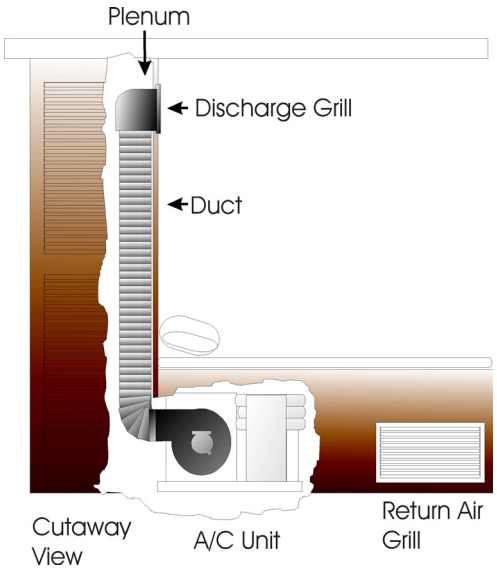
Marine Air Conditioning

What is a Marine Air Conditioner

The principle behind air conditioning is the movement of heat. An air conditioner pulls the heat from the air by transferring the heat in the cabin to the refrigerant gas within the air conditioner. A marine air conditioner then transfers the heat from the refrigerant gas to the sea water. The process can also be reversed, the air conditioner can pull heat from the sea water and transfer that heat to the cabin. This is called reverse cycle air conditioning.



Types of Air Conditioners

There are three basic types of marine air conditioners. Self Contained Direct Expansion Systems (**DX**), Remote Systems (**Split Gas**), and Tempered Water Systems (**Chilled Water**). Use the size and layout of the boat to determine which system is right for you.

•Self Contained **DX** systems are typically the best choice for boats up to 40 feet, due to their lower cost and ease of installation. A single unit can cool one or multiple areas with ducting and wyes to save space and cost. The unit itself is larger however due to the air handler and cooling unit being on one "skid". Also, since the compressor is mounted on the same unit these systems are somewhat noisier than Split Gas or Chilled Water Systems.

•**Split Gas** are often seen on boats up to 80 feet. The condensing unit of a remote system is generally installed in an engine room while the air handlers are mounted in the areas needing cooling. The air handlers are connected to the condensing unit with copper lines. The maximum distance of the line is 50 feet. Remote systems usually cost more to install due to high component costs and the requirement that a certified technician must "charge" the refrigerant system. The advantage to a remote system is that the units take up less space in living areas and are more quite because the compressor is mounted remotely where it is less likely to be heard.

•For larger boats, a **Chilled Water** System uses the refrigerant to chill coolant water which is then pumped throughout the boat to air handlers to distribute cool air. There is no limitation to the size a vessel this type of system is used on or the length of run between the cooling unit and the air handler. Tempered Water Systems have the added benefits of flexible load management and often reduced peak electrical load.

WHY THE RIGHT SIZE IS IMPORTANT

Many factors are involved when choosing the right air conditioner for a particular boat. The boat's size, insulation, and available electrical supply are all considerations that need to be taken into account. Where the owner intends to take the boat is also a factor. An air conditioner that is too small will run continuously and still not cool the area adequately. Too large of an air conditioner will draw unnecessary power and cycle excessively.

SIZING A BOAT

Considering these issues, choosing the right air conditioner is obviously very important. When deciding which air conditioner to purchase you first must **measure the square footage** of each area you need to cool. This measurement will then be **multiplied by a load factor** taking into consideration how well insulated the area is, how much exposure the area has (e.g., the many windows of a flying bridge area will require a larger air conditioner than a stateroom "down below" due to the amount of surface area affected by the outside heat). The other consideration to account for is the climate that the boat is intended for. A boat in a temperate climate will require less BTU's to cool than a boat in a tropical climate. We will define a **Temperate Climate as: 95°F air, 85°F water, moderate humidity**. **Tropical Climate is defined as: 105°F Air, 95°F water, high humidity.** Use the chart below to determine the correct size BTU air conditioner for the intended space. Multiply the ft^2 x the appropriate load factor **(BTU=Load Factor x ft^2)**.

LOAD FACTORS, MULTIPLY X SQ. FT. TO ESTIMATE BTU REQUIREMENTS

Climate	Below Deck	Mid Deck	Above Deck
Temperate	60	90	120
Tropical	80	120	150

A single unit can be used to air condition multiple areas. Keep in mind that the typical maximum ducting run is 15 ft. If there are multiple bends and restrictions in the duct run the maximum length should be reduced. Improper ducting can lead to problems. Ensure good air flow! Remember if you use a single unit to cool multiple compartments consider which area monitored by the temperature controller and which areas will be manually controlled by opening/closing vents.

By selecting the right air conditioner for your application the system will work well and the owner will be happy.

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Location

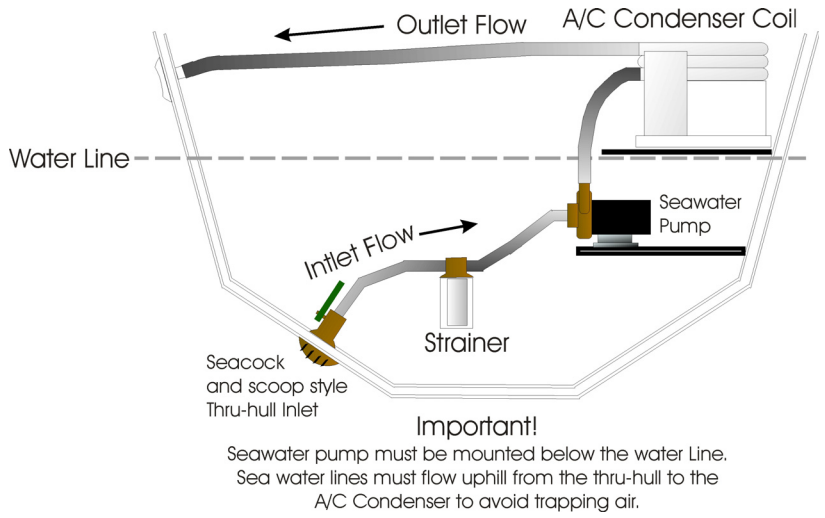
The air conditioner should be located in an area with proper return air flow to and from the compressor (see chart below). Improper air flow will lead to problems with icing or poor air circulation. Discharge should be located to a high point in the cabin as cool air is "heavier" than warm air. Ensure that their is sufficient space around the unit to service or remove the unit if necessary.

Typical Duct and Grill Sizing

Capacity (BRU/hr)	Duct (in)	Return Air Grill (sq in)	Discharge Grill (sq in)
5,000	4	60	30
7,000	5"	80	45
10,000	6"	100	60
12,000	6"	130	70
16,000	7"	160	80
18,000	7"	200	100

Seawater Components

It is typically recommended that each unit use an independent circulation pump. As a general rule of thumb you will need a circulation pump that move 250 gallons per hour per ton of air conditioning (one ton is 12,000 BTU's). You will also need a properly sized sea water strainer, thru-hulls, sea cock, and supply/discharge hose (see diagram below). If a single pump is used for multiple units a pump relay box and manifold will need to be employed.



Electrical Requirements

All marine air conditioners run on AC (alternating current) power. Most units are available in 115V, 230 V 60hz., and 230V 50hz. Large units are also available with 3-phase compressors.

The product specification sheets should show both running and starting amp draws. Ensure you have enough power to start the compressor. Starting (locked rotor) amp draw is typically 2 to 3 times the running amp draw. There are means to accommodate high starting amp draws if power is not available. Ask Sure Marine for details if you are in need of help.

Follow the manufacturer's recommendations in regards to wire and breaker size. Wiring should be done by a qualified technician and abide by ABYC recommendations.

Load Calculation Table

Cabin	Length (ft)	Width (ft)	Area (sq ft)	Factor	Capacity (BTU/hr)

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