

Frigoboat keel cooler systems



What is a keel cooler?

On large commercial & fishing boats, the cooling water from engines, generators, etc., is often circulated through pipes that are mounted on the underside of the boat, below the waterline. This gives a very efficient method of cooling without having to pump raw water into the boat & then discharge it. We have borrowed the term "keel cooler" to describe a unique fitting that is installed through the bottom of the boat, below the waterline, with the boat out of the water.

How does the Frigoboat keel cooler work?

The keel cooler condenser fitting has two copper tubes projecting from it, & these are connected together through a cupro-nickel loop that is cast into the sintered bronze. Through the action of the compressor, the hot, high pressure refrigerant gas is circulated through the keel cooler where it is cooled & condensed into a cool, high pressure liquid that is then fed to the evaporator (the part that is in the insulated box). Here it is subjected to a large pressure drop & evaporates (boils) at a very low temperature before being fed back to the compressor as a cool, low-pressure gas.

Why is it more efficient than other systems?

In small, 12v dc refrigeration systems, the most popular method of cooling & condensing the refrigerant gas is with an air cooled condenser coil, usually with a fan forcing air over it. This is also common in domestic refrigerators, & the efficiency depends on the temperature of the cooling air. The system is essentially removing heat from the insulated box & giving it up to the cooling air, & if an air cooled condenser is installed in an enclosed space, the air will be re-circulating & getting hotter & hotter, making the system less & less efficient.

A water cooled condenser is generally regarded as being at least 20% more efficient than an air cooled equivalent, & so, as a boat is usually sitting in water, it would make sense to substitute a water cooled heat exchanger for the air cooled version mentioned above. All that is then needed is a pumping system to bring water into the boat, through the condenser coil, & then overboard. This will result in a far more efficient system, but it has drawbacks, the most significant & obvious being the 1 amp (typical at 12v dc) current draw of the pump. Pump failure, clogged strainers, noise & inconvenience are some other negative factors of a pump-fed, water cooled system, so if we replace it with a keel cooler we now have the most efficient system of all, together with minimum current draw (compressor only), almost silent operation, unequaled reliability, & mechanical simplicity.

Will it work in tropical waters, & will I be able to keep ice cream & make ice for drinks?

The Frigoboat keel cooler has been carefully designed & tested to work in conditions exceeding those found in the harshest of environments, & the warmest of waters. If you have not seen the working keel cooler system at boat shows, you will have missed the opportunity to sample rock-hard high-fat ice cream. This is being kept in a cooler with only 1" insulation that is cooled by an off-the-shelf 12v keel cooler system running in 85 deg F or higher water temperature, & drawing just over 3 amps! There are several ingenious ways to make ice, & kits are available.

How much current will it draw?

This is a very difficult question to answer, as there are so many variables. How big is the box? How thick is the insulation? What is the water temperature? What is the ambient air temperature? What is the temperature in the box? What is the operating voltage? etc., etc. In general, operating on 12 volts at 3500 rpm, as a refrigerator it will probably draw between 4 & 4.5 amps, & as a freezer, between 3 & 3.5 amps. Run times can be estimated by consulting the "Consumption guide", & from that the daily amp/hours consumed can be approximated. As a rough guide, a 6 cu ft refrigerator box with average insulation will consume something like 20 to 25 amp/hrs per day.

Is the Frigoboat keel cooler more efficient than another system I have seen that uses a modified thru-hull fitting for the condenser?

Both systems work on the same principle & will probably show comparable performance when the boat is under way or rocking in a choppy anchorage. But whereas the Frigoboat keel cooler dissipates the heat into the water surrounding it, the modified thru-hull heats up the water inside the thru-hull which is recessed up into the boat. Unless the vessel has substantial motion, the heated water cannot escape, so that as the column of water heats up, the system becomes increasingly less efficient.