
The ColdMachine Installation and Operating Manual



Adler-Barbour

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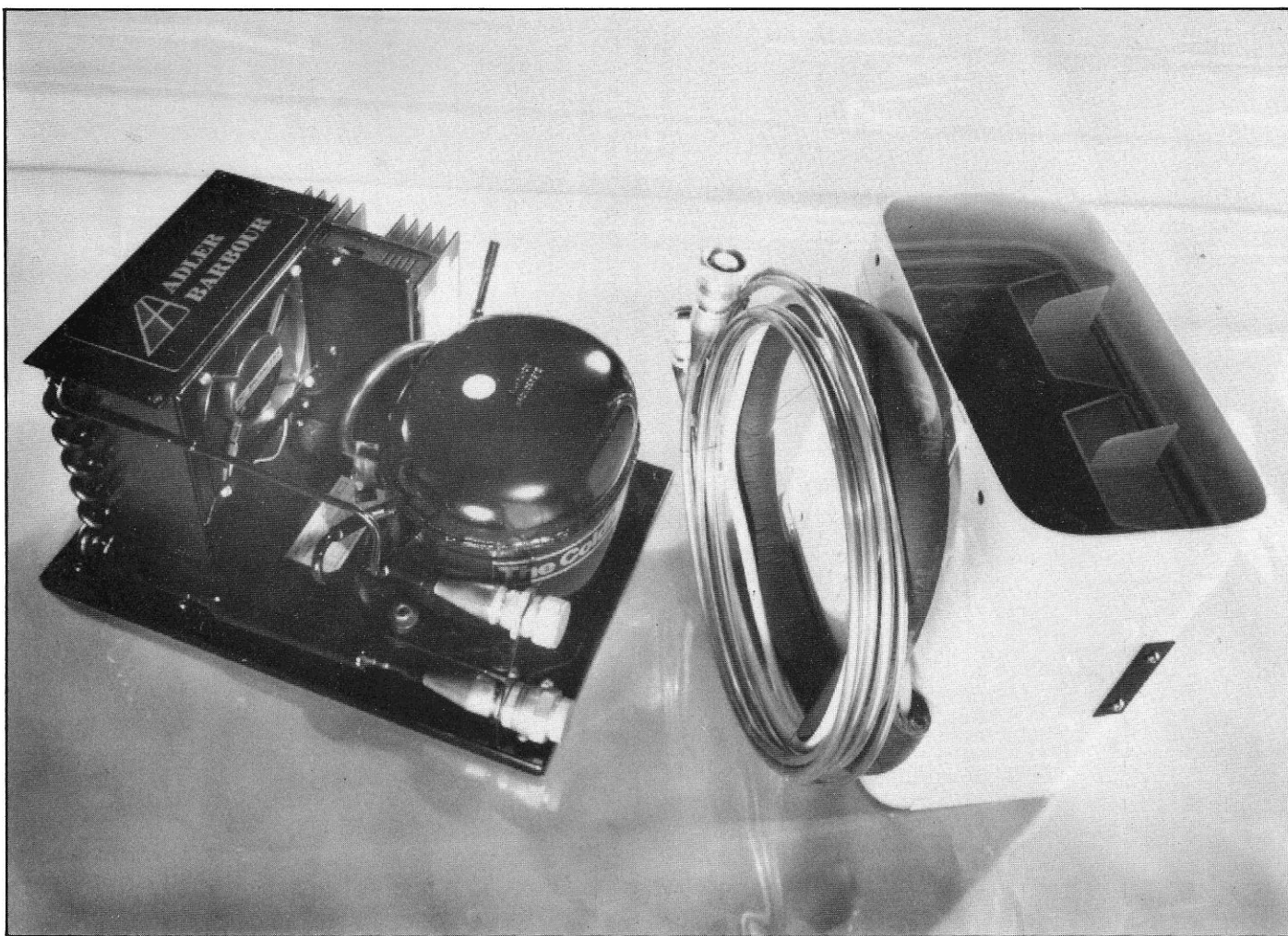
IMPORTANT NOTICE

**BEFORE YOU PROCEED READ THIS BOOKLET FROM COVER TO COVER.
FAILURE TO FOLLOW INSTRUCTIONS MAY VOID YOUR WARRANTY!**

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INTRODUCTION

You are now owner of the finest 12 Volt DC refrigeration system available. Every ColdMachine system we sell has been test run for over 24 hours. We leak check each system no less than four times during manufac-

ture. Our standards for quality assurance and acceptance are the highest in the industry. All this and more to insure that you receive exactly what you paid for: years of trouble free, dependable performance.

If your ColdMachine is to operate properly, five things are essential:

- Careful reading of these instructions
- Good compressor ventilation
- Good batteries
- Tight couplings
- Good icebox insulation

This manual covers air-cooled ColdMachines of these models:

PB101V—Vertical Model Freezer
 PB105H—Horizontal Model Freezer
 PB110LV—Large Vertical Model Freezer
 PB111H—Large Horizontal Model Freezer

When unpacking carefully check for shipping damage. Save all packaging materials.

Identify all components:

Compressor unit
 Freezer unit
 Thermostatic control
 Accessory/hardware package
 Hole location template

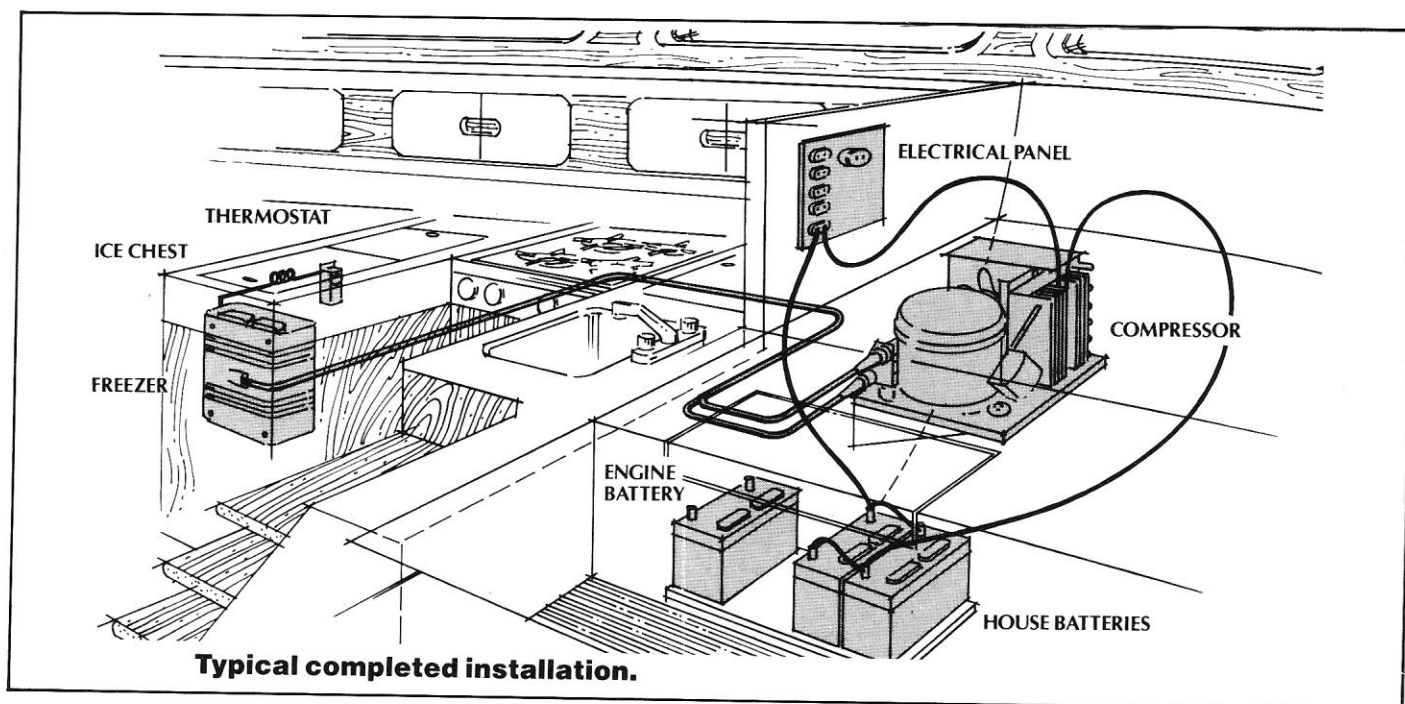
Icecube trays:

Model PB101V—2 Verticube trays
 Model PB105H—2 Standard ice trays
 Model PB110LV—3 Verticube trays
 Model PB111H—3 Standard ice trays

Tools and materials required are:

Electric drill with assorted small drill bits including 9/64".
 "Stubby" screwdriver.
 Hole saw (2" diameter).
 Electrical wire (2 conductor). See table page 15 for sizes.
 One 12" and one 10" adjustable wrench.

INSTALLATION



Typical completed installation.

COMPRESSOR UNIT

Keep the following in mind while planning your installation:

- The connecting refrigerant tube set between the compressor unit and the freezer unit is 15' long. Plan locations of the two units accordingly.
- The route of the refrigerant tube set through the boat from the compressor unit to the icebox must be determined before starting any work. The tube set must be kept clear of bilge water and protected from chafe and damage.
- Ventilation openings will be required if the compressor unit is located in a small, confined compartment.
- Engine room location of the compressor unit is okay if the continuous environment is not over 125°F. But remember, a cooler location = less running time = lower average amp draw.
- Accessibility is important.
- All components must be protected from bilge water, spray or possible damage.

Ventilation Requirements

The ColdMachine is a device that moves heat from one place to another. It does not "create cold". The heat it removes from your ice box via the freezer unit is transferred to the air around the compressor unit.

If you locate the compressor in a small, hot or confined enclosure it will suffocate. Its built-in fan will have to recirculate hotter air, round and round. It will run continuously, draw excess amps and not cool efficiently. It will never shut off and you will not be pleased with its performance.

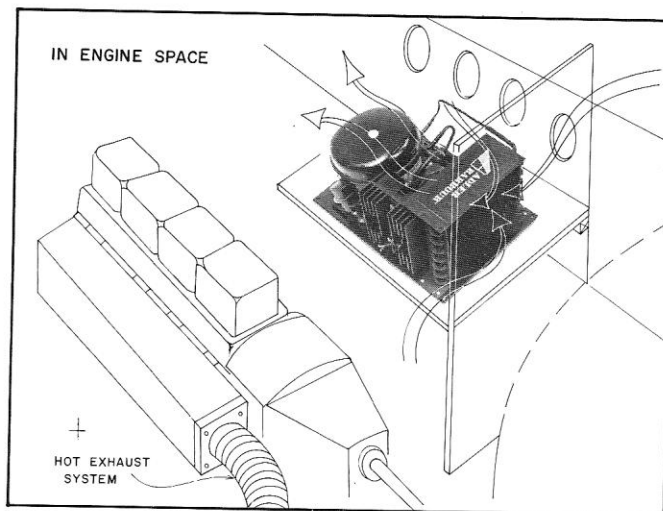
LET THE UNIT BREATHE! Position the compressor

so that its fan can intake air from one space and discharge it into another. *Don't recirculate the same air, unless the compartment in which you mount the compressor is 100 cubic feet or larger in volume.*

Location Considerations

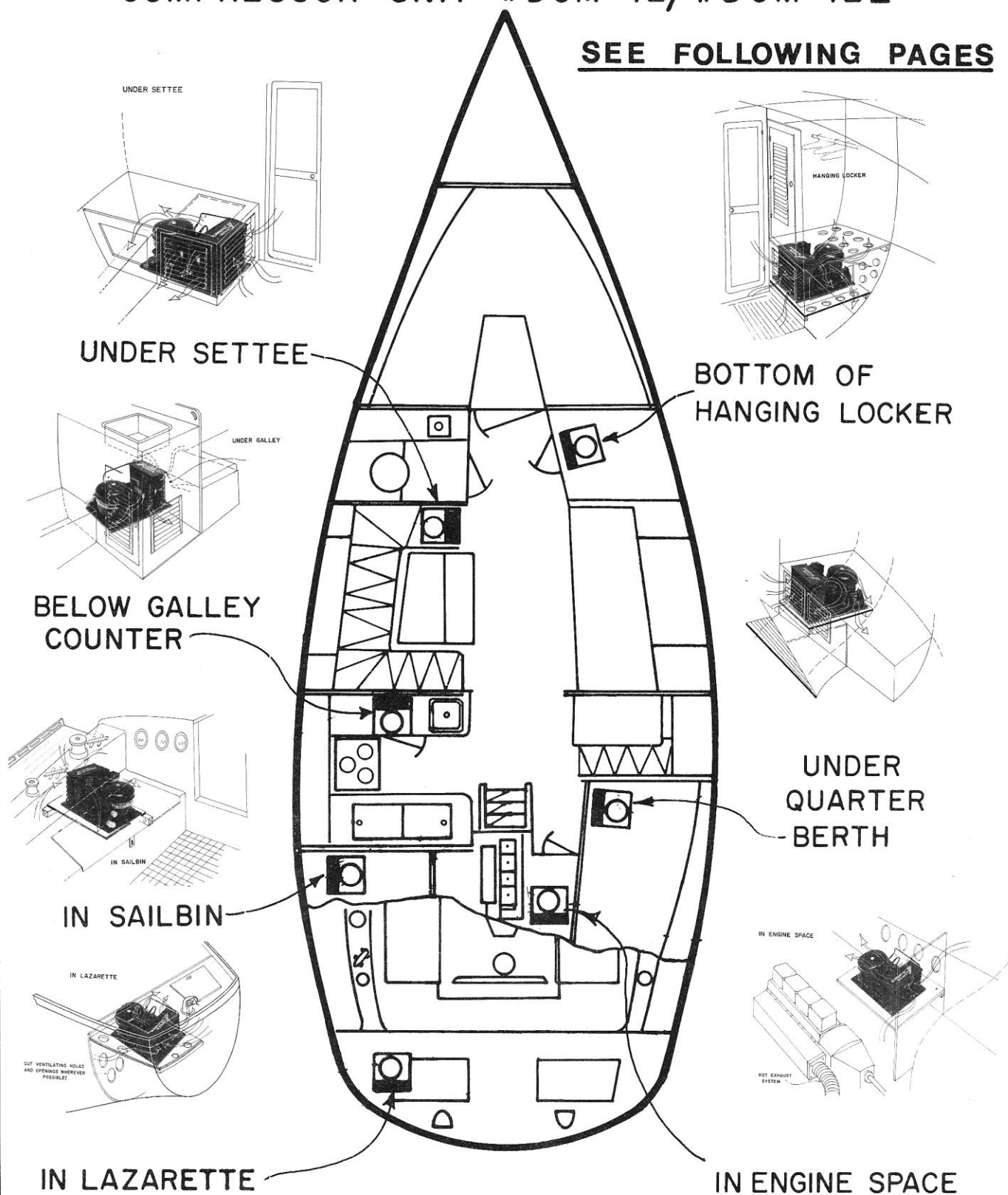
Generally, find the coolest possible location in the largest compartment available. Installation drawings of some suggested locations are given below. See illustration on page 6.

- **ENGINE COMPARTMENT:** Mount the compressor unit as far as possible from the engine, particularly the hot exhaust pipe sections. Route the connecting tubing away from hot spots such as the engine, manifold or hot water pipes. If the ColdMachine tube set must be run close enough to local hot spots to become noticeably heated, protect it with insulated sponge tubing (Armaflex or similar product).

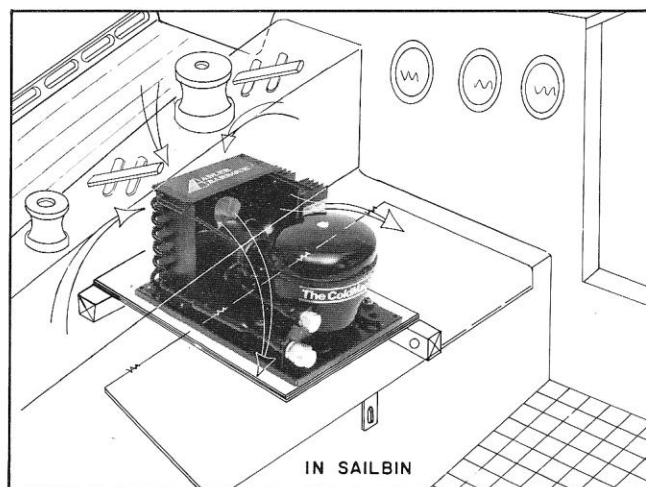


TYPICAL LOCATIONS FOR YOUR COLDMACHINE COMPRESSOR UNIT #DCM-12/#DCM-12L

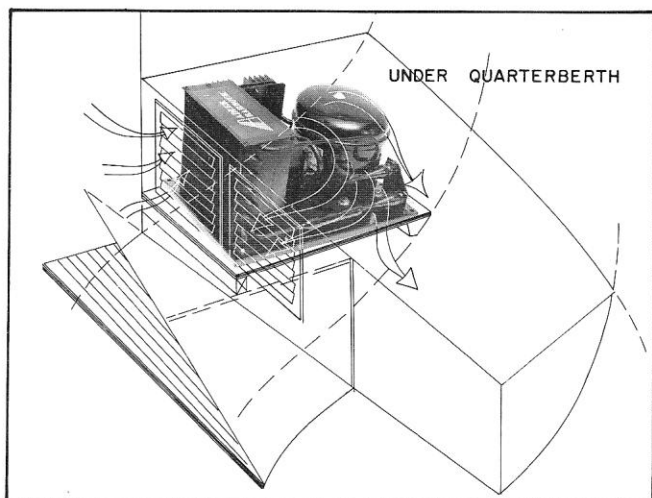
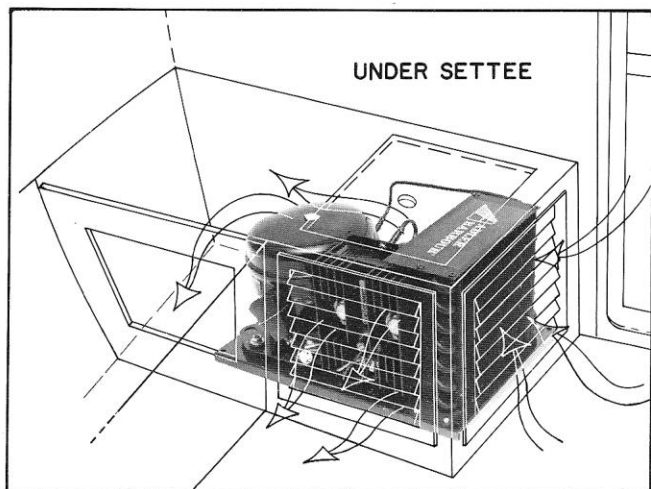
SEE FOLLOWING PAGES



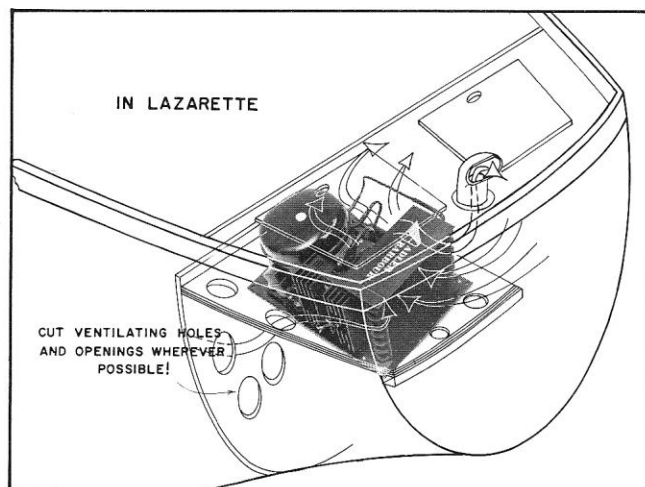
- **SAILBIN OR LARGE LAZARETTE:** Generally okay without additional ventilation. Position the



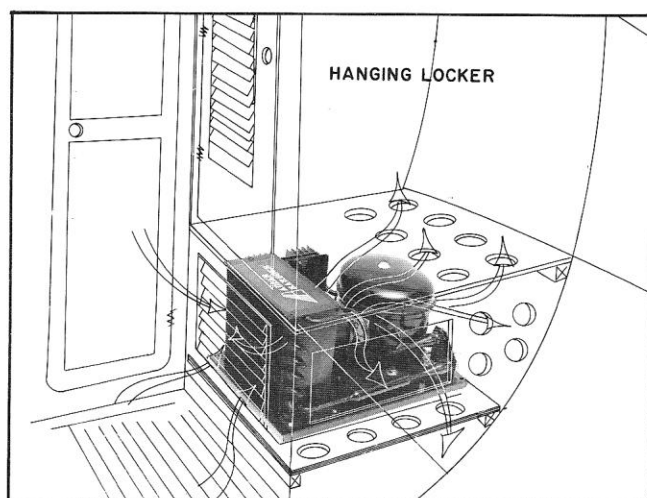
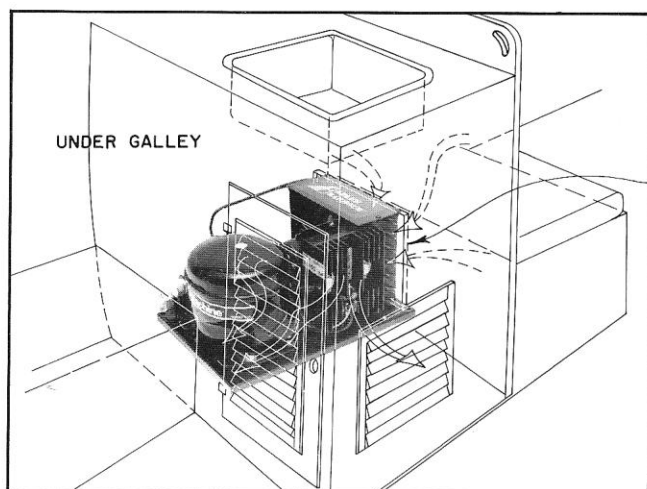
- **UNDER A SETTEE, GALLEY COUNTER, BERTH OR LOCKER (OR ANY SPACE UNDER 100 CUBIC FEET):** Position the unit so that it can positively draw air from one space and discharge it into another. Cut a rectangular opening in the bulkhead equal in size to the condenser (8" x 8"). Mount the unit with its condenser up against the opening for air intake. Now provide another opening of at least equal size at the other end (or either



unit so that it can still move air freely despite an occasional sail bag or two dropped nearby.



side) of the unit so that warm air can exhaust. Slots or airholes generally are not satisfactory. One big opening is much better. However, if visible finished joinery must be cut into, plan to use teak louvered grilles (available in many stock sizes from teak woodwork and marine hardware catalogs). Increase the size of an outlet opening by at least 1/3 (i.e., to about 100 sq. in. or more) to compensate for the teak louvre obstruction.



- **ANY CLOSED COMPARTMENT:** Generally OK provided there is 100 cubic feet of volume or more. In such case heat will transfer outside the compartment via conduction. Be sure that airflow into and out of the condenser is unobstructed (by sailbags, lines, etc.).

Mounting

Handle the compressor unit carefully. Don't pick it up by the tubing. The cooling fins on the condenser (the radiator like object) are very thin for maximum efficiency and bend easily. If bent they should be straightened using the flat blade of a screwdriver or "combed" (using a "fin comb" obtainable at a refrigeration supply house).

Use four (owner supplied) fasteners to mount the compressor unit on a suitable, sturdy horizontal platform. Use either 1/4" diameter wood screws, self-tapping screws or machine screws and nuts, depending on the type of mounting platform. There are mounting holes in each of the four corners of the compressor unit base for this purpose.

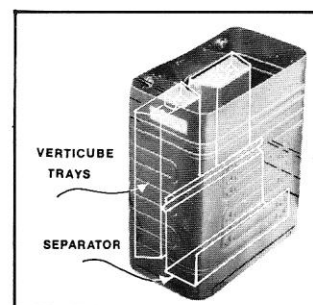
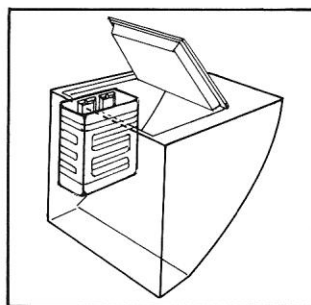
THE FREEZER UNIT

Vertical Freezers

Locate the freezer unit vertically as high as possible on any side wall in the icebox. Standoffs (1") and mounting screws (1-3/4") are supplied.

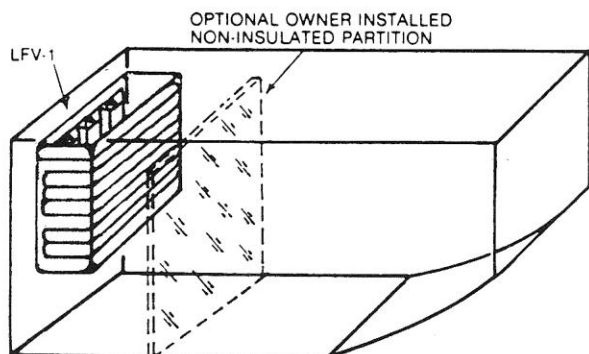
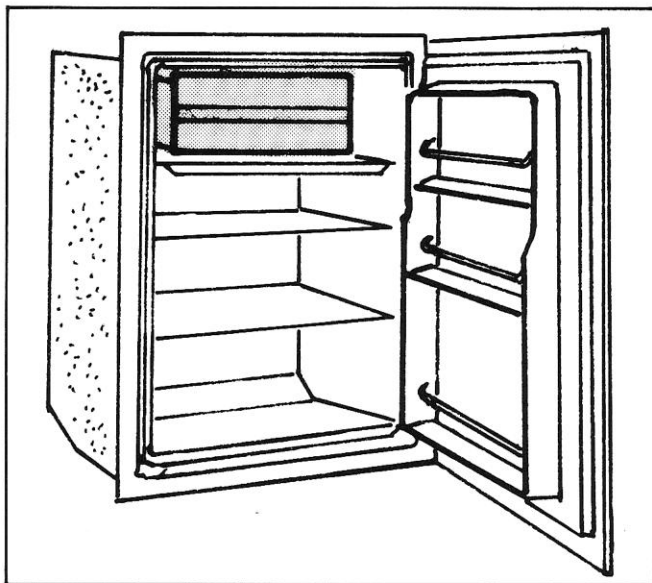
Allow sufficient space for access to the freezer interior, insertion and removal of the VertiCube icetrays and periodic cleaning.

See photo for proper use of the Verticube icecube tray separator.

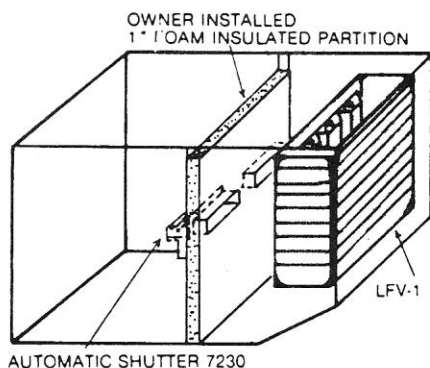


Horizontal Freezers

Mount the freezer unit horizontally from the roof of the icebox. Standoffs (1") and mounting screws (1-3/4") are supplied. Allow a clearance for the freezer door to swing open.

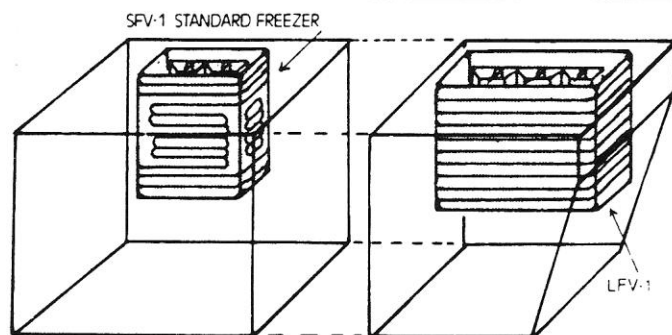


LARGE REFRIGERATOR (9-16 CU. FT.) utilizing the DCM-12L Compressor/LFV-1 Freezer with ample capacity for 6 ice trays (3 standard) plus frozen foods. A minimum of 3" insulation is recommended. The drawing illustrates a customer-installed plexiglass partition providing additional Freezer capacity (up to approximately 2 cu. ft.)



REFRIGERATOR/FREEZER spillover arrangement for **Freezer** compartment up to **4 cu. ft.** and **Refrigerator** up to **6 cu. ft.**, utilizing the DCM-12/LFV-1 system. The partition is constructed of 1" foam core with fiberglass or formica faces, with 1" opening across top convection for air flow return.

Our optional Automatic Shutter #7230, (thermostatically controlled, non-electrical) provides adjustable temperature control for the Refrigerator, mounts on slot through partition. One Automatic Shutter is used for up to 4 cu. ft. of refrigerator; two for larger volumes. A minimum of 4" insulation is recommended for this application.



NOTE: Since each box is completely independent and adjustable in temperature, either unit can be shut off and the other used as a Refrigerator with small Freezer — useful when only one or two people are aboard.

SEPARATE REFRIGERATOR AND FREEZER boxes utilizing two separate, independent ColdMachine systems. Use this arrangement for a single, large, fully-partitioned ice box, or two separate boxes in different locations.

FREEZER: The large capacity DCM-12/LFV-1 system is used for freezer applications up to **6 cu. ft.** with box insulation of 4" or better (up to 8 cu. ft. with insulation of 6" or better).

REFRIGERATOR: The Standard DCM-12/SFV-1 or SFH-1 (Vertical of Horizontal Freezer) is used for Refrigerators up to **9-1/2 cu. ft.** The DCM-12L/LFV-1 Cold-Machine is for larger boxes **9-16 cu. ft.**

Optional Icebox Modifications

(MODEL PB110LV LARGE FREEZER SYSTEMS ONLY)

If you would like larger freezer capacity than is provided by the freezer unit itself, you may partition the icebox into two sections. The amount of space allotted to each section will depend on your needs and the capacity of the ColdMachine. Some experimentation may be necessary. (We recommend a minimum of 4" icebox insulation for this application.) In boxes up to 8 or 9 cubic feet, it is generally possible to obtain 4 cubic feet of below freezing space with a suitable partition.

For the partition, use a sheet of plexiglass (1/2" minimum) or 1" foam core with fiberglass or formica faces. Drill a 3" diameter hole halfway up in the partition and leave about a 1" gap at the top. This will provide for natural convection airflow from the freezer to the refrigerator section.

You may need to install a manual damper over the hole to better control individual compartment temperatures. As an alternative, you can use our self-powered thermostatically controlled Automatic Shutter (Part #D7230). Use one Automatic Shutter for each four cubic feet of refrigerator space. For the shutter cut a slot 1-1/8" high x 4" wide instead of 3" hole.

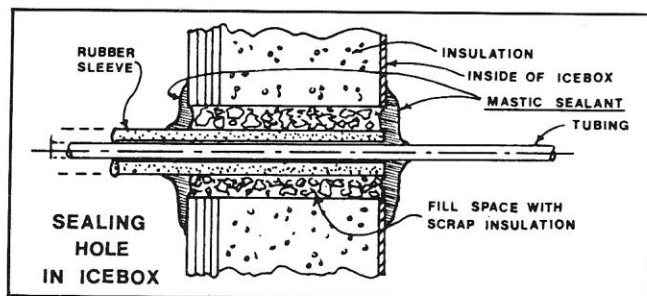
The necessary materials should be obtainable locally and are relatively easy to work with.

Mounting the Freezer Unit

Plan your installation to allow for minimum modification of existing shelving.

1. Using the paper hole location template supplied, mark the location of the four mounting holes for the freezer unit.
2. Position the refrigerant tube set exit hole in the icebox for minimum bending of and strain on the freezer and tube set. Mark its location (2" diameter).
3. Drill the freezer unit mounting holes using a 9/64" drill, and the tube set exit hole using a 2" hole saw.

4. Unroll the entire tube set. An assistant is very helpful here. It is often easier if you unroll the entire tube set and stretch it out inside the boat. You can then feed the tube set and couplings through the holes in the icebox and bulkheads while your helper supports the freezer unit and keeps the tubing feeding smoothly without damage to it. *Be careful not to kink, flatten or strain joints.* Make sure the metal sealing caps are in place over the refrigerant couplings. *Keep dirt out of the couplings!*
5. Feed the tube set through boat to the compressor unit. Do not attempt to connect the mating couplings or remove the metal sealing caps yet.
6. Fasten the freezer unit to the icebox liner with the four 1-3/4" stainless steel screws and 1" plastic standoffs supplied.
7. Position the rubber insulation sleeve on the tube set so that its end is flush with the inside of the liner of the icebox with the balance extending *outside*.



8. Excess tubing, if any, should be formed into an 18" (approx.) diameter coil in the horizontal plane above the compressor unit or at any other convenient location.

THERMOSTAT

Mount the thermostatic control unit high in the icebox, away from moisture and spillage. It should also be visible and accessible. It is okay to mount the thermostatic control unit outside of the icebox space if you prefer. At least 12" of capillary sensing tube must be inside the icebox.

The capillary sensing tube is 36" long and must reach

from the thermostatic control unit to the clamping plate on the side of the freezer unit. It must be routed along the icebox wall clear of food, shelving, etc.

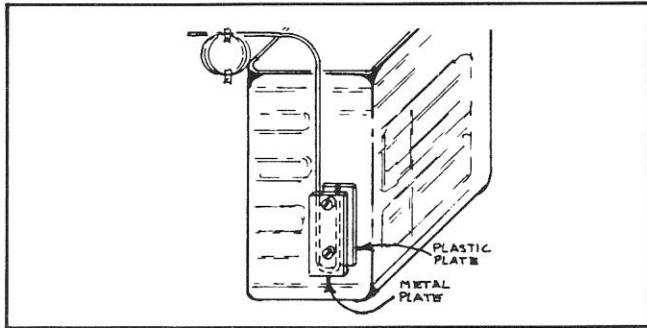
The thermostat can be mounted by using either the adhesive backing of the thermostat mounting flanges or the stainless steel mounting screws (supplied).

If using the adhesive backing, the mounting area must be clean and dry. Peel off the protective backing from the adhesive foam on both mounting flanges of the thermostatic control unit, position carefully and press firmly to adhere.

If you wish you may also use the mounting screws by drilling two 9/64 holes through the thermostat flange holes.

Installation Procedure

1. Carefully unroll just enough capillary tubing to reach the metal and plastic clamp plates on the side of the freezer unit. Via this tube, the thermostatic control unit "senses" the temperature of the freezer unit. Slide the "U" shaped end of this tube *between* the metal and plastic plates and fasten the screws firmly. Be sure four inches of tubing are clamped under the metal plate or the thermostatic control unit will not function properly.



2. Secure the coil and tube against chafing. (Leave the excess capillary tubing coiled.) *The tube must not touch the freezer unit at any point except the clamp plates or an erratic control cycle will result.*
3. Uncoil the 15' thermostat electrical harness and run it alongside the refrigerant tube set to the compressor unit electronic module. Plug this harness into its mating end attached to the electronic module.

REFRIGERANT COUPLINGS

It is especially important that the following instructions be read in their entirety before proceeding with further work!

Prepare yourself by having at hand two separate open end or adjustable wrenches:

One 1-3/16"/30mm hex or 12" adjustable wrench

One 1-1/8"/29mm hex or 10" adjustable wrench

Keep the refrigerant couplings dry and clean. Leave the metal sealing caps in place until you are ready to install.

1. Carefully wipe off the fittings with caps and plugs

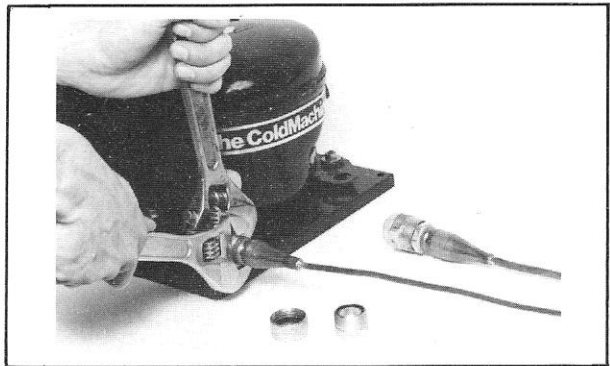
in place to remove dirt, dust and moisture. Remove the metal sealing caps from the refrigerant couplings on the compressor unit, and from the mating refrigerant couplings at the end of the 15 foot tube set. Thread the coupling halves together by hand to insure proper mating of threads. Connect the lower refrigerant coupling first.

Turn only the female coupling. *Do not turn the male coupling.* If you twist the male coupling from its base, you will have a refrigerant leak. (That is why you must use two wrenches.)

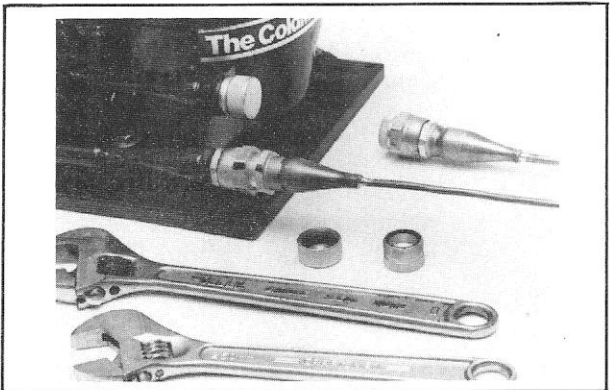
When screwing the refrigerant coupling male and female halves together, align them carefully to avoid strain and cross-threading. If you have difficulty aligning the coupling halves properly, it may be necessary to temporarily shift the compressor unit for better alignment.

Using the 1-1/8" hex wrench on the male coupling body hex and the 1-3/16" hex wrench on the female union nut (holding the male coupling hex fast), rotate the female nut until the coupling body halves bottom out and definite resistance is felt (approximately five turns). If you lose count of the turns, you may start over. No freon gas will be lost providing you complete this step promptly. (See Photo #1.)

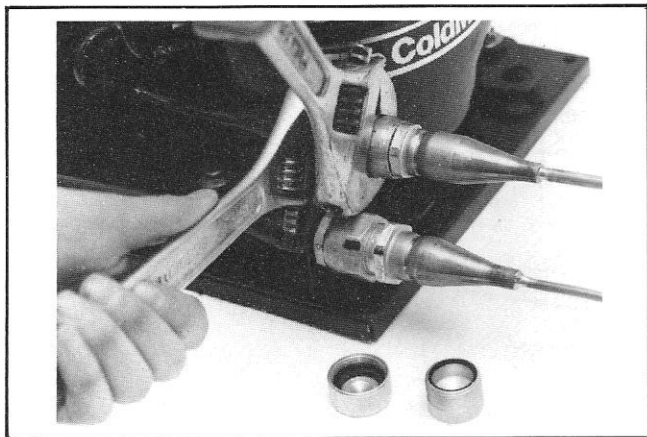
Ignore the sudden increase in resistance that occurs within the first two turns. This merely indicates that the two spring-loaded poppet valves are in contact and beginning to push each other open.



2. Using a marker pen or crayon, draw a line from the male coupling body to and over the female union nut to act as a reference point. (See Photo #2.)



3. This step must be performed correctly or a leak-proof joint will not be made. Using the lines you have drawn as reference points, tighten the female union nut one hex flat (1/6 turn) while holding the male coupling hex fast (refer to photos). This 1/6 turn is necessary to insure that the metal seal ring in the male coupling half "bites" into the brass seat of the female coupling half, forming a leak proof joint. (See Photo #3.)



Work rapidly to minimize possible escape of refrigerant. Occasionally there may be a slight hiss and/or a drop or two of refrigerant oil when making these connections. This will stop when the couplings are tightened.

4. Support the refrigerant tube set and thermostat wiring harness with clamps and wire ties (four supplied). Keep the tube set and harness out of bilge water, and protected from chafe and vibration. Coil the excess tubing and wiring, and secure in a horizontal orientation. The tubing must not be allowed to vibrate or chafe. Seal the exit hole in the icebox with the supplied mastic.

The system is fully charged with refrigerant at the factory and requires no charging in the field.

Retain the metal sealing caps in event the unit is ever returned for service.

ELECTRICAL CONSIDERATIONS

Battery Recommendations

We strongly recommend a minimum of two marine grade batteries, one exclusively for engine starting and a second for all other DC electrical devices such as lights, electronics and your ColdMachine. The second battery or group of batteries (wired in series or parallel depending on voltage) is commonly called the "house bank." A standard marine battery selector switch should be installed to isolate each battery or battery bank.

The house bank should be at least 100 amp/hour capacity. More is desirable. The larger the battery bank, the longer you can operate the various loads between engine charging, and the faster you can recharge. This is because the alternator's actual output in amps is greater into a larger battery bank.

We recommend the following amperage/hour capacity for the house bank, which services the ColdMachine:

For the "casual cruiser"
25 to 35 ft., seldom away
from dock longer than
overnight Minimum 100 amp/hours

For the "serious cruiser"
30—50 ft., often cruising
for a week or more Minimum 200 amp/hours

For the charter yacht or
tropics-based "serious
cruiser" operating in hot
climates and requiring
greater quantities of ice
cubes and frozen foods ... Minimum 300 amp/hours

Alternator Recommendations

A 55 amp alternator is generally standard on and adequate for most cruising yachts. However, we strongly recommend a larger alternator of 90 amps or more (rated capacity) for charter boat applications.

"Fast-Charge" Devices, Alternator Controllers and Batteries

The continuing proliferation of electrical and electronic devices aboard boats has produced great interest in reducing engine running time required for battery charging.

If top-quality batteries are installed in the boat, one of several available types of alternator controllers (or "regulator bypasses") can be installed and will substantially shorten charging times. The acceptable versions of these products are fully protected and automatically revert to standard regulator control before battery voltages and temperatures rise to damaging levels.

As to batteries, a good deal of misinformation still exists regarding "marine," "deep-cycle" and "deep-discharge" batteries. These terms generally describe a battery constructed to provide small to moderate currents for long periods of time, as opposed to short bursts of high current to start engines. While "deep-cycle" batteries will, nevertheless, start engines quite satisfactorily, engine-starting batteries are very poor at small-current long-term tasks. Automotive, sealed, or so-called "maintenance-free" batteries are okay for the engine start battery but are not suitable for the house or service battery bank that runs all the other equipment on your boat *regardless of how they are labeled*. A few manufacturers of genuine marine heavy-duty deep-cycle batteries are creating a public awareness of the inadequacies of disguised, re-labeled automotive batteries for marine use, particularly as house batteries in sailing yachts.

What all this means is that a boat owner with a full complement of equipment aboard such as electronics, refrigeration, autopilot, stereo, etc., and who feels the

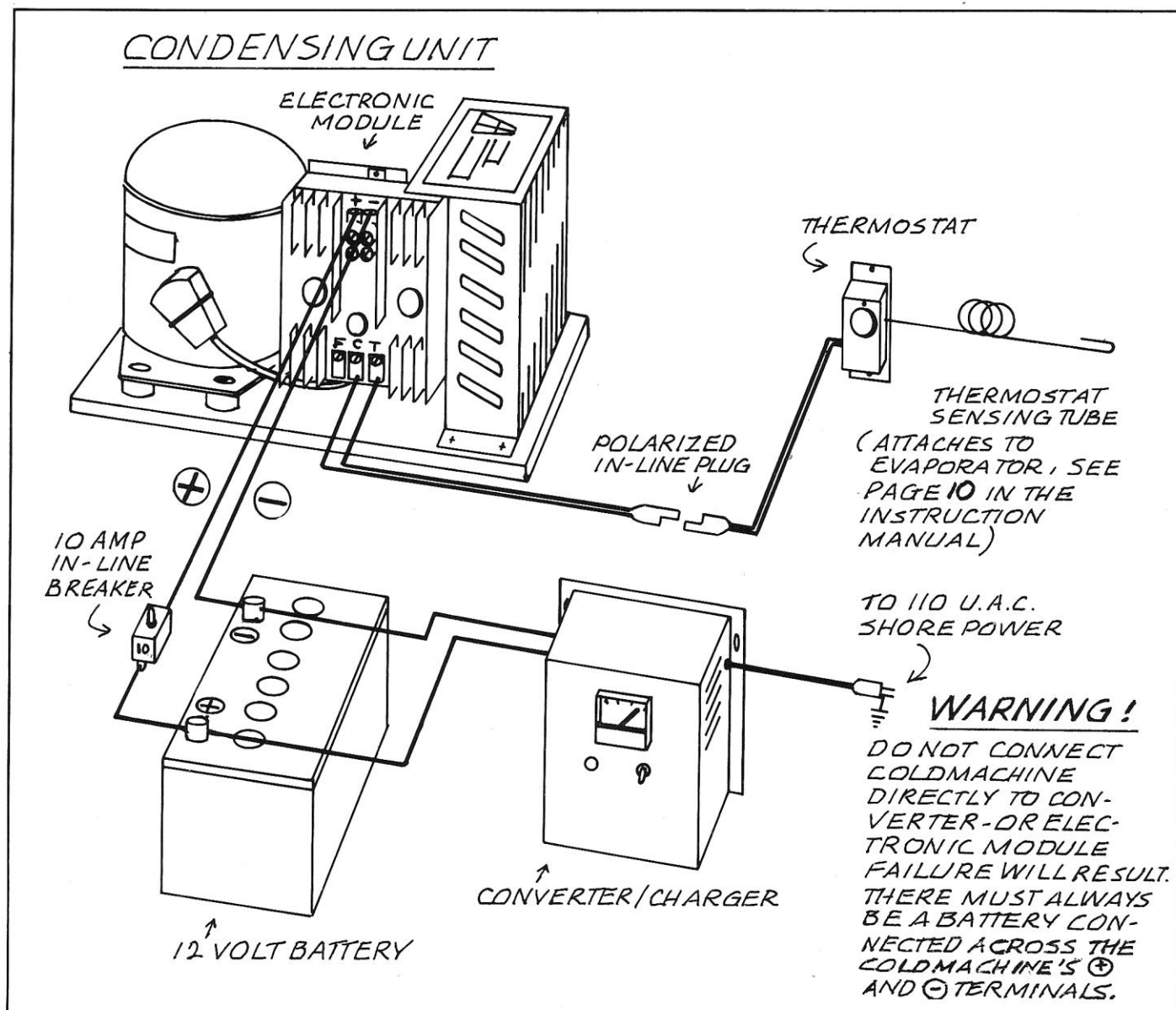
engine must be run too long for battery charging, can get very substantial improvements by using the technology and equipment now available to him.

Wiring the System

The ColdMachine has a brushless DC motor which is controlled by the electronic module (the finned device located on the side of the compressor unit). This control unit sends small amounts of current back to the battery during operation. *Operating the ColdMachine directly from an AC/DC converter, battery charger or other DC source without a battery will damage the unit's electronic circuitry.*

This control unit, like most electrical devices, requires fairly "clean" DC current for stable operation and long service life. Batteries provide clean DC current. Battery chargers, alternators, and AC/DC converters may not. This means that the ColdMachine must never be connected to any of these devices unless a battery is in the circuit, otherwise damage will result.

This also means that you or your mechanic must never momentarily lift the battery cable terminals off the battery posts while the engine and alternator are running, or operate any switch circuits which may have the effect of removing the battery from the ColdMachine circuit.



Therefore, to avoid damage to The ColdMachine, wiring connections must be made in one of three ways:

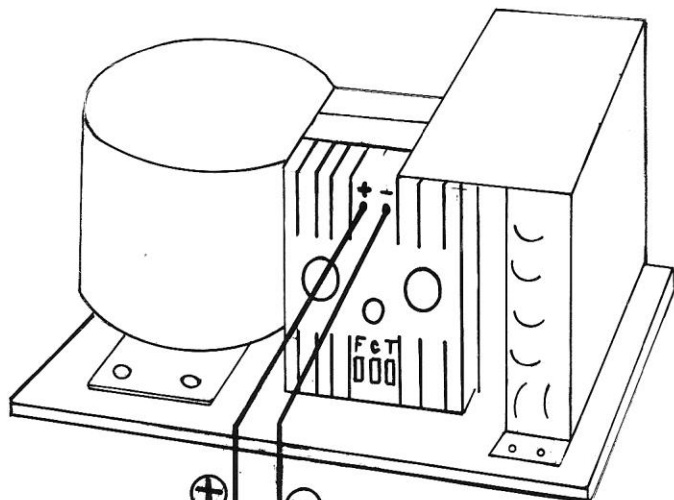
1. Directly to the battery (refer to page 13).
2. To the battery via the battery selector switch. This is recommended. (refer to page 13).
3. Through the ship's distribution panel via the battery selector switch to the battery (refer to page 14).

Use the shortest possible route for wiring between unit and battery to avoid voltage drops.

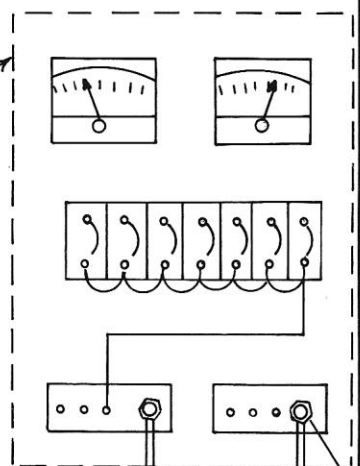
Install a 10 amp in-line fuse with an on/off switch or a 10 amp circuit breaker in the positive leg for line protection. The switch or circuit breaker is also necessary for long "off" periods because even with the thermostat off, there is still a minimal current flow in the system.

DIRECT CONNECTION TO BATTERY

RECOMMENDED!



PANEL

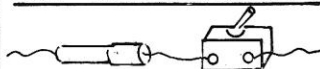


SEE TABLE FOR WIRE SIZES

BEST:

10AMP. CIRCUIT BREAKER SHOWN

NOT SATISFACTORY:



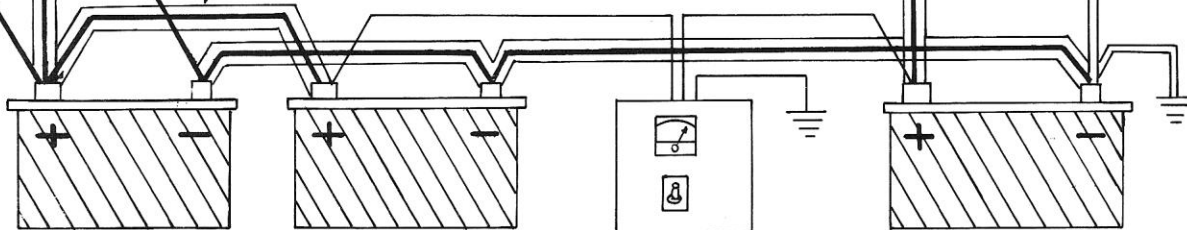
FUSE & TOGGLE SWITCH

OWNER-INSTALLED POWER LEADS FOR THE COLDMACHINE - MUST BE HEAVY WIRE AS SPECIFIED IN WIRE SIZE TABLE

CONNECT: { EITHER TO SELECTOR SWITCH OUTPUT
OR TO BATTERY POST }

BATTERY
SELECTOR
SWITCH

MAIN BATTERY CABLES



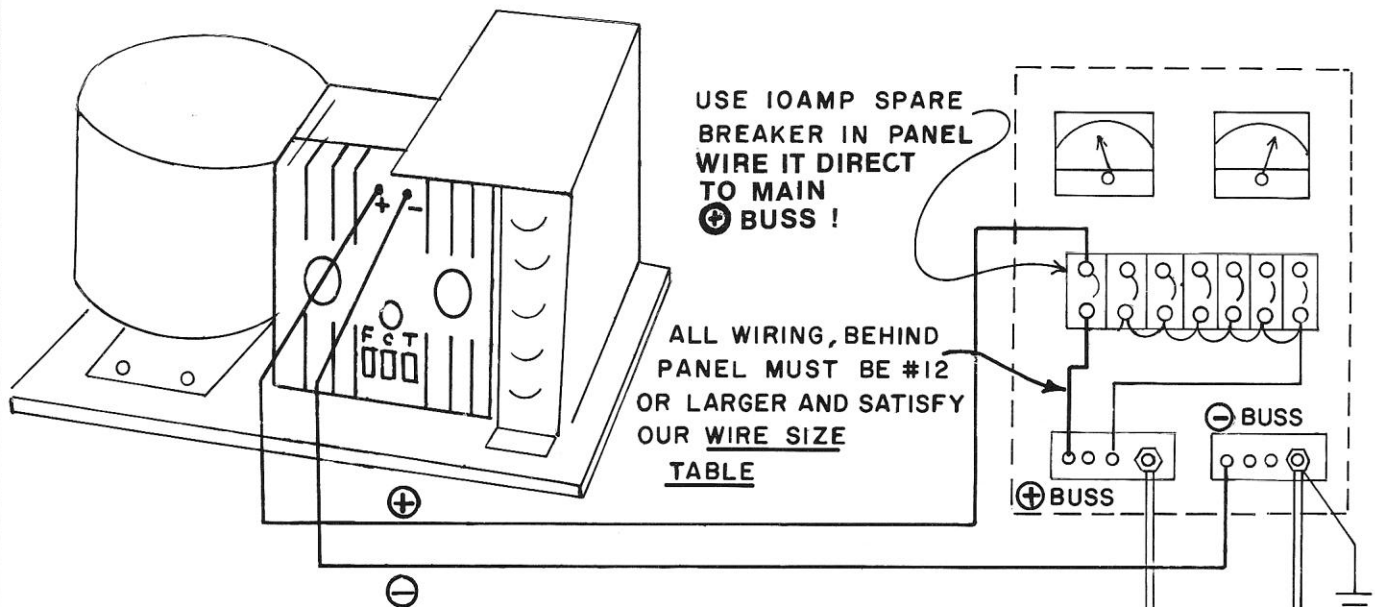
HOUSE BATTERY BANK

CHARGER

ENGINE START BATTERY

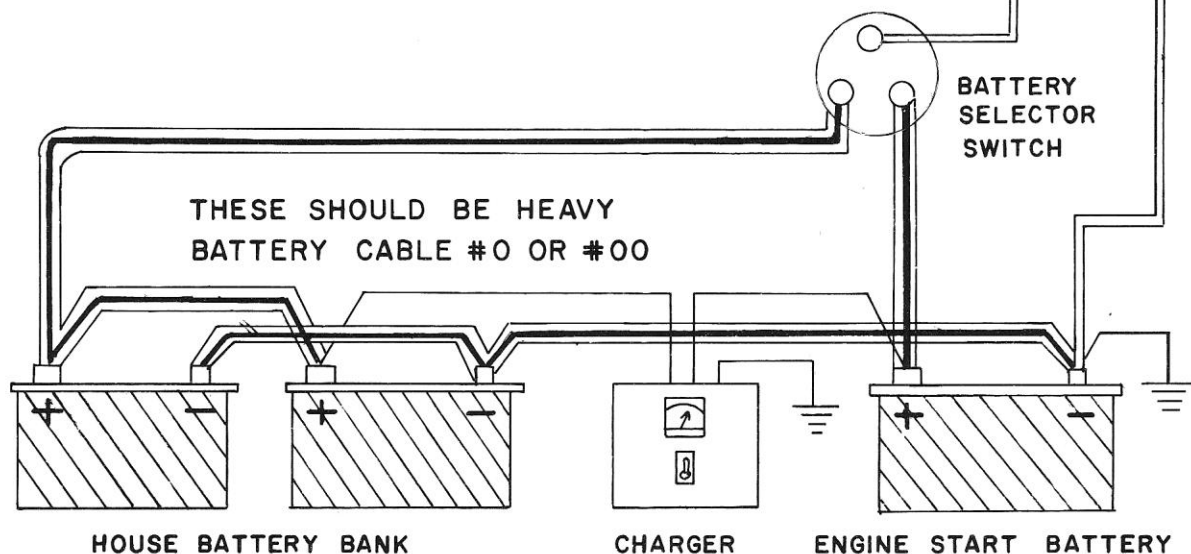
WIRE LENGTH FROM BREAKER TO BATTERY 72" MAXIMUM!

CONNECTION TO EXISTING PANEL BREAKER



THESE PANEL FEEDER CABLES MUST BE MINIMUM = 8 AWG WIRE SIZE.

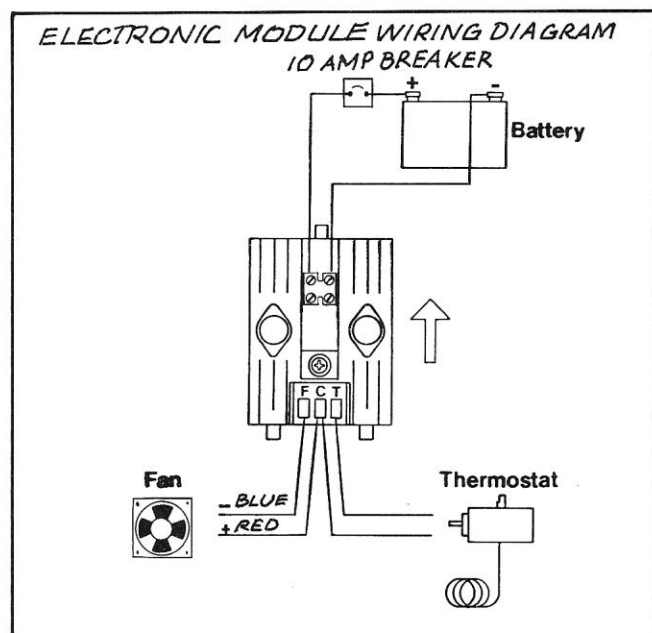
2/10 VOLT MAXIMUM TOLERABLE VOLTAGE DROP AT COLDMACHINE TERMINALS, WITH ALL OTHER D.C. LOADS ON, MEASURED WHEN COLDMACHINE STARTS.



Make sure that all wiring conforms to applicable Federal and State safety regulations. Note that a replaceable fuse located in the electronic module protects the ColdMachine unit (refer to page 15).

Use marine quality connectors and switch or circuit breaker to prevent voltage drops in the supply circuit to the ColdMachine. Also do not install voltage dropping devices such as indicator lights, volt and amp meters, etc., in the 12 volt DC wiring circuit.

Correct polarity is critical. If you connect in reverse, the fuse located in the electronic module will blow and the system will not operate. Should this occur,



correct your wiring and replace the fuse. A spare fuse is bagged and stapled to the compressor wire harness (Buss GLN-10 or AGC-10). Replacements are available from the factory.

NOTE: LEFT TERMINAL IS (+)

RIGHT TERMINAL IS (—)

Use color coded wire so you know which is positive (+) and which is negative (—). Connect the ColdMachine positive terminal directly to the house battery positive terminal or the battery selector switch common terminal. Connect the negative lead to the battery negative terminal or negative busbar.

Wire size is important. If you use undersized wire, your system will run erratically, often fail to start, not produce normal cooling or fail early in its service life. Use a wire gauge size based on the total distance from the compressor unit to the battery or battery selector switch (refer to Wire Size Table).

WIRE SIZE TABLE

MAXIMUM DISTANCE FROM COMPRESSOR UNIT TO BATTERY	GAUGE AWG
4 feet and under	#14
5 feet to 10 feet	#12
11 feet to 17 feet	#10
18 feet to 27 feet	# 8
28 feet to 35 feet	# 6
36 feet to 50 feet	# 4

OPERATION OF SYSTEM

START UP

When the thermostat is turned on, up to two minutes may elapse before the compressor starts. This is because the electronic module contains an integrated circuit control that may "inch" the compressor rotor several times until it is in the correct position to start.

Turn the thermostatic control clockwise to about #2 or #3 (#1 on the thermostatic control is the warmest setting, #7 is the coldest).

The ColdMachine system will now start. Within a few minutes, the freezer unit will begin to frost. The system will operate continuously until the icebox cabinet and contents have been brought to the selected temperature. The system will then cycle off, and thereafter cycle on and off maintaining proper temperature (like a home refrigerator).

AC/DC OPERATION

The ColdMachine will also operate automatically at dockside with the addition of a battery charger. We recommend a quality marine battery charger of suffi-

cient size to handle your ColdMachine along with the other on-board DC loads (such as lights, stereo and electronics). For the ColdMachine, figure approximately 5 amps when running. The average draw, as the ColdMachine cycles on and off, is 1.8 to 2.4 amps for most 4 to 8 cubic foot iceboxes with average insulation.

MAINTENANCE

Regular or seasonal maintenance is normally not needed, nor is maintenance required for winter storage or decommissioning. However, you should wash the freezer unit occasionally, and again before winter storage (use a mild detergent such as Joy or Ivory). Also the condenser (the radiator-like object on the compressor unit) can become clogged with dirt and should be carefully vacuumed seasonally with a soft brush attachment. Be careful not to bend the cooling fins.

Defrosting

Defrost your refrigerator when frost gets over 1/4" thick. This should not occur in less than a month or

so. Excessively fast or thick frost formation is an indication of moist outside air entering through a poorly sealed lid, doors or liner joints. These conditions must be eliminated for proper performance.

The best way to defrost is to turn your thermostatic control to the "OFF" position or disconnect the Cold-Machine from the power source. Open the icebox lid or door and allow sufficient time for the freezer unit to defrost naturally. *Never use an ice pick, knife or other metal object—you may pierce the refrigerant coils.*

Battery Care

Batteries are one of the most neglected and abused items on boats. Unlike automobiles, boat engines run slowly and not very often. The batteries tend to be buried in the bilge, are damp, dirty and chronically undercharged. Boat wiring is subject to corrosion at various connections, which creates voltage drops as we add more electrical devices each season. As these electrical loads grow, it becomes even more important that you keep your battery and charging system at top efficiency.

Also batteries can be deceptive. They may look good and read normal voltage, but may have deteriorated internally and be no longer able to deliver adequate power for more than short periods of time.

Check your batteries at least monthly with a hydrometer (inexpensive and available from automotive supply stores). The readings of each cell should be approximately the same. If one reading is lower than the others, it indicates a defective battery.

Also check your batteries seasonally with a "Battery Load Tester" (which your boatyard or mechanic probably has). This tests the battery's condition and capacity under a simulated actual load.

If your batteries do not pass these tests, *replace them*. You are just wasting valuable fuel, engine hours and time in trying to charge them.

Observing the following points can add to your battery's dependability and operational life:

- Keep the tops of batteries clean and dry. A damp battery can lose 20% of its charge in a day!
- Keep the battery post clamps tight, clean and free from corrosion.
- Use distilled water only.

Winter Operation

When ambient temperatures drop below 65 degrees F in the operational area of the compressor unit, it becomes necessary to block off 1/2 of the condenser coil face area (on the side opposite the condenser fan motor) with a piece of cardboard to maintain system efficiency. The cardboard can be simply taped in place for the winter season and removed in the spring when seasonal temperatures return to above 65 degrees F.

ELECTRONIC MODULE PROTECTION SYSTEM

The ColdMachine, designed for nominal 12 volt DC

operation, operates in the 9—15 volt range. The electronic module will automatically shut off the system if voltage at the module input terminals falls below approximately 9 volts. As the battery recharges, the electronic module will automatically turn the system on when the voltage reaches approximately 11 volts. This circuitry protects the battery from the damaging effects of a complete discharge and the ColdMachine from chronic low voltage operation.

If the electronic module "senses" a malfunction it will automatically switch into its protective mode and will make four attempts to start at approximately 80 second intervals.

If the system fails to start after four attempts, it will wait 45 minutes and then make four more attempts, etc. You may abort the 45 minute waiting time by turning the main power supply off, waiting 5 to 10 minutes for internal refrigerant pressures to equalize, and then turning the power back on.

If the compressor cannot reach or maintain 1800 RPM at normal amps (due to poor condenser air flow, overcharge, air in system, extremely hot ambient temperature), it will automatically shut down.

The system will then enter into its "protective mode" as described above. If the system fails to start after repeated attempts for an hour or longer, the reasons may be:

1. Low Voltage: when the no-load voltage reaches approximately 11 volts the unit tries to start. The heavy starting current (11—14 amps momentarily) depresses line voltage. The start attempt is aborted because motor does not reach 1800 RPM within programmed 0.8 seconds.
2. Fan Current Limit Circuit: Senses excessively high fan current and shuts down system. The maximum fan current limits are:

Units manufactured prior to January 1984: 0.7 amps.
Units manufactured after to January 1984: 1.2 amps.

Conditions 1 or 2 above may cause subsequent start attempts to be unsuccessful or erratic. Disconnect the fan wires to confirm defective fan. If system then starts and cools, replace the fan.

**DO NOT OPERATE THE SYSTEM
LONGER THAN 10 MINUTES
WITHOUT FAN RUNNING.**

The electronic module also prevents major damage to the system by blowing its built-in ten amp fuse in case of reverse polarity connection. This fuse will also blow in case of short circuit inside the module or a shorted output power transistor.

If your system displays any unusual symptoms, runs continuously or does not cool properly, please refer to the Trouble Shooting Guide.

TROUBLE SHOOTING

This chart is a simple guide to field level troubleshooting of the ColdMachine system. It covers diagnosis and simple parts replacement and/or adjustments. These repairs can be handled by the average owner. Service kits, parts, manuals and additional support services can be obtained from:

Customer Service, Adler-Barbour, International Marine Technology, Inc. (IMTECH) 3 Republic Road North Billerica, MA 01862

Telephone: 617/667-6318 Telex: 921845 (IMI COMBI NBIL)

COLDMACHINE TROUBLESHOOTING GUIDE

SYMPTOM	DIAGNOSIS	CORRECTIVE ACTION
COMPRESSOR AND FAN DO NOT MAKE AN ATTEMPT TO START	CHECK FUSE CHECK ALL WIRING CHECK THERMOSTAT (BYPASSING IT) FAULTY ELECTRONIC MODULE FAULTY COMPRESSOR	REPLACE FUSE CORRECT WIRING (SEE PAGES 13 & 14) REPLACE THERMOSTAT REPLACE ELECTRONIC MODULE RETURN CONDENSING UNIT TO FACTORY
COMPRESSOR AND FAN ATTEMPT TO START, AS EVIDENCED BY MOMENTARY VOLTAGE DIP, FAN MOVEMENT OR COMPRESSOR VIBRATION	LOW VOLTAGE AT ELECTRONIC MODULE EXCESSIVE VOLTAGE DROP IN WIRING INTERNAL REFRIGERANT PRESSURES NOT YET EQUALIZED FAULTY ELECTRONIC MODULE FAULTY COMPRESSOR	REVIEW "ELECTRICAL CONNECTIONS" (SEE PAGES 12-15) RUN TEMPORARY AWG 10 HOT-WIRE DIRECT TO BATTERY WAIT 15 MINUTES BEFORE ATTEMPTING ANOTHER START REPLACE ELECTRONIC MODULE RETURN CONDENSING UNIT TO FACTORY
COMPRESSOR AND FAN START BUT SHUT DOWN AFTER 1 TO 30 SECONDS	CHECK FAN MOTOR (DISCONNECT FAN MOTOR FROM MODULE, TURN ON COMPRESSOR AND SEE IF IT RUNS LONGER THAN 30 SECONDS. WARNING! DO NOT RUN UNIT ANY LONGER THAN 10 MINUTES WITHOUT THE FAN.	REPLACE FAN MOTOR
COMPRESSOR RUNS, FAN DOES NOT	CHECK FAN MOTOR WIRING FAN CONTROL CIRCUIT CHECK FAN MOTOR (TEST WITH 12 V.D.C. POWER SOURCE)	CORRECT WIRING (SEE PAGES 13 & 14) REPLACE ELECTRONIC MODULE DEFECTIVE REPLACE FAN MOTOR

SYMPTOM	DIAGNOSIS	CORRECTIVE ACTION
INTERMITTENT COMPRESSOR AND FAN OPERATION	<p>POOR ELECTRICAL SUPPLY, CHRONIC VOLTAGE FLUCTUATIONS</p> <p>CHECK THE THERMOSTAT (BY BYPASSING IT)</p> <p>FAULTY ELECTRONIC MODULE</p> <p>FAULTY COMPRESSOR</p>	<p>REVIEW "ELECTRICAL CONNECTIONS" IN THE MANUAL. (SEE PAGES 12-15)</p> <p>REPLACE THERMOSTAT</p> <p>REPLACE ELECTRONIC MODULE</p> <p>RETURN CONDENSING UNIT TO FACTORY</p>
COMPRESSOR AND FAN CYCLE, SYSTEM NOT ADEQUATELY COOLING BOX	<p>CHECK THERMOSTAT (ADJUSTMENT)</p> <p>IS TEMPERATURE SENSING TUBE PROPERLY CLAMPED TO EVAPORATOR?</p>	<p>FOR ADDITIONAL ADJUSTMENT SEE "THERMOSTATIC ADJUSTMENT SERVICE BULLETIN"</p> <p>ADJUST SENSING TUBE POSITION (SEE PAGE 10)</p>
COMPRESSOR AND FAN RUN CONTINUOUSLY, SYSTEM NOT ADEQUATELY COOLING BOX	<p>INADEQUATE VENTILATION AT CONDENSING UNIT</p> <p>REFRIGERANT CHARGE TOO HIGH OR TOO LOW</p> <p>BOX INADEQUATELY INSULATED</p> <p>PARTIAL CLOG IN REFRIGERANT CIRCUIT (CHARGE AND PRESSURES ARE NORMAL, AS CONFIRMED BY USE OF "REFRIGERANT SERVICE KIT," AND ONLY PART OF EVAPORATOR IS FROSTING)</p>	<p>PROVIDE IMPROVED AIR FLOW (CONSULT MANUAL FOR SUGGESTIONS PAGES 5-8)</p> <p>ORDER "REFRIGERANT SERVICE KIT" FROM FACTORY</p> <p>ADD INSULATION TO BOX. (WALLS, TOP AND LIDS MUST HAVE MINIMUM 2" + OF URETHANE FOAM)</p> <p>RETURN ENTIRE UNIT TO FACTORY (INCLUDING EVAPORATOR AND CONDENSING UNIT)</p>
COMPRESSOR AND FAN RUN CONTINUOUSLY, NO COOLING AT ALL	<p>NO AUDIBLE "HISS" AT EVAPORATOR, COMPLETE CLOG IN CIRCUIT (MOISTURE, DIRT OR PINCHED TUBE)</p>	<p>RETURN ENTIRE UNIT TO FACTORY INCLUDING EVAPORATOR AND CONDENSING UNIT</p>
COMPRESSOR AND FAN RUN CONTINUOUSLY, FOOD IN REFRIGERATOR FREEZES	<p>CHECK THERMOSTAT (ADJUSTMENT)</p> <p>THERMOSTAT STICKS CLOSED, CHECK BY REMOVING ONE TERMINAL FROM THERMOSTAT</p> <p>TEMPERATURE SENSING TUBE IMPROPERLY CLAMPED</p>	<p>FOR ADDITIONAL ADJUSTMENT SEE "THERMOSTATIC ADJUSTMENT SERVICE BULLETIN"</p> <p>REPLACE THERMOSTAT</p> <p>ADJUST SENSING TUBE POSITION (SEE PAGE 10)</p>

SYMPTOM	DIAGNOSIS	CORRECTIVE ACTION
COMPRESSOR AND FAN CYCLE, FOOD IN REFRIGERATOR FREEZES	BOX TOO SMALL OR TOO WELL INSULATED	PARTITION REQUIRED BETWEEN EVAPORATOR AND REFRIGERATED FOOD (SEE OPTIONAL ICEBOX MODIFICATIONS)
	CHECK THERMOSTAT (ADJUSTMENT)	FOR ADDITIONAL ADJUSTMENT SEE "THERMOSTATIC ADJUSTMENT SERVICE BULLETIN"

PROCEDURE FOR REMOVING COMPRESSOR UNIT

1. Turn off DC power supply to unit.
2. Disconnect the mating plugs of the thermostatic control wire harness about one foot from compressor unit.
3. Remove both DC power terminals from electronic module.
4. Disconnect both refrigerant couplings. Use two open-end wrenches:

One 1-3/16"/30mm hex or 12" adjustable to *turn* the female coupling. One 1-1/8"/29mm hex or 10" adjustable to *hold* the male coupling.

5. Turn only the female coupling. Don't turn the male coupling. If you twist the coupling from its soldered tubing connection, you will have a refrigerant leak. This is why you must use two wrenches.

6. Work quickly to avoid loss of refrigerant gas. A slight hiss and loss of a drop or two of refrigerant oil may occur. This stops when the coupling halves are completely separated. Screw the metal caps into the couplings to keep dirt out and prevent freon leakage.
7. Now remove the compressor unit from the boat. Handle carefully. Don't pick it up by the tubing or electronic module. Be careful not to cut your fingers on the cooling fins, and do not bend them. (The fins are soft and thin for maximum efficiency).

PROCEDURE FOR REMOVING FREEZER UNIT

1. Turn the thermostatic control to OFF (until click).
2. Disconnect the 12 volt DC power supply to the compressor unit. Carefully remove the sensing tube of the thermostatic control from its clamp on the side of freezer by loosening two screws and sliding out the "U" bend section of the tube.
3. Now disconnect both pairs of refrigerant couplings at the compressor unit (see Item 4 of "Procedure for Removing Compressor Unit").
4. Disconnect the mating plugs of the thermostatic control unit (about 1 foot from compressor unit).
5. Remove the soft mastic caulking material from

the exit hole in the icebox where the tubing and wire harness pass through.

6. Using a "stubby" screwdriver, unscrew the four mounting screws (save these) and carefully withdraw the entire freezer and its 15 ft. tubing set from the icebox.
7. Be careful not to kink or flatten the tubing! Screw the metal sealing caps into the couplings to keep them clean and prevent freon leakage.
8. Now carefully roll up the entire coil by rolling it around a cylindrical object of about 12" diameter.

RETURN POLICY

In the event factory repair or replacement is necessary per the Troubleshooting Guide (either in or out of warranty), we require that you return the specified

component(s) to our factory, or an independent authorized service center (after receiving prior authorization from Customer Service).

SHIPPING INSTRUCTIONS

Pack the unit very carefully to avoid damage in transit, preferably in its original carton. If the original carton is not available, pack the compressor unit and the freezer unit in *two separate cartons* and put these into a larger "master carton" for shipment. Each component must be in a sturdy carton with at least 6 inches of crumpled newspaper or other material packed tightly around the unit to prevent damage during shipment. Be sure to use strong cord or tape around the master carton. Do not ship the two smaller cartons separately. This will delay our ability to respond to you.

If the unit is being returned under warranty, it must be accompanied by a copy of the original sales ticket or shipping documents to establish date of purchase. Also include with the unit a letter explaining exactly

what difficulties you have encountered. (Remember to add extra First Class postage and indicate on the outside of the carton that First Class Mail is enclosed).

Ship by prepaid UPS or Parcel Post and mark "DELICATE EQUIPMENT . . . FRAGILE". Clearly address the carton as follows:

Customer Service Adler-Barbour, International
Marine Technology, Inc. 3 Republic Road North Billerica, MA 01862

Tel: (617) 667—6318 Telex 921845 IMI COMBINBIL
We reserve the right to refuse any returned components which show evidence of damage in shipping. In such cases, we will notify the shipper of damage and its repair cost.

NOTES