

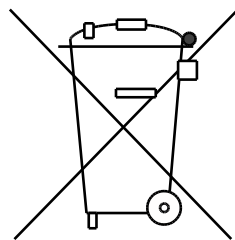
DC Air Conditioner 3000

Service manual

Rev. 1.0

en

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Introduction

Overview

Introduction	This is the service manual for the Dantherm DC Air Conditioner 3000. Please see the below table of content for further information about the sections.
Manual	Part number of this service manual is 366245 and covers units with serial numbers from 1306121273752
Target group	The target group for this service manual are the technicians who install and maintain the DC Air Conditioner 3000 unit, as well as the users of the unit.
Copyright	Copying of this service manual, or part of it, is forbidden without prior written permission from Dantherm Air Handling A/S.
Reservations	Dantherm reserves the right to make changes and improvements to the product and the service manual at any time without prior notice or obligation.
Table of contents	<p>This service manual covers the following main topics:</p> <ul style="list-style-type: none"> Introduction.....3 Product description.....4 <ul style="list-style-type: none"> Overall description.....4 Electronic control description8 Connections.....11 Installation – outdoor.....12 Installation – through wall15 Service guide16 <ul style="list-style-type: none"> Preventive maintenance.....17 Troubleshooting19 Electrical schematic.....21 Cooling circuit22 Spare part list24 Replacing parts25 Technical data28 Contact Dantherm.....31

Product description

Overall description

Introduction	This section describes the overall product, and its functionality
Usage of the DC Air Conditioner 3000	DC Air Conditioner 3000 is designed to control the internal temperature of an outdoor enclosure. DC Air Conditioner 3000 removes dissipated heat from electronic equipment and it's designed to maintain correct temperature for electronic equipment.
Important	Dantherm Air Handling recommends that the cooling system should be running continuously!
Section content	Product description..... 4 Overall description..... 4 Electronic control description 8 Connections 11 Installation – outdoor..... 12 Installation – through wall..... 15

Overall description, *continued*

Outdoor view This illustrates the unit outdoor visible parts

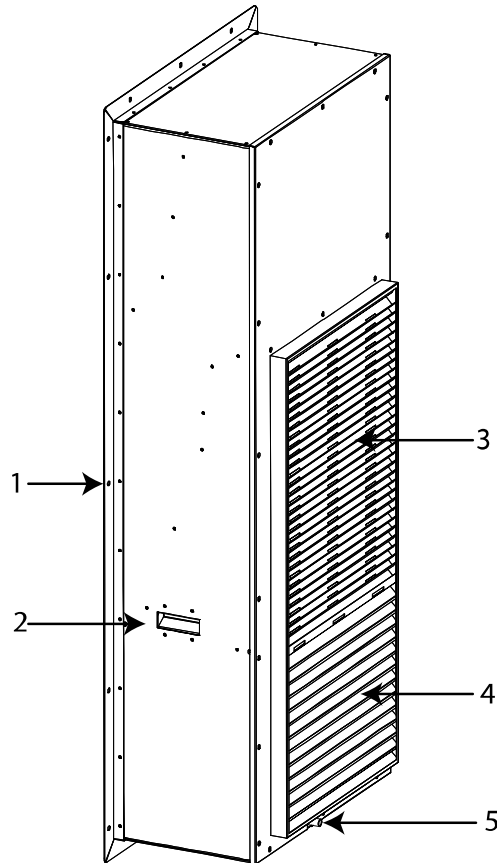


Fig. 1

Parts description outdoor view

This table shows outdoor parts according to Fig. 1

Part	Function
1	Mounting frame
2	Lifting handles
3	Condenser air output
4	Condenser air input
5	Condensed water spigot

Continued overleaf

Overall description, *continued*

Indoor view

This illustrates the unit indoor visible parts

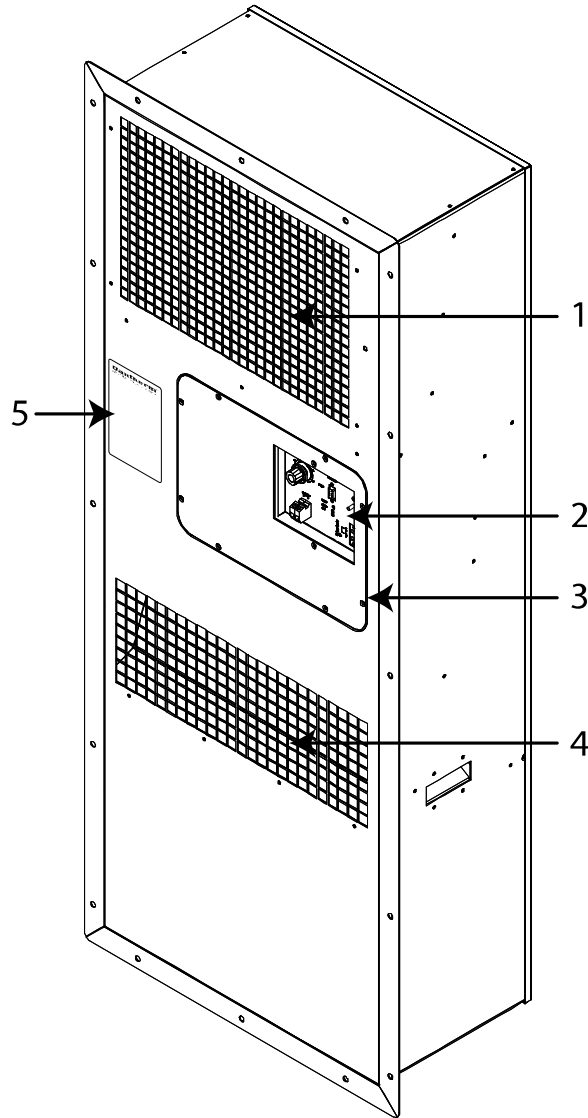


Fig. 2

Parts description indoor view

This table shows indoor parts according Fig. 2

Part	Function
1	Evaporator air inlet
2	Controller
3	Service entrance
4	Evaporator fan blowing cold air out
5	Serial number label

Continued overleaf

Overall description, *continued*

Functionality

The illustration and table below show the airflows of DC Air Conditioner 3000. The two air flows (internal/external) operate separately. External air is only used to cool down the condenser which dissipates the heat absorbed by the indoor evaporator. *The air flows are not mixed.*

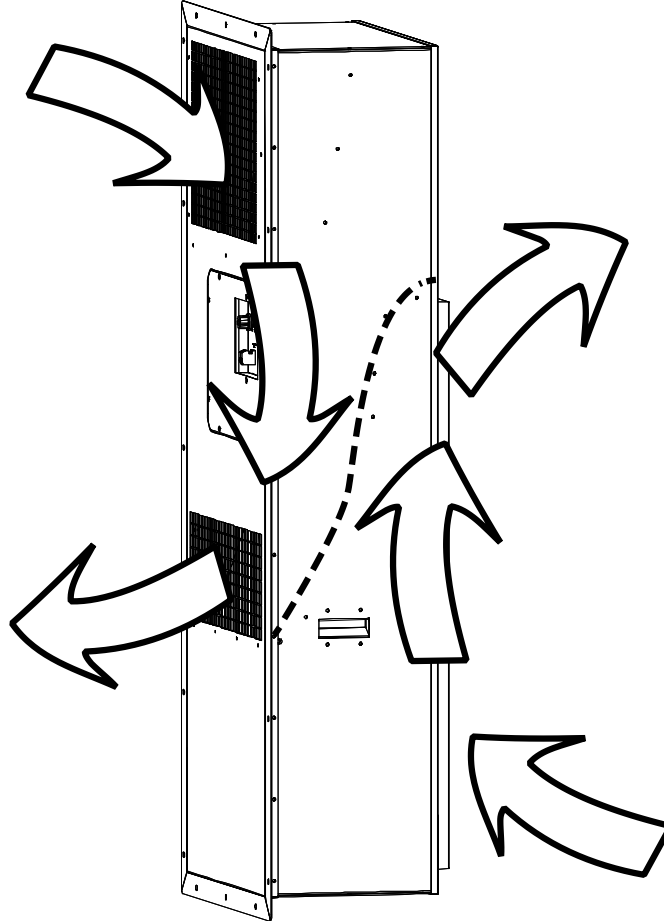


Fig. 3

Internal air flow

Warm, internal air is drawn into the unit by the internal evaporator fan, at the evaporator opening, through the evaporator and the evaporator fan, and then released into the enclosure through the evaporator fan opening.

External air flow

Cold, external air is drawn into the unit by the condenser fan, and routed through the condenser, where it's cooling down the condenser. After passing through the condenser the air is returned to the external environment through the condenser fan.

Electronic control description

Introduction

This section describes key features of the electronic control, and how it operates.

WARNING

Never carry out any installation, maintenance or service, without disconnecting the DC power supply, by means of the external power supply disconnecting devices.

Installation requirements

Please incorporate the following when installing the electrical connections:

1. Any external supply should be protected, with an external disconnecting device
2. These disconnecting device, needs to be labelled, with rated voltage as well as rated current
3. All cables, in a permanent installation, are imperative to install and secure properly, to prevent any damage to equipment and/or humans.
Secure all cables with cable ties or appropriate cable fasteners, made for this purpose.

Controller

Embedded controller

Controller Functionality

The control board controls fans and cooling compressor according to the temperature in return air flow. The cooling capacity is automatically adjusted to match the present heat dissipation from the affiliated applications, so the airconditioner always uses minimum energy according to heat load.

Phase	Description
1	When power is on, the evaporator fan will circulate the indoor air repeatedly on idle speed.
2	When return air temperature reaches the predefined set point, internal fan will speed up, the compressor will start on minimum rotation speed. In case temperature keeps rising the compressor rotation speed will increase until a balanced condition between the applied heat dissipation and cooling performance has been obtained.
3	Temperature set point can adjusted in 5 fixed levels; 20°C–25°C–30°C–35°C–40°C
4	If return air temperature drops below the hysteresis (set point – hysteresis), the compressor will be stopped, the evaporator fan (internal fan) will keep circulating internal air on idle speed, to prevent build-up of local hot spots.
5	Condenser fan speed is controlled according to condenser temperature to keep acoustic noise level as low as possible.
6	Compressor has restart delay to protect the compressor against excessive on/off cycling. Pre-set to 5 minutes.

Operating parameters can be adjusted to comply with specific operating conditions.

Continued overleaf

Electronic control description, *continued*

Alarms

The controller has one hardware alarm output.
Alarm output is a bi-directional dry contact. Max load 60V/50mA. Contact is closed on failure.

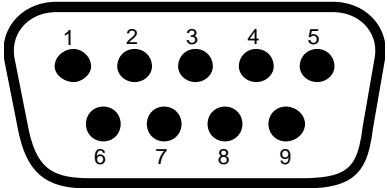
Two LED's indicates status of operation.

LED indication

Color	STATUS	Definition
Green	On	Power supply OK
	Off	No power or Voltage out of range
	Flashing	Selftest on-going. See more at page 10
Red	Off	Normal operation
	1 flash	Internal fan failure
	3 flash	External fan failure
	5 flash	Compressor failure
	7 flash	Return air sensor failure
	8 flash	Condenser sensor failure
	9 flash	Compressor drive communication failure
	10 flash	Low supply voltage
	11 flash	High supply voltage
	13 flash	HP/LP failure
15 flash	High temperature alarm	

Data connection

Communication is possible between computer and the 9 pin D-SUB female.

Pin	Function	Illustration
1	NC	
2	NC	
3	TXD- (Z)	
4	TXD+ (Y)	
5	RXD+ (A)	
6	NC	
7	RXD- (B)	
8	NC	
9	NC	

For service and test purpose, the communication line can be switched to terminal mode.
Can be used with PC and PuTTY terminal program, for change of operational settings and monitoring during service.

Terminal use and adjustable parameters, described in separate document.

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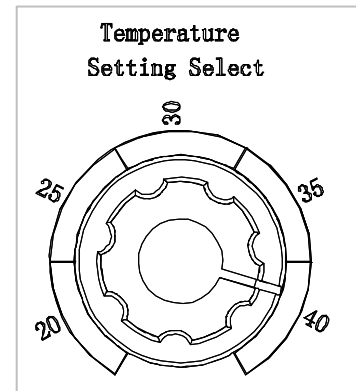
Electronic control description, *continued*

Data communication The controller has an RS 485 communication line with an embedded ModBus protocol. This interface has galvanic insulation.

Communication settings:

RS 485 specification	
Baud rate	9600 baud
Bit	8 bit
Stop bit	1 bit
Parity	Non

Cooling setpoint Cooling set point can be set between 20–40 °C in steps of 5°C. with the set point dial on the front of the unit.



Reset and boot By pressing the reset button for five seconds, the controller enters a reboot and test phase

Step	Description	Eva.fan	Con.fan	Heater	Alarm	Comp.	Duration
1	OFF	Off	Off	Off	Off	Off	10s
2	Int.fan	On (full speed)	Off	Off	Off	Off	30s
3	Ext.fan	On (full speed)	On (full speed)	Off	Off	Off	30s
4	Heater	On (full speed)	On (full speed)	On	Off	Off	10s
5	Alarm	On (full speed)	On (full speed)	On	On	Off	10s
6	Compressor	On (full speed)	On (full speed)	On	Off	On	45s

A duration of **2 minutes and 15 seconds** in total.

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Connections

Connection

This illustration shows the control panel with connections.

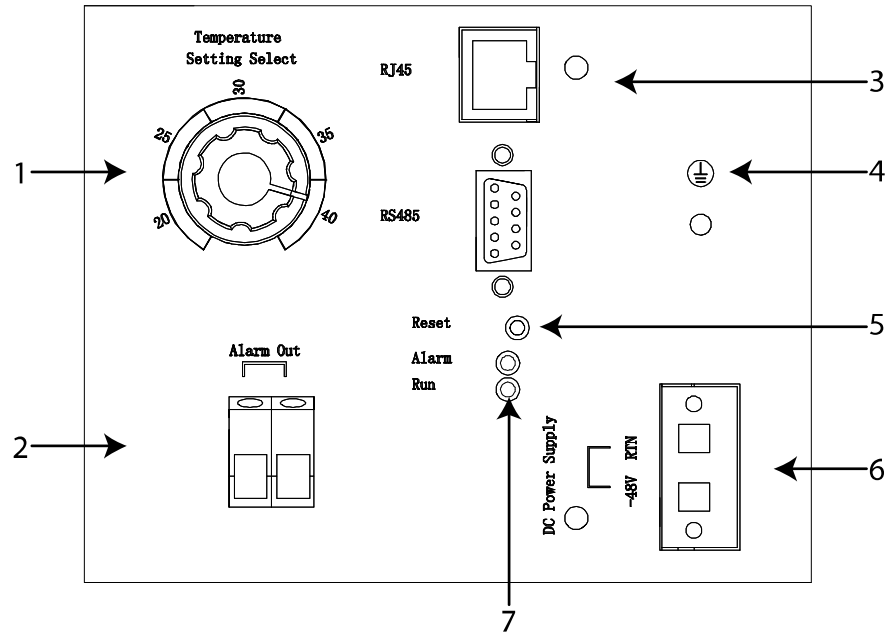


Fig. 4

Connection description

This describes the above connection:

Part	Function
1	Cooling set-point dial
2	Alarm output, see specification at page 9
3	RJ45 - factory only
4	Earth connection
5	Reset switch
6	Power input -44.0 to -58.0 VDC. Reverse polarity protected.
7	LED feedback, see specification at page 9

Installation – outdoor

Introduction

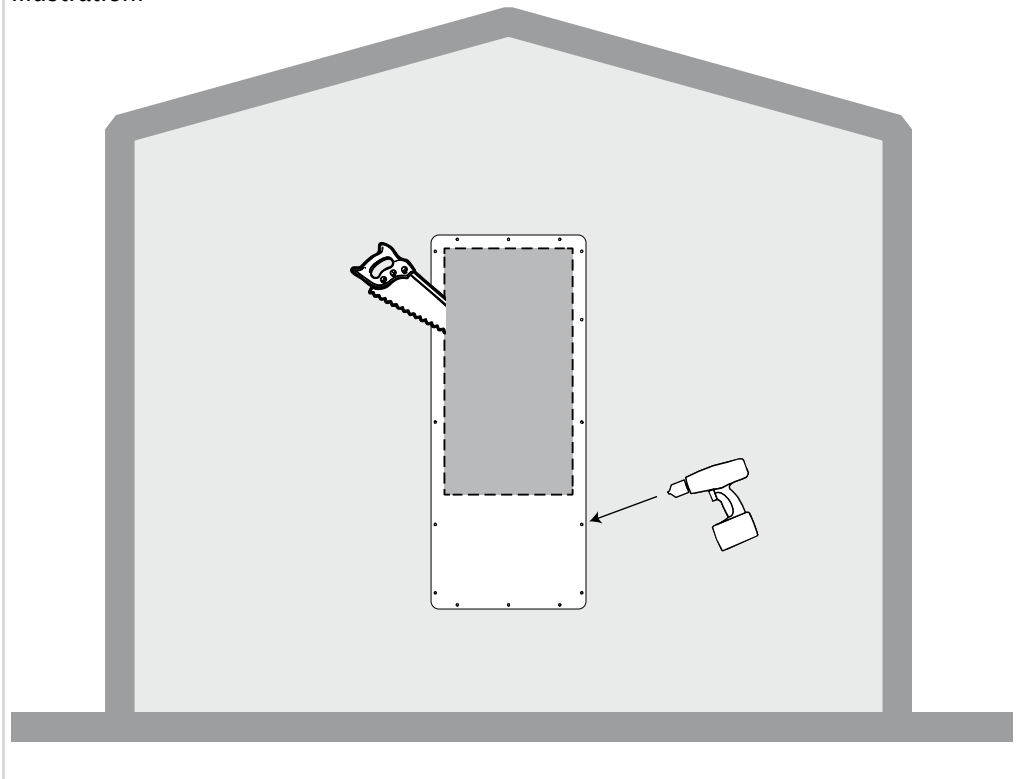
The unit can be mounted outdoor, flush to the wall, or through wall. Is through wall please jump to next section in this manual

Flush wall outdoor mounted

Mounting procedure for outside flush:

Step	Action
1	Unpack the unit, and locate the enclosed paper cutout template
2	Place and secure this paper template on the wall, at an appropriate location and in correct level.
3	Draw up the inner cutout line, and mark the 16 pcs. Holes to be drilled
4	Cut with an appropriate tool the inner wall part away.
5	Drill the 16 pcs holes (8mm appropriate for the M6 holes in the unit frame)

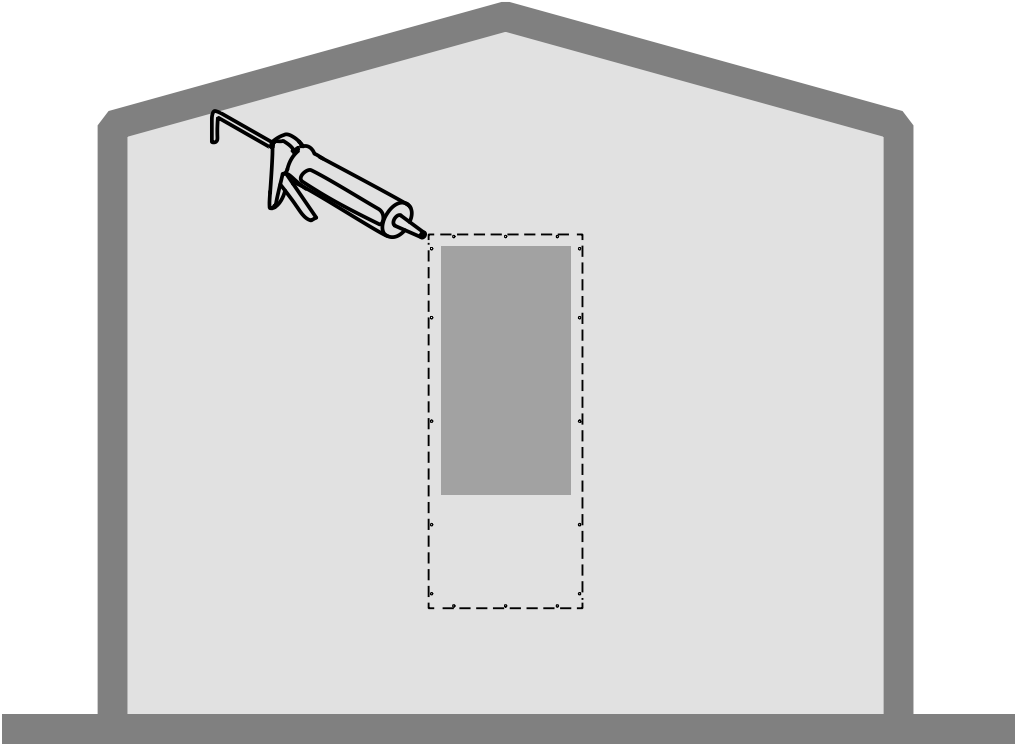
Illustration:



Continued overleaf

Installation – outdoor, *continued*

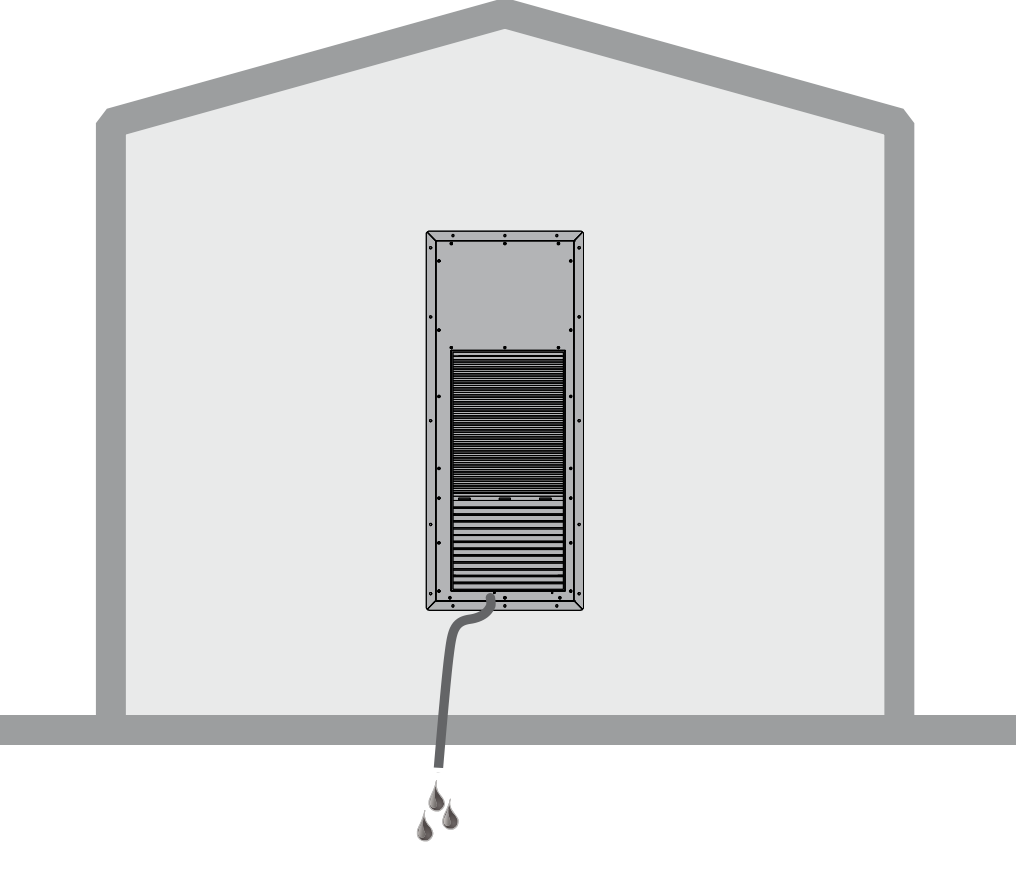
Flush mounted,
continued

Step	Action
7	After cutting apply a polymer sealing, at all four sides, following the outside line of the drilled holes.
Illustration: 	
8	Lift and push the unit into the hole, and install all 16 pcs bolts

Continued overleaf

Installation – outdoor, *continued*

Flush mounted,
continued, *continued*

Step	Action
9	Install the drainage hose
10	Make electrical connection. Always install an external DC circuit breaker.
<p>Illustration:</p> 	
11	Connect additional connection to alarm out if needed, according the connection section in this manual at page 11

Continued overleaf

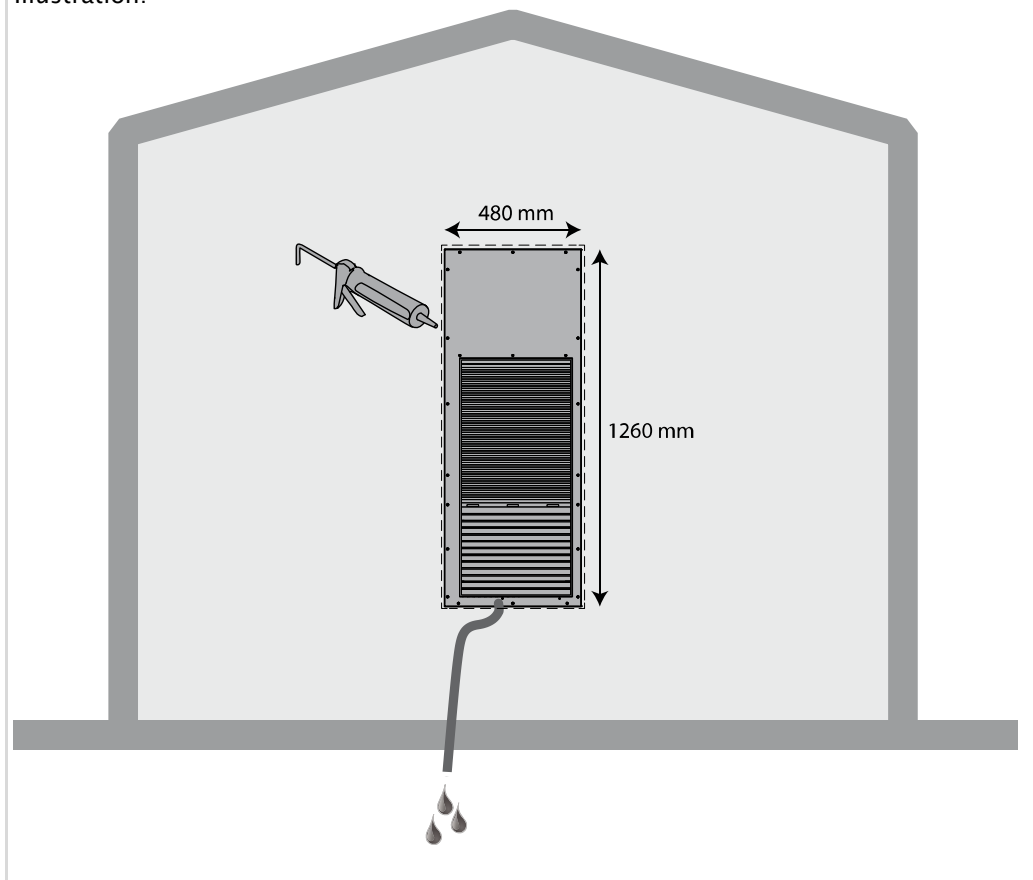
Installation – through wall

Throug wall

The through wall installation differs from outdoor only in two details:
Please read the guide for outdoor, and taking the below changes in consideration

Phase	Description
1	When marking the cutout area, don't use the paper template. Use instead a normal ruler, and mark a square of 480mm wide and 1260 mm high according the dimension shown in the specification part of this manual at page 29.
2	When unit is mounted from the inside, and pushed through the wall, seal from the outside, all around the four edges.

Illustration:



Service guide

Overview

Introduction

This section gives all relevant information about servicing, spare parts and trouble shooting.

Serial numbers

Product model and serial numbers are found on the nameplate.
Please have product model and serial numbers ready if you are contacting After Sales Support.

Contents

This section covers the following topics:

Service guide	16
Preventive maintenance.....	17
Troubleshooting	19
Electrical schematic.....	21
Cooling circuit	22
Spare part list	24
Replacing parts	25
Technical data	28

Preventive maintenance

Introduction

Preventive maintenance has to be carried out to:

- Anticipate a continues operation in product expected lifetime of 10 years or more
- Meet the warranty conditions
- Avoid malfunctions
- Avoid inefficient operation
- Maximize the unit's lifetime

The factory warranty is only valid if documented preventive maintenance has been carried out, with an time interval of:

- Maximum 6 months when unit is located in normal air quality environment
- Maximum 2 months when unit is located in bad quality air environment

A written log at site is adequate documentation for preventive maintenance.

Caution

- Disconnect any supply before working on the unit
- Make sure that all work has been performed correctly before switching power back on

Cleaning

The unit must be cleaned according to the recommended preventive maintenance plan.

Tools required:

- Vacuum cleaner or compressed air
- Soft brush
- TX20 screwdriver
- NHR-60 cleaning agent if it´s very dirty

Phase	Description
1	Open the units outside cover
2	Clean the condenser
3	IF the coils still dirty, please apply NHR-60 cleaning agent on coil fins, and after 5 minutes rinse gently with water, WITHOUT spraying water on any electrical parts
4	Perform end inspection according inspection list below

Continued overleaf

Preventive maintenance, *continued*

Cooling circuit

The cooling circuit should only be serviced by trained cooling technicians.
The following steps is mandatory:

Step	Action
1	Check for any leakages in all junctions, with a suitable leakage detector foam.
2	<p>Check the HP switch functionality.</p> <p>A. After re-assembly, power on the unit, without the internal service cover.</p> <p>B. Cover the outside air inlet going to the condenser, with a piece of plastic foil, covering the inlet completely</p> <p>C. Measure the DC voltage on the two wires from the condenser temperature sensor, connected to the PCB board. See electrical schematics at page 21</p> <p>D. Expect compressor shutdown within a reasonable time (max 10 min), and at approximately 0,88 Volt DC.</p> <p>E. If so the HP safety switch is working, and the refrigerant amount is most likely to be adequate.</p>

Inspection

The unit must be inspected prior to any reassemble and put back into service.
Please follow below steps:

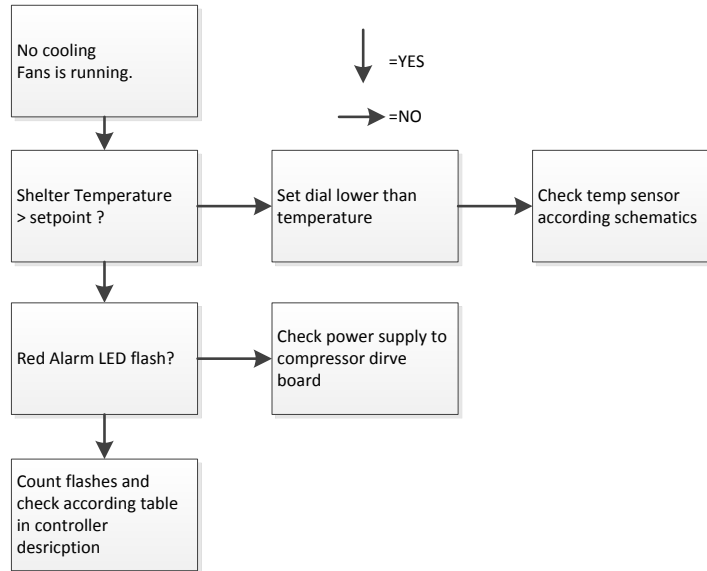
Phase	Description
1	Are the fans clean and free of any corrosion?
2	Are the coolant pipes free of obstructions, damage, corrosion and show no obvious signs of leakage?
3	Are the coil lamellas clean and undamaged?
4	Are all fan blades free of any obstructions, cracks or missing blades?
5	When rotating the fans with the fingers, do the fans rotate freely, without vibrations and noise?
6	Is all wiring and insulation undamaged?
7	Are all connectors secured properly and in good conditions?

Troubleshooting

Introduction

Operating errors may occur. Please follow below service guidelines for possible solutions.

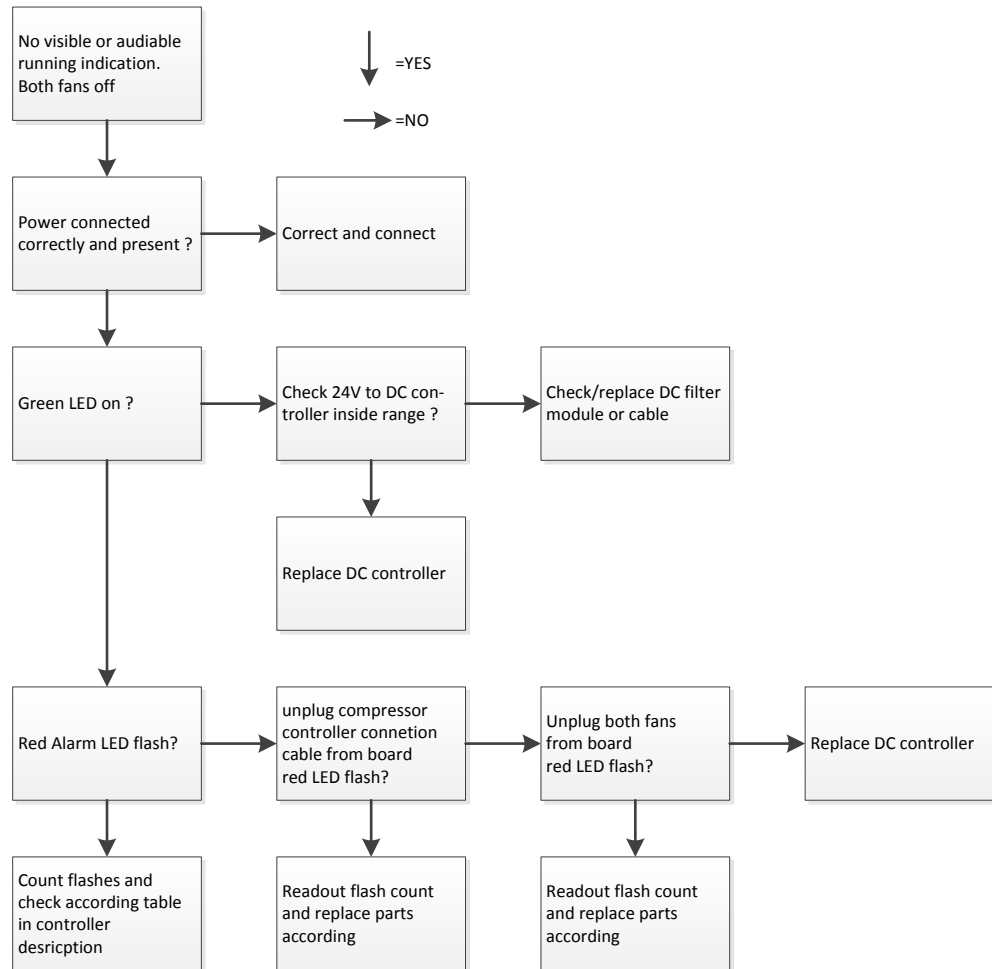
Fault:
No cooling, fan on



Continued overleaf

Troubleshooting, *continued*

Fault:
No cooling, fan off



Cooling circuit

Introduction

This section describes the active cooling system

WARNING

Never carry out any installation, maintenance or service, without disconnecting the AC power supply, by means of the external power supply disconnecting devices.

Service on any cooling circuit with cooling refrigerant is only too carried out by a trained cooling technician.

Cooling circuit

This is the cooling circuit schematic:

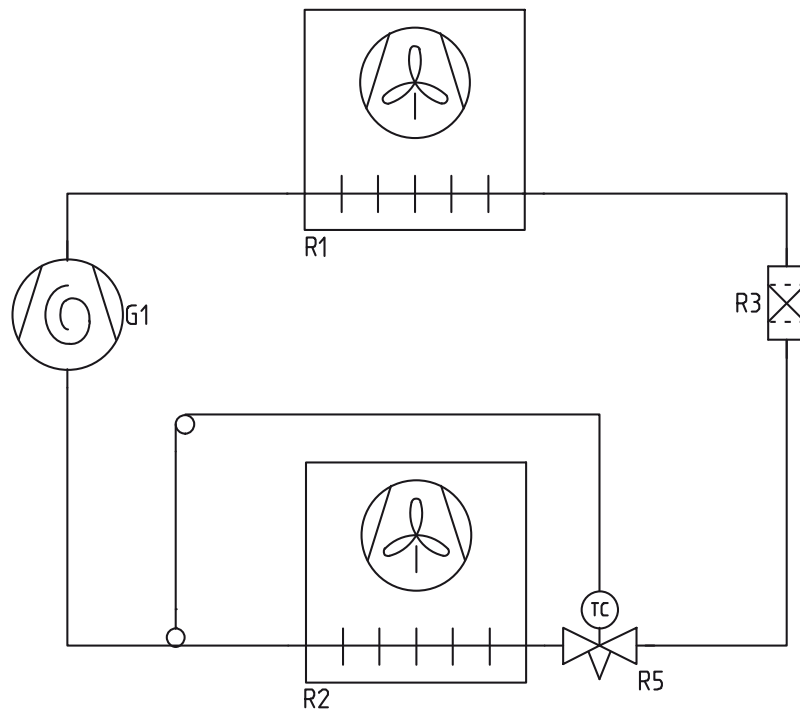


Fig. 6

Part designation

This tables shows the part designation for cooling schematic at Fig. 6

Pos.	Description
G1	Rotary cooling compressor
R1	Condenser
R2	Evaporator
R3	Dry filter
R5	Thermo valve with external capillary sensor

Locating cooling parts

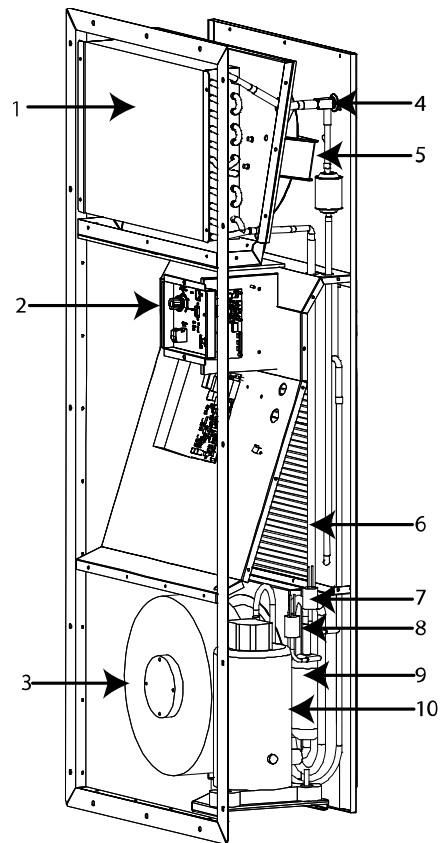


Fig. 7

Parts designation

This table shows the cooling part shown on Fig. 7

Pos.	Part
1	Evaporator
2	Controller
3	Condenser fan
4	Expansion valve
5	Evaporator fan
6	Condenser
7	High pressure switch (HP)
8	Low pressure switch (LP)
9	Receiver
10	Compressor

Spare part list

Illustration

Available spare parts for DC Air Conditioner 3000:

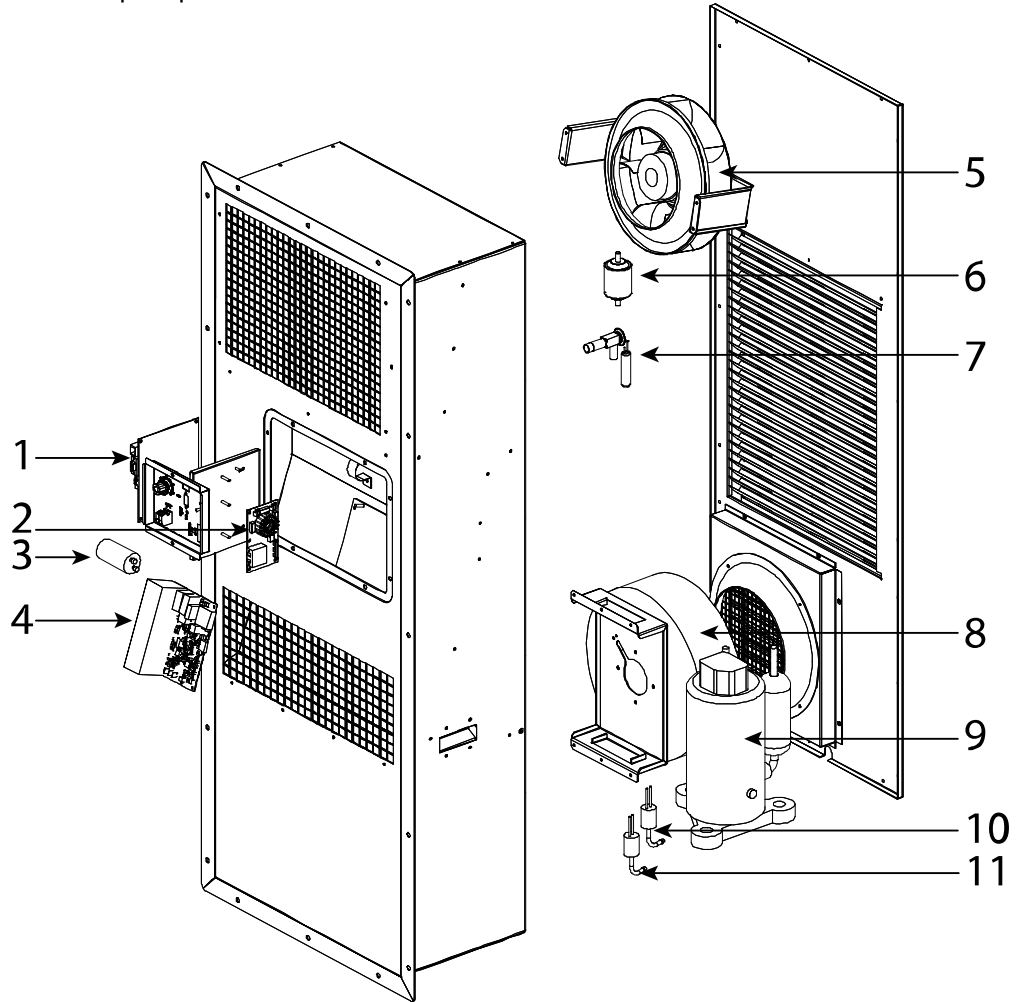


Fig. 8

List

List of spare parts including spare part numbers for DC Air Conditioner 3000:

Pos.	Description	No.
1	Main controller type CC3	218639
2	DC supply filter	218649
3	Capacitor 2200µF	218646
4	Compressor driver board CD-3	218642
5	EBM Fan 250mm	218635
6	Dry filter	218648
7	Expansion valve	218647
8	EBM Fan 280mm	218636
9	Compressor	218634
10	HP switch (1.7MPa/2.3MPa)	218644
11	LP switch (0.05MPa-0.2MPa)	218645
	Cable harness (not illustrated)	218643

Replacing parts

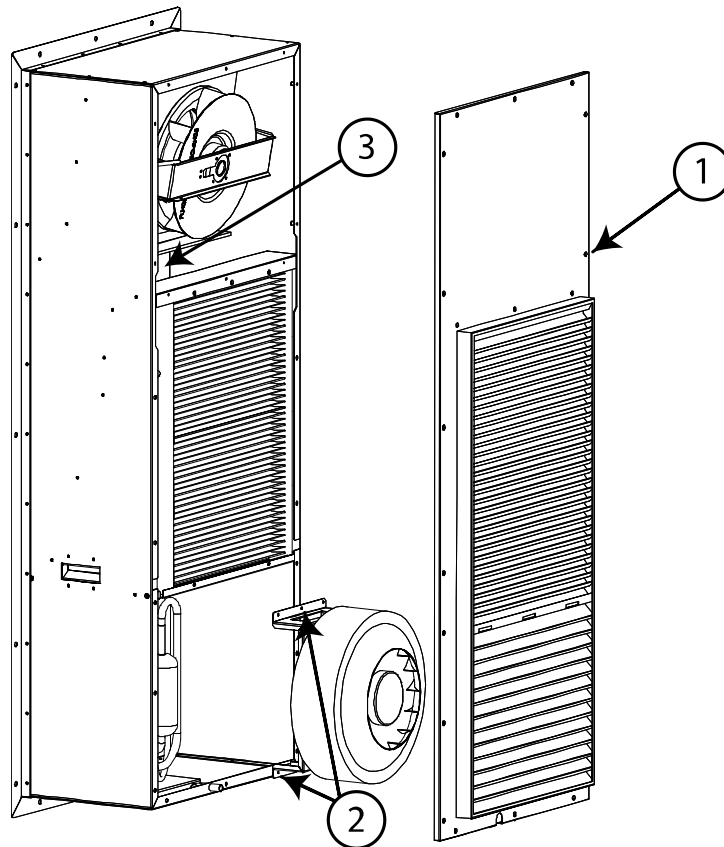
Introduction This section covers the replacement of parts

WARNING Never carry out any installation, maintenance or service, without disconnecting the AC power supply, by means of the external power supply disconnecting devices.

Condenser fan Follow these steps in order to replace the evaporator fan

Step	Action
1	Disconnect power
2	Remove the 23 pcs. TX 20 screws (pos.1) from the outer cover
3	Gently pull out the outer cover, and remove it
	Remove the 6 pcs. M7 nuts (pos. 2), holding the fan bracket
3	Loosen the fan supply cable..
4	Gently pull out the fan assembly
5	Remove the 4 pcs. Screws holding the fan, and replace the fan
6	Run the new wires back to the control board, and swap plug from old fan to new fan, and remove the old fan completely. (pos. 3)
7	Inspect the unit according list at page 18
8	Secure the new cable with cable ties
9	Re-assemble the unit in the opposite order

Condenser fan replacement



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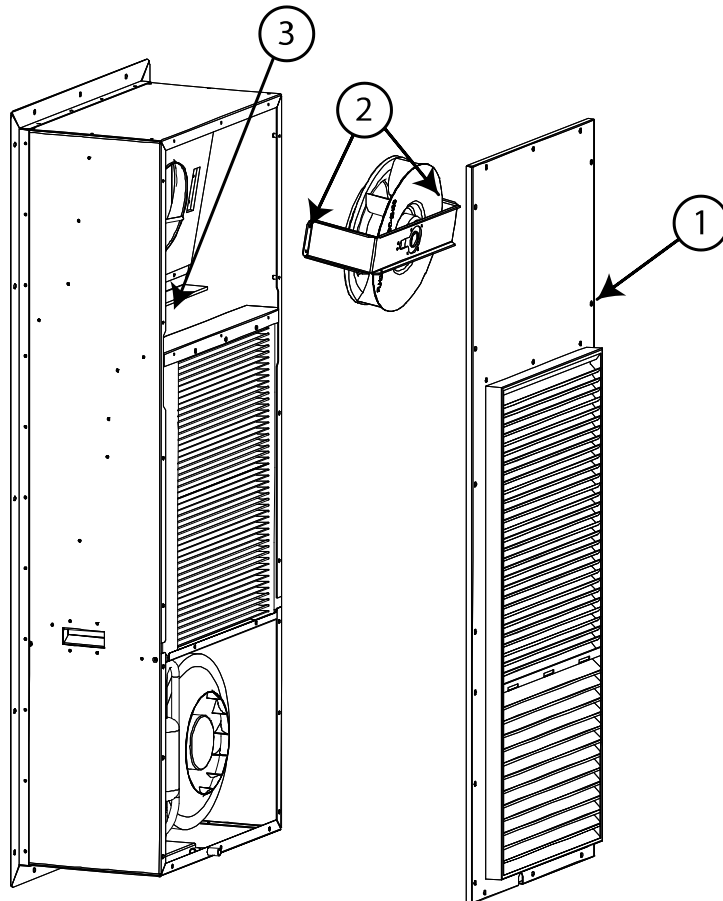
Replacing parts, *continued*

Evaporator fan

Follow these steps in order to exchange one or both of the evaporator fan

Step	Action
1	Disconnect power
2	Remove the 23 pcs. TX 20 screws (pos.1) from the outer cover
3	Gently pull out the outer cover, and remove it
	Remove the 4 pcs. TX 20 screws (pos. 2), holding the fan bracket
3	Loosen the fan supply cable..
4	Gently pull out the fan assembly
5	Remove the 4 pcs. screws holding the fan, and replace the fan
6	Run the new wires back to the control board, and swap plug from old fan to new fan, and remove the old fan completely. (pos. 3)
7	Inspect the unit according list at page 18
8	Secure the new cable with cable ties
9	Re-assemble the unit in the opposite order

Evaporator fan replacement illustration



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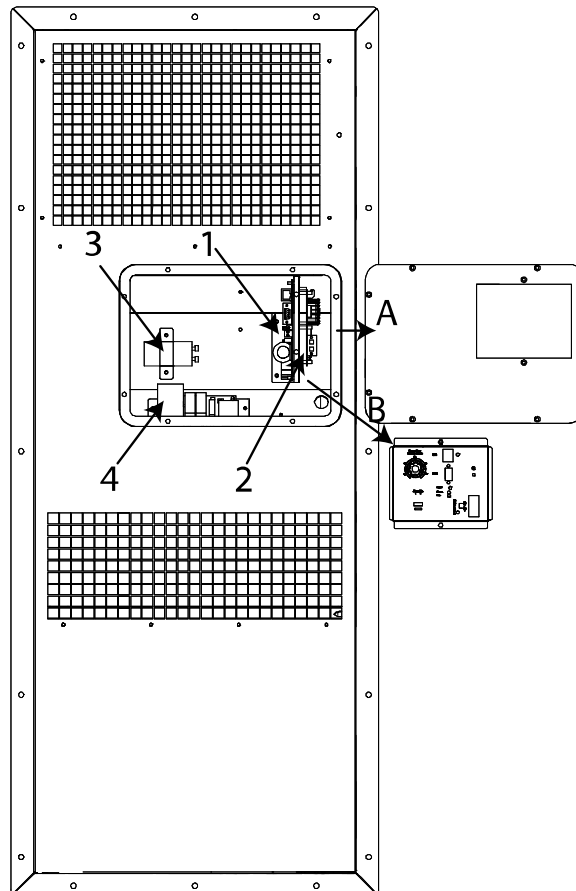
Replacing parts, *continued*

Electronics

Follow these steps to locate and exchange electronic parts from the inside service entrance

Step	Action
1	Disconnect power, and remove all plugs connected to the connection panel
2	Remove the 10 pcs. TX 20 screws and remove the cover plate pos.A
3	Remove the 2 pcs. TX 20 screws from the connection place Pos B and gently pull the plate out 5–10 cm, and disconnect the temperature dial plug from the controller PCB.
4	Locate any possible fault according the troubleshooting section in this manual, and exchange defective modules. Parts location: 1:CC3 controller PCB 2:DC filter PCB 3:Capacitor 4:Compressor drive PCB
5	Re-assemble the unit in the opposite order

Electronics replacement illustration



Technical data

Introduction

This section covers technical data and dimensions for DC Air Conditioner 3000.

Technical data

This table shows the technical data for the DC Air Conditioner 3000

Specification	Unit	Value
Operational temperature range	°C	-15 ~ +55
Storage temperature	°C	-40~70
Storage relative humidity	RH%	5~80
Noise level, outside 2m distance at 35°C internal and 35°C ambient	dB(A)	65
Protection from dust, water and wind driven rain according to EN 60529	IP Class 2	55
Refrigerant / amount	Type/Kg	R134a / 0,9
CE, RoHS, UL, c UL and WEEE compliant		Yes
Cooling capacity at 35°C internal and 35°C ambient	W	3000
Internal airflow	m ³ /h	950
External airflow	m ³ /h	1250
Power consumption at 35°C internal and 35°C ambient	W	1000
Efficiency ratio at 35°C internal and 35°C ambient	COP	3
Input voltage range	V DC	45-57
Colour	RAL	7035
Net weight	kg	63

Unit illustration (Fig. 9) with dimension to be found on next page

Continued overleaf

Technical data, *continued*

Dimensions

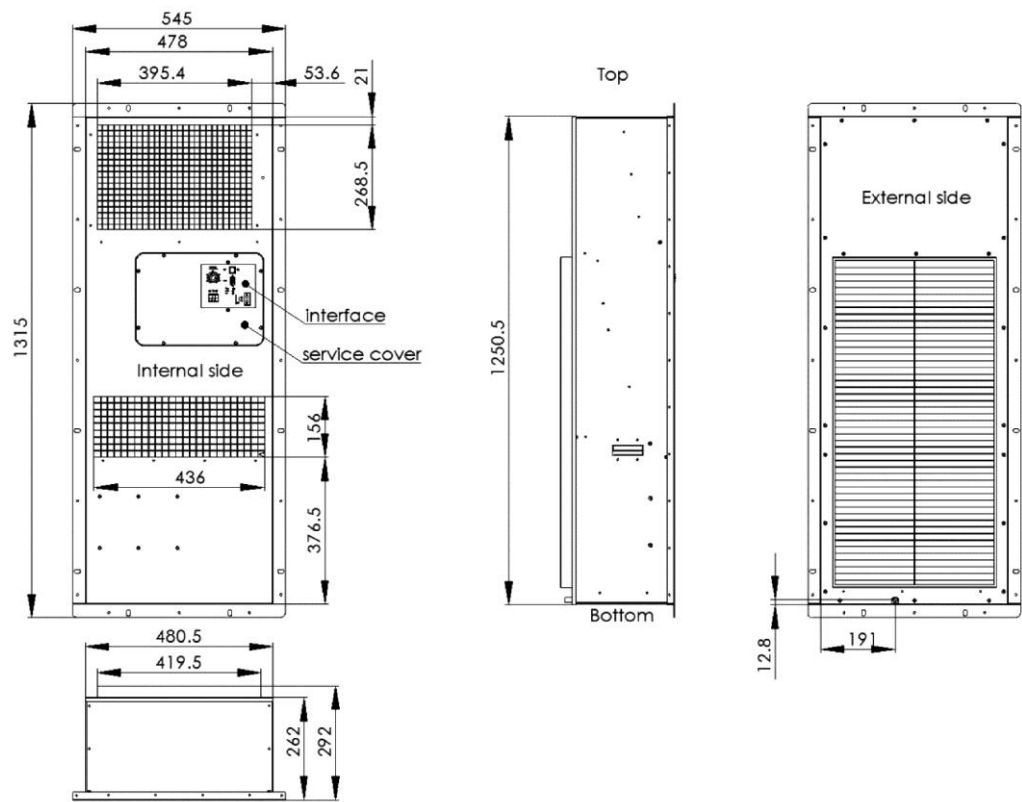


Fig. 9

Continued overleaf

Technical data, *continued*

**EC-Declaration of
Conformity**



Dantherm Air Handling A/S, Marienlystvej 65, DK-7800 Skive hereby declare that the units DC Air Conditioner 3000 are in conformity with the following directives:

2006/42/EC	Directive on the Safety of Machines
2006/95/EC	Low Voltage Directive
2004/108/EC	EU EMC Directive (December 2004)
97/23/EEC	The Pressure Equipment Directive
2004/12/EC	Packing Directive

- and are manufactured in conformity with the following standards:

EN ISO 12100-1	Machine safety
EN 60 950-1	Electrical machinery safety
EN 60 335-1	Low voltage
EN 60 335-2-40	Low voltage particular requirements for electrical heat pumps, air-conditioners and dehumidifiers
EN 61000-6-2	Immunity(industrial environments)
EN 61000-6-3	Emission (residential, commercial and light-industrial Environments)
EN 50 106	Safety for electrical machinery (Particular rules for routine tests)
GR-487-CORE	According to Belcore (shock)
GR-63-CORE	According to Belcore (shock)
IEC 60529	IP Rating According to IEC
UL 484	Safety for Electrical Machinery
ETSI EN 300-019-1-2	Transportation shock
ETSI EN 300-019-1-4	Operation shock

Suzhou, 29.05.2012

Recycling

The unit should be recycled according to national rules and procedures to protect the environment. Please consult your local authorities for further information.

Contact Dantherm

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