

Installation Instructions

FCF Evo Series

Marine air conditioning systems



English

230 V versions:

FCF Evo 6K 230V R32
FCF Evo 10K 230V R32
FCF Evo 13K 230V R32
FCF Evo 16K 230V R32
FCF Evo 27K 230V R32

115 V versions:

FCF Evo 6K 115V R32
FCF Evo 10K 115V R32
FCF Evo 13K 115V R32
FCF Evo 16K 115V R32

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1 About this document

1.1 Purpose of this document

These Installation Instructions (II) are an integral part of the product and contain the information required to ensure correct and safe installation.

1.2 Using this document

Before installing the unit, read the installation instructions and the supplementary information "Important Information on Operating and Installation Instructions".

Further technical documentation is also available at <http://dealers.webasto.com>

For the operator:

- Operating instructions

For the installer (password-protected):

- Maintenance Instructions
- Troubleshooting Guide

1.3 Warranty and liability

Webasto shall not assume liability for defects or damage that are the result of the Installation Instructions / Operating Instructions and the instructions contained therein being disregarded.

This liability exclusion particularly applies to:

- Installation by untrained personnel.
- Improper use.
- Repairs not carried out by a Webasto service workshop.
- Use of non-genuine parts.
- Conversion of the unit without permission from Webasto.

1.4 Webasto Service App

The type label of the FCF Evo Series unit (see chapter 4.3, "Type label " on page 5) contains a QR code that can be used to call up additional technical documentation in various languages. For this purpose, please use the Webasto Service App, which can be downloaded for iOS (Apple) and Android (Google). For more information regarding the app, visit:

<https://dealers.webasto.com>

2 Safety

2.1 Intended use

The FCF Evo Series is used for heating and cooling on boats and ships.

The FCF Evo Series has been built according to the current state of technology and the recognised safety rules.



DANGER

Improper or inappropriate use may result in danger to life and limb of the user and others, as well as impairment of the unit and other property.

Any other use of this product is not permissible.

Any other use of or changes to the product, including as part of assembly and installation, will result in any and all warranty claims being voided.



WARNING

Moving parts

Risk of injury, damage to the product.

The FCF Evo Series must only be operated in their final installed position.



WARNING

Ignition of surrounding gases or highly flammable liquids by sparking of the FCF Evo Series.

You must always switch off the air-conditioning system when refuelling, or while in a petrol station area.



WARNING

This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the unit by a person responsible for their safety.

- ▶ Children should be supervised to ensure that they do not play with the unit.
- ▶ Cleaning and user maintenance must not be carried out by children.
- ▶ This unit should not be accessible to the public.
- ▶ Non-observance of these precautionary measures may lead to severe or mortal injuries.



NOTE

Follow these instructions carefully when installing the electric wiring and water pipes, the electrical boxes and the air ducts.

2.2 Qualifications of installation personnel

Installation personnel must have the following qualifications:

- Successful completion of the relevant Webasto training.
- Qualification applicable to working on technical systems.

2.3 Regulations and legal requirements

Regulations on the supplementary sheet "Important Information on Operating and Installation Instructions" must be observed.

2.4 Safety on installation

Danger posed by live parts:

- Disconnect the power supply before installation.
- Make sure the electrical system is earthed correctly.
- Always comply with all legal requirements.
- Observe the data on type label.

Risk of fire or toxic gases by incorrect installation:

- Protect parts near the FCF Evo Series from prohibited heating by the following measures:
 - Maintain minimum safety distances. See also chapter 14.1, "FCF Evo Series self-contained air-conditioning unit 230 V" on page 30, chapter 14.2, "FCF Evo Series self-contained air-conditioning unit 115 V" on page 31, chapter 14.3, "Dimensions and minimum distances Type 6K- 16K" on page 32 and chapter 14.4, "Dimensions and minimum distances Type 27K" on page 33.
 - Ensure adequate ventilation.
 - Use fire-resistant materials or heat shields.

3 Scope of delivery

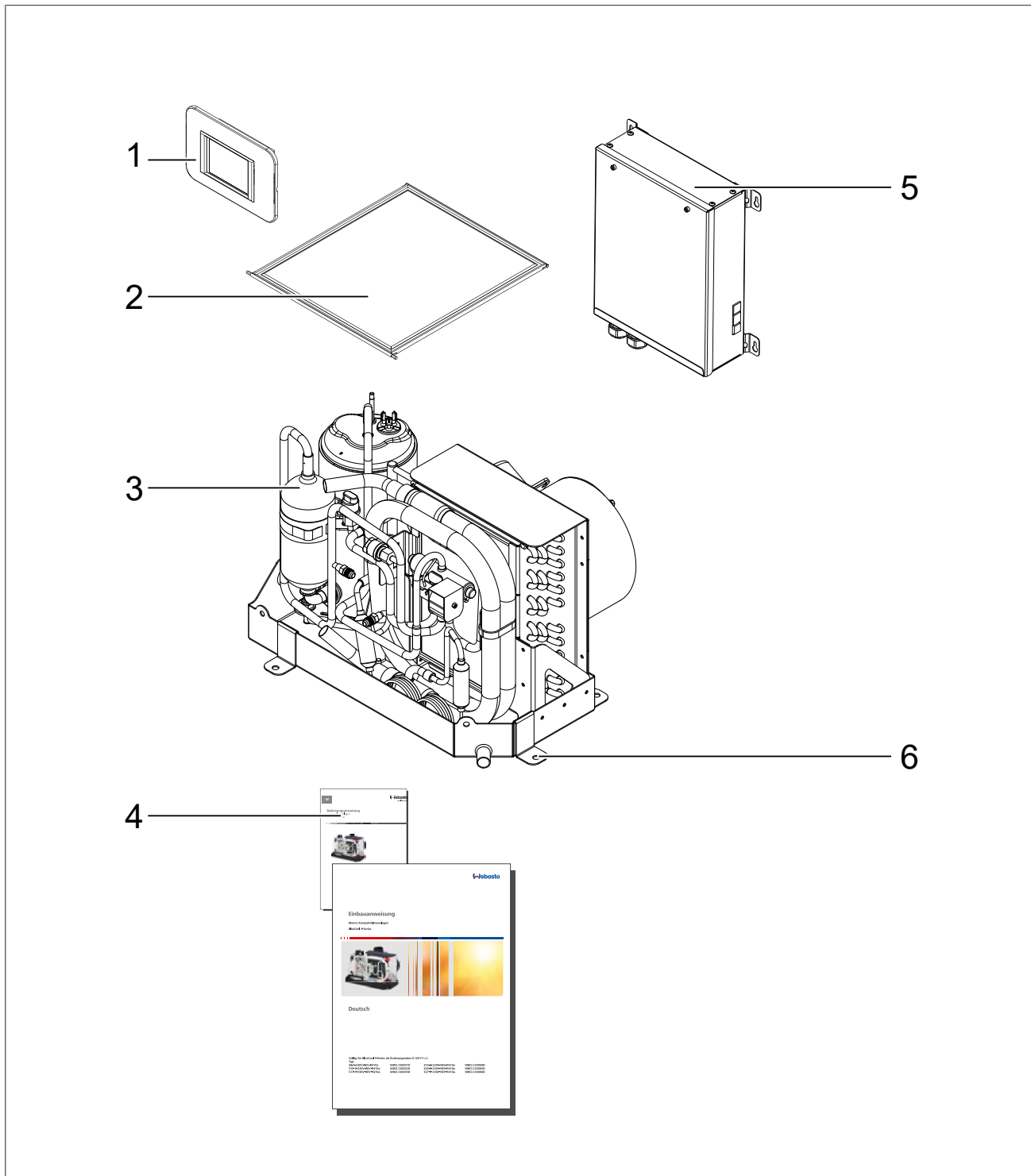


Fig. 1 Scope of delivery, example of FCF Evo Series air conditioning systems

1	Control element with cover
2	Air filter (already installed)
3	Air-conditioning unit
4	Installation instructions / Operating instructions
5	Electrical box
6	Fixation bracket/L clamp (4x)
7	Cabin temperature sensor (without illustration)
8	Cable for control element (without illustration)

4 Information on Unit

4.1 Conformity

Webasto herewith declares that this product conforms with the basic directives for marketing in the EU:

- 2014/68/EU Pressure Equipment Directive in accordance with DIN EN 387
See also: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32014L0068>
- 2006/42/EC Machine directive
See also: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32006L0042&qid=1678353600345>
- 2014/30/EU Electromagnetic compatibility (EMC)
See also: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32014L0030&qid=1678353923671>
- 2011/65/EU RoHS
See also: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32011L0065&qid=1678353780822>

Declaration of Conformity is available online at: <http://dealers.webasto.com>

4.2 Variants

Self-contained air-conditioning units 115 V:

FCF Evo 6K 115V R32
FCF Evo 10K 115V R32
FCF Evo 13K 115V R32
FCF Evo 16K 115V R32

Self-contained air-conditioning units 230 V:

FCF Evo 6K 230V R32
FCF Evo 10K 230V R32
FCF Evo 13K 230V R32
FCF Evo 16K 230V R32
FCF Evo 27K 230V R32

Example: FCF Evo 16K 115V R32

FCF Self-contained air-conditioning unit
Evo:
16K Cooling capacity in kBTU/h
115 V: Rated voltage
R32: Refrigerant

4.3 Type label

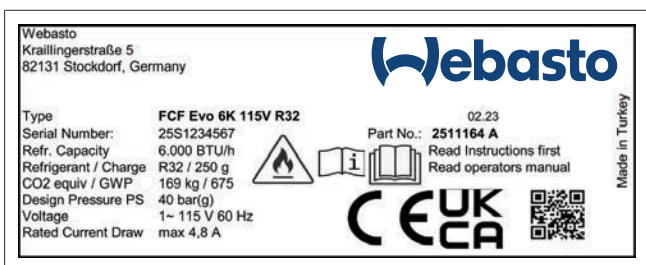


Fig. 2 Example of type label

The type label is located on the evaporator of the unit. You will find the output, serial number and registration data there.

4.4 Unit description

4.4.1 FCF Evo Series

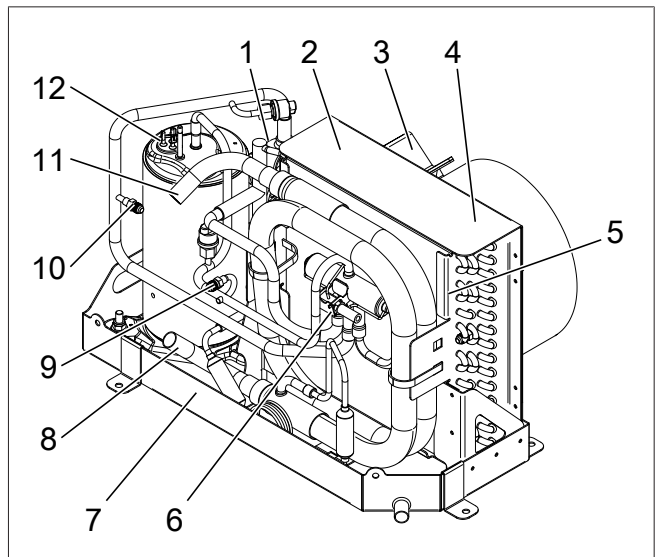


Fig. 3 FCF Evo Series self-contained air-conditioning unit

1	Refrigerant collector	7	Condensed-water tray
2	Evaporator	8	Sea water inlet
3	Fan outlet	9	High-pressure service port
4	Type label	10	Service port, low-pressure
5	Air filter	11	Sea water outlet
6	4/2-way reverse valve (cooling / heating)	12	Compressor unit

4.4.2 General

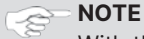
The FCF Evo Series is an air-conditioning system with its four basic components, i.e. compressor, condenser, evaporator and throttle element.

- **Evaporator (air heat exchanger)**
Refrigerant vaporises at low pressure and a temperature below the ambient temperature of the evaporator. It absorbs heat from the ambient air in the process.
- **Compressor (refrigerant compressor)**
The refrigerant vapour extracted from the evaporator at low pressure is compressed to a higher pressure, and therefore to a higher temperature. In the process, additional heat is fed to the refrigerant.
- **Condenser (sea water heat exchanger)**
The compressed, heated refrigerant vapour is condensed at a temperature which is above the sea water temperature. In the process, the entire heat absorbed in the evaporator and compressor is given off to the sea water.
- **Throttle element (capillary tube)**
The pressure in the refrigerant subjected to condensing pressure is relieved and transferred to the evaporator.

4.4.3 Cooling operation mode

In the evaporator, the FCF Evo Series air-conditioning system absorbs heat from the cabin air and cools it by approx. 15 K. The cooled air is blown into the cabin with the fan. The compressor now compresses the refrigerant vapour, which is then condensed to a liquid when flowing through a condenser cooled with sea water. The heat released is emitted to the sea water. The condensed refrigerant passes through the throttle element and the pressure is relieved to

form wet vapour on entering the evaporator. The liquid component of the refrigerant is now evaporated and again takes up heat from the cabin air. As a result, the refrigerant circuit is closed.

**NOTE**

With these air-conditioning systems, sea water flows through the condenser, which is sucked in via a pump. This ensures the cooling process. The FCF Evo Series air-conditioning systems are designed for maximum sea water temperatures of up to 45 °C.

4.4.4 Heating operation mode

Heat can also be generated with the FCF Evo Series air-conditioning system. A 4-way reverse valve is installed in the system for this purpose. As a result, the condenser becomes an evaporator and vice versa. The sea water heat exchanger (now evaporator) takes available heat away from the sea water which is then transferred to the refrigerant. The air heat exchanger becomes the condenser and gives off the condensation heat to the cabin air and heats it up to 45 – 50 °C.

**CAUTION**

Danger of water damage to installations, equipment, etc.

Do not damage the insulation of the condensed-water tray to avoid condensed-water from forming on the outside of the condensed-water tray.

**NOTE**

Heating mode becomes inefficient when the sea water temperature drops to below 6 °C as sufficient heat can no longer be taken from the cold sea water. The interior air then cannot be heated sufficiently.

4.4.5 Refrigerant

This device uses The refrigerant R32, Safety class A2L: non-toxic, highly flammable. High ignition energy is required for combustion. However, escaping refrigerant can burn if it comes into contact with open flames.

The system complies with the Kyoto Protocol and the EU F-Gas Regulation (EU No. 517/2014).

5 Installation

5.1 General

**NOTE**

To ensure proper operation, the following must be observed:

- ▶ All components must be positioned and installed in accordance with their installation instructions.

5.2 Installation location

**DANGER**

Danger of ship exploding

- ▶ FCF Evo Series air conditioning systems in rooms with highly flammable liquids or gases.

FCF Evo Series air-conditioning systems are generally installed in the living area.

5.2.1 Installation location requirements

- Sufficient space must be available to ensure access to the condensed-water drains and electrical connections.
- See chapter 14, "Technical data" on page 30 and chapter 14.3, "Dimensions and minimum distances Type 6K- 16K" on page 32 or chapter 14.4, "Dimensions and minimum distances Type 27K" on page 33.

- The air conditioning system must be accessible for service and maintenance purposes.
- The air conditioning system must be mounted on an even, horizontal surface.
- Since operation of the air conditioning system leads to condensation, two drain lines must be provided on the condensed-water tray.
- Do not directly expose the air conditioning system to splash water or expose to flooding.
- The air conditioning system is approved for a maximum ambient temperature of 40 °C.
- To avoid local ambient temperatures in excess of 40 °C, the air conditioning system and the electrical box may not be installed in the immediate vicinity of heat sources.

5.3 Installation example

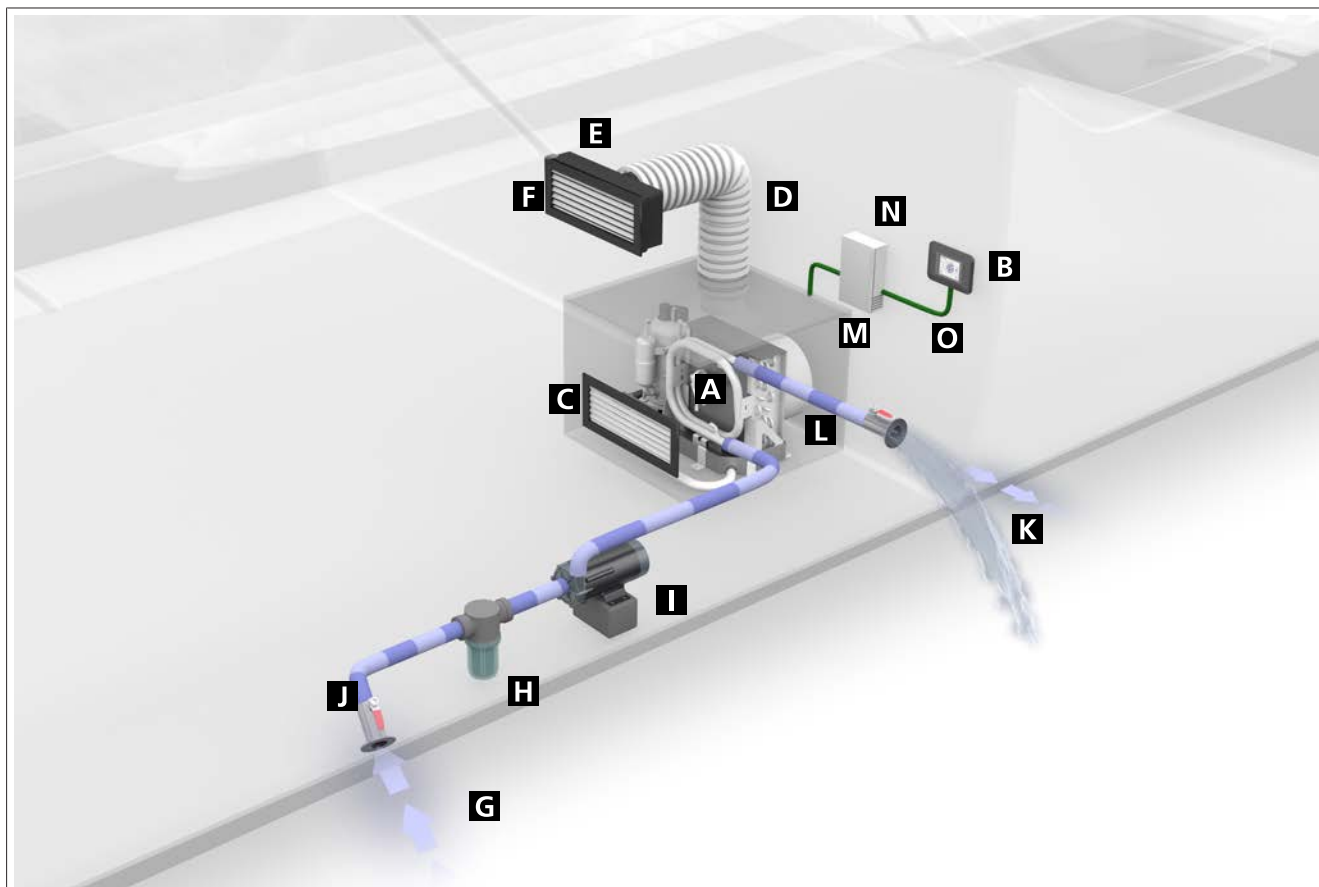


Fig. 4 Installation example

A	FCF Evo Series air conditioning system	I	Sea water pump
B	Control element	J	Sea valve
C	Air inlet grille	K	Sea water outlet
D	Flexible air duct	L	Sea water hose
E	Transition box	M	Electrical box
F	Outlet air grille	N	Power supply
G	Sea water inlet	O	Cable for control element
H	Sea water strainer		

5.4 Transport the unit



WARNING

Risk of injury if the unit is dropped or carried incorrectly.

The unit is heavy and must not be carried incorrectly.



WARNING

Danger of injuries

FCF Evo Series by the refrigerant lines.

- ▶ Only carry the unit by the condensed-water tray, by the fan or by the upper pipe elbows of the condenser. Never grasp and carry the unit by other pipes. See Fig. 5.
- ▶ The evaporator fins can be easily bent. When installing, make sure that bent fins are correctly aligned again to ensure proper air feed.

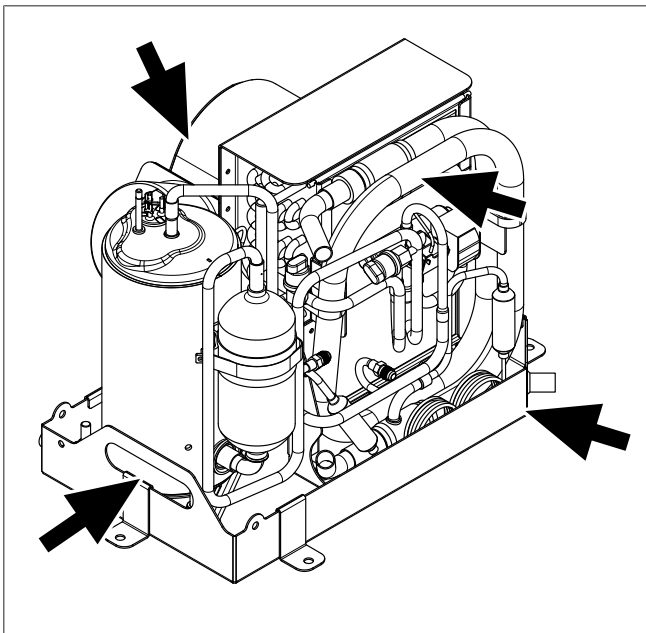


Fig. 5 Transport the unit

5.5 Installing the unit



CAUTION

Danger of damage to the electrical components and refrigerant loss.

Do not remove covers, caps or fittings.
Do not remove covers, caps or fittings used to protect the electrical wiring or to seal off the refrigerant.



CAUTION

Danger of water damage to installations, equipment, etc.

Do not damage the insulation of the condensed-water tray to avoid condensed-water from forming on the outside of the condensed-water tray.

5.5.1 Mounting



NOTE

- ▶ Ensure the unit is mounted stably.
- ▶ Fasten the unit so that secure seating is ensured, however the unit can be removed again later for maintenance purposes if necessary.
- ▶ Use the retaining brackets supplied for mounting the air conditioning system.

1. Lift unit and position it at the installation location.



NOTE

- ▶ If vibration absorbers are used, they are installed between the condensed-water tray and the mounting surface. This will increase the installation height of the system. Refer to the information provided in the installation instructions for the BlueCool Vibration Absorber Kit.
- ▶ A noise reduction can be achieved if desired by insulating the area around the system.

The sea water outlet may not be mounted below the waterline. Although this leads to a reduction in the operating noise of the sea water outlet, it increases the counterpressure in the system and significantly lowers the flow rate and thus the system capacity. Then a simple test of the flow rate is no longer possible.

Each air conditioning system requires a separate sea water outlet to be able to check and secure the minimum required sea water flow rate.

5.6 Installing the condensed-water drain line



CAUTION

The air conditioning system can intake and distribute escaping carbon monoxide and other gases.

- ▶ Condensed-water drain lines must not merge in the engine room.
- ▶ To prevent carbon monoxide or other harmful gases from potentially getting in, a siphon should be installed in the drain line, which is closed by the condensate during normal drainage.
- ▶ Condensed-water drains that lead outwards through the hull must not be installed closer than 915 mm to exhaust gas outlets from combustion engines.



CAUTION

Water damage to furniture, devices, etc..

- ▶ Do not connect the condensed-water drain line to the sea water line of the air conditioning system.
- ▶ Ensure the condensed-water tray drains off properly to prevent damage caused by condensation backing up.



NOTE

- ▶ Ensure the unit is mounted stably.
- ▶ Install condensed-water drain lines on a downward slope and without water pockets.
- ▶ The diameter of the condensed-water drain line must match the condensed-water drain fitting on the condensed-water tray.
- ▶ Connect the condensed-water tray via the condensed-water drain line to the bilge or other condensation/water collection points.
- ▶ There must be no backpressure in the condensed-water drain line.
- ▶ If necessary, make a new water collection point complete with pump, level switch and drain line.

1. Secure hose connector to connection socket of condensed-water tray.
2. Ensure leak-proof fit.

5.7 Installing the sea water circuit

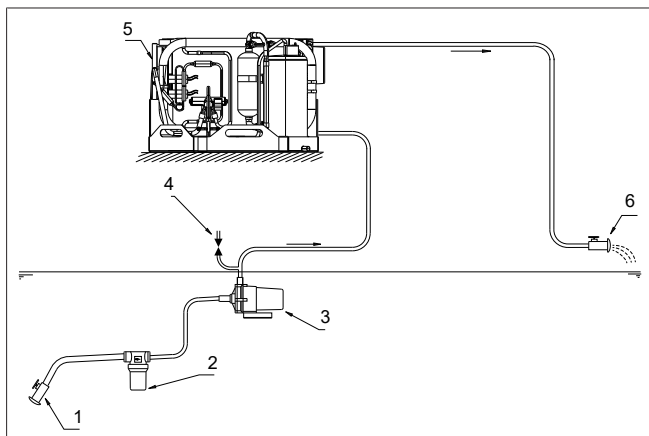


Fig. 6 Installation example

1	Hull bushing with sea valve
2	Sea water strainer
3	Sea water pump
4	Bleeding
5	FCF Evo Series air conditioning system
6	Sea water outlet

NOTE

The sea water components are installed continuously ascending from the through-hull fitting via the strainer and pump up to the FCF Evo Series air conditioning system. This arrangement ensures that bubbles, which would otherwise cause the pump to malfunction, cannot collect in the sea water circuit.

5.7.1 Installing through-hull fitting for the sea water inlet

The sea valve on the through-hull fitting is used for safety and maintenance purposes.

Install through-hull fittings, seal off with sealant and check for leak-tight sealing.



DANGER

Sea water enters when installed incorrectly.

Boat can sink; danger of drowning.

Suitable measures must be taken to install the through-hull fitting in order to prevent an unchecked entry of sea water.

NOTE

The sea water inlet must be arranged at the lowest possible point below the water line and below the sea water pump. The through-hull fitting for the sea water inlet must be installed with the opening facing in direction of travel in order to create a boosting backpressure in the intake line.

- ▶ Sailboats: install the through-hull fitting near the centre of the hull.
- ▶ Fast motor boats: install through-hull fitting in rear section of hull.

5.7.2 Installing sea water pump



NOTE

Webasto recommends installing the sea water pump at least 0.25 m below the water line. If installation below the water line is not possible, a self-priming pump must be used.

Selecting sea water pump

To increase the operating safety, Webasto recommends the use of self-priming pumps. These are significantly less susceptible to air accumulations, which can enter the system during reverse travel or when in a tilted position, for example.

Parallel connection of multiple FCF Evo Series air conditioning systems supplied via one sea water pump and one sea water inlet is possible. However, the maximum number should be limited to four FCF Evo Series air conditioning systems.

Each system requires a separate sea water outlet to check the respective minimum flow rate and to enable an operating check of the system.

If necessary, throttles that reduce the cross section should be used to adjust the flow rates.

A water manifold and pump relay must be fitted if one sea water pump is supplying multiple FCF Evo Series air conditioning systems. See chapter 15.1, "Wiring diagrams" on page 34.

Also, a shut-off valve must be provided for each FCF Evo Series air conditioning system.

Self-priming sea water pumps

If a self-priming pump is installed above the water line, the pump head must be pre-filled during initial start-up or after longer times at standstill to enable self-priming.

Pump characteristics

- The pump characteristics enable the selection and dimensioning of the sea water pump depending on expected pressure losses in the entire system.
- Operating the pumps outside the pump characteristic can damage the pumps due to motor overloading or cavitation.
- Damage which occurs due to improper operation is excluded from the warranty.
- The delivery head of a pump is often specified in metres water column and represents the pressure drop between the pump inlet and outlet. This pressure drop corresponds to the total pressure differential in the sea water system from the sea water inlet up to the sea water outlet. Do not confuse this with the position of the pump below the water line.
- The effective water flow through the pump and therefore through the sea water system changes considerably depending on the pressure drop.
- The minimum sea water flow rate through the air-conditioning system must be maintained at all times. This should be checked every time the system is placed into operation.

Installation



NOTE

Make sure that the pump is accessible for maintenance work. It is urgently recommended that a vent be installed directly behind the outlet opening of the sea water pump to allow the collected air bubble to escape when the system is started up.

1. Installing the sea water pump (see Fig. 6).

5.7.3 Installing sea water strainer



NOTE

Match the size of the sea water strainer to the sea water quality. If a great deal of dirt is to be expected, then a strainer of the corresponding size should be chosen. The sea water strainer must be installed between the through-hull fitting and the sea water pump. Comply with specified direction of flow. Make sure that the sea water strainer is accessible for maintenance work.

Install the sea water strainer in accordance with the manufacturer's specifications.

5.7.4 Installing sea water outlet



NOTE

The sea water outlet must be installed approx. 0.10 m above the water line. At least the first 150 mm of the sea water outlet line within the interior of the boat should be self-emptying to prevent breakage caused by freezing. Do not install the sea water outlet in the bow area of the ship to prevent back flow.

The sea water outlet may not be mounted below the waterline. Although this leads to a reduction in the operating noise of the sea water outlet, it increases the counterpressure in the system and significantly lowers the flow rate and thus the system capacity. Then a simple test of the flow rate is no longer possible.

Each air conditioning system requires a separate sea water outlet to be able to check and secure the minimum required sea water flow rate.

5.7.5 Installing sea water lines



DANGER

The boat may sink; risk of drowning as sea water enters when installed incorrectly

Install double hose clamps on sea water lines. Install the two hose clamps mirror-inverted.



NOTE

Pay attention to the minimum required diameter of the sea water lines. Only use reducers when this serves the specific distribution of the volume flows when several systems are connected to one pump. Avoid 90° fittings wherever possible as they create a considerable pressure loss, thus unnecessarily reducing the sea water flow. It is preferable to install the line in a kink-free bend.

On the intake side of the pump, it is advisable to use a line with over-dimensioned cross-section, as soiling can occur here most frequently, resulting in an unintentional reduction of the flow rate.

The sea water lines must be installed as follows:

- ▶ as short as possible,
- ▶ kink-free,
- ▶ without water pockets,
- ▶ protected against rubbing.

1. Install intake line(s) so that there is a slight upward incline from the sea water inlet to the air conditioning system.
2. Install pressure line(s) to the air conditioning system and to the sea water outlet.

5.8 Installing the air ducts



CAUTION

Danger of water damage.

Completely insulate the air ducts, as otherwise condensed water will result on the outside of the air duct and drip water will form.



CAUTION

Risk of damage to furniture, equipment, lines, etc.

Bear in mind there may be objects behind the point where openings for air inlet grille and supply air grille are to be made.

5.8.1 Mounting



NOTE

- ▶ Prevent a restriction of the air supply due to excessively tight bending radii of the air ducts or due to accidental deformations.
- ▶ Keep the air ducts as short as possible (<2.5 m). Excessively long air ducts result in a reduction in the air quantities, and therefore in a decrease in the cooling/heating capacity of the system.
- ▶ The air inlet grille should be mounted offset so that the air flowing in does not flow directly into the evaporator inlet. This enables the intake noises from the fan to be considerably reduced (see Fig. 7).
- ▶ Avoid a cold air short-circuit between the air outlet and air inlet. These must be mounted with a sufficient distance from each other.
- ▶ Air outlets must be installed above below the ceiling to ensure sufficient mixing and cooling or heating of the cabin air.



CAUTION

Danger of damage to the duct.

When installing the air duct at the side, ensure that it does not come into contact with the compressor, collector, refrigerant lines or other parts of the system due to the at times very high surface temperatures of the system.

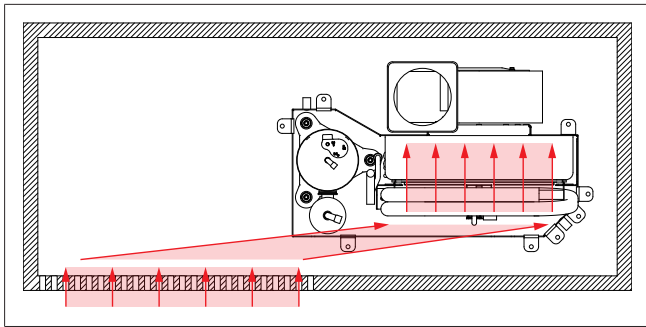


Fig. 7 Mount air inlet grille offset

Minimum cross section of air inlet and supply air grilles

The minimum cross-sections of the return air and supply air grille and the air ducts must be taken into account for a satisfactory functionality of the air conditioning system.

Requirements for air duct

FCF Evo Series	Outlet air grille cross-section	Air inlet grille cross-section	Air duct < 2 m length diameter	Air duct < 5 m length diameter
[BTU/h]	[cm ²]	[cm ²]	[mm]	[mm]
6,000	150	325	100	125
10,000	250	550	100	125
13,000	390	800	125	150
16,000	390	800	125	150
27,000	650	1,600	2 x 125	2 x 150

Type of duct

If flexible air ducts are used they must be high quality and adequately reinforced with steel or plastic spirals to avoid them being dented.

Flexible air ducts should be extended to their maximum length to ensure the inner surface is as smooth as possible. For extremely long air duct sections, rigid ducts (e.g. made of PVC) should be given preference. These ducts are much smoother than flexible air ducts, and therefore also have a considerably lower inside resistance.

Fan outlet

Flexible air ducts mounted directly on the fan outlet and then bent at right angles must be avoided, as they considerably restrict the air flow. All Webasto fans can be mounted in several positions to enable a straight outlet out of the fan. An example of proper installation is shown in Fig. 8.

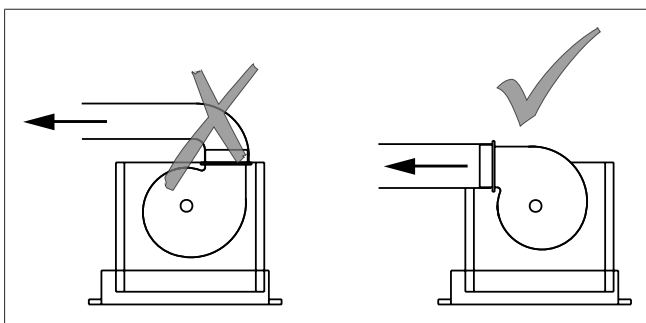


Fig. 8 Fan outlet turned (on right)

Turning fan

The fan must be removed to turn it:

1. Remove the black insulation off the fastening screws of the fan motor on the back of the fan.

2. Screw out the screws of the fan motor and carefully remove the fan without bending the fan wheel. The power cable to the fan can remain connected when doing so.
3. The fastening screws of the fan housing are now accessible through the opening of the fan motor. Undo the mounting screws, detach the fan housing and reinstall in the required position.
4. Remount the fan motor.

Transition boxes

The transition boxes behind the supply air grilles serve as an equalisation volume for the air flow and thus reduce the noise level of the air flowing through the grille fins. The depth of the transition box therefore has a considerable effect on the distribution of the air flow.

1. Install air inlet grille.
2. Install transition boxes and supply air grille.
3. Install insulated air ducts from the air conditioning unit to the transition box.
4. Secure air ducts to ensure they do not move at high fan speeds.

6 Electrical connections

6.1 General



WARNING

Connection to your 115 V/230 V electrical system

Danger of injuries or fatal accidents and damage to the air-conditioning system or other electrical devices.

Installation must only be carried out by persons who are certified to carry out work on 115 V/230 V electrical systems.

Before working on the electrical system, the system must be disconnected from the power supply.

In addition to the power supply for the system, a separate power supply must be provided for the sea water pump.



NOTE

The entire air-conditioning system must be protected by external circuit breaker.

With the FCF Evo Series 10K – 16K (115V) and 13K – 27K (230V), not only the power supply of the PCB, but also a separate power supply for the compressor must be provided, which must also be protected externally.



DANGER

Danger of electric shock!

A suitable residual current-protection switch (FI/RCD) with a rated residual current of 30 mA must be present in the upstream electrical installation for this device. The RCD (FI) switch serves the additional protection against electrical shock dangers.

6.1.1 Minimum wire cross-sections

Minimum wire cross-sections must be taken into account. Information on determining the minimum wire cross-sections for each device in the FCF Evo Series can be found in chapter 14, "Technical data" on page 30 and chapter 15.1, "Wiring diagrams" on page 34.

NOTE

Earth conductors are not specified.

Pay attention to the following requirements:

- ▶ Line length
- ▶ Power consumption
- ▶ Maximum temperatures in the vicinity of the cables

6.1.2 Installing line fuse protection

1. Line fuse protection chapter 15.1.2, "Line fuses " on page 34. The fuses must also be selected in accordance with the national and local standards.
2. Fuses of class gG for IEC and UL-type T with a tripping time of less than 0.5 s are generally required; if a magnetic circuit breaker (MCB) is used the MCB must be at least of type B, as specified in the data in the chapter 15.1, "Wiring diagrams" on page 34.
3. Make sure that the voltage, frequency and number of phases match the data of the type used.

6.2 Installing the electrical box

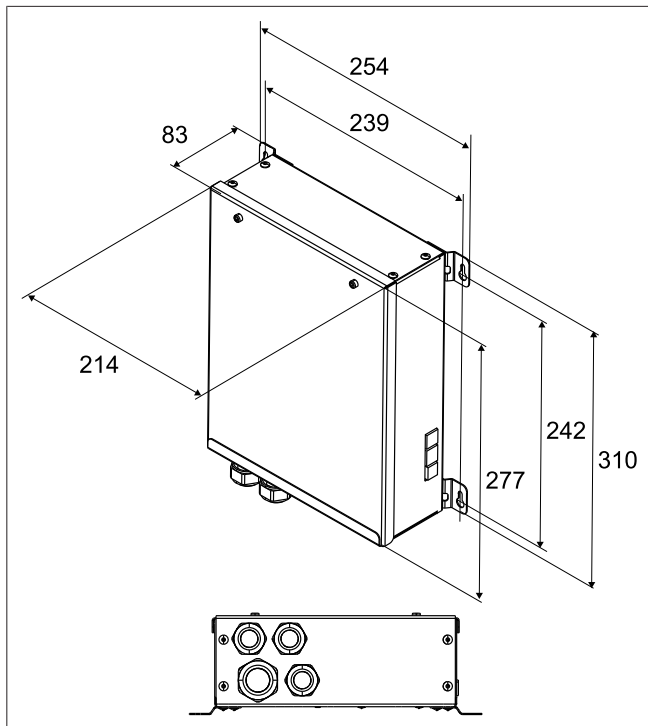


Fig. 9 Electrical box dimensions

NOTE

- ▶ For Protection Class IP21 and higher, the connections for the control element and cabin temperature sensor and the USB connection must be directed downward.
- ▶ Make sure that the maximum permissible ambient temperature of 40 °C is not exceeded.

Any desired installation position may be chosen for the electrical box if no requirements are placed on the IP protection class. For protection class IP21 and higher, the electrical box must be installed either horizontally reclined with the cover facing upward or vertically upright with the connections facing downward.

1. Install the electrical box. Make sure that the fastening screws are accessible for opening and removal.

6.3 Connecting the FCF Evo series

NOTE

Always refer to the wiring diagrams (see chapter 15.1, "Wiring diagrams" on page 34).

The FCF Evo Series air conditioning system has a number of pre-installed electrical connections.

1. Connect the sea water pump. Pass connection cable through a PG cable gland and connect to the cable terminal (see chapter 15.1.3, "Layout diagram - FCF Evo Series PCB" on page 35). When operating multiple FCF Evo Series air conditioning systems with a sea water pump, observe the chapter 15.1, "Wiring diagrams" on page 34.
2. Produce the mains connection. Guide the mains cable through the PG cable gland. Slide the ferrite over the mains cable in the electrical box and secure it with cable ties. Connect the phase and neutral (PEN) conductor of the power supply cable to the cable terminal (see chapter 15.1.3, "Layout diagram - FCF Evo Series PCB" on page 35) on the PCB.
3. Secure the earthing cable for the sea water pump and power supply at the marked earthing terminal in the electrical box next to the pc-board.

Additionally for FCF Evo 10K-16K (115V) and 13K-27K (230V):

1. Guide the mains cable for the compressor through the PG cable gland and connect the phase and neutral conductor to the external relay.
2. The mains connection for the compressor must be established via a separate supply line (including additional fuse protection).

6.4 Installing soft start

It is possible to retrofit the Webasto BlueCool Soft Start in the electrical box. Refer to the wiring diagrams in chapter 15.1, "Wiring diagrams" on page 34. Make sure that the phase and zero conductors are installed correctly.

6.5 Installing the control element

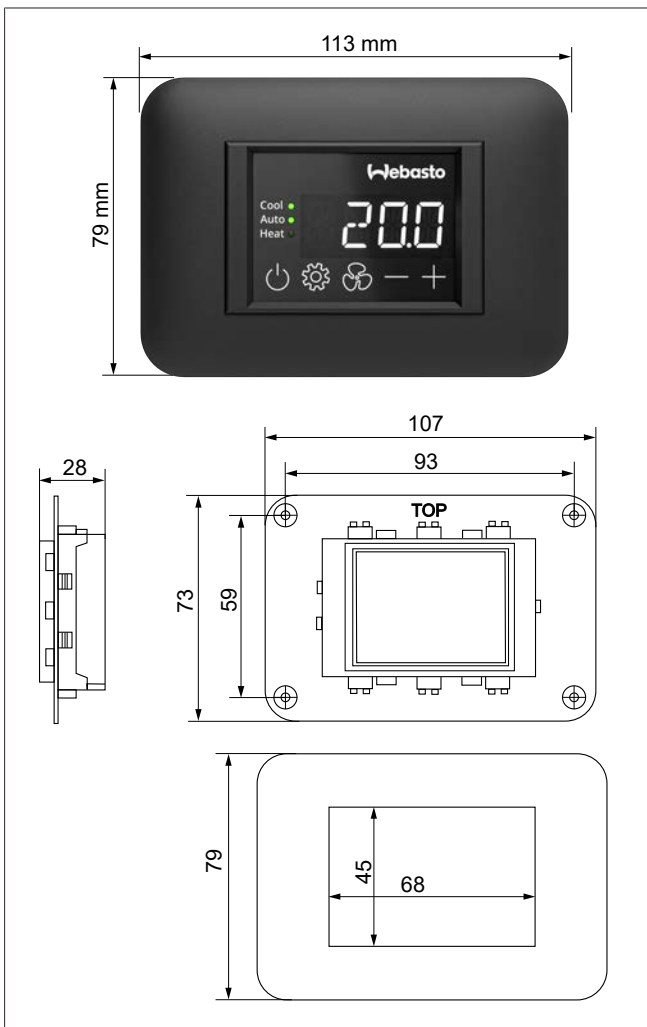


Fig. 10 Installing the control element

NOTE
Use the supplied connection cable to connect the control element. A commercially available 8-pin cable with RJ45 connector (e.g. same as the power cable) can also be used. The connection cables formerly used by Webasto for the control element with a membrane keypad are no longer suitable as their polarity has been changed.

1. Make the cutout for the control element in the required position. For cut-out dimensions see Fig. 10.
2. Plug in the connector of the connection cable for the control element at the back of the control panel.
3. Connect the connection cable for the control element to the electrical box from the outside.
4. Attach the control element with screws.
5. Fit trim cover.

6.6 Installing the cabin temperature sensor

The cabin temperature sensor is required to register the cabin temperature. To ensure trouble-free operation make sure the cabin temperature sensor is positioned correctly.

NOTE
Positioning the cabin temperature sensor
Direct sunlight and other heat sources can impair the operation of the system.
Do NOT install the cabin temperature sensor in the immediate vicinity of a supply air grille.

Select an installation location which is free from external influences if possible. Among other things, the following external influences should be avoided:

- Radiator
- Kitchen cooker
- Light sources

It is advisable to mount the cabin temperature sensor in the area of the return flow, e.g. on the back of the air inlet grille.

1. Fit cabin temperature sensor in required location.
2. Connect the sensor cable to the electrical box from the outside.

7 Operation

7.1 Description



Fig. 11 Control element

1	Display		2	Plus button for changing the setpoint temperature	
3	Minus button for changing the setpoint temperature		4	Fan setting button for controlling the fan speed	
5	Function button for setting/programming		6	On/Off button	
7	LED display for heating mode		8	LED display for automatically switching between operating modes	
9	LED display for cooling mode				

The FCF Evo Series air-conditioning systems are operated with the control element that enables access to all functions for normal operation of the air-conditioning system.

7.2 Operating levels for operator

The operating level for the operator is accessible without an access code. It shows important information and offers adjustment options which require no special prior knowledge.

7.3 Switching on the system

After connecting the power supply, first all LEDs and all segments of the numeric display flash for a few seconds, then "INIT" is briefly displayed on the control element.

This is followed by the "boot" message and the firmware version, e.g. V104.

If the system was switched on before cutting off the power supply, the current cabin temperature appears on the control element and the system starts up automatically in the set operating mode. Otherwise the control element will go dark and the system will assume standby mode.

- ▶ Switch on the system by pressing the "On"  button


Now the electronic controller assumes the step-by-step start-up of the air-conditioning system and the standard operation.


The control element shows the current cabin temperature of the cabin in which the control panel is mounted or where the cabin temperature sensor is located (if it is in another cabin). After approx. 20 seconds, the control element provides information on which operating mode (cooling or heating) the system is started in. The selection depends on the selected setpoint temperature and the cabin temperature measured by the cabin temperature sensor.

After another approx. 50 seconds, the compressor is switched on and the standard mode begins.

The sea water pump always runs as soon as the system is switched on and the compressor starts up. If only the system is switched on and no change is made on the control element, the compressor and the sea water pump start up with a delay of 20 sec.

7.4 Switching off the system

The system can be switched off by pressing the "On/Off" button . The condition for this is that the user is in the start menu with the display of the cabin temperature.

On the setting levels, the "On/Off"  button is used to confirm the setting and not to switch off the system.

7.5 Switching on cooling mode/ heating mode



NOTE

The system only cools under the following conditions:

- ▶ Cabin temperature > 15 °C.
- ▶ Sea water temperature < 35 °C.
- ▶ Setpoint temperature < cabin temperature.



NOTE

The system only heats under the following conditions:

- ▶ Cabin temperature < 29 °C.
- ▶ Sea water temperature > 6 °C.
- ▶ Setpoint temperature > cabin temperature.


- ▶ Switch on the system, see chapter 7.3, "Switching on the system" on page 14.

Switching over to cooling (heating) means selecting an operating mode which contains cooling (heating):



- F01 = cooling only.
- F02 = only heating (reverse heating operation).
- F03 = automatic toggling between cooling and heating (via reverse heating operation).

- F07 = dehumidification (when ship is unmanned).

F01 and F03 are possible for cooling (F02 and F03 for heating).

- ▶ Press the function button  3 times until "F x" appears on the display.

- ▶ Cooling mode: The value "F x" (operating mode) changes to "F01" or "F03".

Heating mode: Press the plus button  or minus button  repeatedly to change the value "F x" (operating mode) to "F02" or "F03".


- ▶ Confirm the entry by pressing the "On/Off" button .

7.6 Setting setpoint temperature

Set the setpoint temperature in accordance with your own preferences.

- ▶ Press the plus button  or minus button . The setpoint temperature is displayed.

- ▶ Press the plus button  or minus button  to change the setpoint temperature.

- ▶ Confirm the entry by pressing the "On/Off" button  or wait at least 5 seconds so that the entered value is automatically adopted.

Standby mode


The control element will enter into standby mode if no button is pressed for 5 minutes. The corresponding operating mode LED will then flash discretely every 20 seconds. Press any button to return to the normal display.


7.7 Set the fan speed


- ▶ Switch on the system, see chapter 7.3, "Switching on the system" on page 14.

- ▶ Press the fan setting button . The current fan speed is displayed.




- ▶ Press the plus button  or minus button  to change the setpoint temperature.

If the plus button  is pressed again when the highest speed has already been selected, automatic fan mode is switched on and "b A" appears on the control element.

Pressing the minus button  exits the automatic fan mode and returns to the manual mode.

- ▶ Confirm the entry by pressing the "On/Off" button  or wait at least 5 seconds so that the entered value is automatically adopted.

7.8 Setting the brightness

The brightness of the display can be set to four levels. To do this, simultaneously press the function button  and either the plus button  or the minus button  to increase or decrease the brightness.

8 Dehumidification

In the FCF Evo Series air conditioning system can control the heating and cooling on the boat in the absence of the crew, removing humidity from the cabin air in the operating mode F7. For this purpose, the air-conditioning system runs in heating mode for a set period of time and then in cooling mode. In cooling mode condensation forms on the heat exchanger, thus drying the cabin air. The heat/cooling cycles can be activated up to 3 times in 24 hours. There must be sufficient power available for the air-conditioning system. Dehumidification mode cannot run simultaneously with regular air conditioning; simultaneous temperature control is not possible. Dehumidification does however take place in regular cooling mode.

Settings

It may be necessary to enter further system settings before dehumidification can run. This is generally already done during the installation/commissioning phase. Setting level 1 must be called up if the system parameters need to be changed, see chapter 9.1, "Operating structure" on page 16.

To achieve efficient operation of the dehumidification cycle throughout the boat, the same settings should be chosen for all components of the air conditioning system.

Selecting the dehumidification profile

The system can be set such that it starts dehumidification mode once, twice or three times in a 24-hour period or there is no dehumidification at all. To change the cycles you need to set the number of cycles per day in setting level 1 under the parameter "Number of dehumidification cycles". See chapter 9.1, "Operating structure" on page 16.

Synchronising all installed FCF Evo Series air conditioning system components

If the entire boat is to be optimally dehumidified, it is expedient to switch off all the FCF Evo Series air conditioning systems in succession within a few seconds of each other via the control elements using function mode F7. All FCF Evo Series air conditioning systems then switch on simultaneously when the previously selected dehumidification cycle starts and then switch off again simultaneously. If all control elements are not switched on at the same time, the FCF Evo Series air-conditioning systems will start the dehumidification cycle at different times. This will restrict the dehumidification efficiency.

Operating restrictions - extreme climatic conditions

The dehumidification cycle is designed for use in temperate climatic regions where extreme weather conditions are not expected. In the dehumidification cycle, the air-conditioning system runs in both heating as well as cooling mode and may therefore not function correctly if the temperature of the sea water is either too high or too low. At low sea water temperatures, the system operates inefficiently in heating mode and there is a danger that the sea water could freeze in the capacitor. As a precautionary measure, the air conditioning system may therefore switch off at low water temperatures (at approx. 6 °C and below) (Fault message A01 - low pressure compressor). Heating mode may switch off (Fault message A02 - high pressure compressor) at high sea water temperatures (above 25 °C) as the air conditioning system is designed to produce heat under cold climatic conditions where sea water temperatures in excess of 25 °C are unlikely.

9 Overview of control and setting levels

9.1 Operating structure

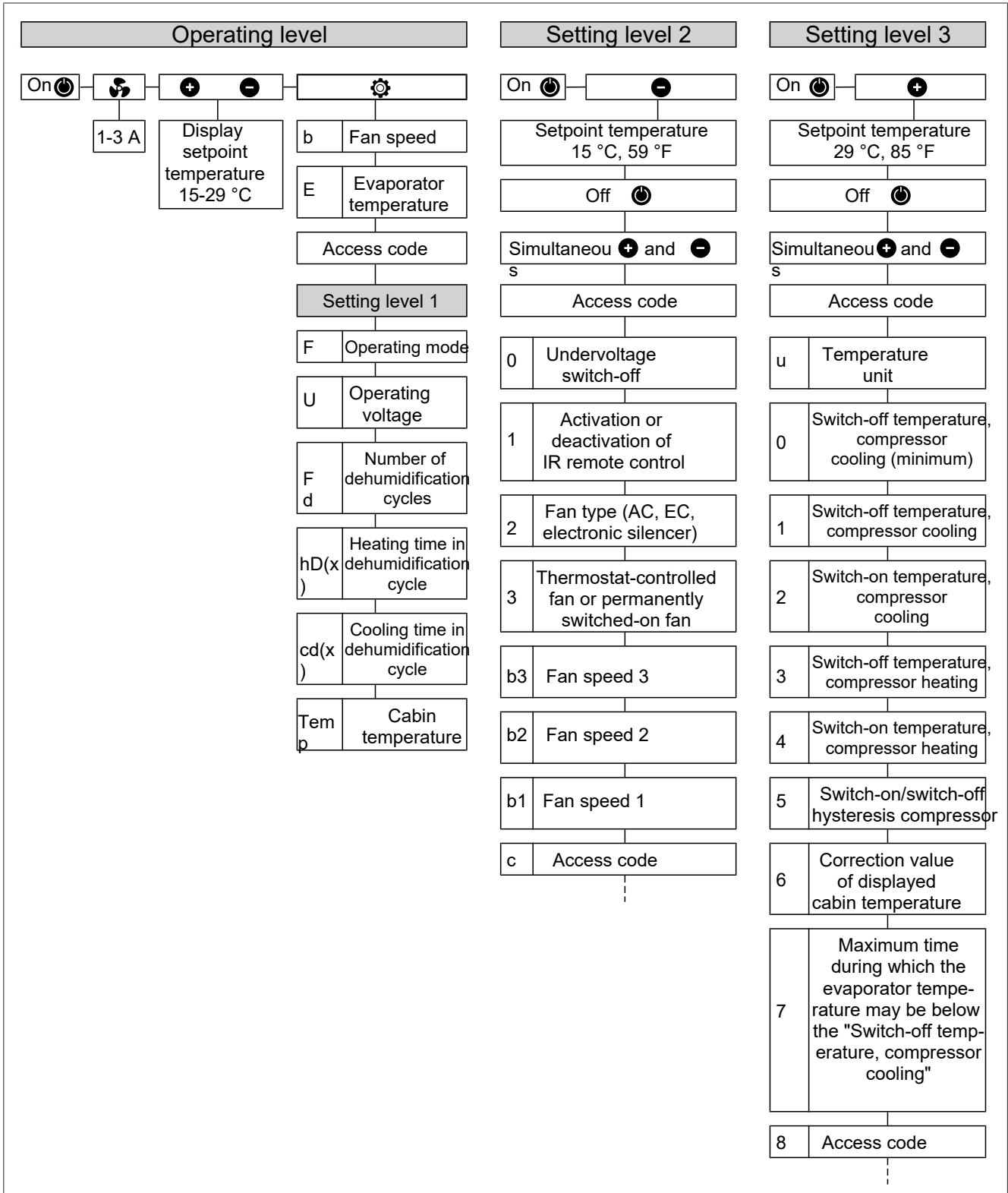



Fig. 12 Overview of control and setting levels

9.2 Calling up the setting levels


9.2.1 Setting levels for the installer




The settings levels for the installer should only be used by persons with technical knowledge and are therefore access code-protected. The installer can adjust the system operating parameters here.

9.2.2 Running Setting level 1

If the air-conditioning system is switched on, Setting level 1 can be reached by repeatedly pressing the function button .


First, the fan speed "b x" appears, then the evaporator temperature "E xxx".

When the access code is activated, the display "CodE" appears on the control element. If you do not wish to enter Setting level 1, you can return to the fan speed setting by pressing the function button  again.






The access code must be entered to begin on Setting level 1. For this purpose, select the access code (factory setting 64) by pressing the plus button  or the minus button  and confirming with the function button . Then the selection menu for an operating mode "F x" is accessed as the first setting parameter.


If the access code is disabled (set to 00), code entry is skipped and you access Setting level 1 after the evaporator temperature is displayed.


Pressing the function button  again runs through the further steps of Setting level 1. See Table 1 on page 18.

Setting level 1 can be exited at any time using the "On/Off" button . „memo" briefly appears on the control element to show that the changes have been saved.

9.2.3 Running Setting level 2





- ▶ Switching on the system.
- ▶ Set the setpoint temperature 15 °C (or 59 °F).
- ▶ Switch off the system by pressing the "On/Off" button .
- ▶ Press the plus button  and minus button  simultaneously for several seconds. When the access code is deactivated, the parameter for undervoltage cut-off appears on the display: „0 x"
When the access code is activated, then the access code must be entered first. Then the parameter for undervoltage detection appears: „0 x"
- ▶ The setting values can be changed using the plus button  or minus button .


Pressing the function button  advances the programming process by one step. See Table 1 on page 18.


Setting level 2 can be exited at any time using the "On/Off" button .

„memo" briefly appears on the control element to show that the changes have been saved.

9.2.4 Running Setting level 3

- ▶ Switching on the system.
- ▶ Set the setpoint temperature 29 °C (or 85 °F).
- ▶ Press the plus button  and minus button  simultaneously for several seconds. If the access code is deactivated, the parameter for the temperature unit appears in the display: „u.x"
If the access code is activated, then the access code must be entered first. Then the parameter for the temperature unit appears: „u.x"
- ▶ The setting values can be changed using the plus button  or minus button .

Pressing the function button  advances the programming process by one step. See Table 1 on page 19.

Setting level 3 can be exited at any time using the "On/Off" button .

„memo" briefly appears on the control element to show that the changes have been saved.

9.3 Parameter description


NOTE

The display or configuration of the parameters in setting levels 1 to 3 can only take place after entering the access code.

	Display	Parameter	Value range	Assignment	Factory setting	See Page
Operating level	b	Fan speed	1 to 3, A	1 = Level 1 3 = Level 3 A = Automatic	A	chapter 9.4.1, "Operating level" on page 20
	E	Evaporator temperature	-	Display evaporator temperature in °C or °F	-	chapter 9.4.1, "Operating level" on page 20
Setting level 1	F	Operating mode	1,2,3,7	1 = Cooling only 2 = Heating only 3 = Automatic switching between cooling and heating 7 = Dehumidification	03	chapter 9.4.2, "Setting level 1" on page 20
	U	Operating voltage	-	Display of operating voltage in V	-	chapter 9.4.2, "Setting level 1" on page 20
	Fd	Number of dehumidification cycles in 24 h, operating mode F07	01 to 99	01 = 1 cycle 02 = 2 cycles 03 = 3 cycles	01	chapter 9.4.2, "Setting level 1" on page 20
	hD	Heating time in dehumidification cycle	01 to 99	01 = 1 min. 99 = 99 min.	01	chapter 9.4.2, "Setting level 1" on page 20
	cd	Cooling time in dehumidification cycle	01 to 99	01 = 1 min. 99 = 99 min.	01	chapter 9.4.2, "Setting level 1" on page 20
Setting level 2	0	Undervoltage switch-off	180 to 210	-	195	chapter 9.4.3, "Setting level 2" on page 20
	1	Activation or deactivation of IR remote control	00 to 01	00 = deactivated 01 = activated	00	chapter 9.4.3, "Setting level 2" on page 20
	2	Fan type (AC, EC, electronic silencer)	00 to 02	00 = AC 01 = EC 02 = electronic silencer	00	chapter 9.4.3, "Setting level 2" on page 20
	3	Thermostat-controlled fan or permanently switched-on fan	00 to 01	00 = thermostat-controlled 01 = permanent	00	chapter 9.4.3, "Setting level 2" on page 20
	b3	Fan speed 3	30 to 100	30 = 30% 00 = 100%	100	chapter 9.4.3, "Setting level 2" on page 20
	b2	Fan speed 2	30 to 100	30 = 30% 100 = 100%	49	chapter 9.4.3, "Setting level 2" on page 20
	b1	Fan speed 1	30 to 100	30 = 30% 100 = 100%	35	chapter 9.4.3, "Setting level 2" on page 20

	Display	Parameter	Value range	Assignment	Factory setting	See Page
	c	Access code for setting levels	00 to 99	-	64	chapter 9.4.3, "Setting level 2" on page 20
Setting level 3	u	Temperature unit	00 to 01	00 = °C 01 = °F	00	chapter 9.4.4, "Setting level 3" on page 21
	0	Switch-off temperature, compressor cooling (minimum)	-4 to 15 °C 24 to 59 °F	x = x °C/°F	-4 °C 25 °F	chapter 9.4.4, "Setting level 3" on page 21
	1	Switch-off temperature, compressor cooling	-4 to 15 °C 24 to 59 °F	x = x °C/°F	-2 °C 28 °F	chapter 9.4.4, "Setting level 3" on page 21
	2	Switch-on temperature, compressor cooling	2 to 18 °C 35 to 65 °F	x = x °C/°F	4 °C 39 °F	chapter 9.4.4, "Setting level 3" on page 21
	3	Switch-off temperature, compressor heating	30 to 55 °C 86 to 131 °F	x = x °C/°F	52 °C 126 °F	chapter 9.4.4, "Setting level 3" on page 21
	4	Switch-on temperature, compressor heating	27 to 50 °C 81 to 122 °F	x = x °C/°F	48 °C 118 °F	chapter 9.4.4, "Setting level 3" on page 21
	5	Switch-on/switch-off hysteresis compressor	0.1 to 0.8 °C 0.2 to 1.4 °F	x = x * °C/°F	0.8 °C 1.4 °F	chapter 9.4.4, "Setting level 3" on page 21
	6	Correction value of displayed cabin temperature	-5.5 to 5.5 °C -9.9 to 9.9 °F	x = x * °C/°F	0 °C 0 °F	chapter 9.4.4, "Setting level 3" on page 21
	7	Maximum time during which the evaporator temperature may be below the "Switch-off temperature, compressor cooling"	000 to 999s	x = x s	600	chapter 9.4.4, "Setting level 3" on page 21
	8	Firmware revision	-	Control unit type display	-	chapter 9.4.4, "Setting level 3" on page 21

Table 1: Parameter list of setting levels

9.4 Explanation of parameters

9.4.1 Operating level

Parameter b: Fan speed

Setting range: 1, 2, 3, A

Factory setting: A

This parameter is used to manually set the fan speed in operation or activate the automatic fan setting.

1 = Fan speed "1"

2 = Fan speed "2"

3 = Fan speed "3"

A = Automatic

Parameter E: Evaporator temperature

Display value of current evaporator temperature in °C or °F.

Display value only

9.4.2 Setting level 1

Parameter F: Operating mode

Setting range: 1, 2, 3, 7

Factory setting: 3

This operating mode defines whether the system only cools, only heats or automatically switches between both modes. Dehumidification mode can be additionally activated.

1 = Cooling only

2 = Heating only (reverse heating operation)

3 = Automatic switching between cooling and heating (reverse heating operation)

7 = Dehumidification (dehumidification of the cabin air via cooling or heating)

Parameter U: Operating voltage

Display value of current operating voltage in V.

Parameter Fd: Number of dehumidification cycles in 24 hours in operating mode F07

Setting range: 01 to 03

Factory setting: 01

This parameter is used to set the number of dehumidification cycles when dehumidification mode (F07) in Parameter F is activated. The duration of the individual cycles is defined with the parameter hD or cd.

00 = Dehumidification mode deactivated

01 = 1 cycle every 24 hours

02 = 1 cycle every 12 hours

03 = 1 cycle every 8 hours

Parameter hD: Heating time in dehumidification cycle in operating mode F07

Setting range: 01 to 99

Factory setting: 01

This parameter is used to set the heating time in minutes in a dehumidification cycle when the dehumidification mode (F07) in Parameter F is activated.

01 = "Tropical Zone"

15 = "Summer" setting - temperate climate zone

40 = "Winter" setting - temperate climate zone

e. g., 10 = 10 minutes

Parameter cd: Cooling time in dehumidification cycle in operating mode F07

Setting range: 01 to 99

Factory setting: 01

This parameter is used to set the cooling time in minutes during a dehumidification cycle when the dehumidification mode (F07) in Parameter F is activated.

20 = "Tropical Zone"

45 = "Summer" setting - temperate climate zone

45 = "Winter" setting - temperate climate zone

e. g., 10 = 10 minutes

9.4.3 Setting level 2

Parameter 0: Undervoltage cut-off

Setting range: 180 to 210

Factory setting: 195

The undervoltage switch-off is defined for a supply voltage of 230 V. Dropping below the undervoltage threshold for more than 5 seconds switches off the system. The error message AAA is displayed.



ATTENTION

Reducing the value below the factory setting of 195 V can result in damage to the compressor. Webasto shall accept no liability whatsoever for faults caused by operating the compressors below the recommended voltage level. Do not select any settings that are lower than the factory settings.

Parameter 1: Activation or deactivation of the IR remote control

Setting range: 00, 01

Factory setting: 00

To use the optionally available remote control, this value must be set to 01.

Although the Webasto control panels are designed so that interference with most TV models or household appliances by the remote control is avoided, the user should note that interactions can occur in certain cases.

In this case, the value should be set to 00.

Parameter 2: Fan type

Setting range: 00 to 02

Factory setting: 00

Both AC fan motors (alternating current) and low-noise EC fan motors can be used. If electronic silencers are used, these can also be activated with this parameter.

00 = Standard AC Fan motor

01 = Electronically commutated (EC) fan motor

02 = When optional electronic silencers are used



ATTENTION

If this parameter is changed without the corresponding fan type being connected, malfunctions can occur.

Parameter 3: Thermostat-controlled fan or permanently switched-on fan

Setting range: 00, 01

Factory setting: 00

This parameter defines the behaviour of the fan when the set setpoint temperature is reached in the cabin.

00 = Fan switches off thermostat-controlled when setpoint temperature is reached.

01 = Fan remains switched on when setpoint temperature is reached. Only cooling circuit is switched off.

Parameter b3: Fan speed "3"

Setting range: 30 to 100

Factory setting: 100

The speed in fan speed "2" can be set with this parameter.

If this value is adjusted, a permanent humming noise can result when using an AC fan. If electronic silencers are used, the speed on the AC fan cannot be changed.

Parameter b2: Fan speed "2"

Setting range: 30 to 100

Factory setting: 49

The speed in fan speed "2" can be set with this parameter. If this value is adjusted, a permanent humming noise can result when using an AC fan. If electronic silencers are used, the speed on the AC fan cannot be changed.

Parameter b1: Fan speed "1"

Setting range: 30 to 100

Factory setting: 35

The speed in fan speed "1" can be set with this parameter. If this value is adjusted, a permanent humming noise can result when using an AC fan.



ATTENTION

Never set the output (speed) of the fan too low. The fan must not stop or restart. The motor winding of the fan can burn through. Such damage is not covered by the Webasto warranty.

Parameter c: Access code for setting levels

Setting range: 00 to 99

Factory setting: 64

The access code for the setting levels is stored in this parameter to prevent accidental changing of the programmed values. The access code can be selected as desired in a value range from 00 to 99. If the value 00 is set, this function is deactivated. The access code is not requested.



ATTENTION

If the system is blocked and the access code is not available, you can call up the setting level with the aid of the following factory code: 64.

9.4.4 Setting level 3

Parameter u: Temperature unit

Setting range: 00, 01

Factory setting: 00

Change the temperature display from °C to °F for all temperature values

00 = °C

01 = °F

Parameter O: Switch-off temperature, compressor cooling (minimum)

Setting range: -4 to 15 °C

24 to 59 °F

Factory setting: -4 °C

25 °F

This parameter is used to set the minimum evaporator temperature. If this temperature value is dropped below during normal operation, then the compressor is switched off immediately.



ATTENTION

Changing this value can result in impairment of operation and damage to the air-conditioning system.

Parameter 1: Switch-off temperature, compressor cooling

Setting range: -4 to 15 °C

24 to 59 °F

Factory setting: -2 °C

28 °F

This parameter is used to set the lower evaporator temperature. If this temperature value is dropped below during normal operation for the time set in Parameter 7, then the compressor is switched off.



ATTENTION

Changing this value can result in impairment of operation and damage to the air-conditioning system.

Parameter 2: Switch-on temperature, compressor cooling

Setting range: 2 to 18 °C

35 to 65 °F

Factory setting: 4 °C

39 °F

This parameter is used to set the evaporator temperature at which the compressor is to be switched on again. If this temperature value is exceeded during normal operation, and if the cabin temperature also has a corresponding value, then the compressor is switched on.



ATTENTION

Changing this value can result in impairment of operation and damage to the air-conditioning system.

Parameter 3: Switch-off temperature, compressor heating

Setting range: 30 to 55 °C

86 to 131 °F

Factory setting: 52 °C

126 °F

This parameter is used to set the maximum condenser temperature at which the compressor is switched off.



ATTENTION

Changing this value can result in impairment of operation and damage to the air-conditioning system.

Parameter 4: Switch-on temperature, compressor heating

Setting range: 27 to 50 °C

81 to 122 °F

Factory setting: 48 °C

118 °F

This parameter is used to set the condenser temperature at which the compressor is to be switched on again. If this temperature value is dropped below during normal operation, and if the cabin temperature also has a corresponding value, then the compressor is switched on.



ATTENTION

Changing this value can result in impairment of operation and damage to the air-conditioning system.

Parameter 5: Switch-on/switch-off hysteresis compressor

Setting range: 0.1 to 0.8 °C

0.2 to 1.4 °F

Factory setting: 0.8 °C

1.4 °F

This parameter is used to set the switch-on hysteresis of the setpoint temperature at which the compressor is switched on.

In the heating mode, the switch-on temperature is calculated = setpoint temperature minus switch-on/switch-off hysteresis.

In the cooling mode, the switch-on temperature is calculated = setpoint temperature plus switch-on/switch-off hysteresis.

If the switch-on temperature in the cabin is reached during normal operation, and if the condenser or evaporator temperature also reaches a corresponding value, then the compressor is switched on.



ATTENTION

Changing this value can result in impairment of operation and damage to the air-conditioning system.

Parameter 6: Correction value of displayed cabin temperature

Setting range: -5.5 to 5.5 °C
 -9.9 to 9.9 °F
 Factory setting: 0 °C
 0 °F

This parameter is used to calibrate the cabin temperature display. The component tolerances of the sensor and of the evaluation electronics can be compensated.



ATTENTION

This parameter cannot be used to set an incorrectly positioned cabin temperature sensor.

Parameter 7: Maximum time during which the evaporation temperature may be below Parameter 1, "Switch-off temperature, compressor cooling"

Setting range: 000 to 999
 Factory setting: 600

This parameter is used to set the time (in seconds) in which the compressor still remains switched on, although the evaporator has already reached the "Switch-off temperature, compressor cooling".

Parameter 8: Firmware revision

Display value of current firmware version.

Resetting setting values to factory setting

This parameter is used to reset to factory settings. In the process, the following procedure must be complied with:

- 10) Display the firmware version (8.xxx)
- 11) Continually press the plus button **+**
- 12) The firmware display flashes
- 13) "INIT" appears on the control element
- 14) The plus button **+** can now be released.

10 Commissioning

10.1 Check connections

Check all connections:

- Check the electrical connections for firm seating.
- Check that the sea water piping is firmly mounted and not leaking.
- Check that the air ducts are firmly mounted and not leaking.
- The air inlet and outlet air grilles must not be blocked.

10.2 Checking operation of condensed-water drain

Pour water into the condensed-water tray and ensure correct drainage:

- The drain must be clear.
- Connections sealed.

10.3 Filling sea water pump head

Self-priming sea water pumps:

- Fill pump head with water.

10.4 Test run



Fig. 11 Control element

1	Display		2	Plus button for changing the setpoint temperature	
3	Minus button for changing the set-point temperature		4	Fan setting button for controlling the fan speed	
5	Function button for setting/programming		6	On/Off button	
7	LED display for heating mode		8	LED display for automatically switching between operating modes	
9	LED display for cooling mode				

1. Connect the power supply as shown in the wiring diagram. Switch on the generator if necessary.
2. Switch on the air-conditioning system in the cooling mode. See chapter 7, "Operation" on page 13.
3. Check the sea water flow rate. Determine the flow rate of the exiting sea water with catch containers and a stop watch.



NOTE

The actual flow rate must be above the required minimum flow rate (see chapter 14, "Technical data" on page 30) to ensure fault-free operation at high sea water temperatures.

If the minimum value is not reached, the pressure losses in the sea water system should be reduced using the following measures:

- ▶ Use larger cross-sections
- ▶ fewer bends
- ▶ shorter lines
- ▶ use a more powerful pump

11 Inspection and Maintenance



WARNING

Evaporator fins can be damaged.

The evaporator fins can be easily bent. When installing, make sure that bent fins are correctly aligned again to ensure proper air feed.

It is recommended that a number of routine checks be carried out at regular intervals and when switching on the air-conditioning system so that the system continues to function properly and maintains its performance level for many years.

At least once a month, the function of the air conditioning system must be checked.

- Switch on the air conditioning system. The air conditioning system must run for at least 10 minutes.

11.1 Air filter

At least once per year:

Check the air filter on the evaporator of the air conditioning system and clean if necessary:

1. Pull the air filter upward out of the guide rails.
2. Clean the air filter with a vacuum cleaner and use water to flush it if necessary.
3. Reinsert air filter in the air conditioning system.

11.2 Sea water circuit

The operation of the sea water circuit must always be checked, especially after a longer absence.

Every time it is switched on, immediately

- Check whether sea water flows out of the sea water outlet.

At least once per week

- Check the sea water strainer for cleanliness.
- Clean if necessary.

At least once per month

- Check the entire sea water circuit from the through-hull fitting to the sea water outlet for leaks.

At least once per month

- Check the condensate outflow from the condensed-water tray for free passage and leaks.
- Check the condensed-water drain line for free passage and leaks.

Once per year



NOTE

The sea water circuit is only to be cleaned by an expert (installer or Webasto Service Centre).

- Clean the sea water circuit, including the condenser of the air conditioning system.

The time interval depends on the degree of biological fouling (by shellfish etc.).

Soiling of the sea water circuit reduces the sea water flow rate, which decreases the heat dissipation and can result in high-pressure switch-offs.

If the condenser is soiled, the cooling or heating capacity of the system decreases.

11.3 Important information on cleaning the sea water heat exchanger (condenser)

Please note the following important information before starting to clean the sea water heat exchanger (condenser).

Using cleaning agents

Excessive contact with acidic or corrosive cleaning agents can significantly shorten the service life of the condenser. In particular, this applies if this cleaning agent is used frequently, over a longer period of time or if it is highly concentrated. Bear in mind that excessive cleaning without sufficient reason to do so may result in the warranty being void.

No regular cleaning

Cleaning of the condenser is not part of routine maintenance and must only be carried out if there is a sound reason for doing so.

Indications for cleaning

Cleaning of the condenser is only necessary if various parameters such as the refrigerant pressure, power consumption and cooling capacity of the unit over longer periods of time differ considerably from typical values.

Forbidden cleaning agents

The sea water heat exchanger is made of titanium and must never come into contact with hydrochloric acid, formic acid or oxalic acid.

Disposing cleaning solutions

Make sure that all local regulations and legal requirements are observed when disposing of cleaning solutions.

Recommended chemicals

Nitric acid as well as organic acids (lactic acid, acetic acid, citric acid) are suitable. Avoid contact: Titanium must never come into contact with hydrochloric acid, formic acid or oxalic acid.

Sulphuric acid: Only use in low concentrations of up to a maximum of 5%.

Phosphoric acid: Up to 30% concentration permissible but only for a one-off treatment, not for frequent or continuous cleaning.

Chlorine/bromine Tablets: Suitable for one-off use but not recommended for permanent or continuous use.

Electrical chlorination: Possible for titanium sea water capacitors.

Mechanical cleaning: Titanium is very resistant to erosion and is therefore suitable for mechanical cleaning. High-speed flushing: Flushing of the titanium capacitor with an abrasive sand-water mixture at high speed (up to 8 times nominal flow) is possible.



WARNING

Webasto will not bear any responsibility for the effectiveness of external cleaning agents. Never exceed the recommended concentration or exposure time of cleaning agents. Following these regulations is of the utmost importance to ensure ideal performance and the longest possible service life of your sea water heat exchanger.

11.4 Electrical wiring

At least once a year, the electrical connections must be checked for corrosion of the contacts and firm seating. Also check the mechanical strain relief of the lines.

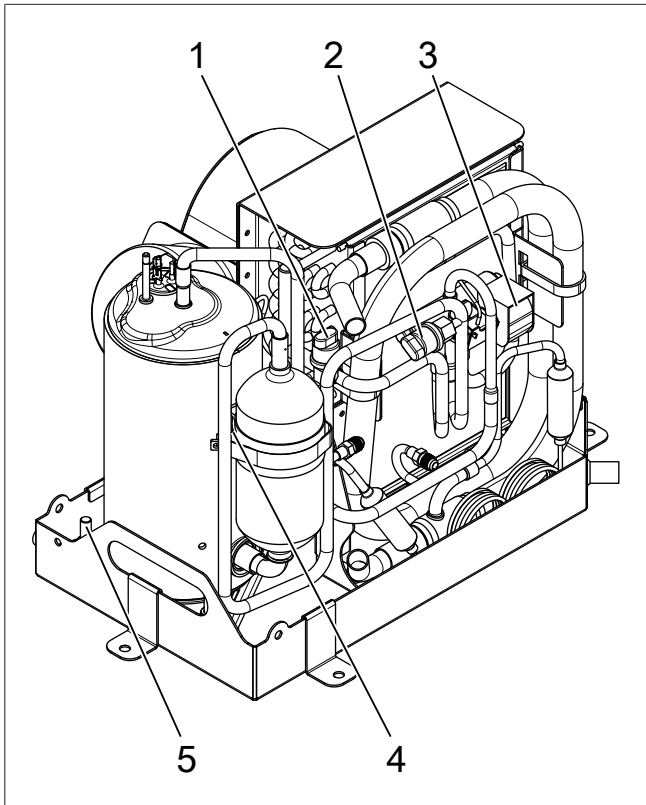


Fig. 14 Graphic for checking wiring

1	High-pressure switch
2	Low-pressure switch
3	Coil 4/2-way reverse valve
4	Compressor connection cable with earth
5	Condensed-water tray earthing cable

11.5 Repairing the refrigerant circuit



WARNING

Danger of explosion

Use suitable extraction devices, refrigerant hoses and recycling bottles.

- Use suitable extraction devices to remove the refrigerant.
- Check connections for leakage before removal.
- Transfer the extracted refrigerant to a suitable disposable bottle.
- Do not mix the refrigerant with others refrigerants.
- Do not overfill the disposable bottle.
- Flush the system with air or nitrogen.
- Thoroughly ventilate the room. Forced ventilation is recommended.
- Keep the fire extinguisher ready and wear personal protective equipment.



WARNING

Danger of explosion

Fully ventilate the machine room before commencing work. Remove the refrigerant and recycling bottle from the working area.

Please perform the following steps before refilling the system:

- Check the refrigerant circuit and all connections for leakage. It is important to ensure that there are no leaks to ensure efficient operation of the system.

- Avoid overfilling the cooling system. Add the correct quantity of refrigerant to ensure optimal performance.
- Carefully close and release the hoses. Proceed carefully when connecting and removing the hoses to prevent damage.

Before starting the system:

- Remove the refrigerant and recycling bottle from the working area. Ensure that there is no refrigerant left in the working area to ensure safety.
- Thoroughly ventilate the room. Forced ventilation is recommended.



WARNING

Danger of explosion

After completing the work on the refrigerant circuit, check it for leakage.

11.6 Checklist for inspection and maintenance

Maintenance task	Date								
1	Check the air filter on the evaporator and clean if necessary. See chapter 11.1, "Air filter" on page 23 and Fig. 3, No. 5.								
2	Check the flow rate of the sea water circuit at the sea water outlet. See chapter 11.2, "Sea water circuit " on page 23 and Fig. 6, No. 6								
3	Check and clean the sea water strainer. Refer to the filter manufacturer's specifications. See Sea water circuit and Fig. 6, No. 2.								
4	Check the entire sea water circuit for leaks. See chapter 11.2, "Sea water circuit " on page 23 and Fig. 6.								
5	Check the condensate outflow from the condensed-water tray and the condensed-water drain line for free passage and leaks. See chapter 10.2, "Checking operation of condensed-water drain" on page 22.								
6	Clean the sea water circuit. See chapter 11.2, "Sea water circuit " on page 23.								
7	Check the electrical connections for corrosion to the contacts and firm seating. See chapter 11.4, "Electrical wiring " on page 23: and Fig. 14.								
8	Check the shaft seal of the sea water pump and replace it if necessary (does not apply to magnetically coupled pumps).								

12 Decommissioning

If the air conditioning system is to be decommissioned, for example during winter, you must proceed as follows:

1. Switch off system on the control element.
2. Disconnect the power supply.
3. Close all sea water valves.
4. Completely empty sea water circuit, i.e. sea water lines, sea water strainer, sea water pump and condenser or fill with antifreeze.

13 Faults

13.1 Troubleshooting



ATTENTION

Troubleshooting is restricted to professionals

Troubleshooting requires comprehensive knowledge on the design and operation of the individual components of the air-conditioning system and may only be carried out by authorized professionals trained by Webasto for this purpose.



NOTE

Only use genuine Webasto spare parts to ensure fault-free operation of the air-conditioning system.

If faults occur, the system must be switched off immediately.

13.2 Faults that are displayed

The FCF Evo Series can display malfunctions in the following ways:

- On the screen in the form of a code (e.g. E101) and a text message.
- As an LED flash code, directly in the electrical box of the air conditioning system.

Every time a fault code occurs, the unit stops for approx. 60 seconds and then attempts to restart. If the same malfunction occurs more than six times consecutively within 30 minutes, then the system is completely shut down and a fault code is displayed continuously. No further restarts are attempted. The FCF Evo Series can only be reset after the cause of the fault has been rectified.

To reset the FCF Evo Series switch the device off and on again via the control element. Alternatively, disconnect and re-connect the power supply to reset the FCF Evo Series.

Fault code		Description	Possible cause	Correction
Display	"Alive" LED			
AAA	1x flashing, pause...	Undervoltage	Switch-off in case of under-voltage. Power supply below set undervoltage value for longer than 5 seconds. The cause is probably excessively long power cable for the on-shore connection, small cable cross sections, overloading or low power generator output.	Check setting (default setting 195 V (230 V) or 97 V (115 V)). Do not set below 195 V (230 V) or 97 V (115 V) to prevent damage to the compressor and subsequently voiding of the warranty. Ensure a better power supply. If necessary retrofit soft starts to lower the start-up current and therefore reduce the voltage drop.
A01	2x flashing, pause...	Compressor 1 shut-down due to low pressure	Pressure switch defective or power circuit interruption/short circuit.	Check electrical wiring. Replace pressure switch on Schrader valve.
			Cooling mode: - Air supply insufficient	Check air supply. Difference between air inlet/air outlet temperature of evaporator at least 4 K.
			Heating mode: - Sea water flow rate insufficient or sea water too cold (Temperature below 6 °C) - Sea water strainer blocked or no intake.	Check the flow rate of the sea water circuit at the sea water outlet. Difference between in/outflow temperature of condensers approx. 5 K. At sea water temperature < 6 °C: no heating possible in reverse heating operation. Clean sea water strainer and bleed sea water circuit.
A02	3x flashing, pause...	Compressor shut-down due to high pressure	Refrigerant shortage.	Check for refrigerant leak.
			Pressure switch defective or power circuit interruption/short circuit.	Check electrical wiring. Replace pressure switch on Schrader valve.
			COOLING MODE: - Sea water cooling insufficient. Sea water strainer soiled or no intake.	Check the flow rate of the sea water circuit at the sea water outlet. The minimum flow rates must be complied with. Clean sea water strainer and bleed sea water circuit.
			HEATING MODE: - Air supply insufficient	Check air supply. Difference between air inlet/air outlet temperature of evaporator at least 4 K.
A09	4x flashing, pause...	Fault, cabin temperature sensor	HEATING MODE: - Sea water temperature too high	Check sea water flow, set lower setpoint temperature, increase fan speed.
			Cabin temperature sensor defective, break/short-circuit in electrical circuit, cabin temperature sensor not connected.	Connect or replace cabin temperature sensor.

Fault code		Description	Possible cause	Correction
Display	"Alive" LED			
A10	5x flashing, pause...	Fault in temperature sensor of evaporator	Temperature sensor of evaporator defective or power circuit interruption/short circuit.	Check electrical wiring or replace sensor.
tA11 ^{*1}	n/a	Set evaporator temperature exceeded	Evaporator temperature too low in cooling mode or too high in heating mode	No corrective measures necessary. The compressor switches off and switches on again as soon as the cut-in temperature is reached. ^{*1}
INIT	6x flashing, pause...	Initialisation procedure or system blocked.	Electrical wiring defective, power circuit interrupted/short circuit.	Check cables and connections of pc-board and of control element. Replace defective cable, control element or pc-board.
n/a	n/a	No pc-board output.	Fuse faulty or break/short-circuit in this electrical circuit.	Repair or replace fuse, rectify break/short-circuit in electrical circuit or replace pc-board.
			Pc-board damaged by high voltage (RT1 blown)	Replace pc-board.
			Electronic relay (TRIAC) defective.	Replace defective TRIAC or defective pc-board.
n/a	n/a	Compressor not running.	Compressor defective or break/short-circuit in compressor wiring.	Check electrical wiring or replace defective compressor.
			Compressor overload or overload protection element on top of compressor defective.	Allow to cool down for some time or replace defective overload protection element.
n/a	n/a	No or insufficient cooling or heating capacity.	Poor air or sea water flow, soiling or circulation blocked.	Secure adequate air or sea water flow (see A01 and/or A02).
			Refrigerant shortage.	A low refrigerant level is generally indicated by low static pressure before start-up as well as non-fluctuating low pressure in connection with low high pressure reading. Check for refrigerant leaks, repair if necessary and top up required quantity of refrigerant.
			Oil block.	Leave air-conditioning system running in heating mode. Call out a refrigerant specialist if necessary. Technical datasheet available.
			Refrigerant circuit blocked. (capillary lines).	Have checked by refrigerant specialist. Technical datasheet available
			Compressor fault.	Have checked by refrigerant specialist.
n/a	n/a	Incorrect cabin/ambient temperature or water temperature displayed.	Temperature sensor positioned incorrectly, subject to interference or displayed values are not correct.	Check whether the sensor is subject to direct fault sources such as direct sunlight or devices radiating heat. Calibrate sensor. Replace defective sensor.

*1 = This status code is system information and not a fault which must be eliminated. The status indicator will go out automatically on reaching the cut-in temperature.

Table 2: Status / Error message table

13.3 Faults not displayed on control element

Symptom		
1	After switching on, the system does not react.	<p>Check:</p> <p>power supply, fuses in supply lines, fuses on pc-board, etc.</p>
2	The compressor starts up, however no sea water exits from the sea water outlet:	<p>If the sea water pump is running:</p> <p>Check whether the shut-off valves are opened. Check whether the sea water strainer is blocked. There could be air in the pump head causing the pump to malfunction. Bleed the air out of the sea water line, e.g. with a bleeder valve downstream of the pump.</p>
		<p>If the sea water pump is not running:</p> <p>Check the power supply to the sea water pump. The pump rotor may be blocked by dirt. If possible and accessible, using a tool turn the pump rotor from the motor side until it moves freely.</p>
3	The compressor and the sea water pump are running, but neither the heating mode nor the cooling mode function satisfactorily.	<p>Allow the fan to run in the automatic fan mode.</p> <p>Check the air ducts. If the air flow is interrupted with the compressor running, the evaporator can completely freeze, causing the entire air stream to be blocked. If the sea water flow rate is too low, the sea water in the condenser can freeze in heating mode, blocking and damaging the system. Check the fan speed setting, correct if necessary. Check the voltage level. Do not operate the system continually with insufficient voltage (under 195 V (230 V) or 97 V (115 V)). Heating mode takes a long time to start up. This is normal when the sea water is very cold. When the temperature of the sea water drops below approx. 6 °C, the heating efficiency decreases and the air-conditioning system takes a long time before producing the expected heat. If the performance of the system is still unsatisfactory after checking all of the above points, you should check the refrigerant filling. Check the fan speed setting, correct if necessary.</p>
4	The compressor does run, however it switches off continually before the set setpoint temperature has been reached. The high-pressure and low-pressure switch switch off the compressor due to an excessively high or excessively low working pressure.	<p>Check the minimum flow rate in the sea water circuit.</p>
5	An incorrect cabin temperature is displayed.	<p>Cabin temperature sensor positioned incorrectly, fault sources are present or display values are falsified.</p>
		<p>Check whether the cabin temperature sensor is subject to direct fault sources, like direct sunlight or devices radiating heat. Calibrate sensor or replace defective sensor.</p>

Table 3: Faults not displayed on control element

14 Technical data

14.1 FCF Evo Series self-contained air-conditioning unit 230 V

Type	FCF Evo 6K- R-230V-REV- R32	FCF Evo 10K- R-230V-REV- R32	FCF Evo 13K- R-230V-REV- R32	FCF Evo 16K- R-230V-REV- R32	FCF Evo 27K- R-230V-REV- R32
Cooling capacity [BTU/h] ¹⁾	6,000	10,000	13,000	16,000	27,000
Cooling capacity [kW] ¹⁾	1.8	2.9	3.8	4.7	7.9
Rated voltage [V]	230				
Frequency [Hz]	50/60				
Current consumption, operation [A] 50 Hz ²⁾	2.4	3.7	5.5	6.3	13
Fan output, free-blowing [m ³ /h] (cfm)	275 (162)	500 (294)	580 (342)	625 (368)	2x550 (2x324)
Supply air grille [cm ²]	150	250	390	390	650
Air inlet grille [cm ²]	325	550	800	800	1600
Minimum thickness insulation air duct [mm] (inch)	5mm (13/64")				
Recommended line fuse protection [A]	16				20 ³⁾
Fan connection [mm] (inch)	100 (4)		125 (5)		2X125 (2X5)
∅ Sea water connection [mm] (inch)	16 (5/8")	16 (5/8")	19 (3/4")	19 (3/4")	19 (3/4")
Minimum sea-water flow rate [l/min] 50 Hz	6	10	12	14	23
Minimum sea-water flow rate [l/min] 60Hz	7.5	12	15	17	28
max. permissible ambient temperature [°C]	+40°C				
Net weight [kg]	20.5	24	28.2	32	48
Dimensions (LxDxH) [mm] (inch). See also chapter 14.3, "Dimensions and minimum distances Type 6K- 16K" on page 32 and chapter 14.4, "Dimensions and minimum distances Type 27K" on page 33	405 x 320 x 315 (15.9 x 12.6 x 12.4)	480 x 335 x 315 (18.9 x 13.2 x 12.4)	510 x 350 x 370 (20.1 x 13.8 x 14.6)	550 x 350 x 370 (22 x 13.8 x 14.6)	575 x 515 x 410 (22.6 X 20.3 X 16.1)
Refrigerant Qty R32 [g]	250	250	260	640	850
Min. Sea water temperature in heating mode [°C]	5				
Max. Sea water temperature cooling mode [°C]	45				

¹⁾ BTU/h and electrical data are based on 7 °C evaporation temperature and 38 °C condensation temperature.

²⁾ Current consumption air conditioning system is dependent on compressor output. Maximum values under tropical conditions.

³⁾ Compressor only

14.2 FCF Evo Series self-contained air-conditioning unit 115 V

Type	FCF Evo 6K- R-115V-REV-R32	FCF Evo 10K- R-115V-REV-R32	FCF Evo 13K- R-115V-REV-R32	FCF Evo 16K- R-115V-REV-R32
Cooling capacity [BTU/h] ¹⁾	6,000	10,000	13,000	16,000
Cooling capacity [kW] ¹⁾	1.8	2.9	3.8	4.7
Rated voltage [V]	115			
Frequency [Hz]	60			
Current consumption, operation [A] 60 Hz ²⁾	4.2	7.4	9.1	13.2
Fan output, free-blowing [m ³ /h] (cfm)	275 (162)	350 (206)	430 (253)	650 (382)
Supply air grille [cm ²]	150	250	390	390
Air inlet grille [cm ²]	325	550	800	800
Minimum thickness insulation air duct [mm] (inch)	4 (5/32")			
Recommended line fuse protection [A]	16			25 ³⁾
Fan connection [mm] (inch)	100 (4)		125 (5)	
∅ Sea water connection [mm] (inch)	16 (5/8")	16 (5/8")	19 (3/4")	19 (3/4")
Minimum sea-water flow rate [l/min] 60Hz	6	10	12	14
max. permissible ambient temperature [°C]	+40°C			
Net weight [kg]	19.5	22	27	30.4
Dimensions (LxDxH) [mm] (inch). See also chapter 14.3, "Dimensions and minimum distances Type 6K- 16K" on page 32	405 x 320 x 315 (15.9 x 12.6 x 12.4)	480 x 335 x 315 (18.9 x 13.2 x 12.4)	510 x 350 x 370 (20.1 x 13.8 x 14.6)	550 x 350 x 370 (22 x 13.8 x 14.6)
Refrigerant Qty R32 [g]	250	200	340	580
Min. Sea water temperature in heating mode [°C]	5			
Max. Sea water temperature cooling mode [°C]	45			

¹⁾ BTU/h and electrical data are based on 7 °C evaporation temperature and 38 °C condensation temperature.

²⁾ Current consumption air conditioning system is dependent on compressor output. Maximum values under tropical conditions.

³⁾ Compressor only

14.3 Dimensions and minimum distances Type 6K- 16K

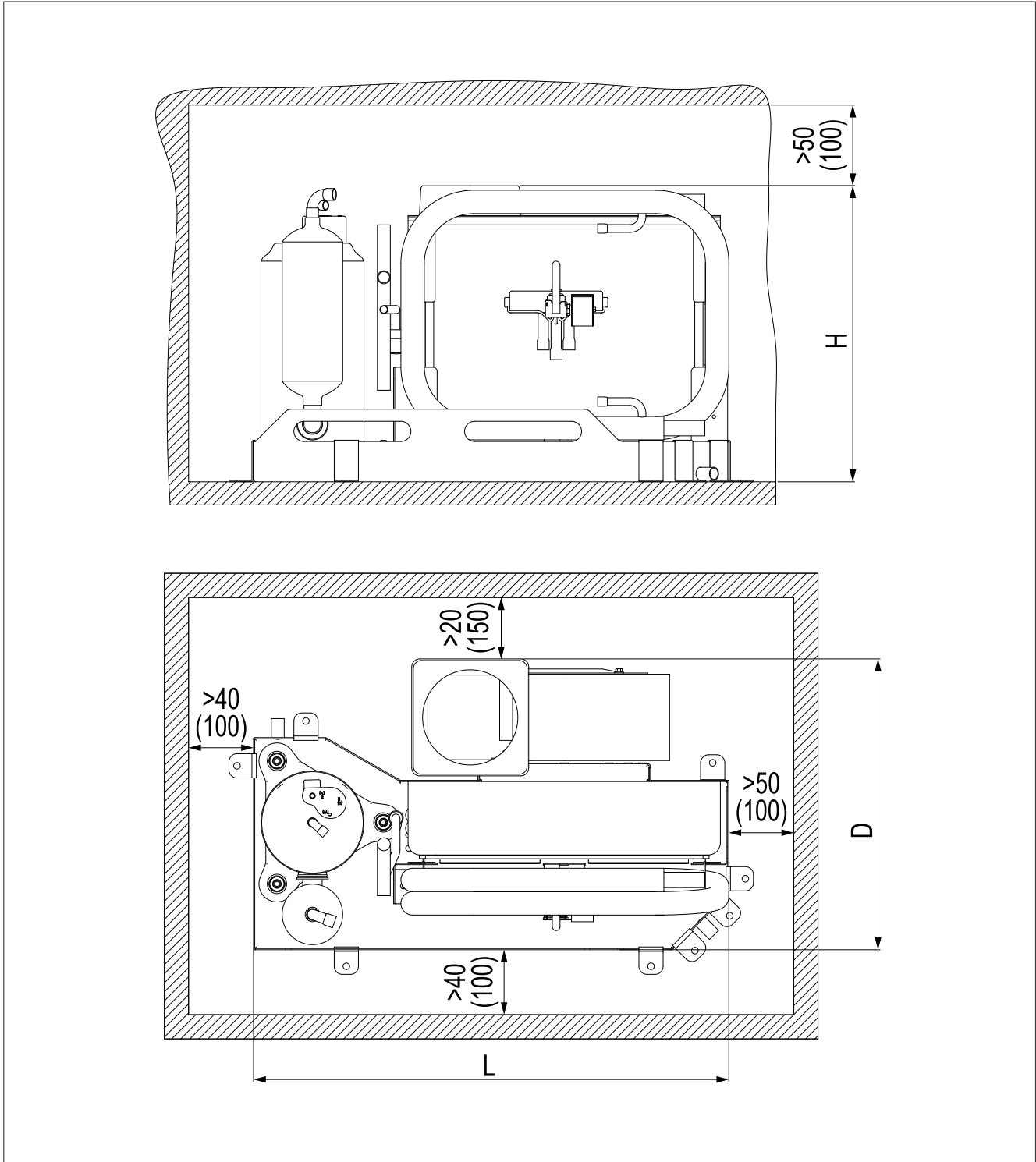


Fig. 15 Dimensions and minimum distances Type 6K- 16K (mm)

For the dimensions L, W and H of the type, see chapter 14.2, "FCF Evo Series self-contained air-conditioning unit 115 V" on page 31 or chapter 14.1, "FCF Evo Series self-contained air-conditioning unit 230 V" on page 30.

- > xx Minimum distance (mm)
- >(xx) Recommended distance (mm)



NOTE

If the cover plate cannot be removed, a distance of >100 mm should be maintained above the system to allow the air filter to be removed and cleaned.

14.4 Dimensions and minimum distances Type 27K

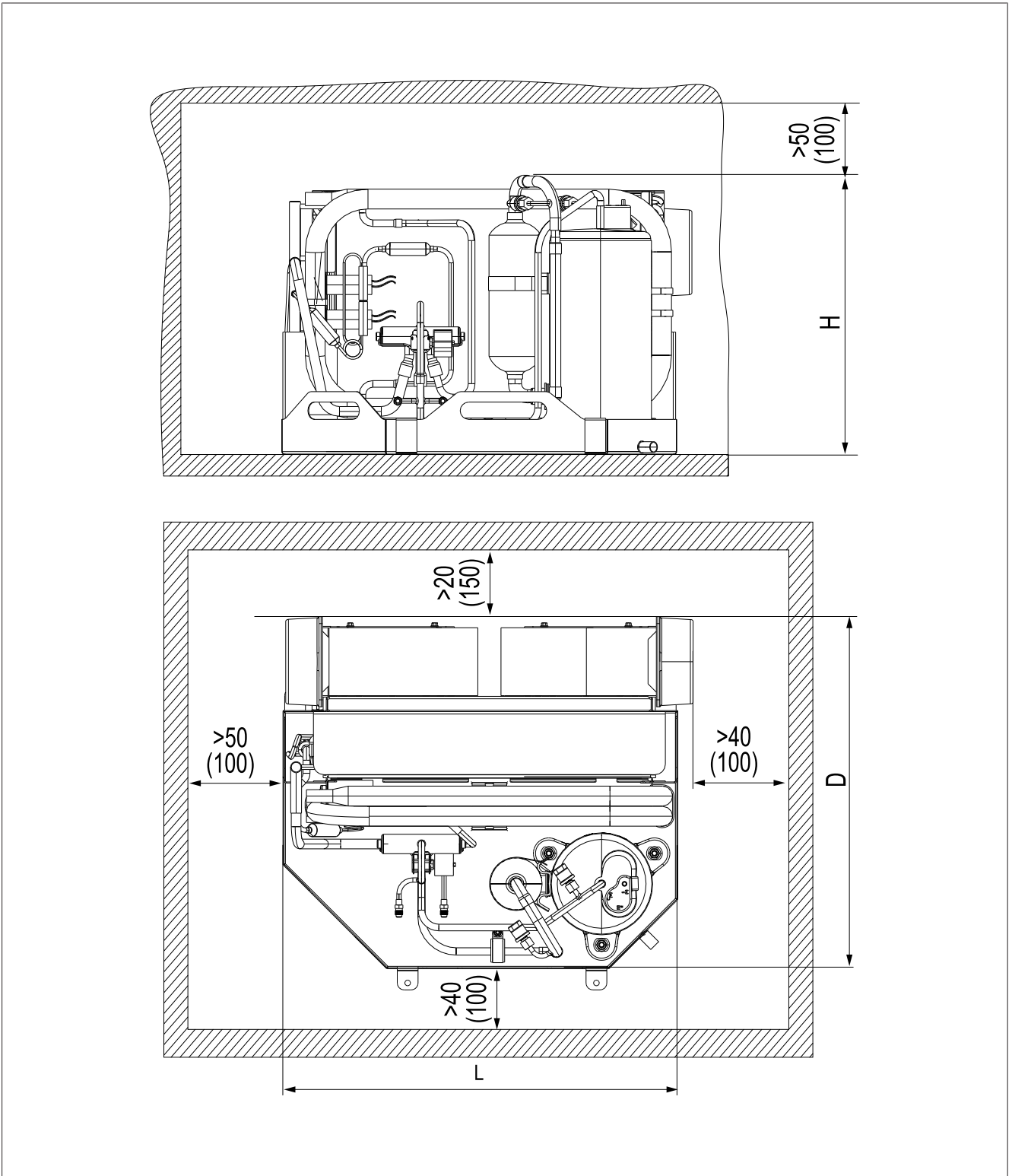


Fig. 16 Dimensions and minimum distances Type 27K (mm)

For dimensions L, W and H by type see chapter 14.1, "FCF Evo Series self-contained air-conditioning unit 230 V" on page 30.

> xx Minimum distance (mm)

>(xx) Recommended distance (mm)



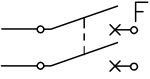
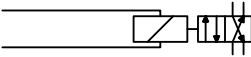
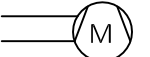
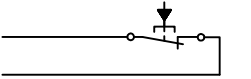
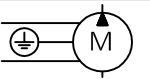
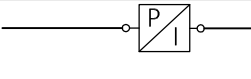
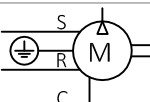
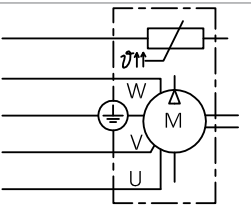
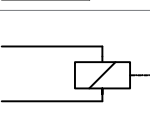
NOTE

If the cover plate cannot be removed, a distance of >100 mm should be maintained above the system to allow the air filter to be removed and cleaned.

15 Annex

15.1 Wiring diagrams

15.1.1 Wiring diagram, overview of symbols

Symbol	Description	Symbol	Description
	Line fuse protection		4/2-way reversing valve
	Fan		Pressure switch
	Sea water pump		sensor
	Compressor		Compressor with temperature sensor
	Relay		

15.1.2 Line fuses

Line fuse protection		Values
F1	Compressor	Max. 25 A (for recommended values, see chapter 14, "Technical data" on page 30)
F2	Power supply	Max. 16A

 **NOTE**

*: Use Type K or C circuit breaker conforming to EN IEC 60898-1.

15.1.3 Layout diagram - FCF Evo Series PCB

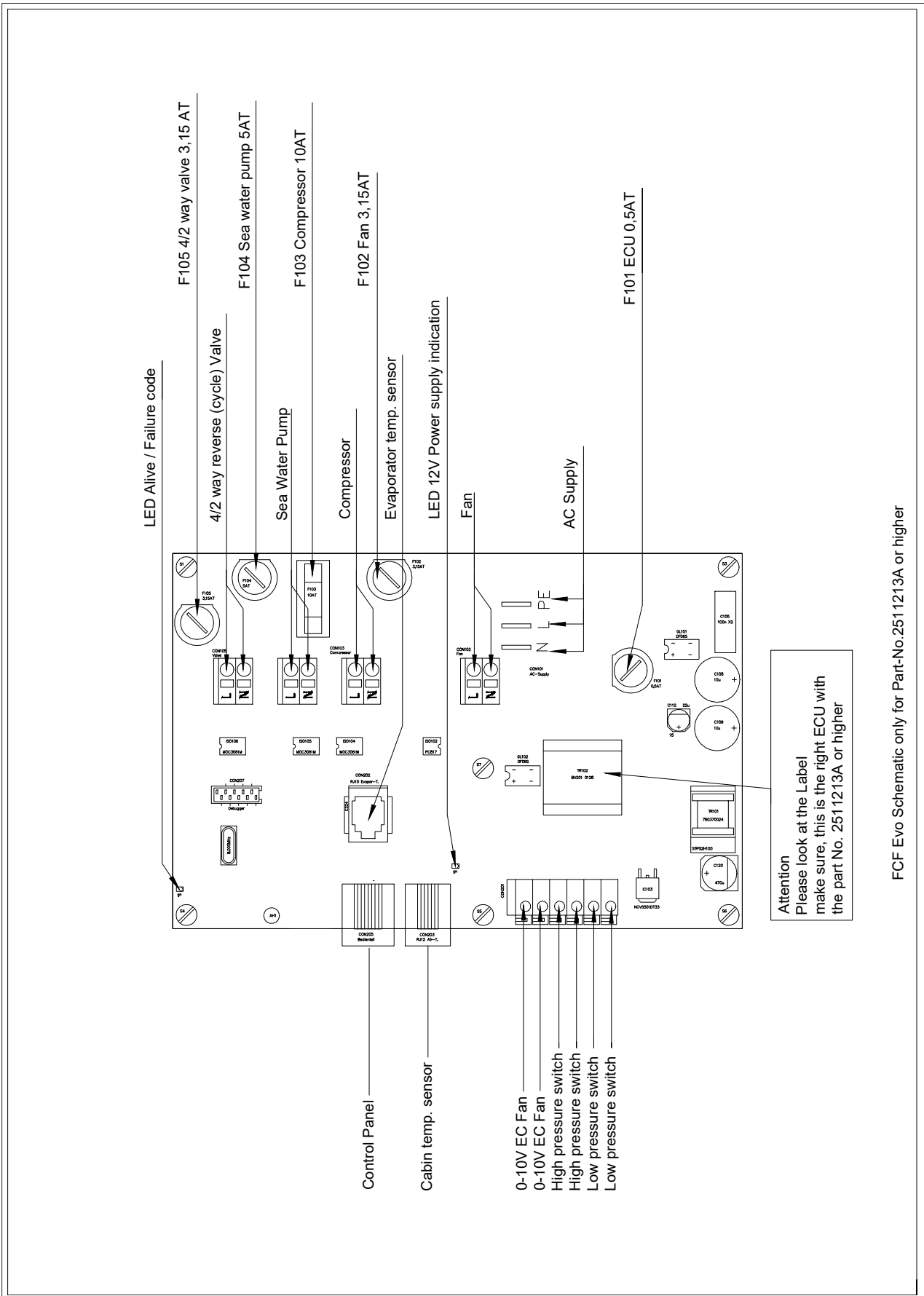
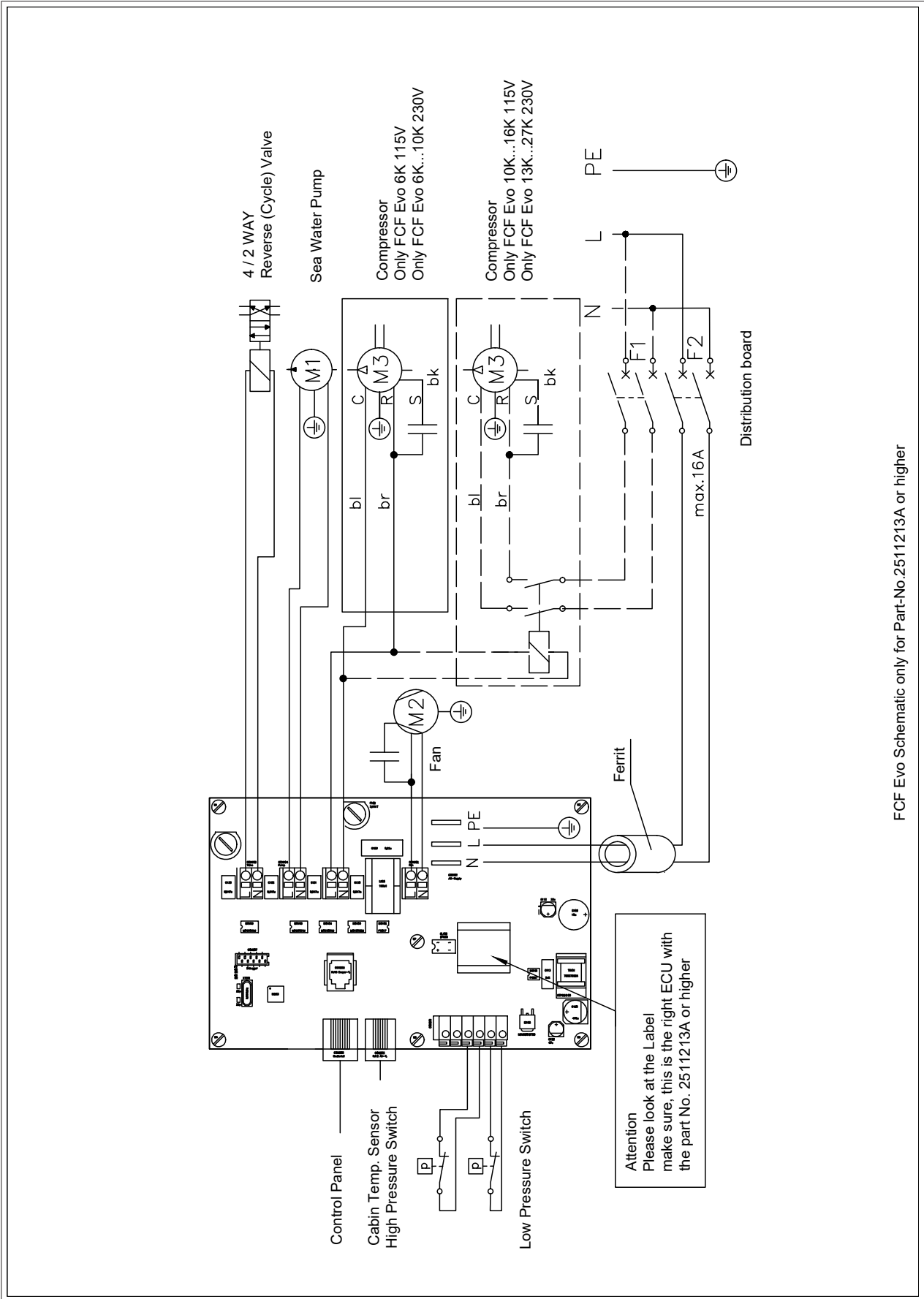


Fig. 17 Layout diagram - FCF Evo Series PCB

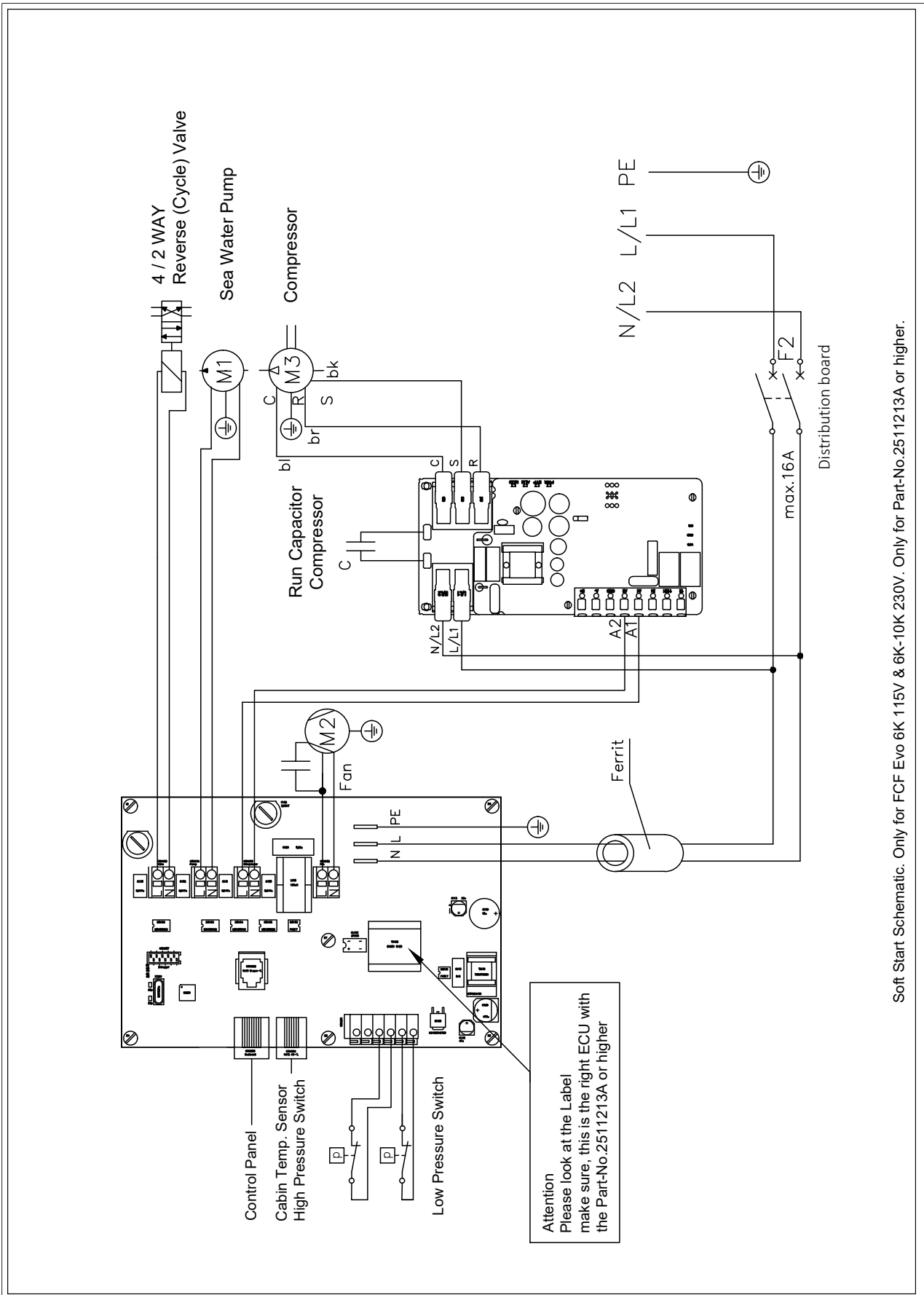
15.1.4 Wiring diagram - FCF Evo Series without soft start



FCF Evo Schematic only for Part-No.2511213A or higher

Fig. 18 Wiring diagram - FCF Evo Series without soft start

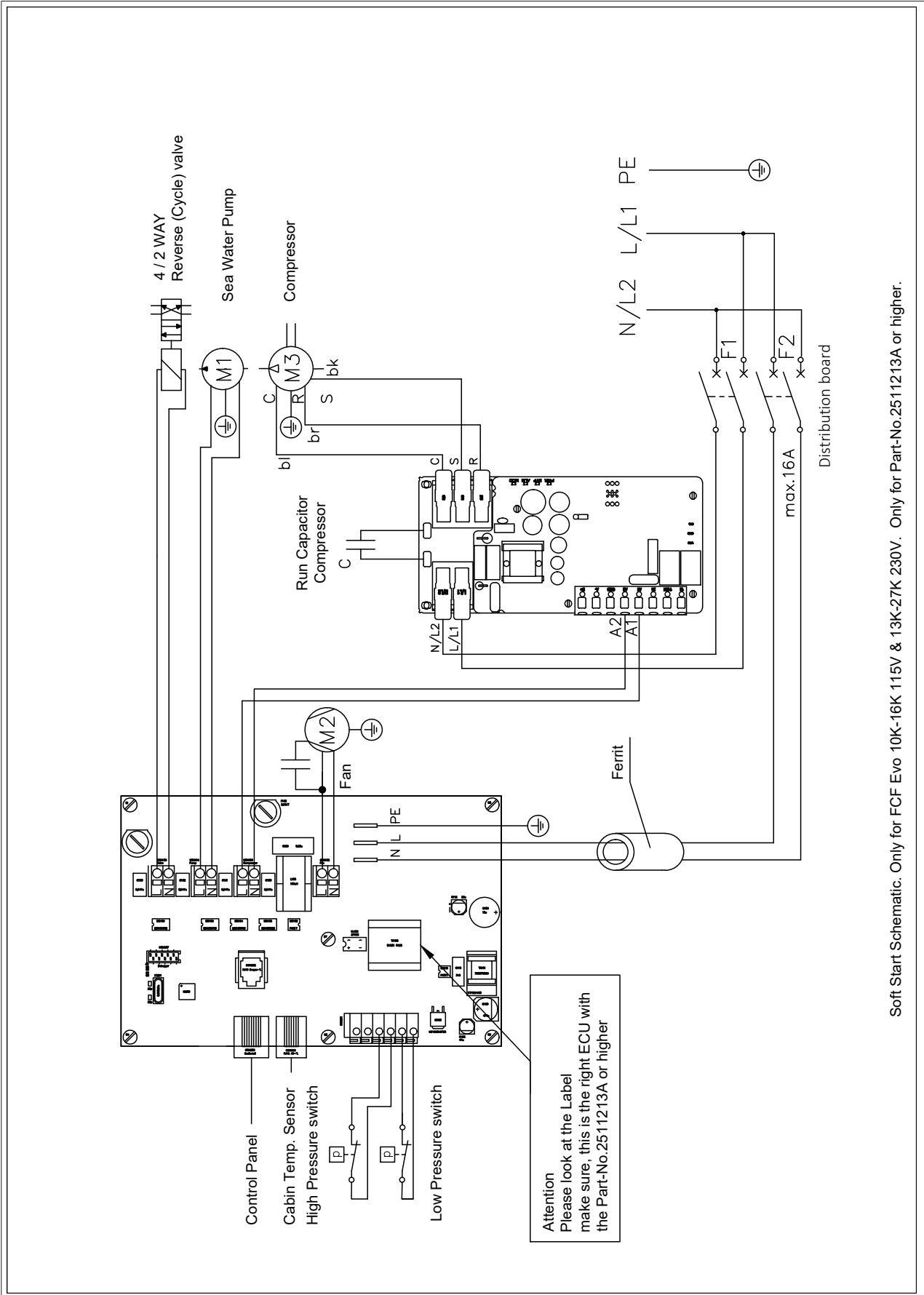
15.1.5 Wiring diagram - FCF Evo Series 6K to 10K 230V and 6K 115V with Soft Start



Soft Start Schematic. Only for FCF Evo 6K 115V & 6K-10K 230V. Only for Part-No.2511213A or higher.

Fig. 19 Wiring diagram - FCF Evo Series 6K to 10K 230V and 6K 115V with Soft Start

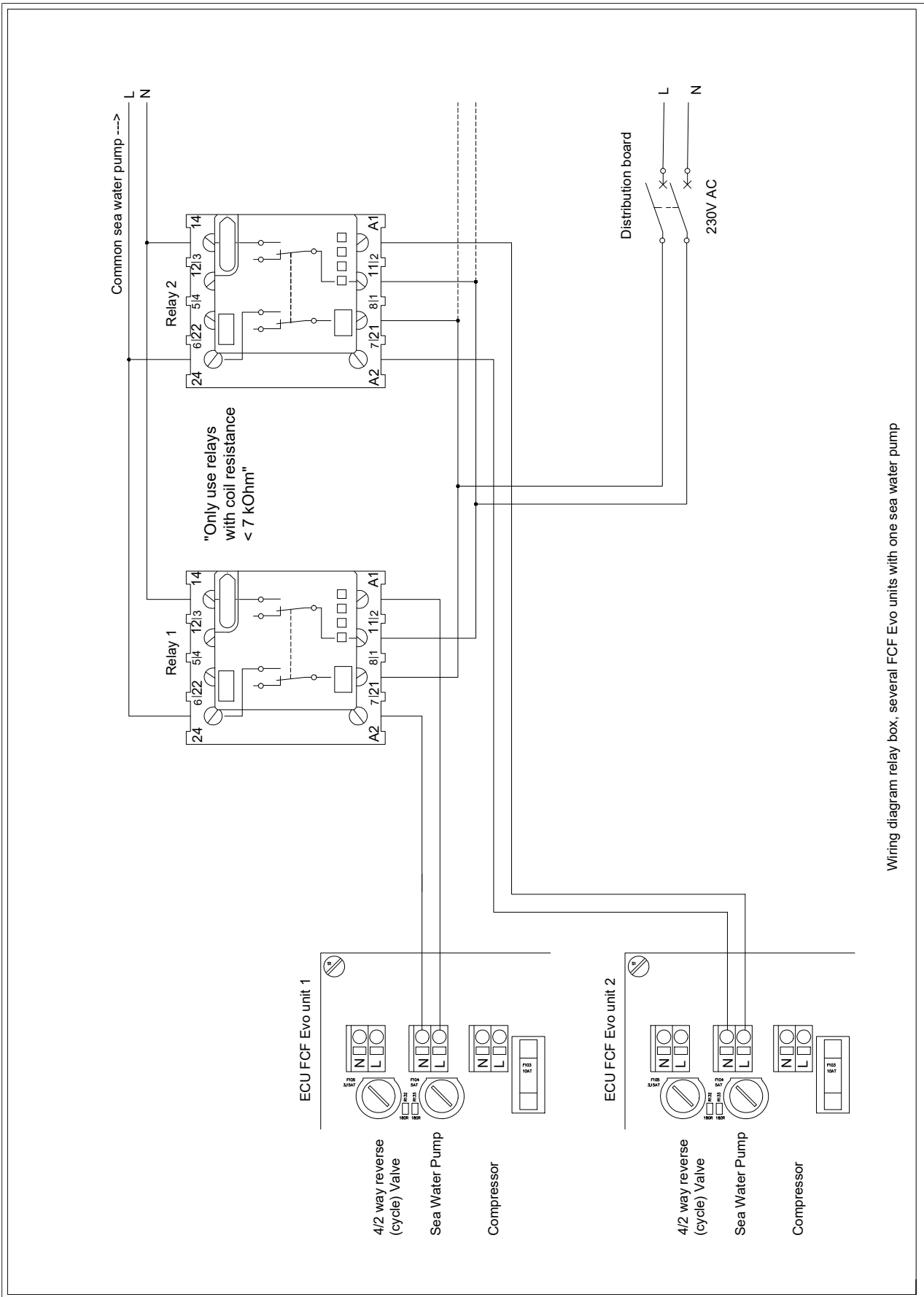
15.1.6 Wiring diagram - FCF Evo Series 10K to 16K 115V and 13K to 27K 230V with Soft Start



Soft Start Schematic. Only for FCF Evo 10K-16K 115V & 13K-27K 230V. Only for Part-No.2511213A or higher.

Fig. 20 Wiring diagram - FCF Evo Series 10K to 16K 115V and 13K to 27K 230V with Soft Start

15.1.7 Wiring diagram - FCF Evo Series multiple systems with one sea water pump



Wiring diagram relay box, several FCF Evo units with one sea water pump

Fig. 21 Wiring diagram - FCF Evo Series multiple systems with one sea water pump

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