Dantherm®
CONTROL YOUR CLIMATE

Combo Cooling 10000/1000

Service manual

Rev. 1.0

GB

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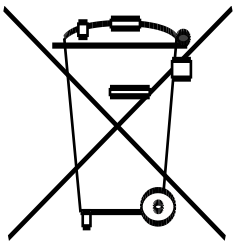

Introduction

Overview

Introduction

This is the service manual for the Dantherm Combo Cooling 10000/1000
Please see the below table of content for further information about the sections.

Manual

Part number of this service manual is 075073 and covers units with serial numbers from 1207121273752

Target group

The target group for this service manual are the technicians who install and maintain the Combo Cooling 10000/1000 unit, as well as the users of the unit.

Copyright

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

This service manual covers the following topics:

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Product description

Overall description

Introduction

This section describes the overall product, and its functionality

Usage of the Combo Cooling 10000/1000

Combo Cooling 10000/1000 is designed to control the internal temperature of an outdoor enclosure. Combo Cooling 10000/1000 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

Outdoor view

This illustrates the unit outdoor visible parts

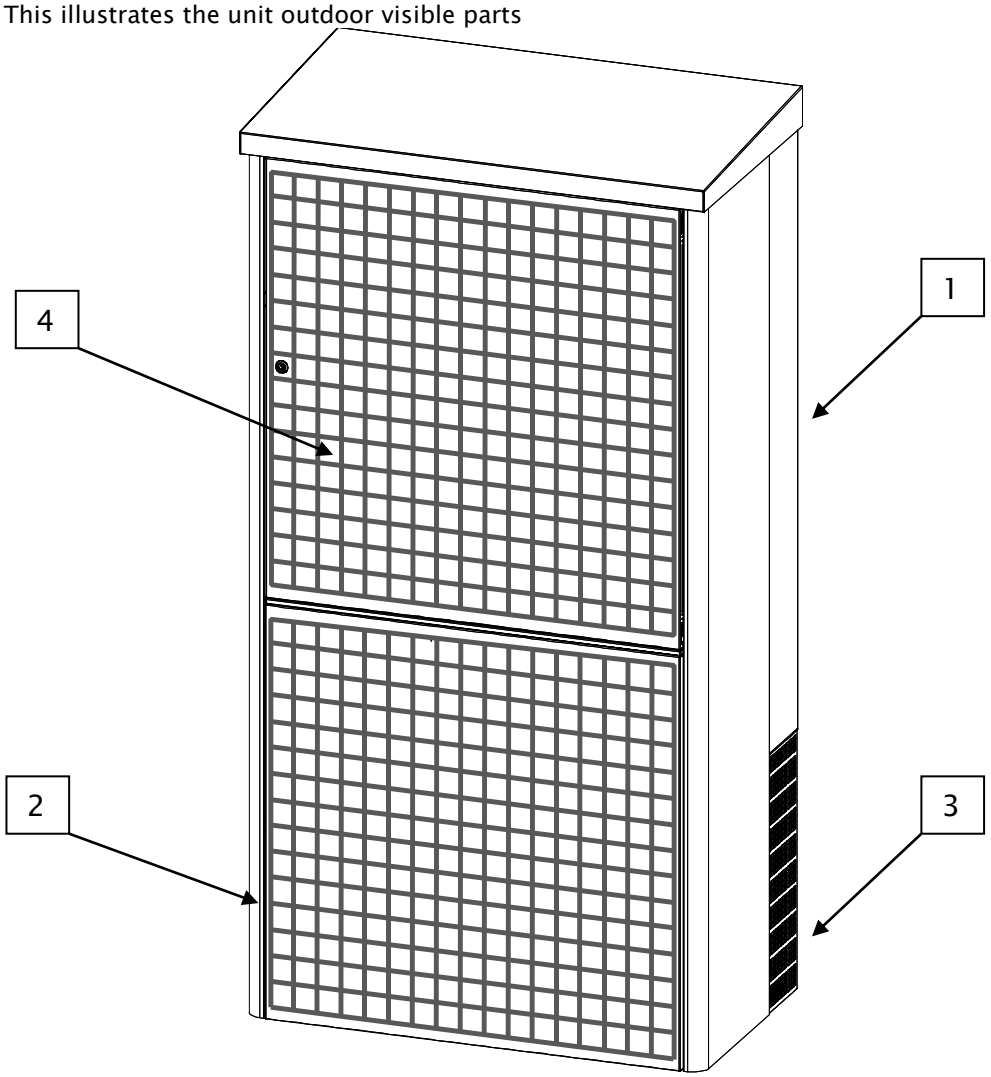


Fig. 1

Parts description outdoor view

This table shows outdoor parts according to Fig. 1

Part	Function
1	Mounting frame
2	Condenser fan output
3	Condenser air input
4	Free Cooling air inlet / Service door

Continued overleaf

Product description, *continued*

Indoor view

This illustrates the unit indoor visible parts

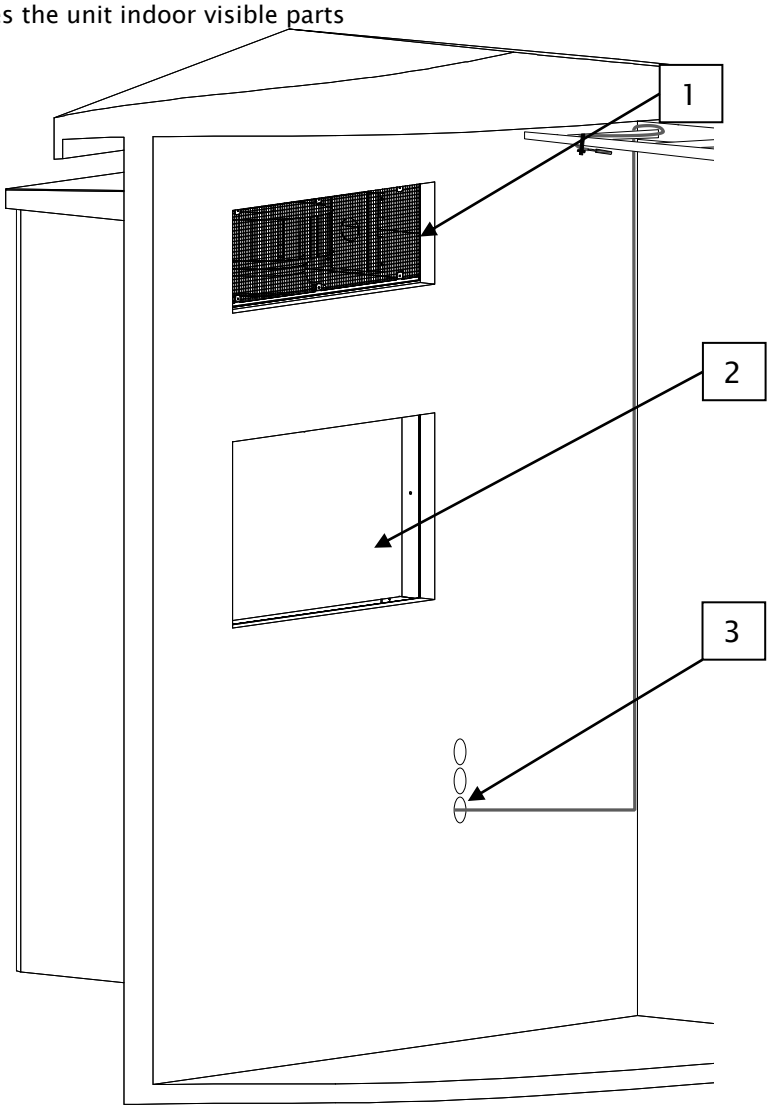


Fig. 2

Parts description indoor view

This tables shows indoor parts according Fig. 2

Part	Function
1	Supply air inlet (free cooling & active cooling)
2	Exhaust air outlet
3	Suggested cable routing

Continued overleaf

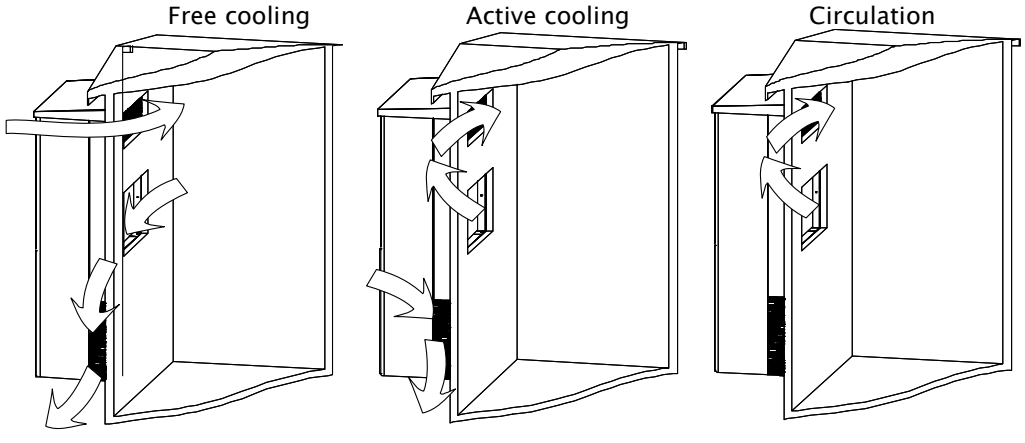
Product description, *continued*

Functionality

The illustration and table below show the airflows of Combo Cooling 10000/1000. The unit is combining free cooling and active cooling to obtain the target temperature inside the shelter application. The different cooling modes are:

1. Free cooling mode – Fresh outdoor air is used to cool
2. Active cooling mode – Air conditioner is used in a closed loop.
3. circulation mode – Internal air is recycled (closed loop) without active cooling

Air paths:



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 is cooling down the condenser. After passing through the condenser the air is returned to the external environment through the two condenser fans.

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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 power supply (please notice that this units has dual power source AC & DC), by means of the external power supply disconnecting devices.

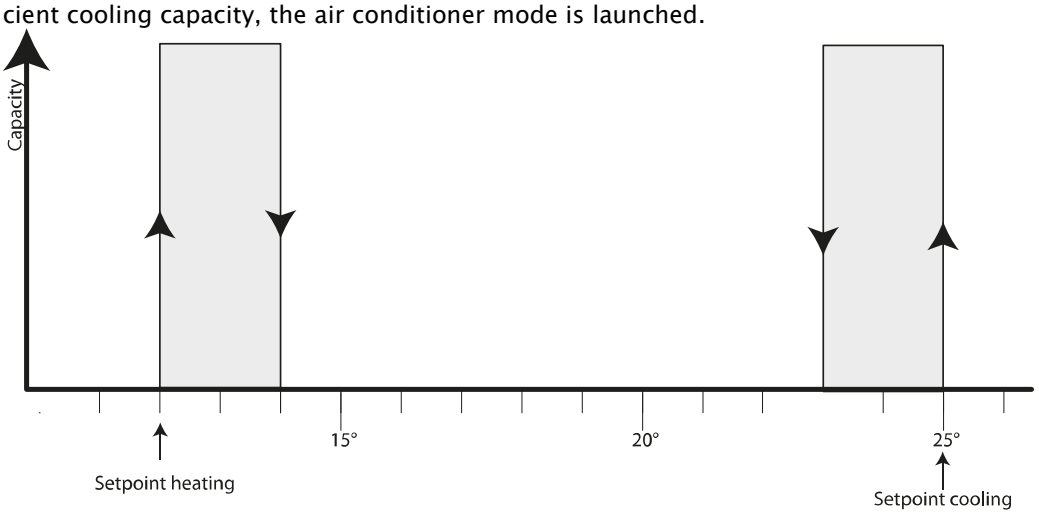
Installation requirements

Please refer to the installation section for this information.

Control strategy

The control board controls fans, dampers and cooling compressor according to the temperature in return air flow
The control strategy is determined by the outdoor temperature in order to optimize the total power used for cooling. When the difference between outside temperature and the set point cooling (shelter target temperature) is above 3°C the controller will initiate free cooling mode (or recycling mode if shelter temperature is below the set point). In this mode air conditioner operation will only be initiated if shelter temperature is increased above set point cooling, even though free cooling is running.

In case temperature outside increases and the free cooling thereby no longer has sufficient cooling capacity, the air conditioner mode is launched.



As soon as temperature decreases to level where free cooling has sufficient cooling capacity the free cooling mode is reinitiated.
For detailed information please refer to installation section.

Controlling external Air Conditioner

The controller can handle up to 2 external air conditioners (AC1 & AC2), these can either be handle as individual units (starting at 2 fixed individual temperatures) or as Lead/lag units.
Operating AC1 & AC2 as lead/lag will generate a toggle function changing the order of operation.

Continued overleaf

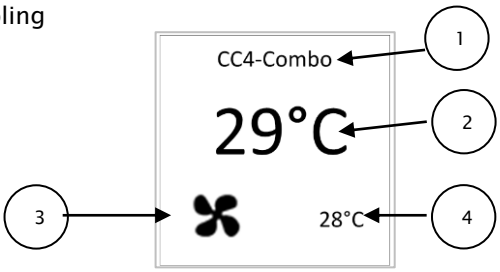
Electronic control description, *continued*

Display

The Display is an optional feature providing easy access to change of parameter value. The layout is optimized towards intuitive understanding of the parameters. For physical dimensions and installation please refer to the installation section.

The main screen contains the following information:

1. Controller name
2. Actual operating temperature
3. Cooling mode
4. Set point cooling



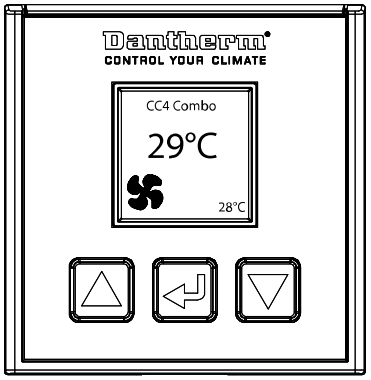
The Cooling mode (3) contain 5 different icons indicating the operation mode of the unit:

Icon	Description
	Free cooling mode
	Active cooling mode
	Heater mode (if external heater is installed)
	Recycling mode
	Alarm indication

Continued overleaf

Electronic control description, *continued*

Changing parameters using the display



Pressing either one of the buttons the display backlight will turn on.
A second push the display will change to parameter editor.

By pushing down button (▽) the display will toggle between the available parameters, if a specific parameter should be changed press [ENTER] (middle button) and change the value by pushing either up or down button, finish editing by pushing [ENTER] and save.

If the display has not been used for 2 minutes it will go into Idle mode and the backlight will turn off. In this mode it will be updated every 2nd minute.

Connections

Items	Values/Range
Power supply voltage	40-60 Vdc
Fan 1,2,3 supply voltage	40-60Vdc
Fan 1,2,3 control voltage	0-10VDC (Optional PWM Control)
Digital output. Heater/Compr/Cond	40-60Vdc/300mA
Digital outputs, NO or NC AL1/AL2 & AC1/AC2	Dry contact. (max 0,5A@60Vdc) Min recommended contact load 10mA@20mV
Digital Inputs, NO or NC Dig1/Dig2/phase/filter/Door	For use with dry contact (10mA @ 12V) (1K pull up resistor to 12V)
Temperature Sensor Input. Amb/sup/cond/room	NTC type NTCLE100E3272GB0
Damper output. Ext/Int.	40-60Vdc/100mA
UART- TTL interface	5V signalling
RS 485 Modbus(NOT Ethernet)	Galvanic isolated. Biasing resistor 1K. No termination resistor.
SD Card Interface	Supports up to 32GB SD Card.

SD card interface

Introduction

The CC4 controller provides following features through SD card interface.

- Upload system configuration from a file.
- Download system configuration to a file.
- System status log to a file.

The controller can start with SD card inserted or inserted while in operation.

WARNING

PLEASE NOTICE THAT CHANGING THE CONFIGURATION CAN AFFECT THE COOLING STRATEGY AND THE PRODUCT SERVICELIFETIME!

Controller parameters configuration

Follow these steps to change parameter:

- Insert a blank FAT32 formatted SD card
- The controller downloads the existing configuration to the SD card as CC4_config.txt file.
- Move the SD Card to a computer and open file explorer to make sure the card is found and can be read
- Open the CC4_config.txt file in using an appropriate text file editor, as Notepad on a windows computer
- Edit the Cooling strategy and control parameters and then save and close file.
- Switch off the Combo unit
- Insert the SD card, and power up the unit. The new config will now be operationel.

Log

System Status logging:

- The controller system status can be periodically logged on the SD card in file name STAT_LOG.TXT.
- The periodic logging can be enabled in the configuration file through SD card.
- In addition, the logging can be enabled through editing configuration file in SD card.

Then after the controller starts logging the System status parameters in a status log file

Continued overleaf

SD card interface, *continued*

Alarms

The Controller has 2 alarm outputs AL1 & AL2. There are an number of functions that can initiate an alarm, these are:

- Pwr Save Mode – Input Power out of range
- Room Temp H/L – Actual temperature out of range
- Fan 1 – Tacho readout different from control output
- Fan 2 – Tacho readout different from control output
- Fan 3 – Tacho readout different from control output
- Onbrd. Sens – Temperature sensor failure
- Room Sens – Temperature sensor failure
- Amb. Sens – Temperature sensor failure
- Supp. Sens – Temperature sensor failure
- Cond. Sens – Temperature sensor failure
- Digi.1 – Input defined as Alarm (e.g. fire or other external inputs)
- Digi.2 – Input defined as Alarm (e.g. fire or other external inputs)
- Filt Grd – Differential pressure out of range
- Phase – 1 phase missing or fail connected (only 3 phase models)

The mode indicated by “alarm LED” flashing at 1Hz.
In this mode, the digital outputs namely; 1 and 2 are toggle to active state. The alarm status remains, until the alarm scenario recovers or rectified by the user.

Continued overleaf

SD card interface, *continued*

Default settings

This section describes the default settings:

Parameter	Range	Factory setting
Set point cooling		25
Set point heater		12
Lead/Lag AC1 & AC2	On/OFF	ON
Modbus slave address	1-255	23

Alarm Mapping	1. Alarm	2. Alarm
1.Pwr Save Mode [PSM][0/1]	0	1
2.Room Temp H/L [THL][0/1]	1	0
3.Fan 1 [F1][0/1]	0	1
4.Fan 2 [F2][0/1]	0	0
5.Fan 3 [F3][0/1]	0	1
6.Onbrd. Sens [OS][0/1]	0	0
7.Room Sens [RS][0/1]	1	0
8.Amb. Sens [AS][0/1]	1	0
9.Supp. Sens [SS][0/1]	0	0
10.Cond. Sens [CS][0/1]	1	0
11.Digi.1 I/P [FIL][0/1]	0	0
12.Digi.2 I/P [FI][0/1]	0	0
13.Door Xtch I/P [DI][0/1]	0	1
14.Filt Grd I/P [FI][0/1]	1	0
15.Phase I/P [FI][0/1]	0	1

Connections

Introduction

The Combo1000/1000 has various interfaces for covering every need. Below is an description. Please see page 28 - wiring schematic for details.

WARNING

The RJ45 sockets IS NOT TCP/IP ethernet, its RS485 connectors, and if connected to Ethernet network, you could risk damaging both interfaces.

Digital Interfaces

These are control interface for the control comprises of following signals and interfaces

- **Temperature sensor**:
  NTC type temperature sensor.
- **Digital 1 and 2 Inputs:**
  Interfaces provide low power DC source of 12V. The inputs can be used as Normally Open or Normally Closed circuit. The interface can source maximum of 10mA
- **Phase, filter and door inputs:**
  Interfaces provide low power DC source of 12V.
  The inputs can be used as Normally Open or Normally Closed circuit. The interface can source maximum of 10mA
- **AC1 & AC 2 Outputs:**
  Interfaces can be used as Normally Open or Normally Closed circuit. Dry contact, rated 0,5A@60Vdc.
- **AL1 & AL2 Outputs:**
  Interfaces can be used as **Normally Open** or **Normally Closed** circuit. Dry contact, rated 0,5A@60Vdc.

The Wires corresponding to the above interfaces are inserted to the appropriate insertion pluggable slots. See more at page 28

Communication

The CC4 controller has a double RJ45 connector supporting an RS 485 communication Line. The left side RJ 45 has a build in 12V DC supply for powering a display unit.
The RS 485 communication line supports a RTU Modbus protocol.
Hardware layer:

- baud rate - 9600
- data bits - 8
- parity - none
- stop bits - 1
- Flow control - none.

Wiring: please refer to the installation section.

Installation

Introduction

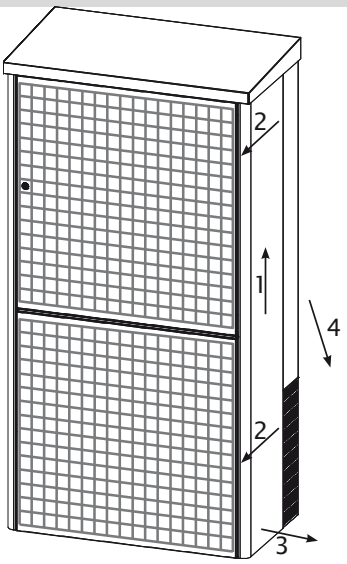
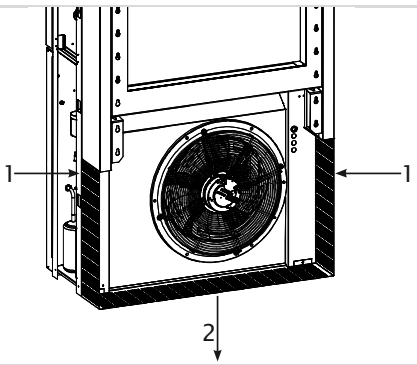
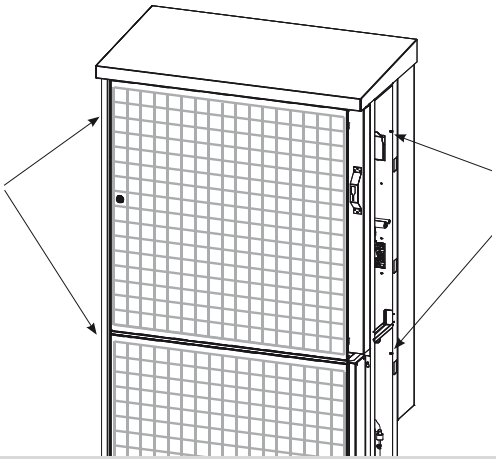
The Combo Cooling 10000 unit needs proper installation in order to operate flawless for many years. Please follow this section for installation

WARNING

NEVER lift the unit, use only forklift or similar hoisting device

Preparation

Unpack and prepare unit for mounting:

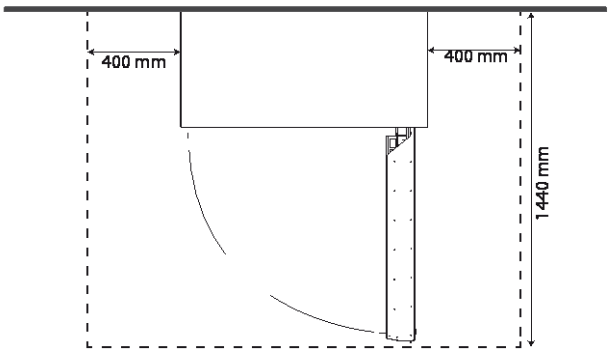
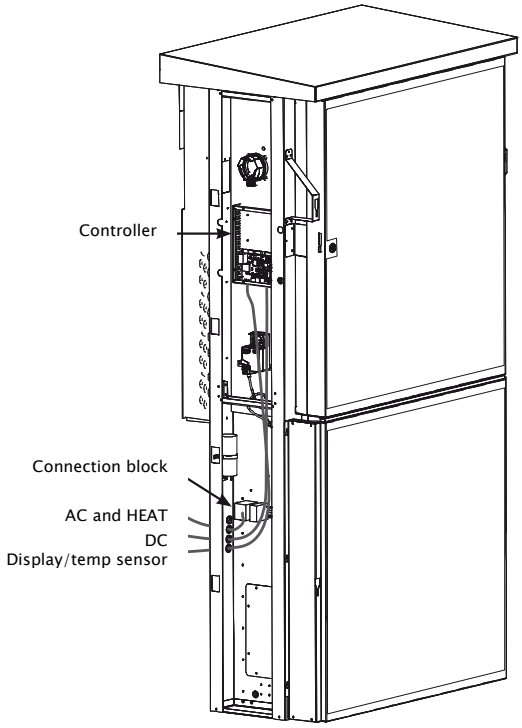
Step	Action	Illustration
1	Remove both side panels 1. Lift side 2. Pull outwards 3. Pull out in lower part 4. Pull sideways down	
2	Remove lower air grill 1. Push both sides 2. Pull downwards	
3	Remove mounting frame 1. Remove the two M10 bolts each side of the unit.	

Continued overleaf

Installation, *continued*

Considerations

Please select possible mounting location based on the below consideration:

Consideration	Illustration
Exempted space for service. Please allow minimum 400 mm each side, and 1440 mm in total depth	
Locate possible cable run	

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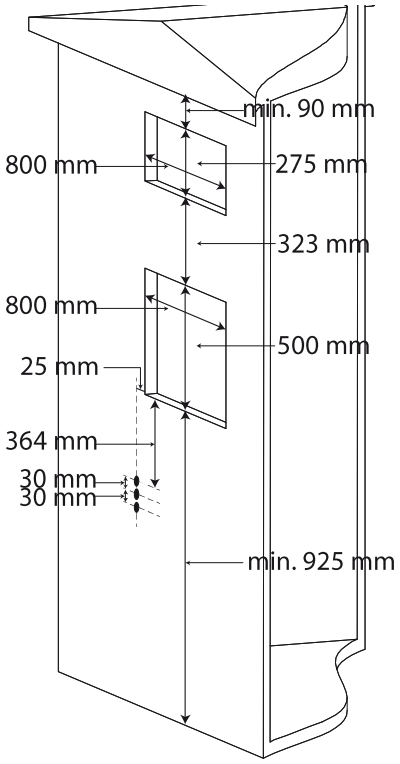
Installation, *continued*

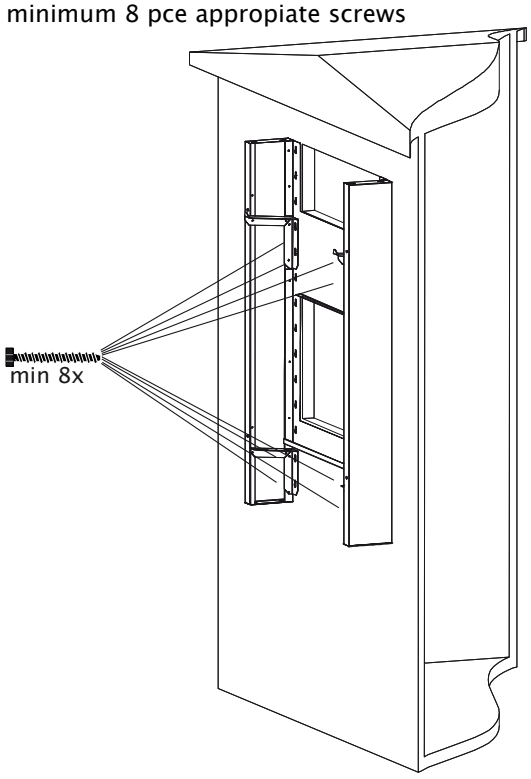
Cutout

Cut according these measures- consider drilling the correct amount of cable inlets.



Frame mounting

Fasten the frame with minimum 8 pce appropiate screws



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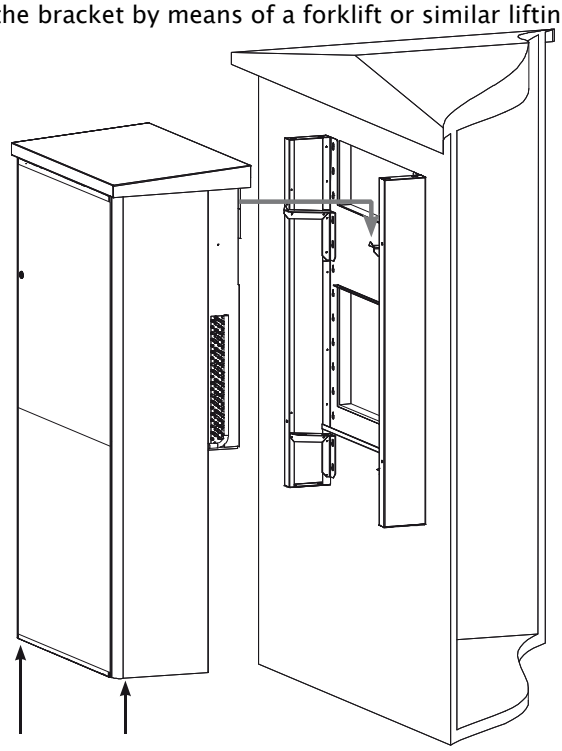
Installation, *continued*

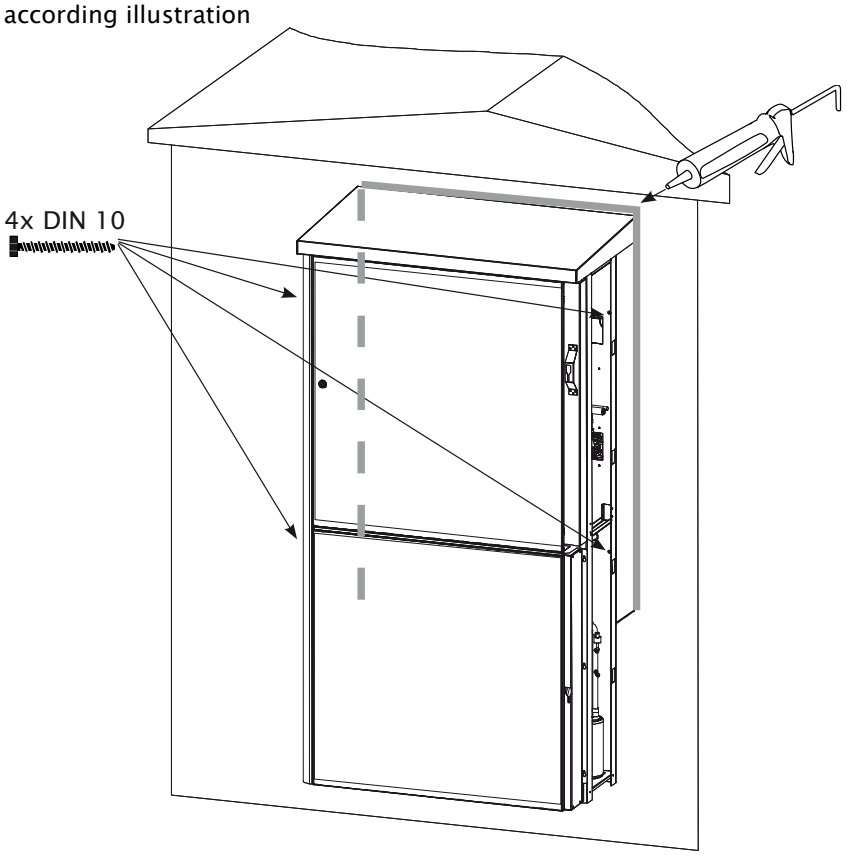
Mounting

Place the unit onto the bracket by means of a forklift or similar lifting device.



Secure and seal the unit

Mount the four bolts, securing the unit to the frame, and seal the edges between unit and wall according illustration



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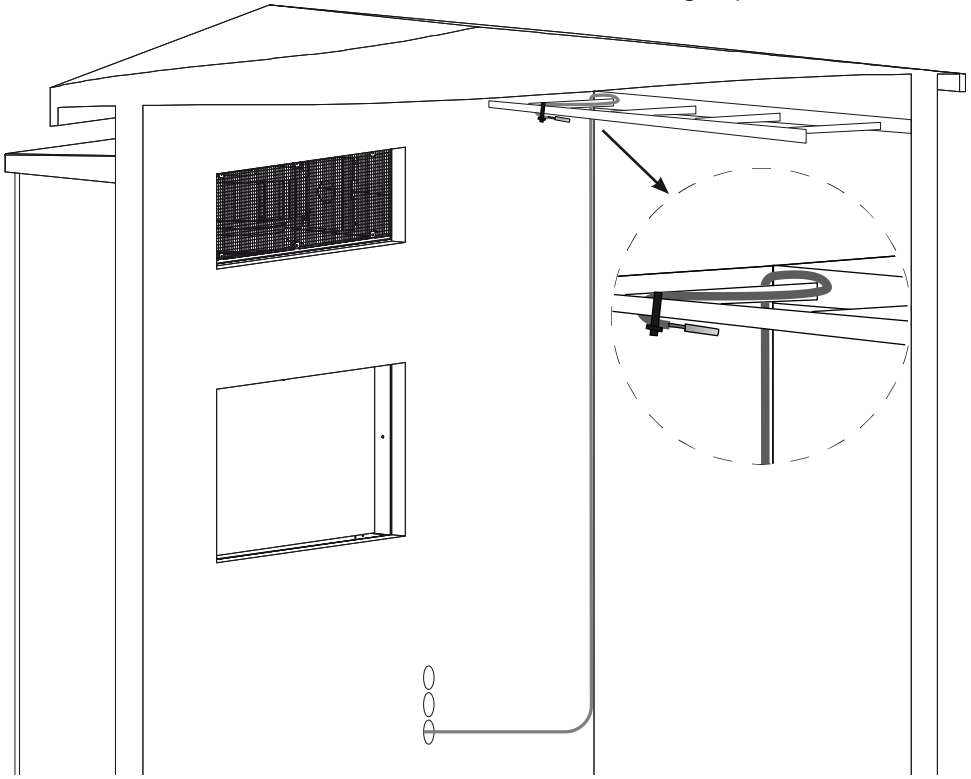
Installation, *continued*

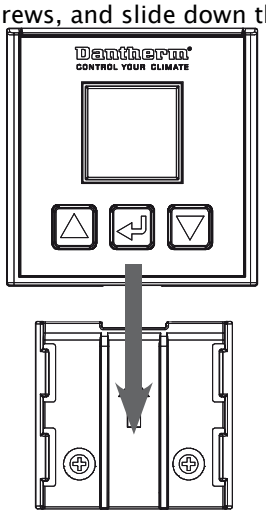
Indoor sensor

Route the room sensor to the indoor, and close to the ceiling, NOT into the airpath from the unit. Please make sure the sensor isn't blocked or touching any metal



Display

Mount the back plate with two screws, and slide down the display.



Connection

Follow appropriate schematics from page 28 to connect cables.

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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:

Preventive maintenance

Introduction

Preventive maintenance has to be carried out to:

- Continues operation in specified range
- 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

- Switch off AC and DC 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 cover, both evaporator and condenser side
2	Vacuum the condenser and evaporator coils
3	Vacuum the condenser and evaporator fans
4	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
5	Perform end inspection according list below

Continued overleaf

Preventive maintenance, *continued*

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?
8	Are Damper clean and free of any corrosion
9	Are filter clean and free of obstructions and show no obvious sign of damage?

Free cooling system and filter change

Introduction

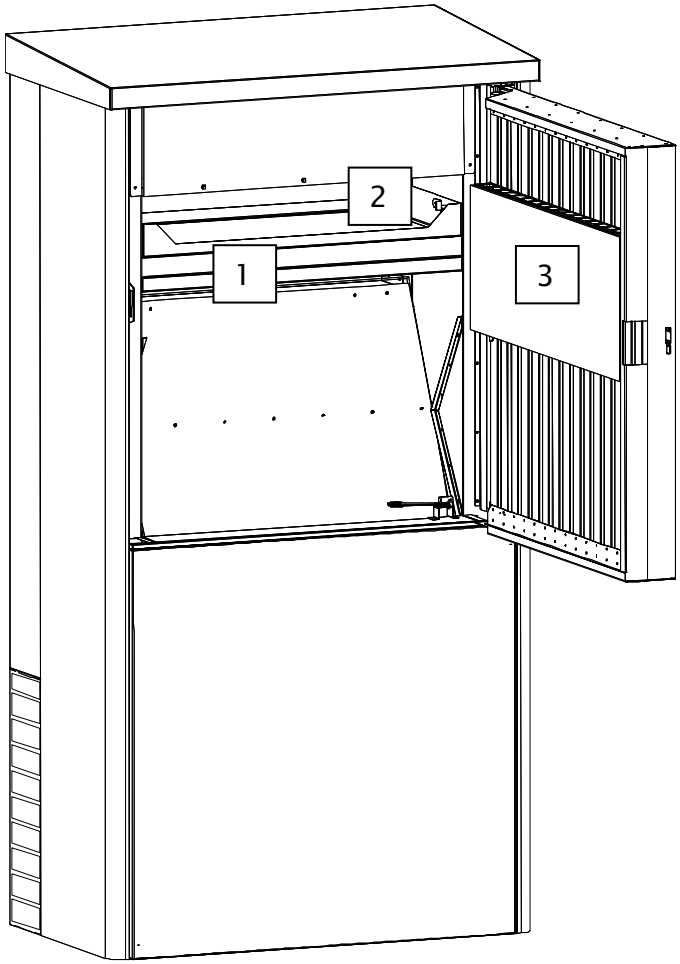
This section describes the free cooling system

WARNING

Never carry out any installation, maintenance or service, without disconnecting the AC and DC 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.

Free cooling system overview



Parts designation free cooling

POS.	Description
1	Filter
2	Filter frame
3	Inlet protection plate

Continued overleaf

Free cooling system and filter change, *continued*

Changing filter

Filter should be changed if it shows sign of degeneration or clocking. Please notice that the unit is equipped with a pressure differential switch indicating that the filter has a pressure drop of 150Pa, equal to 2/3 of capacity used.
To change filter please follow below procedure (refer to FIG 1 for detailed information):

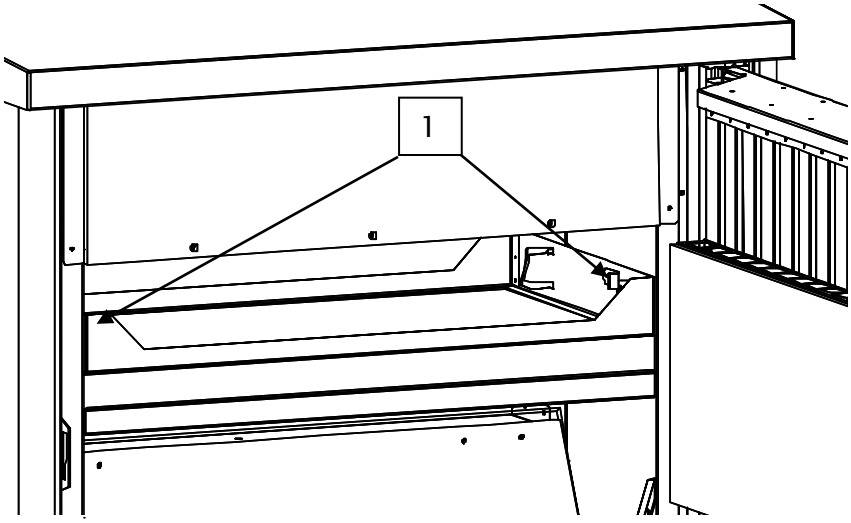
	Instruction
1	Open inspection lid (Use the supplied triangular key)
2	Remove inlet protection tool [3]
3	Release the filter frame by pulling towards yourself [2]
4	Change the filter [1]

Filter Type change

The Combo cooler can handle 2 different filter heights, by changing the position of the filter frame.
Dantherm supplies 2 filter types:

- G4 (EU4)/Merv 8 – 3" (Standard supplied)
- F5/M5/EU5/Merv10 -4"

To change the filter type (from 3" to 4") please follow below procedure:



	Instruction
1	Release the lock 1by turning both of them 90°
2	Move the filter frame by following the punched track
3	Re-engage the locks

Active cooling circuit

Introduction

This section describes the active cooling system

WARNING

Never carry out any installation, maintenance or service, without disconnecting the AC and DC 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:

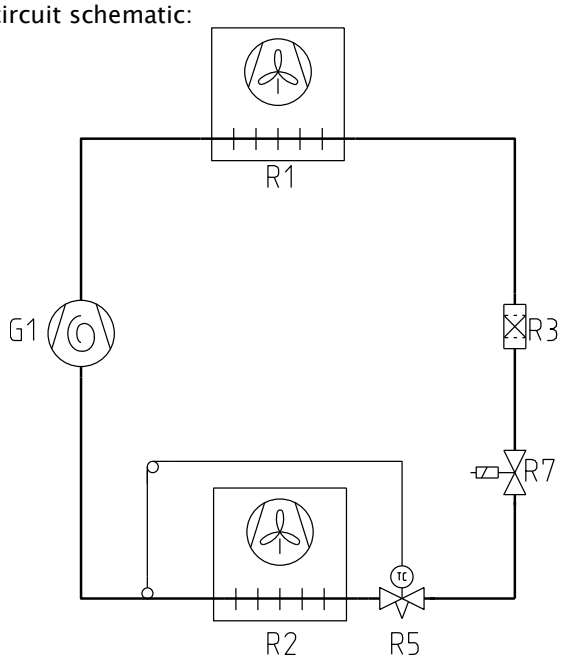


Fig. 3

Part designation

This tables shows the part designation for cooling schematic at Fig. 3

Pos.	Description
G1	Rotary cooling compressor
R1	Condenser
R2	Evaporator
R3	Dry filter
R5	Thermo valve with external capillary sensor
R7	Pump down valve

Cooling parts
Outside view

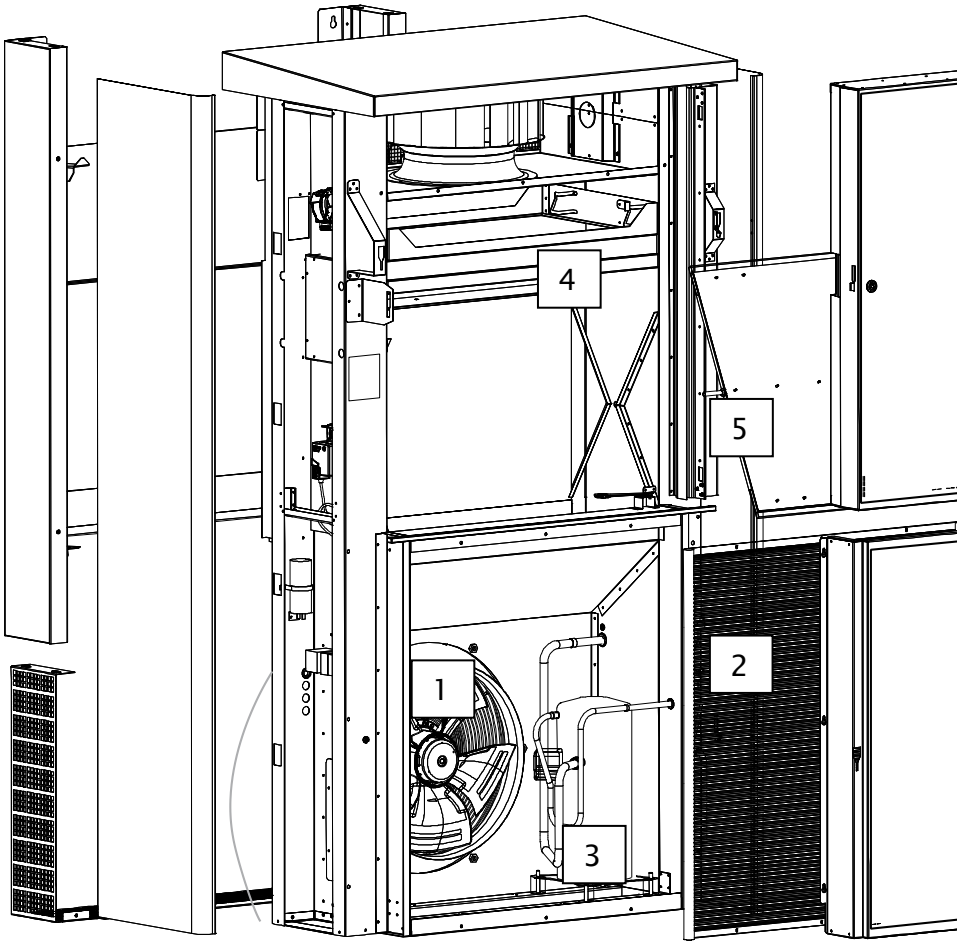


Fig. 4

Parts designation
Outside view

This tables shows the part located from the condenser side shown on Fig. 4

Pos.	Part
1	Condenser fans
2	Condenser
3	Compressor
4	Filter
5	Damper

Cooling parts evaporator view

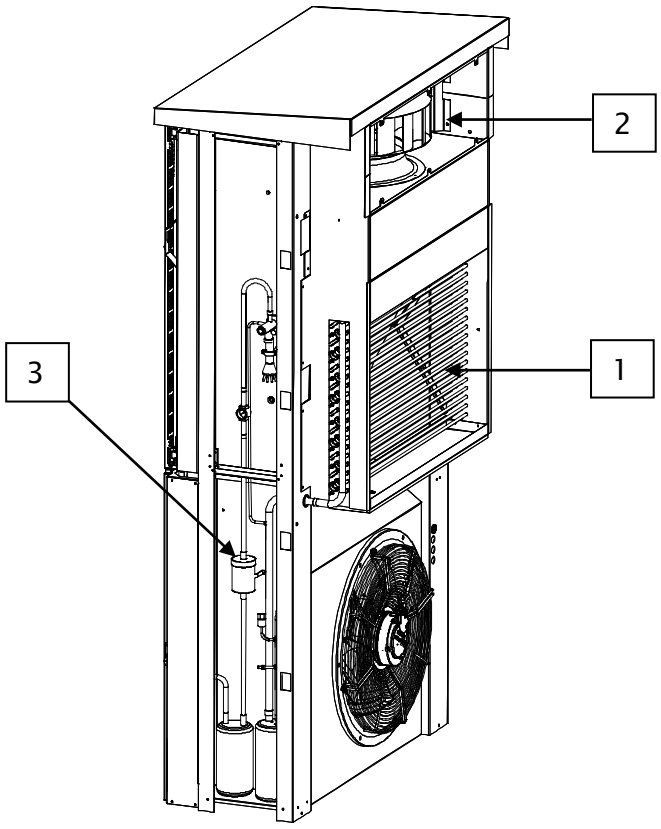


Fig. 5

Parts designation Evaporator view

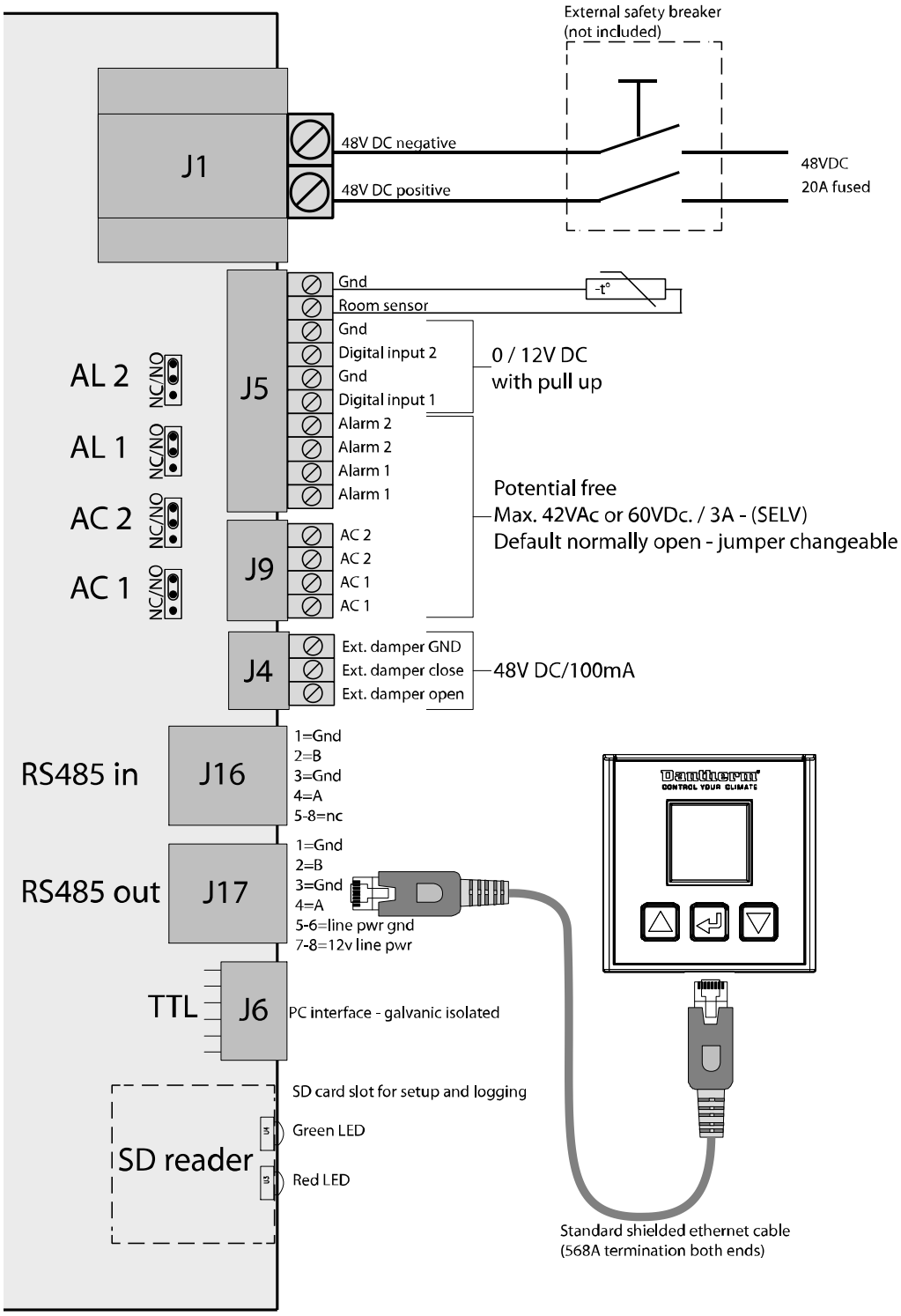
This tables shows the part located from the condenser side:

Pos.	Part
1	Evaporator
2	Evaporator fan
3	Dry filter

Schematics

Controller connections

The illustration shows the controller PCB and its connections:



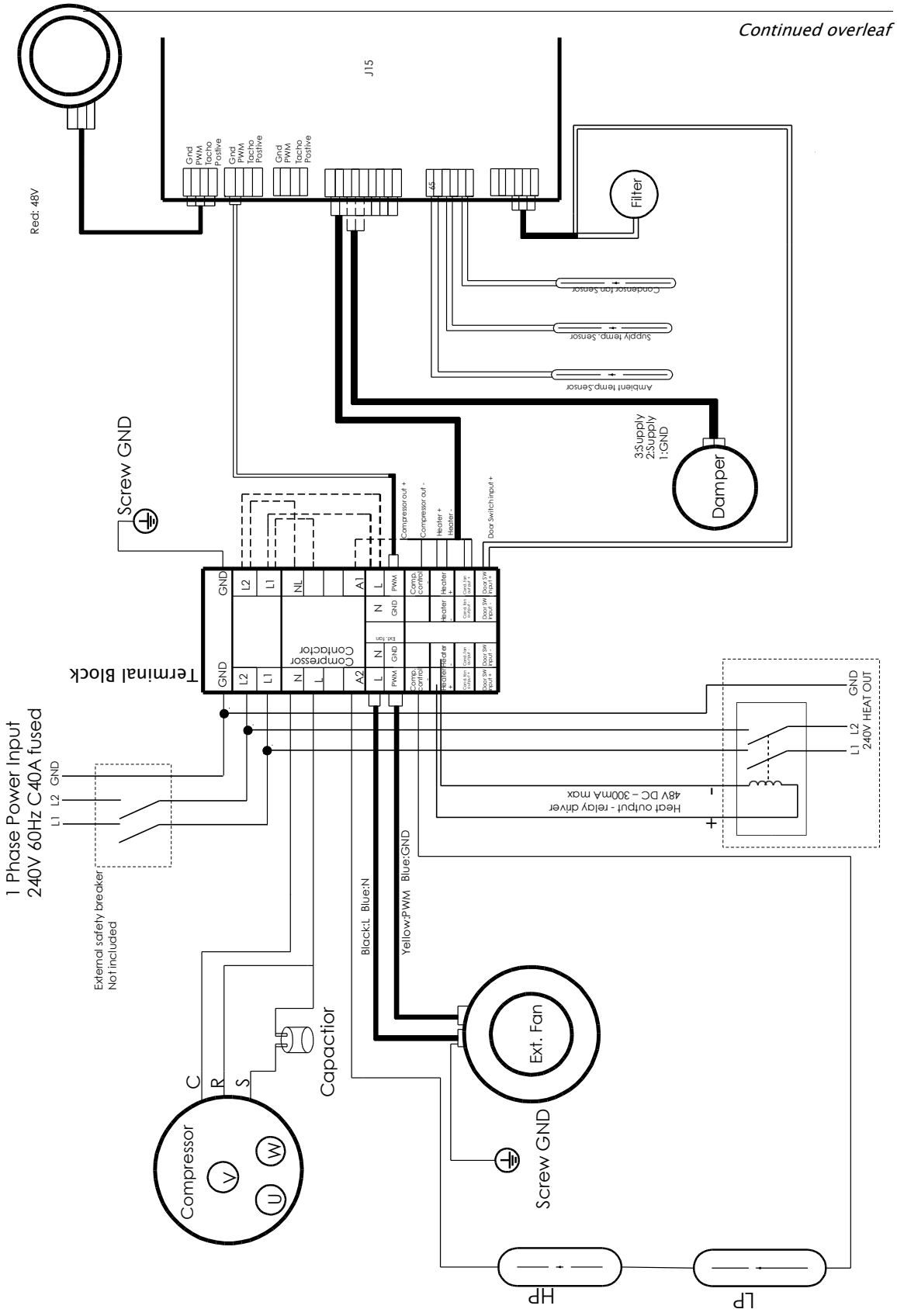
Continued overleaf

Schematics, *continued*

Unit schematic
1 PHASE units

The illustration shows the units schematics:

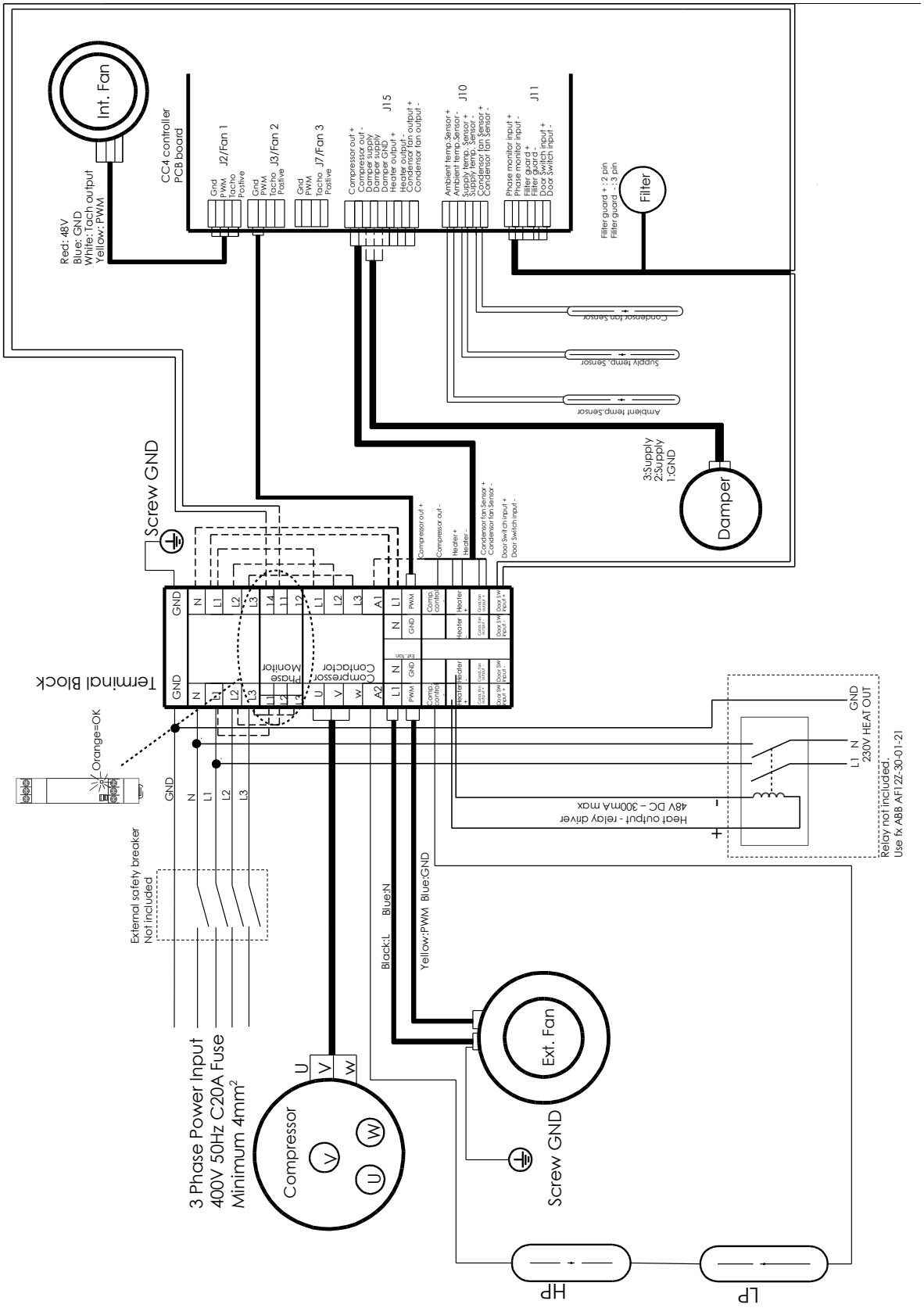
Continued overleaf



Schematics, *continued*

Unit schematic
3 PHASE units

The illustration shows the units schematics:



Spare part list

Illustration

Available spare parts for Combo Cooling 10000/1000:

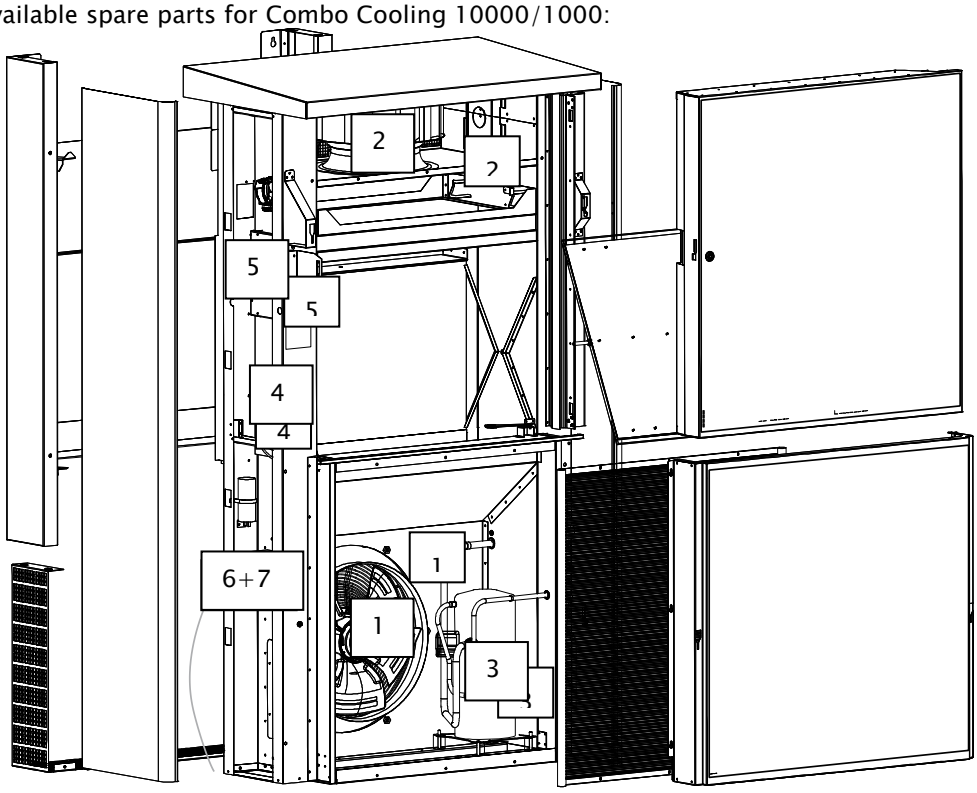


Fig. 6

List

List of spare parts including spare part numbers for Combo Cooling 10000/1000:

Pos.	Description	No.
1	Condenser Fan EC -230V AC	075250
1	Condenser Fan AC -230V AC	075251
2	Evaporator/Free Cooling fan	012848
3	Compressor 3 phase-400V AC	075252
3	Compressor 1 phase-230V AC	075253
4	Damper motor, 48V DC -Internal	075254
5	CC4 Controller	075255
6	3-Phase monitor	075256
7	Soft starter	075257
8	Display	TBD

Technical data

Technical data

Dimensions, weight & mounting		
Unit dimensions (height×width×depth)	mm	2062 x 1072 x 598
Single packing dimensions (height×width×depth)(wooden package)	mm	2225 x 1192 x 720
Net weight	kg	238
Single package weight incl. unit	Kg	284
Mounting method		Separate frame
Controller location/interface		RS485 (modbus) and USB serial
Environmental protection & performance		
Operational temperature range	°C	-33°C - 53°C
Storage temperature	°C	-40°C - 80°C
Storage relative humidity	RH	0-99
Noise level, outside 2m distance at 27°C internal and 35°C ambient	dB(A)	64
IP rating (EN 60529)	IP Class 2	IP 55
Refrigerant / amount	Kg	R410a /3.0
CE, RoHS, UL, c UL and WEEE compliant		✓
Expected service life		10 years
Cooling capacity & operational data (230V/50Hz)		
Cooling capacity at 27°C internal and 35°C ambient (sensible)	W	9600
Free cooling capacity (48VDC)	W/K	1000
Internal airflow at air conditioning	m³/h	800-3000
External airflow at air conditioning	m³/h	800-3500
Free cooling airflow	m³/h	800-3000
Power consumption at 27°C internal and 35°C ambi-ent	W	3700
Power consumption, free cooling at 35°C internal and 25°C ambient	W	Max. 450 (48VDC)
Power, frequency & range		
Input voltage range	VAC/VDC	3x400 (342-456) or 230 (197-253) (/ 48 (40-60)
Frequency	Hz	50 (3 phase) 60 (1phase)
Startup current without softstart (compressor LRA)	A	63 /123
Key components		
Compressor		Sanyo Scroll
Controller		CC4
Fans		EBM Papst EC/DC
Sheet metal parts		Aluzink
Colour	RAL	7035/7015

Cable and circuit-breaker

This table shows the size of the circuit breakers as well as the wire gauge size:

3phase model (3x400V AC)		
Voltage	3 x 400V/50Hz.	48V DC
Circuit Breaker	20A	16A
Wire Size	4mm2	2,5mm2/12AWG

1phase model (1x230V AC)		
Voltage	1 x 230V/60Hz.	48V DC
Circuit Breaker		16A
Wire Size		2,5mm2/12AWG

EC-Declaration of Conformity

CE

Dantherm Air Handling A/S, Marienlystvej 65, DK-7800 Skive hereby declare that the units Air Conditioner 600 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

Skive, 08-17-2012

Recycling

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

Index

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CONTROL YOUR CLIMATE

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