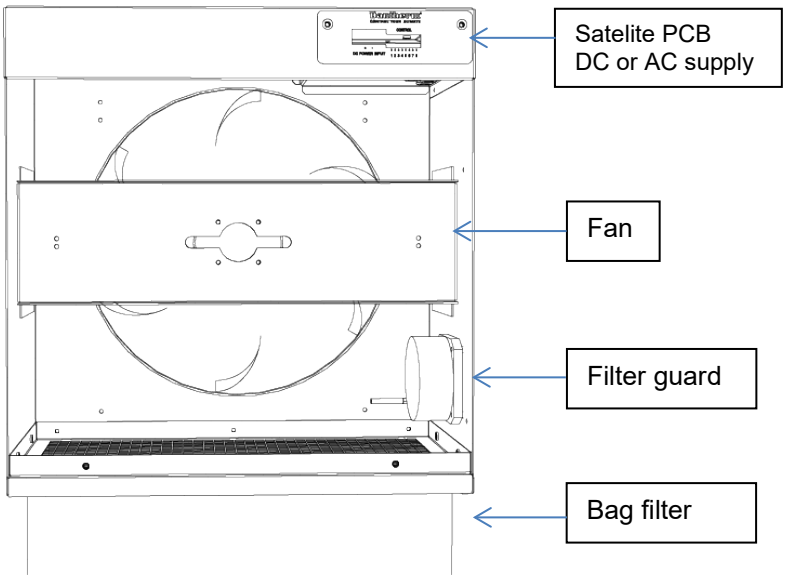
Parts and function

Introduction

The DFC units have a simple but very robust design. The parts are shown below.

Illustration

This drawing shows the parts of the DFC unit. It includes a fan and a filter guard



Parts

This table describes the parts in the illustration:

Part	Description
Filter guard	Measures the pressure on both sides of the filter. When the pressure drop exceeds 150 Pascal (factory setting) the built-in switch which is connected to the controller will open and cause an alarm.
Fan	The fan is a centrifugal fan either 48 V DC or 230 V AC. See technical data for further information.
Bag filter	The Bag filter is either filter class F5 or F6, see technical data for further information.

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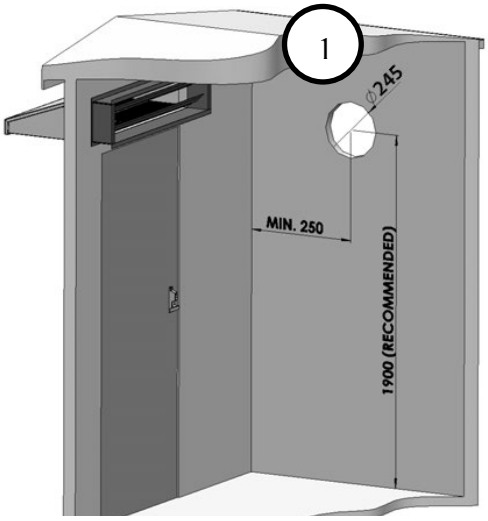
How to Mount the DFC 350 or DFC 450

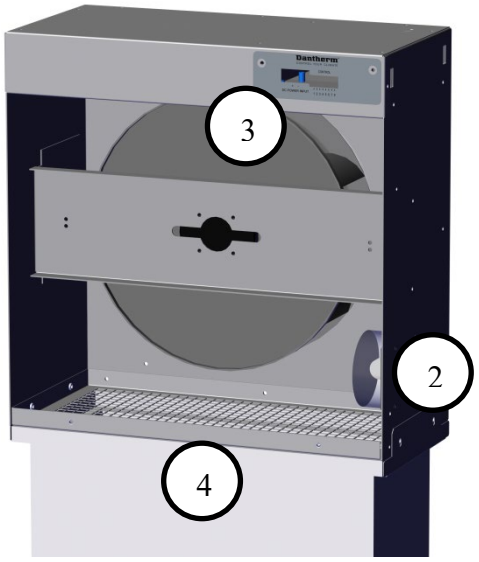
Procedure

Follow these steps to mount the DFC 350 or DFC 450:

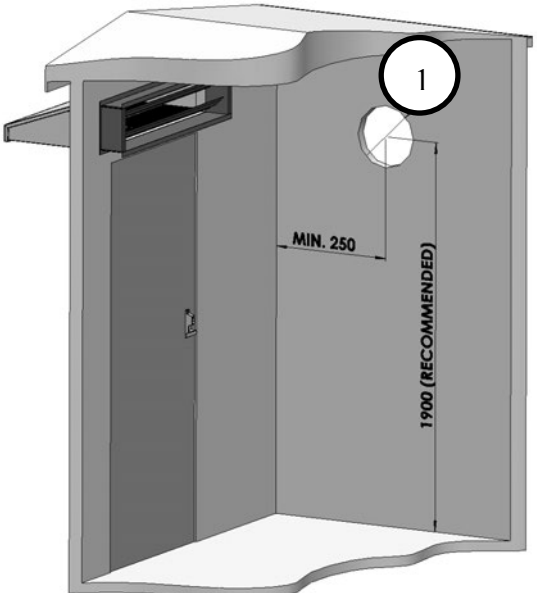
Step	Action
1	Make a Ø245 or Ø 330mm hole in the wall about 1900 mm above the floor.
2	Demount the front cover of the unit by removing the 2 fluted grip knobs.
3	Hold the unit in position and fasten it to the wall with minimum 4 screws.
4	Slide the filter into place and remount the front cover.

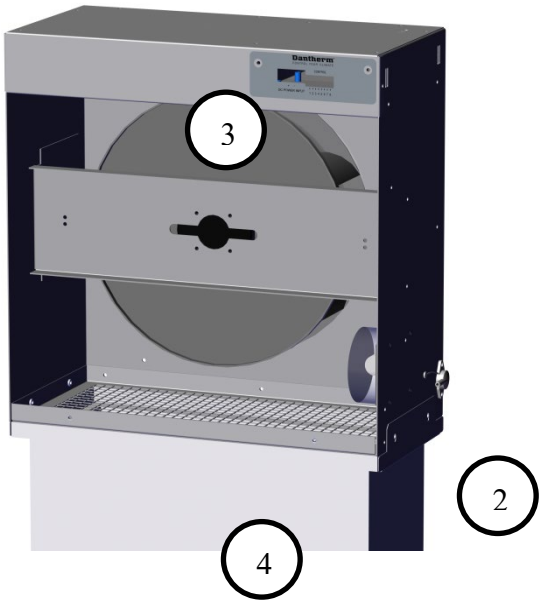
DFC 350





DFC 45(





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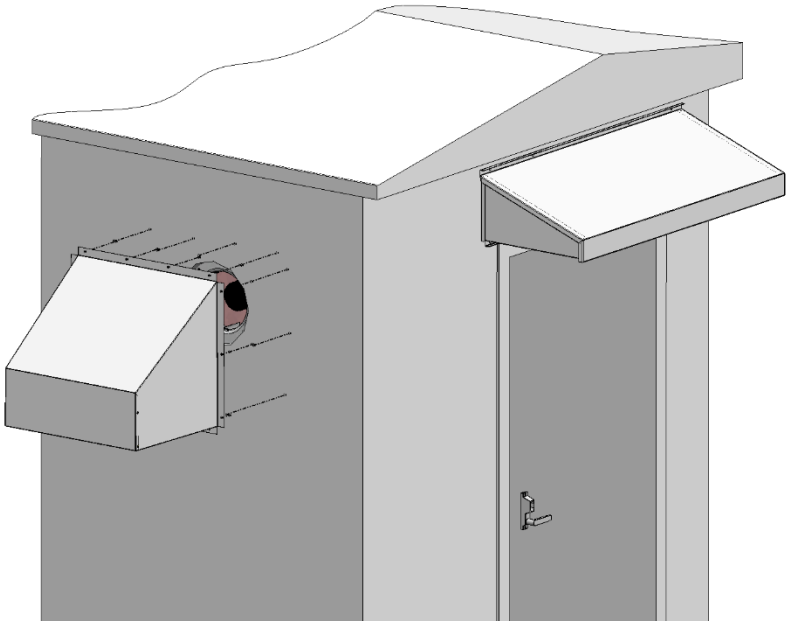
How to Mount the DFC 350 or DFC 450, *continued*

Air inlet hood

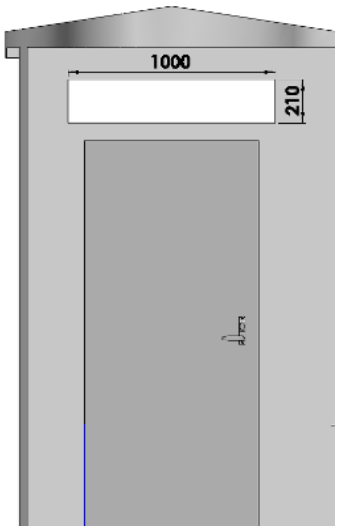
Put sealing rubber on the flanges of the hood, hold it in position above the inlet hole and fasten it to the wall.

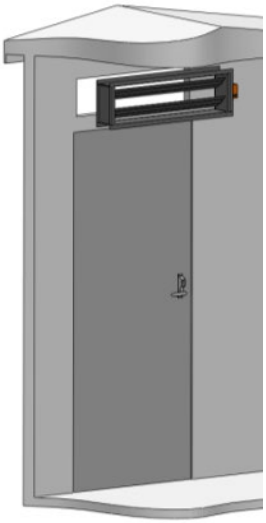


Exhaust damper

Cut out an exhaust opening W: 1000xH: 210mm above the door (when possible).

Hold the motorized damper in position and fasten it to the wall.





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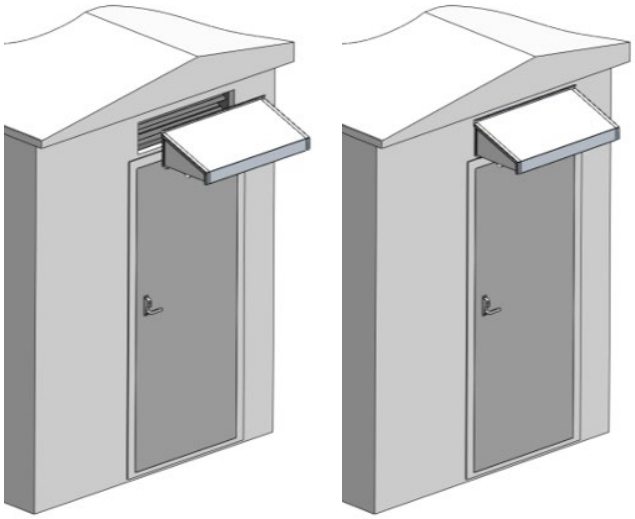
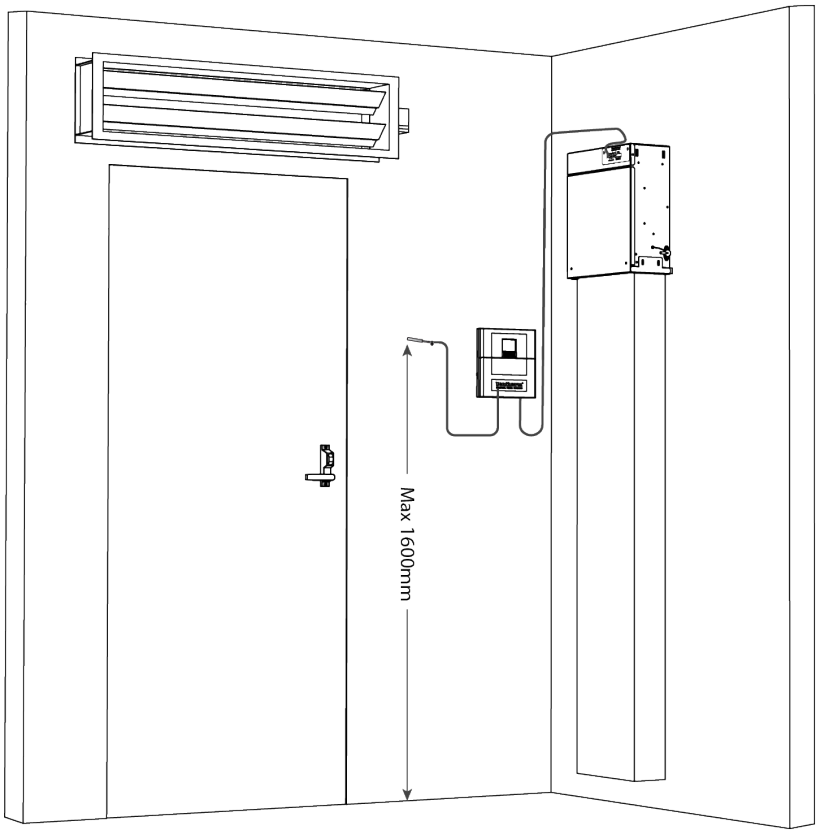
How to Mount the DFC 350 or DFC 450, *continued*

Exhaust hood

Put sealing rubber on the flanges of the exhaust hood.
Hold it in position and fasten it to the wall.



Sensor placement



Example

Starting up

Installing newest firmware

Insert SD card into CC 3000 controller, switch power on and the firmware update will start automatically. Wait while the firmware is installed.

(See, where to insert SD card and find more details about this process in the separate CC 3000 manual)

Choose config file

When the installation process is finished, the CC 3000 display will automatically open the product configuration menu.

Different config-files will show up depending on the variant of your product. Choose the variant specific configuration that fits best to your cooling needs (see control strategy on page 25) , if different options are available.

Variant	Config File	Using Control strategy…
DFC-350-230V-C3-W-FG	DFC350AC	Standard configuration for DFC 350-450 AC/DC • Standard control strategy
DFC-450-230V-C3-W-FG	DFC450AC	
DFC-350-48V-C3-W-FG	DFC350DC	
DFC-450-48V-C3-W-FG	DFC450DC	
DFC-350-230V-C3-W-FG_X10	DFCNOMIN	WITHOUT minimum speed • normal control strategy. Fan stops at low temperature. • FR + NL language incl. on SD card
	DFCMINSP	WITH minimum speed • fan continues running even at low temperatures • FR + NL language incl. on SD card

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Technical data DFC 350

Introduction

This Free Cooling unit is very compact, quiet and economic due to the Displacement Free Cooling system. In this product the EC-fan signal is reduced to 5V to achieve the optimized performance.

Air flow and sound

This table shows the technical data for airflow and sound pressure:

Parameter	48V DC	230V AC
Max air flow	514 m^3/h	514 m^3/h
Max air flow	143 l/s	143 l/s
Free cooling capacity at Δt=5°C	3 kW	3 kW
Max power consumption	40 W	35 W
Sound pressure at 5m from shelter	36 dB(A)	34 dB(A)
Sound pressure at 10m from shelter	31 dB(A)	31 dB(A)

Cabinet

This table shows the specifications for the cabinet:

Specification	Designation	DFC 350
Weight	Controller included	10 kg
Metal sheet material	Aluzinc AZ150	0,8-1,5 mm

Fan motor

This table shows the data for the fan motor:

Voltage version	48V DC	230V AC
Voltage nominal	48V DC	230V AC
Current	2,3 A	0,9 A
Max power consumption at standard settings	40 Watt	35 Watt
Speed	1500 rpm	1450 rpm

Filter

This table shows the data for the filter:

Specification	Filter data	
Type	Bag filter	
Filter Class	M5	M6
Total Area	1,4 m^2	1,4 m^2
Recommended filter monitor settings	200 Pa	200 Pa

Technical data for DFC 450

Air flow and sound This table shows the technical data for airflow and sound pressure:

Voltage version	48V DC	230V AC
Max air flow	1100 m^3/h	1100 m^3/h
Max air flow	306 l/s	306 l/s
Free cooling capacity at Δt=5°C	5 kW	5 kW
Max power consumption	40 W	61 W
Sound pressure at 5m from shelter	36 dB(A)	34 dB(A)
Sound pressure at 10m from shelter	31 dB(A)	31 dB(A)

Cabinet Data and dimensions of the cabinet are shown in the following table:

Specification	Designation	DFC 450
Weight	Controller excluded	13 kg
Metal sheet material	Aluzinc AZ150	0,8-1,5 mm

Fan motor Data of the fan motor is shown in the following table:

Voltage version	48V DC	230V AC
Voltage nominal	48V DC	230V AC
Current	2,3 A	1,1 A
Max power consumption	40 W	54 W
Speed	1100 rpm	1000 rpm

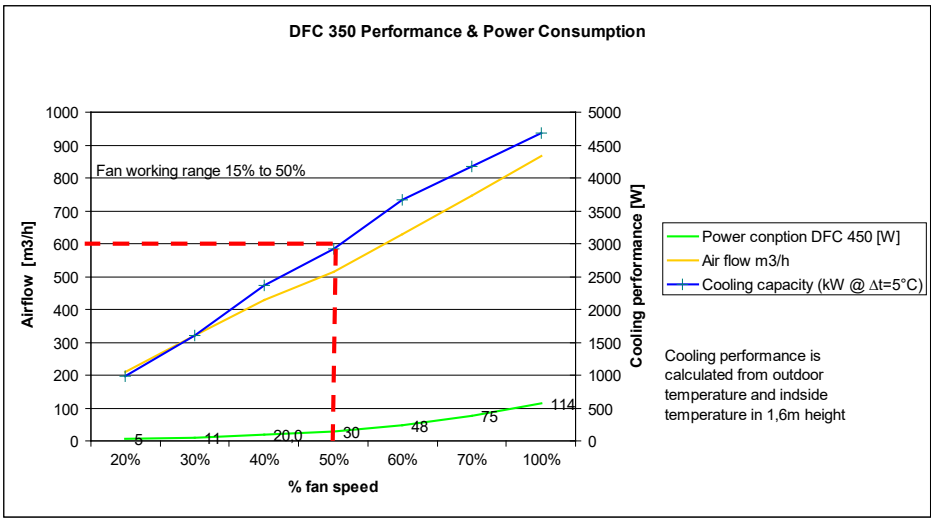
Filter In the table below the data of the filter are specified:

Specification	Filter data	Filter data
Type	Bag filter	
Filter Class	F5	F6
Total Area	2 m^2	
Recommended filter monitor setting	100 Pa	150 Pa
Can be increased to	200 Pa	250 Pa

Capacity and data diagrams

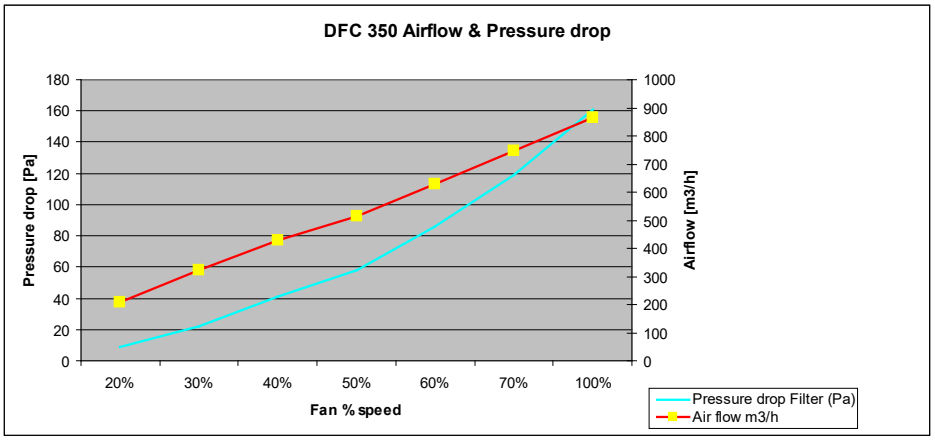
Performance

The diagram below shows data for DFC 350:



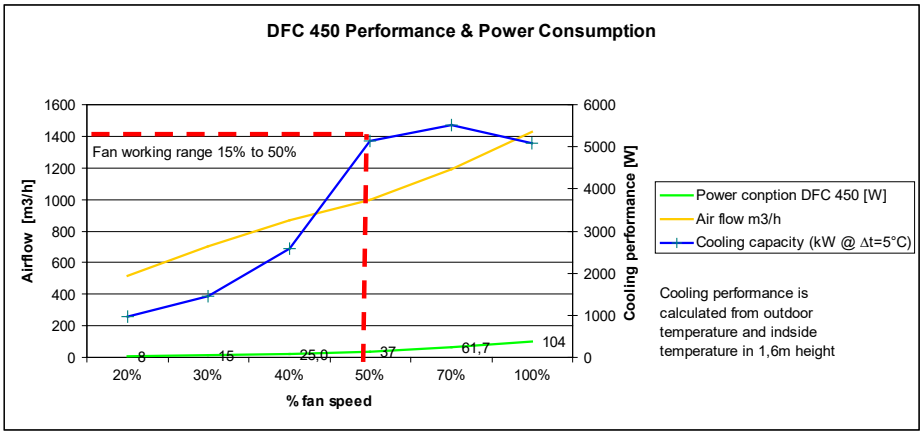
Airflow & Pressure drop

The diagram below shows data for DFC 350:



Performance

The diagram below shows data for DFC 450:



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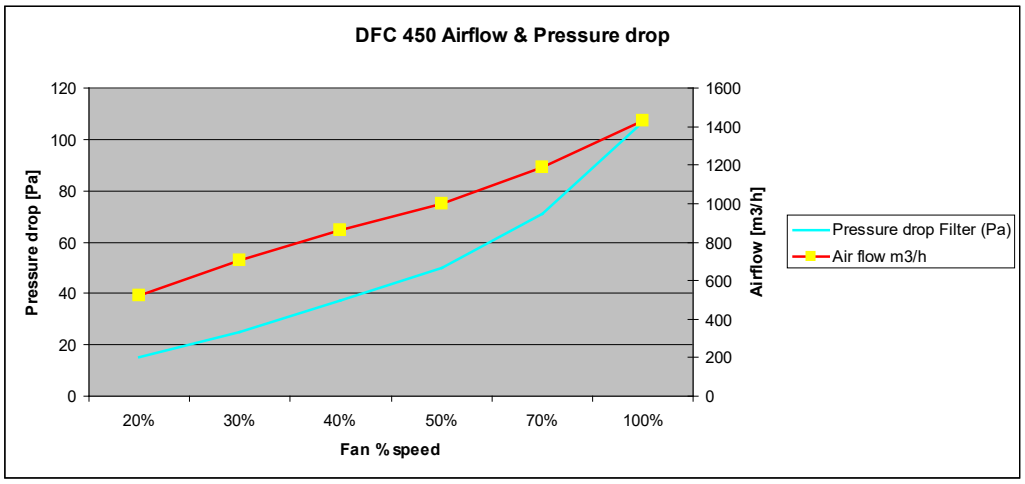
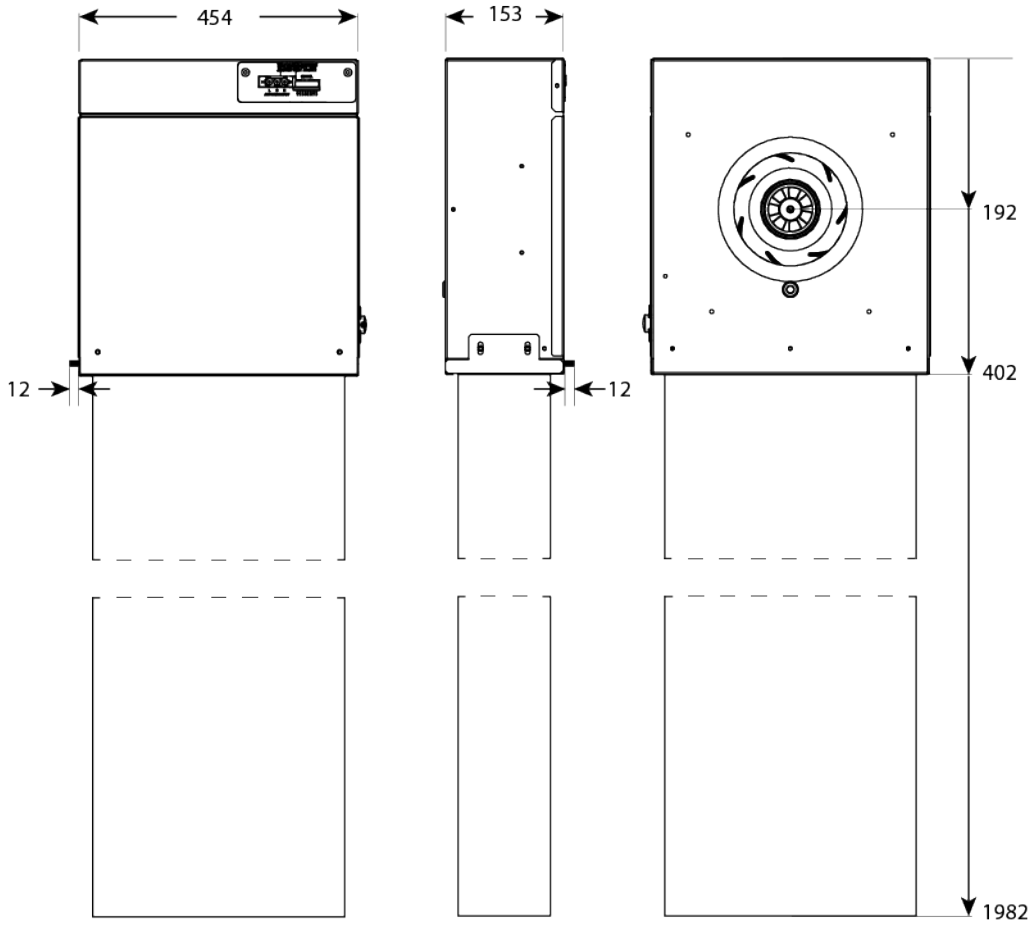
Capacity and data diagrams, *continued*

Airflow & Pressure drop The diagram below shows data for DFC 450:



Dimensions

Illustration DFC 350 The drawings below illustrate the dimensions of the DFC 350.



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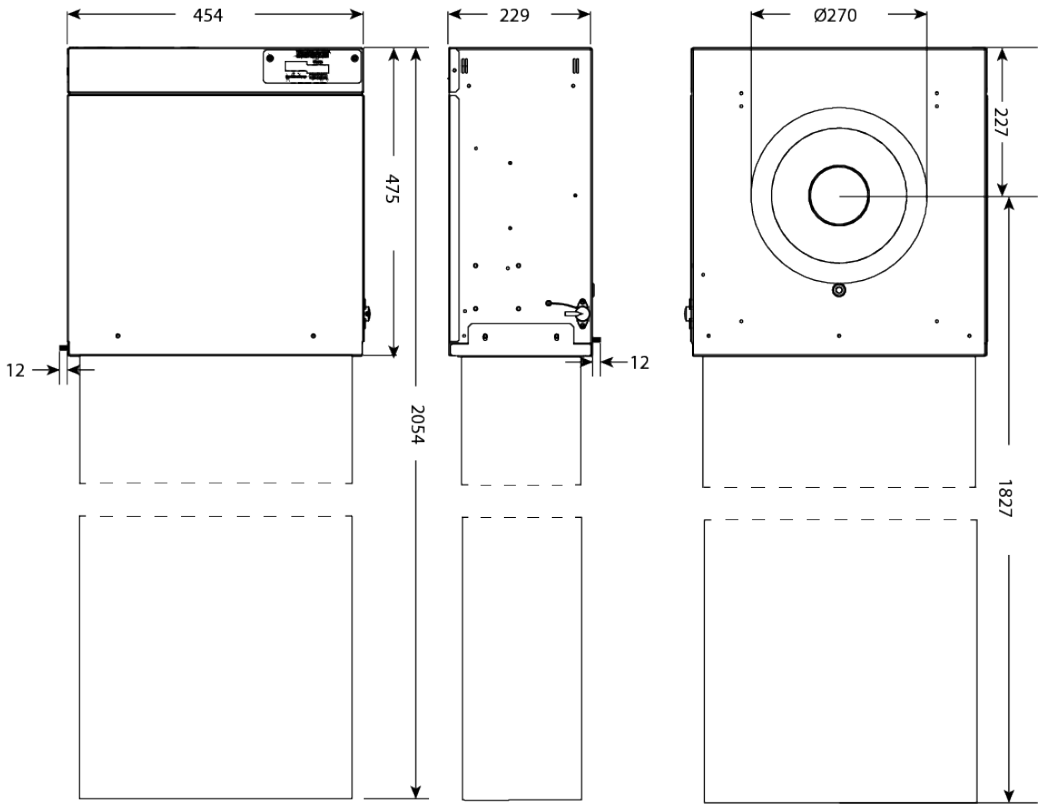
Dimensions, *continued*

Illustration DFC 450 The drawings below illustrate the dimensions of the DFC 450.



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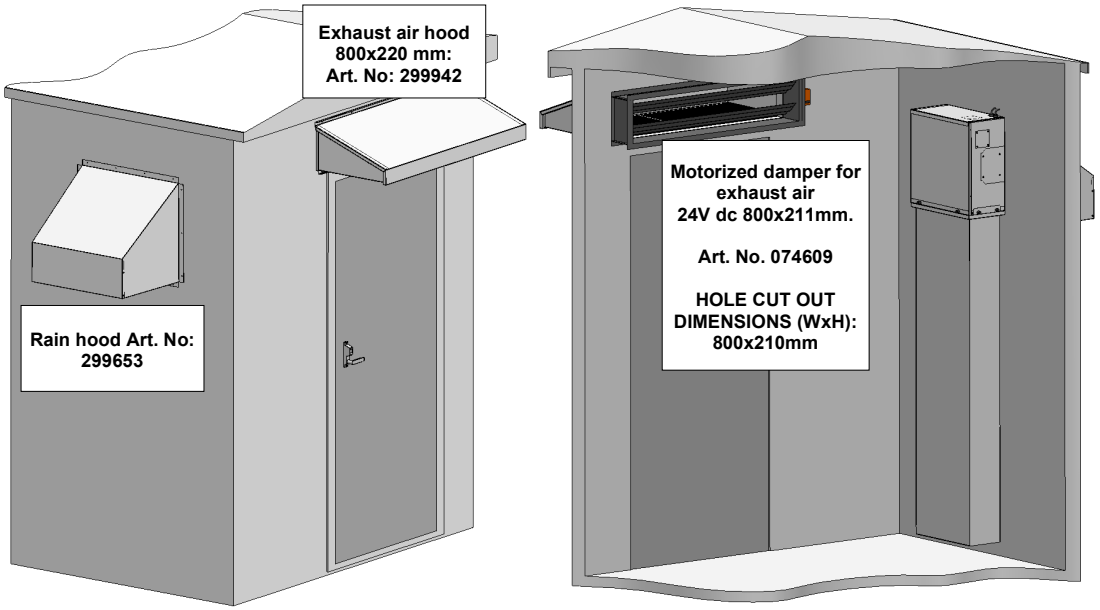
Dimensions, *continued*

External accessories

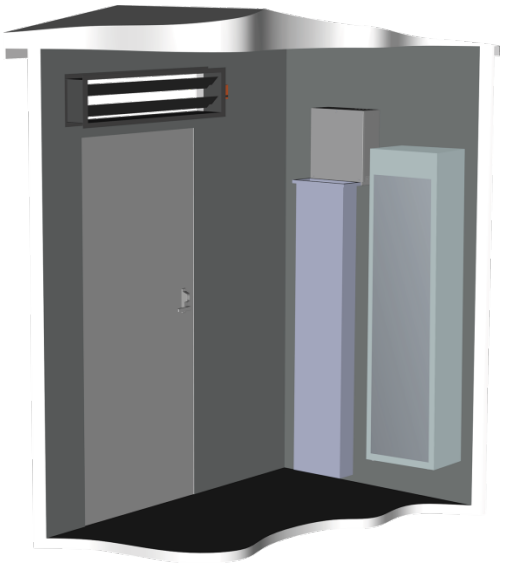


Installation alternatives

Introduction

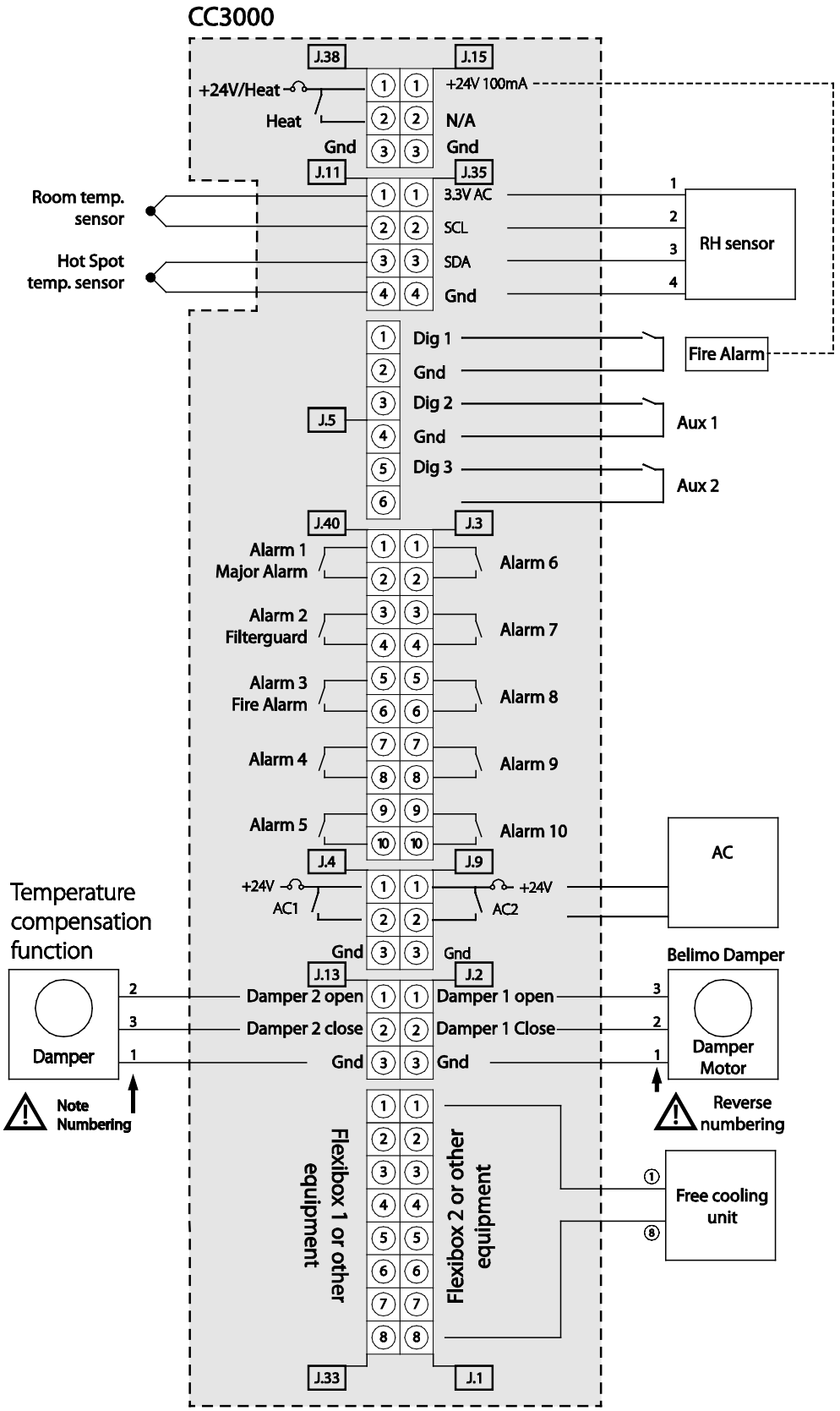
The pictures below shows the three ways the Displacement Free Cooling unit can be mounted and still make filter exchange easy. There are three different lids, of which only one should be opened to take out and replace the bag filter.

Front service



Left and right service

Wiring diagram – CC3000

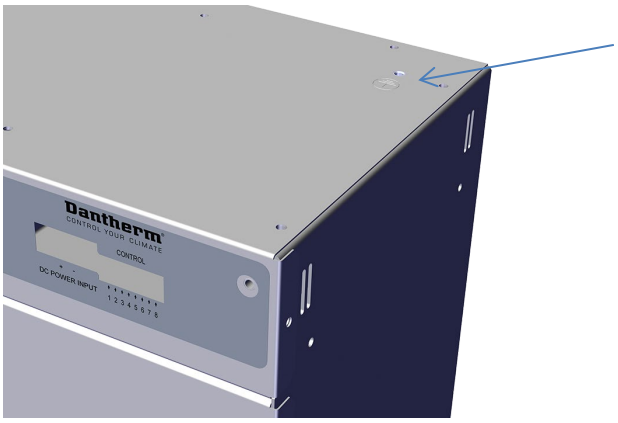


Connections 48V and 230V

Ground

Connect the DFC 350/450 to ground by using the nut marked with ground symbol.

For more wiring information, please see section *Wiring Diagram*.

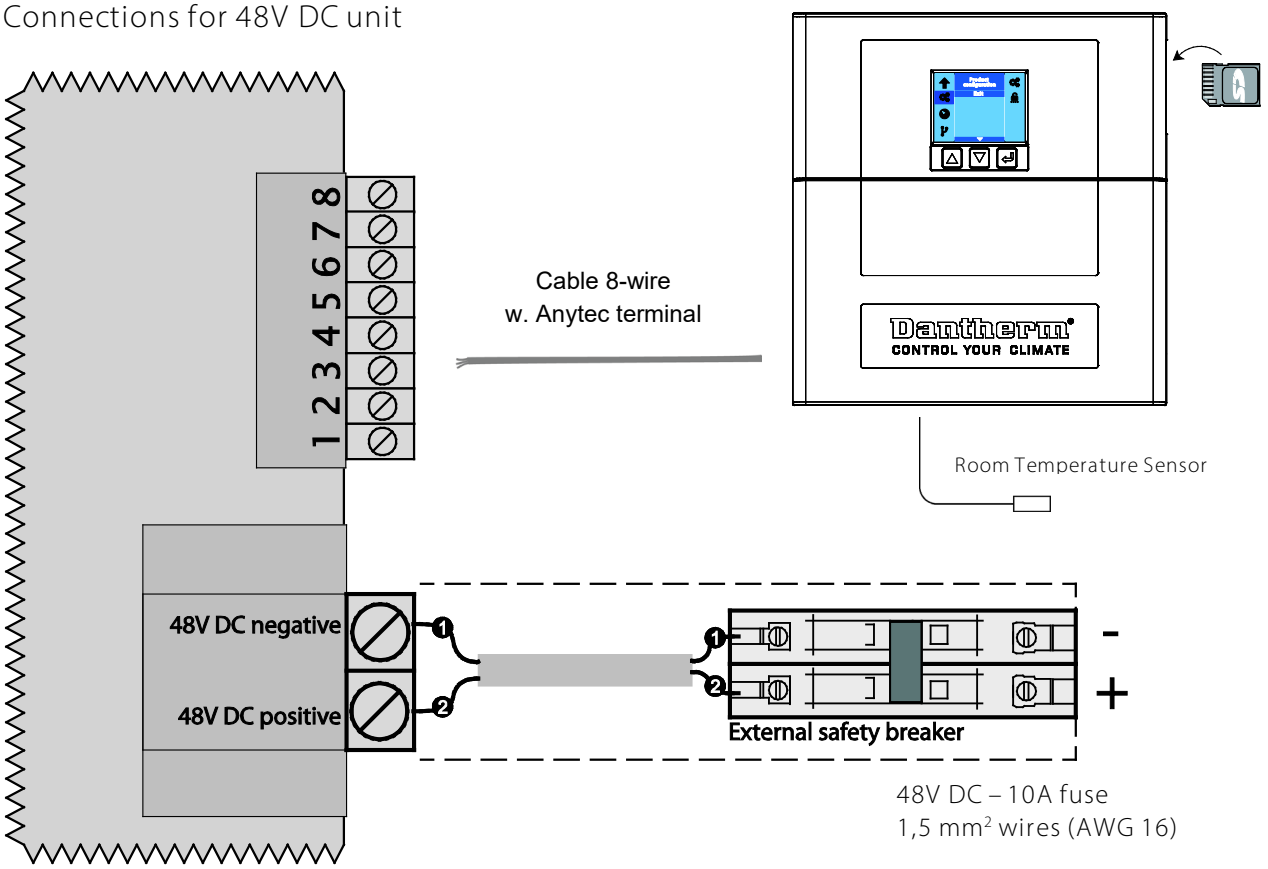


Electrical Connection

For electrical connection of the unit see the Service Manual for the specific controller you are using, or see “Wiring Diagram”.

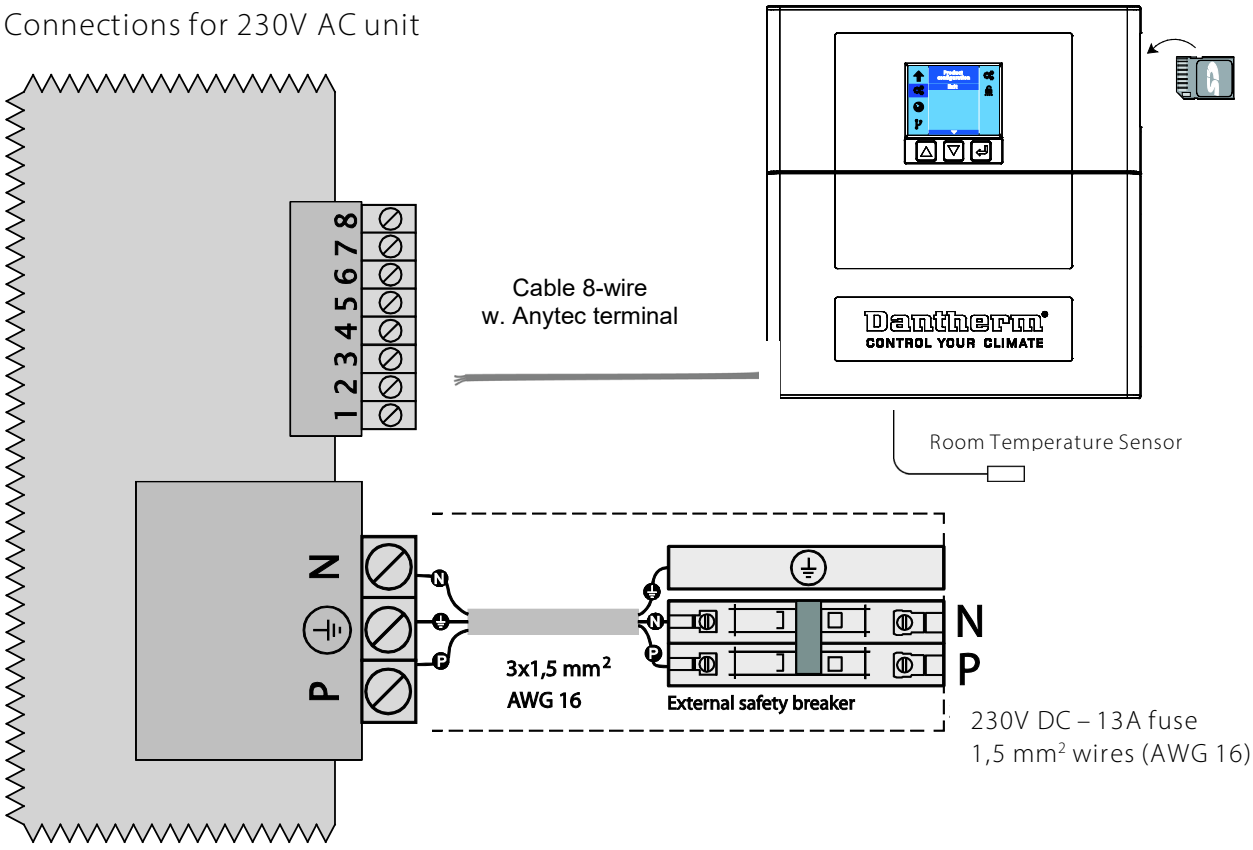
Connections 48V and 230V

Connections for 48V DC unit



48V DC – 10A fuse
1,5 mm² wires (AWG 16)

Connections for 230V AC unit



230V DC – 13A fuse
1,5 mm² wires (AWG 16)

Preventive maintenance

Introduction

The unit needs preventive maintenance with specific intervals to avoid breakdown or inefficient operation. It is important to notice that interval between maintenance can vary depending on the specific environment.

Caution!

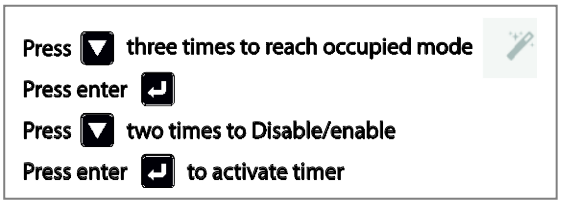
Switch off both the DC and AC supply before working on the unit!

Make sure that all work has been performed before switching on the power again.

Service function "Timer"

Occupied mode can be used by service personnel to obtain a suitable temperature in shelter during service job. Free cooling fan is limited to idle RPM.

Temperature set point can be changed and the duration for the set point change.



Interval

Dantherm Air Handling A/S recommends that intervals between preventive maintenance do not exceed 1 year. It is also our recommendation that the site and unit is examined closely during the first preventive maintenance to determine whether the interval is too long.
We recommend that preventive maintenance visits are carried out during spring.

Condition for warranty

The factory warranty is only valid if documented preventive maintenance has been carried out with an interval of maximum 1 year. The documentation should be in form of a written log.

Leaving the site

Before leaving the site, make sure there are no alarms!

Recommended approach

Follow these steps to carry out preventive maintenance on the unit:

Step	Action
1	Make sure that the power to the unit is safely switched off.
2	Remove the worn-out filter and clean the unit carefully.
3	Clean the dampers and check function and tightness.
4	Clean the fan and check that the mounting is OK.
5	Check and clean the air intake and exhaust accessories.
6	Insert the new filter carefully into the unit.
7	Close the unit and make sure that the service is completed correctly.
8	Turn on the power to the unit.
9	Run the Self test according to the separate manual for the controller.

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Spare parts list

Spare parts DFC 350 only

This table shows the spare parts for **DFC 350**:

Spare part	Type	Part number
Bag filter	Filter class F5	299821
Bag filter	Filter class F6	067335
Fan – 48V DC	EC, Centrifugal fan, 48V DC	067738
Fan – 230V AC	EC, Centrifugal fan, 230V AC	096880

Spare parts DFC 450 only

This table shows the spare parts for **DFC 450**:

Spare part	Type	Part number
Bag filter	Filter class F5	299749
Bag filter	Filter class F6	840058
Fan – 48V DC	EC, Centrifugal fan, 48V DC	067739
Fan – 230V AC	EC, Centrifugal fan, 230V AC	840061

DFC 350/450

Description	Spare Part No.
Satellite PCB 48V DC	093713
10 pce. Fuse 58V DC / 10 Amp	094152

DFC 350/450

Description	Spare Part No.
Satellite PCB 230V DC	093716
10 pce. Fuse 4A, 250V Ø5,2 x 20mm	096645
48V DC Power supply for 230V AC models	093717

Common

Description	Spare Part No.
CC3000 control incl. SD card configured for all units	093719
CC 3000 Connector Kit	092081
Controller Cable for CC3000	093724
Filter Guard monitor	840020
Outdoor Temp. sensor 2000 mm cord	087429
Room Temperature sensor 8000 mm cord	096873
Damper actuator for 48V and 230V controller LM24A KTE	840021

Appendix

Introduction

The DFC unit is by default set up to operate in one of the following free cooling modes:

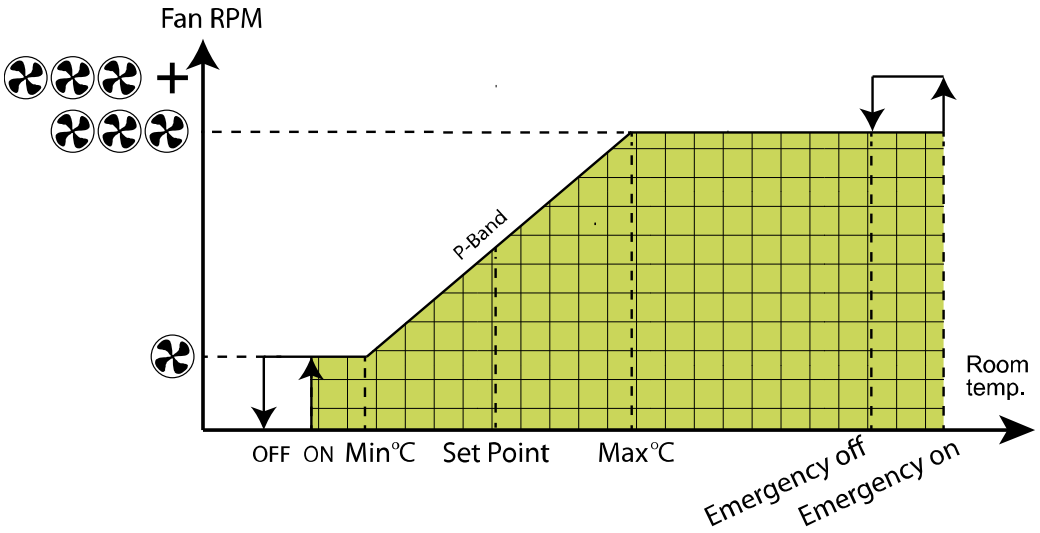
- Standard configuration (for DFC 350-450 AC/DC)
- DFCNOMIN configuration or
- DFCMINSP configuration

Mode can be changed using the CC 3000 controller.

Free cooling mode

The basic operation strategy can be described in the following way:

- Connected heater (optional) starts, when temperature is too low (on/off set points for heater can be adjusted).
- Free cooling unit(s) start(s) up slowly, when temperature rises above Min °C set point and fan will increase speed gradually (according to P-band) until Max °C set point is reached.



Appendix, *continued*

Cooling strategies (Free cooling mode)

This table shows the values of the Free cooling mode depending on the configuration (see also page 10):

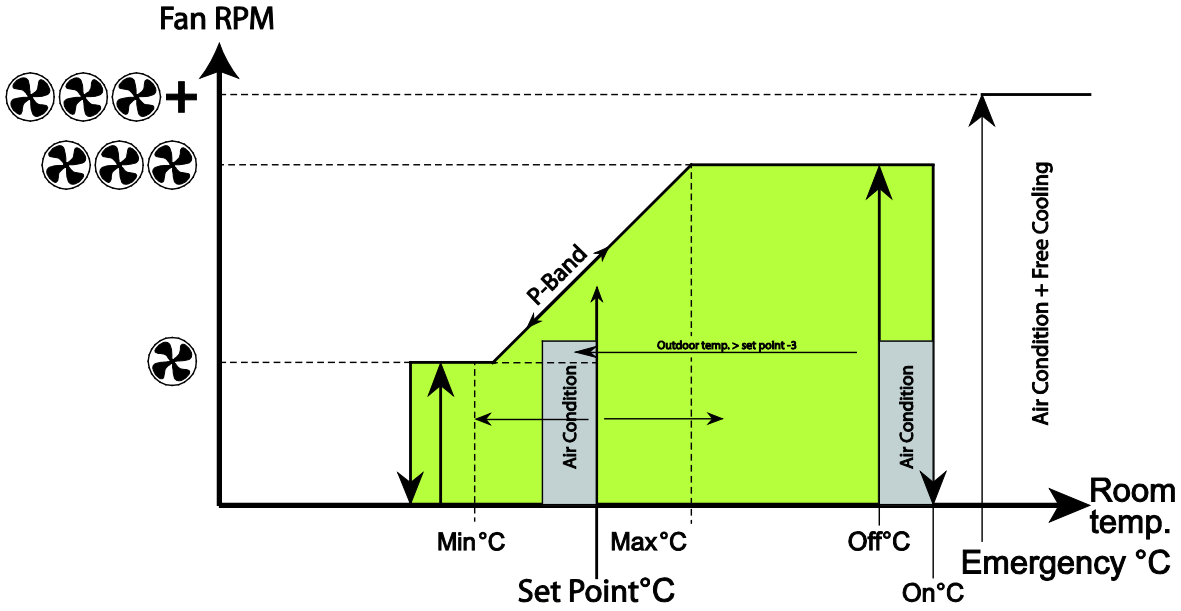
Abbr.	Description	Standard	DFC NOMIIN	DFC MINSP
Off	Temperature when fan stops	20	18	-40
On	Temperature when fan starts	23	20	-38
Min °C	Temperature at bottom of P-band • Fan operates at min. performance	25	22	
Max °C	Temperature at top of P-band • Fan operates at max. performance (100%)	29	26	
Set Point	The wanted indoor temp.; • Fan speed will be adjusted between Min°C and Max °C	27	22	
Emergency on	Fan runs 100%	38	38	
Emergency off	Fan returns to nominal speed	36	36	
Heater on °C	Temperature when heater starts	12	16	
Heater off °C	Temperature when heater stops	16	18	
Low temperature alarm °C		10	10	
High temperature alarm °C		40	40	

Appendix, *continued*

Standard Mode (Freecooling <> A/C)

	Description	Value
Off	Temperature when fan stops	20
On	Temperature when Fan starts	23
Min °C	Temperature at bottom of P-band	25
Max °C	Temperature at top of P-band	29
Set Point	The wanted indoor temp.; fan speed will be adjusted between Min°C and Max °C	27
A/C 1 on	External Air Con unit 1 start if connected	31
A/C 1 off	External Air Con unit 1 stops if connected	29
A/C 2 on	External Air Con unit 2 start if connected	33
A/C 2 off	External Air Con unit 2 stops if connected	31
Emergency on	Fan run 100% and both A/C 1 and A/C 2 starts	38
Emergency off	Fan stops both A/C 1 and A/C 2 continue to run	36

A/C unit 1 start at set point if outdoor temperature is less than 3°K colder than set point. If outdoor temperature is more than 3°K colder than setpoint the A/C unit 1 will start at 31°C

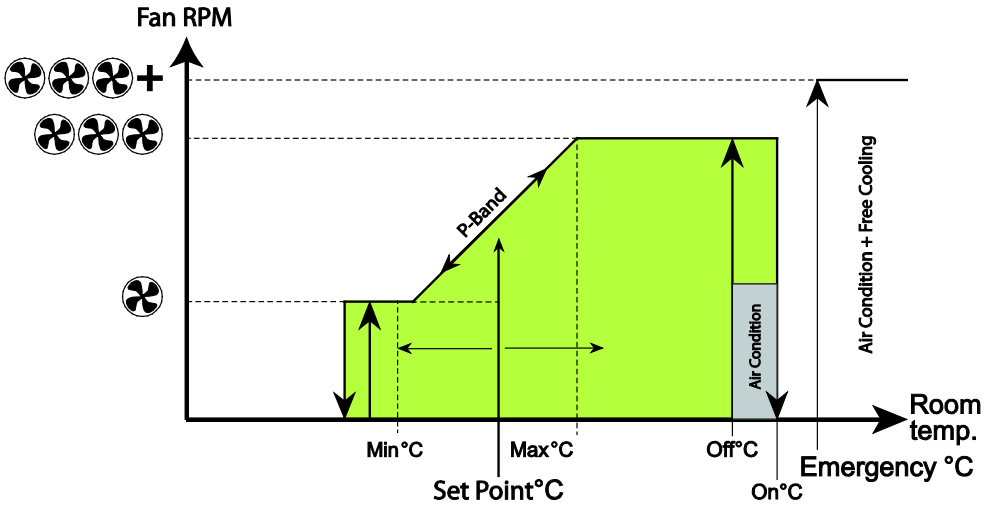


Appendix, *continued*

Energy save Mode (Freecooling > A/C)

	Description	Value
Off	Temperature when fan stops	20
On	Temperature when Fan starts	23
Min °C	temperature at bottom of P-band	25
Max °C	Temperature at top of P-band	29
Set Point	The wanted indoor temperature; fan speed will be adjusted between Min°C and Max °C	27
A/C 1 on	External Air Con unit 1 start if connected	31
A/C 1 off	External Air Con unit 1 stops if connected	29
A/C 2 on	External Air Con unit 2 start if connected	33
A/C 2 off	External Air Con unit 2 stops if connected	31
Emergency on	Fan run 100% and both A/C 1 and A/C 2 starts	38
Emergency off	Fan stops both A/C 1 and A/C 2 continue to run	36

If outdoor temperature is less than 1°C colder than indoor room temperature the Fan will stop.
The connected Air-con units will start and stop according to the table above.

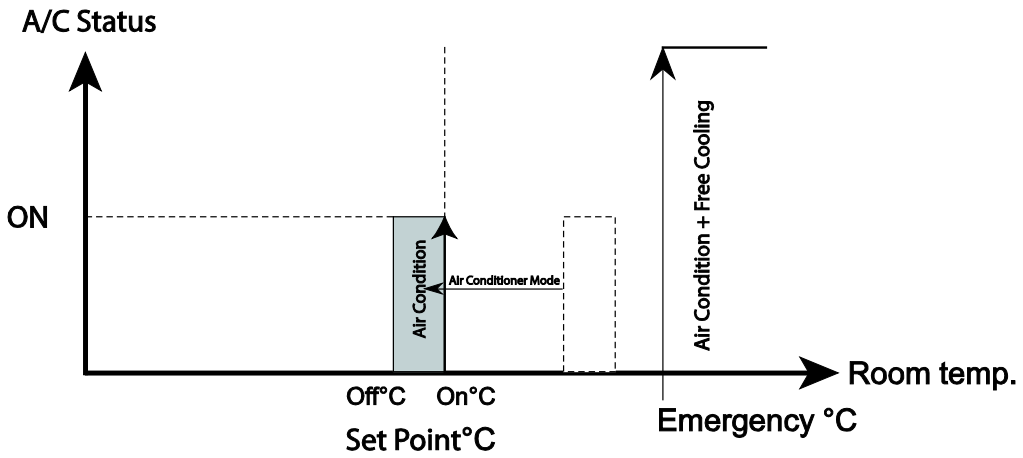


Appendix, *continued*

Air Conditioner Mode

Description		Value
Set Point	External Air Con unit 1 start if connected	27
A/C 1 off	External Air Con unit 1 stops if connected	25
A/C 2 on	External Air Con unit 2 start if connected	29
A/C 2 off	External Air Con unit 2 stops if connected	27
Emergency on	Fan run 100% and both A/C 1 and A/C 2 starts	38
Emergency off	Fan stops both A/C 1 and A/C 2 continue to run	36

The free cooling unit is not active, only the connected Air conditioners



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