Frigoboat

Marine Refrigeration Systems

Installation & Instruction Manual

For All Models:

Air Cooled, Pumped-Water Cooled,
Keel Cooled, and Keel-plus-Air Cooled

(Systems using Secop (formally Danfoss) BD 35 or BD 50 compressors)

It is important to read this manual thoroughly before installing and operating a Frigoboat system.

Coastal Climate Control, Inc.
301.352.5738

info@CoastalClimiateControl.com

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Cautions! - Warnings!

- Frigoboat refrigeration systems are designed to preserve foodstuffs, drinks, and other consumables intended for human consumption, and at normal refrigerator and freezer temperatures. Any use other than that specified above invalidates the warranty and releases Coastal Climate Control, Inc. of any liability for consequent damage, failure, malfunction, injury, illness, or death.
- Never install items containing electrical or electronic components in an area where there is the potential for liquids to splash onto them or drip down onto them.
- In the unlikely event that servicing is required, never inject anything but unadulterated pure refrigerant R134a into any Frigoboat system. The addition of even a small amount of leak detecting fluid, leak sealer, extra refrigerant oil, "conditioner", flushing fluid, Thawzone, or other substances may cause irreversible damage.
- Never operate a Keel Cooled system while the boat is out of the water without having first rigged some form of temporary water cooling on the Keel Cooler. If a Capri air cooled condensing unit or an Air Add-On air cooled condenser is installed together with a Keel Cooler, ensure that the fan is operated only when the boat is out of the water, and then switched off when the boat is launched.
- Never defrost an evaporator using a hard or sharp object like an ice pick, knife, or screwdriver. Never defrost using an appliance that generates high heat, like a heat gun or hairdryer. Natural defrosting is safest, but mild heat may be used if absolutely necessary.
- With a Keel Cooler installation, it is vital that the Keel Cooler be electrically connected to a point that is at the same potential as the boat's battery negative, with no switch in the circuit between the Keel Cooler connection and the battery negative.

Contents

Chapter 1

Frigoboat Systems

A Frigoboat refrigeration system consists of the following components:

(1) A compressor/condensing unit that is either:
Air cooled – Paris 35F, Capri 35F, Capri 50F
Pumped-water cooled – W35F, W50F (with pump)
Keel cooled – K35F, K50F (with keel cooler)
Keel plus Air Cooled - Paris 35F, Capri 35F, or Capri 50F with Keel Cooler

(2) An electronic controller connected to and installed on the compressor.

(3) Either a mechanical thermostat dedicated for either refrigerator or freezer or a Coastal MK 3 digital thermostat/thermometer

(5) An aluminum or stainless steel evaporator plate

(6) A water pump (For W35F or W50F only)

(7) A Keel Cooler. Standard with K35F and K50F models, optional with Air Cooled models.

APPLICATION

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Chapter 2

Paris 35F, Capri 35F, Capri 50F - Air cooled

These units are designed to be mounted with compressor right way up on a horizontal surface in areas where they will not be susceptible to physical or water damage, but accessible for service. They require good ventilation, preferably expelling the heated air to another location by attaching a flexible duct of not more than 6' in length to the duct ring on the unit. A duct kit is available for Capri 35 and Capri 50 models. Do not add any filter type material anywhere in the air flow.

If air is required to be drawn *into* the unit from another area, the fan may be reversed by removing the housing and re-mounting the fan in the opposite orientation. **Reversing the fan leads does not make the fan run in reverse, and the incorrect polarity will result in the fan not operating.**

There should be adequate ventilation to allow cool air to enter the condenser, and precautions made to prevent the heated expelled air from being drawn back in. The temperature of the air entering the condenser determines the efficiency of the system. Re-circulating the heated air back into the condenser in a sealed or poorly ventilated cabinet will result in poor system performance. Poor system performance will also result from air being drawn in from a heated space, i.e. an engine room.

Chapter 3

W35F, W50F - Water cooled with pump

NOTE: The W35F and W50F compressors are designed to work with sea water only. They are not designed to use water from other sources, i.e. water tanks, skin tanks, or coolant pumped through secondary heat exchangers. Serious health risks and/or performance issues can occur if any form of liquid coolant delivery is used other than sea water being pumped directly into the system and then expelled back overboard.

This unit must be mounted with compressor right way up on a horizontal surface in an area where it will not be susceptible to physical or water damage, but accessible for service. Consideration should be given for access to the water and refrigerant line connections. A mounting kit is supplied with the compressor that includes rubber mounts and steel inserts. The unit may be screwed or bolted down using the supplied white, plastic washers, if desired. If a Bulkhead Bracket (PN E52135) is used, remove the stainless steel mounts from the compressor and use the plastic mounts provided with the Bulkhead Bracket.

3:1 Raw water pump

The pump supplied by Frigoboat is self-priming and requires a good intake strainer of 120 mesh. Other pumps of similar performance may be used. After installation, check for leaks and a water flow of at least 1 gal/min. The pump power must be supplied through a 12v relay whose coil is connected to the fan terminals. The fan terminals on the module are limited to a current draw of 0.7 amps and will deliver 12v even if the system is connected to a 24v supply. Full wiring instructions are included with the compressor.

If more than one W35 or W50 is sharing a single water pump, they must be plumbed in a parallel configuration so that the pump output is split equally to each unit, and each unit receives water direct from the pump. The water discharges from each unit can then be combined into one single overboard discharge. Multiple W35 or W50 units must *not* be plumbed in a series string; i.e. pump output into unit 1; output from unit 1 to inlet of unit 2, etc., etc.

The positive (+) lead to the pump can be wired in parallel to the individual 12v relays so that any unit can operate the water pump independent of the other(s).

Chapter 4

K35F, K50F - Water cooled with Keel Cooler

The compressor unit must be mounted with compressor right way up on a horizontal surface in an area where it will not be susceptible to physical or water damage, but accessible for service. **Consideration must be given to the fact that the compressor must be mounted within 5' of the Keel Cooler.** This dimension cannot and must not be extended.

A mounting kit is supplied with the compressor that includes rubber mounts and steel inserts. The unit may be either screwed or bolted down using the supplied white, plastic washers, if desired. If a Bulkhead Bracket (PN E52135) is used, remove the stainless steel mounts from the compressor and use the plastic mounts supplied with the Bulkhead Bracket.

4:1 Keel Cooler

This must be mounted through the hull by drilling a 1 9/16" (40mm) hole (a 1.5" hole may be used, carefully enlarging it, if necessary). Make a dry run(s) without the rubber O-ring and sealant installed,

making sure that the keel cooler fits up flush with the hull, chamfering the hole if necessary. **The rubber O-ring must then be installed and properly seated in the groove provided. Do not install the Keel Cooler without the rubber O-ring**. Adequate sealant of the correct type must be used, and a bead applied to the area between the O-ring and the shaft of the Keel Cooler is all that is normally required. The compressing of the rubber O-ring will serve to force sealant into any voids around the shaft as the fitting is tightened. Consult your local marine store if you are uncertain of which sealant to use. With the sintered "Ground Plate" models, a dab of sealant should also be applied to the fore and aft ends of the Keel Cooler where it meets the hull to secure its orientation. If installing the "Bare Bones" model, an adequate amount of sealer should be applied under the end fairing cap before the cap is secured to the hull with screws.

When installing the thread-type Keel Cooler you will need someone to hold the Keel Cooler outside the boat while you tighten the nut inside. **The mounting location should be carefully chosen. Select a location with a flat exterior surface, as a concave area will damage the sintering on the Keel Cooler when it is tightened. Also, avoid areas where lifting slings may be applied or where other damage may occur. On the boat's interior, the Keel Cooler should be installed in a location that is normally dry, and not where it is likely to be submerged or be subjected to frequent and/or heavy dousing.**

Consideration should be given to the fact that the Keel Cooler must be below the water-line, and the compressor unit must be mounted within 5' of the Keel Cooler location. On power boats it may be possible to mount the Keel Cooler in a vertical orientation on a section of the transom that is below the waterline when at rest. Keep the two tubes from the Keel Cooler separate from each other, and do not insulate them.

It is extremely important to orientate the cylindrical Filter/Drier fitted to the Keel Cooler discharge tube in a vertical manner, with the arrow pointing downwards. Failure to do so will lead to poor system performance.

Special constraints and working practices apply when installing the keel cooler on a vessel with a cored, metal, or carbon fiber hull. For these applications we suggest you consult a marine professional who is conversant in that particular field.

4:2 Grounding and cleaning

Provision is provided for a grounding/bonding wire to be attached. **It is very important that the Keel Cooler is electrically connected to a point that is at the same potential as the boat's battery negative, with no switch in the circuit between the Keel Cooler connection and the battery negative**. This connecting wire should be green in color and of 8 AWG or higher.

If the Keel Cooler being installed is the type without zincs, it must be connected to the vessel's bonding system and also to a sacrificial zinc anode. This is an important safety precaution and does not alter the fact that a connection must be made between the Keel Cooler and a point that is at the same potential as the boat's battery negative, whether the Keel Cooler has zincs or not. Bonding wire should be green in color and of 8 AWG or higher.

If the installer is in any doubt as to how to make the grounding/bonding connections, a marine electrical technician should be consulted.

The connections must be checked with a multi-meter after installation to ensure that Keel Cooler and the battery negative post are at the same potential.

The sintered "Ground Plate" Keel Cooler should not be painted unless heavy and consistent fouling proves to be an issue. Clean occasionally with a brush, never with a metal scraper. All models of Keel Cooler must be inspected periodically for corrosion.

NOTE: ***Never operate a Keel Cooled system while the boat is out of the water without having first rigged some form of temporary water cooling on the Keel Cooler. If a Capri air cooled condensing unit or an Air Add-On air cooled condenser is installed together with a Keel Cooler, ensure that the fan is operated only when the boat is out of the water, and then switched off when the boat is launched.***

Chapter 5

Danfoss/Secop Electronic Controller for Frigoboat systems

The Danfoss/Secop Electronic Controller is an integral part of the Danfoss/Secop BD compressor system. It transforms direct current power from the vessel's batteries into modified alternating current to run the compressor. **Never attempt to run the compressor directly from the batteries or other power source.**

5:1 Voltage

A supply voltage of either nominal 12 or 24 volts dc is required. The controller will run from either voltage without any special settings or adjustments, switching automatically to 24v mode if the voltage is above 17v.

5:2 Multi-speed compressor

Depending on the system, automatic or manual compressor speed selection is used to run the compressor at speeds between 2000 RPM and 3500 RPM. *NOTE: With no form of compressor speed control installed, the compressor will run at the slowest speed and with the lowest capacity.* The Paris 35F has no speed control, running at 2000 RPM. All others must have either a manually adjustable compressor speed controller like a Speed Board, or alternatively, an automatic smart speed control such as the Merlin II Smart Speed Controller. If your compressor unit comes with a Speed Board installed and you are installing a Merlin II, the Speed Board must be removed from the Danfoss/Secop controller.

5:3 Fault Codes

Protection is provided for the following:

(1) **Low voltage.** To prevent the batteries from being totally discharged, the compressor will be stopped if the voltage at the terminals on the controller falls below 10.4volts (22.8v on a 24v system). It will not re-start until the voltage rises above 11.7 volts (24.2 on a 24v system).

(2) **High voltage.** If the voltage exceeds 17v, the controller stops the compressor and switches into 24v mode, but will not attempt to start the compressor until the voltage reaches 24.2v.

(3) **Compressor non-start.** If the compressor does not start, the controller will cease the starting process and attempt a re-start approximately every 45-90 seconds.

(4) **Compressor speed too low.** If the compressor speed falls below 1900 RPM the controller will stop the compressor.

(5) **Fan (and pump) protection.** If the current draw across the fan terminals exceeds 0.7 amps at 12v dc, the compressor will be stopped and a re-start attempted every 45-90 seconds.

(6) **Module overheat.** If the heat sink on the controller exceeds 100 deg C (212 deg F), the compressor will be stopped and will be re-started when normal operating temperatures are resumed.

5:4 LED Alarm Indicator - Diagnostic Diode

A 12v LED may be installed across the "+" and "D" (or “D/I”) terminals of the controller to indicate a failure condition. On the Coastal MK3 one is installed on the front panel and labeled “Fault”. On the Merlin II a red LED is installed on the face of the PCB and labeled “Alarm”. Under a fault condition, the compressor will be stopped and an attempted restart will be made approximately every 45 -90 seconds. Under this condition the LED will blink between 1 and five times every 5 seconds, as follows:

1 Blink:	Supply voltage low, below 10.4v on a 12v system, 22.8v on a 24v system
2 Blinks:	Excessive load on fan terminals, above 0.7 amps
3 Blinks:	Compressor non-start (Common occurrence, and normal when compressor stopped and started again too quickly)
4 Blinks:	Compressor speed below 1900 RPM
5 Blinks:	Controller electronics temp too high. Re-sets on cool-down

Note 1

After power is applied to the controller there may be a delay of up to 30 seconds before the compressor starts.

Note 2

If initial power is applied that is above the low-voltage threshold but below the cut-in voltage value (see 5:3 (1), digital displays will be lit, but the compressor will not start and there will be no fault indication on the LED. System will start when voltage is increased above the cut-in value.

Note 3

The electronic controller, although designed for harsh and marine applications, can be damaged by either direct or incidental contact with water and by water flowing down wires attached to the terminals. When attaching wires to the terminals on the controller, make sure that all wires approach from below the terminal, and endeavor to mount the compressor and controller combination in a location that is clear of existing and potential water leaks.

Note 4

The electronic controller is secured to the compressor by a single screw and a push-on three-pin plug. The hole in the controller housing is larger than the screw head, and it is permissible to lever the casing over the screw for easier removal if access is limited.

Chapter 6

Aluminum H-, F- and B-Type Evaporators
(Horizontal, Flat, Bin Type)

6:1 Location

All types of evaporator need to be located as high as possible in the icebox to maintain the correct temperatures, with consideration being given to access to the interior freezing section in the H and B-type. **Special attention must be given to the fact that air flow must be allowed to circulate to and from the rear of the evaporator plate.** This necessitates leaving a gap of approximately 1" between the top of the evaporator and the roof of the box, and similar spacing at the lower edge. In conjunction with this, it is important that the ¾" spacers provided be used to offset the evaporator on all points from the icebox wall. Additional spacers may be fashioned from wood, hose, or similar material, if required.

The H- and B-types may be mounted in any position. The F-type **must** be mounted with the indicator arrows pointing upwards, on a vertical wall, and with the refrigerant channels running in a horizontal orientation.

Do not alter the orientation of the tubing and/or tubing components secured to the end of the evaporator plate. Do not remove any securing zip ties, or attempt to straighten the tubing.

6:2 Bending Instructions for flat plates:

The F-type flat evaporators may be carefully bent on a minimum 1.5" radius to follow the shape of the icebox. This is best done by holding a section of suitably padded PVC pipe (with an outside diameter of 3.0" or greater) firmly down on the plate, and then carefully bending the section upwards with the palm of your hand. The stainless steel plates need more force to bend and may require the assistance of a second person. This must be done slowly and with great care to avoid excessive kinking of the channels in the evaporator. Never attempt to bend a plate downwards over a pipe, as damage may result. The area to be bent should be warmed with a hair dryer or heat gun to approximately 200°F before bending, in order to prevent the paint from cracking. There are sections of the evaporator that must not be bent, and these are indicated on the Bending Sheet included with the evaporator. If the Bending Sheet has been misplaced, a replacement can be obtained from Coastal Climate Control.

All F-type evaporators can be mounted with either side facing inwards, including the 380F which has one smooth side and one with channels. F-type plates with a stainless steel cover must be mounted with the stainless side facing inwards.

6:3 Installation

All evaporators have approximately 9' of copper tubing attached, **with dust-plugs in the end fittings that must remain installed until the very last moment when the connections are ready to be made.** A 1.5" hole needs be drilled in the wall of the icebox, as high as possible, and through successive bulkheads, as required. Carefully unroll the tubing, feeding it through the holes to the area where the compressor/condenser is located. Any bends that need to be fashioned in the tubing must be made carefully with as large a radius as possible to avoid kinking. Excess tubing should be carefully coiled up **outside of the box** and fastened out of the way in a horizontal orientation. One tube is made intentionally longer than the other to enable as small a hole as possible to be made in the box wall, bulkheads, etc. and this allows the couplings to be fed through one after the other. When the tubing run is complete, carefully fashion the longer tube so that the two halves of the coupling can be easily connected. Some evaporators have fragile sections of aluminum tubing close to the body of the evaporator that must be handled very carefully. Warnings to that effect are attached to the evaporators in question.

The section of foam insulation that is free to slide on the tubing should be positioned **starting at the point where the tubing exits the icebox and leads back to the compressor.** It is neither necessary nor desirable to add more insulation to the tubing, as any sweating or ice formation seen on the exposed section of tubing indicates an overcharged condition which will require remedial action.

Once the evaporator is installed, the exit hole in the box must be sealed with expanding foam, refrigeration putty, or other suitable material that will inhibit air flow. Make sure that any drains are plugged and that there are no other holes or gaps through which cold air can escape, and through which warm, moist air can enter.

If the tubing is too short to reach the compressor/condensing unit, pre-charged extensions are available in 3 ft, 6 ft, and 10 ft lengths.

6:4 Mechanical thermostat sensing tube attachment

Check to see how you need to attach the Mechanical Thermostat sensing tube before mounting the evaporator. The last 3" or so of the Mechanical Thermostat's sensing tube must be bent into a "U" shape and then secured under the black plastic plate on the evaporator so that it lays in the special grooves of the plastic plate. Finish by tightening the clamping screw.

If using the Coastal MK3 digital thermostat, the sensor mounts on the icebox wall, **not on the evaporator**. Full instructions are included with the Coastal MK3 thermostat.

6:5 Mounting evaporators

See also 6:1 Location

H- and B-type evaporator plates can be mounted in any position.

To mount the 130H and 160H horizontally, drill four mounting holes in the roof of the icebox. Start two screws in the rear holes, with the spacers provided installed. Slide the mounting slots of the evaporator over the screws, then insert and tighten the two front screws with spacers. Finish by tightening the two rear screws.

There are Lid Kits available for the 340B and 250B evaporators to facilitate horizontal mounting. Mount these items horizontally using the screws and spacers provided.

The B-type can be mounted by using the row of holes along the top rear face of the evaporator.

The F-type has numerous mounting holes along the top and bottom edges, but only some need be used.

Holes may be drilled in the base that has been added to B-type evaporators, as this is a separate piece of aluminum.

Always use the ¾" mounting spacers supplied to protect the tubing and to provide adequate air circulation. Additional spacers may be fashioned from hose or similar material, if required.

Chapter 7

Mechanical Thermostat for H, B, and F Evaporators

(See separate instruction sheet for Coastal MK3)

7:1 Refrigerator & Freezer thermostats

There are two different thermostats for different applications. The refrigerator version is mounted in a white housing and is designed to be used where the evaporator is mounted in an icebox that is intended to be kept at refrigerator temperatures. If the evaporator is of the H- or B-type and is correctly sized, a refrigerator mechanical thermostat is used and this ensures that the interior portion of these evaporators will be kept at freezer temperatures.

The freezer version is mounted in a blue housing and must be used where the evaporator is mounted in a space that is intended to be all at freezer temperatures.

If an existing icebox is divided with an insulated barrier, a spillover system can be employed whereby the evaporator is mounted in the freezer compartment, and a thermostatically controlled fan, mounted on the refrigerator side of the barrier, draws air from the freezer to keep the refrigerator section at the desired temperature. A gap or holes at the top of the barrier allow air to return to the freezer.

7:2 Mounting

The mechanical thermostat can be mounted either inside the icebox, or in an alternative location that is within the scope of the sensing tube. If the thermostat is mounted inside the box make sure that liquids or condensation cannot flow down the shaft and into the mechanism by positioning the housing so that the shaft exits either on the bottom or the side. The Frigoboat logo will be the right way up if the thermostat is mounted correctly. Markings can be made on the perimeter of the knob to assist in determining the setting. Do not mount on the ceiling of the box. The sensing tube controls the thermostat by the pressure of the gas it contains and must not be kinked, broken, or cut. Any excess tubing may be carefully coiled up and secured out of the way to avoid damage.

When securing the sensing tube, make sure contact is made only with the evaporator at the point where it is attached under the plastic mounting plate and that it does not touch any part of the aluminum or copper tubing. If necessary, the tube can be protected with small-bore plastic tubing, either by sliding it on prior to attaching to the evaporator or by slitting it along its length and feeding it over the sensing tube. Run the cable together with the copper lines to the compressor /condensing unit. Care must be taken to ensure that the sensing tube does not come into contact with any electrical component either inside or outside the icebox. There is an insulating cover over the most exposed wire terminal and connector inside the plastic thermostat housing. An inspection must be made before mounting, to ensure that the entire terminal and connector is covered and that no metal parts are exposed. Confirm, before mounting the thermostat, that the capillary tube is not in contact with any wire terminal, connector, or bare wire. If the sensing tube needs to be bent within the confines of the plastic thermostat housing, it must be done with great care, heeding the warnings above.

7:3 Operation

The thermostat knob is marked from 0 to 7 with 7 being the coldest setting. From this position the knob can be rotated counter-clockwise to setting 1, which is the warmest. On initial system start-up, it is recommended that you set the thermostat to number 4, letting the system run through a few cycles while monitoring box temperature before any adjustments are made. Once the right setting is found for your application there should be no need for the thermostat to be adjusted again. If it is not possible to see the numbers on the dial, it is recommended to reproduce them on the perimeter.
Setting the knob to the 0 position will turn the system off. It is recommended that the system *not* be turned off and on from the thermostat. To turn the system off and on, use a panel-mounted breaker or install a switch in line with the power supply.

Chapter 8

Spillover Kit Installation Instructions

8:1 Mounting

The Frigoboat Spillover Kit (with integral mechanical thermostat) should be installed on the barrier dividing the freezer and refrigerator sections, on the refrigerator side, and no lower than at mid-height. Screws may be used after drilling holes in the plastic flange.

A 2.25” diameter hole needs to be cut through the barrier to allow air to flow to the fan; a piece of PVC pipe can be used to line the hole if desired. This will also make a neat finish while sealing the hole from the ingress of moisture. The hole may be directly behind the evaporator in the freezer section, and this will not be detrimental to performance. If a stand-alone Spillover Fan is used (this requires a Coastal MKII thermostat), the Spillover Fan may be surface-mounted or installed within the thickness of the barrier.

A return air path must be established at the top of the barrier to allow air back into the freezer. This can either be in the form of a gap at the top of the barrier (1” should be sufficient) or 3 or more holes of the same size as the one behind the spillover fan. All other holes, gaps, etc, in the barrier must be completely sealed, including drains.

8:2 Electrical Connections

The Spillover Kit (with integral mechanical thermostat) must be powered by an *independent* 12v supply. This may be from a breaker on the electrical panel or via an in-line 2-amp fuse from the same supply that is feeding the refrigeration system. Do not power the Spillover Kit from the fan terminals on the controller. If using the stand-alone Spillover Fan (this requires a Coastal MK II digital thermostat), refer to wiring diagrams included with these products.

8:3 Operation

The temperature dial of the Spillover Kit must be set to the desired temperature in the refrigerator compartment. This may take some trial and error before the ideal temperature is achieved. A period of at least one day is suggested between changes in settings. The temperature dial is in degrees Celsius and the setting is read against an indent in the plastic housing at the six o-clock position, above the Frigoboat sticker. A setting of +5 is suggested initially and then adjusted accordingly as desired.

Chapter 9

Quick Connect Refrigerant Fittings

Each component of a Frigoboat system is fitted with one male and one female proprietary Quick Connect fitting that connects to a corresponding fitting on other components of the system. The Keel Cooler systems are comprised of three components, and special attention is required to avoid incorrect connections. The refrigerant tubes are color coded with red, yellow, and blue tape, and matching the colored tags will ensure correct connections. (The red plastic tubing on the Keel Cooler is to be considered as a red marker). If a Keel Cooler is to be connected to an air cooled condensing system in place of a K35 or K50, match the two blue tagged couplings first, then connect the red tagged tube on the Capri to the yellow tagged tube on the Keel Cooler. Finally, connect the red plastic covered tube from the Keel Cooler to the red tagged tube on the evaporator. All other air and water-cooled systems have only two components, each with a male plus a female fitting, and therefore they cannot be connected incorrectly.

The individual items are pre-charged with the correct amount of refrigerant at the factory. When the Quick Connect fittings are joined together, they allow the refrigerant to flow through the system without leaking out into the atmosphere**.** If needed, they can be uncoupled without loss of refrigerant in order to re-run refrigerant lines, upgrade components or enable a faulty component to be removed and replaced. When they are uncoupled, immediately install dust plugs, (removed when originally installed and kept in a safe place) into the exposed female/male fittings.

Note: Never run compressor unless all components of system are correctly connected together.

9:1 Connecting the Quick Connect fittings

Leave the dust plugs installed until the very last moment when you are ready to connect the system together. Once the dust caps have been removed, it is imperative that the exposed components and surfaces be kept free of dust, dirt, construction debris, etc. After you have removed the plugs, keep them in a safe place in case you need to remove or replace a component later.

Push the male and female fittings together and then carefully rotate the collar on the female fitting until it starts to thread onto the male thread, making sure that the fitting is not cross-threaded, the male end does not rotate, and the O-ring remains seated in its groove. Do not use any thread sealant or tape.

Continue rotating the collar of the female end, either by hand or with a 15/16" or adjustable wrench, while preventing the male end from rotating by restraining it with a 13/16" or adjustable wrench**. It is most important not to let the male end rotate at all during this whole process.**

Tighten the collar until it completely covers the threads on the male fitting and then make it “snug” with wrenches. Excessive tightening is not required, as the O-ring makes the seal and making up the threads simply opens the internal valves and allows refrigerant to flow. If resistance is felt before the threads are covered, back off the collar and ensure that the shaft in the female coupling has not been mis-aligned. If it has, straighten it and re-make the coupling.

If there is a continuous hiss after the connection has been completed, quickly disconnect the fitting and check that the O-ring has not been damaged or unseated. If it has, carefully re-seat it or replace it with one of the spares provided that are taped to the compressor, and then re-make the fitting.

NOTE: The spare O-rings provided as a convenience for use if any get damaged during system installation. They are NOT provided for use as routine replacements, and the original O-rings should never require replacement if the systems are installed and operated as designed.

Chapter 10

Electrical

General

(a) **The use of electrical grease and other anti-corrosion products is strongly discouraged.**

(b) **Do not attempt to make wiring connections or alterations with power supplied to system.**

(c) **Always disconnect the power supply by removing the fuse or turning off the breaker before working on electrical components and/or connections.**

10:1 Power supply

The power supply to the electronic controller must be given particular attention to prevent nuisance problems and compressor non-operation, shutdown, or failure. All electrical connections should be either soldered or made with good quality crimpers and crimp connectors of the correct size and type. All switches, breakers, and connections must be in good condition and be designed and constructed for marine use. It is suggested that during the initial start-up the supply voltage be monitored at the terminals on the controller before, during, and after the compressor starts, to ensure that the voltage stays steady and does not fall appreciably. This test should be conducted with as many other DC loads turned on as is practical.

10:2 Wire size

Never use less than 10-gauge wire. If the sum of positive and negative cable lengths exceeds 30 feet, consult ABYC tables for appropriate wire size for 3% volt drop.

10:3 Overload protection

Use either a breaker or fast-blow fuse with **15-amp rating** for a 12v supply, or 7.5 amp for 24v.

10:4 Connections, Power

Connect the power supply to the controller on the top two terminals using slip-on connectors and wire size no greater than 10 AWG, observing the correct polarity. If wire of greater than 10 AWG is used for the power supply, this must terminate remote from the controller and down-size to no greater than 10 AWG for the final connection to the controller. Reversing the polarity at the terminals will prevent the compressor from running, but should not cause immediate harm to the controller if the correct fuse or breaker is installed.

10:5 Connections, Mechanical Thermostat

Connect the two slip-on connectors from the thermostat to the “C” and “T” terminals on the Danfoss (Secop) controller, or the Merlin II mini Smart Speed Controller if installed. Color and polarity are not important.

On some models, a Speed Board is mounted on the lower terminals of the controller, and the “C” and “T” terminals are replicated on this board. The speed must be set to a speed specified for the system and size of evaporator, as outlined below, and the voltage switch set accordingly to ensure the correct low voltage threshold setting.

NOTE: The Speed Board cannot be used if a Merlin II is installed. If your compressor unit was supplied with a Speed Board already installed, this must be removed if you are using a Merlin II.

See separate instructions for systems using the Coastal MK3 digital thermostat.

- Paris

These systems have no manual speed selection capability. The thermostat wires must be connected directly to terminals C and T on the controller.

- W35F and W50F

The thermostat wires must be connected with one wire to the "T" terminal on the Speed Board (or Merlin II if installed), and the other to the vacant terminal of the high temperature cut-out mounted on the condensing coil. There is a factory installed white wire connecting the "C" terminal to the other terminal on the high temperature cut-out.

Evaporator type	Compressor speed, refer	Compressor speed, freezer
80F	2000	----------
130H / 130F	2500	3000
160H / 160F / 180F-SS	2500	3500
200H / 200B / 200F/ 250B	3000	3500
340B/ 380F-SS	3500	3500

10:6 Connections, Fan

The wires from the fan on air cooled condensing units will be factory installed on the terminals marked "F" (Black or Blue), and "+" (Red). If the wires are reversed the fan will not run. The K50F and W50F models have a small oil cooler fan installed. Full instructions are included with the W35F and W50F.

10:7 Connections, Pump

The W35F and W50F model use a 12v pump that must be connected through a relay (PN E251002) that is activated from the fan terminals on the controller. This relay is supplied with W35F and W50F compressors.

See separate instructions for wiring multiple W35 or W50 systems to one pump.

It is important to note that the output voltage at the fan terminals will be 12v even if the power supply to the controller is 24v, so a relay with a 12v coil must always be used.

The W35F and W50F have temperature sensors on the water-cooled heat exchanger that is connected in series with the thermostat and will stop the system if the cooling water flow is insufficient. Full wiring instructions are included with the system.

Chapter 11
Troubleshooting Guide

For the interactive online Troubleshooting Guide go to:
http://veco-na.com/images/Frigoboat_BD35_and_BD50_Troubleshooting_Guide.pdf

Note (1) **Do not inject anything but unadulterated pure refrigerant R134a into any Frigoboat system. The addition of even a small amount of leak detecting fluid, leak sealer, extra refrigerant oil, "conditioner", flushing fluid, Thawzone, or other substances may cause irreversible damage.**

(2) **Always disconnect power supply by turning off the breaker or removing the fuse before working on electrical components or connections.**

(3) Never operate a Keel Cooled or pumped-water cooled compressor when the boat is out of the water without having rigged temporary water cooling or installing an Air Add-On air cooled condenser. Failure to do so may cause irreversible damage.

(4) Voltage must be checked at the power terminals on the controller, with the supply wires attached.

(5) Always apply a suitable load when testing the output of electronic components such as a Voltage Divider, as open-terminal conditions will vary greatly from the designed output.

(6) Start-up may occur up to one minute after power is supplied and thermostat is on. This will also occur after a fault condition has been cleared.

(7) Run **all** applicable tests before assuming controller or compressor to be faulty. Controller can be removed by unscrewing the retaining screw or by levering the plastic case over the screw head.

11:1 Compressor not running, no start attempt

	Probable cause	Action
1	Supply voltage too low	Check voltage with a multi-meter at the terminals on the controller. This must be 11.7v or more for a 12v supply, (24.2v at 24v) for compressor to start. Inspect power supply, ground connections and components for integrity. Check wire sizing. Charge batteries, if necessary.
2	Supply voltage too high	If a 12v supply is faulty and delivers over 17v, the compressor will not run. If it is over 24v, it will assume that it is a 24v supply and act accordingly.
3	Polarity incorrect	Check that the polarity is correct at the controller.
4	Faulty thermostat	Remove the thermostat wires and bridge the "C" and "T" terminals. If the system then runs, make the connection permanent and control the system manually from the breaker on your supply panel. Replace thermostat as soon as possible.
5	Thermostat wired incorrectly, or faulty connections	Refer to the installation instructions to confirm that connections are as they should be. Ensure that the thermostat connectors are pushed firmly on to the terminals on the Controller. Pull wires to confirm integrity.
6	Speed board or Merlin II incorrectly installed (if fitted)	Check to make sure that the connectors at the rear of the Speed Board or Merlin II are mated correctly to the C, P, T and D (or D/I) terminals of the controller.

	Probable cause	Action
7	Faulty Speed Board or Merlin II (if fitted)	Remove board and jumper terminals C and T on the controller. Note: When thermostat wires are connected directly to C and T on the controller, the compressor will run only at its slowest speed. Speed Board **must not be** installed with Merlin II
8	Compressor plug not connected	Disconnect the controller by removing the retaining screw. Then ensure that the 3-pin plug is seated firmly on the pins of the compressor.
9	Faulty compressor (Highly unlikely)	Remove the controller as above, unplug from the compressor. Check that ohm readings are the same across all terminals of the compressor and there is no continuity to ground. ***Do not*** attempt to connect power directly to compressor.
10	Heat sink overheated	Allow components to cool down before attempting re-start.
11	Compressor too cold	If compressor is below freezing temperature, allow to warm up before attempting re-start.

11:2 Compressor attempts to start, or starts then stops soon after

	Probable cause	Action
1	Faulty or inadequate power supply (Most likely)	Monitor the supply voltage at the power terminals on the controller before, during, and after start attempts to ensure that it does not fall below threshold levels. If it does, check power supply, ground connections, and components for integrity. Check for correct wire sizing. Charge batteries, if necessary.
2	Faulty fan or pump relay or unauthorized component installed	Remove connectors from F and + terminals on controller and attempt re-start. Maximum current draw on these terminals is limited to 0.7 amps at 12v.
3	Quick Connect fittings not made	Check that all refrigerant couplings are properly made.

11:3 System runs, box temperature too high

	Probable cause	Action
1	Thermostat setting	Rotate mechanical thermostat knob clockwise to a higher number, or adjust set point on Coastal MK3 model.
2	Speed setting	Check that the speed setting is the one recommended for the installed evaporator and for its intended use, i.e. refrigerator or freezer.
3	Thermostat type	If planning to convert an icebox into a freezer, or to a spillover system, a freezer thermostat (blue housing) must be used. Bin (B) and Horizontal (H) evaporators must be controlled by a refrigerator thermostat in normal applications.

4	Evaporator type and size	If the evaporator has an even coating of frost, thermostat set on 7, and system is not cycling, evaporator may be too small. Either replace evaporator with a larger model, add insulation to the bottom of the box to reduce volume, or re-locate evaporator lower in box. The latter may cause the temperature at top of the box to be above acceptable levels.
5	Excessive frost build-up	If an excessive layer of frost is allowed to build up on the evaporator it will act as an insulator and adversely affect box temperatures. Defrost system by interrupting power supply at the breaker panel. Restore power when evaporator is free of frost. Never use any hard or sharp implement in an attempt to loosen the frost on the aluminum evaporator. Check that all drains are blocked and there are no other openings or gaps that will allow air to enter or leak from the box.
6	Incorrect refrigerant charge	If, after the compressor has been running for an appreciable length of time, the evaporator surface does not have an even coating of frost or it is only cold and sweating to the touch in some areas and frosting in others, the system may be low on refrigerant or overcharged. Call for advice or go to www.CoastalClimateControl.com "Technical Information".
7	Drain left unplugged	If your icebox is equipped with a drain in the bottom of the box, this must be blocked off to prevent loss of cold air. The drain should only be used if you revert to melting ice, or after a major clean-up.
8	Tubing hole left unplugged	The hole that was drilled to allow the evaporator's copper tubes to pass through the box's side during installation must be sealed, as well as all other openings or gaps.

11:4 System runs, box temperature too low

	Probable cause	Action
1	Thermostat setting	Rotate mechanical thermostat knob counter clockwise to a lower number or adjust-set point on digital thermostat model.
2	Thermostat type	Check that you are using a refrigerator thermostat (white housing) for a refrigerator application and with Bin (B) and Horizontal (H) type evaporators in normal applications.
3	Faulty thermostat	If system is running continuously and box temperatures are too low with thermostat set on the lowest number, first check for correct thermostat connections at the controller, then remove one connection. If compressor stops, turn off breaker, replace connection, and then control system manually from the breaker until the thermostat can be replaced.

4	Sensor of Mechanical Thermostat not in good thermal contact with evaporator at designed location.	The free end of the Mechanical Thermostat sensor must be in good thermal contact with the evaporator at the point where the black plastic clamp is situated. Not attaching the sensor, or attaching at somewhere other than the designed location will result in undesirable box temperatures.
5	Poor spillover system construction	If you are running the evaporator as a freezer and cooling an adjoining refrigerator compartment with spillover air, there must be an adequate thermal barrier between the two. It also must be completely sealed down the sides and along the bottom to prevent unwanted air-flow. Temperatures in the refrigerator side should be controlled either with trial-and-error convection holes, or a thermostatically controlled fan, (Spillover Fan/Thermostat Kit, PN E26200). Two apertures are necessary, one high and one mid-height for adequate air circulation.

11:5 Excessive frost build-up

Note This is the result of moist air being allowed to enter the box. Problems are compounded when cold, dense air leaks from the lower area of the box through an open drain or weak door seal and is replaced by warm, humid air being drawn in elsewhere.

	Probable cause	Action
1	Drains and holes not plugged	Make sure all drains and holes in the floor and walls of the box are sealed.
2	Circulating fan	If a small fan is used to circulate air in the box, make sure that it is not too powerful, and that cold air is not escaping from a door/lid seal. This could force cold air out of the refrigerator box, and the freezer then has to draw air in from a weak seal to replace it.
3	Poor or damaged door/lid seals	Check seals and replace if necessary. A good seal will grip a $1 bill when inserted between the seal and door/lid when closed. A front opening door/top opening lid combination with poor seals is likely to result in excessive frost build-up on the evaporator and cause extended run times. To determine leaking seals, apply masking tape to suspect areas after defrosting, and then check after several days for frost build-up.