

HC INVERTER CHILLER

INSTALLATION AND USER MANUAL

VARIABLE CHILLER SYSTEMS



Chilled water air conditioning with inverter compressor.
Reverse-cycle cooling and heating · 230 V 1~ and 400 V 3~, 50/60 Hz.

HC24 – HC120 VFD

CFPG 08 · 10 · 12 · 16 · 24 fan coil units

VERSION 2.4 · OCTOBER 2026 · EN



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About this manual

Thank you for choosing MBC Marine

This manual covers the planning, installation, commissioning, operation, maintenance and troubleshooting of the MBC Marine **Variable Chiller** chilled water air conditioning system: the chiller unit with inverter compressor, the fan coil units (air handlers), the chilled (fresh) water circuit and the seawater circuit. Keep it on board, close to the chiller, for the whole life of the system.

WHO SHOULD READ WHAT

Reader	Read these parts
Boat owner / user OWNER	Part 1 Safety · Part 10 Operation · Part 12 Maintenance · 13.2 First checks
Installer INSTALLER	All parts, especially Parts 3–9. Hand this manual to the owner after commissioning.
Service technician TECHNICIAN	Parts 8, 11, 12 and 13. Refrigerant work requires certification (1.6).

Section headings carry the same coloured tags, so each reader can find the parts relevant to them at a glance.

SAFETY SIGNS USED IN THIS MANUAL



DANGER

A hazardous situation which, if not avoided, **will result in death or serious injury**.



WARNING

A hazardous situation which, if not avoided, **could result in death or serious injury**.



CAUTION

A hazardous situation which, if not avoided, **could result in minor or moderate injury**.



NOTICE

Information about **damage to the system or the boat**, or loss of performance or warranty. No personal injury risk.



NOTE

Useful information and tips for correct installation and operation.

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PART 1

Safety

Read this part completely before installing, operating or servicing the system. Ignoring these instructions may result in death, serious injury, fire, flooding or damage to the boat.

1.1 Intended use **OWNER** **INSTALLER**

The system is designed exclusively for cooling and heating the interior of boats. The chiller uses seawater as the heat source and heat sink and circulates chilled or heated fresh water (with glycol) to the fan coil units in the cabins. Any other use is considered improper. Use the system only within the operating limits in 2.5 and according to this manual.

1.2 Qualified personnel **INSTALLER**

Installation, electrical connection and commissioning must be carried out only by qualified personnel familiar with marine AC electrical, plumbing and refrigeration practice and with the applicable regulations. All electrical work must be done by a qualified marine electrician. Work on the refrigerant circuit is reserved for certified refrigeration technicians. A professional installation according to this manual is a condition of the warranty.

1.3 Electrical safety **OWNER** **INSTALLER**



DANGER – ELECTRIC SHOCK

Parts of the chiller are powered by 230 V or 400 V AC. The inverter can hold a dangerous charge for some time after switch-off. Always switch off and lock out the supply at the main switchboard before opening the chiller or any electrical box. Failure to do so can result in severe injury or death.

- Protect the chiller with its own circuit breaker (8.4) and connect the protective earth (PE) to the chiller housing.
- Do not operate the chiller with covers removed.

1.4 Location, fire and exhaust gases OWNER

INSTALLER



WARNING

Do not install the chiller near petrol engines, fuel tanks, LPG/CNG cylinders, regulators, valves or fuel lines, or near any other combustible material. Do not install fan coil units or route air ducts where they could draw carbon monoxide, exhaust gases or other toxic vapours into the accommodation.

The chiller is usually installed in the engine room (3.2). During installation and maintenance wear safety glasses and work gloves, and keep a fire extinguisher close to the work area. The refrigerant circuit contains pressurised copper pipes.

1.5 Water and flooding OWNER INSTALLER



WARNING – FLOODING

A seacock (ball valve) on the seawater intake is mandatory. Without it the water flow cannot be shut off in case of a leak or during maintenance, which can sink the boat. Never run the seawater pump with the strainer opened or removed.

1.6 Refrigerant R32 OWNER TECHNICIAN



DANGER – FLAMMABLE REFRIGERANT R32

- The chiller contains refrigerant **R32** under pressure. It is factory charged for the life of the system.
- R32 is **mildly flammable** (safety class A2L). Keep open flames, sparks, smoking and hot surfaces away from the chiller, and install it only in a ventilated space.
- Do not pierce, cut, drill or heat any part of the refrigerant circuit.
- Escaping refrigerant can cause frostbite. In a closed space it displaces oxygen; when heated by an open flame it produces toxic gases.
- Only certified technicians trained for flammable refrigerants may open the refrigerant circuit, using R32-approved tools and leak detectors. If you suspect a leak, switch off the system, ventilate the space and call a technician.

1.7 Protective devices OWNER TECHNICIAN



WARNING – NEVER BYPASS SAFETY DEVICES

Never bridge, bypass or disable the water flow switch, the high-pressure switch, the low-pressure sensor or any temperature protection, not even for testing. Running without these devices can freeze and burst the evaporator, destroy the compressor or cause a fire. If a protection trips repeatedly, find and remove the cause or contact MBC Marine technical service.

To ensure continuous improvement, MBC Marine reserves the right to modify specifications and designs without prior notice.

1.8 Limitation of liability OWNER INSTALLER

MBC Marine assumes no liability for damage resulting from:

- installation or connection not in accordance with this manual;
- mechanical impact or electrical overvoltage;
- modification of the product without written permission from MBC Marine;
- use outside the intended purpose or the specified operating limits;
- electrolysis or corrosion where no sacrificial anode or bonding is installed (7.8).

PART 2

System overview

2.1 Main components OWNER INSTALLER

The Variable Chiller system cools or heats several independent zones of the boat. It consists of four parts that work together:

- 1 **Chiller unit** – contains the inverter compressor, the condenser (seawater heat exchanger), the evaporator (fresh water heat exchanger), the 4-way valve and the controller.
- 2 **Fan coil units** (air handlers) – blower and water coil in each cabin, each with its own fan coil (FCU) controller and motorised water valve.
- 3 **Chilled (fresh) water circuit** – a closed loop with circulation pump, strainer and expansion tank, carrying water with glycol from the chiller to each fan coil and back.
- 4 **Seawater circuit** – intake, seacock, strainer and seawater pump; the seawater passes through the condenser and is discharged overboard.



Fan coil unit with electrical box and controller



Chiller unit

2.2 How the system works **OWNER** **INSTALLER**

COOLING MODE

- 1 The fan coil blower draws warm, humid cabin air through the water coil; the air gives its heat to the circulating water and is cooled and dehumidified.
- 2 The warmed water returns to the chiller and gives its heat to the refrigerant in the evaporator.
- 3 The compressor raises the refrigerant pressure; in the condenser the heat is transferred to the seawater and discharged overboard.
- 4 The chilled water returns to the fan coils and the cycle continues.

HEATING MODE

The 4-way (reversing) valve reverses the refrigerant flow: the chiller extracts heat from the seawater and heats the circulating water, which releases the heat in the cabins through the fan coils (reverse-cycle heating). Fan coils with an electric heater can add heat in each cabin separately (6.1).

2.3 Inverter compressor and zone control

OWNER **INSTALLER**

The compressor is driven by an inverter (VFD), so its speed (frequency) follows the actual load. Each fan coil has its own controller that opens and closes its motorised water valve, so the water flow in the system varies continuously with the number of open zones.

The chiller control monitors the supply and return water temperatures. Their difference (ΔT) shows the actual heat load. When all fan coil valves are closed, ΔT approaches zero, the control recognises that the set temperature has been reached and it can stop the circulation pump (standby, 11.10). This keeps the system stable and avoids unnecessary circulation.

2.4 Models **OWNER** **INSTALLER**

Chiller units, 24 000–120 000 Btu/h: **230 V 1~** HC24, HC36, HC50, HC64 and HC80 VFD; **400 V 3~** HC64, HC80, HC96 and HC120 VFD. Fan coil units: CFPG 08, 10, 12, 16 and 24 (8 000–24 000 Btu/h). Full technical data: Part 14.

2.5 Operating limits OWNER INSTALLER

Seawater temperature strongly affects performance. The limits refer to the seawater temperature at the chiller's seawater inlet, assuming correct installation, continuous water flow and clean strainers.

Mode	Full capacity	Reduced capacity	Do not operate
COOL	below 27 °C	27–40 °C	above 40 °C
HEAT	above 7 °C	5 °C–7 °C	below 5 °C



NOTICE

Never operate the system at seawater temperatures below 5 °C. The seawater can freeze in the condenser, stop the flow and cause compressor drive faults (E1:30, E1:33). Operation outside these limits is excluded from warranty.

PART 3

Planning the installation

3.1 Before you start **INSTALLER**

Plan all connections before starting: chiller location, chilled water main loop and branches, circulation pump, expansion tank and fill point, fan coil locations, air ducts and grilles, condensate drains, seawater intake, strainer, pump and outlet, power supply and display. Good planning gives easy access for installation and for later maintenance of both the chilled water system and the fan coils.

The plumbing is the most common root cause of problems in chilled water systems (air traps, dirt, undersized pipes, missing balancing). Give Part 5 special attention.



NOTICE

Start the installation only when every component location complies with the applicable regulations. Follow the tags and labels on the equipment as well as this manual.

3.2 Chiller location **INSTALLER**

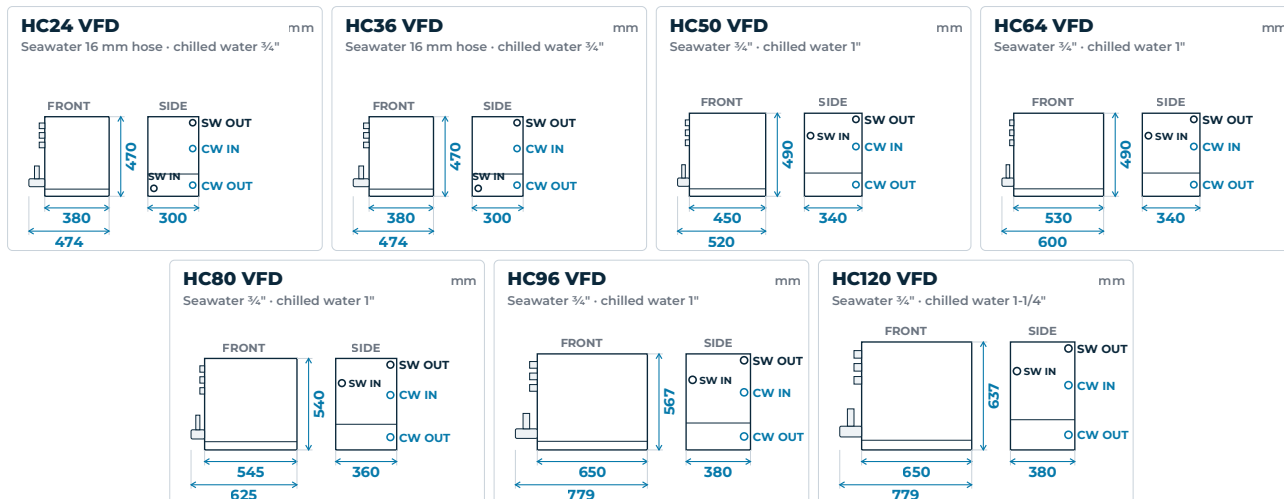
- Usually installed in the engine room, on a stable, horizontal base that supports its weight when the boat is moving.

- Dry location with easy access for service. Keep 0.9–1.2 m free space around the unit and at least 0.9 m above it.
- Below the fan coils and above the circulation pump (5.2).
- Close to the seawater pump and the circulation pump, to keep pipes short.
- Use vibration-damping mounts so that noise and vibration are not transmitted to the hull.

3.3 Display and controllers **INSTALLER**

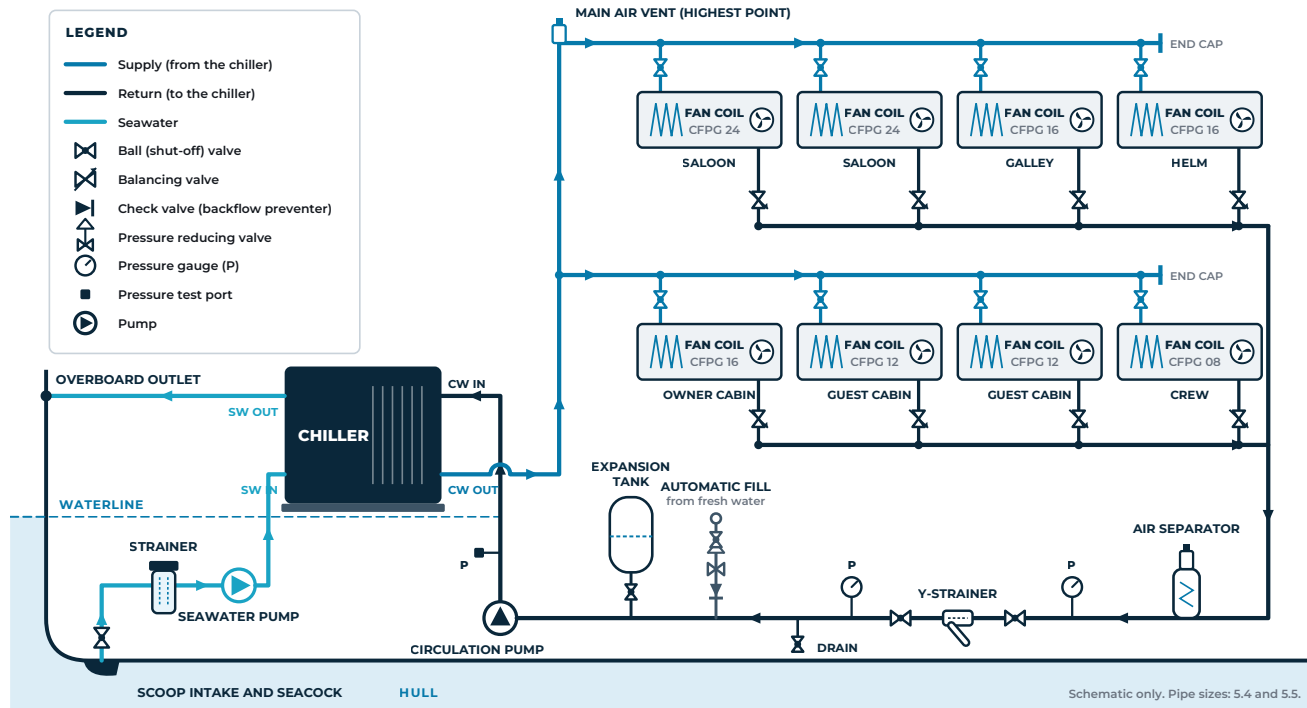
Install the chiller display on a dry, flat horizontal or vertical surface with easy access. Each fan coil controller is installed in its cabin, away from direct sunlight, heat sources and supply air grilles.

3.4 Chiller dimensions and connections **INSTALLER**



Outline dimensions in mm, drawn to a common scale. Front: housing length and overall length including the service valves. Side: connections. SW = seawater, CW = chilled water. Chilled water enters at the upper (CW IN) and leaves at the lower connection (CW OUT); seawater enters at the lower (SW IN) and leaves at the upper connection (SW OUT). Follow the flow arrows on the unit: reversing the flow can cause malfunction, for example of the water flow switch. Technical data: 14.1.

3.5 Typical piping layout **INSTALLER**



Sample piping schematic with reverse return. The circulation pump sits at the lowest point and feeds the chiller; strainer, gauges, air separator, expansion tank and automatic fill are on the return (pump suction) side. Each fan coil has a shut-off valve on the supply and a balancing valve on the return.

PART 4

Installing the chiller

4.1 Mounting **INSTALLER**

- 1 Place the chiller on a solid, horizontal surface in the location chosen in 3.2, with the required free space around it.
- 2 Put vibration-damping material under the base and secure the unit so that it cannot move in a seaway.
- 3 Fasten all seawater and chilled water pipes so that they do not load the connections, the pump or other components.
- 4 Avoid loops and sharp bends in the pipes; they create air or water traps.
- 5 Route any condensate from the chiller to the bilge with a continuous fall and keep the drain free of blockages.

4.2 Pressure gauge on the chiller **TECHNICIAN**

The pressure gauge on the front of the chiller shows the refrigerant pressure. It helps the technician monitor operation and diagnose faults; the refrigerant pressure is also shown on the status screen (10.3). The owner does not need to adjust anything.

4.3 Testing after installation **INSTALLER**

After installation pressure-test the water circuits for leaks (9.1) before insulating joints and before the first start. This finds problems before they become major.

**NOTICE**

Follow all safety regulations and the tags and labels on the equipment. Wear safety glasses and gloves, and keep a fire extinguisher near the work area.

PART 5

Chilled water circuit

5.1 Glycol INSTALLER OWNER



NOTICE

Failure to maintain the correct glycol concentration can freeze and burst the evaporator and voids the warranty.

- Add glycol only after the system has been flushed, bled and leak-tested (Part 9).
- Use **non-toxic, inhibited propylene glycol**, 25–30 % concentration, following the glycol manufacturer's instructions. Any brand can be used.
- Do not use automotive antifreeze: its additives are corrosive to copper.
- At 25–30 % the freeze point is about –10 to –13 °C; keep it below –10 °C. Check the concentration with a refractometer at least once a year and whenever water has been lost or added.
- With PVC piping the concentration must not exceed 30 %, with CPVC 25 %; higher concentrations damage these materials.

5.2 Layout: air and water traps INSTALLER

Place the circulation pump at the lowest point of the loop, the chiller above it and the fan coils at the highest points.

Minimise changes of vertical direction: pipes should follow a steady upward or downward slope. Every vertical reversal creates an air or water trap, which causes noise, blocks the flow and makes filling, venting and draining difficult.

- Install a vent valve (bleeder) wherever an air trap can form, and a drain at the lowest point of every water trap.
- All MBC fan coils and chillers have bleeder valves. In addition, install a main bleeder at the highest point of the system, routed to a valve with a discharge in the engine room, so that the system can be filled and vented at the same time. Local high points may need their own bleeder valves.
- Run the return lines (to the chiller) above the supply lines (from the chiller), so that air rises with the water.
- Secure all piping with the correct fittings and support it by fastening it to the boat's structure. Check that all connections and hose clamps are properly tightened.
- Install service valves for later maintenance; use only full-flow ball valves. Unions or flanges may be added, but leak-test them after installation.
- Follow the flow arrows on the chiller: chilled water enters at the upper and leaves at the lower connection; seawater enters at the lower and leaves at the upper connection.

AUTOMATIC AIR BLEEDER

Install an automatic air separator vertically on the return (warm) side of the loop, where air bubbles separate most easily (recommended: SpiroVent AA100 or AA200). Once the pump is primed, it removes air automatically; only the highest fan coils may still need manual venting. If automatic bleeders are used, an automatic fill system must also be installed (5.7).

5.3 Strainer and cleanliness INSTALLER



WARNING

Never operate the system without strainers in both the chilled water and the seawater circuit. Without a strainer the pump and the heat exchangers fail. Missing strainers void the warranty.

- Chilled water circuit: 20-mesh Y-strainer. Seawater circuit: 10-mesh strainer. Coarser meshes must not be used; finer meshes need more frequent cleaning.
- Install the strainer upstream of the chiller, normally just before the circulation pump. No fan coil may be connected between the strainer and the chiller.
- The strainer must be serviceable and marked with a flow arrow. The arrow may point horizontally or downwards, never upwards; if horizontal, the basket must hang below the pipe.

- Install ball valves before and after the strainer, so that it can be cleaned without losing much water, and pressure gauges on both sides to show when it needs cleaning.
- Placing the pump before the strainer is acceptable but not recommended.
- The water system must be able to be shut off in case of a malfunction or for maintenance.

Cleanliness. Strainers do not catch fine particles. Build the system from clean pipes and components, seal the ends of stored pipes, and clean any dirty part before installation. Even a small amount of dirt can collect in the evaporator and cause it to freeze. Frozen evaporators clogged with mud or debris are not covered by the warranty. A mud separator gives extra protection but is not needed if the system is clean.

5.4 Sizing the main loop INSTALLER

Correct sizing of the main loop is essential. Incorrect sizing causes noise, unstable operation, uneven temperatures or shutdowns.

- 1 Add up the nominal capacity of all fan coils (kW; 1 kW = 3 412 Btu/h).
- 2 Calculate the water flow: $V [m^3/h] = Q [kW] / (1.163 \times \Delta T [K])$, where ΔT is the design difference between supply and return water and 1.163 follows from the density and specific heat of water.

- 3 Choose the pipe size so that the water velocity stays between **0.8 and 1.5 m/s**.

Example: 18 kW with $\Delta T = 5 \text{ K}$: $V = 18 / (1.163 \times 5) \approx 3.1 \text{ m}^3/\text{h}$.

Water flow (m ³ /h)	Pipe size (internal)	DIN nominal size
below 2	20 – 25 mm	DN20 – DN25
2 – 3.5	25 – 32 mm	DN25 – DN32
3.5 – 6	32 – 40 mm	DN32 – DN40
6 – 10	40 – 50 mm	DN40 – DN50
10 – 15	50 – 65 mm	DN50 – DN65
15 – 20	65 – 80 mm	DN65 – DN80

Velocity too high: pressure loss and noise. Too low: air pockets and unstable flow.

The chilled water flow rate is critical for the correct operation of the chiller. Check that it is within the range given in the specifications (14.1). For questions about the installation or operation, consult MBC Marine Technical Service.

DESIGN CONSIDERATIONS

- **Distance:** the further a fan coil is from the chiller, the higher the pressure loss. Because the fan coil valves open and close automatically, water always flows towards the path of least resistance; long branches need careful sizing and balancing.

- **Fittings:** every tee, elbow and valve adds pressure loss. Use one size larger pipe or a preset valve on branches with many fittings.
- **Future expansion:** if fan coils may be added later, size the main loop for the final load.
- **Variable flow:** size the main loop and the pump for the dynamic, zone-dependent flow, not for one fixed load.
- **Balancing and minimum flow:** balance multi-zone systems with preset valves, automatic balancing valves or differential pressure controllers. Where needed, a bypass maintains the minimum flow through the chiller (5.7).

COMMON MISTAKES

Mistake	Result
Oversized pipes	Unstable flow, air pockets, noise; slow control response
Undersized pipes	High pressure drop, too little water flow, poor cooling or heating; overloaded pump
Pipe length and fittings ignored	Distant fan coils get too little water and cabins stay uncomfortable

5.5 Fan coil branches INSTALLER

Connect each fan coil with pipes sized for its capacity. Use a hose connector that matches the fan coil connections; never reduce or enlarge the pipe diameter at the connection.

Fan coil capacity	Pipe size (internal)	DIN / inch
6 000 – 12 000 Btu/h	16 mm	DN15 (½")
16 000 – 24 000 Btu/h	20 mm	DN20 (¾")
30 000 – 36 000 Btu/h	25 mm	DN25 (1")

Install a full-port ball valve before each fan coil for maintenance:

Fan coil capacity	Shut-off valve
up to 24 000 Btu/h	¾" full-port ball valve
30 000 Btu/h and above	1" full-port ball valve

BALANCING VALVES

Branch lengths and positions differ, so their hydraulic resistance differs too. Install balancing valves:

- static preset balancing valve – limits the flow with a one-time setting;
- automatic differential pressure control valve – ideal for variable flow systems;
- thermal balancing valve – for special cases.



NOTICE

Hydraulic balancing is not optional: it is a basic requirement for comfortable operation. Never reduce the connection size, and give every fan coil its own shut-off valve.

5.6 Circulation pump INSTALLER

The circulation pump is the heart of the system. Because the fan coil valves open and close independently, the flow changes continuously; choose the pump with this dynamic operation in mind.

- **Flow:** the total flow from 5.4, plus a 10–20 % safety margin.
- **Head:** enough to overcome the friction losses of the supply and return pipes and the resistance of fittings, valves and heat exchangers.
- **Variable flow:** the pump must be able to sense and adapt to changes in pressure and flow as the fan coil valves open and close.
- **Voltage:** the pump is powered from the chiller (8.2, 8.3); use a pump rated for that voltage.

INSTALLING THE PUMP

- As low as possible in the loop and as close as possible to the chiller, easily accessible for maintenance.
- Discharge pointing vertically upwards with a straight vertical pipe, so that no air is trapped in the pump head.
- Straight pipe of at least 30 cm on the inlet and discharge side.
- Vibration isolation mounts; service valves on both pump connections.
- A pressure gauge on the pump inlet, visible from the fill valve; a gauge on the discharge side is recommended.

- Pressure ports directly before and after the pump, to determine the flow from the pump curve.

5.7 Expansion tank, fill and bypass **INSTALLER**

EXPANSION TANK

Connect a closed membrane expansion tank to the suction (inlet) side of the circulation pump, with a service valve at the tank connection. Set the pre-charge pressure according to the static pressure of the system. Mount the tank preferably vertically and support its weight; the tank or the valve must not load the pipe connection.

PRESSURE GAUGE

Install a pressure gauge on the return line near the expansion tank and the pump, clearly visible, so that the operating pressure can be checked and any pressure loss detected.

AUTOMATIC FILL

With automatic bleeders an automatic fill system is required: low pressure causes pump cavitation and shortens the pump life. The fill valve must keep the pump inlet pressure at about 1.4 bar and must include a backflow preventer. Check the glycol concentration regularly, because the fill dilutes it.

BYPASS AND MINIMUM FLOW

The chiller needs a minimum water flow. Each MBC fan coil has its own flow control valve, so the flow through the chiller changes with the open fan coils.

- If the fan coil capacity exceeds the chiller capacity by more than 10 %, a bypass around the flow control valves may be needed if the pump cannot force enough water through the chiller.
- If the chiller capacity is more than 10 % greater than the fan coil capacity, a bypass flow control (for example a differential pressure valve) may be needed to balance the system and keep enough water flowing through the chiller.

TWO-PUMP SYSTEM

Large multi-zone systems can use two pumps: one circulates water through the chiller, the other to the fan coils. A balancing pipe connects the two circuits, so no extra flow control devices are needed. A full-flow valve in the balancing pipe lets the remaining pump supply the whole system if one pump fails.

5.8 Insulation **INSTALLER**

- Insulate all chilled water pipes with closed-cell insulation at least 19 mm thick; thicker in spaces without air conditioning. Condensation is a common problem and often goes unnoticed until it causes water damage.

- Insulate the straight sections before the leak test; insulate joints and fittings after the system has passed the test.
- Label supply and return pipes. Cover all pipe ends and tape split insulation; supports must not compress or damage the insulation.
- Enclosing the pumps reduces condensation on them.

PART 6

Fan coil units

6.1 Fan coil overview OWNER INSTALLER

Each fan coil unit contains a blower, a water coil, a drain pan and a motorised water valve controlled by its own fan coil controller. CFPG 10, 12 and 16 fan coils have a built-in 1 000 W electric heater, CFPG 24 a 2 000 W heater (14.2). The heater can heat each cabin independently and boost heating when needed. The fan coils are not electrically connected to the chiller or to the chiller display; each is supplied separately with 230 V.

6.2 Placement and mounting INSTALLER

- Install the fan coil as low as possible (e.g. under a berth or at the bottom of a locker) and the supply air outlet as high as possible. This gives good air circulation and prevents short cycling.
- Mount the unit directly behind the return air grille. Keep at least 76 mm free space from bulkheads or other obstructions.
- Apply the non-slip isolator tape supplied to the base of the unit to reduce vibration.
- Fix the unit to a flat, level surface with the four mounting brackets supplied, spaced evenly around the drain pan. Screws and washers are supplied by the installer.

- Mount the fan coil's electrical box (with the blower start capacitor) remotely on a bulkhead or a sturdy frame.

6.3 Blower orientation and ducting INSTALLER

Before installation, turn the blower outlet to the position that gives the most direct duct route: loosen the fixing screw, rotate the blower horizontally or vertically, then tighten the screw firmly.

- Install ducts as straight and smooth as possible; avoid excessive bends and loops. Secure the duct so it cannot move, but do not compress or pinch it.
- Never reduce the duct diameter (e.g. from 150 mm to 100 mm); the system is sensitive to reduced airflow.
- Avoid 90°–180° bends; each can reduce the airflow by up to 25 %.



NOTICE

Do not direct the supply air towards the return air intake: short-circuited air causes a loss of performance.

6.4 Condensate drain **INSTALLER**

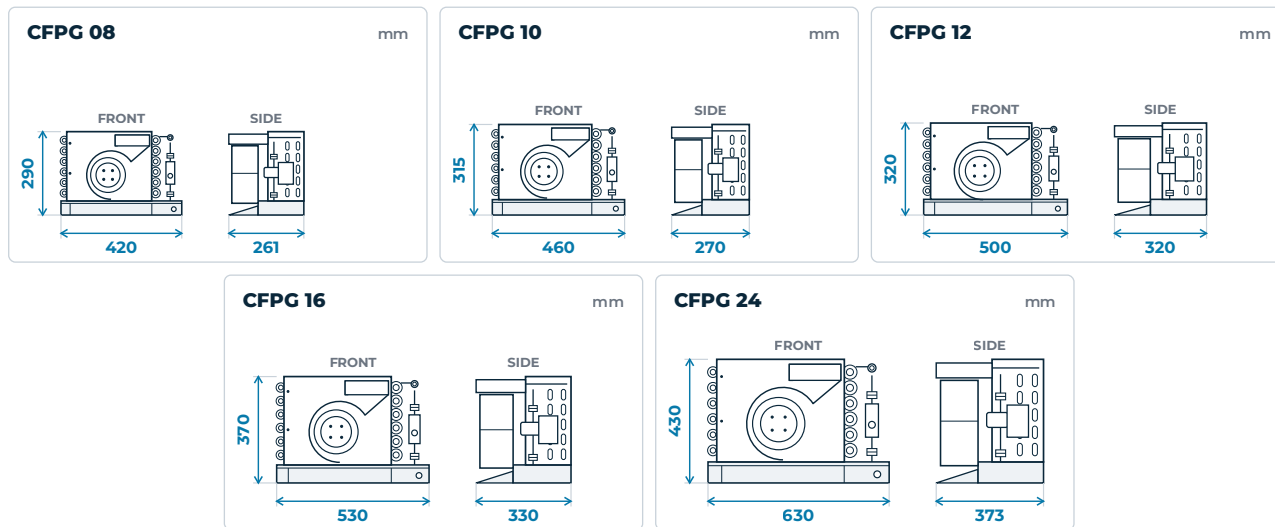
In cooling mode the fan coil produces condensate, collected in the drain pan. Choose the location so that drainage is always possible. Route the drain with a continuous fall to the bilge, ideally near the automatic bilge pump. The drain pan has two drains, one at each end.

Where gravity drainage to the bilge is not possible, collect the water and pump it out. The outlet of the drain pump must not be combined with the outlets of other systems.

6.5 Water and electrical connection **INSTALLER**

Connect the supply and return pipes as described in 5.5, with a shut-off valve before each unit and the water sensor fixed and insulated on the water inlet of the fan coil (12.10). All fan coil connections are $\frac{3}{4}$ ". Connect the 230 V supply to the fan coil electrical box according to the label on the box. Size the supply circuit for the electric heater (up to about 9 A for a 2 000 W heater).

6.6 Fan coil dimensions **INSTALLER**



Fan coil units, front and side view. The electrical (control) box is mounted separately and not shown. Chilled water OUT (top) and IN $\frac{3}{4}$ " on the valve side, condensate drain $\frac{1}{2}$ " in the drain pan. Outline dimensions per model in mm (W × H × D, drawn to a common scale); further data: 14.2.

PART 7

Seawater system

The seawater circuit removes heat from the condenser (cooling) or supplies heat to it (heating). Insufficient seawater flow is the most common cause of high-pressure, high-temperature and compressor drive faults.

7.1 Component order **INSTALLER**

- 1 Scoop-type through-hull intake
- 2 Ball valve (seacock), directly on the fitting
- 3 Seawater strainer (10-mesh, observe the flow arrow)
- 4 Seawater pump
- 5 Condenser inlet of the chiller (lower connection)
- 6 Condenser outlet (upper connection) → overboard outlet

**NOTICE**

Always use a separate intake and seacock for the air conditioning. Never draw seawater from the engine or generator intake.

7.2 Seawater intake **INSTALLER**

Install the intake as deep and as close to the keel as possible: within 15 cm of the keel and ahead of the engine intake. On

most boats, especially fast ones, use a forward-facing scoop-type intake, so that it stays submerged while the system runs. Consider how the boat's motion and heel change the position of the intake relative to the waterline; on sailing boats the intake can rise out of the water when heeling and air-lock the pump. Make sure the intake fitting is easily accessible. Use the correct drill size and seal the fitting with a marine sealant suitable for underwater use, following the sealant manufacturer's instructions.

7.3 Seacock **INSTALLER**

**WARNING**

A ball valve on the seawater intake is mandatory. Without it the water flow cannot be shut off safely, which can be life-threatening.

Install the ball valve on the intake fitting and fit the bronze hose connector to the valve.

7.4 Strainer **INSTALLER**

Install the strainer where it is easy to open and clean, with the flow direction according to its marking. Never run the

pump with the strainer removed: shells or debris can lodge in the condenser and cause system failure.

7.5 Seawater pump **INSTALLER**

- The centrifugal pump is **not self-priming**: install it below the waterline, close to the chiller, so that water flows to it freely.
- Bolt it to a horizontal surface with resilient mounts; the discharge must point upwards and be the highest point of the pump head, with a straight vertical pipe leaving the pump.
- Straight inlet pipe of at least 30 cm.
- Do not install check valves in the seawater circuit: trapped air then cannot escape and the pump air-locks.
- Choose a pump that delivers the seawater flow of all connected units (Part 14).
- Install it where it is accessible but cannot be stepped on or hit by moving machinery.
- Never run the pump dry; dry running destroys it.

7.6 Hoses and outlet **INSTALLER**

- Connect intake → strainer → pump → lower condenser inlet (marked with an arrow) → condenser outlet → overboard outlet.
- Route hoses with a continuous rise from the intake to the chiller and then down to the outlet. Avoid loops, kinks, high points and 90° bends; use smooth curves or 45° fittings.

- Seal all metal threaded joints with thread sealing cord (e.g. Loctite 55) or an approved pipe thread sealant; do not use PTFE tape on metal threads.
- Double-clamp all hose connections below the waterline.

7.7 Pump relay box (several units) **INSTALLER**

When one seawater pump serves several air conditioning units, use an MBC pump relay box. It runs the pump whenever any connected unit runs. The pump must deliver the combined flow of all units.

7.8 Sacrificial anode and bonding **INSTALLER**

Install a sacrificial anode (zinc or aluminium) upstream of the seawater pump to protect the system, especially the condenser, against corrosion.

Connect all metal parts in contact with seawater to the boat's common bonding (grounding) system: the intake fitting, the pump (through its ground wire) and the chiller. This prevents electrolysis and corrosion by stray currents.



NOTICE

MBC Marine assumes no liability for damage caused by electrolysis or corrosion if no sacrificial anode or bonding is installed.

7.9 Pump wiring INSTALLER

Connect the pump only to the pump output of the chiller (8.2, 8.3) or of the relay box. Check the wiring label on the pump motor and the supply voltage. Make sure the pump turns in the direction of the arrow on the pump head. Use the correct wire size and terminals.

7.10 Leak check INSTALLER

After installation and launching, inspect all fittings, hoses and seals for leaks, especially around the pump, the intake and the chiller; leaks there can cause significant water damage over time. Check again when the system runs for the first time.

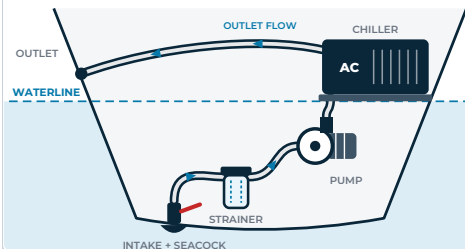
Final check. Before starting the unit, inspect the entire water system for leaks. Make sure all connections are tight and that no water seeps from any joint. If possible, carry out a pressure test to confirm that the system holds the expected water pressure without leaking.

7.11 Correct and incorrect seawater installation **INSTALLER**



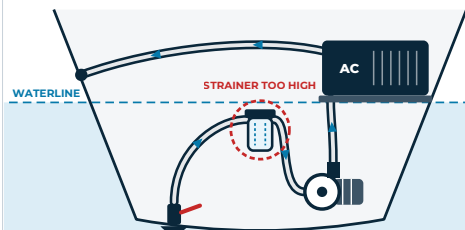
CORRECT

Steady rise from intake to unit, then down to the outlet. Pump and strainer below waterline.



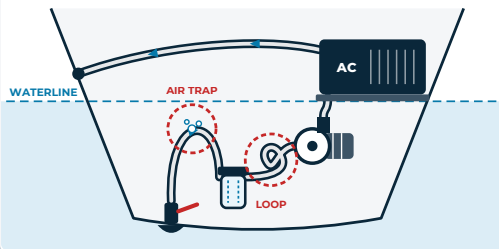
INCORRECT

The strainer must not be higher than the pump. Keep it low and close to it.



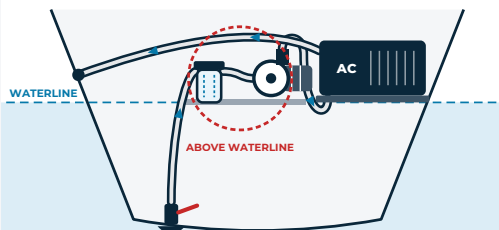
INCORRECT

Loops, kinks or high points in the hose trap air and stop the flow.



INCORRECT

Pump and strainer above the waterline: the pump cannot fill and runs dry.



PUMP HEAD ORIENTATION



Outlet pointing up
Air escapes, pump primes



Outlet sideways
Air stays in the pump



Outlet pointing down
Air stays in the pump

Correct: steady rise from intake to chiller, then down to the outlet; pump and strainer below the waterline. Incorrect: loops or high points that trap air; pump or strainer above the waterline; pump outlet not pointing upwards.

PART 8

Electrical installation



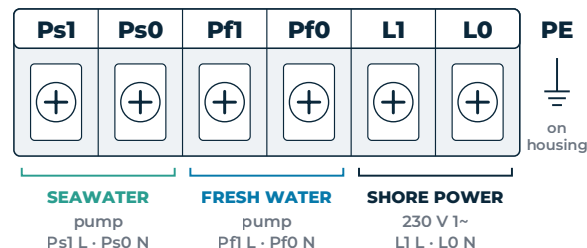
DANGER – ELECTRIC SHOCK

All electrical work must be carried out by a qualified marine electrician. Switch off and lock out the main power supply before working on the unit.

8.1 General INSTALLER

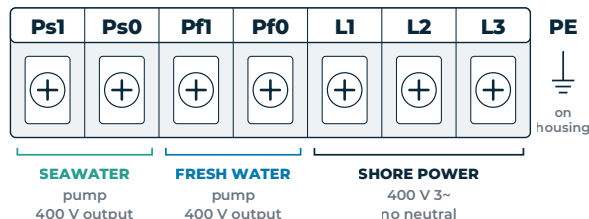
- Check that the supply matches the rating plate: 230 V single-phase or 400 V three-phase, 50/60 Hz.
- Connect the protective earth (PE) with a ring terminal directly to the metal housing of the chiller.
- The pump outputs carry the supply voltage of the chiller: use 230 V pumps on 230 V chillers and 400 V pumps on 400 V chillers.
- Check and tighten all terminals and check the earthing before switching on.
- The fan coils have their own 230 V supply (6.5).

8.2 230 V single-phase chiller INSTALLER



Terminal	Connection
Ps1 / Ps0	Seawater pump, phase / neutral (230 V)
Pf1 / Pf0	Circulation (fresh water) pump, phase / neutral (230 V)
L1 / L0	Supply, phase / neutral (230 V)
PE	Ring terminal on the housing

8.3 400 V three-phase chiller INSTALLER



Terminal	Connection
Ps1 / Ps0	Seawater pump, 400 V
Pfl / Pf0	Circulation (fresh water) pump, 400 V
L1 / L2 / L3	Supply, phases 1, 2, 3 (400 V, no neutral)
PE	Ring terminal on the housing

The 400 V chiller has no neutral connection, and its pump outputs supply 400 V. A missing phase or wrong supply causes E1:36 (phase loss) or E1:30 (drive fault). Check the phase voltages before the first start.

8.4 Circuit breaker and cables INSTALLER

- Protect each chiller with its own circuit breaker, rated for the maximum (heating) current of the model in 14.1.
- Size the supply cable for the breaker and the cable length; the minimum cross-section is **2.5 mm²**.
- When one seawater pump serves several units, connect it through an MBC pump relay box (7.7).

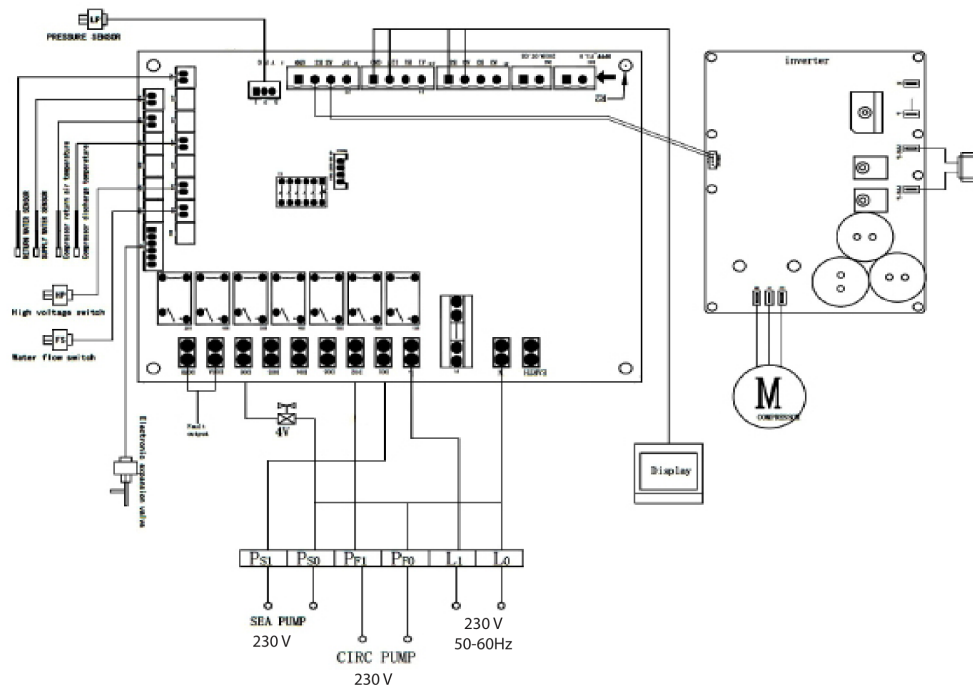
Use marine-grade tinned multi-strand cable and crimped terminals, sized for the cable length and the protective device. Route cables away from hot or moving parts and secure them against vibration.



NOTICE

Loose terminals cause voltage drops, arcing and drive faults. Re-tighten the terminals after the first weeks of operation (12.6).

8.5 Wiring diagram **INSTALLER** **TECHNICIAN**



Wiring diagram, 230 V 50/60 Hz chiller. Control board with return and supply water sensors, compressor suction and discharge temperature sensors, pressure sensor (LP), high-pressure switch (HP), water flow switch (FS), electronic expansion valve, 4-way valve (4V), fault output, display; inverter board with compressor (M); terminal strip Ps1/Ps0 (seawater pump), Pfl/Pf0 (circulation pump), L1/L0 (supply).

8.6 Several chillers with one display INSTALLER

TECHNICIAN

Two or more chillers (max. 8) can run synchronised from one common display. The display of unit 1 (MASTER) controls all connected units, so they do not have to be set individually.

- 1 Connect the units with one pair of 0.3–0.5 mm² wires on terminals **A1** and **B1** of each unit (A1 to A1, B1 to B1). A twisted pair is recommended.
- 2 Give each unit a unique address with DIP switches 1–3 on the control board (table). The address is also the unit's name on the display.
- 3 On the MASTER display open OPERATION SETTINGS and enable each SLAVE unit (Unit 2 Enable ... ON).



NOTICE

Each unit must keep its own display connected; a unit cannot operate without it. The common control is done from the MASTER display.

DIP1	DIP2	DIP3	Unit
OFF	OFF	OFF	Unit 1 – MASTER
ON	OFF	OFF	Unit 2 – slave
OFF	ON	OFF	Unit 3 – slave
ON	ON	OFF	Unit 4 – slave
OFF	OFF	ON	Unit 5 – slave
ON	OFF	ON	Unit 6 – slave
OFF	ON	ON	Unit 7 – slave
ON	ON	ON	Unit 8 – slave



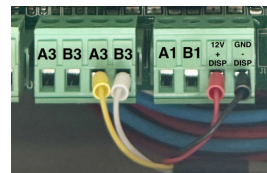
Unit 1 (MASTER)
1-2-3 OFF



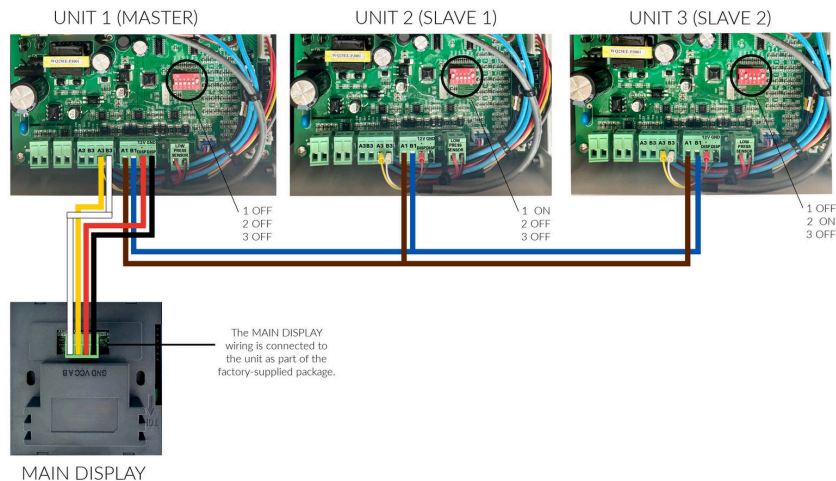
Unit 2
1 ON



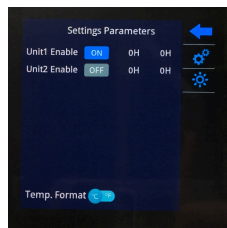
Unit 3
2 ON



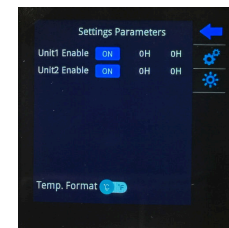
A1 / B1 bus terminals and display connection on the control board



Example: three units on one display. Unit 1 (MASTER) DIP 1-2-3 OFF; unit 2 DIP1 ON; unit 3 DIP2 ON. The main display is connected to unit 1 (factory-supplied cable).



OPERATION SETTINGS: slave unit disabled



Slave unit enabled (Unit 2 Enable ON)

PART 9

Commissioning



NOTICE

As a condition of the warranty, the installer must provide clean circulating water. Dirt collects in the evaporator, which can freeze and rupture, and it clogs the fan coil valves.

9.1 Leak test and flushing **INSTALLER**

- ➊ Leak-test the fresh water plumbing during installation and again when it is complete, especially joints that will be hidden. Pressurise the pipes with air: the piping must hold **5 bar for at least 12 hours**.
- ➋ Assembly leaves debris such as sealing tape or sealant in the pipes. Flush the whole circuit thoroughly with clean water before the first fill. Do not let water into the chiller or the fan coils before the circuit has been flushed.
- ➌ Collect some of the drained water in a bucket and check that it is clean. Clean the strainer basket until no more debris appears.
- ➍ Repeat the pressure test after flushing and before adding glycol.

9.2 Filling and venting **INSTALLER**

Use clean, potable water, preferably warm: warm water holds less dissolved air, which reduces air locks. Check that all components are connected and locate the main air vent (or the vent of the highest fan coil).

- ➊ Open the main air vent (or the vent of the highest fan coil).
- ➋ Open the fill valve and fill until water without air bubbles flows from the vent; close the vent.
- ➌ Let the static pressure build up to about **1.4 bar**, then close the fill valve.
- ➍ Vent the chiller and each fan coil, starting from the lowest point and moving upwards. If the pressure drops significantly, add water.
- ➎ Refill to 1.4 bar.
- ➏ Pressure test: watch the pressure for stability. A falling pressure indicates a leak, which must be repaired immediately.
- ➐ Add glycol (5.1) and bring the system back to pressure.
- ➑ Run the system for a while, switch it off and let the water settle. Vent again from the lowest point upwards.

9.3 Before switching on **INSTALLER**

- ☐ Chilled water circuit flushed, leak-tested, filled with glycol, vented and at pressure.
- ☐ Strainers clean; all service valves and fan coil valves open.
- ☐ Seacock open; seawater pump and strainer below the waterline; no loops in the hoses.
- ☐ Anode installed and all seawater parts bonded.
- ☐ Supply, breaker, PE and pump wiring checked; terminals tight.
- ☐ Fan coils mounted, ducts connected, drains tested, filters fitted.
- ☐ For several chillers: DIP addresses set, bus wired, slaves enabled (8.6).

9.4 First start **INSTALLER**

- 1** Switch on the supply and the chiller display; select the mode and the set temperature (Part 10).
- 2** Check that the circulation pump starts immediately and that water flows (no E1:08).
- 3** Check that the seawater pump runs and water flows steadily from the overboard outlet.
- 4** Set the cabin temperatures on the fan coil controllers and check that every fan coil delivers cool (or warm) air.
- 5** Check the status screens: supply/return water and seawater temperatures, pressure and compressor frequency (10.3).

- 6** During and after filling, clean the strainer baskets regularly.
- 7** When running, the water must be clear and free of air bubbles; vent again if needed.

9.5 Handover to the owner **INSTALLER**

- Explain the controls (Part 10), the seacock, the strainers and the operating limits (2.5).
- Show the expansion tank pressure gauge and the normal system pressure.
- Fill in and sign the commissioning and handover record (9.6), start the maintenance log (12.14) and hand over this manual.

9.6 Commissioning and handover record INSTALLER OWNER

Fill in at the first start, sign together with the owner and keep a copy with this manual. A copy also serves as proof of professional installation for the warranty registration (15.3).

Boat name / hull no.

Chiller model / serial no.

Fan coils (model × quantity)

Installer company

Date of first start

Measured at first start	Value
Supply voltage under load	V
System pressure (cold, pump running)	bar
Glycol concentration / freeze point	% / °C
Fresh water in / out (F/W In / Out)	°C
Seawater in / out (S/W In / Out)	°C
Compressor frequency / phase current	Hz / A

- ☐ Circuit flushed, pressure-tested (5 bar, 12 h) and vented (9.1, 9.2)
- ☐ Strainers in both circuits, clean; flow arrows correct
- ☐ Seacock, seawater pump below the waterline, no loops (Part 7)
- ☐ Anode installed, all seawater parts bonded (7.8)
- ☐ Breaker, cable size, PE and terminals checked (Part 8)
- ☐ No safety device bridged or bypassed (1.7)
- ☐ All fan coils deliver cool and warm air; drains tested
- ☐ No error code on the display after the test run
- ☐ Owner instructed (9.5); manual and maintenance log handed over

Installer – name and signature

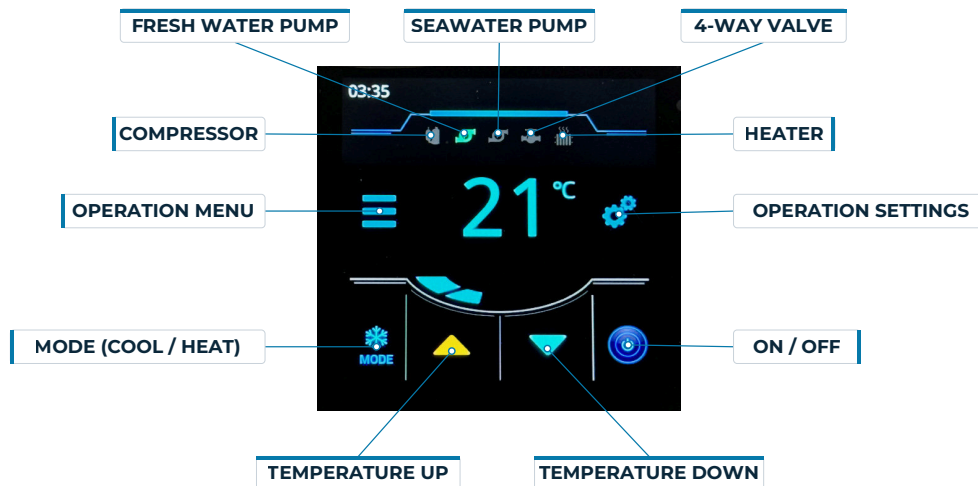
Owner – name and signature

PART 10

Operation

10.1 Chiller display OWNER

The control panel of the chiller has an intuitive touch display with real-time information about the operating parameters of the system. The displayed data let you monitor the status and performance of the system and make any necessary adjustments quickly. Key information includes temperatures, pressure readings, compressor frequency and electrical parameters. The cabin temperatures are set on the fan coil controller in each cabin; the chiller display controls the chiller itself.



Display overview: main screen

Element	Function
Status icons (top row)	From left: compressor, circulation (fresh water) pump, seawater pump, 4-way valve, electric heater. A highlighted icon is on.
Temperature	Water set temperature, adjusted with ▲ / ▼
Operation menu (≡)	Opens the operation control menu with the status screens (10.3)
Operation settings (⚙)	Units, °C/°F, slave units (8.6), service menu (PIN)
MODE	Selects cooling or heating
▲ / ▼	Raises / lowers the set temperature
ON/OFF	Switches the chiller on or off

10.2 Everyday use OWNER

- 1 Make sure the seacock is open and the chiller breaker is on.
- 2 Press ON/OFF on the chiller display.
- 3 Press MODE to select cooling or heating.
- 4 Set the temperature with ▲ / ▼ within the limits set by the installer (11.3).
- 5 Set the desired temperature on the fan coil controller in each cabin.



NOTICE

When you change the mode, the compressor stops and restarts only after its minimum stop time (parameter 08), and the 4-way valve switches with a short delay (parameter 31). This is normal.

10.3 Status screens OWNER TECHNICIAN

The operation control menu (≡) shows two status screens. They are the first place to look when the system does not perform as expected.

Screen 1	Meaning
Exhaust temp.	Temperature of the refrigerant leaving the compressor, directly after it has been compressed
Suction temp.	Temperature of the refrigerant entering the compressor. It shows whether the refrigerant has been sufficiently superheated in the evaporator before it is compressed again.
Suction saturation temp.	Temperature at which the refrigerant changes from liquid to gas at the suction pressure (evaporating temperature). Suction temp. minus this value = superheat.
Low pressure sensor	Refrigerant pressure in the evaporator (suction side)
EXV opening	Opening of the electronic expansion valve (0 = closed, 500 = fully open). The EXV meters the correct amount of refrigerant into the evaporator, which directly affects the cooling performance.
Step comp. freq. / Comp. max freq.	Actual compressor frequency, which sets its speed and capacity so that the system can follow the demand, and the highest frequency currently allowed
Phase current	Current drawn by the compressor, an important indicator of its power consumption

Screen 1	Meaning
Bus voltage	DC bus voltage of the inverter that supplies the compressor
IPM temp.	Temperature of the intelligent power module (IPM) of the inverter, which drives the compressor

Screen 2	Meaning
1# / 2# Compressor	On/off and operating hours of compressor 1 (and 2, if fitted)
Fresh water pump	On/off and operating hours of the circulation pump, which circulates the chilled water to the fan coils
Sea water pump	On/off and operating hours of the seawater pump, which supplies seawater to the condenser
4-way valve	On/off state of the 4-way (reversing) valve, which switches the refrigerant circuit between cooling and heating
Electric heating	On/off state of the electric heating output. The electric heaters of the fan coils can also be controlled individually, so that each cabin can be heated independently.
F/W In / F/W Out	Fresh water temperature returning to / leaving the chiller. The return temperature shows how much the water has warmed up in the fan coils; the difference shows the actual load.
S/W In / S/W Out	Seawater temperature entering / leaving the condenser. Colder incoming seawater allows better heat rejection; the difference shows how much heat the seawater carries away.



Status screen 1 – refrigerant circuit and inverter



Status screen 2 – outputs and water temperatures

10.4 Tips for comfort and efficiency **OWNER**

- Keep hatches, windows and doors closed while cooling or heating.
- Keep return and supply grilles free; clean the fan coil filters regularly.

- Choose moderate cabin temperatures; the inverter then runs at lower speed and uses less energy.
- Check the system pressure gauge from time to time (12.4).

PART 11

Service settings

11.1 Service menu TECHNICIAN

The service menu gives access to the control parameters of the chiller: limits, compressor, frequency, protection delays, temperature protections, expansion valve, resonance and standby settings. Access is restricted to authorised personnel and requires a PIN code, which MBC Marine provides to authorised partners.


NOTICE

Incorrect settings can impair operation and protective functions and are excluded from warranty. Change parameters only with the approval of MBC Marine technical support, and record every change in the maintenance log.

Factory values below are those shown on the service screens of the current software. They are the factory defaults with the unit switched on and idle. Parameters 07, 10, 14 and 15 are set outside the range shown on the screen; do not change them without consulting MBC Marine.

11.2 Parameter groups TECHNICIAN

Group	Parameters	Section
Limit parameters	01–06, 21	11.3
Compressor parameters	07–10, 19, 20	11.4
Frequency parameters	14–18	11.5
Protection delays	22–25, 31–33	11.6
Temperature protection	34–40	11.7
Cool / heat EXV	41–50, 54, 55	11.8
Resonance frequency	57–61	11.9
Standby protection	26–30, 56	11.10

11.3 Limit parameters TECHNICIAN

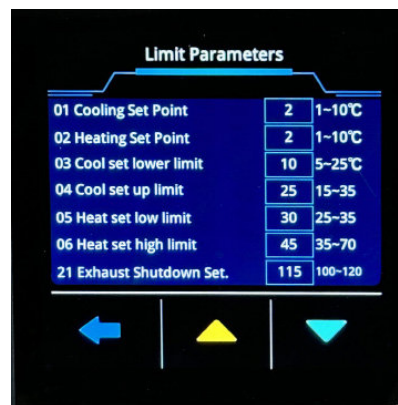
No.	Parameter	Factory	Range
01	Cooling differential (control hysteresis)	2 °C	1-10 °C
02	Heating differential (control hysteresis)	2 °C	1-10 °C
03	Lowest set temperature in cooling	10 °C	5-25 °C
04	Highest set temperature in cooling	25 °C	15-35 °C
05	Lowest set temperature in heating	30 °C	25-35 °C
06	Highest set temperature in heating	45 °C	35-70 °C
21	Compressor shutdown at discharge temperature	115 °C	100-120 °C

01 Cooling differential. The control hysteresis in cooling; the compressor starts when the water temperature rises this much above the set temperature, so that the system does not switch on and off at every small change.

02 Heating differential. The control hysteresis in heating; heating starts when the water temperature falls this much below the set temperature.

03 Lowest set temperature in cooling. The minimum temperature that can be set for cooling. Users cannot set a lower cooling temperature.

04 Highest set temperature in cooling. The maximum temperature that can be set for cooling.



05 Lowest set temperature in heating. The minimum temperature that can be set for heating. Users cannot set a lower heating temperature.

06 Highest set temperature in heating. The maximum temperature that can be set for heating. Users cannot set a higher heating temperature.

21 Compressor shutdown temperature. Compressor protection: if the discharge temperature reaches this value, the system stops the compressor automatically to prevent overheating and damage. Adjustable between 100 °C and 120 °C.

11.4 Compressor parameters TECHNICIAN

No.	Parameter	Factory	Range
07	Minimum running time before the compressor may stop	20 s	30–120 s
08	Minimum stop time before the compressor may restart	180 s	30–240 s
09	Loading cycle: interval between frequency increases	60 s	10–180 s
10	Unloading cycle: interval between frequency decreases	10 s	30–180 s
19	Oil return frequency: compressor frequency during the oil return run	55 Hz	30–60 Hz
20	Oil return interval: time between two oil return runs	5 h	1–10 h

07 Minimum running time. How long the compressor must run before it may stop. It prevents the compressor from cycling on and off too often, which could damage it. Longer run times give better efficiency and a longer service life.

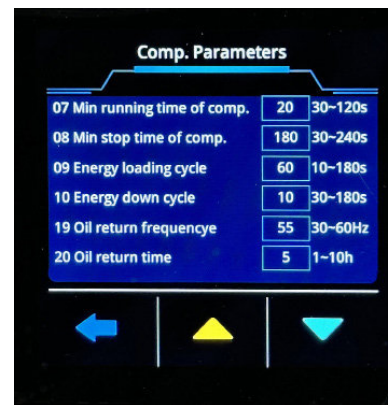
08 Minimum stop time. How long the compressor must remain off before it may restart. It prevents excessive starts, which cause mechanical stress.

09 Loading cycle. The interval at which the compressor output is increased. A gradual increase gives smooth and efficient operation.

10 Unloading cycle. The interval at which the compressor output is reduced when full capacity is no longer needed. The compressor slows down gradually instead of stopping abruptly, which saves energy and extends its service life.

19 Oil return frequency. The compressor frequency during the oil return run. Regular oil return keeps the compressor properly lubricated and protects its parts from wear.

20 Oil return interval. The time between two oil return runs. Too little oil return can cause wear; too frequent oil return wastes energy.



11.5 Frequency parameters TECHNICIAN

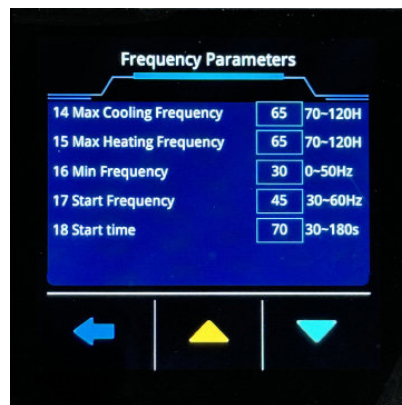
No.	Parameter	Factory	Range
14	Maximum compressor frequency in cooling	65 Hz	70–120 Hz
15	Maximum compressor frequency in heating	65 Hz	70–120 Hz
16	Minimum compressor frequency	30 Hz	0–50 Hz
17	Start frequency	45 Hz	30–60 Hz
18	Start time: time to reach the operating frequency	70 s	30–180 s

A higher maximum frequency gives more capacity but higher current and pressure. With cold seawater in heating mode, limit parameter 15 to 55 Hz (E1:30, E1:33).

14 Maximum frequency in cooling. The maximum compressor speed in cooling. A higher frequency gives more cooling capacity; within this limit the system adjusts the speed to the demand.

15 Maximum frequency in heating. The maximum compressor speed in heating. A higher frequency gives more heating capacity.

16 Minimum frequency. The lowest operating frequency, used when the demand is low, for energy-efficient operation. 0 Hz means the compressor is stopped.



17 Start frequency. The frequency at which the compressor starts. It gives smooth starts and avoids excessive current or mechanical strain.

18 Start time. How long the compressor takes to reach its operating frequency after starting. The gradual acceleration avoids sudden load increases, improves stability and extends the compressor life.

11.6 Protection delays TECHNICIAN

No.	Parameter	Factory	Range
22	Pump start before the compressor	60 s	30–80 s
23	Water flow switch check time before the compressor starts	15 s	10–60 s
24	Minimum pump off time before restart	10 min	1–10 min
25	Pump run-on after the compressor stops	30 s	30–180 s
31	4-way valve delay after a mode change (pressure equalisation)	6 s	0–20 s
32	Low pressure check time	120 s	5–180 s
33	Low pressure confirmation time before a fault	30 s	10–90 s

22 Pump start before the compressor. How long the circulation pump runs before the compressor starts, so that the water flows before the compressor operates. This prevents operation with insufficient water flow.

23 Flow switch check time. How long the system checks the water flow switch to confirm proper water flow before the compressor starts.

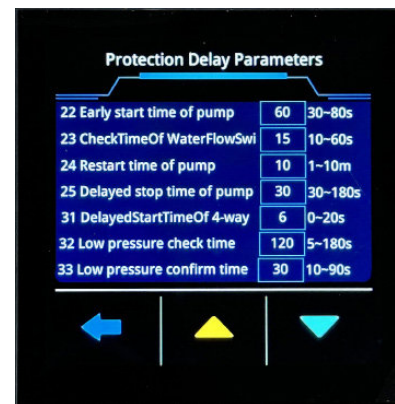
24 Pump restart time. How long the pump must remain off before it restarts, so that it does not restart too quickly, which causes unnecessary wear and energy waste.

25 Pump run-on. How long the pump keeps running after the compressor stops. The water continues to flow, which prevents overheating or pressure build-up in the refrigerant circuit.

31 4-way valve delay. The delay of the 4-way valve after a change between cooling and heating, so that the pressures can equalise before the valve switches.

32 Low pressure check time. How long the system monitors the low pressure sensor before reacting, so that only sustained low pressure triggers an alarm or shutdown.

33 Low pressure confirmation time. How long the system waits before confirming low pressure as a fault. It distinguishes a temporary pressure drop from a persistent problem.



11.7 Temperature protection TECHNICIAN

No.	Parameter	Factory	Range
34	Heating: max. water outlet temperature (stop)	60 °C	50–80 °C
35	Cooling: min. water outlet temperature, freeze protection (stop)	3 °C	0–10 °C
36	Water inlet/outlet temperature difference limit	10 °C	0–20 °C
37	Cooling: min. seawater temperature	5 °C	1–20 °C
38	Heating: min. seawater temperature	7 °C	0–25 °C
39	Cooling: max. seawater temperature	40 °C	35–55 °C
40	Heating: max. seawater temperature	35 °C	30–50 °C

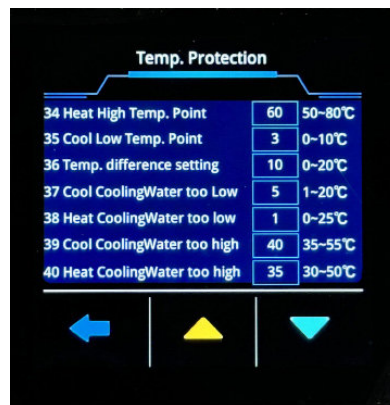
When a limit is reached the compressor stops to protect the system (E1:13, E1:14, E1:15).

34 Heating: high water temperature. If the water temperature in heating reaches this value, heating stops to protect the system from overheating.

35 Cooling: low water temperature. If the water temperature in cooling falls to this value, cooling stops to prevent freezing or overcooling.

36 Temperature difference. The permissible difference between the water inlet and outlet temperatures. It avoids large temperature variations in the water circuit.

37 Cooling: seawater too cold. The minimum seawater temperature in cooling. Below this value cooling stops to protect the system.



38 Heating: seawater too cold. The minimum seawater temperature in heating. Below this value heating stops, because heating with very cold seawater is inefficient.

39 Cooling: seawater too hot. The maximum seawater temperature in cooling. Above this value cooling stops to prevent overheating and damage.

40 Heating: seawater too hot. The maximum seawater temperature in heating. Above this value heating stops to protect the system.

11.8 Expansion valve (EXV) TECHNICIAN

No.	Parameter	Cool	Heat	Range
41/46	Initial opening at start	350	150	0–500
42/47	Holding time of the initial opening	120 s	120 s	10–600 s
43/48	Target superheat	4 °C	4 °C	–10–10 °C
44/49	Minimum opening	50	50	0–500
45/50	Regulation period	20 s	25 s	0–255 s
54	Discharge temp. above which the EXV may not close further	95 °C	–	80–120 °C
55	EXV increase temperature	–	5 °C	1–10 °C

Superheat is the suction temperature minus the suction saturation temperature (10.3). The EXV opens to lower the superheat and closes to raise it. A shorter regulation period gives faster but less stable control.

41 / 46 Initial opening. The opening of the electronic expansion valve at the start of cooling (41) or heating (46). A higher value means a wider opening and more refrigerant flow.

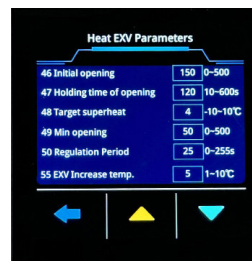
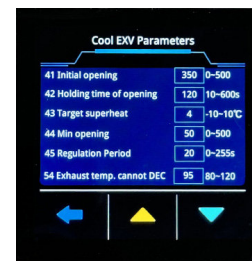
42 / 47 Holding time. How long the EXV stays at the initial opening before it starts to regulate. This stabilises the start of the cycle.

43 / 48 Target superheat. The superheat the EXV regulates to. Superheat is the suction temperature minus the suction saturation temperature. It is important for efficiency and stable operation.

44 / 49 Minimum opening. The smallest opening of the EXV during operation, so that the valve never closes completely and a minimum refrigerant flow is guaranteed even at low demand.

45 / 50 Regulation period. How often the EXV adjusts its opening. A shorter period gives faster adjustment; a longer period gives smoother operation with fewer changes.

54 Discharge temperature limit. When the compressor discharge temperature reaches this value, the EXV is not allowed to close further, to protect the compressor from overheating.



55 EXV increase temperature. In heating: when the refrigerant temperature exceeds this range, the EXV opens further to let more refrigerant flow and keep the heat exchange optimal.

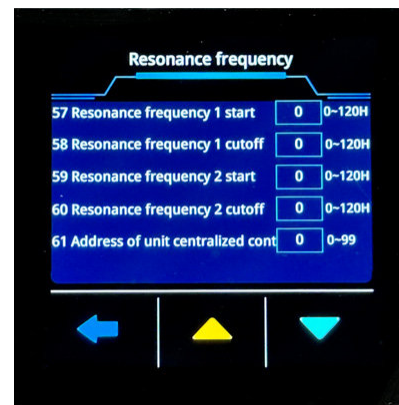
11.9 Resonance frequency and address

TECHNICIAN

No.	Parameter	Factory	Range
57	Resonance band 1, start	0 Hz	0–120 Hz
58	Resonance band 1, end	0 Hz	0–120 Hz
59	Resonance band 2, start	0 Hz	0–120 Hz
60	Resonance band 2, end	0 Hz	0–120 Hz
61	Address for centralised control	0	0–99

If the installation vibrates or is noisy at a certain compressor speed, the compressor can skip up to two frequency bands. 0 = no band set.

57 / 58 Resonance band 1. Start and end frequency of the first band the compressor avoids. Compressors and other moving parts can resonate at certain frequencies, which causes noise and can damage the equipment.



59 / 60 Resonance band 2. Start and end frequency of a second band to avoid, if the installation resonates in more than one frequency range.

61 Address for centralised control. A unique address (0–99) for each unit in a centralised control system, so that the central controller can manage the units individually.

11.10 Standby protection TECHNICIAN

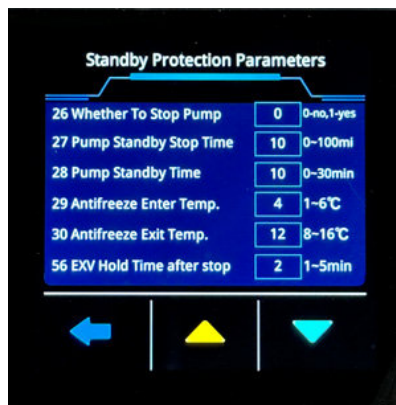
No.	Parameter	Factory	Range
26	Stop the pump in standby (0 = no, 1 = yes)	0	0 / 1
27	Pump run time in standby before stopping	10 min	0-100 min
28	Pump idle time in standby before restarting	10 min	0-30 min
29	Antifreeze function: start temperature	4 °C	1-6 °C
30	Antifreeze function: end temperature	12 °C	8-16 °C
56	EXV hold time after stop	2 min	1-5 min

The antifreeze function protects the circuit when the water temperature falls to the start value in standby, and ends when it reaches the end value. It needs power and does not replace glycol or winterization.

26 Stop the pump in standby. 0: the pump keeps running in standby. 1: the pump stops in standby to save energy.

27 Pump standby stop time. How long the pump runs in standby before it stops, so that it does not run unnecessarily.

28 Pump standby time. How long the pump remains idle in standby before it restarts periodically.



29 Antifreeze start temperature. When the water inlet temperature falls to this value, the antifreeze protection starts.

30 Antifreeze end temperature. When the water outlet temperature reaches this value, the antifreeze protection ends.

56 EXV hold time after stop. How long the EXV remains open after the system stops, so that the pressures equalise and no residual pressure difference remains.

PART 12

Maintenance and lay-up



WARNING

Switch off and lock out the power supply before any maintenance. Close the seacock before opening the seawater strainer.

To ensure optimal performance and a long service life of the system, keep an air conditioning maintenance log. Start it at the first start-up and record every maintenance task and every parameter change in detail.

12.1 Maintenance schedule OWNER TECHNICIAN

When	Task
Daily in use	Seawater strainer (12.2)
Monthly	Fan coil air filters; run the system when not in use (12.3)
Every 3 months	System pressure (12.4), condensate drains (12.5), electrical and seawater connections (12.6)
Yearly	Refrigerant, glycol and anode (12.7), pumps (12.8), fan coil water valves (12.9), sensors (12.10), seawater circuit (12.11)
Before cold weather	Winterization (12.12)

12.2 Daily: seawater strainer OWNER

- Check the seawater strainer daily.
- Inspect the strainer for debris and remove any accumulated material, such as seaweed, shells or other obstructions. Check that water flows from the overboard outlet.
- **Never run the seawater pump while the strainer basket is removed, not even for a short time.** Shells or other debris picked up by the pump can lodge in the condenser and cause a system failure.

12.3 Monthly: air filters and running the system OWNER

Air filters. Dirty filters reduce airflow and system performance. Check the dust filter behind the return air grille or at the front of the fan coil at least once a month, and clean or replace it if necessary.

Run the system. Operate the system regularly. When the boat is not in use, switch the air conditioning on for 30–60 minutes once a month, and also switch it to the reverse mode (from cooling to heating or from heating to cooling). This preserves the pump seals and internal mechanical

components and reduces marine growth in the seawater circuit.

12.4 Every 3 months: system pressure **OWNER** **TECHNICIAN**

- Check the pressure at the pump inlet while the water is cold, the fan coils are off and the circulation pump is running. If the pressure has dropped below the normal level (1.4 bar), add water.
- When a fan coil vent is opened, water or air should come out.
- Do not overfill the system: the expansion tank then cannot work properly.
- If the pressure drops frequently, there is a leak that must be found and repaired. Check the glycol concentration after adding water (5.1).

12.5 Every 3 months: condensate drains **OWNER**

Check that the condensate drains of the fan coils (and of any refrigerator on the same drain) are not blocked: pour a few litres of water into the fan coil drain pan. If the water does not drain completely within 30 seconds, check that the drain holes are not obstructed. Note that the drain pan has two drains, one at each end of the unit.

12.6 Every 3 months: electrical and seawater connections **TECHNICIAN**

Inspect the electrical connections and tighten them as necessary, also after the first weeks of operation. Heat and vibration can loosen connectors, which leads to poor contact, voltage drops or arcing, and can cause component malfunction or premature failure. When servicing electrical components:

- disconnect the power before repairing or replacing parts or wiring;
- tighten any loose connections at the terminal strip and on the components;
- inspect connectors for burn marks, frayed wires or other damage, and repair or replace the connector or connection if needed;
- measure the supply voltage of the equipment regularly to make sure the power supply is adequate.

Seawater connections. Verify that all seawater connections are tight and that water flows from the overboard discharge.

12.7 Yearly: refrigerant, glycol and anode **TECHNICIAN**

- **Refrigerant:** the chiller is pre-charged with refrigerant at the factory, and the charge is adequate for the life of the system. Routine seasonal charging is not necessary. If the charge is low, there is a leak, which must be repaired before the system is operated again.

- **Glycol:** check the concentration with a refractometer (5.1).
- **Anode and bonding:** replace a worn anode and check the bonding connections (7.8).

12.8 Pumps **TECHNICIAN**

Remove oil, dust, dirt, water and chemicals from the exterior of the motor and the pump. Make sure that the air inlet and outlet openings of the motor are unobstructed. Blow out the interior of open motors with clean, low-pressure compressed air. Inspect the pump housing and the impeller cover for excessive wear. Worn or damaged impellers reduce the water flow and should be replaced. Excessively worn or corroded housings can cause leaks. Treat any signs of corrosion immediately.

12.9 Fan coil water valves **TECHNICIAN**

Inspect the motorised water valves of the fan coils for corrosion that could impede the gear mechanism.

- Check all bleeder valves regularly and replace them if necessary.
- With the fan coil switched off, open the water valve and remove the motor (actuator) housing. Inspect the gears and clean any deposits from the motor gear and the valve gear.
- Dry all parts thoroughly and coat them with silicone spray or an equivalent product.

- Before reassembly, test the actuator manually with the lever on top of the valve.

12.10 Sensors **TECHNICIAN**

Check that all control probes and sensors are in the correct position and properly secured. Badly positioned or loose probes give inaccurate readings and lead to system faults.

- Check all temperature probes and sensors on the chiller.
- Probes inserted into the water circuit must be fully inserted into their wells, which are filled with thermal paste for efficient heat transfer. Insulate the end to hold the probe in place and prevent condensation.
- Probes attached externally to coils or pipes must be securely fastened with good thermal contact (for example with hot glue between the contact surfaces) and insulated if necessary.
- Check the sensors on the fan coils. Water sensors must be securely fixed and insulated on the water inlet of the fan coil. If the built-in air sensor of the cabin controller is not used, place the remote air sensor in the return air stream as close to the cabin as possible, away from hot or cold surfaces.
- All sensors must be securely attached.

12.11 Cleaning the seawater circuit **TECHNICIAN**

Condenser coils and seawater lines below the waterline become fouled over time by marine growth and deposits. This obstructs the water flow and prevents proper heat

transfer, so the compressor runs continuously at high pressure, temperature and current (E1:51, E1:57). Clean the condenser and the seawater hoses by connecting a closed-loop system and circulating a descaling solution, then flush them with fresh water.

12.12 Winterization

OWNER

TECHNICIAN

Proper winterization protects the system from freezing and ensures a long service life. Winterize before cold weather arrives; frost damage is excluded from warranty. Switch off the system and close the seacock first.

1. Drain the fresh water (chilled water) circuit. This is only necessary if the circuit is not filled with glycol with the correct freeze point (5.1). Open all valves, including the lowest drain points, and drain the circuit completely. Pay particular attention to places where water can collect.

2. Drain the seawater circuit. Open the strainer and all drain connections in the seawater circuit. Make sure all water is drained from the seawater pump, the condenser (heat exchanger) and the hoses.

3. Flush the circuits. After draining, flush the fresh water circuit with clean water to remove residual dirt. Flush the seawater circuit with fresh water to remove salt, dirt and debris that could cause corrosion or blockages.

4. Antifreeze. Use a non-toxic, propylene glycol based antifreeze that is safe for the marine environment and

suitable for the lowest expected winter temperature. Follow local regulations.

5. Protect the seawater side. Where seawater may freeze, fill the seawater circuit with antifreeze as well. Alternatively, drain it completely and make sure no water is left in the pump, the condenser or the hoses. Keep the seacock closed to prevent water from flowing back into the system.

6. Check the insulation. Make sure that all piping, especially parts exposed to cold air, is properly insulated to prevent freezing. Repair or replace damaged insulation. Cover or insulate pumps exposed to cold temperatures.

7. Final check. Make sure the system is depressurised where it has been drained, all valves are closed and no water remains at low points. Carry out a final visual inspection of the chiller, pumps and piping to make sure no water remains where it could freeze. Label the closed seacock.

12.13 Recommissioning

OWNER

INSTALLER

Refill and vent the circuits (9.2), check all connections for leaks, open the seacock and follow the first-start steps in 9.4.

12.14 Maintenance log

OWNER

TECHNICIAN

Record every maintenance task, repair, refill and parameter change. Copy this page when it is full.

Date	Op. hours	Work carried out / parameter changed	Pressure (bar)	Glycol (%)	Name / signature

Maintenance log (continued)

Date	Op. hours	Work carried out / parameter changed	Pressure (bar)	Glycol (%)	Name / signature

PART 13

Troubleshooting

13.1 How faults are shown **OWNER**

When the controller detects a fault during operation, it protects the system and shows an error code on the display, for example **E1:08**. The error codes are grouped into four categories: unit-resumed protection, system-resumed protection, serious unit fault and serious system fault. Some protections clear automatically when the cause is gone; others need a restart or a technician. Most codes do not mean that a component is broken, but point to an installation or operating problem: water flow, seawater flow or power supply.


WARNING

Owners: only carry out the checks marked for owners. Do not open the chiller, the electrical boxes or the refrigerant circuit. Never bypass a protective device (1.7).

13.2 First checks for owners **OWNER**

Symptom	Check
Display dark	Chiller breaker on? Shore power or generator running?
Chiller runs, a cabin stays warm	Fan coil controller on and set correctly? Fan coil filter clean? Grilles free? Shut-off valve of that fan coil open?
No cooling or heating anywhere	Correct mode? Seacock open? Water flowing from the outlet? Strainers clean? Seawater within limits (2.5)? System pressure normal?
Noise of water or air in the pipes	Air in the system: vent the fan coils (9.2) and check the pressure.
Water around a fan coil	Drain blocked (12.5)? Pipe insulation damaged?
Error code	Note the code and look it up in 13.3. If it persists, call a technician.

13.3 Error code overview **OWNER** **TECHNICIAN**

Find the code shown on the display, then go to the page given for its meaning, causes, consequences and solution. Owners: note the code and carry out only the checks in 13.2; all other work is for a qualified technician.

Code	Error	Page
E1:01	Freshwater return temperature sensor fault	58
E1:02	Freshwater supply temperature sensor fault	58
E1:03	Seawater outlet temperature sensor fault	58
E1:04	Seawater inlet temperature sensor fault	59
E1:05	Compressor discharge temperature sensor fault	59
E1:06	Compressor suction (return gas) temperature sensor fault	60
E1:07	Low pressure sensor fault	60
E1:08	Insufficient freshwater / glycol flow	61
E1:11	High voltage alarm	62
E1:13	High freshwater outlet temperature protection	62
E1:14	Low freshwater outlet temperature protection	63
E1:15	Freshwater inlet / outlet temperature difference protection	63
E1:17	High compressor discharge temperature protection	64
E1:18	Compressor driver communication fault	65
E1:30	Compressor drive fault	65
E1:33	IPM overcurrent protection	66
E1:34	Compressor drive failure	67
E1:35	Compressor phase current fault	68
E1:36	Input voltage phase loss	69

Code	Error	Page
E1:37	Phase current sampling fault	69
E1:38	Communication fault with the control board	70
E1:39	EEPROM (memory) fault	71
E1:40	DC bus overvoltage / undervoltage	72
E1:41	AC input overvoltage / undervoltage	73
E1:42	AC input overcurrent	74
E1:43	Input voltage sampling fault	75
E1:44	Freshwater condenser temperature sensor fault	76
E1:45	Overvoltage (Ov) sensor fault	76
E1:46	Overheat (OHB) sensor fault	77
E1:48	Input current sampling fault	78
E1:49	Compressor overcurrent alarm	79
E1:50	Compressor weak magnetic field protection	80
E1:51	IPM overheat alarm	81
E1:52	AC input undervoltage alarm	82
E1:53	AC input overcurrent alarm	82
E1:54	EEPROM fault alarm	83
E1:57	IPM overheating shutdown	84

13.4 Error code details **TECHNICIAN**

For each error code: what the code means, possible causes, possible consequences and the solution. Work on the electrical and refrigerant parts is for qualified technicians only (1.2).

E1:01 Freshwater return temperature sensor fault

The freshwater return temperature sensor has malfunctioned. This sensor measures the temperature of the returning freshwater in the system. If the sensor fails, the system cannot accurately monitor the return water temperature.

POSSIBLE CONSEQUENCES

- The system may not regulate the temperature properly, leading to excessive cooling or heating.
- Equipment efficiency may decrease as the system does not account for the return water temperature during regulation.
- An error code will appear on the control panel, indicating the sensor malfunction.

SOLUTION

- The sensor must be replaced to restore accurate monitoring of the return water temperature.
- After replacing the sensor, the system needs to be restarted to clear the error code and verify proper operation of the temperature sensors.

E1:02 Freshwater supply temperature sensor fault

This sensor measures the temperature of the freshwater as it leaves the chiller towards the fan coils (supply). The sensor is crucial for maintaining the correct temperature, as it helps the system optimize the cooling or heating process. If this sensor malfunctions, the system cannot accurately measure the inlet water temperature, which may lead to improper cooling or heating.

POSSIBLE CONSEQUENCES

- The system may overheat or undercool, as it cannot properly monitor the inlet water temperature.
- Equipment energy efficiency may decrease, as the system operates at non-optimal temperatures.
- An error code will appear on the control panel, alerting the operator to the sensor malfunction.

SOLUTION

- Replacing the sensor is essential to restore accurate inlet water temperature monitoring.
- After replacement, the system needs to be restarted, and the sensors should be checked for proper operation.
- The error code will clear once the new sensor is functioning properly.

E1:03 Seawater outlet temperature sensor fault

This sensor measures the temperature of the seawater as it exits the system. Accurate temperature measurement ensures that the system operates within the desired

temperature range, avoiding overheating or reduced efficiency.

POSSIBLE CONSEQUENCES

- The system may overheat if it cannot properly monitor the seawater return temperature, potentially causing long-term damage to the equipment.
- Cooling efficiency may decrease as the system lacks proper data on the return seawater temperature, affecting the condenser unit's performance.
- An error code will appear on the control panel, alerting the operator of the sensor malfunction.

SOLUTION

- The sensor must be replaced to restore proper system operation.
- After replacement, the system needs to be restarted, and the temperature sensors should be checked for accurate readings.
- The error code will automatically clear once the system returns to normal operation.

E1:04 Seawater inlet temperature sensor fault

This sensor measures the seawater temperature before it enters the condenser (seawater heat exchanger). Accurate temperature measurement is key to ensuring that the heat exchanger operates at optimal temperatures and that the cooling system performs efficient heat exchange. If this sensor malfunctions, the system cannot accurately

determine the seawater temperature, negatively affecting heat exchanger performance.

POSSIBLE CONSEQUENCES

- The heat exchanger may not regulate the temperature properly, leading to decreased system efficiency.
- The cooling system may overheat or fail to reach the desired temperature, disrupting the cooling cycle.
- An error code will appear on the control panel, indicating the sensor malfunction and the need for maintenance.

SOLUTION

- The sensor must be replaced to restore accurate seawater temperature measurement.
- After replacement, the system needs to be restarted to ensure that the new sensor functions properly.
- The error code will disappear once the sensor operates normally, and the system returns to optimal heat exchange performance.

E1:05 Compressor discharge temperature sensor fault

This sensor monitors the temperature of the refrigerant as it leaves the compressor (discharge). Accurate refrigerant temperature measurement is essential for proper compressor operation, ensuring that the system works within the correct temperature range and prevents overheating or improper cooling cycles.

POSSIBLE CONSEQUENCES

- If this sensor fails, the system cannot monitor the refrigerant temperature exiting the compressor, leading to potential overheating.
- The system may operate inefficiently, unable to regulate refrigerant temperature, reducing cooling performance.
- An error code will appear on the control panel, indicating sensor failure and the need for maintenance.

SOLUTION

- Replacing the sensor is necessary to restore accurate monitoring of the refrigerant temperature exiting the compressor.
- After replacing the sensor, the system should be restarted and checked to ensure proper sensor operation.
- The error code will clear once the system is functioning correctly, and the compressor returns to optimal performance.

E1:06 Compressor suction (return gas) temperature sensor fault

This sensor measures the temperature of the refrigerant as it returns to the compressor (suction). Proper temperature monitoring is critical for efficient compressor operation, as it helps maintain an optimal cooling cycle and ensures that the compressor operates without overheating or becoming overloaded.

POSSIBLE CONSEQUENCES

- The compressor may overheat if the system cannot accurately measure the return refrigerant temperature, potentially leading to long-term system failure.
- The system may not regulate effectively, resulting in reduced cooling performance and increased energy consumption.
- An error code will appear on the control panel, alerting the operator to the sensor malfunction and indicating the need for maintenance.

SOLUTION

- Replacing the sensor is essential for accurate monitoring of the return refrigerant temperature.
- After the sensor is replaced, the system should be restarted to ensure proper operation of the temperature sensors.
- The error code will clear once the new sensor is functioning, and the compressor returns to optimal operation.

E1:07 Low pressure sensor fault

The system's low-pressure sensor is malfunctioning or has failed. This sensor measures the refrigerant pressure on the compressor's suction side and ensures the pressure is at the desired level for proper operation. The low-pressure sensor is crucial for monitoring system pressure to prevent compressor overload or reduced cooling efficiency.

POSSIBLE CONSEQUENCES

- If the sensor fails, the system cannot monitor refrigerant pressure, potentially leading to compressor overload and damage.
- System performance may decrease as the refrigerant pressure cannot be properly regulated, leading to faulty cooling cycles and reduced efficiency.
- An error code will appear on the control panel, alerting the operator of the sensor failure and indicating maintenance is needed.

SOLUTION

- The low-pressure sensor must be replaced to restore proper pressure monitoring.
- After replacement, the system should be restarted, and refrigerant pressure should be checked to ensure it is at the desired level.
- The error code will automatically clear once the system operates correctly and the pressure is within the appropriate range.

EI:08 Insufficient freshwater / glycol flow

The flow of freshwater or glycol in the system is insufficient. Proper flow is critical for the efficient operation of the cooling or heating cycle, because the water carries the heat between the chiller and the fan coils. If the flow is inadequate, system performance will significantly degrade.

POSSIBLE CAUSES

- Blockages in pipes or clogged filters.

- A faulty pump that does not provide sufficient flow.
- Closed service valves or fan coil valves.
- Flow direction reversed at the chiller connections.
- Air bubbles in the cooling system, causing pressure fluctuations and inadequate heat transfer, especially if the system has not been properly purged.

POSSIBLE CONSEQUENCES

- Cooling or heating efficiency decreases, leading to improper temperature maintenance in spaces.
- The evaporator may freeze in cooling mode or the system may overheat in heating mode due to insufficient water flow, causing inadequate heat dissipation.
- An error code will appear on the control panel, alerting the operator that the issue needs to be resolved.
- The compressor and other critical components may become overloaded, reducing the lifespan of the equipment.

SOLUTION

- Check the filters and pipes for blockages and inspect the pump's functionality.
- Check the system pressure and refill with water and glycol if it is low (12.4).
- Restart the system to verify adequate flow and clear the error code.
- Bleed the system to remove any air bubbles that may be obstructing proper flow.

- After restarting, ensure the flow is sufficient and that the error code clears.
- Never bridge or bypass the water flow switch (I.7).

E1:11 High voltage alarm

The system has detected overvoltage, which could potentially damage electronic components. High voltage is dangerous for the control panel, compressor, and other sensitive components, potentially causing serious malfunctions or complete failure. The source of the overvoltage may be fluctuations of the shore power or generator, a faulty (isolation) transformer, or other electrical problems.

POSSIBLE CONSEQUENCES

- Sensitive electronics, such as the control panel and compressor, may be damaged, leading to total system failure.
- The cooling or heating system may shut down as the overvoltage disrupts critical components.
- Repeated overvoltage occurrences can shorten component lifespan and increase maintenance needs.
- An error code will appear, warning the operator that immediate action is required to protect the system.

SOLUTION

- Check the system's power supply to identify the source of the overvoltage.

- It may be caused by external network problems, in which case a stabilizer or surge protection device should be installed to prevent future issues.
- Replace any damaged electrical components, such as transformers or control panels, if damage has been detected.
- Restart the system after resolving the overvoltage issue and verify that the problem has been resolved.
- Check the condition of components, and the error code will clear if no further issues are detected.

E1:13 High freshwater outlet temperature protection

The system provides protection against excessively high freshwater outlet temperatures. If the freshwater outlet temperature exceeds the allowed limit, the system intervenes automatically to protect the equipment. High temperatures can damage the heat exchanger and other key components and reduce system efficiency.

POSSIBLE CONSEQUENCES

- Excessively high freshwater outlet temperatures jeopardize the cooling system's efficiency and can damage connected components.
- Overheating in the heat exchanger may create undesirable temperature differences, leading to system malfunction.
- The system may display an error code and shut down to prevent more severe damage.

SOLUTION

- First, check the cooling system for proper freshwater flow and ensure the heat exchanger is functioning correctly.
- Blockages or faulty components may hinder adequate cooling.
- Inspect or replace the freshwater outlet temperature sensor if it is malfunctioning, as it could affect temperature monitoring and regulation.
- Ensure the system pressure and water flow are appropriate, and check the heat exchanger and related components for any issues.
- Restart the system after necessary repairs to verify that the temperature protection mechanism is functioning correctly.

Ei:14 Low freshwater outlet temperature protection

This feature protects the system from excessively low freshwater outlet temperatures. Extremely low temperatures can cause problems such as system freezing or reduced heat exchanger efficiency. If the outlet temperature drops below the permitted threshold, the system intervenes automatically to prevent equipment damage and operational disturbances.

POSSIBLE CONSEQUENCES

- The water in the cooling system could freeze, causing damage to pipes, pumps, or heat exchangers.

- System efficiency may drop as low temperatures can interfere with the cooling cycle and proper heat dissipation.
- An error code will appear on the control panel, warning the operator of the issue, which may require urgent attention.

SOLUTION

- Check the freshwater outlet temperature sensor for proper function and replace it if necessary.
- Check the glycol concentration (5.1) and the freshwater circulation to ensure the appropriate temperature range is maintained.
- Ensure that the system regulates the cooling process adequately and prevents the freshwater temperature from falling below the critical threshold.
- After performing repairs, restart the system and verify that the temperature protection mechanism is working properly.

Ei:15 Freshwater inlet / outlet temperature difference protection

The system monitors the temperature difference between the freshwater inlet and outlet, activating protective mechanisms if the difference becomes too large or too small. Ideally, the temperature difference should be between 5°C and 10°C, ensuring efficient operation of the cooling system. If the difference falls outside this range, it signals reduced efficiency, possibly due to faulty heat exchange or water flow issues.

POSSIBLE CAUSES

- Insufficient water flow due to clogged filters or a faulty pump, reducing system performance.
- Heat exchanger malfunction, impeding proper heat transfer between the freshwater and the refrigerant.
- Leaks or air bubbles in the system, reducing water flow and the overall efficiency.

POSSIBLE CONSEQUENCES

- The cooling system may not maintain an optimal cooling cycle, leading to reduced cooling capacity and increased energy consumption.
- Components like the heat exchanger may be overworked, causing long-term damage.
- The system may shut down to prevent further damage, displaying an error code.

SOLUTION

- Clean water filters and inspect the pump to ensure adequate water flow in the system.
- Check the heat exchanger for proper operation and confirm that there are no blockages or damage.
- Bleed the system to remove any air bubbles that could obstruct proper water flow.
- Check for any leaks and fix them as necessary.

E1:17 High compressor discharge temperature protection

The system has detected that the forward temperature on the compressor discharge side has reached a critical level,

activating protective measures to safeguard the compressor and other components.

POSSIBLE CAUSES

- Insufficient refrigerant flow, which fails to provide adequate cooling and leads to compressor overheating.
- Refrigerant leaks, reducing the system's cooling capacity and causing temperature rise.
- Insufficient seawater flow through the condenser, preventing efficient heat dissipation from the heat exchanger and drastically reducing the cooling process's efficiency.
- Internal compressor failure, causing abnormal pressure and temperature increases.

POSSIBLE CONSEQUENCES

- Compressor overheating can lead to long-term damage or complete failure.
- The system may shut down to prevent further damage and display an error code.
- Reduced compressor performance or failure will significantly impact the overall cooling system's capacity.

SOLUTION

- Technician: check the refrigerant circuit (pressures, superheat, EXV opening).
- Check the seawater flow and the seawater pump to confirm sufficient flow through the condenser.
- If the pump is not providing adequate seawater flow, the heat cannot effectively leave the system.

- Check for a clogged seawater strainer or a fouled condenser, as they may hinder water flow and cause heat buildup.
- Inspect the refrigerant level for any leaks that could be reducing cooling capacity.
- Ensure the compressor is functioning correctly and has no internal failures or overloads causing the temperature rise.
- Restart the system after performing necessary repairs and monitor temperature readings to restore normal operation.

EI:18 Compressor driver communication fault

Communication between the compressor inverter unit and the central system has been interrupted or is faulty. This controller unit is responsible for overseeing the compressor's operation, including temperature, pressure, and flow data monitoring. A communication failure prevents proper control of the compressor, potentially leading to malfunction or complete system shutdown.

POSSIBLE CAUSES

- Faulty wiring or connection issues between the compressor and the controller unit.
- Software error in the controller unit or communication module of the central system.
- Power supply problem at the compressor controller unit, hindering proper communication.

- Electrical interference disrupting the communication signals.

POSSIBLE CONSEQUENCES

- The compressor may not receive proper control signals, leading to malfunction or shutdown.
- The cooling system's efficiency may decrease due to improper compressor regulation.
- Safety mechanisms may be activated, and warning alerts may appear on the control panel to protect the compressor from further damage.

SOLUTION

- **Check wiring and connections:** Ensure all connections are properly functioning, and no cables are damaged or loose.
- **Inspect the controller unit's power supply:** Verify the controller unit is operating correctly and receiving adequate power.
- **Update or inspect the software:** If a software issue is suspected, update the system's software or restart the communication modules.
- **Check for electrical interference:** Ensure no disruptive signals are interfering with the communication between the controller unit and the central system.

EI:30 Compressor drive fault

General drive error – the system is unable to start or control the compressor.

POSSIBLE CAUSES

- Cold seawater temperature (below 5 °C) causing slow flow or freezing in the condenser
- Compressor running at too high frequency in heating mode
- Loose or incorrect motor wiring
- Phase loss or incorrect power supply
- Internal inverter failure (driver IC, IGBT module, or PCB)

POSSIBLE CONSEQUENCES

- Complete system shutdown
- Compressor fails to start
- "Drive Fault!" appears on the display
- System unresponsive to start commands

SOLUTION

- Power cycle the unit (disconnect and reconnect power)
- Check seawater temperature, and ensure proper seawater flow
- **Reduce the compressor frequency in heating mode:** set parameter 15 to 55 Hz (11.5)
- Inspect and secure motor wiring connections
- Verify input voltage and phase order
- If the fault persists, contact technical service – inverter PCB or IPM module may require replacement

E1:33 IPM overcurrent protection

The Intelligent Power Module (IPM) has detected an overcurrent or overvoltage and has activated protection

mechanisms. The IPM regulates motor current and switching processes and includes components such as transistors, diodes, and various protection features to ensure safe system operation. The IPM controls the current and speed of the compressor. It contains components such as transistors and diodes that generate heat during operation. The IPM relies on the seawater condenser for cooling, making proper seawater circulation within the system critically important.

POSSIBLE CAUSES

- **Overcurrent to the compressor:** If the compressor draws too much current, the IPM detects this abnormality and activates protection to prevent damage.
- **Short circuit in the system:** A short circuit in a component may cause an overvoltage, which the IPM detects and blocks to prevent severe damage.
- **Cooling issues within the IPM:** If the IPM overheats due to inadequate cooling, it can malfunction.
- **Faulty transistors or diodes:** Component failure within the IPM may result in overcurrent or overvoltage.
- **Cold seawater:** in winter the seawater can become so cold that it freezes in the condenser during heating operation and stops the seawater flow.

POSSIBLE CONSEQUENCES

- The compressor's power supply may be interrupted, causing system performance to decline or shut down.

- IPM protection activation may stop the system to prevent severe damage to the compressor, controller, or other related components.
- The system may display an error code indicating overcurrent or overvoltage.

SOLUTION

- **Check system power supply:** Ensure there are no overvoltage or overcurrent conditions and that the current flow meets prescribed limits.
- **Limit the heating frequency:** set parameter 15 (maximum heating frequency) to 55 Hz, so that the compressor runs at a lower frequency.
- **Inspect the compressor:** Ensure the compressor is not drawing excessive current and check for any short circuits or other faulty components.
- **Examine the IPM cooling:** Ensure the seawater flow and the condenser are in good condition and that the IPM is not overheating.
- **Replace faulty IPM components:** If transistors, diodes, or other internal parts have failed, replace them to restore system function.
- **Restart the system:** After repairs, restart the system and ensure the issue does not reoccur.

E1:34 Compressor drive failure

The compressor drive system, which includes the motor and associated control systems, has failed or detected an operational issue. This failure typically stems from

mechanical motor problems, control unit faults, overloads, or electrical errors that prevent proper compressor function.

POSSIBLE CAUSES

- **Motor failure:** Mechanical issues with the compressor motor, such as bearing wear or rotor failure, can cause the drive to shut down.
- **Overload:** The motor is under excessive load, leading to increased current draw and motor shutdown.
- **Electrical fault:** Faulty electrical connections, wiring issues, or power supply disturbances may cause the drive to fail.
- **Control unit failure:** A malfunction in the compressor control unit, such as a motor control module failure, can prevent proper motor operation.
- **Short circuit or leakage:** A short circuit or leakage in the system's electrical network may cause compressor drive failure.

POSSIBLE CONSEQUENCES

- The compressor may shut down, interrupting the cooling or heating process.
- System efficiency will drop significantly or completely cease until the issue is resolved.
- The system may suffer further damage if the problem is not addressed promptly, potentially leading to component failures.

SOLUTION

- **Inspect the motor:** Check the motor's mechanical condition, focusing on bearings, the rotor, and other moving parts that may fail.
- **Examine electrical connections:** Ensure there are no broken or loose wires, short circuits, or other electrical issues preventing the motor from operating.
- **Check the control unit:** Ensure the compressor control unit is functioning properly and that no modules or control functions are faulty.
- **Monitor motor temperature and current draw:** In case of overheating or excessive current draw, inspect the motor's cooling system and load conditions.
- **Replace faulty components:** If any mechanical or electrical parts are defective, replace them to restore the compressor's operation.
- **Restart the system:** After repairs, restart the system and ensure the issue does not persist.

E1:35 Compressor phase current fault

An issue with the electrical current in one of the compressor's phases has been detected. This fault is typically the result of phase shift, imbalance between phases, or overcurrent. In three-phase power systems, the balance of current between the phases is crucial for proper compressor operation. If an imbalance occurs or overcurrent happens in one phase, it can reduce compressor performance and potentially cause severe damage.

POSSIBLE CAUSES

- **Phase shift or imbalance:** Unequal current between the compressor's three phases due to voltage differences or faulty phase connections.
- **Overcurrent in one phase:** Excessive current in one phase leads to phase imbalance.
- **Faulty wiring or connection issues:** Damaged or loose connections in one of the phase wires can cause current irregularities.
- **Mechanical issues in the compressor:** Problems like worn-out bearings or rotor faults can increase or imbalance current consumption.
- **Faulty power supply:** Voltage fluctuations or a malfunctioning transformer in the power network can cause phase imbalances.

POSSIBLE CONSEQUENCES

- Phase imbalance can cause motor overheating or damage, leading to long-term failure.
- Cooling system performance can drop significantly, potentially slowing or stopping system operation.
- Prolonged imbalance may cause premature compressor failure and expensive repairs.

SOLUTION

- **Check phase currents:** Measure the current in all three phases to ensure balance. If there's a discrepancy, locate the cause of the imbalance.
- **Inspect wiring and connections:** Verify that all phase wires are intact and connections are secure.

- **Examine power supply:** Ensure the system is receiving properly phased and balanced voltage from the electrical network.
- **Check the compressor for mechanical issues:** Inspect internal mechanical components like bearings for wear or other issues that might disrupt phase balance.
- **Restart the system:** After completing necessary repairs, restart the system and check if the phase balance has returned to normal.

EI:36 Input voltage phase loss

One phase in the three-phase power supply to the compressor or other equipment has been lost or experienced a significant voltage drop. This phase loss, also known as phase failure, can cause severe operational issues for equipment dependent on balanced three-phase power. Proper operation requires that all three phases provide consistent current and voltage. If one phase is lost or experiences a significant voltage drop, it may lead to compressor failure or motor overload.

POSSIBLE CAUSES

- **Phase wire failure or disconnection:** One or more phase wires may be damaged or disconnected, causing phase loss.
- **Faulty switches or breakers:** Defective switches, breakers, or fuses may prevent one phase from receiving sufficient power.
- **Supply failure:** phase loss or voltage fluctuations of the shore power or the generator.

- **Loose or damaged electrical connections:** Improperly secured wires or connectors may cause voltage drops or phase loss.

POSSIBLE CONSEQUENCES

- **Compressor overload:** The remaining phases may take on more load, leading to compressor overheating and potential failure.
- **System shutdown:** The three-phase system cannot operate effectively on two-phase power, leading to a shutdown.
- **Equipment damage:** Extended phase loss may result in severe compressor damage, especially if the motor continues trying to run on two phases.

SOLUTION

- **Inspect phase wires and connections:** Ensure that all phase wires are intact and securely connected.
- **Check switches and breakers:** Verify that no faulty breakers or switches are causing phase loss.
- **Examine power supply:** If the issue lies with the power supply, check the shore power connection or the generator for an outage or voltage fluctuation.
- **Install phase loss protection devices:** Consider installing a device that detects phase loss and shuts down the system before significant damage occurs.
- **Restart the system:** After resolving the issue, restart the system and confirm that the voltage across all phases is within acceptable limits.

E1:37 Phase current sampling fault

This error occurs when the system cannot correctly measure or monitor the three-phase current required for compressor operation. Incorrect current sampling may result in the compressor not receiving proper control signals, leading to malfunction, decreased performance, or system shutdown.

POSSIBLE CAUSES

- **Faulty current sensors:** Sensors (such as current transformers) measuring the three-phase current may fail, leading to inaccurate or incorrect sampling.
- **Wiring issues:** Damaged or loose connections in the current measurement circuit may disrupt accurate phase current readings.
- **Control unit failure:** The compressor control unit may not process the phase current sampling properly, causing incorrect signals to the motor.
- **Interference or noise:** Electrical disturbances or interference may disrupt the current sampling process, leading to faulty readings.

POSSIBLE CONSEQUENCES

- **Compressor malfunction:** Incorrect current measurement affects control, leading to malfunction.
- **System overheating:** The compressor may not receive accurate current data, leading to overload or reduced efficiency.

- **System shutdown:** The system may shut down to prevent further damage to the compressor or other components.

SOLUTION

- **Check current sensors:** Ensure the sensors measuring three-phase current are functioning properly and not defective.
- **Inspect wiring:** Verify that all connections from the sensors to the control unit are intact and properly connected.
- **Examine the control unit:** Ensure the control unit processes phase current sampling data accurately.
- **Filter electrical interference:** Confirm that there is no electrical noise or interference affecting the phase current measurement.
- **Restart the system:** After repairing or replacing faulty components, restart the system to ensure the error does not reoccur.

E1:38 Communication fault with the control board

This error occurs when communication between the upper printed circuit board (PCB) of the compressor control system and the compressor control unit is disrupted. Proper data exchange between the various control modules is essential for compressor operation. Communication failure may lead to faulty compressor control or complete system shutdown.

POSSIBLE CAUSES

- **Faulty wiring or connection issues:** Communication cables between control units may be damaged or loose, causing the error.
- **Upper PCB failure:** The compressor's upper PCB may malfunction, failing to send or receive proper signals.
- **Software error:** A software issue in the control system may prevent proper communication.
- **Electrical interference:** Disruptive electrical noise or interference may obstruct communication between control units.

POSSIBLE CONSEQUENCES

- **Compressor fails to receive commands:** This can lead to malfunction or shutdown.
- **Cooling or heating process interruption:** The system may stop regulating the compressor and related components.
- **Reduced system performance or shutdown:** The system will not operate efficiently until the communication issue is resolved.

SOLUTION

- **Check communication cables and connections:** Ensure that all communication cables between the control system and the PCB are securely connected and undamaged.
- **Inspect the upper PCB:** Ensure the PCB is working correctly with no damaged components.

- **Update or restart software:** If a software issue is suspected, update or restart the control system's software.
- **Filter electrical interference:** Ensure no electrical interference or noise is disrupting communication signals.
- **Restart the system:** After completing repairs, restart the system to verify communication between the control system and the PCB has been restored.

E1:39 EEPROM (memory) fault

This error occurs when the system is unable to communicate with or access data stored in the EEPROM (Electrically Erasable Programmable Read-Only Memory). The EEPROM stores critical settings and configuration data necessary for the compressor and control system's proper operation. If the system cannot access this data, it will negatively affect compressor performance and overall system operation.

POSSIBLE CAUSES

- **EEPROM failure:** The data stored in the EEPROM may be corrupted, or the memory module may malfunction, causing communication issues.
- **Faulty read/write process:** The system may be unable to read from or write to the EEPROM due to communication or control problems.
- **Voltage fluctuations:** Power supply issues, such as voltage fluctuations, can damage EEPROM data or prevent normal operation.

- **Software error:** A software malfunction in the control system may block access to the EEPROM.

POSSIBLE CONSEQUENCES

- The compressor or control system may operate incorrectly because it cannot retrieve necessary configuration settings.
- The system may fail to start properly or enter a fault mode.
- Overall system efficiency may decrease, or control functions may halt until the issue is resolved.

SOLUTION

- **Check the EEPROM:** Ensure the EEPROM is functioning properly and that there is no data corruption or hardware failure.
- **Restore or update configuration data:** If possible, restore or rewrite the configuration data stored in the EEPROM.
- **Check power supply:** Ensure there are no voltage fluctuations or power issues affecting the EEPROM's performance.
- **Update or reinstall software:** If a software error is suspected, update or reinstall the control system software to restore communication with the EEPROM.
- **Replace the EEPROM module:** If the EEPROM is faulty, replacing the module may be necessary to restore proper operation.

- **Restart the system:** After restoring data or completing repairs, restart the system to verify the error has been resolved.

E1:40 DC bus overvoltage / undervoltage

This error occurs when the DC bus voltage in the compressor is too high (overvoltage) or too low (undervoltage). The DC bus plays a key role in power distribution, converting AC (alternating current) to DC (direct current) for motor controllers and other devices. Maintaining the correct voltage range is crucial for the system's safe and efficient operation.

POSSIBLE CAUSES

- **Power supply voltage fluctuations:** Voltage variations in the electrical network can cause overvoltage or undervoltage in the DC bus.
- **Faulty capacitors or components in the inverter:** Defective capacitors or other energy management components can destabilize power supply.
- **Voltage regulation failure:** The inverter or voltage regulation system may fail to manage fluctuations properly, causing excessive or insufficient voltage in the DC bus.
- **Overload or short circuit:** Sudden load increases or short circuits in the system can cause voltage spikes or drops.

POSSIBLE CONSEQUENCES

- **Overcurrent or overheating:** Excessively high voltage can overload circuits, leading to overheating and severe system damage.
- **System shutdown or underperformance:** Low voltage can cause the system to shut down, or the compressor may not function properly, leading to reduced performance.
- **Equipment damage:** Prolonged overvoltage or undervoltage in the DC bus can damage motor controllers, inverters, and other key components.

SOLUTION

- **Check the power supply:** Ensure that the power supply is stable and there are no significant voltage fluctuations. Use a voltage stabilizer if necessary.
- **Inspect inverter components:** Check capacitors, voltage regulation circuits, and other critical components in the inverter to ensure they function properly.
- **Measure DC bus voltage:** Measure the DC bus voltage to verify that it is within the required range. If not, the inverter's regulation system may be at fault.
- **Check for overloads or short circuits:** Verify that there are no excessive loads or short circuits in the system causing voltage fluctuations.
- **Replace faulty components:** If any components, such as capacitors or voltage regulators, are faulty, replace them to restore system stability.

- **Restart the system:** After repairs, restart the system and verify that the voltage is back within the proper range.

El:41 AC input overvoltage / undervoltage

This error occurs when the AC input voltage exceeds the safe operating range, either due to overvoltage or undervoltage. The system requires the AC input voltage to remain within a specified range for optimal operation. Excessively high or low voltage can cause system components to malfunction, leading to poor performance or damage.

POSSIBLE CAUSES

- **Power grid voltage fluctuations:** Voltage spikes or drops, network overloads, or power outages can cause the AC input voltage to deviate.
- **Faulty electrical infrastructure:** Defective transformers, breakers, or other components in the power supply can cause overvoltage or undervoltage.
- **Improper wiring:** Damaged or improperly secured wires or connectors can lead to voltage issues.
- **Overloaded circuits:** System overloads can cause voltage drops or excessive power input.

POSSIBLE CONSEQUENCES

- **System malfunctions:** High voltage can overload components, leading to overheating and failure.
- **System shutdown:** Low voltage can prevent the system from receiving adequate power, resulting in decreased performance or shutdown.

- **Component damage:** Voltage fluctuations, particularly overvoltage, can damage circuits and system components, resulting in costly repairs.

SOLUTION

- **Check the power supply:** Ensure that the power supply is stable, with no significant voltage spikes or drops. Check the shore power and the generator if needed.
- **Inspect wiring and connections:** Verify that the wires and connectors are in good condition and properly sized for the system's requirements.
- **Check for system overloads:** Verify that the system is not overloaded, and if necessary, distribute the load across multiple circuits to reduce the risk of overcurrent.
- **Restart the system:** After making necessary adjustments or repairs, restart the system and confirm that the input voltage is within the proper range.

EI:42 AC input overcurrent

This fault occurs when the system's AC input current exceeds the safe operational limit. Excessive current can cause overheating, damage, or operational disturbances to critical system components, especially the compressor and electrical parts. Overcurrent can severely reduce the system's reliability and pose significant risks.

POSSIBLE CAUSES

- **System overload:** Excessive load on the system, such as high energy demand from the compressor, can cause overcurrent.

- **Short circuit:** A short circuit in any component may lead to overcurrent, causing severe damage to the system.
- **Faulty power supply:** An unstable or defective power supply can result in overcurrent.
- **Defective electrical components:** The compressor or other electrical components may fail, leading to an overcurrent situation.
- **Faulty fuse or breaker:** If the fuse or breaker is defective, it may fail to regulate current properly.

POSSIBLE CONSEQUENCES

- **Compressor failure:** Excessive current may damage the compressor, leading to shorter lifespan or complete failure.
- **System shutdown:** The system may automatically shut down to prevent further damage from overcurrent.
- **Overheating of components:** Overcurrent can cause electrical components to overheat, potentially posing a fire risk.
- **Activation of safety systems:** Fuses or breakers may trip to cut off power and protect the system from further damage.

SOLUTION

- **Check the load:** Ensure the system is not overloaded, and confirm that the compressor and other components are operating within the normal current range.
- **Inspect electrical circuits:** Check for short circuits or faulty electrical circuits causing overcurrent.

- **Check the power supply:** Ensure that the system is connected to a stable power source without overcurrent or voltage spikes.
- **Inspect the compressor:** Verify that the compressor is functioning properly without defects.
- **Check fuses and breakers:** Ensure that fuses and breakers are operational and correctly rated for the system's power needs.
- **Restart the system:** After making the necessary repairs, restart the system and verify that the input current is within the safe operational limit.

E1:43 Input voltage sampling fault

This error occurs when there is an issue with sampling or measuring the system's input voltage. Inaccurate or faulty voltage detection can lead to improper control signals being sent to the system, resulting in poor performance, overloads, or incorrect operation, compromising the stability and safety of the system.

POSSIBLE CAUSES

- **Faulty voltage sensor:** The sensor responsible for measuring the input voltage may malfunction, leading to inaccurate readings.
- **Wiring issues:** Damaged or loose connections in the voltage sampling cables may cause incorrect readings.
- **Control unit fault:** The circuits responsible for voltage measurement within the control unit may be malfunctioning, providing incorrect data.

- **Electrical interference:** Interference from external electrical signals can affect the accuracy of voltage readings.
- **Unstable power supply:** Fluctuations in the power supply can lead to incorrect sampling results.

POSSIBLE CONSEQUENCES

- **Faulty control signals:** Incorrect voltage readings may cause the control system to send improper signals, leading to malfunctions.
- **Overload:** If the system doesn't receive accurate voltage data, it may experience overloads or underperformance, damaging components over time.
- **System shutdown:** The control system may shut down the unit to prevent further damage to the compressor and critical components.

SOLUTION

- **Check voltage sensors:** Ensure that the voltage sensors are working correctly and providing accurate readings.
- **Inspect wiring and connections:** Verify that the voltage sampling cables are intact and securely connected.
- **Examine control unit circuits:** Inspect the control unit circuits to ensure they are functioning properly and delivering accurate voltage measurements.
- **Filter electrical interference:** Ensure that there is no external interference affecting the voltage sampling process.
- **Stabilize the power supply:** Ensure the power supply is stable, with no significant fluctuations.

- **Restart the system:** After addressing the issues, restart the system to confirm the voltage sampling accuracy is restored.

E1:44 Freshwater condenser temperature sensor fault

This fault occurs when the temperature sensor in the freshwater condenser malfunction, which measures the temperature of the condenser's water. The sensor is critical for monitoring the condenser's temperature to ensure that the cooling process is efficient. A faulty sensor may lead to inaccurate temperature readings, causing overheating or insufficient cooling.

POSSIBLE CAUSES

- **Sensor failure:** The sensor may fail, providing inaccurate temperature readings.
- **Wiring issues:** Damaged or loose connections between the sensor and the control system can affect sensor performance.
- **Sensor displacement:** The sensor may be misaligned or have moved from its correct position.
- **Dirt or buildup:** Dirt or scale on the condenser may interfere with accurate temperature readings.

POSSIBLE CONSEQUENCES

- **Inadequate cooling:** If the sensor provides incorrect data, the system may not be able to regulate the cooling process properly, leading to overheating or insufficient cooling.

- **Compressor overload:** The compressor may be overloaded if the system cannot accurately monitor condenser temperatures, potentially leading to long-term damage.
- **System shutdown:** The control system may shut down to prevent damage to the condenser or compressor.

SOLUTION

- **Check the temperature sensor:** Ensure the sensor is functioning properly and providing accurate readings.
- **Inspect wiring and connections:** Verify that the connections between the sensor and the control system are intact.
- **Clean the condenser:** Remove dirt or buildup from the condenser to ensure accurate sensor readings.
- **Reposition the sensor:** Ensure the sensor is correctly placed and properly secured.
- **Replace the faulty sensor:** If the sensor is defective, replace it to restore accurate temperature monitoring.
- **Restart the system:** After repairs, restart the system to ensure the sensor operates normally.

E1:45 Overvoltage (Ov) sensor fault

This fault occurs when the overvoltage (Ov) sensor malfunctions. The Ov sensor monitors for excessive voltage on the electrical network to protect the system components. If the sensor fails, the system becomes vulnerable to voltage spikes, which can damage the compressor, electrical components, and the control system.

POSSIBLE CAUSES

- **Faulty Ov sensor:** The sensor itself may fail and become unable to detect overvoltage properly.
- **Wiring issues:** Loose or damaged connections between the sensor and the control system may lead to malfunction.
- **Sensor misalignment or misconfiguration:** The sensor may be improperly calibrated or displaced from its proper position.
- **Frequent voltage fluctuations:** If there are frequent power fluctuations, the Ov sensor may become overloaded and fail.

POSSIBLE CONSEQUENCES

- **Lack of overvoltage protection:** Without proper protection, the system is exposed to voltage surges, risking damage to electrical components.
- **Compressor failure:** Overvoltage can damage the compressor, potentially leading to short-term breakdown.
- **System shutdown:** The system may shut down to prevent damage, but the lack of overvoltage protection means it remains vulnerable until the sensor is fixed.

SOLUTION

- **Check the Ov sensor:** Ensure the sensor is functioning correctly and detecting voltage surges.
- **Inspect wiring and connections:** Confirm the wiring between the sensor and the control system is intact and properly connected.

- **Recalibrate the sensor:** If misaligned, recalibrate the sensor to ensure accurate voltage monitoring.
- **Examine the power network:** Check for frequent voltage spikes or overvoltage conditions on the electrical network.
- **Replace the faulty sensor:** If the Ov sensor is defective, replace it to restore proper protection.
- **Restart the system:** After repairs, restart the system to verify that the Ov sensor is working properly.

El:46 Overheat (OHB) sensor fault

This fault occurs when the sensor responsible for overheat protection (OHB sensor) malfunctions. The OHB sensor is critical for ensuring the system's safety, as it detects overheating risks and activates protective mechanisms to prevent overheating. If the OHB sensor fails, the system's overheating protection may not function correctly, leading to potential damage.

POSSIBLE CAUSES

- **Faulty OHB sensor:** The sensor may malfunction, providing incorrect data about the system's overheating status.
- **Wiring issues:** Damaged or loose connections between the OHB sensor and the control system may disrupt data transmission.
- **Incorrect installation:** The sensor may be incorrectly installed or dislodged from its position, preventing it from accurately measuring temperature.

- **Voltage fluctuations or electrical issues:** Electrical disturbances, voltage fluctuations, or short circuits may interfere with the OHB sensor's performance.

POSSIBLE CONSEQUENCES

- **Overheating risk:** If the OHB sensor malfunctions, the system may not detect overheating, leading to excessive heat buildup and component damage.
- **Compressor failure:** Overheating can cause the compressor to fail, resulting in a shorter lifespan or complete failure.
- **System shutdown:** The control system may shut down the system to prevent overheating, but the shutdown may be delayed or missed if the sensor is faulty.

SOLUTION

- **Check the OHB sensor:** Ensure the sensor is functioning properly and providing accurate temperature readings.
- **Inspect wiring and connections:** Verify that the connections between the sensor and the control system are secure and undamaged.
- **Reposition the sensor:** Ensure the sensor is correctly installed and positioned to detect overheating effectively.
- **Check for electrical issues:** Inspect for electrical disturbances or voltage fluctuations that could interfere with sensor performance.
- **Replace the faulty sensor:** If the OHB sensor is defective, replace it with a new, working sensor to restore proper overheating protection.

- **Restart the system:** After making the necessary repairs, restart the system and check that the OHB sensor is functioning correctly.

E1:48 Input current sampling fault

This error occurs when there is an issue with measuring or sampling the system's input current. Inaccurate input current detection provides incorrect data to the control system, preventing accurate regulation and leading to potential performance issues.

POSSIBLE CAUSES

- **Faulty current sensor:** The sensor responsible for current sampling may malfunction, providing inaccurate data to the control system.
- **Wiring issues:** Damaged or loose connections between the current sensor and the control system.
- **Control system malfunction:** The control unit may not properly process input current data for regulation.
- **Electrical interference:** External electrical signals or interference may disrupt the current sampling process, leading to incorrect data.
- **Unstable power supply:** Voltage fluctuations or power supply issues can affect the accuracy of current sampling.

POSSIBLE CONSEQUENCES

- **Faulty control signals:** Incorrect current sampling may cause the control system to send improper signals to the compressor, leading to faulty operation.

- **Overload or underload:** The system may experience overload or underload due to inaccurate current data, potentially damaging components.
- **System shutdown:** The system may shut down to prevent damage caused by faulty current sampling.

SOLUTION

- **Check the current sensor:** Ensure the sensor responsible for measuring input current is functioning correctly and providing accurate data.
- **Inspect wiring and connections:** Verify that connections between the current sensor and the control system are intact and securely fastened.
- **Check the control system:** Ensure that the control unit can process input current data accurately.
- **Filter electrical interference:** Check for any external electrical interference that may be affecting current measurement accuracy.
- **Ensure stable power supply:** Verify that the system is connected to a stable power source without significant voltage fluctuations or power loss.
- **Restart the system:** After repairs, restart the system to verify that proper current sampling has been restored.

ET:49 Compressor overcurrent alarm

This fault occurs when the compressor's current draw exceeds the normal operating range, leading to an overcurrent condition. Excessive current draw indicates that the system is under heavy load, which could cause the

compressor and other related electrical components to become overloaded and potentially damaged.

POSSIBLE CAUSES

- **Overload:** The compressor is working under excessive load, such as high pressure or temperature, resulting in increased current draw.
- **Short circuit:** A short circuit within the electrical system or the compressor can cause overcurrent.
- **Cooling issues:** Blockages in the cooling system (e.g. clogged strainers, low seawater or freshwater flow) force the compressor to work harder, leading to overcurrent.
- **Motor failure:** Internal motor issues can result in excessive current consumption.

POSSIBLE CONSEQUENCES

- **Compressor failure:** Excessive current draw will damage the compressor, reducing its lifespan or leading to complete failure.
- **Overheating:** Overcurrent can cause overheating in the compressor and other electrical components, resulting in further damage.
- **System shutdown:** The system may automatically shut down to prevent further damage from overcurrent.

SOLUTION

- **Check the compressor load:** Ensure the compressor is not operating under excessive load and is set to proper pressure and temperature levels.

- **Inspect the cooling system:** Check the seawater and freshwater flow and clean clogged strainers to reduce the compressor load.
- **Inspect the compressor motor:** Check for internal damage or wear that could cause excessive current consumption.
- **Check the electrical system:** Ensure no short circuits or wiring faults are causing overcurrent.
- **Replace faulty components:** Replace any defective parts to prevent further compressor overcurrent issues.
- **Restart the system:** After repairs, restart the system and monitor the compressor's current draw to ensure it is within normal limits.

EI:50 Compressor weak magnetic field protection

This fault occurs when the compressor's magnetic field is too weak, potentially affecting the motor's operation. An insufficient magnetic field can reduce motor efficiency and performance. The protection alarm activates to prevent damage caused by a weak magnetic field, which can lead to motor overload or failure.

POSSIBLE CAUSES

- **Faulty windings or magnetic components:** The compressor motor's windings or magnetic components may be damaged or weakened, reducing the magnetic field.
- **Electrical power issues:** Inadequate or unstable power supply can weaken the motor's magnetic field, lowering performance.
- **Faulty control unit:** The compressor control system may fail to send the correct signals to maintain a strong magnetic field.
- **Compressor motor overload:** Operating the compressor under excessive load can weaken the magnetic field.
- **Overheating:** Excessive heat can damage the motor windings, reducing the magnetic field strength.

POSSIBLE CONSEQUENCES

- **Reduced efficiency:** A weak magnetic field prevents the motor from operating at full capacity, reducing system efficiency.
- **Compressor overload:** The motor may consume more energy and wear out faster under a weak magnetic field.
- **System shutdown:** The system may shut down to prevent motor damage from a weak magnetic field.

SOLUTION

- **Inspect motor windings and magnetic components:** Check for damage or wear in the windings and magnetic components.
- **Ensure stable power supply:** Verify that the system is receiving stable power without interruptions or fluctuations.
- **Check the control unit:** Ensure the control system is providing the correct signals to maintain the magnetic field.

- **Check for signs of overheating:** Ensure the motor is not overheating, which could weaken the magnetic field.
- **Replace faulty components:** Replace any damaged parts to restore motor performance.
- **Restart the system:** After repairs, restart the system and verify that the magnetic field strength has returned to normal.

E1:51 IPM overheat alarm

This fault occurs when the Intelligent Power Module (IPM) overheats. The IPM controls power distribution to the motor, and overheating can affect motor performance and lead to system shutdown. Overheating may result from cooling system failures, excessive load, or environmental factors.

POSSIBLE CAUSES

- **Inadequate cooling:** Low seawater flow, a fouled condenser or a blocked heat sink can cause IPM overheating.
- **Excessive load:** The compressor or motor may draw too much power, causing the IPM to overheat.
- **High ambient temperature:** Elevated environmental temperatures may contribute to IPM overheating, especially if cooling is inadequate.
- **Poor heat dissipation:** Faulty heat dissipation components, such as heatsinks or thermal paste, may lead to overheating.
- **Faulty IPM components:** Defective electronic components within the IPM can cause overheating.

POSSIBLE CONSEQUENCES

- **System shutdown:** The system may shut down to prevent further damage due to IPM overheating.
- **Component damage:** Prolonged overheating can damage the IPM and other electronic components, leading to costly repairs.
- **Reduced efficiency:** An overheated IPM may fail to manage power efficiently, lowering system performance.

SOLUTION

- **Check the IPM cooling:** Ensure the seawater flow is sufficient, the condenser is clean and the heat sink is free. Clean any blockages if necessary.
- **Monitor ambient temperature:** Ensure the system is operating in a properly ventilated environment with manageable temperatures.
- **Inspect heat dissipation components:** Check heatsinks and thermal paste for damage or wear.
- **Check the compressor load:** Ensure the compressor is not drawing excessive power, which could overheat the IPM.
- **Replace faulty IPM components:** Replace damaged internal components to prevent future overheating.
- **Restart the system:** After making repairs, restart the system and verify that the IPM temperature has stabilized.

E1:52 AC input undervoltage alarm

This error occurs when the alternating current (AC) input voltage drops below the expected level, preventing the compressor, motors, and other system components from receiving enough power to function correctly. If the voltage is too low, system components may not receive the necessary current, causing performance issues or even system shutdown.

POSSIBLE CAUSES

- **Network voltage fluctuation:** Fluctuations in the input power grid can result in low voltage.
- **Power supply issue:** The power grid may be unable to provide stable voltage due to load peaks or infrastructure issues.
- **Wiring problem:** Faulty or damaged wiring between the system and the power source can lead to voltage drops.
- **Faulty electrical components:** Malfunctioning fuses, breakers, or other electrical components may fail to supply the system with proper voltage.

POSSIBLE CONSEQUENCES

- **Decreased performance:** Compressors and motors will not receive enough power, reducing cooling or heating capacity and overall performance.
- **System shutdown:** The system may automatically shut down to protect sensitive components like the compressor from damage due to low voltage.

- **Component damage:** Prolonged low voltage can harm electrical components, particularly motors, compressors, and control units.

SOLUTION

- **Check power supply:** Assess the stability of the power grid and verify there are no voltage fluctuations. If needed, check the shore power and the generator.
- **Use a voltage stabilizer:** If the network produces frequent voltage fluctuations, consider installing a voltage stabilizer to protect the system.
- **Inspect wiring:** Ensure cables and connections are undamaged and able to deliver proper voltage.
- **Inspect electrical components:** Verify fuses, breakers, and other electrical components are functioning correctly without faults.
- **Replace faulty components:** Replace any malfunctioning parts to restore stable power delivery to the system.
- **Restart the system:** After repairs, restart the system to ensure the input voltage has returned to the normal range.

E1:53 AC input overcurrent alarm

This alarm indicates that the alternating current (AC) input current has exceeded the maximum allowable level. Excessive current can strain the compressor and other electrical components, leading to potential damage and compromising the system's stability and reliability.

POSSIBLE CAUSES

- **Overload in the system:** Compressors or other system components may draw too much current, causing the input current to exceed the limit.
- **Short circuit:** A short circuit in the electrical circuits can cause voltage surges and overcurrent.
- **Faulty power supply:** Voltage fluctuations or improper power supply from the electrical network can result in excessive current draw.
- **Faulty electrical components:** Defective parts, such as motors, capacitors, or fuses, can lead to overcurrent.
- **Improper wiring:** Damaged or undersized wiring may contribute to overcurrent.

POSSIBLE CONSEQUENCES

- **System shutdown:** The system may automatically shut down to prevent further damage caused by overcurrent.
- **Component damage:** Prolonged overcurrent can harm compressors, motors, and other electrical components, especially fuses and breakers.
- **Overheating:** Overcurrent can cause electrical components to overheat, leading to operational issues or fire hazards.

SOLUTION

- **Check system load:** Ensure compressors and other components are not drawing too much current, preventing overcurrent situations.
- **Inspect system circuits:** Verify that no short circuits are present and that all circuits function properly.

- **Check power supply:** Ensure the electrical grid provides stable voltage without surges or current fluctuations.
- **Inspect wiring:** Verify that cables are not damaged and have the proper current capacity.
- **Replace faulty components:** Replace malfunctioning electrical components like motors, capacitors, or fuses to prevent further overcurrent issues.
- **Restart the system:** After completing repairs, restart the system to confirm that input current has returned to normal.

E1:54 EEPROM fault alarm

This error indicates that the system cannot properly access the EEPROM (Electrically Erasable Programmable Read-Only Memory) or has detected a fault in the stored data. The EEPROM stores critical system settings, configurations, and operational parameters. If it fails or the data becomes corrupted, the system may not operate correctly.

POSSIBLE CAUSES

- **Damaged or faulty EEPROM:** The EEPROM memory may have corrupted data, or the EEPROM module itself may be faulty.
- **Faulty read/write process:** Errors in writing to or reading from the EEPROM can occur due to hardware or software issues.
- **Power supply issues:** Voltage fluctuations or power failures can corrupt EEPROM data.

- **Software failure:** Software bugs in the control system may prevent proper access to or storage of EEPROM data.

POSSIBLE CONSEQUENCES

- **System errors:** The system cannot access correct settings or operational parameters, leading to malfunctions or shutdown.
- **Improper control functions:** Without access to EEPROM data, the control system cannot maintain optimal operation.
- **System shutdown:** In severe cases, the control system may completely shut down until the EEPROM issue is resolved.

SOLUTION

- **Check EEPROM memory:** Ensure that the EEPROM module is functioning correctly and is free from physical or electronic damage.
- **Restore or rewrite data:** If possible, restore or rewrite the configuration data stored in the EEPROM.
- **Update system software:** If the issue is software-related, update or reinstall the control system software, ensuring proper data access.
- **Check power supply:** Verify that there are no voltage fluctuations or power outages affecting the EEPROM.
- **Replace faulty EEPROM module:** If the EEPROM is damaged, replace it with a new module to restore proper operation.

- **Restart the system:** Once data is restored or the module is replaced, restart the system to confirm that the issue is resolved.

E1:57 IPM overheating shutdown

This error indicates that the Intelligent Power Module (IPM) has overheated, and the system has automatically shut down the compressor or affected equipment to prevent further damage. The IPM regulates power delivery to the motor, and overheating can lead to module failure or reduced compressor efficiency. The system shutdown serves as a protective measure to prevent serious failures.

POSSIBLE CAUSES

- **Inadequate cooling:** Low seawater flow, a fouled condenser or blocked ventilation around the chiller can cause the IPM to overheat.
- **Excessive current draw:** Compressors or motors drawing too much current can overload and overheat the IPM.
- **High ambient temperature:** High environmental temperatures can exacerbate IPM heating, especially if the cooling system is compromised.
- **Poor heat dissipation:** Faulty heatsinks or thermal materials within the IPM can cause internal overheating.
- **Faulty IPM components:** Damaged components, such as transistors or switching elements within the IPM, can cause overheating.

POSSIBLE CONSEQUENCES

- **System shutdown:** The system automatically shuts down to prevent further damage to the IPM and compressor.
- **Compressor performance reduction:** Compressor efficiency may decline, leading to a drop in overall system performance.
- **Component damage:** Prolonged overheating can damage the IPM and other sensitive electrical components, leading to costly repairs.

SOLUTION

- **Inspect the cooling system:** Ensure that the seawater flow is sufficient and that the ventilation around the chiller is free from blockages. Clean as needed.
- **Check ambient temperature:** Verify that the system operates in a well-ventilated environment with manageable temperatures.
- **Inspect heat dissipation:** Check the heatsinks and thermal materials within the IPM to ensure they function correctly.
- **Check current load:** Ensure that the compressor is not drawing excessive current, which could cause the IPM to overheat.
- **Replace faulty IPM components:** If any internal components of the IPM are damaged, replace them to fix overheating problems.
- **Restart the system:** After repairs, restart the system and confirm that the IPM is no longer overheating.

PART 14

Technical data

14.1 Chiller units

230 V 1~ models		HC24 VFD	HC36 VFD	HC50 VFD	HC64 VFD	HC80 VFD
Cooling capacity	Btu/h	24 000	36 000	50 000	64 000	80 000
Cooling capacity	kW	7.0	10.6	14.7	18.8	23.4
Power supply		230 V 1~, 50/60 Hz				
Current, cooling	A	6	10	13	18	25
Current, heating (max.)	A	8	12	15	20	28
Compressor		Inverter (variable speed)				
Refrigerant		R32				
Chilled water flow	l/min	21	28	35	36	60
Chilled water connection		¾"	¾"	1"	1"	1"
Seawater flow	l/min	25	33	40	55	65
Seawater connection		16 mm hose	16 mm hose	¾"	¾"	¾"
Seawater operating range	°C	Cooling up to 40 °C · heating from 5 °C				
Height	mm	470	470	490	490	540
Width	mm	300	300	340	340	360
Length: housing / overall	mm	380 / 474	380 / 474	450 / 520	530 / 600	545 / 625
Net weight	kg	35	38	52	56	75
Supplied with		LED display, 5 m network cable				

400 V 3~ models		HC64 VFD	HC80 VFD	HC96 VFD	HC120 VFD
Cooling capacity	Btu/h	64 000	80 000	96 000	120 000
Cooling capacity	kW	18.8	23.4	28.1	35.2
Power supply		400 V 3~ (no neutral), 50/60 Hz			
Current, cooling	A	6	8.3	12	15
Current, heating (max.)	A	6.6	9.3	14	17
Compressor		Inverter (variable speed)			
Refrigerant		R32			
Chilled water flow	l/min	36	60	67	84
Chilled water connection		1"	1"	1"	1-1/4"
Seawater flow	l/min	55	65	75	110
Seawater connection		3/4"	3/4"	3/4"	3/4"
Seawater operating range	°C	Cooling up to 40 °C · heating from 5 °C			
Height	mm	490	540	567	637
Width	mm	340	360	380	380
Length: housing / overall	mm	530 / 600	545 / 625	650 / 779	650 / 779
Net weight	kg	56	75	80	97
Supplied with		LED display, 5 m network cable			

kW values are converted from Btu/h (1 kW = 3 412 Btu/h). Size the circuit breaker for the heating current (8.4). Overall length includes the service valves and connections on the side of the housing; dimension drawings: 3.4.

14.2 Fan coil units

Fan coil units		CFPG08	CFPG10	CFPG12	CFPG16	CFPG24
Cooling capacity	Btu/h	8 000	10 000	12 000	16 000	24 000
Power supply		230 V 50/60 Hz				
Operating current	A	0.4	0.5	0.8	0.9	1.1
Input power (fan)	W	100	120	150	200	220
Electric heater	W	–	1 000	1 000	1 000	2 000
Chilled water flow	l/min	6.5	9.5	11.5	16.5	23.5
Chilled water connection		3/4"				
Condensate drain connection		DN15	DN15	DN15	DN20	DN20
Width	mm	420	460	500	530	630
Height	mm	290	315	320	370	430
Depth	mm	261	270	320	330	373
Net weight	kg	8.5	10.5	11.6	15.5	21

Warranty

15.1 Limited warranty OWNER

MBC Marine provides a limited warranty for its marine air conditioning systems against defects in materials and workmanship, for the original end user, within the warranty period. If a verified defect is found during the warranty period, MBC Marine may, at its sole discretion, repair or replace the defective component(s) or refund the purchase price in part or in full. In the case of a refund, the contract is considered terminated and no further claims can be made.

15.2 Warranty period OWNER

Product status	Warranty
Registered and installed by an official MBC partner	2 years, full warranty
Not registered, or not installed by an MBC partner	1 year: first 6 months parts and labour, last 6 months parts only

The warranty starts on the date of purchase, the date of installation or, for OEM installations, the date the vessel is delivered to the end user, but never later than 3 years after the manufacturing date. The manufacturing date can be verified from the serial number through MBC Marine customer service.

15.3 Product registration OWNER

Register your product at www.mbc-marine.com to benefit from the full warranty. For unregistered products, a valid proof of purchase is required for any warranty claim.



NOTICE

Improper grounding, incorrect connection to the seawater, chilled water or electrical system, or installation not according to this manual voids the warranty.

15.4 Exclusions OWNER

- Normal wear and tear (e.g. filters, fuses, strainer baskets).
- Labour costs for removal or reinstallation of the system.
- Damage during transport or improper storage.
- Galvanic corrosion due to missing or inadequate grounding or galvanic protection.
- Installation not following the official MBC Marine guidelines.
- Corrosion, improper maintenance, misuse or external damage.

- Unauthorised modifications, non-genuine parts or repairs by unauthorised personnel.
- Water damage to electrical components such as control boards or displays.
- Frost damage, including a frozen or burst evaporator or condenser, due to insufficient glycol or winterization.
- Damage caused by dirt or debris in the water circuits, missing strainers or a clogged heat exchanger.
- Pumps that have run dry.
- Use of unauthorised refrigerants.
- Damage caused by undersized power supply wiring or an unstable supply (under- or overvoltage, spikes, phase loss).
- Failures from operation outside the specified limits (2.5) or contrary to this manual.
- Indirect, incidental or consequential damages (including travel costs, lost time, financial loss or personal injury).

15.5 Final provisions **OWNER**

MBC Marine reserves the right to amend this warranty policy at any time without prior notice, in particular to comply with national or EU legislation. Statutory rights of consumers remain unaffected.

PART 16

Legal disclaimer

MBC Marine has prepared this manual based on the most current information available. It cannot cover every possible situation; please contact our experts for specific questions or unusual requirements. While every precaution has been taken to ensure accuracy, MBC Marine is not liable for errors or omissions, nor for damage arising from the proper or improper use of the product or of the information in this manual.

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EU Declaration of Conformity: see the following page.

EU Declaration of Conformity

Manufacturer	MBC Marine Ltd. Petőfi Sándor u. 39/A, 2049 Diósd, Hungary
Product	Variable Chiller marine chilled water air conditioning unit with inverter compressor
Models	230 V 1~: HC24, HC36, HC50, HC64, HC80 VFD 400 V 3~: HC64, HC80, HC96, HC120 VFD
Refrigerant	R32

This declaration of conformity is issued under the sole responsibility of the manufacturer. The products described above are in conformity with the relevant Union harmonisation legislation:

- **2014/35/EU** Low Voltage Directive
- **2014/30/EU** Electromagnetic Compatibility Directive
- **2011/65/EU** and **(EU) 2015/863** RoHS Directive

Harmonised standards and technical specifications applied:

EN 60335-1	Household and similar electrical appliances – Safety – General requirements
EN 60335-2-40	Particular requirements for electrical heat pumps, air conditioners and dehumidifiers
EN 55014-1 / -2	Electromagnetic compatibility – Emission / Immunity
EN 61000-3-2 / -3-3	Harmonic current emissions; voltage fluctuations and flicker (≤ 16 A per phase)
EN 61000-3-12 / -3-11	Harmonic current emissions; voltage fluctuations and flicker (> 16 A per phase)
EN IEC 63000	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

Conformity applies when the product is installed and operated according to this manual.

PLACE AND DATE OF ISSUE	NAME AND FUNCTION	SIGNATURE
Budapest, 15.10.2025	Roland Várnai, CEO	



Notes

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MBC Marine Ltd.

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