



FRIGOMAR
EXCLUSIVE MARINE REFRIGERATION



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Installation and Maintenance Manual

Fan coil AH series





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1.0 INTRODUCTION

This Document is confidential by law and may not be copied or transferred to any third party without the express permission of the manufacturer. The manufacturer reserves the right to make changes at any time to their models, without prejudice to the essential features described in this manual.

This manual has been prepared with the aim to give you all the explanations to be able to properly install and maintain the **Fan coil unit** and to better manage the device. Improper installation procedures can result in unsatisfactory performance and / or premature failure of this air conditioning unit.

We invite you to read it carefully before operating the product. If there are any statements or procedures described in this manual, that you do not understand, contact FRIGOMAR for assistance:

Phone: +39 (0) 185 384 888

E-mail: tecnico@frigomar.com

Keep the manual in a dry location to prevent deterioration, for at least 10 years for any future reference.

In the interest of product improvement, specifications and design of the Fan Coil units will be subject to change without giving notice.

2.0 SAFETY

This instruction manual is an integral part of the appliance and therefore must be kept with care and must ALWAYS accompany the appliance even in case of its sale to another owner or user or to a transfer to another plant. In case it is damaged or lost, request another copy from the Technical Service of the area.

During all operations on the device it is necessary to observe the precautions specified in this manual and on the labels attached to the appliance, as well as all the precautions suggested by common sense, and the safety regulations currents at the place of installation.

Please read this manual carefully before proceeding with any operation (installation, maintenance, use) and follow scrupulously the instructions contained in the individual chapters. Failing to comply with the instructions contained in this manual and use the appliance outside the operating limits specified will void the warranty.

Make known these instructions to all staff interested at the unit.

The manufacturer assumes no responsibility for damage to people or property arising from the failure to compliance with the rules contained in this booklet.

In case of replacement of parts, use only original spare parts.

You should always use personal protective elements to perform actions on the devices.

In the case of water spills from the water circuit, switch off immediately the pump and shut off Manual Valves in order to stop the water flow.

During the cold period if the unit is not in use, drain the unit and all the hydraulic circuits connected to the unit to prevent them from freezing.

2.1.1 RECOGNIZE SAFETY SYMBOLS, WORDS AND LABELS

The following symbols and labels are used throughout this manual to indicate immediate or potential safety hazards. It is the owner's and installer's responsibility to read and comply with all safety information and instructions accompanying these symbols. Failure to heed safety information increases the risk of personal injury, property damage, and/or product damage.



WARNING

The word "**WARNING**" indicates hazards or unsafe practices which **COULD** result in severe personal injury or death.



CAUTION

The word "**CAUTION**" indicates hazards or unsafe practices which **COULD** result in minor or moderate personal injury, product damage, or property damage.



2.1.2 OPERATIONAL SAFETY

Installation and servicing of this system can be hazardous due to system pressure, moving parts, heat, and electrical components. Only trained and certified service personnel should install, repair, or service the unit. When working on this equipment, always observe precautions described in the literature, tags, and labels attached to the unit. Follow all safety codes. Wear safety glasses and work gloves and place a fire extinguisher close to the work area. Do not work alone.



WARNING

Never install your air conditioner in the bilge or engine room areas. Ensure that the selected location is sealed from direct access to bilge and/or engine room vapors.

Do not terminate condensate drain line within 4 feet of any outlet of engine or generator exhaust systems, nor in a compartment housing an engine or generator, nor in a bilge, unless the drain is connected properly to a sealed condensate or shower sump pump.

Failure to comply may allow bilge or engine room vapors to mix with the air conditioner's return air and contaminate living areas which may result in injury or death.



WARNING

Do not locate the unit or ducting in locations where they could become conduits for hazardous fumes. For example, do not locate the inlet of a unit such that it could suck in exhaust fumes or any other hazardous fumes.



WARNING

Electrical shock hazard. Disconnect voltage at main panel or power source before opening any cover.



WARNING

To minimize the hazard of electrical shock and personal injury all electrically powered equipment must be effectively grounded. Refer to installation guidelines for further information.



WARNING

The electric heaters inside the units can cause severe burns. After disconnecting power to the heater, allow the blower to continue to run for 5 minutes at high speed before working near the heater. If the blower cannot be used to cool the heater, then let the heater cool for 2 hours after disconnecting power before working near the heater.



WARNING

The blowers have moving parts that can cause severe injuries. Never touch a spinning blower wheel. Always turn the blower off and allow it to come to a complete stop before working near it. Always wear eye protection. If a screw or other small object hits the spinning blower wheel, the small object will become a dangerous projectile. Note that drafts can cause the wheel to begin to spin even when there is no power to the blower. Thus, even an unpowered blower wheel can cause injury. Eliminate the draft and wait for the blower wheel to stop spinning.

2.1.3 PROHIBITIONS

We remember that the products using electricity and water requires the observance of the following rules:

- It is forbidden the use by children and unassisted disabled people.
- Do not touch the appliance when barefoot or with wet or damp parts of the body.
- It is forbidden any operation before disconnecting the unit from the mains supply by moving the power switch to "off".
- Do not modify safety devices or adjustment without permission and instructions from the manufacturer.
- Do not pull, detach or twist the electrical cables coming from the appliance, even if it is disconnected from the mains power supply.
- It is forbidden to open the access panels to the internal parts of the unit without having first disconnected the unit from the mains by putting the system power switch to "OFF position".
- Do not dispose, abandon or leave within the reach of children the packaging material because it can be a potential source of danger.
- It is forbidden to use water pipes for the unit grounding.

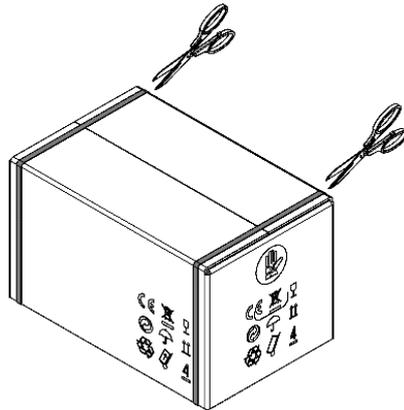


2.1.4 RESPONSIBILITY

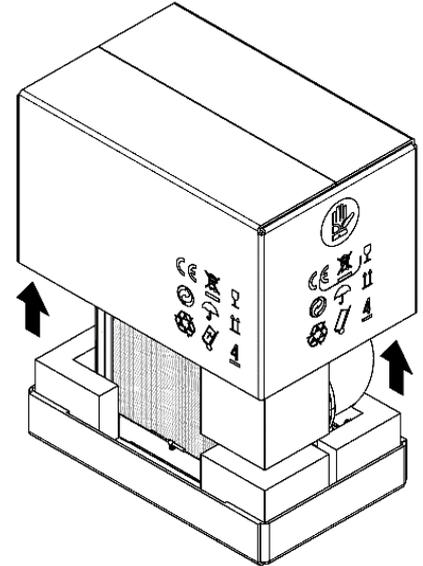
FRIGOMAR S.r.l. disclaims any liability for damage to people, animals or property resulting from the installation, use or maintenance improper of the product, or due to failure of compliance with standards and directives mentioned in this manual.

3.0 PACKAGING AND IDENTIFICATION

The packaging is made of suitable materials to protect the machine from the stress of transport and handling. All units are delivered complete and in perfect condition, however, to control the quality of transport services, check the following:



- Upon receipt check if the box is damaged, if that is the case, accept the goods with reservations and keep photographic evidence of any damage found.
- Unpack and check the presence of the individual components.
- Check that all components have not been damaged during transport.



IMPORTANT! Lift the unit by the upper dedicated handles avoiding to catch it in sensitive parts such as tubing and air adapters. When the load is lifted off the ground stay away from below and surrounding area.

During transport operations respect the symbols on package and avoid to place in a vertical position the product. In fact, the refrigerator compressor is mounted on vibration dampers, and there may be a shift of the compressor or piping connecting outside their seats.

Each product is identified by a label as below:

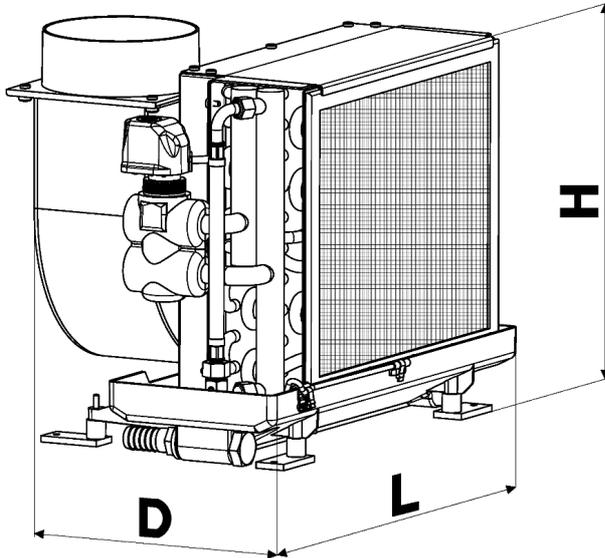
		FRIGOMAR® Frigomar S.r.l. Via Vittorio Veneto, 112		
EXCLUSIVE MARINE REFRIGERATION & AIR CONDITIONING SYSTEMS		Loc. Rivarola 16042 Carasco (GE)		
Type: FANCOIL UNIT XXXXX BTU/h				
MOD: AHX	Serial number XXXXXXXXXX			
Voltage 230V-1ph-50/60Hz	Max input power XXX W	Max current X.X A		
Hydraulic connections GX/X"	Max water pressure 5 bar	Air outlet dim. ØXXXmm		

Not dispose of, abandon or leave within the reach of children packaging materials (cardboard, staples, plastic bags, etc..) as it can be a potential source of danger.

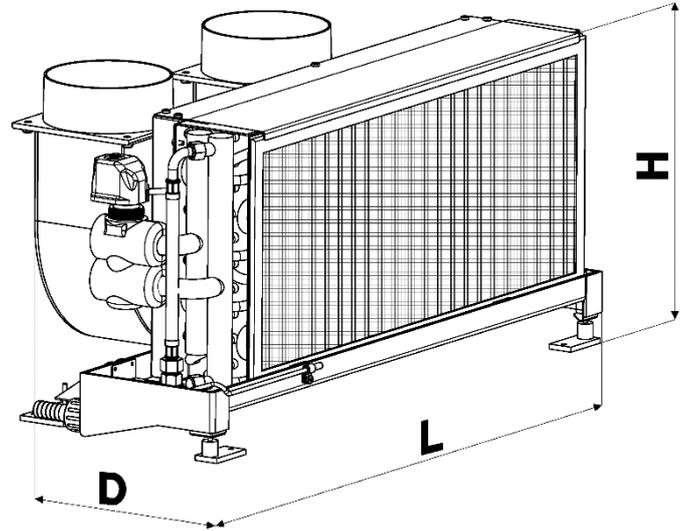


4.0 NOMINAL TECHNICAL FEATURES

AH series is composed by 5 sizes of fancoil units. In the table below we can resume the principal nominal technical features:



SINGLE FAN MODELS AH1, AH3, AH5



DOUBLE FAN MODELS AH7, AH9

	FANCOIL MODELS				
	AH1	AH3	AH5	AH7	AH9
Cooling capacity (Btu/h)	5000	9000	12000	18000	28000
Heating capacity (Btu/h)	5000	9000	12000	18000	28000
Max. water inlet temperature (°C)	50	50	50	50	50
Min. water inlet temperature (°C)	4	4	4	4	4
Ductable fill (m)	3	3	3	3	3
Air outlet (mm/inch)	1x Ø101 / 4	1x Ø127 / 5	1x Ø127 / 5	2x Ø127 / 5	2x Ø127 / 5
Power supply	230V -1ph - 50/60Hz	230V -1ph - 50/60Hz	230V -1ph - 50/60Hz	230V -1ph - 50/60Hz	230V -1ph - 50/60Hz
Water pipe connections	G 1/2"M	G 1/2"M	G 1/2"M	G 3/4"M	G 3/4"M
Water side	Left and Right	Left and Right	Left and Right	Left and Right	Left and Right
Standard water side	Left	Left	Left	Left	Left
Drain discharge (mm/inch)	Ø16 / 0,63	Ø16 / 0,63	Ø16 / 0,63	Ø16 / 0,63	Ø16 / 0,63
Drain discharge possible positions	4 positions	4 positions	4 positions	2 positions	2 positions
Default drain discharge positions	2 x Back	2 x Back	2 x Back	2 x Back	2 x Back
Adjustable feet (mm/inch)	0÷10 / 0÷0,39	0÷10 / 0÷0,39	0÷10 / 0÷0,39	0÷10 / 0÷0,39	0÷10 / 0÷0,39
Length (L) (mm/inch)	360 / 14,17	400 / 15,75	400 / 15,75	665 / 26,18	665 / 26,18
Deep (D) (mm/inch)	285 / 11,22	291 / 11,45	307 / 12,08	294 / 11,57	310 / 12,20
Height (H) (mm/inch)	225 / 8,85	305 / 12,00	380 / 14,96	305 / 12,00	355 / 13,97
Weight (kg/lbs)	5 / 11,02	6,5 / 14,33	7 / 15,43	12 / 26,45	13,5 / 297,62
Environmental operating conditions	Maximum ambient operating temperature 45°C (113°F) If needed Higher temperatures please contact Frigomar Service.				



5.0 INSTALLATION

A circulated water system will only perform as well as the quality of the installation. This consists mainly of plumbing and wiring, which can be handled by most boatyards. Each aspect of the installation should be thoroughly planned to minimize time-consuming mistakes and maximize performance. Read carefully this manual before starting with the installation.

5.1.1 FIXING AND LEVELING THE UNIT

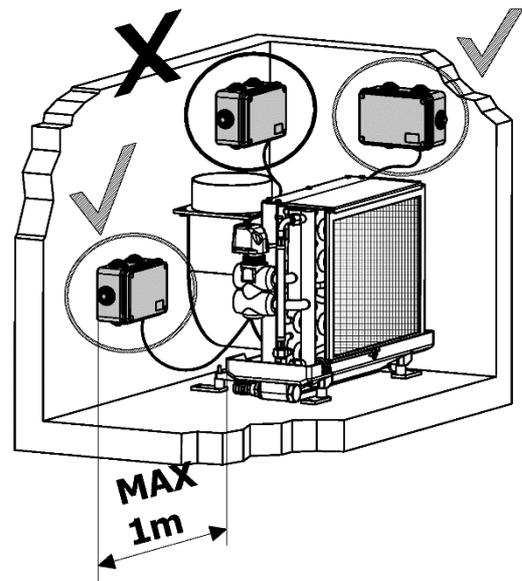
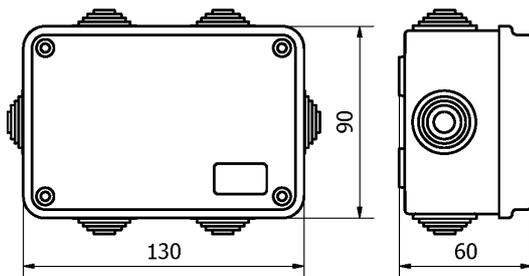
The fan coil unit must be securely mounted to a strong, unmoving structure. The fan coil unit will tip with the boat when the boat tips, but when the boat is level, the fan coil unit must also be level.

5.1.2 ELECTRIC CONNECTION BOX FIXING

The electrical connection box must be fixed near the machine with a maximum distance of 1m.

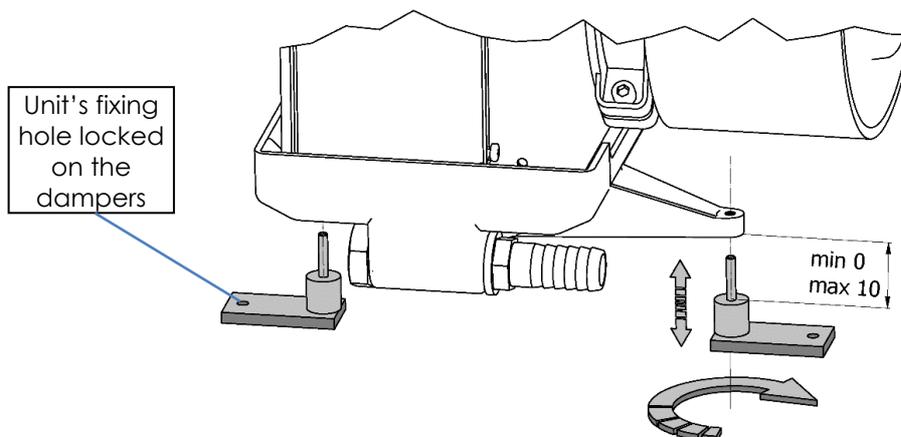
It can be fixed to the wall or to the floor (as long as it is not in floodable areas).

It is important to fix it in easily accessible areas avoiding excessive proximity to the parts of the machine subject to inspection or maintenance such as the fan and the air filter.



5.1.3 DUMPERS AND DRAINS

Units must always be secured to a rigid, massive structure, even if vibration is seldom an issue for these kind of products. Each unit has 4 Dumpers (Silent block) assembled. If necessary they can be used as height-adjustable feet.



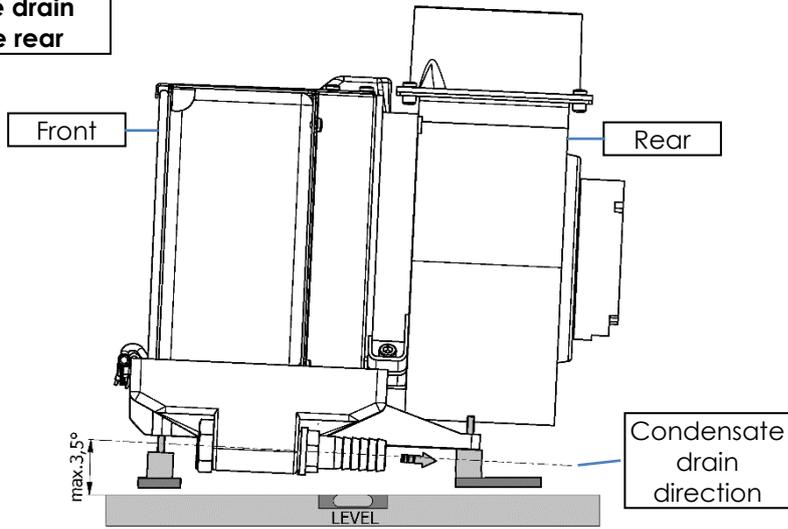
These Dumpers in fact could be screwed and unscrewed to adjust the machine's slopes for a maximum height of 10mm.

Please be sure that the machine's inclinations are in favor of the disposal of condensate drain.

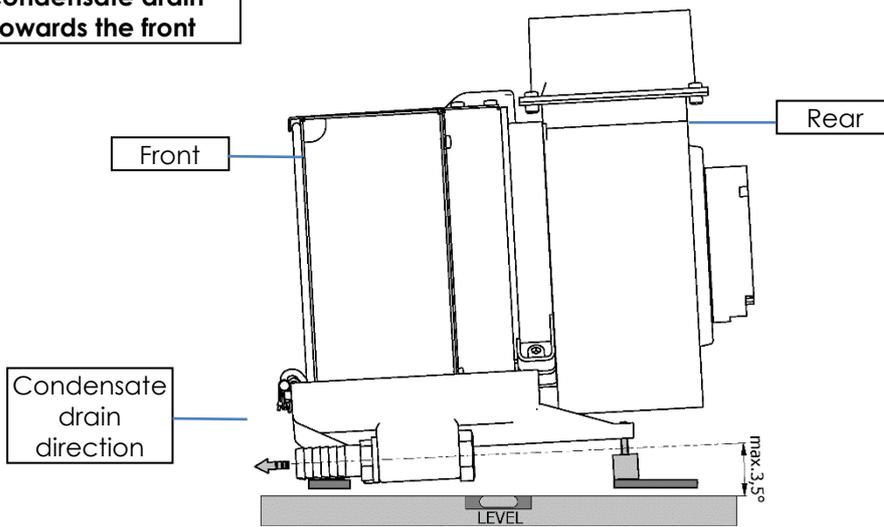


Here below some installation examples:

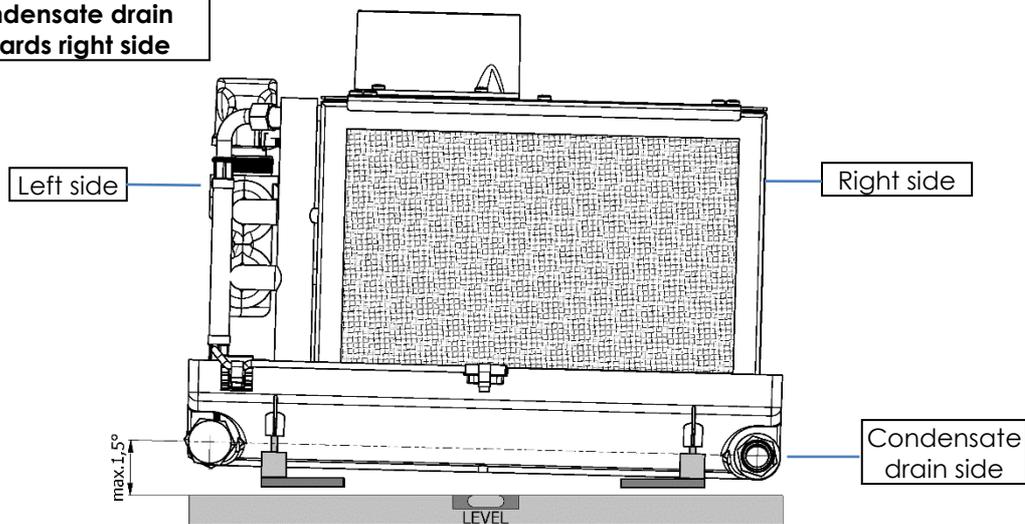
**Condensate drain
towards the rear**

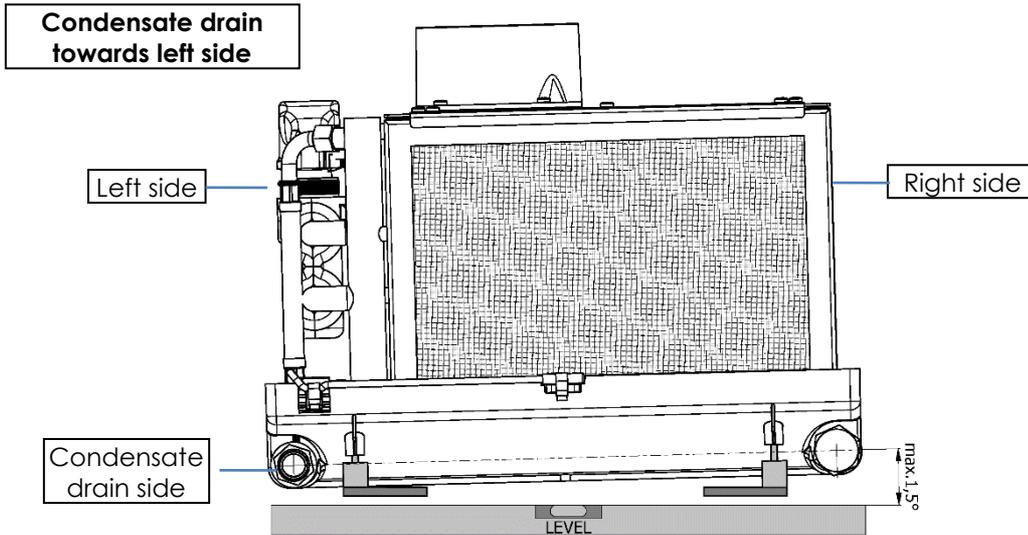


**Condensate drain
towards the front**

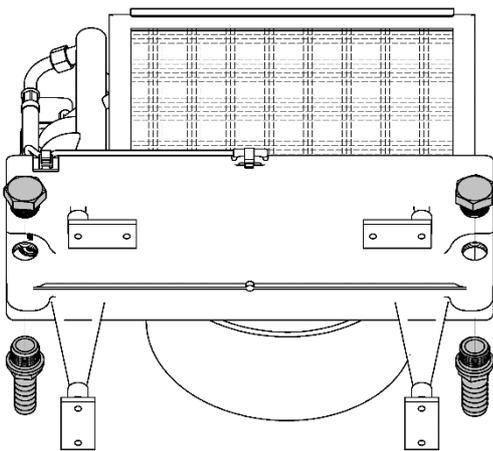


**Condensate drain
towards right side**

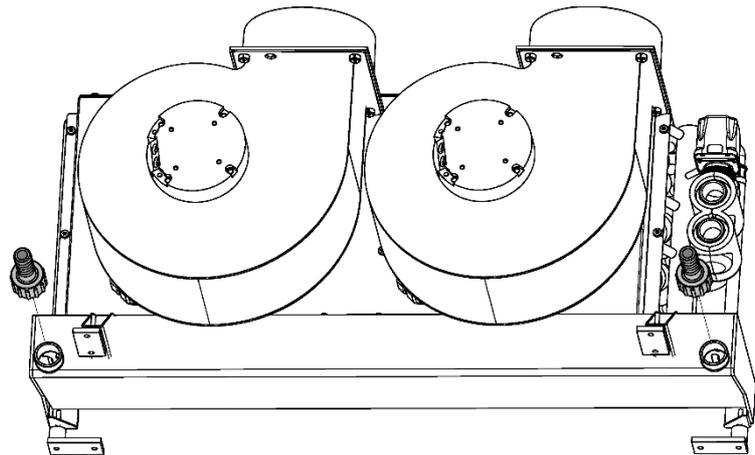




Drains: The drains must always be connected to the drain hose. It is possible to choose the condensate drain position from 4 possible positions for the models AH1, AH3, AH5 and 2 possible positions for the models AH7, AH9



Drains for AH1,AH3,AH5 models



Drains for AH7,AH9 models

5.1.4 ACCESSIBILITY

Select a location that allows good access for service, visual inspection, and removal of the unit. It is especially important to make sure that the filter can be conveniently replaced. The 3-way valve, electric heat, manual thermal overload (for units with electric heat), blower, bleeder, duct connection, water connections, and the service ball valves (supplied by the installer) must all be accessible for service.

5.1.5 AVOID CONDENSATION

Most fan coil units only have 5mm of insulation. They will perform better, make less condensation, and look better longer if they are located in a semi-conditioned space. If possible, avoid putting them in places where the exterior of the fan coil unit will be exposed to outside air or air from saunas or showers.

Note that engine rooms usually have large ventilators, exposing everything in the engine room to outside air.



5.1.6 FREEZE PROTECTION

These units are designed to operate indoors. Exposure to sub-freezing ambient air may freeze the coil if adequate precautions are not taken. When possible, avoid the situation entirely by not exposing the fan coil unit to sub-freezing temperatures.

5.1.7 MINIMIZING AUDIBLE NOISE

Air movement causes noise. Thus, a certain amount of noise is an unavoidable consequence of any air-moving device. The more air is moved, the lower the noise will be. However, some ways of moving air cause less noise than others.

KEY PRINCIPLES

- Rigid, heavy materials tend to reflect airborne noise. Soft, THICK materials tend to transmit a small fraction of the noise passing through them. Thus, these two types of material tend to work well together, especially when layered. The (first) layer of soft material should be set between the noise source and the heavy, rigid layer.
- In general, anything that causes turbulence or restriction is likely to create noise. Exception: There are sound absorbing boxes and duct configurations that are restrictive, but their net effect is to REDUCE the transmitted noise. A good example is the return-air arrangement described below.
- Sharp transitions tend to create more noise than smooth transitions.
- Straight duct tends to create less noise than bends.
- A gradual bend (large radius) in the duct tends to create less noise than a sharp bend (small radius).

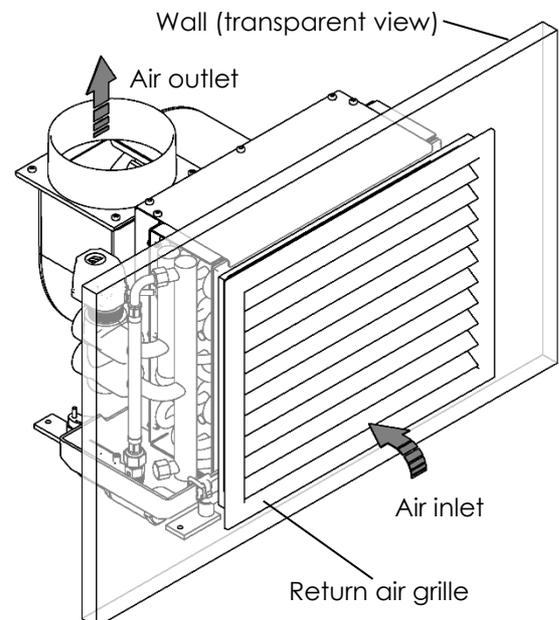
PRACTICAL SUGGESTIONS

- **Vibration:** Transmission of vibration generated by fan coil units is rarely if ever an issue. But, make sure the fan coil unit is securely fastened to a rigid, massive structure. If vibration isolators are included with the fan coil unit, use them. Aside from that, focus on airborne noise.
- **Multiple units:** For noise-critical spaces, multiple small units may be better than one large unit. Smaller units move less air. More diffusers usually mean less "throw" is required. Ductwork tends to be shorter and simpler. It will usually be easier to oversize the duct.

- **Return-air grilles:** Putting the unit close to the return-air grille is usually a good idea. But if noise is critical, it may be better to put it at a slight distance. Airborne sound likes to travel down a short, straight path with heavy, rigid walls that channel the noise. So, make the distance long. Include one or more 90-180° changes of direction. Use heavy, rigid walls to keep the noise from escaping, but line these walls with a soft, sound-absorbing material.

Cautions: Be sure the unit is drawing its air from the space to be conditioned. Be sure that the return-air path is generously sized. (The cross-sectional area at every point in the return-air path should be at least as large as the minimum return-air grille size. Any restriction here will adversely affect the units airflow and performance, and will tend to cause air to be drawn in from undesirable places.) Be sure the unit is still accessible for service and removal. Be sure that the materials you use are suitable from a flammability and smoke-generation standpoint. The filter can be remote from the unit, but be sure that air cannot bypass the filter. Be sure the filter is readily replaceable.

- **Duct length:** Most fan coil units should have at least 1.5m of duct. This length reduces motor





noise and blower vane tip noise transmitted to the space.

- **Bends:** ONE 90° bend in the supply duct is desirable, because it will attenuate noise that was generated upstream. It should be downstream of the unit and any transition boxes.

Each additional elbow will provide successively decreasing noise attenuation, and the benefit of any additional noise attenuation is usually outweighed by the additional noise generated by the restriction.

- **Blower speed:** Do not use duct work or diffusers to reduce airflow. This will create noise. Instead, reduce the blower speed.
- **Experiment:** The more realistic the relevant conditions are, the more significant the results will be. Some top-quality yacht builders routinely assemble mock systems outside the vessel. They can easily modify it and try different things because it is not installed in a boat. They know how well a given duct design will work BEFORE they install it, perhaps even before the layout of the boat is finalized.

6.0 AIR DISTRIBUTION

6.1.1 THERMAL INSULATION

Good air flow is critical for the performance of the entire system. It is highly dependent on the quality of the ducting installation. The ducting should be run as straight, smooth and taut as possible. Minimize the number of bends.

Most duct should have at least 25mm polyester or equivalent insulation. Duct in very hot spaces, such as above or in front of a flybridge, should have 40mm insulation. Return ducts in semi-conditioned spaces do not require insulation unless there is reason to believe the temperature in a given space may be more than 5° warmer than the return duct. The most critical feature is that the supply duct be adequately insulated. This not only keeps the supply air cold, but it prevents condensation from forming.

Do Not Compress: Do not compress the insulation. For example, do not use tie wraps or wire to support insulation. The localized compression will cause poor performance, condensation, and eventually damage the insulation. Use broad straps to support the duct. Ideally, support for flex duct should wrap around the bottom half of the duct, and should be at least 6" long. This will spread the weight out so the insulation will not be pinched.

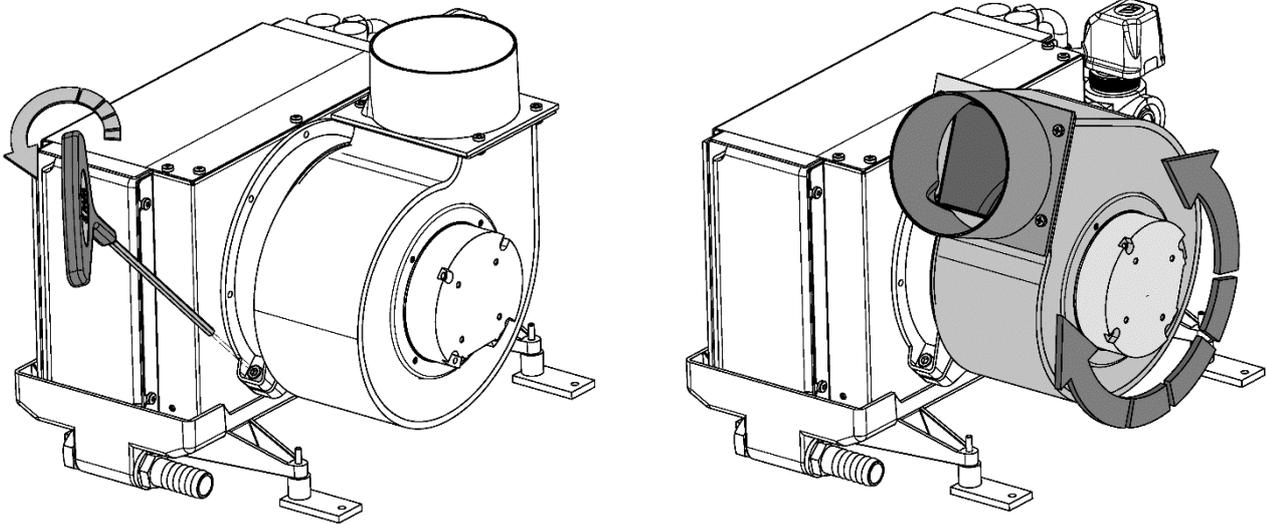
Vapor Barrier: Insulation always needs a vapor barrier to effectively prevent condensation. This means that the outer surface of the insulation must be impenetrable to water vapor. For example, if the outer surface of a piece of flex duct is torn, water vapor can enter. As the water vapor migrates through the fiberglass, it will eventually come in contact with the cold inner lining of the duct. Condensation will form, and the duct will soon be saturated with water. Thus it is important to maintain an air-tight vapor barrier around the insulation. Location of the vapor barrier is also critical. The insulation must be between the vapor barrier and the cold surface.

Sealing Duct: Various aluminum backed tape and mastics are specifically made for sealing duct. Use them liberally. Note that both require clean, dry surfaces. Most fiberglass insulation requires a separate vapor barrier. Most flex duct includes a vapor barrier jacket on the outside. Rigid fiberglass usually has an aluminum paper vapor barrier on one side.



6.2.1 FAN ROTATION

To make easier the duct installation operations, the fan can be rotated from standard vertical position for at least 180° (see figure above). To release the rotation it is necessary to loosen the screw of the fan support flange.



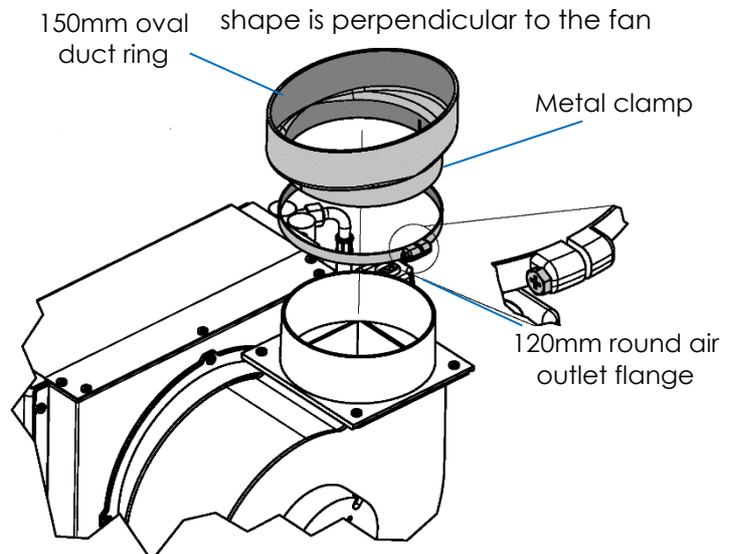
After defining the correct position of the fan it is required to lock it again with its screw.

6.2.2 ATTACHING FLEX DUCT TO MOUNT RING

1. Pull back the fiberglass insulation exposing the inner duct hose.
2. Slide the inner duct hose around the mount ring until it bottoms out. (The "mount ring" is the plastic ring on the discharge of the unit.)
3. Secure the hose to the mount ring with a screw metal clamp.
4. Wrap duct tape around the ducting and ring joint to prevent any air leaks. Do NOT use mastic on the fan coil unit, because it will make servicing the unit difficult.
5. Pull the insulation back up over the mylar to the base of the ring and again secure with duct tape.

6.2.3 OVAL DUCT RINGS

The oval \varnothing 150mm duct ring **is available only for AH3,AH5,AH7 and AH9 models** (with \varnothing 120mm air outlet flange), can be fitted as additional diameter expansion adapter (oval shape), which must be fixed by a metal clamp. For its right installation, to facilitate the fan movement it is important that the narrowest axes of the oval shape is perpendicular to the fan rotation axis.



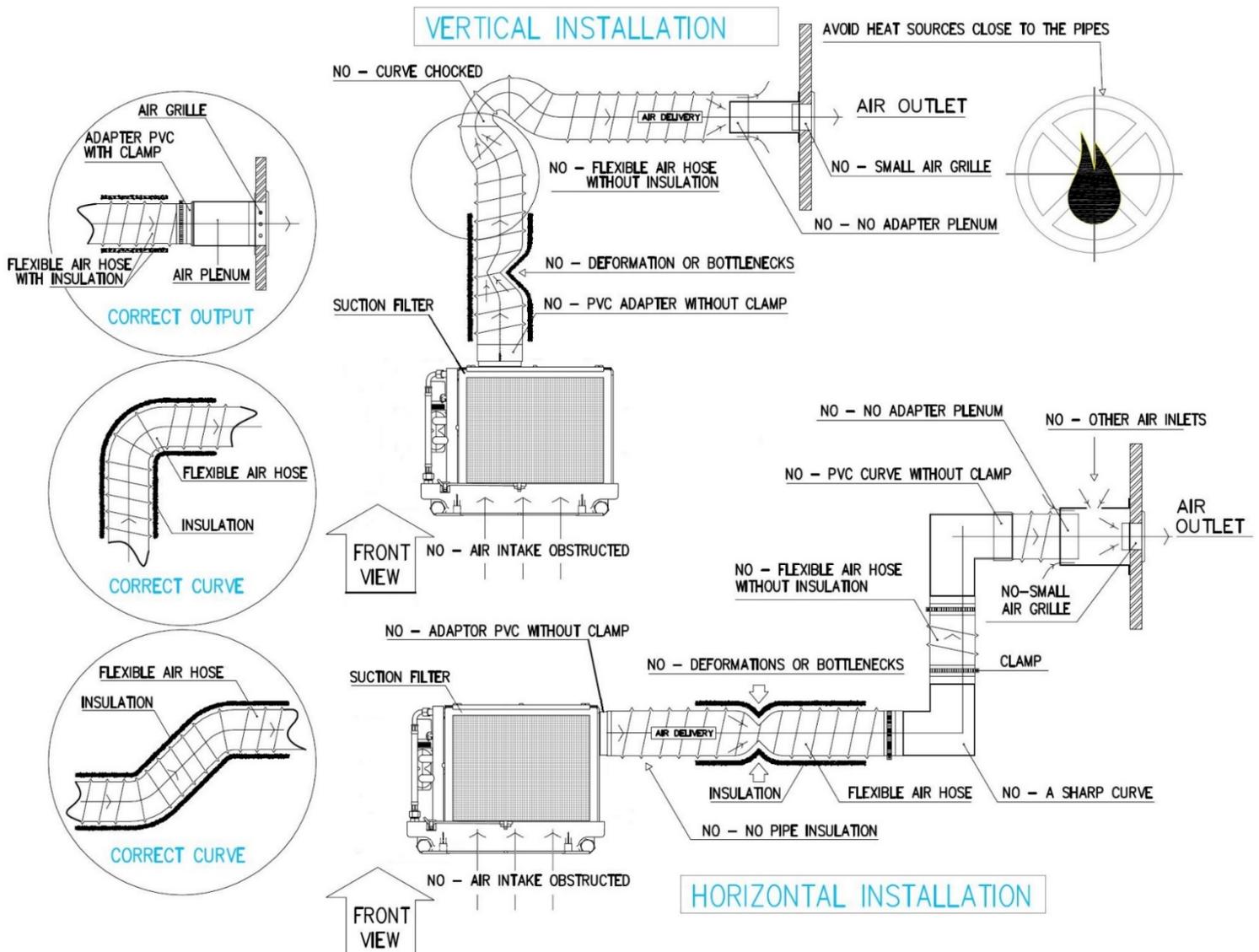


6.2.4 DUCT INSTALLATION

CRITICAL: Ducting MUST be installed BEFORE other systems. Otherwise, conduit, wiring, plumbing, etc. will prevent the duct from going in properly. The resulting compromises will decrease performance and increase noise.

All ducting should:

- Be appropriately sized for each application.
- Run as smoothly and be as taut as possible.
- Have as few bends or loops as possible.
- Be securely fastened to prevent sagging during boat operation.
- Have all excess ducting lengths trimmed off.
- Not be flattened or kinked.
- Be appropriately insulated, especially in hot or humid spaces (hull side, mechanical compartments, fly bridge ceilings, etc.)





6.2.5 SIZING OF DUCTS, GRILLES AND PLENUMS

The design of a proper supply-duct system begins with the outlet from the blower. The ring sizes are designed to keep the footprint small but still keep the air velocity and frictional pressure drop relatively low. Reducing the blower ring size will create higher air velocities. Higher air velocities will increase pressure drop and noise. Increased pressure drop will reduce the overall airflow (m³/h) and the heating or cooling capacity of the unit (BTU/h).

Table below is only a guide. Larger duct size may be needed when the duct runs are longer than 20 feet (6 m), have more than three 90° bends, or have a transition box. In such cases, increase the duct size shown by one inch.

FREE AREA

Free area is the area NOT occupied by the vanes of the grille. Free area is the total cross-sectional area through which the air can actually pass. For some grilles, especially some "linear diffusers", the free area may be considerably less than the face area of the grille.

CALCULATING AREA

1. The area of a square or rectangle in square inches: Multiply the length (in inches) by the width (in inches).
2. The cross-sectional area of a round duct in square inches: The radius equals half the internal diameter. Multiply the radius (r) by itself (r²), and multiply that number by 3.1416 (pi). The result is the cross-sectional area of the duct.

Table: System Ventilation Sizing

Model	AH1	AH3	AH5	AH7	AH9
Duct Diameter (mm/inches)	101 / 4	127 / 5	127 / 5	2x 127 / 5	2x 127 / 5
Duct Area (mm ² /sq inches)	8100 / 12.6	12600 / 19.6	12600 / 19.6	2x 12600 / 19.6	2x 12600 / 19.6
Return air grill, free area (mm ² /sq inches)	45000 / 70	50000 / 78	60000 / 93	100000 / 155	14000 / 217
Supply air grill, free area (mm ² /sq inches)	35000 / 54	40000 / 62	50000 / 78	90000 / 140	2x 60000 / 93

6.3.1 TRANSITION BOXES

The total outlet area of a transition box should be at least equal to the inlet area. The inlet area should be at least equal to the area of the inlet duct.

6.3.2 PLENUMS

Built-in air plenums should be constructed to deliver proper airflow and minimize air noise. Plenums should be fully pressurized by the air delivery through the duct work and incorporate diffusers when necessary to create an even flow across the entire surface of the supply grille or outlet. The cross sectional area of the plenum should be equal to or SLIGHTLY greater than that of the supply duct. Undersized plenums create air turbulence and noise. Oversized plenums do not pressurize sufficiently and cause low discharge air velocity. Plenums, especially those made of wood, must be properly insulated. Wood is permeable to water and water vapor, and should be sealed to prevent delamination.



6.3.3 RETURN AIR DUCT

We do not recommend return-air duct. If done, then it should be as unrestrictive as possible. The return-air duct should be AT LEAST 2" (50mm) larger in diameter than the supply.

6.3.4 SUPPLY AIR GRILLES

- Locate the supply-air grille as high as possible. Air should flow gently across the ceiling of the cabin to form natural convection currents with the cool supply air falling and forcing warm air through the return-air stream or up to the ceiling to mix with the cooler supply air. Failure to deliver the supply air high can result in stratification of the air, causing cooler temperatures near the floor and warmer temperatures near the ceiling.
- Do not let air from the supply-air grille immediately travel to the return-air grille. This is known as "short cycling", and it will result in poor performance and inadequate air conditioning.

6.3.5 RETURN AIR GRILLES

- Locate the return-air grille as low as possible.
- The return-air grille should be very close to the fan coil unit to provide minimally restricted airflow to the coil.
- If a filter is put in the return-air grille, then it is important to force ALL the air going to the unit to go through that filter. Carefully seal up all gaps where air might bypass the filter. If a filter is NOT put in the return-air grille, then the filter must be attached to the fan coil unit.
- The return-air grille must be appropriately sized or it will restrict the airflow.

6.3.6 EXCESSIVE AIR VELOCITY

If the air velocity at the coil is too high, droplets of water can be stripped off the coil and blown into the duct. Adjust the fan coil unit controls as necessary to limit the maximum air velocity across the coil. The actual setting required will depend on many things, especially the restrictiveness of the duct. For this reason, it is not possible to determine the ideal setting until the unit is installed.

Do not allow the velocity of the air to exceed 500 fpm (2.5 m/s) across the coil at any point. Use a vane anemometer to measure the velocity at the coil.



7.0 CIRCULATING WATER SYSTEM

7.1.1 SERVICE VALVES

Ball valves are required before and after each fan coil unit (see Figure below). Always use full-flow ball valves. The ball valve for a fan coil unit should be full port ¾" for all fan coil units AH1, AH3 and AH5. Fan coil units AH7 and AH9 should be 1" full port.

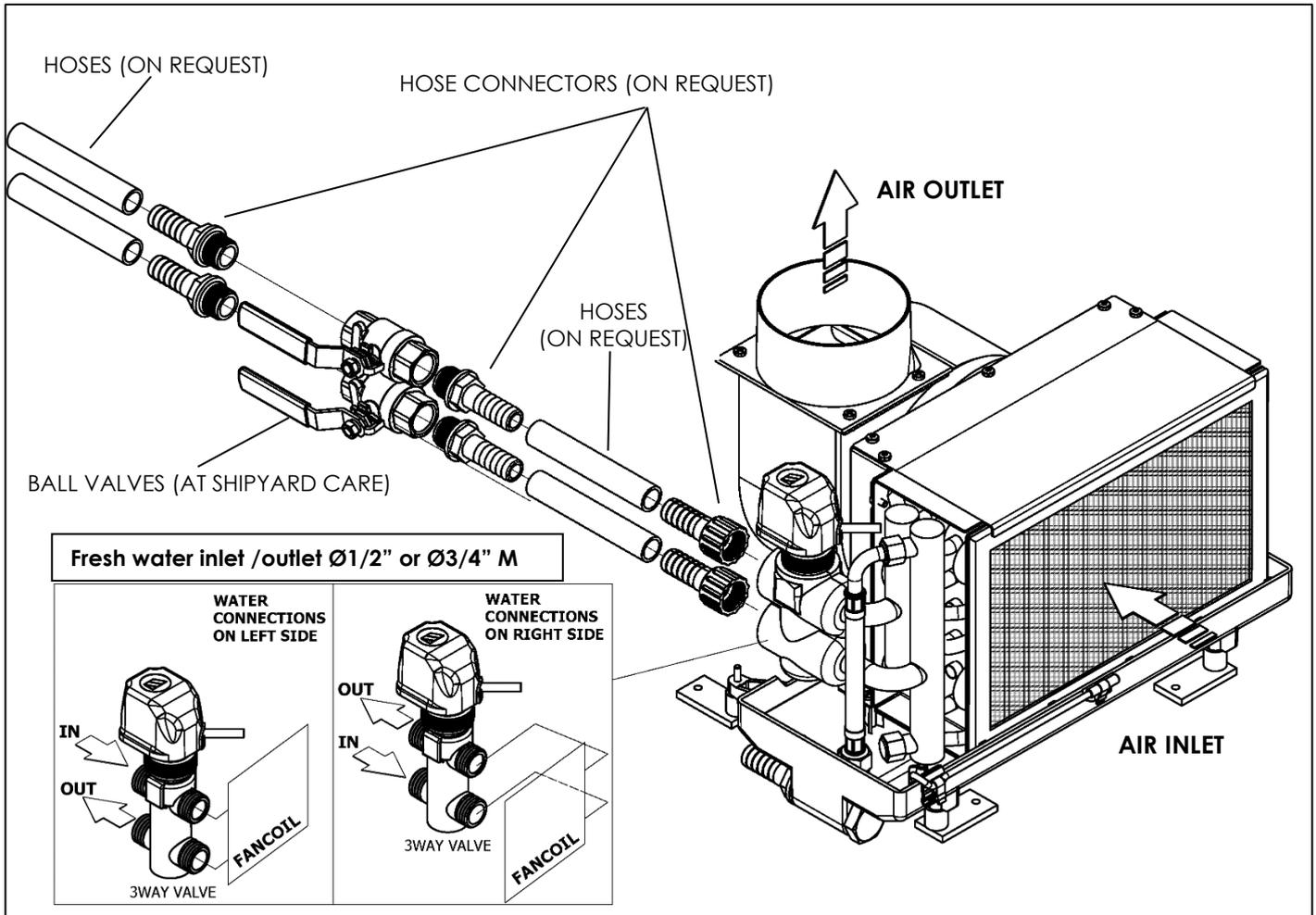


Diagram of Fan coil unit Piping and Service Valves

7.1.2 HOSE

Flexible, reinforced hose between the service valve and the unit will isolate vibration. Hose to a fan coil unit should match the hose-barb that comes with the fan coil unit. Each hose connection should use double/reversed stainless steel hose clamps.

7.1.3 WATER FLOW DIRECTION

Note the arrows on the unit indicating direction of water flow (see also the previous diagram). Reversing the flow can cause a number of problems, such as reduced performance and air lock. In this case we must to follow the coil's water collectors so, with water connections on left side the water enters high and exits low; with water connections in the right side the water enters low and exits high.

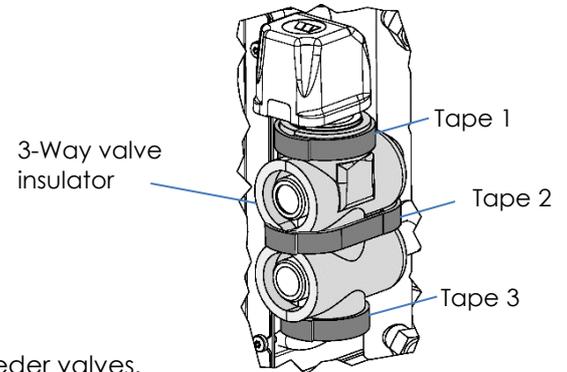


7.1.4 CONNECTION

Always be sure to double-check connections (especially hose clamps) for correct placement and tightness. If possible, double hose clamps should be used at every hose connection for redundant protection against leaks. The hose clamp screws should be located opposite one another.

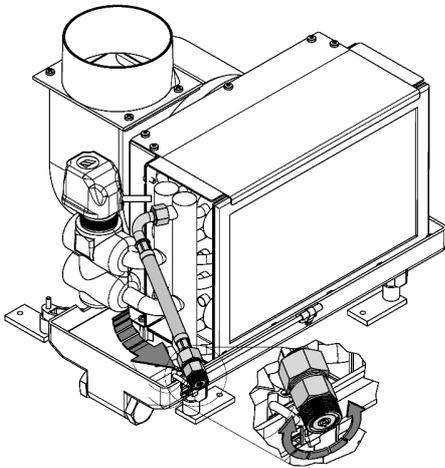
7.1.5 3-WAY VALVE INSULATION

3-way valve must be insulated with the apposite insulator shell supplied. Once connected the valve is very important to close the shell very carefully . Our recommendation is not use cable ties but use 3 pieces of adhesive tape so as not to stress the material too much, as shown in the side figure.



7.1.6 AIR BLEEDERS

Provision must be made to remove air from the system.



All fan coil units include bleeder valves.

AH series bleeder valves are installed on a flexible pipe connected to the top of the water coil heat exchanger. This facilitates the air bleeder operations even in the units positioned in the most confined spaces.

Note: that when air is bled from the system, water will usually be released also. The water may be collected in a sump or a bucket or directly in the condensate water pan. Plan ahead to avoid a mess.

Once the operation has been completed it is advisable to lock the bleeder valve with a clamp to the collector of water coil heat exchanger in order to avoid noising vibrations.

7.1.7 STRAINER

Strainers are mandatory in the condenser/seawater circuit AND in the circulated water circuit.

Failure to follow these guidelines will void the warranty!

The circulated water strainer should be a 20-mesh "Y-strainer". Finer meshes will clean the system better, but they are likely to need cleaning too often and thus become a nuisance. More open meshes must not be used because they will not adequately protect the components.

7.1.8 CLEANLESS

- **Clean Coils:** Boat yards are often very dusty places, especially while a boat is being built. This dust can quickly clog a fan coil unit coil if precautions are not taken. The safest thing to do is to put a piece of cardboard in front of the coil for protection, and do not operate the fan coil unit until the boat is finished. However, it is usually necessary to run the fan coil units during construction. If so, use a good quality, disposable filter. This will keep the coils looking new. Be sure to remove and replace those filters as needed and before delivery of the boat to the customer.
- **Clean Water:** Be sure the water going to the fan coil units is clean. When the boat is first constructed, or if much piping is changed, the circulated water system should be thoroughly flushed. Short-circuit the fan coil unit's service ball valves so that no water flows through the fan coil unit during this process. And, include a 20-mesh strainer. The chiller manual describes these requirements in more detail.

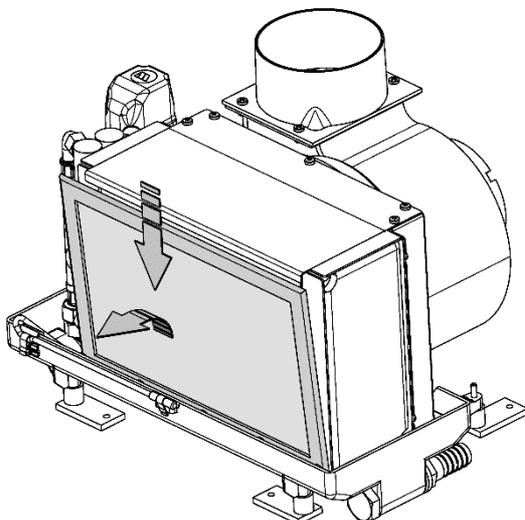


7.1.9 THERMAL INSULATION

- **When to insulate:** Leak checking the system after everything is insulated is sure to create frustration. Before the leak check, it is OK to insulate straight lengths of pipe, but do not insulate the joints or fittings until AFTER the leak check. If there are any leaks, they will probably be at the joints or fittings. Having the joints and fittings still uninsulated will make the leaks easier to find and fix. After checking for leaks, insulate the joints and fittings. Any exposed pipe can sweat and cause water damage so it is very important to insulate the piping thoroughly.
- **Insulation material:** We recommend closed cell insulation at least 3/4" (20mm) thick insulation on the pipes. Piping through unconditioned space or other areas where the dewpoint may exceed 74°F (23°C) will require thicker insulation.
- **Size:** The internal diameter of the insulation should match the external diameter of the pipe. If the insulation is too large, air will get between the insulation and the pipe and create condensation that may run down the pipe and show up some place else. This condensation will be minimal if the air cannot circulate, but it is better to avoid it altogether by avoiding the air gap. If the insulation is too small, it will be difficult to install. If split insulation is too small, it may eventually split open. Taping the split insulation all around will prevent this. The ideal solution is un-split insulation that closely fits or is just a little snug.
- **Thorough:** All piping should be thoroughly insulated to prevent condensation. Improper insulation is a common problem with chilled water systems, and very difficult to find and correct, even after the water damage is noticed. A gap in the insulation will produce condensation on the pipes, which can run down inside the insulation to a different location. Insulation must be air tight.
- **Split insulation:** If using split insulation, seams should be closed tightly, sealed with glue or tape. Completely wrapping split insulation with a sturdy cloth tape will also make it more durable and much less likely to split back open. All water fittings, connections, valves, etc. in the system should be well insulated, after the system is leak tested.
- **Do not compress:** Do not compress the insulation. For example, do not use tie wraps on insulation. The localized compression will cause poor performance, condensation, and eventually damage the insulation.

7.2.1 WATER CONNECTIONS INVERSION

AH series are ready for the inversion of the water connections on the field. In the event one needs to invert the position of the hydraulic coil connections from the left side to the right side of the device please follow these steps:



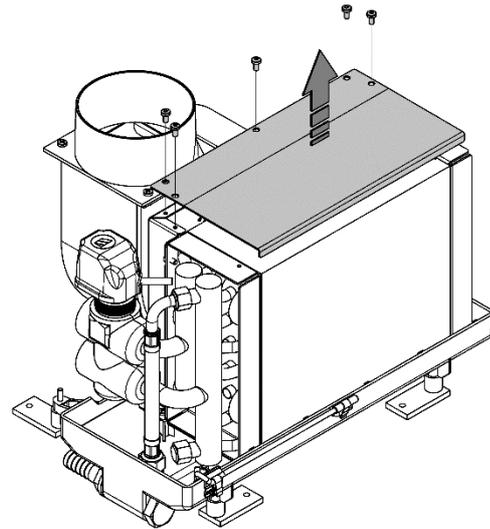
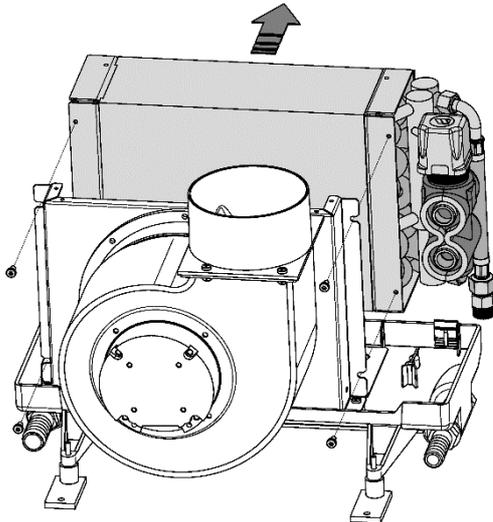
1. Remove the air filter:

- Push down the filter (inside the condensate drain pan);
- Pull the upper zone in order to release it from the locking fold of the box-blower cover;
- Extract the filter and remove it;



2. Remove the box-blower cover:

- Remove the M4 screws for box-blower cover fixing;
- Pull up the box-blower cover and remove it;

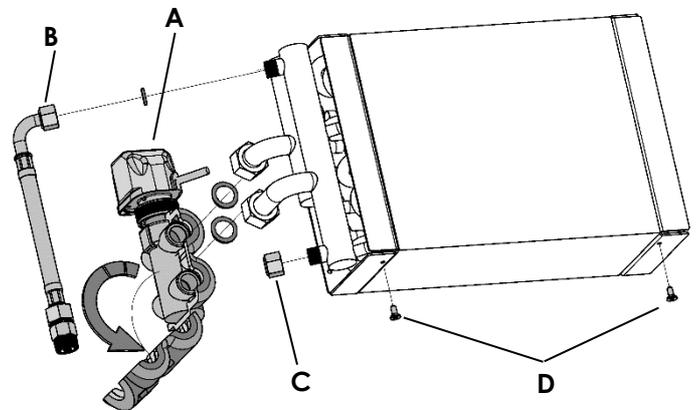


3. Remove the water coil group:

- Remove the M4 screws from the rear of the unit;
- Push the water coil forward to release it from the box-blower;
- Once released remove it;

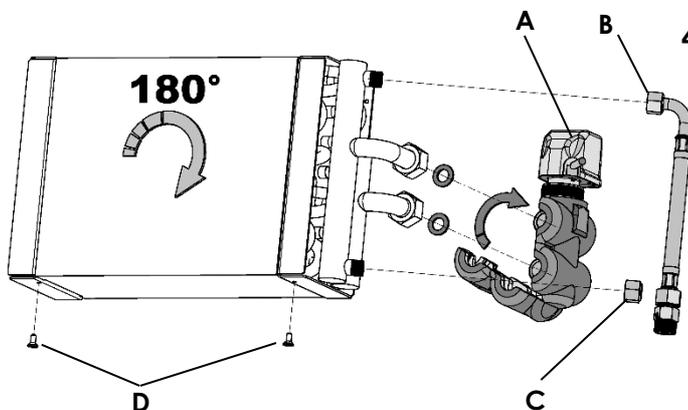
5. Remove 3-way valve (A), air exhaust flexible pipe (B), water plug (C) and hooking screws (D):

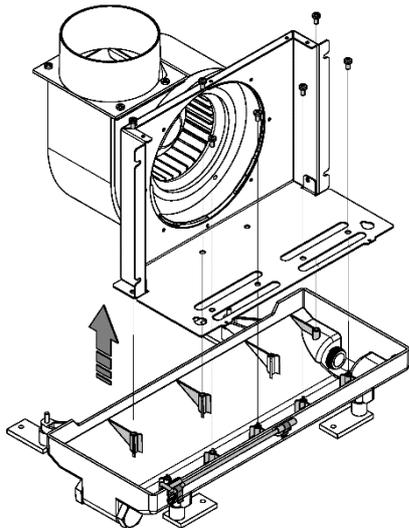
- Remove the insulating shell from the 3way valve;
- Unscrew the 3-way valve fixing unions taking care not to lose the gaskets;
- Unscrew the flexible pipe taking care not to lose the gasket;
- Unscrew the water plug;
- Unscrew the 2 M4 hooking screws;



4. Rotate the water coil 180° and reassemble 3-way valve (A), air exhaust flexible pipe (B), water plug (C) and hooking screws (D):

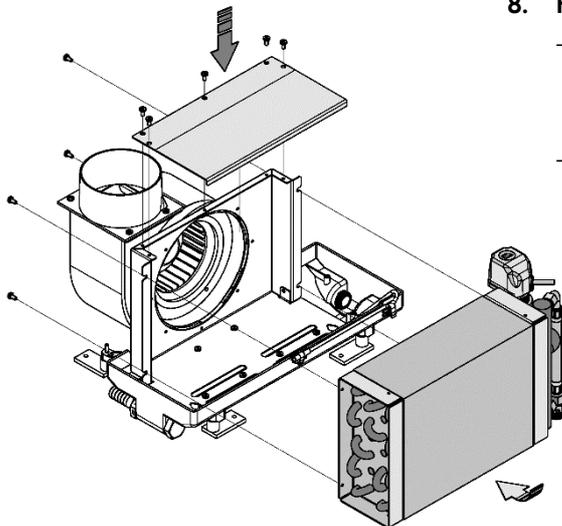
- Rotate the water coil 180° as shown;
- Assemble the 3-way valve with its gaskets with the actuator facing up;
- Assemble the insulating shell from the 3way valve;
- Assemble the flexible pipe with its gasket;
- Assemble the water plug;
- Assemble the 2 M4 hooking screws (these screws must always be screwed into the bottom of the coil);





7. Fix the box-blower:

- Fix the box-blower in the fixing holes of the drain water pan with the screws removed in point 6; if the new position of the hydraulic connections is on the right side fix the box-blower in the leftmost holes of water drain pan; If new position is on the left fix the box blower in the furthest holes of drain water pan;

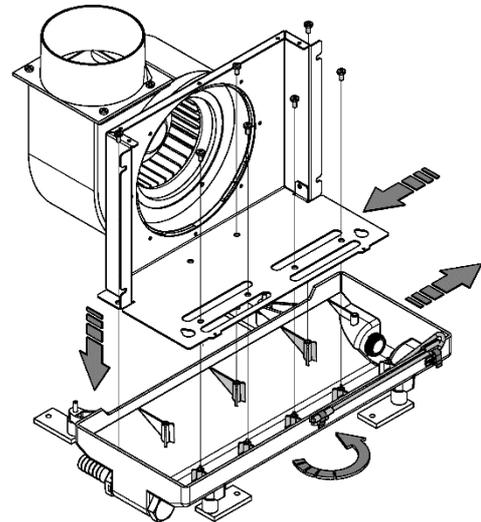


9. Replace the air filter:

- Place the filter in front of the water coil;
- Push the filter inside the condensate drain pan then leave it; he will get stuck in the fold of the box-blower cover;

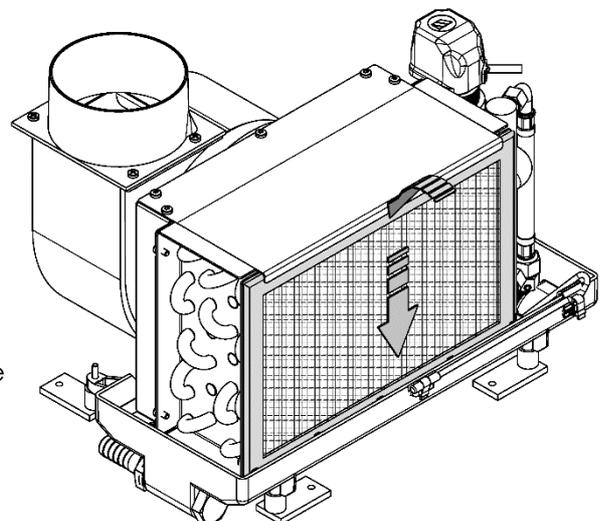
6. Remove the box-blower:

- Remove fixing screws from the box-blower and the drain water pan;
- Remove the box-blower;



8. Fix the water coil group and box-blower cover:

- Fix the water coil group with hydraulic connections on the opposite side with the screws removed in point 3;
- Fix the box-blower cover with the screws ;





8.0 CONDENSATE WATER



WARNING

Do not terminate condensate drain lines within four (4) feet of any outlet of engine or generator exhaust fumes, nor in a compartment housing an engine or generator, nor in a bilge, nor anywhere else containing hazardous fumes, unless the drain is connected properly to a sealed condensate or shower sump pump. Otherwise, those fumes may travel up the condensate line and contaminate living spaces.

8.1.1 ROUTING

Connect the condensate outlets to proper tubing and route to an appropriate location such as an overboard fitting or sump. Do not permit condensate to puddle in the bilge. Be sure the condensate line follows a consistently downhill route free of loops, kinks, or upward bends. Air traps will prevent proper drainage.

8.1.2 TEE FITTINGS

Most fan coil units have at least two condensate drains. These may be connected together into a single drain line using a tee if a minimum 2" (5.1 cm) drop exists from the drains to the tee.

8.1.3 HEEL PROTECTION

For installations on sailboats or any vessel that heels more than 15°, position fan coil units so that the condensate pans drain port and starboard. Note that most fan coil units have two or more drain connections. One drain connection should be on the port side, the other should be starboard.

8.1.3 CONNECTION

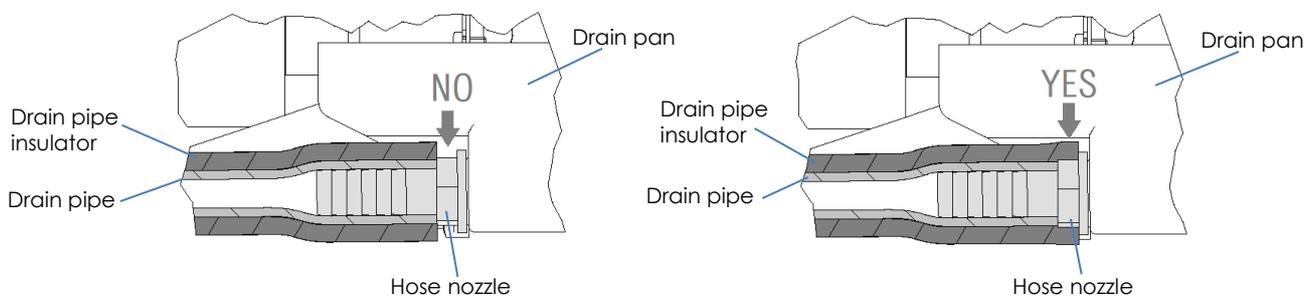
Attach a 5/8" (16mm) id reinforced hose to the connection provided and tighten with a single hose clamp.

8.1.4 THERMAL INSULATION

Because the condensate water is cold, it will make the condensate plumbing cold, too. Thus, water can condense on the outside of the condensate plumbing if it is not insulated. This is called "secondary condensation". This is why Frigomar always insulates condensate drain pans.

In many applications, the condensate lines do not get cold enough and the ambient air is dry enough that little or no condensate occurs even on uninsulated condensate plumbing. However, we recommend 3/8" wall closed cell insulation on the condensate plumbing as a precaution, especially if it must pass through unconditioned spaces.

We also recommend to push the drain pipe insulator firmly against the condensate drain pan in order to isolate completely the hose nozzle connector.



8.1.5 TEST

Test the condensate routing by pouring a liter of water into the pan and checking for flow.

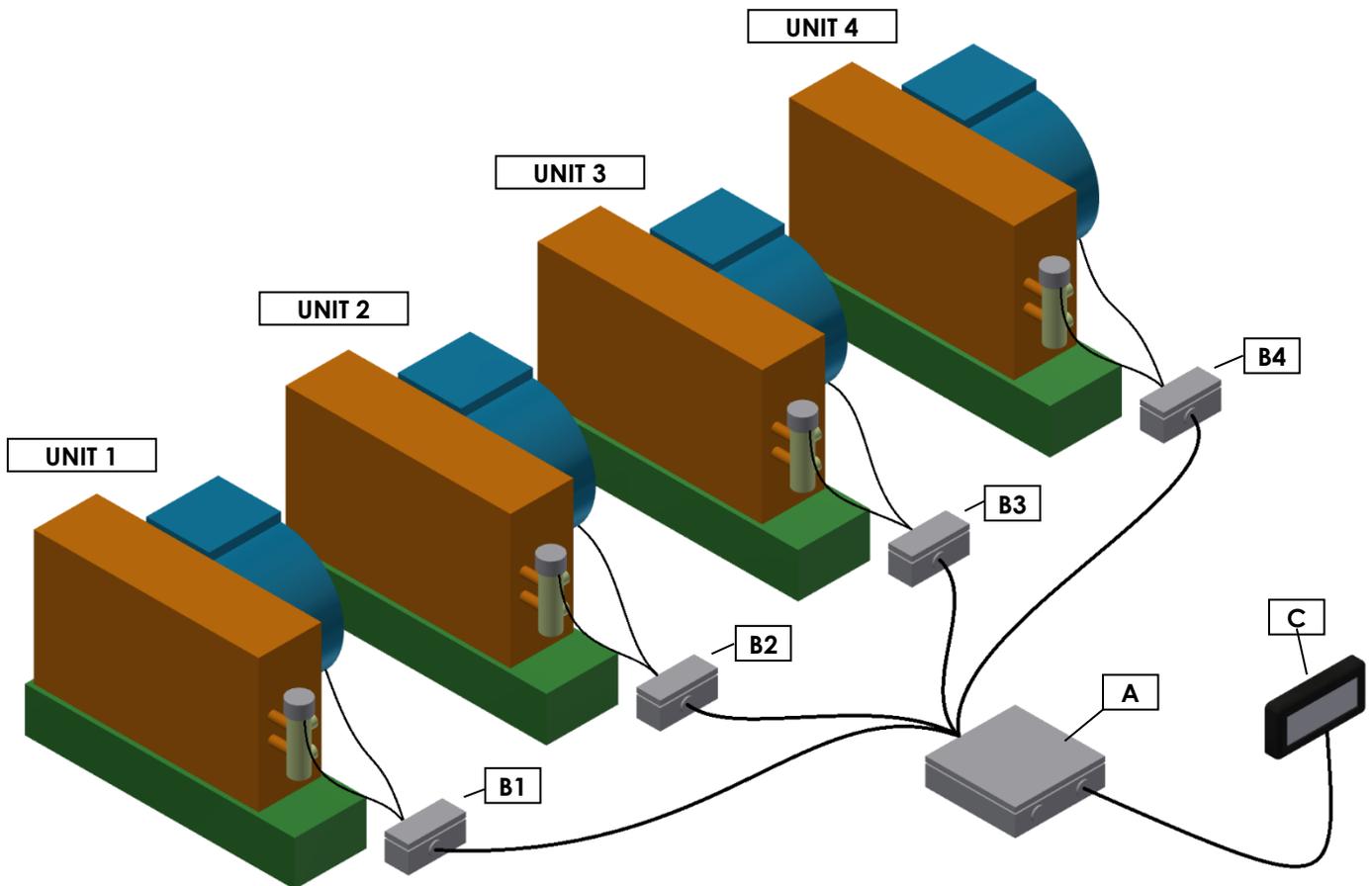


9.0 ELECTRIC CONNECTIONS

9.1.1 ELECTRIC CONNECTION COMPONENTS

The components that make up the electrical connection of the AH series fancoils are:

- **Motherboard box (A):** it contains the motherboard. It can control up to a maximum of **4** units of models with single fan (AH1, AH3, AH5) and **2** units of models with double fan (AH7, AH9). It can be controlled by the display (default version) and also with other control systems as RS485, MODBUS-RTU and CANBUS.
- **Unit's connection box (B):** it is always connected to the machine and it contains the terminal block for connecting the machine to the motherboard. It is different between models with single fan (AH1, AH3, AH5) and models with double fan (AH7, AH9). Each unit must be connected through a connection box.
- **Display (C):** it is the interface from the user and the units. It is always connected to the motherboard, and it can be bypassed by other control systems as MODBUS and CANBUS.



9.1.2 ELECTRICAL GROUNDING



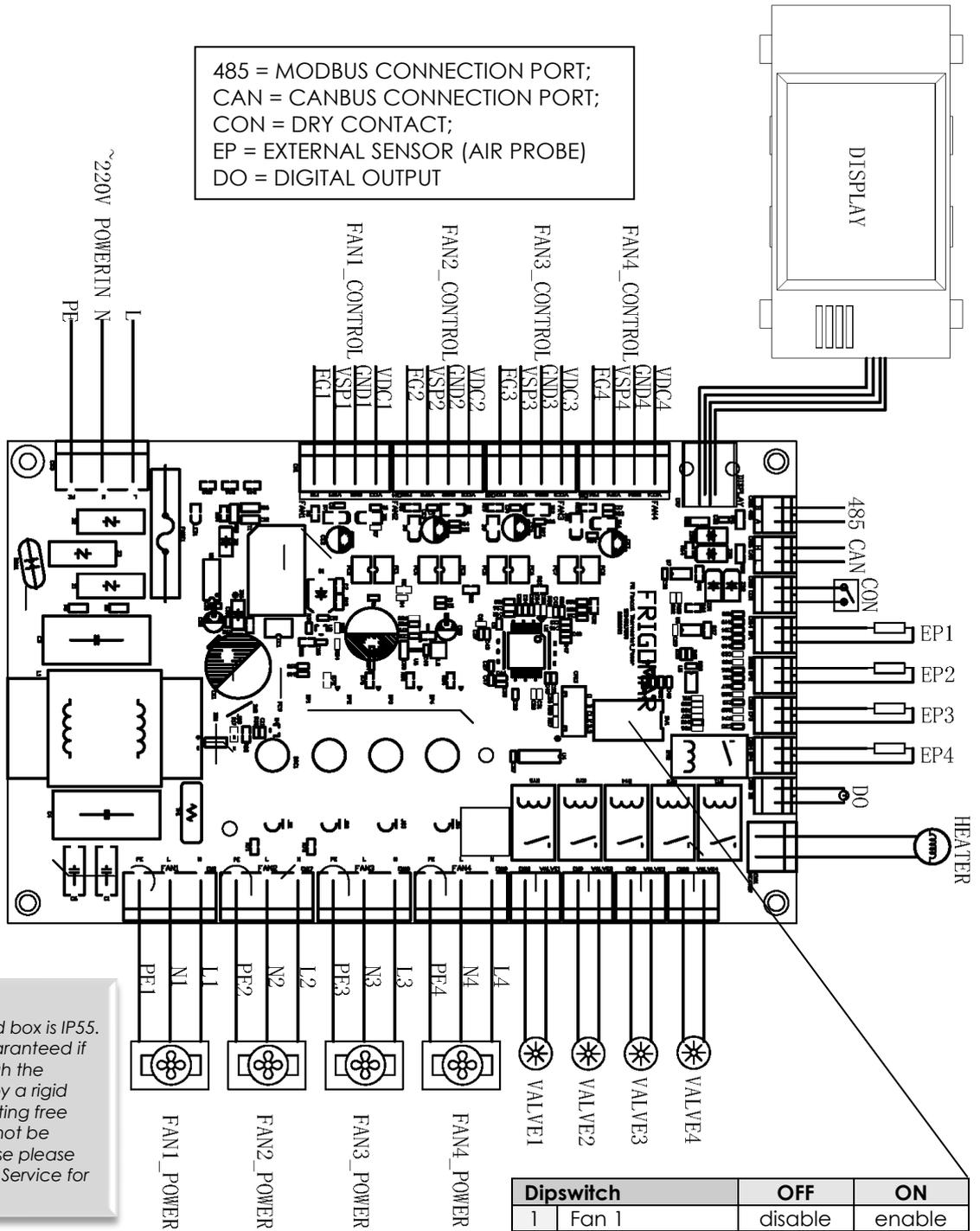
WARNING Failure to properly ground the unit can result in injury or death.

All units must be effectively grounded to minimize the hazard of electric shock and personal injury. This should be done by connecting a ground wire to the ground inside the electric box. Ground any given unit as indicated by the wiring diagram that comes with it.



9.1.2 MOTHERBOARD BOX (COD.ACFC0COM001) CONNECTIONS:

It is essential for the functioning of the machines. Each unit must be connected by the motherboard. Here below the connection's scheme:



IMPORTANT:
Standard Motherboard box is IP55. This IP rating is only guaranteed if the cables pass through the flexible cable glands by a rigid sheath or pipe. By inserting free wires this IP rating cannot be guaranteed. In this case please contact our Customer Service for a custom solution.

9.1.3 Dipswitch:

The dipswitch located on motherboard allows activation or deactivation of the fans to be managed and it allows to choose the external sensor utilization mode (see Dipswitch table).

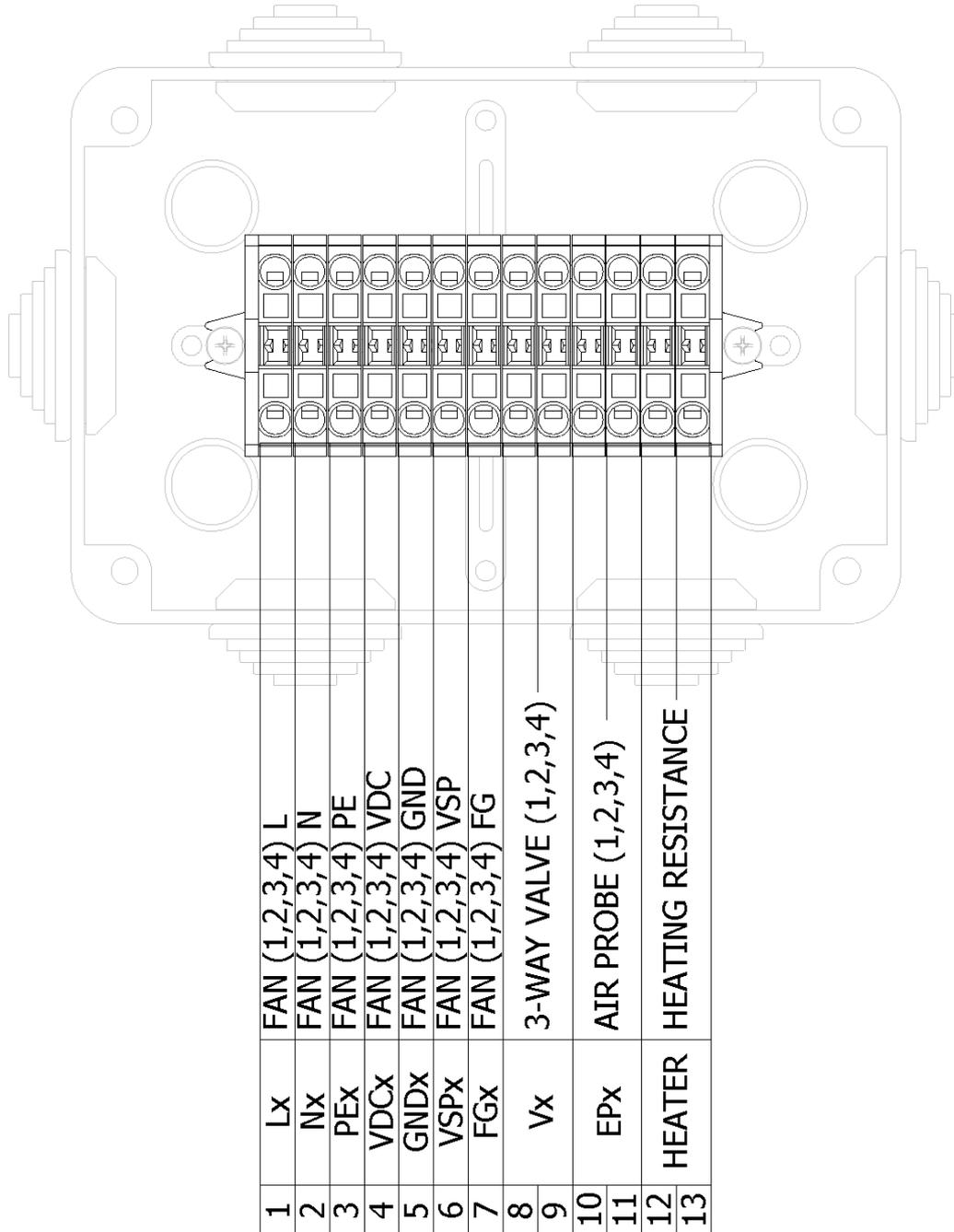
Dipswitch		OFF	ON
1	Fan 1	disable	enable
2	Fan 2	disable	enable
3	Fan 3	disable	enable
4	Fan 4	disable	enable
5	External sensor	single	multi
6	Reserved		



9.1.4 CONNECTION BOX FOR SINGLE FAN UNITS (AH1, AH3, AH5)

Electrical connection to the unit must be done through the connection box.

For single fan versions (AH1,AH3,AH5) is the one shown below:



If the unit is UNIT 1 connect on motherboard L1, N1, PE1, VDC1, GND1, VSP1, FG1, V1, EP1*, HEATER (if available);

If the unit is UNIT 2 connect on motherboard L2, N2, PE2, VDC2, GND1, VSP2, FG2, V2, EP2*, HEATER (if available);

If the unit is UNIT 3 connect on motherboard L3, N3, PE3, VDC3, GND1, VSP3, FG3, V3, EP3*, HEATER (if available);

If the unit is UNIT 4 connect on motherboard L4, N4, PE4, VDC1, GND4, VSP4, FG4, V4, EP4*, HEATER (if available);

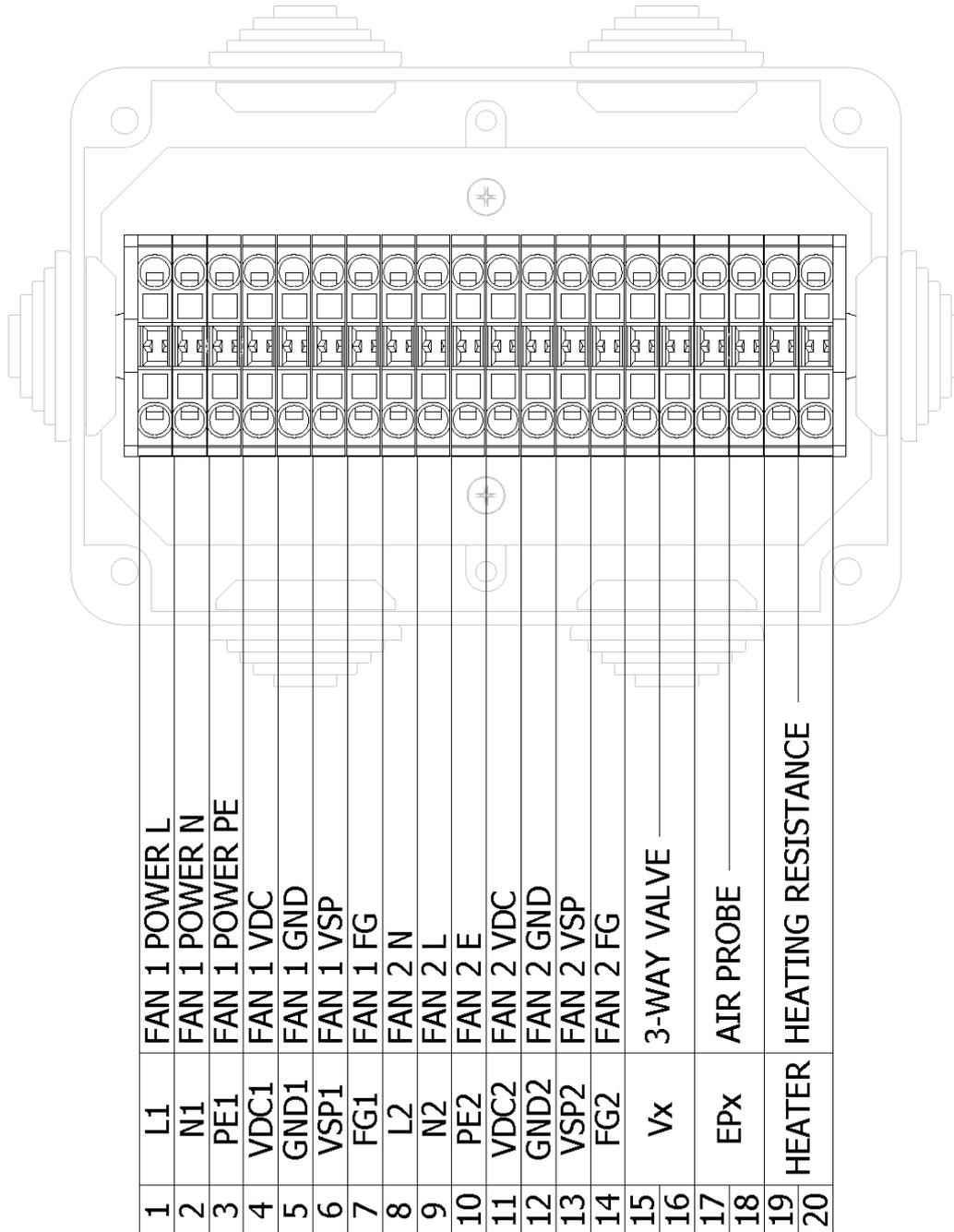
Remember to enable the fan requested by dipswitch on motherboard (n°1/2/3/4) see paragraph 9.1.3.

* for the external temperature detection with EPx see paragraph 9.1.6



9.1.5 CONNECTION BOX FOR DOUBLE FAN UNITS (AH7, AH9)

Electrical connection to the unit must be done through the connection box.
For double fan versions (AH7,AH9) is the one shown below:



With this version is NOT possible connect more than 2 units to the motherboard.

In this version the dipswitch 1 and 2 on motherboard must switched ON.

It is basic the right temperature sensor management (see paragraph 9.1.6): it is possible to choose between

- Display internal sensor;
- Single external sensor (by motherboard);
- 4 external sensors (by units): in this case probes 1-2 must be positioned together on fancoil 1 and probes 3-4 together on fancoil 2



9.1.6 EXTERNAL TEMPERATURE SENSOR (AIR PROBE) MANAGEMENT:

 **WARNING** this operation must be performed from qualified personal; Please make sure before performing any operation that there is no electric current in the circuit.

There will be 3 possible ambient temperature management:

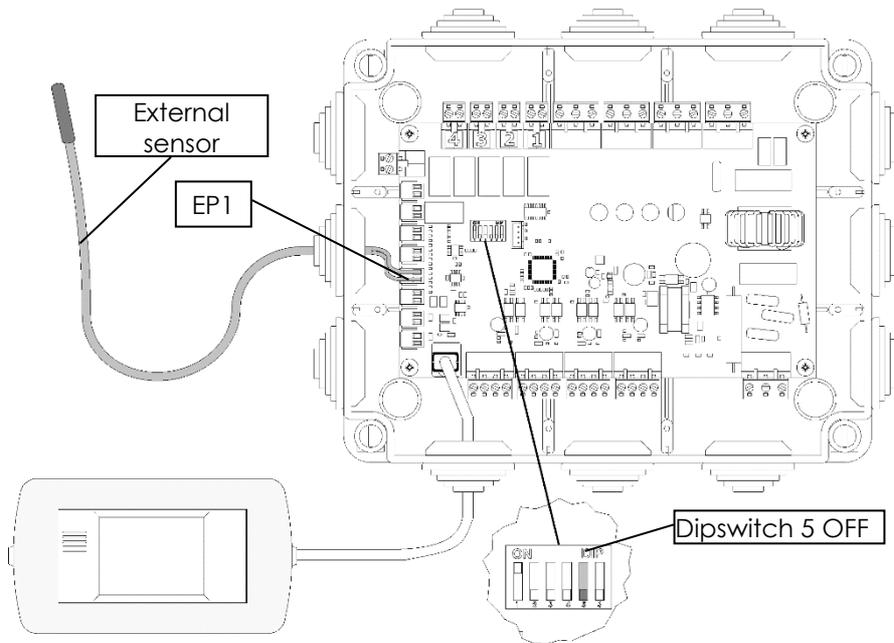
- **Display internal sensor:** room temperature is given by a display internal sensor, all the units will be driven according to internal sensor. The air temperature is then measured in only one point of the room for all units installed.

Be careful not to position the display near heat sources or in areas particularly exposed in direct sunlight or in the supply-air stream.

The display must be put somewhere that it can measure the average room temperature. Mount the display mid- height of the cabin on an inside wall where it can measure freely circulating air.

If internal sensor has a failure E5 is displayed, the units go into *emergency running* that consisting in: all the 3-way valves open, all fans goes automatically in manual mode at low speed with the possibility for the user to change the speed.

- **External sensor by motherboard box (standard solution):** (Centralized external sensor): only one sensor (EP1) is connected and dipswitch 5 is in OFF position. The air temperature is then measured in only one point of the room for all units installed. Be careful not to position the air temperature probe near heat sources or in areas particularly exposed to solar radiation.



Our suggestion is to search an area in the room with average conditions compared to the installed fancoil units. Room temperature is given by external sensor connected directly to the motherboard EP1, all the units will be driven

according to this sensor. If external sensor has a failure, E1 will be displayed and the unit will go automatically into *emergency running*. (see above).

External sensor by units: (more than 1 external sensors installed and dip switch 5 is in ON position): each external sensor (if activated via dip switch and external sensor is selected on display) detects the air temperature of the unit on which it is installed. In case of set point reached by one sensor, the corresponding 3-way valve will be closed and heating resistance will be deactivated (contact open). For all the fan coils, the fan keeps on running even if **FanOFF=ON** selected on display (see paragraph 9.2.6), in this case it should stop.

If one sensor has a failure the corresponding E1, E2, E3, or E4 alarm is displayed and the corresponding valve, fan and heating resistance are put in OFF position.

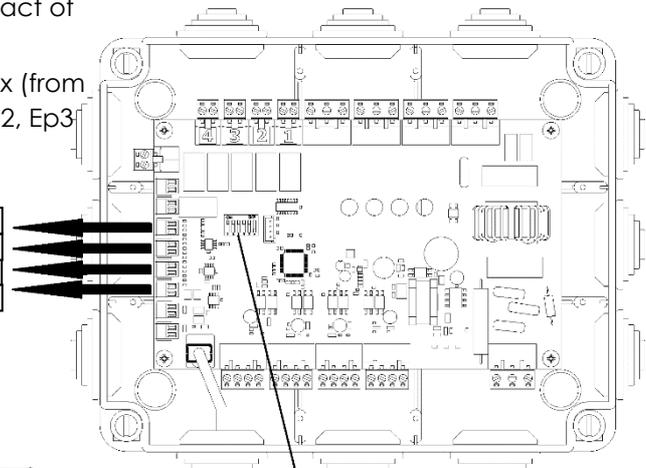
The user can always decide to change the sensor setting to internal sensor through the SETTINGS menu of the touch screen display (see paragraph 9.2.4).



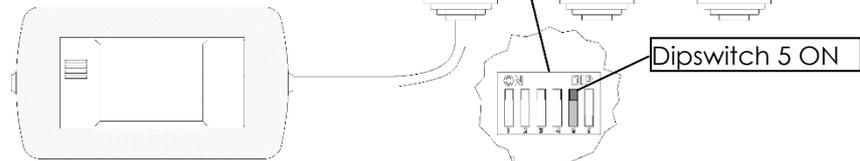
In order to operating with external sensor by units it is necessary to follow the steps below:

1. Remove the External sensor from the EP1 contact of the motherboard;
2. Connect Ep1 with EPx of UNIT1 connection box (from below of terminal block); do the same with EP2, Ep3 and EP4 if there are matching units;

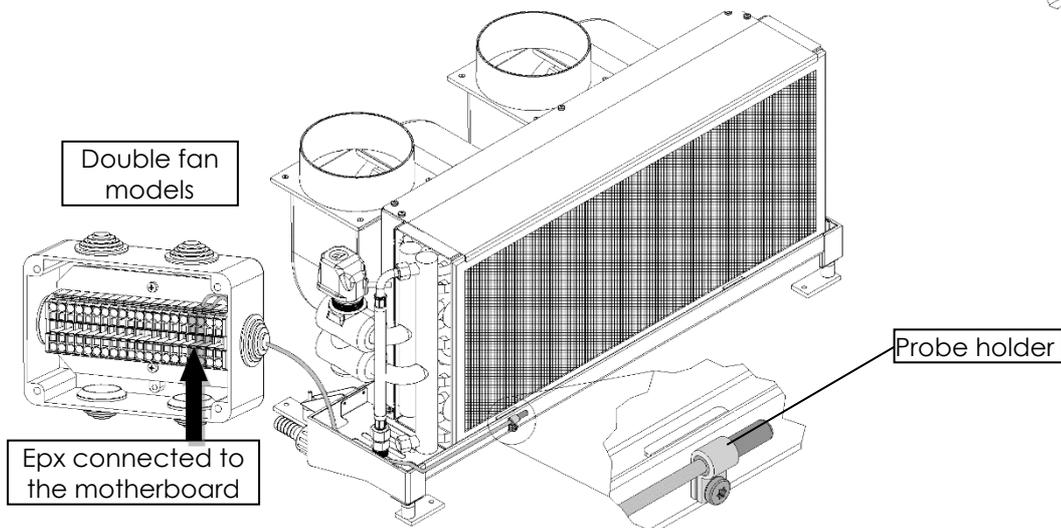
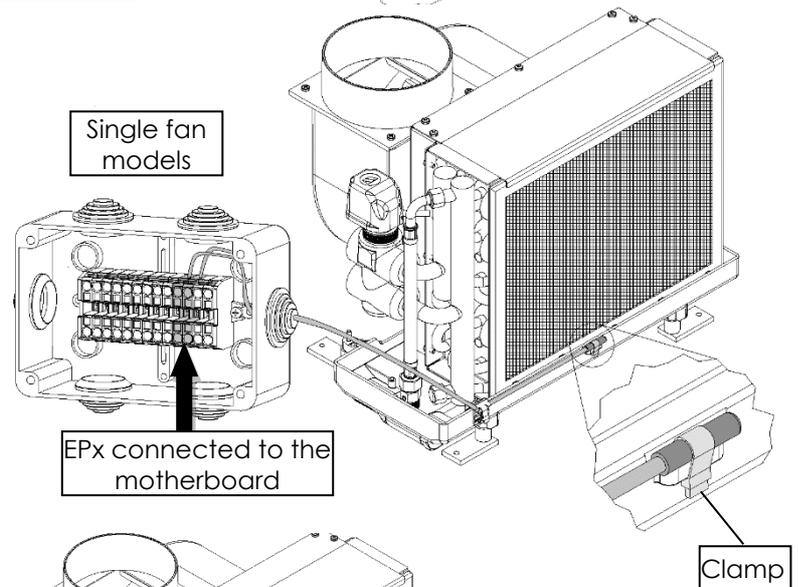
EP4 connect to EPx of UNIT 4 connection box
EP3 connect to EPx of UNIT 3 connection box
EP2 connect to EPx of UNIT 2 connection box
EP1 connect to EPx of UNIT 1 connection box



3. Switch ON the dipswitch 5;

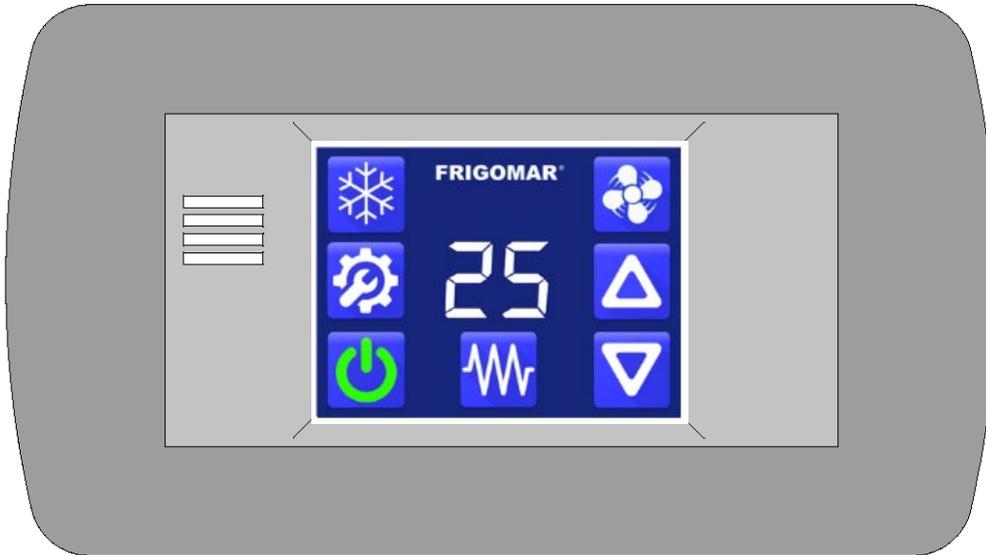


4. Install an external sensor in the terminal block Epx of the unit (from above);
5. Take out the sensor from the connection box and fix it with a clamp on the special coupling (for single fan models) or with the appropriate probe holder (for double fan models) in front of the unit's air intake;
6. Check carefully the right connection and the safe locking of the wires;





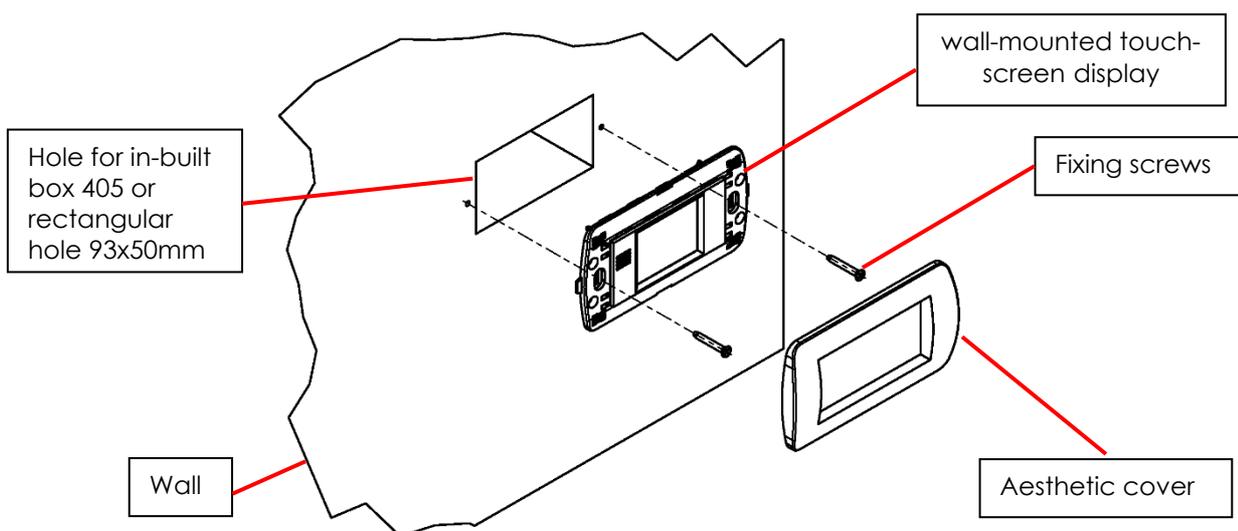
9.2.0 DISPLAY TOUCH SCREEN



9.2.1 DISPLAY'S INSTALLATION

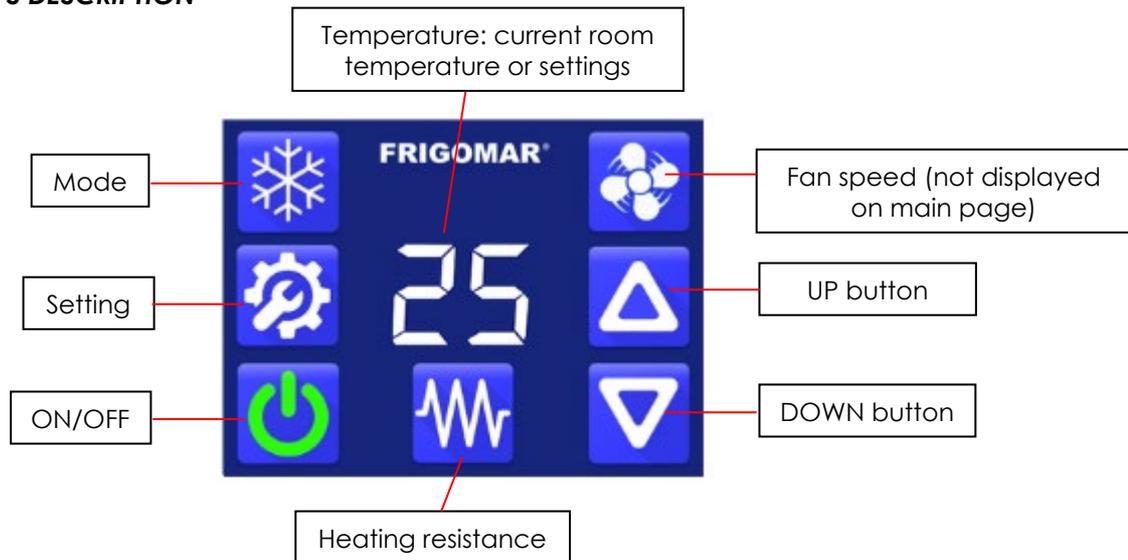
The display must be put somewhere that it can measure the average room temperature. Mount the display mid-height (1.5m from the floor of the cabin) on an inside wall where it can measure freely circulating air. Never mount a display in direct sunlight or in the supply-air stream, away from doors and/or windows and from heat sources around; then proceed with the following operations:

- drill holes in the wall (for in-built box 504 or rectangular min. dimension 93mm x 50mm);
- pass the cable from machine throw the wall and exit from the in-built box (or rectangular hole);
- connect the cable in the connector placed in rear side of display;
- fix the display (from Bticino or Vimar support) to the wall using suitable screws;
- place the aesthetic cover Bticino or Vimar upside the support and around the display;





9.2.1 DISPLAY'S DESCRIPTION



When unit is ON, ON/OFF button is green color, pressing ON/OFF button turns into white color and unit stop. Pressing ON/OFF button again, white turns into green and unit switches ON.

At first switch ON the system will start in cooling mode, Auto fan speed, heating resistance OFF (if available), and temperature setting = 22°C, at each subsequent switch ON it will recover the previous setting of mode, fan speed, heating resistance and temperature set.

ALARMS NOT ACTIVATE BACK-UP LIGHT AUTOMATICALLY, IT WILL BE ACTIVATED ONCE THE SCREEN IS TOUCHED

When unit is ON, Pressing Fan button  will open the fan speed selection page showing the current speed if in manual mode, showing A if in auto fan mode. Default fan speed choice is A.

Mode button can switch in a cycle from cooling mode  (snowflake) to heating mode  (flame).

Heating element button can switch in a cycle from activated mode  (resistance red color) to non activated mode  (resistance white color).

Arrow up and down buttons will be available for temperature set point modification.

All the buttons will be immediately activated after pressing ON/ OFF button, except setting button which will need to be pressed for more than 5s.

Only settings menus can be set both in ON/OFF situation, back-up light must be activated after the first touch, then it is possible to make selections.



9.2.2 FAN SPEED SELECTION

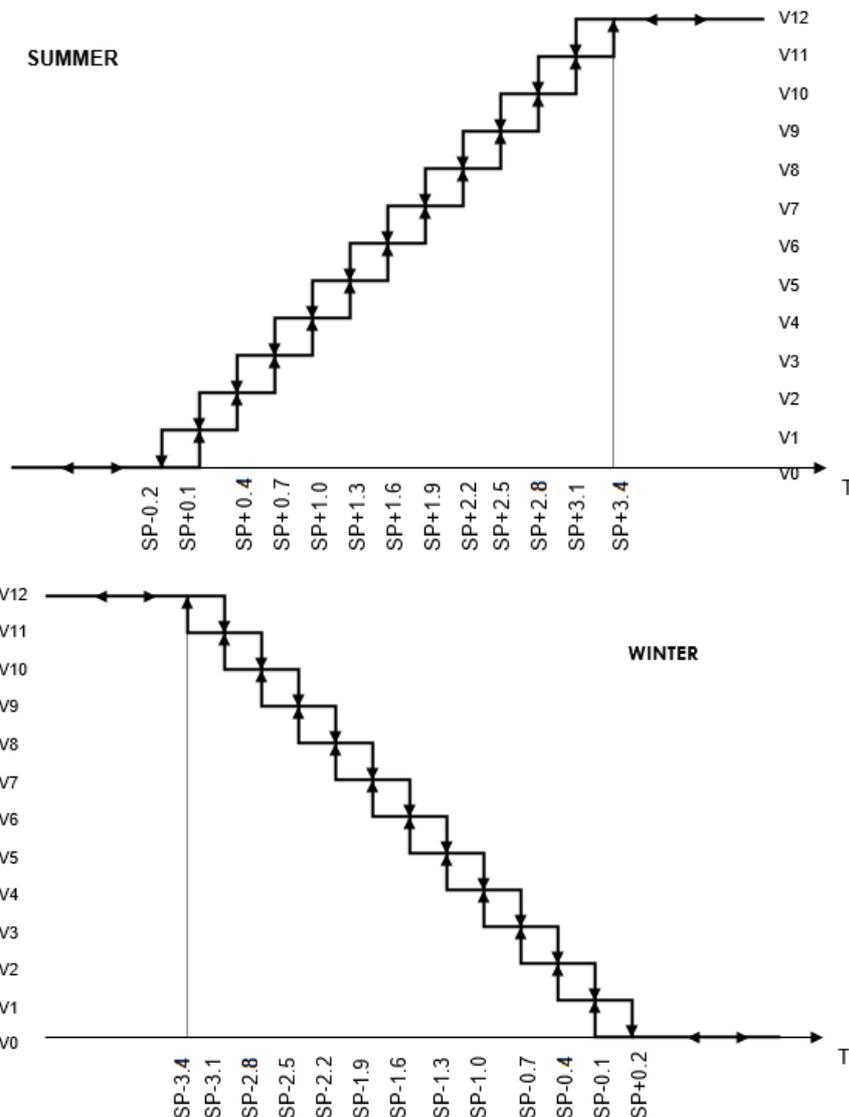
Pressing fan button the fan speed setting window showed as below:

Pressing the +/- button, the number will be showed between A,1,2...12 in cycle.

The fan speed setting window will be automatically close in 5s if no any operation. Or press  confirm the setting and quit to Main window.



When selecting Auto fan the fan speed will be regulated according to the difference between Tamb and Tset. During operation in mode SUMMER or WINTER, the thermostat will automatically adjust the 12 speeds of the FAN with the following diagrams. The diagrams refer to the operation with F.OF=ON that means the fan stops once the set point is reached (see Fan-Off Function next page). If F.OF=OFF, the 12 speeds will be equally spaced between V1=VoF and V12 without stopping at set point. SP indicates the value of the set point set, T the measured room temperature, V is the fan speed.





9.2.3 TEMPERATURE SETPOINT SELECTION

Pressing any of $\Delta \nabla$ button, the room temperature will shift to setting temperature in flashing.

Pressing any of $\Delta \nabla$ again, setting temperature will be rising or going down.

The temperature setting mode will be quit automatically in 5s if no any operation. The number will display the current room temperature, without flashing any more

During temperature setting period, if any other button pressed, the temperature setting situation will be quit immediately.

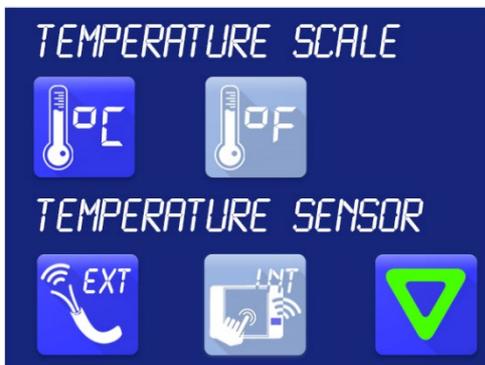
9.2.4 SETTINGS

Pressing the setting button  over 5s , setting window will be displayed as below:

The current choice will be highlighted.

Temperature unit and sensor choice is available.

The selected button will be highlighted after operation.

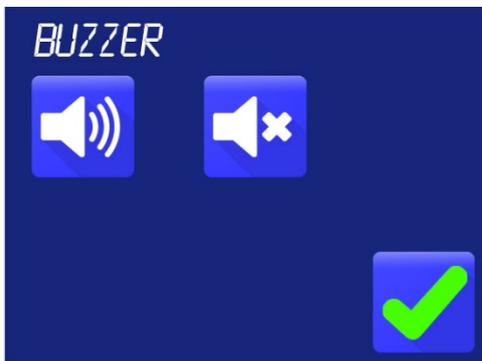


Default settings are °C and external sensor, if °F is selected, for temperature >99°F displayed temperature is 99.

In Settings mode it is possible to choose the

When finish the choice, press  to go to ne next page,

Buzzer activation page is available



Press  to confirm the setting and quit to main Window.



9.2.5 ALARMS

Alarms codes will be displayed in yellow colour instead of the current temperature, alarm history will be displayed in the service menu (only relative time, last one on top).

**ALARMS MUST NOT ACTIVATE BACK-UP LIGHT AUTOMATICALLY.
IT WILL BE ACTIVATED ONCE THE SCREEN IS TOUCHED.**

E1: External sensor 1 (EP1): sensor failure (also for running with single sensor)

E2: External sensor 2 (EP2): sensor failure

E3: External sensor 3 (EP3): sensor failure

E4: External sensor 4 (EP4): sensor failure

E5: Internal sensor (display): sensor failure

F1: Fan 1: fan failure

F2: Fan 2: fan failure

F3: Fan 3: fan failure

F4: Fan 4: fan failure

B1: Board failure

C1: Communication error

9.2.6 FAN OFF MODE (Advanced setting)



WARNING this setting must be performed from the installer or qualified personal.

It is possible to set the Fan-off mode that makes the fan stops once reaching the set-point.

If this function is disabled (OFF selection in the Fan-OFF page of the setting menu), in automatic mode the fan is still activated at the "V.oF" speed (to be set in the V.oF page of the setting menu) despite the ambient temperature reaches the set point, in manual mode the fan remains at the selected speed.

Valve relays are switched off when reaching the set-point as F.OF parameter is related to the fan only.

If the function is active (Fan-OFF in ON) the fan switches off when the setpoint is reached.

V.oF range is 1-6, default value=1



10.0 ACCESSORIES

 **WARNING** what is reported below is only a description of supplied accessories. The detailed installation, use and maintenance instructions will be contained in every accessory package. Every operation must be performed from qualified personal; Please make sure before performing any operation that there is no electric current in the circuit.

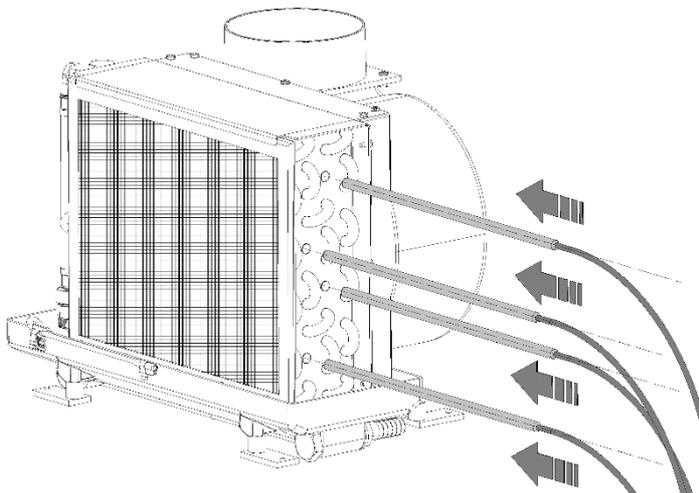
10.1.1 HEATING RESISTANCE (Cabin warming mode function)

This accessory allows the units to heat the air temperature whenever it is required independently if the system is operating in cooling or in heating. It is therefore to heat only a single room (for example the bathroom for having shower) while the system is working in cooling mode.

It consists of 4 armored electric resistances to be inserted inside the heat exchanger and controlled by the motherboard through HEATER contact (contact also reported on the unit's connection box).

IMPORTANT:

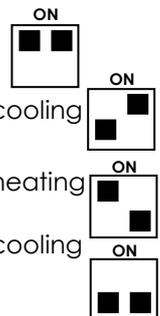
Each fancoil mounting heating resistances needs a dedicated thermostat. It is not possible for a single thermostat to manage one fancoil with heating resistances and other fancoils.



N.B. this contact gives only the consent to switch ON or switch OFF the Heating resistance. The power supply for resistances operation must always be supplied out of the unit.

Heating resistance can be activated or not depending on the setting made via dip switch behind the display. There are 4 possibilities

- No heating resistance available
- Heating resistance available in cooling mode only
- Heating resistance available in heating mode only
- Heating resistance available in cooling and heating mode



Note: When the function is not available the button is not visible.

When pressing heating resistance pattern, heating element button can switch in a cycle from activated mode (resistance red color) to non activated mode (resistance white color).

When the heating resistance is ON, if the unit is switched OFF, the heating resistance symbol remains ON also in OFF mode but resistance is OFF, when switched On again the resistance is ON again.

Post-Ventilation:

In case of cabin warming function active and heating resistances active, when the fan have to be stopped for set point reaching or for panel switching-off, a post-ventilation at "Flo" (parameter) speed is performed, its duration is set by the "tPF" parameter in a 1-120s range, default value=90s.

After the post-ventilation the fan stops, unless parameter "F.OF"=NO. The fan doesn't stop after set point is reached and post ventilation is not performed after panel switching-off.

If the heating resistance is OFF the fan stops immediately without any post ventilation unless "F.OF"=NO.

Fan speed limitations

In case of cabin warming function active and heating resistances active, fan speed can vary in the range Flo...Fhi (parameters), both in automatic and manual mode.

If cabin warming function is not active all the fan speeds are available.



10.1.1 AIR STERILIZATION SYSTEM UVA/UVC

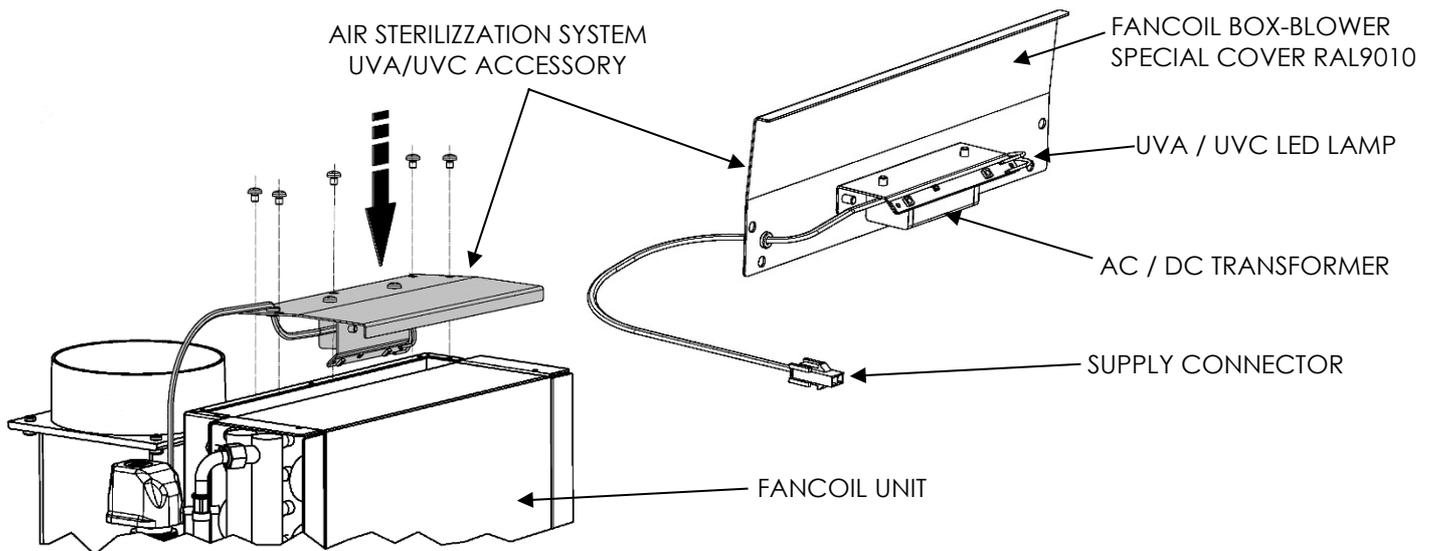
This device is constituted by an UVA/UVC led lamp capable of emitting germicidal radiation. These radiations deactivate bacteria, viruses, and other microbes by attacking their DNA. UV light is able to penetrate the cells of microorganisms and disrupt the structure of the DNA molecules.

The position of this device in the fancoil unit allows the disinfection of the treated air and prevents the bacteria that nesting between the fins of the heat exchanger.

Once installed the device works automatically, however it is advisable to set from the display the function Fan-OFF in ON position (see paragraph 9.2.6).

This LED lamp can last up to 50000 hours and after 20000 can show a 10% yield drop.

For installation of the device, refer to the appropriate instruction manual.

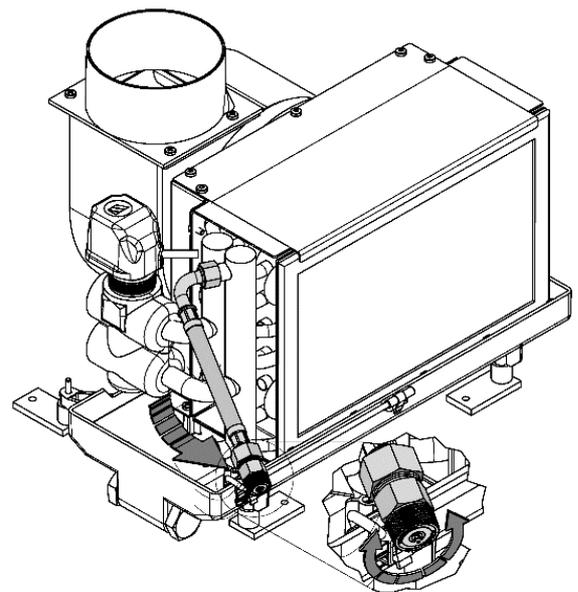


11.0 START-UP

11.1.1 BLEEDING

- When installing a new fan coil unit, open only the inlet valve. Bleed as much air as possible. After bleeding the air, open the return valve (water out of the fan coil unit).
- Add water and anti-freeze as necessary to maintain the correct system pressure and freeze protection.

Note: Low water pressure can cause some fan coil units, especially those high up, to be put into a negative pressure situation. Whenever an fan coil unit's bleeder valve is opened, water should come out in a pressurized stream. If air comes OUT, it means the system has not been completely bled. If NOTHING comes out, it probably means there is not enough water pressure in the system.





11.1.2 FINAL FANCOIL UNIT INSPECTION

The following checklist is only for the fan coil units:

PLUMBING

- Are the units mounted secure and level?
- Are the service valves open?
- Is the bleeder valve closed?
- Is the actuator on the 3-way valve in the proper position?
- Are condensate drains properly routed to an overboard discharge or sump?
- Have any unused drain holes in the condensate pan been plugged?
- Do the condensate line consistently run downhill, with the drain pan as the highest point?
- Has the condensate line been tested with a quart of water poured into the drain pan?
- Are the condensate lines insulated?
- Are the inlet and outlet pipes connected properly?
- Are joints and tees properly insulated?
- Are pipes individually insulated?
- Are pipes fastened securely to the boat as needed throughout their length?
- Does the system have the proper amount of antifreeze? Have you tested it with a refractometer?

AIR DISTRIBUTION SYSTEM

- Is there unobstructed airflow from the return-air grille to the coil?
- Is there a lint screen or filter in the return-air path where it is accessible for regular cleaning?
- Have flexible ducts been pulled tight to remove bends and constrictions?
- Are grills and ducts correctly sized for the system?
- Have all gaps been plugged to prevent air from bypassing the return-air grille's filter?

CONTROLS AND WIRING

- Is the return-air sensor properly located and secured in the return-air path, out of direct sunlight, and out of direct contact with any metal objects?
- Are all wiring harnesses properly secured?
- Are wiring connections made, color to color, correctly at terminal strips?
- Are plugs and pins properly aligned and securely connected?
- Are all components properly grounded?
- Are the breakers and wire of the correct size and type?
- Are terminal strips located in a dry, safe place and properly covered?

12.0 OPERATION

12.1.1 AVOIDING FROZEN FANCOIL UNITS

One of the advantages of chilled water is that dirty filters and reduced air flow cannot cause frozen coils. However, sub-freezing air temperatures CAN cause chilled water fan coil units to freeze if the ambient or inlet air is cold enough.

Anti-freeze in the system will protect the fan coil units AND the chillers to a point. We recommend a 20% by volume propylene glycol solution. Do not greatly exceed 20% propylene glycol, because performance will suffer. In any case, never allow the freezing point to rise above 20°F (-6.6°C). Thus, the unit can never freeze unless the ambient air temperature is below 20°F (-6.6°C). Use a digital refractometer to check the concentration of the antifreeze. Always use a non-toxic antifreeze.

Water flowing through the unit tends to protect against freezing. Hot flowing water gives more protection. But, if a service valve is closed, or if the 3-way valve is in the bypass position for any reason, the water in the coil will eventually reach the same temperature as the ambient air. If the ambient air temperature is below the freezing point of the water, the water will freeze and the coil will rupture.

12.1.2 CONTROLS

Frigomar supplies a variety of controls for fan coil units and chillers. Refer to the appropriate control manual for more information.



13.0 FANCOIL UNIT MAINTENANCE

13.1.1 MONTHLY

AIR FILTERS

Dirty filters will reduce airflow and capacity. At least once a month, check the lint screen or filter behind the return-air grille or on the face of the fan coil unit. Replace or clean if necessary. Reusable plastic filters should be vacuumed or washed with tap water. Do not use soap or solvents.

RUN THE SYSTEM

It is recommended that systems be operated regularly. Vessels not in use should have their chillers and fan coil units cycled on 30-60 minutes once a month. Vessels in use should cycle on limited-use components in similar intervals to those above. Systems should also be cycled to their reverse mode (cool to heat, heat to cool). This helps to maintain pump seals and internal mechanical contacts, while reducing the fouling effect of marine growth in the seawater circuit.

13.1.2 EVERY THREE MONTHS

CONDENSATE DRAINS

Check the fan coil unit condensate drains for obstructions by pouring a quart of water rapidly into the condensate pan. If it does not drain completely within 30 seconds, check the drain outlets for clogging. Remember that many Frigomar systems have two drains, one at each end of the unit.

13.1.3 YEARLY

FREEZE PROTECTION

Check the level of non-toxic anti-freeze protection using a refractometer. 20% propylene glycol is recommended. Never allow the freezing point to rise above 20°F (-6,6°C).

SENSORS

All control probes and sensors should be inspected for proper location and fastening. Improperly located and/or secured probes will provide erroneous readings, causing improper operation.

1. Check all sensors at each fan coil unit for proper location. Water sensors should be securely fastened and insulated on the supply connection (water inlet) of the fan coil unit.
2. If the built in air sensor on the controller display panel is not utilized, the remote air sensors should be located in the return-air stream as close to the cabin area as possible without being in contact with any other hot or cold surface.

14.0 TROUBLESHOOTING



CAUTION

If a safety trips, it is important to find out **WHY** it tripped and fix the root problem.
DO NOT IGNORE THE SAFETIES! Find and fix the root cause.

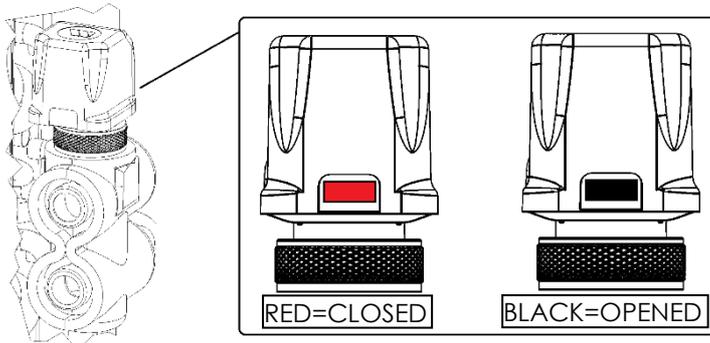
14.1.1 BLOWER NOT RUNNING

- Check the circuit breaker. Turn it completely off, then back on.
- If it trips again immediately, then do NOT turn the breaker back on—there is likely a dangerous short-circuit. Call a trained technician to locate and fix the short-circuit.
- Read the control manual. Are you sure the blower **SHOULD** be running?
- If there is voltage at the blower but it is not running, then the blower motor or capacitor (if any) is bad.



14.1.2 BLOWER RUNNING BUT NOT COOLING/HEATING

- Check the position of the actuator on the 3-way valve. If it moves to the "open"/energized position without resistance, then it is open. The actuator has a transparent zone that allows for checking the status of the actuator



Red = valve closed

Black = valve open.

When the valve is de-energized it is in the by-pass position. If the actuator is removed the valve is in the open position.

- **The 3-way valve is closed:**
 - Is there correct voltage at the valve? If there is correct voltage at the valve, it should be open unless the actuator is bad or improperly connected to the valve.
 - Read the control manual. SHOULD the valve be open?
- **Airflow is low:**
 - Dirty filter - at the return-air grille or on the unit
 - Dirty coil
 - Blower is at low speed
 - Low voltage (more than 10% below the rated voltage) to the blower. Note: Many controls adjust blower voltage to adjust the airflow. Multi-meters often have difficulty reading the "chopped" voltage accurately. Read your control manual for details on fan speed control.
 - Restriction in the ductwork
- **Water flow is inadequate.**
 - Is the coil air-locked? Try opening the fan coil unit's bleed valve for a few seconds. Water should come out in a steady, pressurized stream. If the fan coil unit has to be bled regularly, the system may have inadequate pressure, leaks, or both.
 - A gurgling sound indicates air in the system. Bleed the fan coil unit and the entire system. Fix any leaks, add water, and raise the water pressure as appropriate.
 - Make sure the fan coil unit's service ball valves are open.
 - Dirty circulating water strainer.
 - Pump problem, possibly a worn impeller.
 - Has the water system changed? For example, another fan coil unit has been added or a flow control removed.
- The heat load may be exceeding design. Look out for external loads such as open doors and windows. Look out for internal loads such as showers, ovens, high-wattage electronics/lights - especially if they have recently been added or have increased usage.

14.1.3 NOISY FANCOIL UNIT

- Any foreign object inside the blower can create loud noise and possibly damage the blower.
- Shipping or handling damage may cause the spinning blower wheel to rub on the blower inlet.
- A gurgling sound indicates air in system. Bleed the fan coil unit and the entire system. Fix any leaks, add water, and raise the water pressure as appropriate.
- Air noise may be caused from duct problems or a bad blower. Read the section on Audible Noise.
- A clicking sound with fan coil unit fan off, but circulation pump running, may be a bad flow control valve, or even a circulation pump problem.



15.0 WARRANTY TERMS

15.1.1 LIMITED WARRANTY

The warranty is given to the purchasers who buy Frigomar-manufactured products and components for their own use.

Frigomar guarantees all these products to be free from defects in materials or workmanship. Warranty is limited in term of duration as specified in the following sections.

This Limited Warranty is made in place of all other express warranties, obligations, or liabilities on the part of Frigomar. In those instances, in which Frigomar chooses to make a cash refund of the original purchase price, such refund shall affect the cancellation of the contract of sale without reservation of rights on the part of the owner. Such refund shall constitute full and final satisfaction of all claims which the owner has or may have against Frigomar resulting from any actual or alleged breach of warranty, either express or implied.

Frigomar disclaims any liability for either incidental or consequential damages. This includes any damage to another product or products resulting from such a defect. Any implied warranties of merchantability, satisfactory quality or fitness for any purpose is limited to the duration of this limited warranty.

Frigomar does not authorize the dealer or any other person to assume for Frigomar any liability in connection with the warranty, or any liability or expense incurred in the replacement or repair of its products other than those expressly authorized by Frigomar. Frigomar shall not be responsible for any liability or expense except as is specifically authorized in the following sections.

Frigomar reserves the right to improve or modify its products without notice, through changes in design or material without being obligated to incorporate such changes in products of prior manufacture.

15.1.2 WARRANTY DURATION

The Frigomar product's Warranty Coverage Period begins from the date of possession of the boat by the original owner (if OEM installed) or from the date of installation (if the Frigomar product is installed by a dealer). However, the Warranty Coverage Period will not exceed 3 years from date of manufacture. The Warranty is transferable and will carry any remaining Warranty Coverage Period. The Warranty Coverage Period does not restart following any repair or replacement of the Frigomar product.

All Frigomar products bear a data plate showing the product model and serial numbers. The serial number is date-coded. To determine whether any Frigomar product is covered under this Warranty, proceed as follows:

Determine the manufacture date of the Frigomar product from the serial number found on the data plate. If you are not familiar with the date code, email or call Frigomar Customer Service in order to obtain the Frigomar products manufacture date.

In some cases, there might be a consistent delay between the date a Frigomar product is manufactured and the date it is put in service. For proof of the date that the Frigomar product was put in service, Frigomar will require a copy of the bill of sale from the Frigomar product installer or a copy of the bill of sale showing the date of delivery from the new boat dealer to the original owner. Therefore, owner should retain a copy of the dated bill of sale as evidence of the date of purchase or date of delivery.

- **Chiller, self-contained units and fan coils:** If any part of the Frigomar unit fails due to a manufacturing defect within 24 months from the date of possession of the boat by the first owner,



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Frigomar will supply without charge the required replacement part. The service labour will be at Frigomar charge within 12 months from the data of possession of the boat by the first owner, as long as the conditions specified in Section III are fulfilled.

-Pumps: If any pump fails due to a manufacturing defect within 12 months from the date of original shipment Frigomar will replace or repair the part without charge. The service labour will be at Frigomar charge as long as the conditions specified in Section III are fulfilled.

Pump seals are not covered under warranty.

Catalogue: For Catalogue Sales of any product the warranty duration is 1-year for parts from the date of purchase, 6 months for labour from the date of purchase.

Refitting: Frigomar chillers installed in conjunction with a control system other than a current Frigomar control or a control system that is outdated carries a 90 days warranty on defective material or workmanship from the date it is put into service. There will be no warranty coverage for operation failures such as control malfunctions, freeze failure and the like. Frigomar Customer Service is available to assist with recommendations on the installation, but Frigomar will not be responsible for any non-Frigomar part.

After market: Replacement parts and components: warranty duration is 90 days, parts only

The owner of the product may decide to ship the allegedly defective or malfunctioning product or part to Frigomar at his charge: Frigomar will analyse the defective product and, provided it is covered under warranty, will repair or replace it without charge, taking in charge the return freight with ordinary forwarder (not express or similar). All risks of loss or damage during shipment of the product or parts to Frigomar and back to the owner shall be the responsibility and liability of the owner.

15.1.3 WARRANTY CONDITIONS

The intervention must be prior authorized by Frigomar Customer Service (tecnico@frigomar.com).

All the parts delivered by Frigomar bear a data plate reporting model and serial number: the owner shall give to Frigomar Customer Service all this information related to the faulty parts. Normally the preferred way is to e-mail the data plate photos. Frigomar may also require a copy of the bill of sale from the Frigomar product installer or a copy of the bill of sale showing the date of delivery from the new boat dealer to the original owner, as a proof of the date that the Frigomar product was put in service.

The intervention must be carried out by a local authorized Frigomar service (worldwide service network: <http://www.frigomar.com/en/service-network.html>). In case Frigomar has no one in that particular area, Frigomar will authorize the use of a local service company and Frigomar will work with the local company to assist in any way possible.

Where labour is included for a particular Frigomar product covered under this Limited Warranty, Frigomar is not responsible for additional labour charges associated with the removal, reinstallation, or replacement of any equipment or furnishings beyond the particular covered Frigomar product. This Frigomar Limited Warranty allows up to 1.0 hour for the Servicing Dealer's travel time. Any additional travel time is the owner's sole responsibility.

The labour time necessary to get access to the faulty unit in order to start repairing, will be at owner's charge.



Warranty periods begin from the date of possession of the boat by the first owner, but not to exceed 3 years from date of manufacture.

Any unit or replacement part installed due to a warranty failure carries the remainder of the original warranty. Warranty coverage does not start over from the repair/replacement date.

If the intervention onboard is required but the problem is due to improper installation and use, or any cause independent from the supplied equipment, the cost of intervention will be at owner's charge. Installation and application of Frigomar components is not warranted by Frigomar, because Frigomar has no control or authority over the selection, location, application, or installation of these components.

The responsibility of the owner of the equipment includes the following:

1. To operate the equipment according to the manufacturer's instructions.
2. To provide easy accessibility for service.
3. To check and reset circuit breakers and disconnect before calling for service.
4. To keep the units clean and free of dirt, to keep the air filters clean as well as the air heat exchangers.
5. To keep the condenser coil free of sediment and scale.
6. To keep clean the fan coil water circuit.
7. To pay the charges incurred when any of the above has not been done.
8. To pay for repair or replacement of any material or part other than those within the Frigomar unit.
9. To check any fuses on the circuit board and replace as required.

This warranty shall not apply to:

Failures resulting from improper or faulty installation, installation that does not comply with Frigomar's instructions or otherwise, installation that does not comply with any American Boat and Yacht Council standards, and any damage resulting from such;

Abuse, misuse of equipment, natural disasters, flooding, fire, submerge, any water leakage, or use contrary to instructions;

Items not manufactured by Frigomar;

Transport: product damage as a result of improper return packaging or other freight damage;

Negligent servicing;

Wrong electrical and hydraulic connections;

Power supply not in accordance to manufacturer's specifications;

Fresh water frosting (chilled water circuit);

Exterior corrosion, electrolysis and galvanism, stray current, seawater erosion;

Water damage, including specifically to the following components: pumps, blowers, logic boards and displays heads;

Additional labour charges associated with the removal, reinstallation, or replacement of any equipment or furnishings beyond the particular covered Frigomar product. The original installer or OEM is responsible for the accessibility of the Frigomar product;

Failures due to improper winterization;

Pumps with cracked heads or pumps that have been run dry, are water damaged or have blown freeze plugs;

The following components: pump seals, UV light bulbs, sea strainer elements, cartridge filter elements, sand & gravel in a multi-media filter, pump packing assemblies, pump valve assemblies,



pump crankcase oil, fuses, valve seals and packings, membrane elements and liquid line filter dryers;
Mis-programmed displays;
Logic boards and display heads with water damage;
Environmental and/or recovery fees;
Damages occurring as a result of normal wear or aging;
Replacement of refrigerant with substitute without Frigomar preauthorization;
Welding and Nitrogen Fees.

16.0 DISPOSAL AND GAS RECOVERY

16.1.1 DISPOSAL OF THE EQUIPMENT AND PARTS

Disposal of the equipment and parts of it must be done in compliance with the laws in force for the differentiated disposal of waste and / or recycling.

17.0 GLOSSARY

FAN COIL UNIT: The fan coil unit that circulates air into a specific area for heating or cooling.

BTU: (British Thermal Unit) A common term used to define and measure capacity or refrigeration effect.

3-WAY VALVE: An electrically operated water regulating valve on an individual fan coil unit controlled by the thermostat. This valve provides water flow through the fan coil unit when opened, and bypasses water flow from the supply side to the return side when closed. On fan coil units, 3-Way valves are superior to modulating valves because they provide better humidity control.

BLEEDER PORTS: Capped ports located on the fan coil units for purging air from the chilled water circulation system.

CFM: Abbreviation for "cubic feet per minute", a term used to specify the volume of airflow through the fan coil units and ducting.

CIRCUIT BREAKER: An electrical device which provides high current and short circuit protection for the compressor, fan coil units and pumps used in the chilled water system. HACR (heating, air conditioning & refrigeration) type circuit breakers are recommended for the ship's panel. HACR circuit breakers have a long delay to compensate for the electrical surge associated with compressor.

CONDENSATE DRAIN PAN: The pan directly under the fan coil unit's coil for removal of the "condensed" moisture taken out of the cabin air. Two drain spud attachments are provided for connection to drain hoses for proper removal of the water to a sump.

FILL ASSEMBLY: The point where a water hose is temporarily attached to the circulating water circuit in order to fill it. The fill assembly typically includes a ball valve and a pressure reducing valve.

GPM: Abbreviation for "gallons per minute", a term used to specify the amount of water flow through the chilled water or seawater system.

R-VALUE: R-value is the industry standard measure of a material's resistance to heat transfer. The higher the R-value, the more effective it is as an insulator.

RUN CAPACITOR: An electrical storage device used to reduce amperage to some electric motors for more efficient operation.

SEMICONDITIONED SPACE: A semiconditioned space is a space that meets the following requirements:

- It is at least 95% bounded by conditioned spaces, or by other semiconditioned spaces, or by vertical surfaces with at least R4 insulation.
- It is not exposed to outside air. There must be an effective vapor barrier.
- It is exposed to conditioned, return air.
- It is not conditioned with its own diffusers.

One example is the horizontal crawl space that divides two conditioned decks. Another example is the vertical space between a salon and the wall that separates it from the outdoors. In such a case, the wall should be insulated with at least R4 insulation.



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