GLACIER BAY, INC

DC Breeze^{tm}

DC Air Conditioning System

Installation Guide and Owner's Manual

rev August 19 2005

Glacier Bay, Inc.
2845 Chapman Street
Oakland, CA 94601
(510) 437-9100 (Phone)
(510) 437-9200 (Fax)
www.glacierbay.com

Glacier Bay, Inc.
2845 Chapman Street
Oakland, CA 94601
(510) 437-9100 (Phone)
(510) 437-9200 (Fax)
www.glacierbay.com

INSTALLATION AND OWNER'S MANUAL

TABLE OF CONTENTS

General Information and safety warnings	3
System components	5
Application information	5
Planning your installation	7
How much power do I need?	7
Batteries	7
Engine alternators	8
Shore power battery chargers	9
Solar panels	10
Wind generators	10
Generators (AC or DC)	10
Most common installation mistakes	11
System dimensions	12
Mounting options	13
Selecting locations for major components	15
Condensing unit	15
Raw water pump	15
Standard control and Digital thermostat	16
Control switch mounting diagram	17
Digital thermostat mounting diagram	18
Component installation	19
Condensing/blower unit	19
Ducted vs Non-ducted installation	20
Wiring the electrical connections	20
Wire terminals side view	21
Wire terminals top view	22
Wiring diagram and maximum current draw	23
Basic Electrical Wiring	24
Wire Size Table	24
AWG to Metric Wire Conversion Table	25
System controls, operation, and programing	26
Troubleshooting	29
Warranty Information	31
Appendix (the refrigeration cycle)	34

GENERAL INFORMATION

Congratulations on your purchase of DC Breeze[tm], the world's first true 12v/24v stand-alone marine air conditioner. Your Glacier Bay system has been carefully engineered to provide you with many years of trouble-free, energy efficient operation. To take full advantage of your system's advanced design it is important that the installation and adjustment procedures outlined in this guide are carefully followed. Many DC Breeze[tm] owners choose to install their new Glacier Bay system themselves rather than hire a professional. An advantage in doing it yourself, in addition to the obvious one of saving money, is that you will increase your familiarity with the system's design and operation. The installation manual was written to be useful to owner/installers. If you do your own installation you are likely to find the process easier than than you expected with only a minimal number of inexpensive tools required.

Glacier Bay was founded to provide environmentally responsible systems and introduced the world's first commercial ozone friendly refrigeration system, using R134a. While the refrigerant used in your DC Breeze[tm] does not harm the ozone, it can act as a global warming gas and may not be intentionally released into the atmosphere. 407C is classed in the A1/A1 ASHRAE safety classification, is EPA SNAP accepted, and UL recognized. It is not subject to phase out like the R-22 still used in some systems.

A Note and Warnings about Your HFC-407c System

WARNING - THIS SYSTEM IS PRE-CHARGED WITH 6.25 oz of HFC-407c REFRIGERANT GAS

Your Glacier Bay DC Breeze[tm] air conditioner is designed to use HFC-407c refrigerant gas. The best energy efficiency, overall performance and equipment life will be obtained by using HFC-407c. The Dupont trade name for this gas is Suva® 407C .

Handling Precautions for refrigerants and high-pressure gases

This refrigeration system contains pressurized R-407c refrigerant gas and liquid. At a temperature of 85˚F the pressure is 156 PSI. As with any refrigerant gas, certain safety precautions should be followed when handling R-407. Bare skin exposed to liquid refrigerant may suffer severe frostbite. Although R-407c is non-toxic it is heavier than air and therefore displaces oxygen. Always provide proper ventilation when working in enclosed areas. In the event of a massive refrigerant leak, get out of the area immediately. Never refill containers with R-407c or subject any container to temperatures exceeding 120˚F (50˚C.).
R-407c produces hazardous and toxic byproducts if exposed to open flame or heating elements. The presence of these by-products will be apparent by an acrid odor. Should an acrid odor be detected when working near R-407c remove all persons from the area immediately. NEVER USE A FLAME TYPE LEAK DETECTOR WITH R-407c.

On the top of the compressor is a warning: **STOP READ WARNING LABEL**. This label on the side of the compressor may not be visible. Below is the warning on the label:

WARNING!

IMMEDIATELY GET AWAY if you hear sounds of arcing inside the compressor (sizzling, sputtering or popping). Burns from compressor terminal venting with ignition may result.

Improper servicing can lead to fire, electrocution, or explosion. Never service, repair or troubleshoot a system unless you are a professional service person.

NOTICE: THERMALLY PROTECTED COMPRESSOR EQUIPPED WITH A THERMAL PROTECTOR. ALLOW TIME TO RESET.

Please note:

! DANGER

Do not install the DC Breeze^{tm} in explosive atmospheres such as in spaces containing: gasoline engines, tanks or fuel line fittings, or compressed fuel cylinders, regulators, or valves. Improper installation could result in injury or death.

SYSTEM COMPONENTS

Every DC Breeze[tm] includes:

The condensing unit, this manual, a power and fan control switch, a sea water pump and installation supplies and fittings. You may also have purchased the optional digital control. Because every installation is different, it is very possible that you will need to purchase additional fittings beyond those included in your installation kit. Also, you will need to obtain electrical wire, a circuit breaker, water hose and possibly a sea water strainer.
We strongly recommend that you read this manual in its entirety before beginning your installation. Should you have any questions at all, please contact the Glacier Bay sales department at (510) 437-9100 or by email at support@glacierbay.com.

Application Information

How much cooling will the DC Breeze[tm] provide?
5,000 Btu/hr is the number you should use when doing your capacity calculations. However, the actual capacity of all air conditioning systems vary depending on the ambient conditions. Warmer inlet air will increase the capacity as will cooler sea water flowing through the condenser. The 5,000 Btu/hr capacity claimed for DC Breeze is based on capacity at the "high" setting in 86 degree F (30º C) sea water with an inlet air temperature of 85 degrees F. This amount of cooling might be sufficient for an average volume of around 400 cubic feet in tropical conditions, the volume, for example, of a good sized master cabin. Hull insulation, window space, and personal preference are all large variables in the actual amount of air conditioning that is optimum for your conditions.

What is the temperature difference between the inlet and discharged air?
This will normally be around 25 degrees F, but several factors significantly impact the temperature drop provided at any given time including:

●**Fan Speed** - The DC Breeze has three compressor and fan speeds. At lower speeds the discharge air temperature will be colder even though the unit will be removing less heat overall. The air temperature is colder at low speeds because the heat that is being removed is being taken from proportionately less air volume. The DC Breeze will use less power at the lower speed settings.

●**Humidity** - In high humidity conditions, a great deal of cooling capacity is used to condense moisture out of the air. As the humidity levels are lowered by air recirculation within the cabin, the discharge air temperature will become lower and lower. Under extreme humidity conditions, only 25% of the capacity of the air conditioner will be used to actually cool the air. A 25 degree F difference in low humidity may be reduced to only 6 or 7 degrees F in high humidity. Under high humidity conditions it is important to be able to restrict the amount of fresh air entering the cabin so that the DC Breeze can lower the overall relative humidity.

●**Inlet air and sea water temperature** - These temperatures affect the total cooling power of the system and therefore directly affect the difference in temperature that can be obtained between the inlet and outlet air. The higher the inlet air temperature and the lower the cooling water temperature, the greater the temperature difference between inlet and outlet air that will be achieved, given the same relative humidity. This also means that the actual cooling capacity of the system will be greater than 5000 btus per hour if the seawater temperature is colder than 86 degrees F, or if the air temperature is warmer than 85 F.

How much dehumidification does the DC Breeze do?

On the “high” setting, under rating conditions of 86 degrees F (30º C) sea water with an inlet air temperature of 85 degrees F., the DC Breeze can remove moisture at the rate of:

3.68 pints/hr (11 gallons per day) or 1.74 liters/hr (42 liters per day)

Why do similarly rated air conditioners perform so differently?

As you can see from the above, the environmental conditions under which an air conditioner is operating dramatically affects the capacity. The federal government requires all commercial and residential "non-mobile" systems to be rated using a standard set of conditions developed by ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers).

Unfortunately, no such standard exists for cooling systems used in boats, cars, buses, motorhomes or any other mobile application. The lack of a standard leaves the manufacturers free to rate their systems under any set of environmental conditions they choose (such as 70 degree F water temperature.) The result is that a "Brand A" marine air

conditioner may have only half the cooling power of "Brand B" even though both are sold with the same capacity rating. Some smaller manufactures who lack testing capability simply base their rating on the capacity of the compressor they use. This can result in tremendous inaccuracy since many other system components will also impact the effective capacity. The bottom line is that without enforced testing standards there is no way to really know what you are getting before you buy.

We are proud of the performance of the DC Breeze and want you to understand how our ratings are based and what you can really expect from the system.

Planning your Installation

How much power do I need?

Under the rating conditions (85^{o}F inlet air, 86^{o}F cooling water), the system will draw 48 amps when running from a fully charged 12v battery bank. This equates to 600 watts. Systems operating from 24 volts batteries will draw 24 amps. This number includes the current draw of the seawater pump and the blower. Like the actual system capacity, the current draw will also change under different ambient conditions. If the water or air temperature is lower, the current draw will be reduced, and current can be increased if either is higher. In both 12v and 24v systems, the actual battery voltage effects both the cooling capacity and current draw of the system. A reduction in battery voltage due to low batteries or voltage drop in the wiring will result in lower cooling capacity and lower current draw. The system will shut down automatically if battery voltage drops below 11.5 volts.

How do I come up with enough 12/24v power?

The answer to this question is key to obtaining a satisfactory DC Breeze installation. Although the system is extremely efficient, it is easy to underestimate the amount of energy it takes to cool hot, humid air. Nevertheless, it is easier than you might think to create a low-voltage A/C system which meets your needs. The important thing is to be realistic about your requirements and the amount of power you will need to meets them. Sources of power include:

- Batteries
- Engine alternators
- Shore power battery chargers
- Solar panels
- DC or AC generators

Lets consider each of these individually to see which is the best choice (or combination of choices) for you.

Batteries -

To analyze the practicality of using battery power to provide your air conditioning, let's first review some useful battery facts.

●Lead acid batteries (including wet, sealed and AGM) come in two basic types - "engine starting" and "deep cycle". Battery banks used to power the DC Breeze should be of the "deep cycle" type.

●Deep cycle batteries have a "20 hour rating" which provides the number of amp-hrs of electrical charge they can deliver when new and fully charged. The amount of electrical power a lead acid battery can store is proportionate to its size and weight and remains relatively consistent between manufacturers and battery sub-types (wet cell, AGM, etc.). This energy density is typically 24 watt-hrs per lb (1.9 amp-hrs @ 12.5v)

●To maximize battery life, lead acid batteries should not be discharged more than 60% before recharging. Following this rule gives you a "usable capacity" of 14.4 watt-hours (1.15 amp-hrs @ 12.5v) per lb of battery weight.

We can see that it requires 41.7 lbs of batteries to operate the DC Breeze at full power for one (1) hour*. During this hour, the DC Breeze will remove 5,000 BTUs of heat. To run the system continuously at full power from batteries for 8 hours would require a battery bank weighing 334 lbs. A battery bank this size will require 2.7 ft3. (0.076 m3) of space.

Looking at it another way, we need to have 384 amp-hours (at 12.5vdc) of usable storage capacity available to us. Since we don't want to discharge the batteries more than 60%, we will need a bank with a combined "20 hr" rating of 640 amp-hrs. If we translate this into some commonly available battery sizes we find that for 8 hours of continuous running we would need a bank consisting of one of the following**:

●Three (3) 8D size batteries (20.75" x 11.0" x 11.8")
●Four (4) 4D size batteries (20.75" x 8.75" x 10.8")
●Six (6) Group 31 size batteries (13" x 6.75" x 9.8")
●Seven (7) Group 27 batteries (12.0" x 6.8" x 9.5")
●Eight (8) Group 24 batteries (10.2" x 6.8" x 9.4")

If additional power were being drawn from the bank for other reasons (lights, refrigeration, etc), the bank size would have to be increased.

***** This is determined by taking the amount of energy consumed by the DC Breeze when running at full power (48 amps) and dividing it by the amount of "usable power" contained in 1 pound of batteries (1.15 amps). The same holds true for a 24v battery bank because both the number of amp-hours stored by the batteries and the current consumed by the DC Breeze are cut in half.

****** Some of these combinations provide more than the required capacity.

Engine Alternators -

In many applications you will want to have air conditioning available while the engine is running. In this case you will be using the engine alternator and charging system as the power source for the DC Breeze. If the output of the alternator is equal to, or higher than the power consumed by the air conditioner, then no power is drawn from the battery bank. The batteries are not "cycled" in any way while the air conditioner and alternator are running. In applications where the engine will always be running whenever air conditioning is required (and the boat is away from the dock), it is possible to use nothing more than a small engine start type battery for your DC bank. However, in such a case, your alternator MUST be capable of putting out 50 amps or more at all times to avoid draining your starting battery.

Generally speaking, the alternator that comes with your engine will not provide sufficient output to meet the demand of the A/C system, especially with older systems. However, if you have an in-board or IO propulsion system on your boat, there are many "high-output" alternators available in the marine after market which are easy, direct-swap-out replacements that will work nicely. Some "high-output" type alternators don't provide 50 amps when the engine is running slowly (such as during trolling). In this case, you would want to have at least some additional battery capacity is available to keep up with demand. Most alternator manufacturers will provide a chart showing the output at various engine speeds and pulley ratios. Most manufacturers rate their alternators under cold conditions. Once the alternators warm up (which only takes a few minutes) the output will generally fall off by about 20%.

If your boat has outboard propulsion, you may have a hard time covering 100% of the power draw of the DC Breeze solely from the engine alternator(s), unless it is a newer unit. In this case, you will want to add some reserve capacity to you battery bank to make up the difference. Most outboard users find that the difference is relatively small and DC Breeze still offers an excellent solution to their air conditioning needs.

To take a closer look at this type of applications let's go ahead and make some assumptions. We will assume that this DC Breeze customer owns a cutty cabin sports boat equipped with twin Yamaha 150 four-stroke outboards. The alternator on this outboard is rated at 35 amps at full throttle. When the alternator is hot and the engine is running at trolling speeds, we will assume the the actual output is probably closer to 15 amps. Since we have two engines, we conservatively have a combined output of 30 amps when trolling. That leaves us 18 amps short of having enough power to sustain the air conditioning system.
Since this customer wants to set the boat up to provide full air conditioning for 6 hours of trolling, we need to come up with another 108 amps-hours of "usable" battery capacity to make up for the shortage of our alternators. To get 108 "usable" amp-hours, we need a battery (or batteries) with a 20 hr rating of 180 amps (remember the 60% discharge rule). If we add two (2) Group 27 batteries to the exiting "house bank" we will have sufficient power available to provide continuous air conditioning for six hours of slow engine speed. Running the engine at faster speeds means that even less power is drawn from the batteries (since the alternator output would be greater) so the available air conditioning time would be extended.

Shore Power Battery Chargers -

The DC Breeze can be operated for extended periods when the boat is connected to shore power by using the boat's battery charger to supply the required DC current. As with the alternator-power system, the batteries are not "cycled" so long as the charger is capable of putting out 48 amps (at 12v or 24 amps at 24v) continuously. Used in this way there is no additional wear and tear on your battery bank. The important thing here is to make certain that your battery charger can handle this output for extended periods of time without overheating. Most, but not all, 50+ amp chargers will do this. Be sure and check with the manufacturer of your charger to find out. If necessary, increase the capacity of your charger or supplement it with a second unit.

Solar Panels -

The idea of using the same solar energy that is heating you up to also cool you down has tremendous appeal. How practical that idea is depends on your budget and how much room you have for solar (photovoltaic, or PV) panels. For most people on boats it will make sense to use PV panels to supplement other forms of charging but not entirely replace them.
As mentioned in the beginning of this section, the DC Breeze requires 600 watts of power to run at full speed. High quality crystalline solar panels (such those made by BP Solar) provide a "peak" output of about 11.5 watts per ft_2. The flexible, amorphous type panels have lower output. On a boat in a tropical climate a realistic average over a 6 hour period would be about 50% of peak, or about 6 watts per ft_2. To reliably handle the entire power requirement of the DC Breeze would require 100 square feet of PV panels. Not impossible, but not practical in most cases.
What is practical, is to use the panels to supplement other charging methods. Although PV panels do not put out their peak power all the time, they do provide the most power at the same time the solar load is at its highest. For this 2-3 hour window it is possible to average something much closer to peak output - maybe 80%. Using two PV panels of the most popular size for boaters (BP Solar model BP380 - 47.4" x 21.1") you could reasonably expect
120 watts of usable solar power which would effectively reduce the energy consumed by the DC Breeze by 20% (to 480 watts) during this peak period.

Wind Generators –

Many wind generators are capable of supplying 600 watts of power in breezy conditions. Unfortunately, these are just the conditions where air conditioning is less likely to be needed. Still, depending on your location, a wind generator can make a major contribution to your air conditioning energy budget.

Generators (AC or DC) -

One of the big advantages of the DC Breeze is that it makes air conditioning practical for boats that either do not have traditional AC generators, or want to have air conditioning without turning them on. If you have a generator (either AC of DC) but would like to have air conditioning without the generator running, then you will want to set up your battery bank to provide sufficient storage to handle the "generator-free" run time you want. Later, when running the generator is more convenient, use it to recharge the batteries. If you want to have the option of extended air conditioning operation, make sure your battery charger has sufficient capacity to provide 48 amps of 12v power while the generator runs (see the Shore Power Chargers section above).

For boats with small DC generators designed for battery charging, the DC Breeze is just what you've been waiting for. Nearly all of these chargers create more that enough power to run the DC Breeze directly even while you simultaneously charge the batteries.
Finding room for accessories on a boat is never easy and it is not always possible to find that "perfect" spot. Most installations become a compromise between the available space and the ideal for accessibility and short duct, cooling water and electrical power runs. As you make that compromise, it is important to recognize that the quality and thoughtfulness that goes into your installation can have a major impact on the performance of your air conditioner.

MOST COMMON INSTALLATION MISTAKES

Pay attention – Please don't make these common installation mistakes.

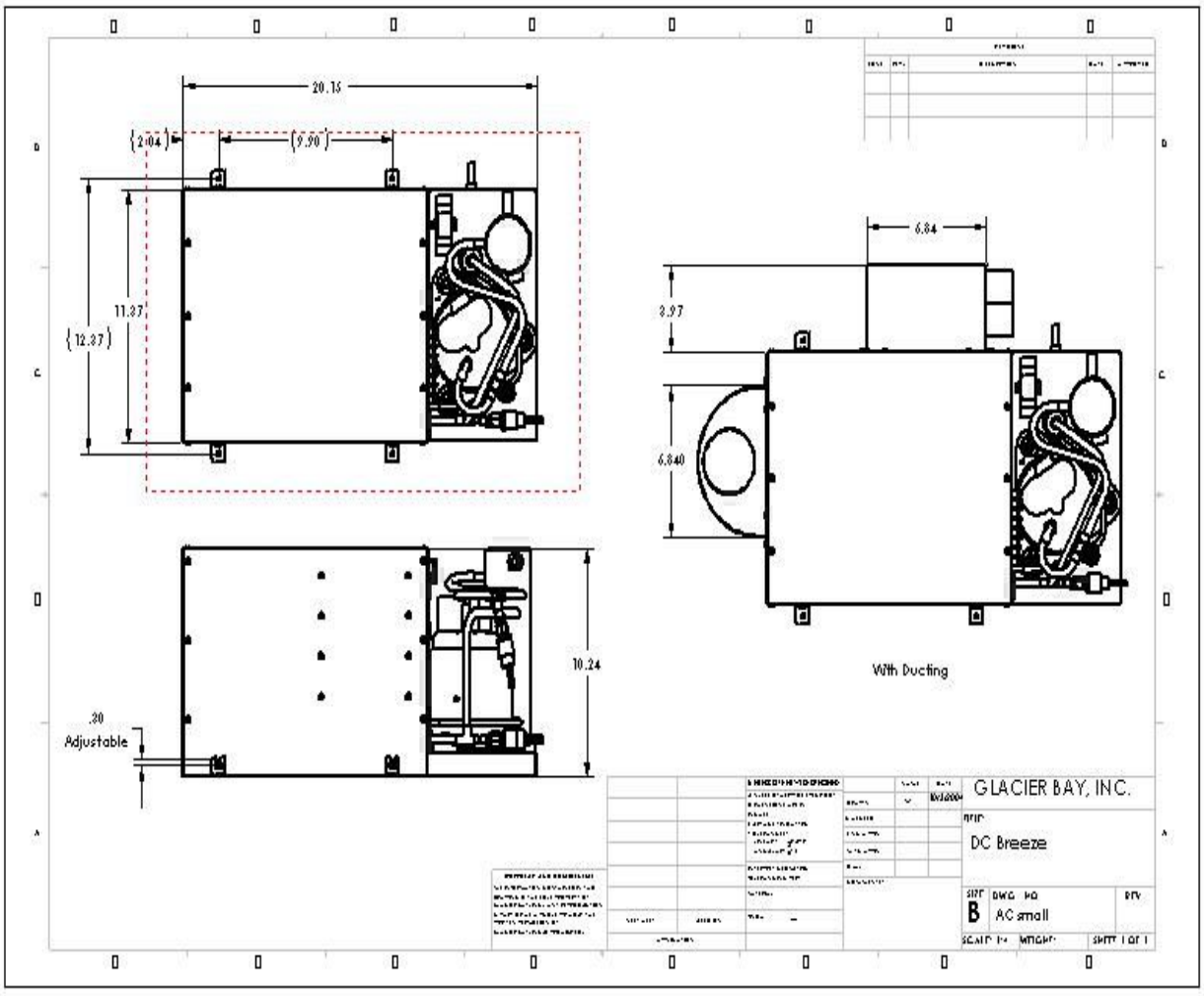
Component Locating Mistakes

- ●Mounting the condensing unit in such a tight space that there is no room for service access.
- ●Mounting the condensing unit in an area that is too hot or has too little ventilation.
- ●Mounting the water pump on a resonating platform so that it transmits noise to the cabin.

Electrical Connection Mistakes

- ●Making poor quality connections when lengthening the temperature probe wires for the optional digital control.
- ●Failure to properly crimp ring terminals or butt connections.

Here are the physical dimensions and mounting hole locations for your DC Breeze[tm] unit:



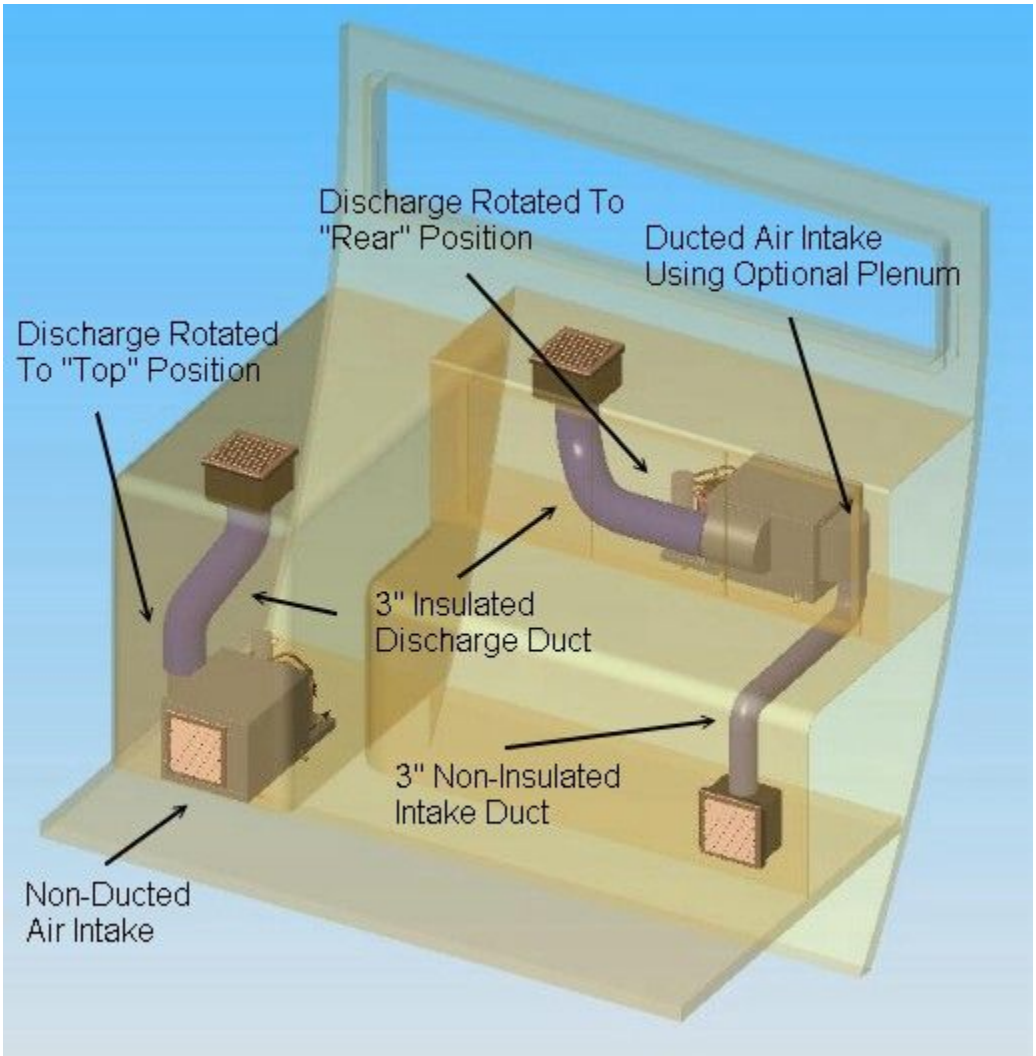
Mounting options

The DC Breeze is designed to give you many installation options. The outlet (discharge air) connection can be rotated to permit the duct to connect from the rear, front, bottom or top of the unity. In most cases, the intake (return air) would enter the front of the unit directly through an inlet grill mounted to a bulkhead (ductless intake). However, for installations where the unit needs to be mounted away from the bulkhead, an optional ducted intake plenum is available. Using the intake plenum, ducted return air can enter the unit from the right side, left side, bottom or top.

There is a removable foam filter in the DC Breeze air intake. This will have to be removed periodically for cleaning, when dust buildup begins to restrict air flow. It can be washed in soapy water and should be dried before replacement. If you install the intake plenum, plan your installation to allow for periodic removal so that the filter can be cleaned.

The illustration on the following page provides an example of two different installation possibilities. The unit on the left has been installed with the intake (return) air coming directly through a grill and bulkhead cut-out. The discharge has been rotated to the "top" position so the air is directed to a vent located directly above it. The second unit on the right incorporates the optional intake plenum which has been installed to permit an intake duct to be attached and enter from the bottom of the unit*. The discharge has been rotated to the "rear" position to permit a convenient duct run to a vent located behind the unit.

*Note: As with the discharge side, the intake plenum can be rotated to four different positions. This is done by removing the plenum mounting screws, rotating the plenum, and replacing the screws.



Some things to keep in mind when planning your installation:

●Minimize duct length - this maximizes air flow and cooling capacity.

●Plan for condensate draining - in humid conditions a considerable amount of water will be produced. This water can be drained to the low point of the bilge to be pumped out. It can also be routed to a separate holding container that is removable for emptying.

●Direct the airflow for maximum benefit and comfort - usually this means high and pointing across the widest part of the room.

●Raw cooling water routing - place the raw water pump near the through-hull and pump the water to the unit. The discharge can be above or below the waterline.

SELECTING LOCATIONS

A successful installation requires planning and forethought. The following are some things to keep in mind as you decide where you want to mount each component.

Condensing Unit

1. Mount it level - The condensing unit must be mounted so that it is level when the boat is at rest. It can be mounted either fore/aft or athwart ships. If on a sailboat, it can operate for extended periods of time at full heel as long as it is mounted to be level at rest. Also be sure to mount on a non-resonating platform.

2. Ventilate it - Ensure that the area is reasonably well ventilated particularly if the space is small. In these spaces it is important to have a means to permit heated air to flow out of the cabinet. Engine room locations are not advised unless it is very well ventilated. The temperature in the compartment must not rise above 130 degrees F (55º C)

3. Service it - Ensure access to those areas of the compressor unit which will require periodic maintenance. At a bare minimum this means access to the wiring and seawater tubing and some access to both sides to provide access to the base screws. It is also a very good idea to have enough access to reach the cover screws.

Raw Water Pump

Intake water access can be obtained by teeing into almost any existing raw water intake line, including head, galley, engine, water maker or deck wash. The intake should be located so that it can't cause the line to take in air during normal modes of operation. If the engine intake is used the tee should be made as close to the thru-hull as possible.

! Warning

Water hose should be heavy duty, certified for use below the waterline.

Hose or clamp failure could lead to sinking your boat.

The hose should be clamped with heat shrink hose clamps or double clamped with high quality 316 stainless steel hose clamps.

If you use transparent hose, it should not be exposed to light, since light can support the growth of algae inside the hose.

Leave room for a suitable seawater strainer. If one does not already exist it will have to be added. The strainer will need to be checked for periodic cleaning so make sure you can get to it.

The supplied pump may be mounted above or below the waterline.

The pump does create vibration when running. Do not mount it to any bulkhead or platform which may amplify pump noise into the cabin interior.

It is wise to place the water discharge above the waterline, so that a glance can show if the water is flowing properly, but not so high that it will create a disturbing splash.

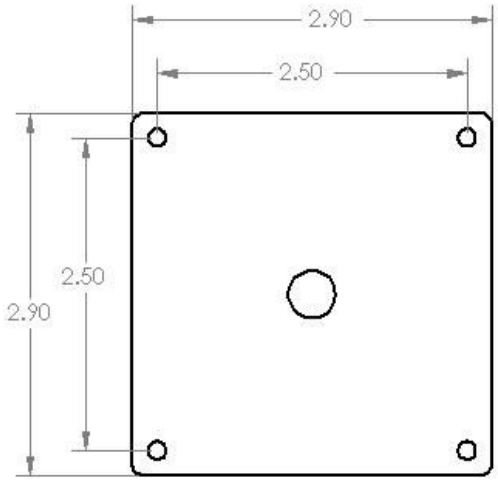
Standard Control and Digital Thermostat

The standard controller is a 4 position rotary switch (off, low, medium and high.) This controls both the compressor speed and the fan speed, which means that your DC Breeze will use less power at lower settings. The switch comes with short lengths of hookup wire soldered to the switch terminals, with butt connectors attached to the other end.

The following page has dimensions in inches for mounting the compressor and fan speed control switch:

2.90 in = 73.65 mm
2.50 in = 63.5 mm

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED



NEXT ASSY	USED ON	
APPLICATION		

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
SURFACE FINISH: 125
TOLERANCES:
LINEAR: ±.010
ANGULAR: ±1°
MATERIAL --
FINISH --
DO NOT SCALE DRAWING

	NAME	DATE
DRAWN	MI	1/4/2006
CHECKED		
ENG APPR		
MFG APPR		
Q.A		
COMMENTS:		

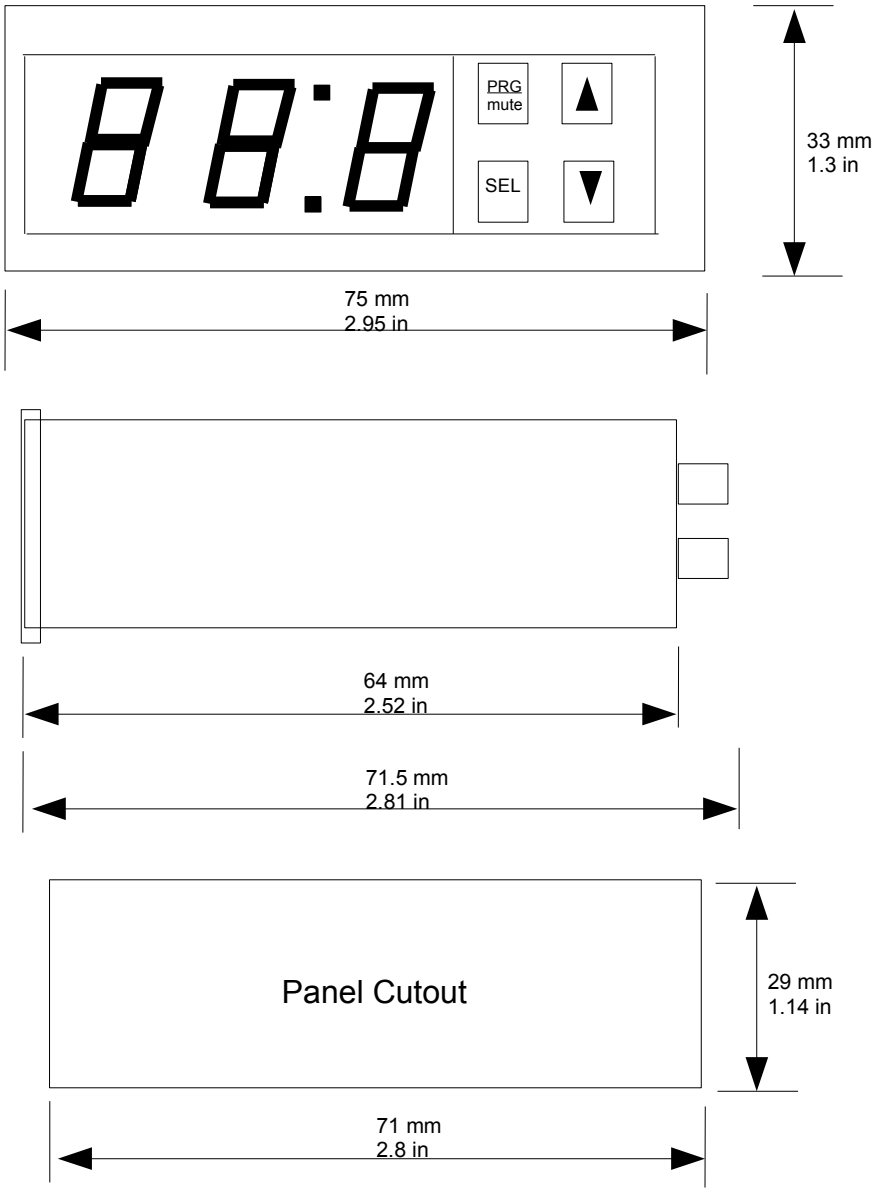
GLACIER BAY, INC.

SIZE	DWG. NO	REV
A	controll panel	
SCALE: 1:1	WEIGHT	SHEET 1 OF 2

Optionally, a digital thermostat may be purchased that will turn the DC Breeze on and off to maintain a set temperature. It may be mounted any distance from the DC Breeze. The digital controls are of the flush-mount type. For panel (or bulkhead) mounted installations it will be necessary to cut a rectangular hole into which the control is mounted. When such a hole is not desired or possible, a box can be constructed to hold the control out from the surface.

Digital Control

Mounting Dimensions



COMPONENT INSTALLATION

Installation of the Condensing Unit

Materials Required

- Stainless steel or bronze wood screws

Tools Required

- Marking pencil
- Tape measure
- Screw driver
- Drill and bit

Locating the Blower/Condensing Unit

The DC Breeze condensing unit is a single unit designed to be used in both ducted and nonducted installations. Use a screwdriver to attach the angled mounting pieces included in a separate bag. Use wood screws or bolts to secure the condensing unit in the selected location.

Physical location

There are two theories on the placement of AC blowers on board. One is that since hot air rises, it is usually desirable to try to mount the blower (intake and discharge) as high in the boat as possible. On the other hand, most boats have a great deal of natural air circulation at the top of the cabin and thus blowers placed high can become very inefficient. In our experience there is truth in both of these positions and it really comes down to the layout of the particular vessel. Many times an “ideal” position simply isn’t possible due to space limitations. While many owners prefer to adapt existing cabinets and storage spaces, don't rule out the construction of custom enclosures for your system. This can expand your options when it comes to placement.

Remember to consider the following items when choosing your location:

1. Condensate drain - Condensation can produce several quarts of water per hour. Most owners of fiberglass vessels route the condensate tubes directly into the bilge. Some owners, particularly those with wooden and metal boats, will want to use a separate, easily emptied container.

2. Air throw – The DC Breeze[tm] has an average air throw of about 12 ft. (3.7 m) in most nonducted installations. A standard adjustable discharge grill can be obtained to allow this flow to be directed (up and/or down) for optimum circulation.

TYPICAL PLACEMENT LOCATIONS FOR THE DC BREEZE$_{tm}$

Ducted vs Non-ducted Installation

DC Breeze$_{tm}$ blower units take air in through the evaporator coil before discharging it out the vent on the side. The air intake may be ducted or non-ducted as required. Since lengthy ducting can significantly reduce air flow (and cooling capacity) a non-ducted installation is always preferred when possible. The minimum non-ducted intake grill size is 6 ¾ x 6 ¾ inches. (171 mm x 171 mm)

Wiring the Electrical Connections

Materials Required

- Tinned copper wire
- Rosin core solder
- Heat shrink tubing
- Cable ties w/screws
- 60 amp breaker (12 volts) or 30 amp breaker (24 volts)

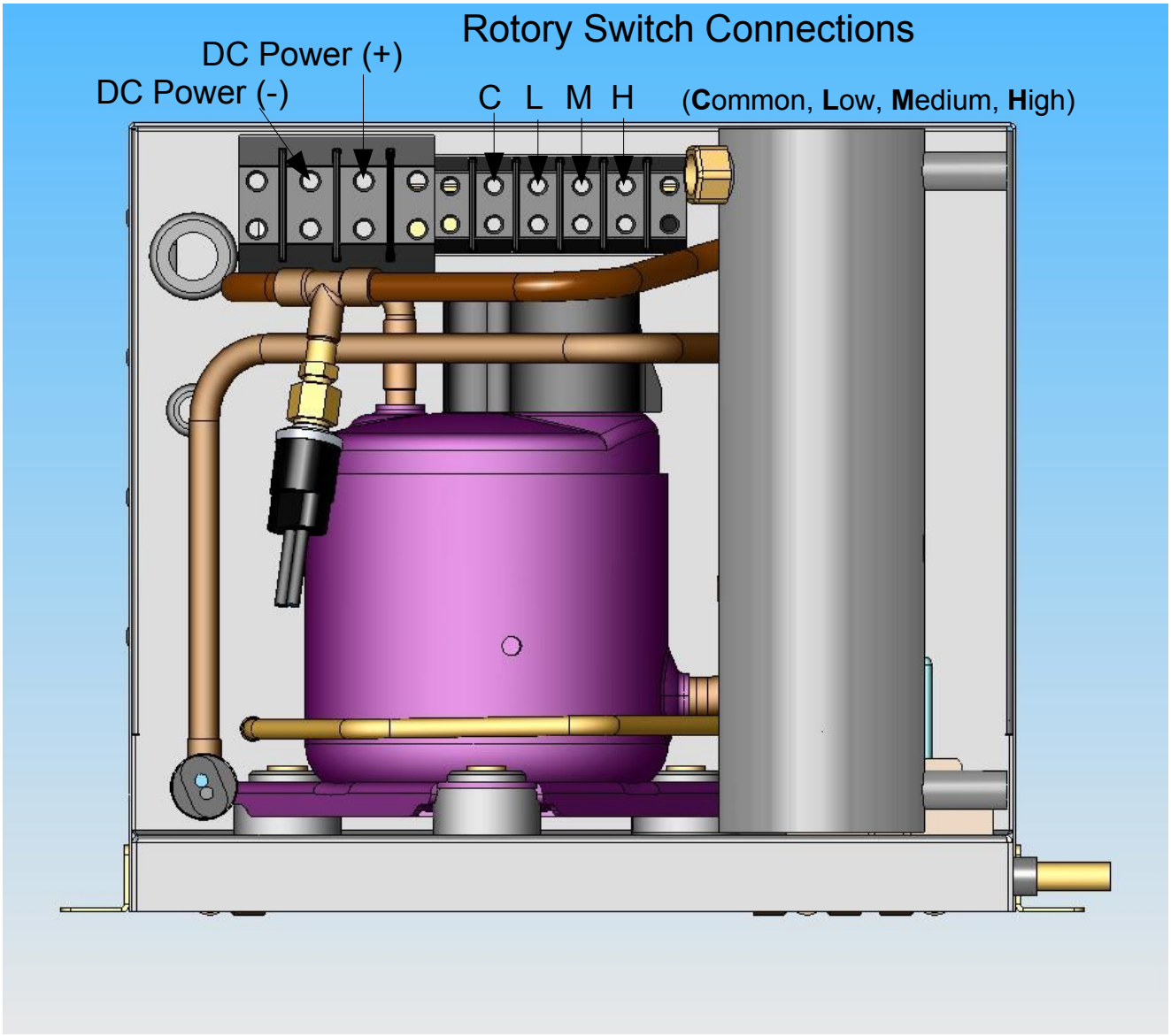
Tools Required

- Screw driver
- Wire cutters/strippers
- Crimping tool
- Soldering iron
- Lighter or heat gun

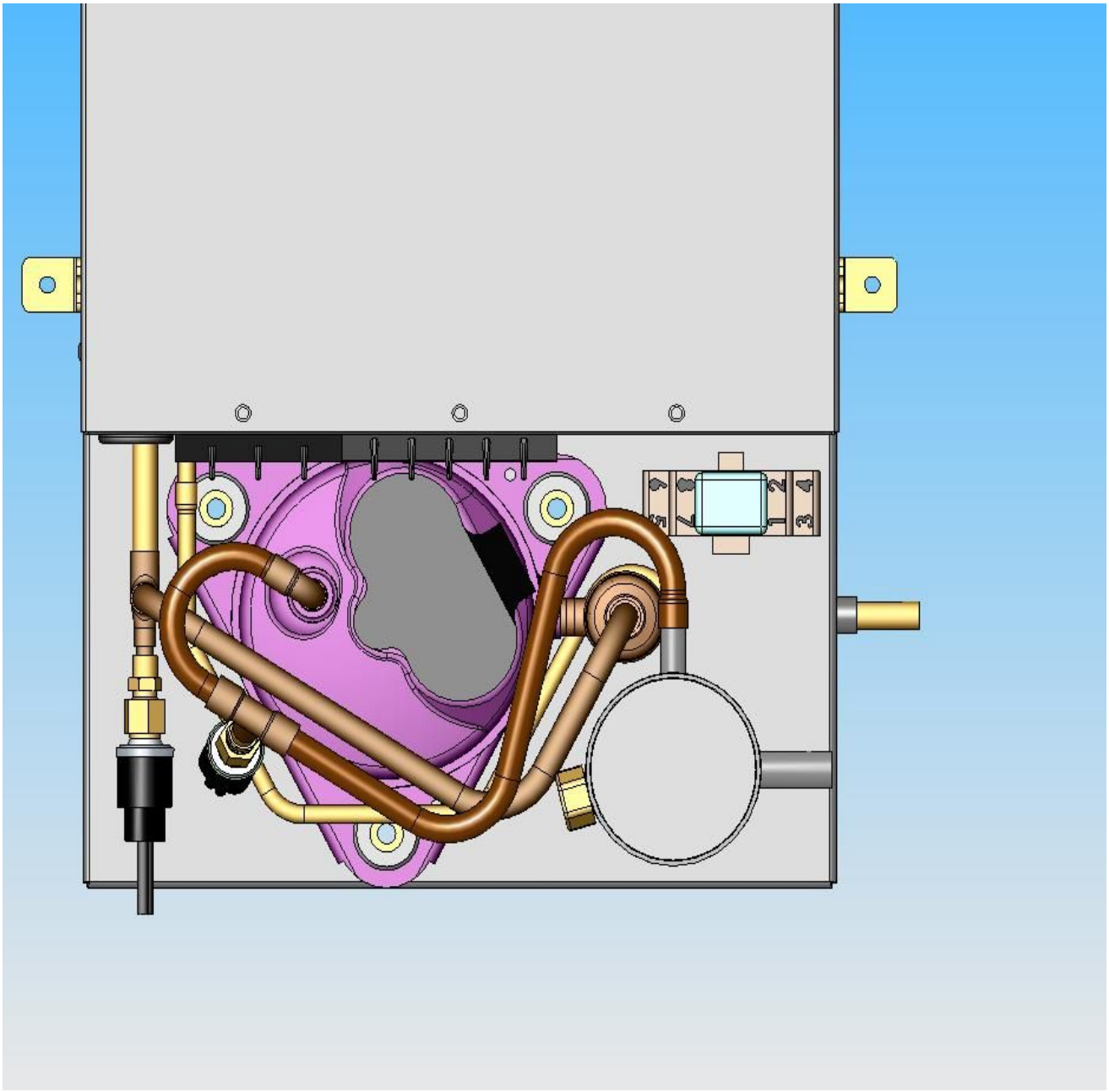
With all components mounted it is time to make the electrical connections. All wire sizes are given in “American Wire Gage” (AWG). Longer runs (always use the combined length of the positive and negative wire) will require heavier wire. Installers outside the US are reminded that this is not the same as metric wire sizes which are given in mm. To retain the reliability inherent in your Glacier Bay system it is important that all connections are done in proper fashion using a high strand count 100% tinned marine-grade wire and using marine grade crimp type connectors. The plastic covers on the supplied in line crimp connectors are adhesive lined heat shrink material, and should be shrunk with a heat source after making the crimps.

When wiring the electrical connections it is important to ensure that all wires are correctly fastened at their proper terminal locations.

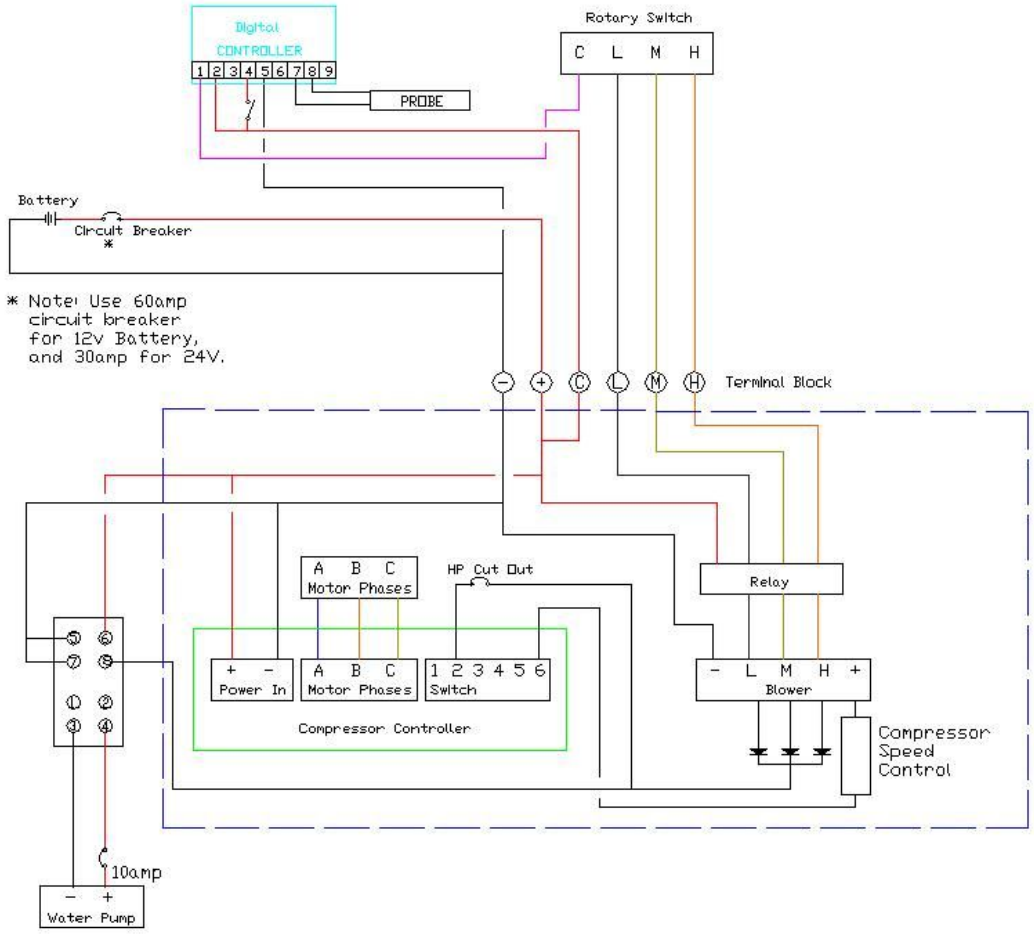
The wire terminals appear as follows:



The view from above shows the water pump connections:



They should be wired according to the following diagram:



Maximum Current Draw for Individual Components

The wiring diagram included above and accompanying text information for your system provides recommended wire sizes and circuit breaker capacities for your system configuration.

Find the maximum current draw from the list below and use the wire sizing table shown on the next page to identify the correct wire size. The DC Breeze[tm] draws 48 amps at 12 V while the air conditioning is running in high speed under the rated conditions. Remember that the wire length is always considered to be the total distance from the power source to the device and back again. The table below gives the current draws which should be considered when sizing the wire runs. The DC is rated at 12 volts. Multiply by .5 for 24v.

- DC Breeze[tm] Compressor (DC) - 50 amps
- Water Pump (DC) - 10 amps
- DC Breeze[tm] Internal Fan - 2 amps

Basic Electrical Wiring

Closely follow the wiring schematic and written identifications of the wiring connections. In planning your wiring remember:

1. Use only 100% tinned stranded copper wire of the recommended AWG size.
2. Always use the recommended size circuit breaker on the main power line.
3. The supplied butt splices should be crimped and the heat shrink plastic cover sealed with a heat gun or other heat source.
4. When making connections to the terminal block, be sure to tighten the clamping screws firmly. (All high-power connections should also be rechecked for tightness at regular intervals)

Wire Size

It is important to use the correct wire type and size. In high-current DC systems installers tend to underestimate the size of wire needed. Refer to the tables on the following pages for a general reference when selecting the wire size as a function of length and current. The table calls out wire size by AWG gages. AWG is used in the United States while Metric diameter is used in the rest of the world. For convenience, an AWG - Metric conversion table is also provided.

REQUIRED WIRE SIZE BY RUN LENGTH & CURRENT (AWG)

AMPS	WIRE LENGTH -SOURCE TO LOAD AND RETURN FEET (METERS)						
	10 (3.0)	20 (6.1)	30 (9.1)	40 (12.2)	50 (15.2)	60 (18.3)	70 (21.3)
5	18	14	12	10	10	10	8
10	14	10	10	8	6	6	6
15	12	10	8	6	4	4	2
20	10	8	6	6	4	4	2
30	10	6	4	4	2	2	1
40	8	6	4	2	2	1	1/0
50	6	4	2	2	1	1/0	2/0
60	6	4	2	1	1/0	2/0	3/0
70	6	2	1	1/0	2/0	3/0	3/0
80	6	2	1	1/0	3/0	3/0	4/0

AWG TO METRIC WIRE SIZES

AWG Ga.	METRIC (MM^2)		AWG Ga.	METRIC (MM^2)
0000 (4/0)	11.7		8	3.3
000 (3/0)	10.4		10	2.6
00 (2/0)	9.2		12	2.1
0 (1/0)	8.3		14	1.6
2	6.5		16	1.4
4	5.2		18	1.0
6	4.1			

SYSTEM CONTROLS AND OPERATION

A Control Overview
The Glacier Bay system is available with two different controls - the standard compressor and fan speed control and the (optional) digital controller.

Standard Control
The standard controller is a 4 position rotary switch (off, low, medium and high.) This controls both the compressor speed and the fan speed. Your DC Breeze will use less power at lower settings. The switch comes with short lengths of hookup wire soldered to the switch terminals, with butt connectors attached to the other end. The butt connectors are sized to accept 18 to 22 gage wire and the wire can be extended to any length. Control mounting diagrams are found on pages 14 and 15.

To activate the DC Breeze simply turn the control knob from Off to one of the three speed positions, Low, Medium and High.

Digital Control
The digital control features a green LED digital display, programming keys and mode indicator light. It works with the standard control to turn the DC Breeze on and off according to the programmed temperature.

Extending the Temperature Probe Wire for the Digital control option.
The temperature probe comes with a 59" (150cm) length of wire attached. This can be extended to any length using #18 AWG tinned wire. If the wire is extended, the connections MUST be soldered and sealed with heat shrink tubing.

DC Breeze[tm] Digital Control Settings
The digital control offers many hundreds of programming options, the vast majority of which have no application in any particular system. Generally, it is only the “setpoint” and “differential” setting that the DC Breeze[tm] operator needs to be familiar with.

The DC Breeze[tm] will run until the temperature reaches the setpoint temperature, and then switch off until the air warms up the number of degrees specified by the differential setting.

Functions
Mode Indicator -Blinks when it has reached the programmed upper temperature limit.

“SEL” Key - Enters the programming mode for the “set point” setting
(The “set point” is the temperature at which the compressor turns “OFF”)

“PRG” Key - Enters the programming mode for the “differential” setting.
(The “differential” + “setpoint” is the temperature at which the compressor turns “ON”)

“Arrow” Keys - Used to scroll numbers and input numbers.

To alter the **“setpoint”** (ie. The DC Breeze^{tm} turns OFF at this temperature)

- ●Press and hold down the “SEL” Key until “St 1” is displayed - then release the Key.
- ●The number flashing is the current setpoint setting. To change it, use the Arrow Keys to scroll to the desired number.
- ●Press “SEL” then “PRG” to retain the new setting.
- ●The factory default setting for “St 1" is 74°F (23°C)

To alter the **“differential”** setting (ie. The DC Breeze^{tm} turns ON at the “differential + setpoint”)

- ●Press and hold down the “PRG” Key until “P 1" is displayed then release the Key.
- ●Press the “SEL” Key to display the current differential setting.
- ●Use the ARROW Keys to scroll to the desired number.
- ●Press “SEL” then “PRG” to retain the new setting

- ●The factory default setting for “P 1" is +6ºF (3ºC)

List of all settings: While they may not be required, the following paragraphs offer a description of some other less often used control settings.

To access additional control settings, one must first force the control into a “Special Programming Mode”. To enter this mode and re-program individual parameters:

1. Press “PRG” and “SEL” simultaneously until “0" appears (it will start flashing).
2. Use the “ARROW” keys to scroll to “77".
3. Press “SEL”. “C 0" will now appear and begin flashing.
4. Use the “ARROW” keys to scroll to the desired parameter (as identified below).
5. When the parameter is displayed, press “SEL” to show the currently programmed setting.
6. Use the “ARROW” keys to alter the parameter setting.
7. Press “SEL” first, then “PRG” to retain the new setting.

Most Common Settings:

For DC Breeze^{tm} Digital thermostats

Change “C 18” from “0” to “1” (if you want your control to display the temperature in ºF rather than °C.).

Parameter “P 14" - Calibration Offset (Default =”0.0”)
Introduces an error offset to the temperature probe.

Parameter “C 17" - Probe response time (Default = “5”)
Changes probe response time for noise filtering

Parameter “C 18" - Display Units °C or °F (Default = “1”)

Changes units to degrees Centigrade (“0”) or Fahrenheit (“1”). Don’t forget, the “setpoint” and differential” values must also be programmed appropriately.

Parameter “P 25" - Low Alarm Limit (Default = “-50”)
An audible alarm is sounded if the temperature falls to this limit.

Parameter “P 26" - High Alarm Limit (Default = “90”)
An audible alarm sounds if the temperature rises to this limit.

Parameter “P 27"- Alarm Hysteresis (Default = “2”)
Audible alarm hysteresis (differential).

Parameter “P 28" - Alarm Delay (Default = “60 min.”)
Time at the alarm limit before the audible alarm is sounded.

Control Error Codes
There are error codes which will be displayed to indicate specific FAULT conditions. They are:

“Er0” - The temperature probe has either a “short” or “open” circuit. Check the wiring. Using an ohmmeter, the resistance on the temperature probe should read 10k ohms @ 25º C (77º F).

“Er2” - Memory Error. Follow the procedures outlined in “Re-programming to Factory Default Settings”, below. If this does not resolve the problem the control must be replaced.

“Er4” - High alarm. Audible alarm sounds. The temperature has exceeded the value set in parameter “P 26” for a period of time exceeding the value of “P 28”.

“Er5” - Low alarm. Audible alarm sounds. The temperature has fallen below the value set in parameter “P 25” for a period of time exceeding the value of “P 28”.

Re-programming to Factory Default Settings

Occasionally, it may become desirable to completely reset the control to its factory defaults and start your tuning from a “clean slate”. This might be the case if someone unfamiliar with the correct programming procedure has been changing settings at random. Because of the large number of settings which could have potentially been changed, it is likely to be easier to re-set everything to known values and then change only what you need.

Re-programming the digital control is a three-step process. The first step is to “clear the settings”, the second step is to “set the mode” and the third step is to “program in values” to particular parameters.

1. “Clearing the settings”. To clear the settings:
    1. Turn off the power to the control (display goes dark).
    2. Turn on power to the control while holding down “PRG”.

Your control settings will now be clear. The temperature will be displayed in ^{0}C but the control will not function properly.

2. “Setting the mode”.
To set the mode:
    1. With power on to the control (display illuminated), press “PRG” and “SEL” simultaneously until “0” is displayed (it will start flashing).
    2. Use the ARROW” keys to scroll to “22“.
    3. Press “SEL” (The display should now show “C 0”).
    4. Press “SEL” to show the currently programmed setting.
    5. Use the “ARROW” keys to alter the parameter setting. (set to “1” for DC Breeze^{tm} thermostats).
    6. Press “SEL” first, then “PRG” to retain the new setting.
    7. Turn off the power to the control (very important).

Turn the power back on to the control. The “mode” is now correctly set.

3. “Program in the values”. This step consists of programming A) the control setting parameters and B) the differential and setpoint. Note that these are two separate steps. The differential and setpoint can normally be adjusted without any of the other steps.

TROUBLESHOOTING

There are several safety systems your Glacier Bay DC Breeze^{tm} system that are designed to protect the equipment and also maximize user safety. Most of these will result in a system shutdown. An understanding of each system will assist in troubleshooting.

Main circuit breaker

The first of these is the main circuit breaker that is supplied by the installer when the system is installed. The location may vary but it is often installed in the boat’s main electrical panel.

Low voltage cut-out

The DC Breeze controller is designed to shut down the system when the voltage reaches approximately 11.7 volts, to avoid discharging your batteries so low that they could be damaged. Clean terminals and larger conductors will result in longer usable run time.

High pressure cut-out

There is a high pressure cut-out that will shut the system down if pressure rises above 350

psi. The typical symptom for a tripping high pressure cut-out switch is that the system will run for a minute or two, and then shut off. If you have a digital display, the display will go dark. After a few minutes the system will start up again as the pressure bleeds off to 250 psi, and the cycle may repeat.

The most common cause of high pressure tripping is inadequate water flow. The first thing to check for is a clogged water strainer in the through hull or sea chest. Make sure that the pump is pumping a good supply of water. If the pump is not pumping a significant amount of water, it may need to be renewed.

Another cause of high pressure cut-out tripping could be an over charged system. Over charging can cause high the pressure cut-out to trip, since this can cause liquid refrigerant to back up in the seawater condenser. Since the system comes pre-charged from the factory, this would be unlikely to occur unless additional refrigerant were added during a service.

Temp sensor on motor controller heat sink
There is a temp sensor on the motor controller heat sink that will shut the system down if the temperature rises too high. The most likely cause is poor ventilation of the space where the condensing unit is installed. Ensure that the temperature of this space remains below 130 degrees F (55 C).

Temp sensor on motor controller heat sink
There is a temp sensor on the compressor case that will shut the system down if the temperature of the compressor rises too high.

Locked rotor shutdown software
If the compressor is unable to start due to lack of motor rotor sync on startup it will keep trying several times with a characteristic rising “chirp” sound, before giving up.

Swap-Out and RMA approval
If the troubleshooting procedures above do not resolve the issues, then contact your Glacier Bay, Inc. representative.

Spare Parts
DCZINC DC Breeze Condenser Zinc
DCBDTU: DC Breeze Digital Thermostat Upgrade
DCDUCT: DC Breeze Non-Insulated Ducting (per ft.)
DCDUIN: DC Breeze Insulated Ducting (per ft.)
DCGRBK: DC Breeze Grill and Register, Black
DCGRWH: DC Breeze Grill and Register, White
DCYDBK DC Breeze Y Duct splitter in black with three hose clamps
DCPLEN: DC Breeze Plenum
DC12PS: 12 V Whale 2.2 GPM Universal Pump UP0815B
DC24PS: 24 V Whale 3.2 GPM Universal Pump UP1225

GLACIER BAY, INC.
LIMITED THREE YEAR WARRANTY

Glacier Bay DC Breeze[tm] air conditioning systems are warranted with the following conditions:

The warranty covers defects in materials and workmanship causing a system failure or serious malfunction for a period of three (3) years from the date of purchase. The warranty is limited to the actual cost of the defective component(s) and does not include coverage for any labor cost incurred in the removal or re installation of such component(s). Shipping costs are not included. Warranted components shall be repaired or replaced at the sole discretion of the manufacturer. This warranty does not include failure due to:

- improper installation
- damage from lightning or other sources of excessive voltage
- abuse, misuse or improper maintenance/service
- rust/corrosion due to water exposure

Expressly excluded from this warranty is:

- cost for any independent service, repair or troubleshooting
- shipping expenses including loss or damage
- sea water pump

Glacier Bay, Inc. shall not be liable for consequential damages resulting from the use of this product. Coverage for any incidental damage to vessel, equipment or supplies caused, either directly or indirectly, by the failure of any Glacier Bay component is specifically excluded. This warranty is valid only for complete systems and does not include Glacier Bay equipment used in conjunction with system components supplied by other manufacturers. The coverage herein described constitutes the whole, no other warranty written or verbal is authorized.

Your Rights Under this Warranty

Customers seeking coverage under this warranty have the right to choose one of the following:

Option 1 - “Repair” of the customer’s equipment at a factory authorized service center.

With the “Repair” option, your original equipment is repaired at the factory or a factory authorized service center and returned to you upon completion. You, or an agent you appoint, remove the equipment from the vessel and returned to us prepaid and fully insured. (Note - Glacier Bay is not liable for shipping loss or damage). After the equipment is examined and tested, you will be notified of the cause of the problem and a finding of whether the cost of the repair is covered under the terms of this warranty. If warranty cover is found, the cost of all in house service labor and parts will be covered. If warranty coverage is declined, a quotation

will be provided and you may choose to have the unit repaired at your expense or returned to you unrepaired. Whether or not the unit is repaired under this warranty, you will be responsible for the cost of removal and replacement of the equipment on your vessel.

Option 2 - "Replacement" with a functionally identical new or factory-refurbished system.

The "Replacement" option offers you the opportunity to get up and running without waiting for equipment repair. In this option, a functionally identical new or factory-refurbished (at Glacier Bay's sole option) will be shipped directly to you before you remove your defective component. Because no determination of warranty coverage has yet been made, you will be asked to sign a purchase agreement and authorize a charge to your credit card for up to the retail purchase price of the component plus shipping costs. The card will only be charged for shipping costs. The value of the component will not be charged for 15 days (or longer if prior arrangement is made). Upon receipt of the new component, you or your appointed agent, swap out the problematic component for the new one. You then return the old component to us prepaid and fully insured (Note - Glacier Bay is not liable for shipping loss or damage).

Upon receiving the old equipment, it will be examined and tested. You will be notified of the cause of the problem and a finding of whether the cost of the repair is covered under the terms of this warranty. If warranty cover is found, there will be no additional charges to your credit card and the matter considered closed. If warranty coverage is declined, a quotation will be provided and your credit card charged to bring refurbish the unit to "like-new" standards. Whether or not warranty coverage is found, additional cost may be incurred to improve the appearance of the unit if it has suffered cosmetic damage. In all cases, you will be responsible for all shipping costs and the removal and replacement of the equipment on your vessel.

To Obtain Warranty Service:

Decide which of the two options you prefer. Contact Glacier Bay for an RMA number by calling the sales department at 510-437-9100 or emailing warranty@glacierbay.com. Do not return anything to us without our RMA number clearly written on the outside of the shipping container. Once the RMA number is obtained, return the defective component(s), properly packaged and postage paid to Glacier Bay, Inc., 2845 Chapman St, Oakland, CA 94601. Glacier Bay is not responsible for loss or incidental damage during shipping. Write the RMA number on the outside of the box. When obtaining an RMA number you will need to provide the purchase date, model and serial number, detailed explanation of the problem (reason for return), place of purchase along with your name address and telephone number.

The issuance of an RMA number or an agreement to accept a product for return does not constitute a decision or commitment to provide warranty coverage.

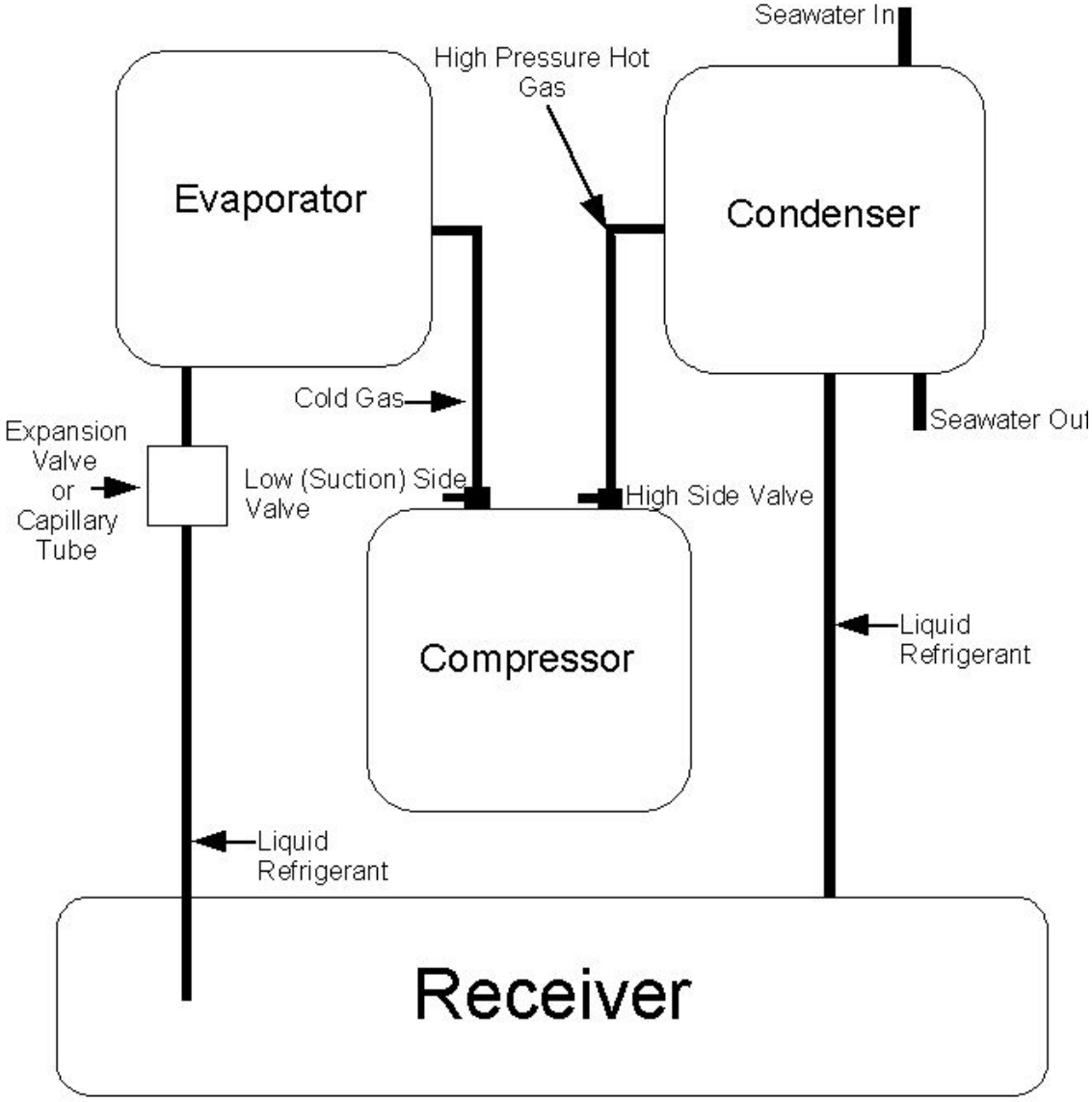
To obtain warranty service:

Contact Glacier Bay for an RMA number by calling the sales department at 510-437-9100 or emailing warranty@glacierbay.com. You MUST have an RMA number to return any

component. Once the RMA number is obtained, return the defective component(s), properly packaged and postage paid to Glacier Bay, Inc., 2845 Chapman St, Oakland, CA 94601. Glacier Bay is not responsible for loss or incidental damage during shipping. Write the RMA number on the outside of the box. When making a warranty claim be sure to include evidence of purchase date, place of purchase, model and serial number along with your name, address, and telephone number.

Appendix

Mechanical Refrigeration Cycle



Your DC Breeze[tm] is an efficient vapor compression cycle mechanical refrigeration system.

1. A Masterflux variable speed brushless DC motor drives a rotary piston compressor to compress refrigerant vapor, and sends the hot, dense gas through the high side valve to the cupronickel seawater condenser.

2. The condenser contains tubing which is surrounded by the refrigerant gas. Seawater is pumped through this tubing. The seawater is cooler than the refrigerant gas. This allows heat to flow from the refrigerant to the seawater, and the warmed seawater is returned overboard. The refrigerant gas condenses to liquid as it gives up its heat.

3. The liquid refrigerant flows into the receiver and through copper tubing to the capillary tube at the beginning of the evaporator. This completes the high pressure portion of the system.

4. The pressure drops at the exit from the capillary tube and the liquid refrigerant boils inside the evaporator, changing to gas and adsorbing heat from the air surrounding the evaporator. Moisture in the air condenses and falls to the bottom of the condensate tray and out through the drain outlet. The cool, dry air is directed by a fan into the cabin.

5. The cold, low pressure refrigerant gas returns to the compressor through the low side valve and the cycle begins again as long as the compressor is running.