SEA FROST®

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ENGINE DRIVE 134A SYSTEM

OPERATION & INSTALLATION
INSTRUCTIONS

NOTICE OF RESPONSIBILITY

It is the SEA FROST intent to provide the safest, most accurate and detailed instructions. SEA FROST cannot be responsible for problems or damage caused by omissions, inaccuracy or interpretation of these instructions.

Revised 2002
Aspects of the SEA FROST design are covered by
US Patent #4,356,708

12th Edition
134

START UP PROCEDURE
For

RECENTLY COMMISSIONED
SEA FROST ENGINE DRIVE SYSTEMS

ATTENTION new SEA FROST owner or operator! PLEASE DO NOT OPERATE THE REFRIGERATION SYSTEM UNTIL YOU READ THIS.

WARNING! Your SEA FROST System can be severely damaged and your warranty will be invalid if these steps are not followed closely. Please read the information here before proceeding to operate your system for the first time.

BREAK-IN PERIOD. LIMIT COMPRESSOR RUNNING TIMES TO THIRTY MINUTES FOR THE FIRST TWO HOURS OF OPERATION. THIS SHOULD BE FOUR SEPARATE THIRTY-MINUTE OPERATIONS WITH A REST PERIOD OF AN HOUR OR MORE BETWEEN THEM. DURING THIS BREAK IN PERIOD KEEP THE ENGINE SPEEDS TO BELOW 1200 RPM.

1. Locate the SEA FROST Receiver/Filter/Drier (RFD). The location of this part varies from boat to boat, but it is often found in the engine compartment, in a locker, or beneath the cabin sole. It is a blue metal can about 9 inches high and 3 inches in diameter, with brass fittings connecting it to copper tubing. If you do not locate the RFD quickly, follow the route of refrigeration copper tubing, from the engine compartment to the icebox. Along the route you will find the RFD, along with other SEA FROST components. The RFD has a sight glass for viewing the flow of refrigerant.

2. Start the boat's engine. Check to be sure the engine is pumping water.

3. Locate the SEA FROST Control Panel. With the engine running at a fast idle (900 to 1200 rpm), and while looking into the sight glass in the RFD, have a helper turn the Panel Timer knob past "10" to cock the switch and start the compressor. The engine should load, slowing slightly.

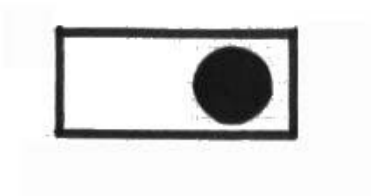
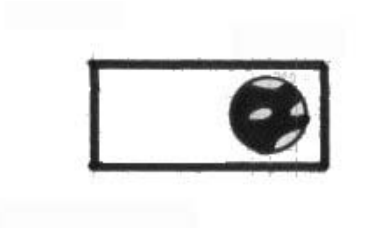
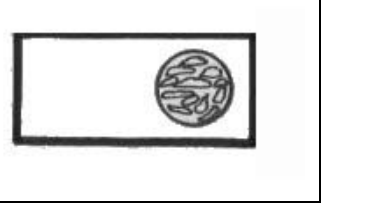
4. **MONITOR THE SIGHT GLASS CONTINUALLY.** White FOAM should appear in the sight glass indicating that refrigerant is present. This foam may disappear quite quickly, but IF NO FOAM IS EVIDENT, that is, if the sight glass does not show presence white high speed foam within a minute of operation, the system is flat. **DO NOT CONTINUE TO OPERATE THE SYSTEM. OPERATION IN THIS MODE WILL RUIN THE COMPRESSOR.** Switch off the 12-volt panel breaker to prevent operation until the problem is corrected. CALL US AT **603-868-5720.**

5. If white foam is evident watch closely for a **transition** from foam to clear: a clear sight glass indicates a sufficiently charged system. This point can be missed if proper attention is not given. A FULL SIGHT GLASS AND AN EMPTY GLASS LOOK THE SAME! It is possible for the sight glass to show large, almost stationary bubbles even when the charge is sufficient, so it is important to differentiate between "foam" and larger bubbles. **The foam condition has velocity and direction, but the larger bubbles are nearly stationary.** If the foam does not clear, the system is low on charge. CALL US AT **603-868-5720** for trouble shooting and correction help.

There are three conditions of charge indicated by the sight glass:

- A black or clear glass and no cooling indicates no charge. ***Turn off the compressor at once*.**
- A white foaming glass and some cooling indicates the system is undercharged or has lost charge. Refer to the manual regarding leak checking and adding charge.
- A black glass and proper cooling indicates all is well.

RFD SIGHT GLASS DETAIL

EMPTY OR CLEAR	STATIONARY BUBBLES	FOAM/LOW
		

6. Feel the SEA FROST Plate in the icebox five minutes after engaging the timer switch. If the sight glass clears yet the plate temperature does not drop after **5** minutes of operation, turn off the system and CALL US AT **603-868-5720.**

7. **If the proper charge is indicated, make ice and go sailing.**

Inspecting the sight glass periodically for several weeks after a new installation and every time after a lay period is assurance that your Sea Frost system is assembled properly and is a good maintenance habit.

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GENERAL DESCRIPTION

The **SEA FROST** Engine Drive is a cold storage refrigeration system powered by the boat's engine. Cold storage is attained by rapidly freezing the solution contained in the plate, creating a captive (replenishable) block of ice. The system uses a compressor belt-driven by the boat's engine. The compressor has an electromagnetic clutch controlled by the timer switch on the SEA FROST control panel. Refrigerant from the compressor is piped to the SEA FROST plate in the icebox.

BREAK IN PERIOD

REFER TO THE START UP PROCEDURE IN THE BEGINNING OF THIS MANUAL.

EVERY TIME THE SYSTEM IS RESTARTED FROM WARM, CHECK TO BE SURE IT IS COOLING BEFORE OPERATING THE COMPRESSOR EXTENSIVELY. THIS IS YOUR SYSTEM. SIMPLE OBSERVATIONS OF YOUR SYSTEM AND OPERATING CAUTION WILL PREVENT DAMAGE.

OPERATION

STEP 1.

To operate the system, the engine must be running. This system is water-cooled and relies on water being pumped by the engine. Water flow is most important, therefore CHECK THE WATER FLOW FROM THE BOAT'S EXHAUST BEFORE OPERATION.

STEP 2. THE TIMER CONTROL

The system may be operated at any engine speed and is not affected by heel angle. When not under way, a fast idle will give good performance. TURN the control panel timer switch **clockwise** past "10" to cock the switch. From this "10" position, the switch may be overridden to "OFF" or advanced to the desired running time. The spring wound timer will turn off automatically. When the timer is started, the red lamp will go on and the engine should see a slight rpm drop (larger engines will be less affected).

Within 5 minutes you will notice the plates getting cold.

WARNING: After 5 minutes of operation, check for a drop in the plate temperature by feeling the plate with your hand. If no noticeable cooling has occurred, turn off the panel timer switch. Check the charge level (Checking the Refrigerant Charge) and check the water flow from the exhaust. TO PROTECT THE COMPRESSOR, DO NOT OPERATE the system if this temperature drop is not noted. CALL US AT 603-868-5720.

After about one half hour, the plate will become very cold. The maximum cold storage is generally attained within an hour.

Starting from warm will require more running than the normal refreezing time of the plate in its usable temperature range.

The concept of the SEA FROST system is to create as much frozen material in the plate as fast as possible. This "coldness" then keeps the cabinet cold. Daily running times are based on the time needed to freeze enough of the plate to maintain proper cooling. The plate must be frozen. Chilling the plate without freezing it will not provide any holdover. You will learn about the daily time required for SEA FROST operation by using the system.

Note: Maximum holdover time will be obtained when the cabinet and contents are at their lowest temperatures and the plate is frozen solid. There is no limit to "on" time however, no advantage is gained by running the system beyond this point and in refrigeration applications over running will freeze items. Experiment with two shorter periods a day over one long run once per day.

Holdover time is effected by cabinet size, cabinet insulation, contents added to be cooled, cabinet opening and closing, and climate. Freezer systems will generally require operation twice a day.

A SUGGESTION.

As soon as the engine has stopped or the timer has run out, the plate will begin to warm up as it absorbs heat, cooling the icebox. You might decide that it is a good idea to run the unit in the last minutes of the day to provide ice for drinks. Short periods of operation whenever the engine is on for other purposes will be beneficial. Maximum storage will require that the plate be frozen. The plate may thaw and still not require running in refrigeration applications. Monitor the box temperature.

Two shorter periods a day may be better than a long one once a day. When the holdover freezing is complete the benefit of running is only to delay warming. (There is some help in that cooling of the contents of the box will increase holdover time but heat ("cold") moves slowly and it will be more efficient to wait and run again later.) Experimentation will provide the best instruction on how the SEA FROST should be operated on your boat.
DEFROSTING will be required. A heavy layer of frost or ice will reduce cooling. This is very important in freezers. The plates may be defrosted by scraping the face with an ice scraper or spatula. Warm water may be used.

ICE MAKING

With the Block System or Flat Mounted Plates

Making ice in plastic self-closing bags will prevent spilling and make large amounts of ice. A good method is to use a bag within a bag. Fill the inner bag with water, seal it, and dry off the outside surface. The outer bag should be wetted to freeze it to the Block. Because the Block freezes quickly, trays and bags hold fast. When the ice is ready, the inner bag may be easily removed. Hit the frozen bag with a winch handle to break it up.

If the Block is well frosted, it may be necessary to allow the top surface of the Block to defrost before operating the system to make ice. If the Block is well frozen several batches of ice can be made without operating the compressor. By the same token ice making doesn't require compressor operation for the whole period ice is forming.

With Vertical Trays (on Vertical Plate Systems)

Fill the vertical trays with water and hang them on the stainless steel rod on the face of the plate. Try to get some water between the tray and the plate surface to increase the thermal contact to speed freezing.

The trays may take time to freeze after the plate is frozen and the engine compressor has been switched off.

Plan to wait for the trays to thaw in a sink or away from the plate in the refrigerator. When the outside surface is wet invert the tray and let the ice slide out.

After ice has been made and harvested, store it in sealable plastic bags in the refrigerator or freezer. Leaving the ice in trays in contact with the plate will allow the ice to melt if the plate goes above freezing.

MAINTENANCE

Like your engine, your SEA FROST needs periodic checking.

ROUTINELY CHECK:

1. The refrigerant charge. (Checking the Refrigerant Charge) NEVER OPERATE SYSTEM WITHOUT PROPER CHARGE!

2. Check belt tension and condition

3. Periodically tighten compressor mounting bracket bolts.

4. Check the condenser zinc. FAILURE TO MAINTAIN THE ZINC ANODE WILL CAUSE EXTENSIVE DAMAGE TO THE SYSTEM!

5. Check all components, bilge and engine room fittings for corrosion and wear. BE SURE TO LOCATE AND INSPECT ALL FITTINGS AND COMPONENTS IN THE SYSTEM. KNOW THE LOCATION OF ALL CONNECTION POINTS. Spray with a rust inhibitor REGULARLY. Corrosion unchecked in the marine environment will severely reduce the life of your system.

6. Winter storage will require that the water-cooled condenser be drained or flushed and filled with antifreeze solution to avoid freeze damage. If the condenser is to be left dry flushing with a large amount of fresh water to remove salt deposits is recommended.

7. For tropical lay up, flush fresh water through the condenser.

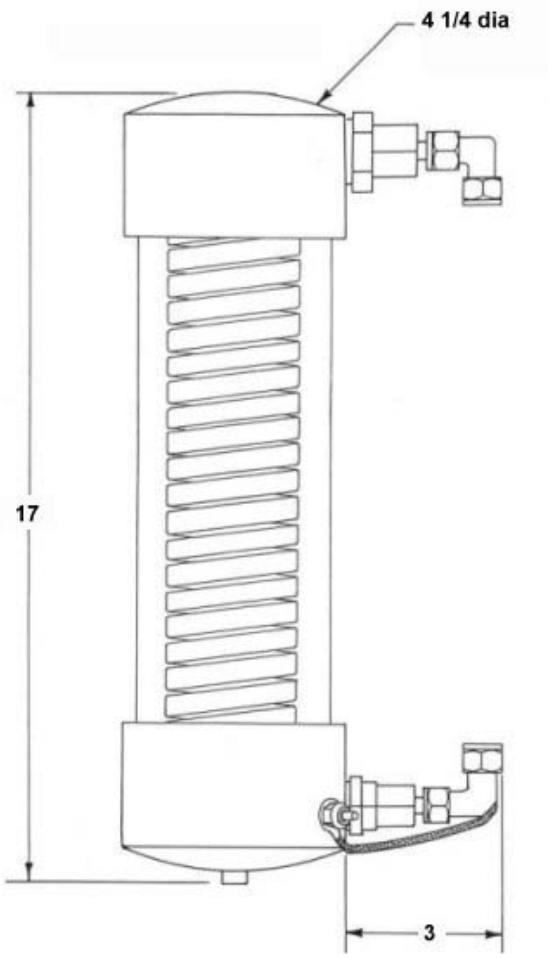
CLEANING

The plate surface protects itself with a layer of oxidation. You might find after a long period of storage the plate will look chalky. This will not effect operation and is easily cleaned up with a pot scrubber and soap.

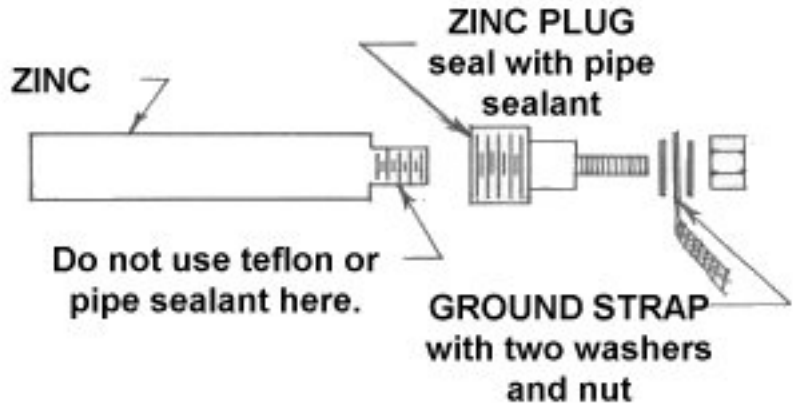
TROPICAL OPERATION MAINTENANCE

A system that has operated in the tropics or is in service in the tropics may need to have the condenser cleaned with muriatic acid. Refer to the data sheet on page 47.

DETAIL OF CONDENSER ZINC ASSEMBLY



To change the zinc, first close the engine seacock. Using a 7/16" and 11/16" open-end wrenches, hold the brass plug and remove the outer nut. Carefully bend the ground strap away from the plug. Remove the plug. Water will drain from the condenser (or drain the condenser by removing a hose down stream.) Compare the old zinc to a new zinc. Using pliers hold the zinc and unscrew the plug. If the zinc breaks in the brass plug, heat the plug holder with a propane torch to melt the remaining zinc. Thread the new zinc into the plug. Snug with pliers making sure that the zinc is not cracked or stressed by over tightening. Use a pipe thread sealant on the plug thread. BE AWARE THAT THIS IS A TAPERED PIPE THREAD. Thread the plug into the condenser housing about 3/4 of the length of the plug. This should seal the connection. EXCESSIVE TIGHTENING WILL CRACK THE CONDENSER HOUSING. Open the seacock and check for leaks. Reassemble the ground strap, and nut. NOTE: This is an electrical connection; the brass plug and the ground strap should be free of corrosion and oxidation. The final assembly should be sprayed corrosion block, T-9, or similar rust inhibitor.



HOW REFRIGERATION WORKS

There are two important concepts to understand in order to learn about refrigeration. They are latent heat and phase changes. A great deal of heat is required to change a solid to a liquid, and a liquid to a gas. A great deal of heat must be removed to reverse these changes. These changes are called phase changes, or changes of state. The heat removed or added at these phase changes has no effect on the temperature of the substances until the change is complete. For instance, ice melts at 32 degrees F. Water freezes at 32 degrees F. Ice and water will remain at 32 degrees F until the freezing or melting process is complete. Latent heat is this hidden energy required to make or break the bonds in a phase change.

By evaporating liquid to a gas, we can absorb heat. By condensing a gas to a liquid, we give up heat. Refrigeration is the use of these phase changes to move heat out of the icebox (cooling it).

We all know that cold is the absence of heat. A practical example of heat absorption by evaporation is rubbing alcohol evaporating in your hand and cools your hands. The alcohol is actually using the heat from your hand to boil. The absorption of heat cools your hand.

Pressure affects the temperature at which a gas phase change will occur. Using water as an example, water boils at sea level at 212 F. On top of Mt. Everest it boils at a much lower temperature. The air pressure is lower allowing the water-to-steam phase change to occur more easily. A pressure cooker increases the pressure on water to restrict boiling to a higher temperature. A pressure cooker will cook food faster because the temperature is higher. Remember that a phase change involves latent heat. The temperature of boiling water is only 212 F at sea level. The evaporation action is absorbing heat at a rate equal to the rate of heat applied, preventing further temperature rise.

R-134a will boil at minus 15 degrees F at sea level. By evaporating liquid R-134a in the SEA FROST plate, heat is absorbed making refrigerant vapor. To dispose of this heat, a condensing phase change is necessary. By increasing the pressure (compressing) we can raise the boiling point of the refrigerant vapor at the condenser. Seawater passing the condenser coils removes the heat, forcing the vapor to a liquid state again. Pressure, therefore, is the key that allows passing the heat we have taken from the icebox to a warmer place (the sea water) and converting the vapor to liquid to be re-evaporated again. By causing R-134a to boil (evaporate) in the SEA FROST plate, we use the heat energy there. This activity cools the liquid solution within the plate, causing it to change phase (freezing to a solid). By freezing this solution, we have increased it's heat absorption capacity more than 100 times. When the cycle is stopped (the compressor is turned off) the frozen plate will begin to absorb the heat that leaks through the insulation in the icebox. The absorption will be at a constant temperature until the phase change to liquid (melting) is complete. This is the principle of holdover refrigeration and the function of your SEA FROST.

INSTALLATION

Work Habits

Installer's care should be stressed. No matter how good SEA FROST equipment is, it's performance and life are in the hands of the installer. To insure your work:

1. Read this manual.
2. Reread any aspect you don't understand.
3. Follow Swagelok instructions carefully.
4. Install the RFD last and the same day the system is charged.
5. Spend enough time leak-checking to be sure there are no leaks.
6. Thanks from all of us who have to guarantee your work.

Two contaminants will give you problems in a refrigeration system. They are WATER and DIRT. Moisture in the air is always present and cannot be eliminated; water in this case refers to puddles and drops. Dirt is any solid. The installer's habits are important in ensuring a trouble-free start-up. We have added a large receiver filter drier (RFD) to take care of all dirt and moisture that might get into the system during a careful installation. Moisture in the system is boiled off when the system is evacuated, or it is captured in the desiccant. There is a screen in the expansion valve to prevent dirt from plugging it.

Excess moisture that the RFD can't handle will plug the expansion valve with ice. This ice stops the cycle. The only cure is to discharge the refrigerant, replace the RFD, re-evacuate the system, and recharge it. This remedy takes time and is somewhat costly. Keep the system clean and dry!

Tube Handling

Installation is quite simple. All the copper tube comes to you with the ends capped. Any routing of the tubing must be done with the tube either taped or capped. Cap both tube ends after each cut. Work with only one line at a time, and uncap only one end at a time.

Tube Cutting

Use only a tube cutter; hacksawing or any other method will introduce chips to the system and also distort the tube, making connections difficult and leak-prone. A miniature cutter is essential for this work. CUT SLOWLY to avoid a ridge on the inside of the tube. We do not recommend reaming or dressing the cut, as it is very easy to get chips of copper in the system that will cause trouble.

Tube Bending

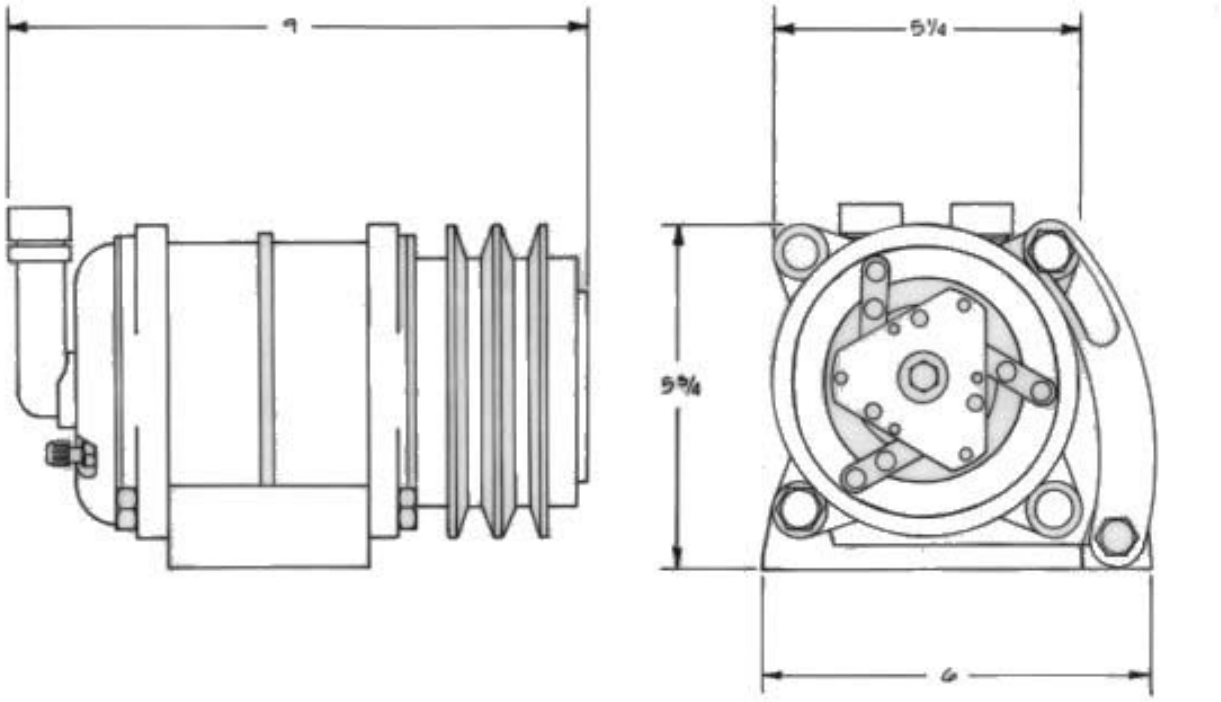
Make all but the long sweep bends with a spring or lever bender; one kink and the line must be re-run. Don't add any more fittings than are absolutely necessary. Route all the lines in such a way that they are most direct but out of the way. Always leave several inches of straight undistorted tubing leading to all Swagelok fittings to allow proper connection. Again, keep everything sealed until you are ready to make that connection.

FIT RFD LAST

The RFD (receiver, filter, drier) should be the last component to be unpacked and fitted. The day the system is charged.

THE COMPRESSOR

The compressor is the first component to mount when installing the SEA FROST system.



FITTING THE COMPRESSOR TO THE BASE BRACKET

WARNING: FAILURE TO FOLLOW THESE DIRECTIONS WILL CAUSE IRREPARABLE DAMAGE TO THE COMPRESSOR AND VOID ANY CLAIMS.

The compressor base bracket may need to be lightly filed or sanded to properly fit between the mounting "ears" of the compressor. It must be a perfect fit with no force required to slide the bracket onto the compressor and yet have **zero clearance** between the two parts. Forcing the compressor on to the bracket will spread the ears cracking the compressor case. Extra space will allow the hinge bolt to work and if tightened break the compressor ears.

If you are using an available SEA FROST engine bracket kit follow the mounting instructions included with it. The "Compressor Posture", "Low Head" option and "Fitting the Compressor to the Compressor Base" must be followed.

In determining the compressor location for custom brackets and off engine mounting of the compressor consider all of the following:

COMPRESSOR POSTURE

❖ When mounted, the compressor **must not lay over more than 45 degrees from vertical**. The port fittings, the clutch coil wire, and the ground screw indicate the top of the compressor.

❖ Allow clearance for the compressor hoses and belt adjustment if the compressor is mounted under the engine.

❖ An optional low profile head is available that requires no top clearance and allows the hoses to exit straight back. Hoses can be ordered with straight fittings.

❖ We recommend that the compressor be driven by its own belt.

❖ A single hi-power "A" belt is all that is required to drive the compressor

❖ The compressor should be driven by a pulley five inches in diameter. The compressor speed ratio should not exceed the crankshaft speed of the engine. This ratio will give proper cooling at a fast idle and also allow operation at cruising RPM's.

❖ The compressor will draw up to two horsepower. It should be ruggedly bolted.

❖ The extra pulley on the compressor may be used to drive a pump or alternator.

❖ The compressor may be mounted to a fabricated bracket that is bolted to the engine.

❖ A jackshaft may be used to drive the compressor.

❖The compressor may rotate in either direction.

OFF-ENGINE COMPRESSOR MOUNTING

Engine motion is a torsional load, concentric around the crankshaft. At the crankshaft center, the engine is stationary which allows off-engine mounting of the compressor. Side loads on the clutch pulley do not affect the compressor since the construction of the free wheel pulley puts all loads on the compressor case. This protects the compressor bearing and shaft seal from failure and leaks from side load. The compressor is a very smooth device and may be hard mounted on the engine beds or other structural members attached to the hull. It will not introduce any vibration or noise by this mounting, and in many cases a much stronger mount is possible. The drive belt will not transmit any engine vibration to the boat. The compressor pulley and the engine drive pulley are large and will provide plenty of belt contact without excessive tightening, so off-mounting will not "ground-out" a flex mounted engine.

PULLEY MOUNTING ON ENGINES

IT IS IMPERATIVE THAT THE EXTRA PULLEY BE MOUNTED TO THE ENGINE CRANK PULLEY USING LOCK WASHERS OR THREAD LOCK ADHESIVE / SEALANT.

FAILURE TO LOCK ATTACHMENT BOLTS WILL ALLOW THE BOLTS TO LOOSEN, CAUSING DAMAGE AND POSSIBLE DANGER FROM FLYING PARTS.

BOLTS SHOULD BE TIGHTENED TO A TORQUE SETTING RECOMMENDED FOR THE DIAMETER AND GRADE OF BOLT BEING USED.

Recommended adhesive/sealant: Loctite 271 by Loctite corporation of Newington, CT. and Cleveland, OH.

COMPRESSOR BELTS

Various belts are available with an "A" section (1/2"). Specify a high power belt. Fractional horsepower belts will stretch and wear rapidly. Cogged belts and Kevlar strand reinforced belts are available but not essential.

Belt length is measured on the back edge of a belt. An easy way to get a belt size is to wrap masking tape around the pulleys with the compressor in the loose position. Break the tape in one place and peel it off. Measure the tape to get the belt length. *When the belt size is determined record the brand and part number. Each belt manufacture has a different sizing.*

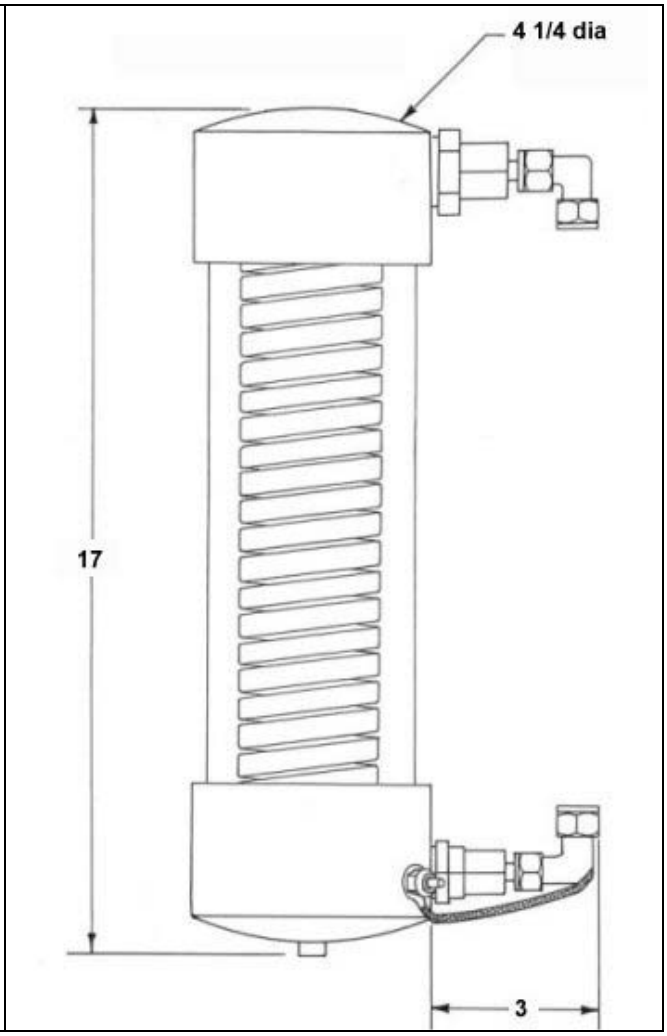
CONDENSER

❖The condenser should be connected into the raw water line to the engine after the in-line strainer.

❖The SEA FROST condenser will not restrict water flow to the engine, but be certain to avoid restrictions in the water line by ensuring sufficient hose ID from the through hull to engine.

❖It may be connected on the discharge side of the engine's raw water pump, be certain it receives the full flow of the coldest water.

❖It MUST be mounted vertically: the zinc element is at the bottom



ZINC SERVICE ACCESS

❖The zinc anode must be accessible as periodic checking is required. For best service access to the zinc, mount the condenser with the zinc away from the bulkhead. There is an alternate zinc location on the bottom. Swap locations of the plastic plug and the zinc plug. Use pipe thread sealant on the threads. Tighten carefully. (See page 9)

❖**Water must enter the bottom** of the condenser and exit the top.

❖Be sure water fittings are tight. A leaky water fitting may prevent engine pump priming by leaking air into the circuit especially if the condenser is installed above the water line.

BLOCK

❖The SEA FROST block is 6 1/4" x 9" x 13 3/4" (excluding the mounting tabs). It must be solidly fixed within the icebox. It should be mounted high in the box to take advantage of natural convection.

❖Leave 2" clearance (more is better) between the inside top of the box and the top of the block for ice making.

❖The block copper tubing should exit the icebox wall to a place where the Valve Unit (V/U) can be fitted, such as a hanging locker, sail locker, or the engine compartment. This provides the cleanest easiest installation. There is some moisture created by the V/U if it is not properly insulated so accessibility for insulation application must be considered. However, if the icebox location is such that the V/U cannot be mounted outside, it is acceptable to install it on the inside of the box. The V/U operation is not effected by its temperature.

❖The block must be installed in the horizontal mode.

❖The mounting tab has been drilled and countersunk for 1/4" fasteners. The tab may be drilled out for larger fasteners. Through bolting with a large backing plate of plywood or to an existing bulkhead will distribute the load and provide a good mount.

❖Support may be provided by a cleat or shelf. Shelving around the block may be used as a cold zone. However, keep in mind that air flow is required to cool all sections of the box, so don't restrict airflow with excessive shelving.

❖A drilling template should be made. Drill 1-1/4" holes for the refrigerant tubes completely through the icebox wall if the V/U is externally fitted. This allows recesses for the white nylon bulkhead fittings on the block, and also facilitates removal of the block without having to ruin the connection tubes by cutting the Swagelok nuts and ferrules off, allowing clearance for the swage attached nuts. The larger holes also allow adding a moisture seal to any wooden bulkhead that has been drilled by filling the holes with the spray foam provided.

❖Note: The fittings on the back of the block are not connection points: there are no internal joints in this system. Therefore field repairs cannot be made if the copper tubes are damaged or cut too short.

PLATES

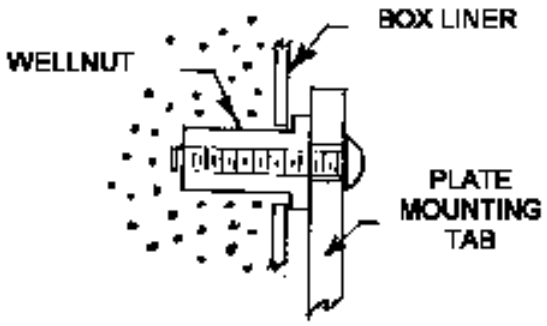
SEA FROST holdover plates mount with a "Wellnut" expandable neoprene blind hole fastener. See the instruction tag packed with the plate. A template or the part itself should be used to locate the mounting holes. Drill 1/4" pilot holes then increase them to 1/2". Install the screw into the mounting tab then screw the mount onto the screw. Install the plate pushing the rubber mounts into the pre-drilled holes. Tighten the screws.	

PLATE LOCATION

The plate size, location, and plumbing are designed for each application. This additional information is provided with each individual system.

VALVE UNIT V/U

❖For appearance and convenience of installation, the valve unit may be mounted outside the icebox. In certain applications and multiple plate systems it may be best to mount it inside. Location of the V/U in multiple plate systems is indicated in the design layout from our application engineer.

On an externally mounted V/U two 1/2" Swagelok fittings fasten the V/U to tubing protruding through the icebox wall. Before cutting the tubing:

1. Leave a minimum of 1 1/4" of tube beyond the bulkhead.

2. Allow room for wrench access.

On any installation:

❖The Valve Unit may be mounted in any position.

❖90-degree elbows can be factory installed on the Valve Unit to reduce the space requirements if necessary.

❖The tubing will support the Valve Unit.

❖The tubing must bottom in the fitting. A pencil mark 1" from the tube end should be flush with the fitting nut face when the tube is seated in the fitting.

❖The V/U will attract moisture. If it is mounted externally to the cabinet be sure it is accessible for proper insulation installation after the system has been leak checked and operationally tested.

❖For final installation the V/U see the Swagelok text.

SUCTION PRESSURE UNIT ~ S/P/U

The S/P/U is an epoxy cast rectangular block measuring 4" X 5 1/2" and 2" thick. *This part contains the system access ports for charging and servicing the system. The access ports are located between the tube connection fittings.* The tube connections are 1/2" and 1/4".

❖The S/P/U is connected into the 1/2" tubing 1' to 4' from the compressor suction hose end. The 1/4" line from the RFD connects to the S/P/U. Then continues to the V/U. (See the drawing on page 24.)

❖The S/P/U may be positioned as is convenient (sideways, upside down, vertical, horizontal.) The tubing has no directional requirement (input on left side or right side.)

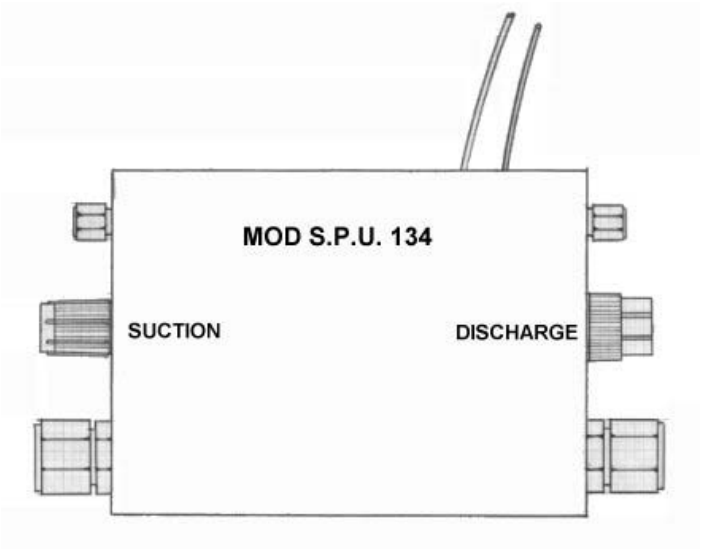
❖When mounting the S/P/U, position the insulation foam wrap behind it first. This insulation will then be wrapped around the section nearest the 1/2" tubing to prevent sweating.

INSTALLATION RULES FOR THE S/P/U

❖The S/P/U must be connected 1 to 4 feet from the suction hose end. (Extending this distance may reduce the performance of the system.)

❖The tubing connected to the S/P/U must be routed allowing room for the 134-A service valves to connect to the ports between the tube connectors. The service valves will require 4" of clear space on each end of the S/P/U.

❖The S/P/U must be insulated to prevent unwanted moisture from collecting and dripping.



NOTES ON SWAGELOK FITTINGS

Swagelok fittings come to you completely assembled, finger-tight. (Pieces a,b, and c in Drawing #1 are already together). They are ready for immediate use.

Disassembly before use can result in dirt and foreign material getting into the fitting and causing leaks and you also risk damaging the threads if nuts are removed. If disassembly is necessary, reassemble per drawing.

This is a double ferrule system. The most serious installation problem encountered with SEA FROST is the improper assembly of these fittings. Be absolutely sure that you assemble all fittings as in Drawing #1.

To ease assembly slacken the fitting nut slightly before assembly. Then retighten with fingers before tightening with a wrench. (This is to avoid cross threading.)

Step 1. Always leave two inches of straight, undistorted tubing leading to all Swagelok fittings to allow proper connection.

Step 2. Prior to inserting 1/2" tubing into the Swagelok tube fitting, make a pencil mark 1" from end of tube. Prior to inserting 3/8" tubing, make a pencil mark 3/4" from the end of the tube. With 1/4" tubing make a mark 5/8" from the end.

Step 3. Insert clean, smooth tubing with the pencil mark into the Swagelok tube fitting. You can be sure the tube is resting firmly on the shoulder of the fitting when the pencil mark is flush with the nut. This mark will also indicate that the tube has not moved before tightening. (As the fitting is tightened the space from the pencil mark to the shoulder will increase.)

Step 4. Tighten the Swagelok nut to a wrench snug* position. Scribe the nut with a pencil at the 6:00 o'clock position (see drawing #1, step # 2).

* Wrench snug is the first point in the assembly tightening when the tube cannot be pulled from the fitting, (i.e. when the ferrules tighten enough to contact the tubing).

Step 5. Now, while holding the fitting body with a back-up wrench, tighten the nut one-and-one-quarter turns (1-1/4). To do so, watch the scribe mark, make one complete revolution, and continue to the 9:00 o'clock position. (See drawing #1, step #3).

DRAWING 1	
	STEP 1 Simply insert the tubing into the SWAGELOK tube fitting. **Make sure that the tubing rest firmly on the shoulder of the fitting and that the nut is wrench snug.**
STEP 2 Before tightening the SWAGELOK nut, scribe the nut at the six o'clock position.	
	STEP 3 Now, while holding the fitting body steady with a backup wrench, tighten the nut 1 1/4 turns. Watch the scribe mark, make one complete revolution and continue to the 9 o'clock position. By scribing the nut at the 6 o'clock position as it appears to you, there will be no doubt as to the starting position. When tightened 1 1/4 turns to the 9 o'clock position you can easily see that the fitting has been properly installed.

SWAGELOK FITTINGS ARE TO BE TIGHTENED TO A TORQUE SPEC, NOT INFINITE TIGHTNESS. BE SURE YOUR STARTING POINT IS WRENCH SNUG. A DISTORTED TUBE MIGHT GIVE A FALSE STARTING POINT.

* When making all connections, USE TWO WRENCHES. Don't allow the fittings to turn or twist when tightening.

RECONNECTING PRE-SWAGED FITTINGS

Connections can be disconnected and retightened many times.

When reconnecting, insert the tubing with pre-swaged ferrules into the fitting until the front ferrule seats in the fitting. Tighten the nut by hand. After tightening to wrench snug, rotate the nut about one-quarter turn with a wrench.

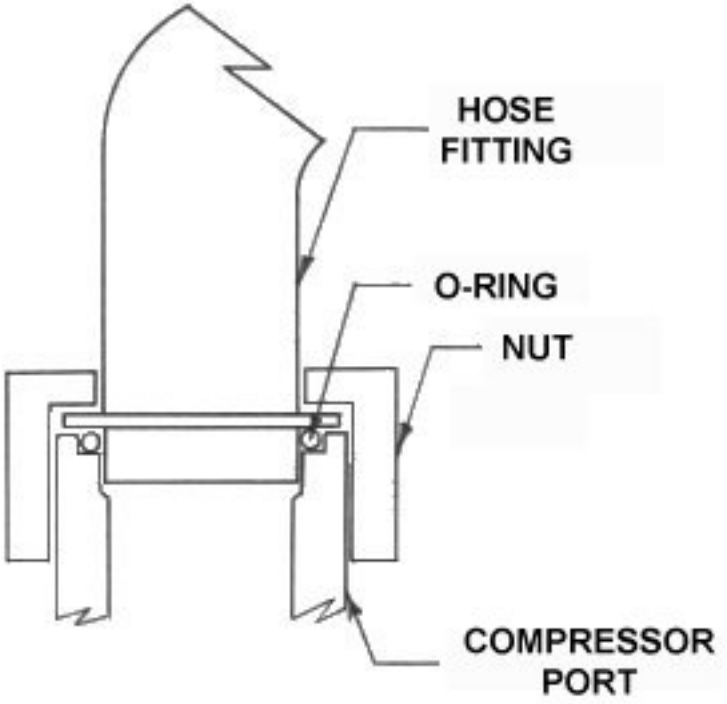
SWAGELOK PERFORMANCE

Swagelok fittings have built-in spring interaction between the ferrules. This compensates for temperature changes and allows the fittings to be reconnected many times. As the fitting is tightened, a burnishing occurs between the body of the fitting and the ferrules and between the ferrules and the tube. This action provides the tightest connection available.

HOSE TO COMPRESSOR FITTINGS

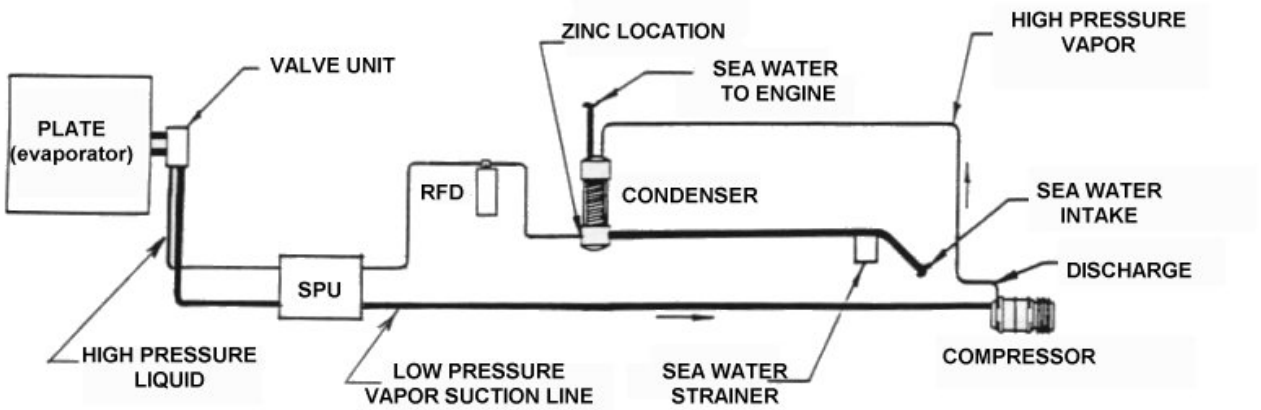
REMOVE THE PLASTIC CAPS FROM COMPRESSOR PORTS.

To install a tube "O" ring fitting on the compressor, inspect the hose ends to be sure they are clean and free from burrs. Apply a drop of oil to the backside of the nut. This will lubricate the nut to allow proper tightening. Install the proper "O" ring on the hose fitting. Uncap the compressor port, removing the nylon cap and rubber insert plug. Insert the correct fitting in the compressor port. Tighten the nut wrench snug. Using a back up wrench on the compressor port, tighten one quarter of a turn more. This fitting should feel tighter than a SWAGELOK. The elbow should not rotate when tightening is complete.



RUNNING THE LINES

See the schematic diagram. Prior to making up connections see "Swagelok Fittings" and "Hose-to-compressor Fittings" texts.



PLANNING

1) The hose assemblies connecting the compressor to the copper tubing allow for movement of the compressor after installation to enable work on and around the engine with out having to disconnect the system. Leave some slack in the hoses and have both hoses directed the same way to allow compressor movement as necessary for access to anticipated repair areas. Hoses without adequate slack will cause failure of the fittings from engine vibration.

2) Keep tube runs as short as possible. The suction (return) line should be as direct as possible with a minimum number of bends.

3) THE RFD IS FITTED WITH A SIGHT GLASS. THIS GLASS MUST BE VISABLE FOR CHARGING AND SERVICING THE SYSTEM. It can be viewed from the top at up to a 45-degree angle but not from the bottom or side. (A mirror installed above the glass is one way of saving a poorly planned installation. Avoid this if possible.) Be sure the sight glass is easily visible!

Observe the inlet/outlet on RFD when mounting it. The glass is offset toward the outlet. The 3/8" (larger) connector accepts the line from the condenser. The 1/4" (smaller) fitting connects to the line leading to the S/P/U. The RFD should be unpacked and installed only after all the lines are run and all other fittings are made.

4) Helpful tools.

❖Coil spring-type tube benders are available for 3/8"-1/2" O.D. tube. These springs are slid over the tube. The bend is formed in the spring then the spring is removed by unscrewing.

❖Mini tube cutter: "IMP" by Gould Imperial requires less than 1 1/2" radius clearance for the cut. This is essential to trim the block or plate tubing.

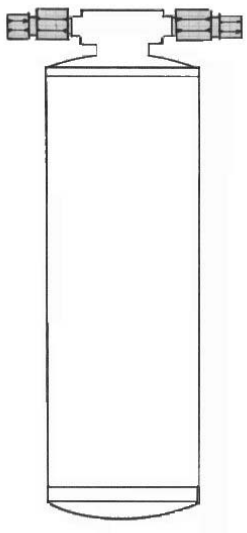
LINE CONNECTION PLAN

The compressor hose with the smaller elbow fitting, attaches to the discharge side of the compressor. The other end of the hose has a 3/8" Swagelok fitting. A 3/8" tube goes from the hose to the top of the condenser. From the bottom of the condenser, 3/8" tube runs to the RFD. From the RFD, 1/4" tube goes to the Suction Pressure Unit (S/P/U). From the S/P/U, 1/4" tube connects to the V/U. The return line from the V/U is 1/2" tube to the S/P/U. From the S/P/U, 1/2" tube returns to the Swagelok-to-hose fitting. The compressor hose then returns to the compressor.

NOTE: It is best to install the S/P/U in the direct line of the 1/2" tube path. The 1/4" liquid line path is easily doubled back through the S/P/U on its way from the RFD to the V/U.

RFD (Receiver Filter Drier)

DO NOT OPEN THE RFD UNTIL ALL THE OTHER CONNECTIONS HAVE BEEN MADE AND YOU ARE READY TO COMMISSION THE SYSTEM.

Because the RFD contains desiccant to absorb moisture and the absorption is limited, it is important to unpack and install it after all other connections are made. Leaving the RFD installed on a partially open system may reduce its capacity by allowing it to absorb moisture in free air before the system is sealed. The RFD is a reservoir for excess refrigerant. The RFD also contains a sight glass in the top. (Please refer to the planning section regarding location and "readability" of the sight glass) A pick-up tube extends from the bottom of the canister to the outlet. For proper function of the reservoir, the RFD must be VERTICAL to ensure proper operation at various heel angles.	

MOUNTING THE RFD

The inlet is 3/8" from the condenser and the 1/4" connection is toward the S/P/U. The sight glass is offset on the RFD toward the outlet. The RFD is mounted using the smaller plastic bracket and a plastic tie wrap. Tie wraps with screws should be used to support the tubes.

INSULATING THE LINES

Insulating should be the last step after leak testing because it will cover fittings that must be leak-checked. On long uninterrupted lengths of tubing the insulation can be slipped over the tube before attaching Swagelok fittings. Insulation should be installed only on dry lines, and only after spraying with Krylon clear coat.

The suction return line is cold and will attract moisture (as frost) when running. The suction return line includes all the exposed 1/2" tubing and the larger fittings. The entire V/U will also frost as well as the section of the S/P/U connected to 1/2" tubing. It is important to insulate the 1/2" line, the V/U, SPU, and all the fittings along the line to prevent moisture from gathering.

INSTALL THE INSULATION IN A MANNER THAT WILL NOT TRAP WATER AROUND A LOW POINT. Trapping salty bilge water in the insulation will reduce the operating life of tubing and fittings. If the insulation is split and wrapped over the tube, install it with the split side down.

Tubing within the icebox need not be insulated.

Closed cell foam is provided to insert the tube into, or to split and wrap onto the tubes that are impossible to feed into the insulation. The foam wrap should be taped with vinyl electrician's tape

TIE WRAPS

Tie wraps should be used to support the wiring, tubing, and insulation. There is a screw hole in the end of each wrap that is used for mounting. Loosely loop the wrap, mount the screw loosely, snug the wrap, tighten the screw, and trim the excess. **Be sure not to leave a sharp edge that might cut someone.**

ELECTRICAL SYSTEM

The electrical system for the SEA FROST system includes a Control Panel comprised of a timer switch, pilot light, circuit breaker, and a high pressure cutout switch in the S/P/U.

CONTROL PANEL LOCATION

In choosing a location for the control panel, find the best location **within the cabin** nearest the cockpit and engine controls. The panel is not waterproof. The system may want to be activated whenever the engine is run.

OPERATION

With 12 volts DC available to the panel, turning the timer clockwise will engage the compressor clutch, indicated by the pilot light. The unit can be shut off by turning the timer to "O" or shutting off the 12-volt supply. In the latter case, the timer will run down by itself. If the system is turned on when the engine is off, the compressor clutch will engage, but no cooling will take place. The light will come on, and normal operating current will be drawn from the battery.

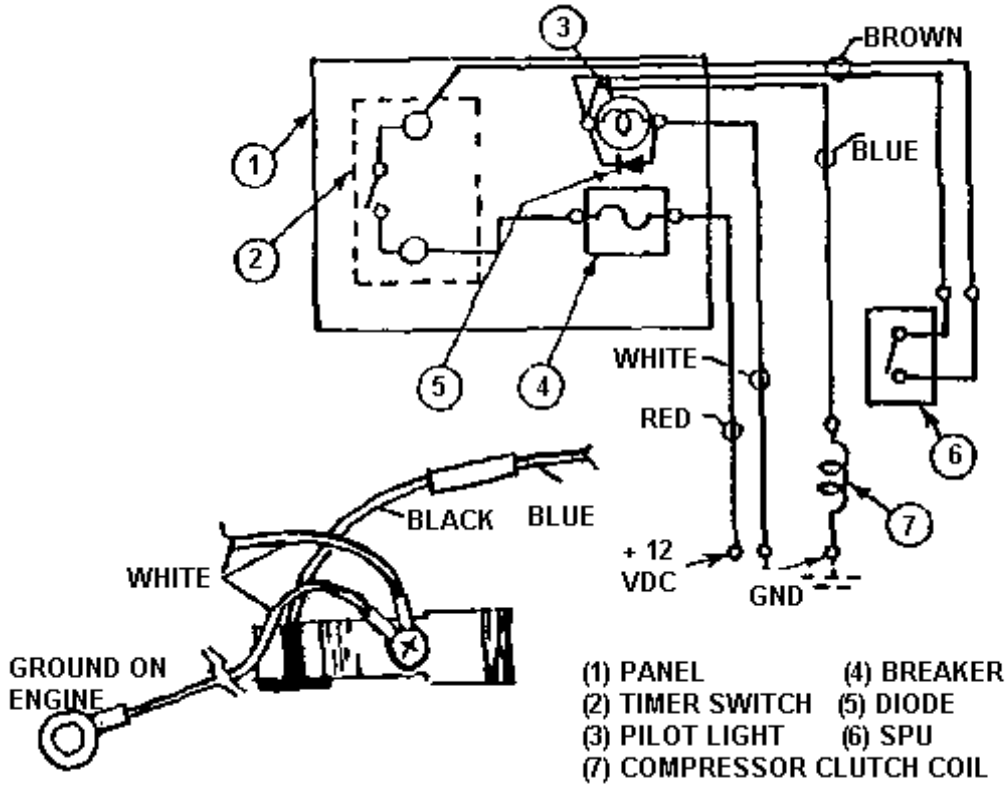
AMPERAGE DRAW

The compressor clutch will draw 3 to 3.5 amps per hour at 12 volts when the timer is operated. (A 24-volt system will draw 1.5 to 1.75 amps per hour.) The timer panel breaker is rated at 7 amps and the wire is rated to about 20 amps. The supply to the timer should have at least a ten-amp breaker.

Because the compressor is switched on only when the engine is on, no power is consumed from the batteries.

TIMER

The timer is a spring wound device that must be "cocked" in order for it to disconnect when it returns to the "off" position. For this reason, it is necessary to turn it clockwise past "10". After the timer is cocked, it may be set to any time reading and may be manually overridden to "off".



WIRING

The electrical system is shown in the diagram. The red wire is connected to a source of 12 volts DC and should be protected by a fuse or breaker of 10 to 15 amps. The blue wire is the power to the compressor clutch, and is connected to the black wire on the compressor with a butt connector. The brown wires are connected to the S/P/U by using crimp type insulated female connectors. Connect the white wire to the phillips head screw on the compressor (adjacent to the black feed wire) along with the 3 ft. white wire in the kit. This 3 ft. white wire is run to the engine block and is connected to a suitable bolt using the 3/8" ring terminal provided. All wires should be routed after the panel is installed and supported every 18" (minimum). Leave enough slack in the wire behind the panel to allow removal of the panel for service. Wires may be tied into existing wire ways. Cut off any excess wire before making the connector.

DISPLACING OIL IN NEWLY INSTALLED COMPRESSOR

The compressor is shipped with the proper amount of oil for the system. **THE OIL MUST BE DISPLACED FROM THE CYLINDERS BEFORE THE COMPRESSOR MAY BE TURNED BY THE BOAT'S ENGINE.** After completing all the connections, turn the outer face of the compressor drive disk at least five turns by hand.

ASSEMBLY INSPECTION CHECK LIST

[ ] 1. Check the lines to be sure they are properly routed. Check to see that the compressor discharge connects to the top of the condenser and the water line enters the bottom.

[ ] 2. Check that the RFD sight glass can be seen.

[ ] 3. Check **all** the connections with wrenches to be sure they have been made up. Refresh your knowledge by re-reading the Swagelok instructions.

[ ] 4. Check the pulley and compressor bolts for tightness.

[ ] 5. Check to make sure the compressor is mounted in an upright position.

[ ] 6. Check the panel wiring by engaging the timer switch. The pilot lamp should come on, and compressor clutch should click.

[ ] 7. Check the neatness of the installation, sufficient service access, secure wiring, tubing, and hoses supported to prevent damage and chafing.

[ ] 8. Check the condenser zinc access to see that it is serviceable.

[ ] 9. Check the service access of the S/P/U. The service access ports must allow attachment of the connecting valves.

[ ] 10. Check (after leak checking and testing) that the system is properly insulated.

REFRIGERANT HANDLING AND SAFETY

Do Not proceed with any aspect you do not fully understand know what results to expect. Understand that pressure exists in refrigeration systems. Be careful.

GENERAL SAFETY THIS IS IMPORTANT. READ THIS!

R-134a is safe if handled properly. Avoid breathing vapors and prolonged skin exposure. Avoid using in areas of open flames. The vapor is heavier than air and may reduce oxygen available for breathing. Use with sufficient ventilation to keep exposure below recommended limits. **Do not mix with air for leak testing or use with air for any purpose above atmospheric pressure.** Liquid R-134a will freeze the skin. It's especially dangerous to the irreparable tissues of the eyes.

Do not pressurize an empty system with R-134a without first evacuating the system with a vacuum pump.

NEVER operate a system with the high side (discharge) open to the refrigerant supply. Pressurization of the refrigerant container could cause it to burst.

WARNING. When charging or working on the system with the engine running, watch for MOVING BELTS AND PULLEYS. Loose clothes and long hair can pull you into a belt. PLEASE BE CAREFUL.

NEVER connect or disconnect gauges to a system while the compressor is operating

PROCEDURES FOR WORKING WITH R-134a

1) A new uncharged system must be evacuated before adding R-134a.

2) An R-134a system must only be pressurized with R-134a or nitrogen.

3) Only service tools dedicated to R-134a are to be used. No parts, tubing, fittings, receivers, dryers, service gauges, or any refrigerant carrying components may be fitted to a R-134a system from a used system or from a CFC based system. Damage caused by the use of parts not supplied by Sea Frost for a R-134a system will cancel all claims against Sea Frost.

4) No oil is to be added to the engine drive system but the PAG oil supplied by Sea Frost, labeled and capped for engine drive use. **No oil is to be added to a system** with out prior consultation with Sea Frost.

5) The oils used in R-134a systems are extremely moisture sensitive (hydroscopic). Do not leave any tube end or component connection open to air while assembling the system. Be sure to use only new, capped copper tubing and be sure to cap the copper coil after cutting it.

ACCESS TO THE SYSTEM ~ SERVICE ACCESS PORTS

The access ports are two small-capped valves on the S/P/U. The ports are labeled "Discharge" and "Suction". These ports are the service access to the system. To access these ports the proper connecting valve must be used.

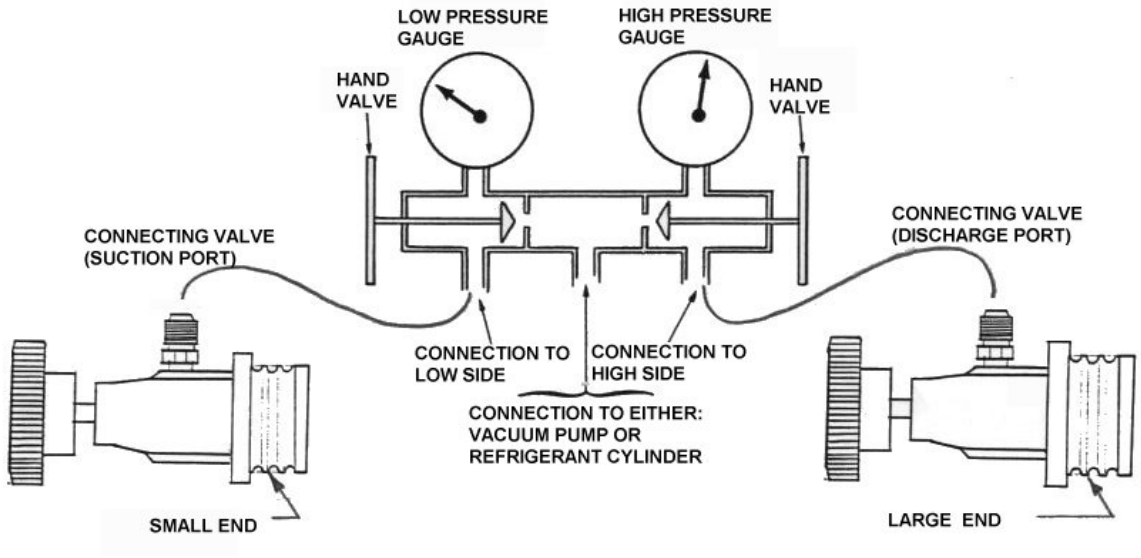
Be sure the plastic port caps are installed tightly after charging or service. The caps are to seal the ports. Without the caps the ports may leak.

NOTE: THIS SYSTEM IS CHARGED WITH R-134a. IT MUST BE CHARGED WITH R-134a ONLY. ONLY DEDICATED R-134a GAUGES AND EQUIPMENT ARE TO BE USED. ANY CONTAMINATION FROM CFC BASED REFRIGERANTS WILL DESTROY THIS SYSTEM.

GAUGES

Gauges must be used in the evacuation and charging. They will provide information on the operation of the system when troubleshooting.

A gauge sets consist of two gauges installed in a manifold with two hand wheel valves and hoses to connect the gauges to the system. The left gauge (blue) is a compound device; it indicates pressure and also vacuum. The right gauge (red) indicates pressure only. The hand wheels open a center port (yellow) to the left or right side respectively. Operation of the hand wheels is only necessary when moving refrigerant or evacuating. With the hand wheels closed, the gauges read the pressures of the connection points. At the end of the red and blue service hoses are R-134a connecting valves.



R-134a SERVICE CONNECTING VALVES

The R-134a connecting valves on the gauge hose ends are quick connect fittings with a specially designed valve that when turned opens and closes the hose end while opening the access service port.

CONNECTING GAUGES TO AN UNCHARGED SYSTEM

To connect the connecting valves to the access service ports, remove the protective sealing caps from the S/P/U. Note that the ports are of different sizes. The larger diameter port is the discharge side and the smaller port is the suction side. Pull back the collar on the connecting valve and push it over the appropriate access port. Turn the connecting valve clockwise to open. It is important to open each connecting valve carefully. Do not force valve or turn it to it's stop**. Forcing the connecting valve will bend the service port core valve causing a leak.** During the service operation these valves are left open. Control of refrigerant and vacuum is by the manifold hand wheels.

TO INSTALL GAUGES ON A CHARGED SYSTEM, with the system off, attach the connecting valves to the S/P/U. Proceed to "Venting the Gauge Set".

VENTING THE GAUGE SET

If the gauge set is not fitted with sealing valves or has not been purged with refrigerant, vent the hoses at the manifold body by opening the hand wheels to an open center hose for a few seconds allowing some of the system refrigerant to purge the hoses of air.

DISCONNECTING GAUGES

Disconnecting the gauge set after running the system may be done by turning off the discharge connecting valve first. Remove the connecting valve and re-cap the port on the S/P/U. Turn off the refrigerant supply. Both hand wheels on the manifold set may be opened and the compressor operated to extract the refrigerant from the manifolds. When the pressure in both gauges drops to the low side operating pressure turn off the hand wheels and the connecting valve. Turn off the compressor. Remove the remaining connecting valve and re-cap the access port.

Disconnecting the gauge set on a static system may be done by turning off the connecting valves and disconnecting them from the access ports on the S/P/U. Re-cap the access ports.

Refer to the gauge drawing on page 32.

Adding charge to a working system should be done through the suction side (blue).

(See Safety) The center hose is connected to the can tap. Be sure to vent the hoses to displace any air that might be in them. Keep your gauges clean. Inspect the rubber gaskets and "o" rings on the hose ends. Leak-check the gauge valve packing and all hose connections. Check and reset the "O" on the low side gauge to atmospheric pressure, if necessary.

TAPPING A CAN OF REFRIGERANT

Be sure the can of R-134a is clean and dry. Any contaminants on the top of the can or in the hose will enter the system. Turn the can tap valve counterclockwise to retract the piercing point, then thread the valve body onto the can. Be certain that the gasket is present and is smooth and elastic. With the can upright, screw the valve until the point pierces the can and the rubber gasket has sealed. The can is now tapped. The refrigerant flow is now regulated with the can tap valve.

VENTING THE CHARGE HOSE

To avoid pulling air or other contaminants into the system, it is necessary to vent the air from the hose that is used to carry R-134a to the system. To vent the hose, open the can tap valve with the can upright (vapor) then loosen the center hose fitting at the manifold. After several seconds of venting tighten the hose end fitting.

LIQUID OR VAPOR

Refrigerant is either a vapor or liquid. To supply vapor to a system, keep the refrigerant can in the upright position. To supply liquid to the system, invert the can, valve down. Be sure the can is handled carefully to ensure the correct refrigerant condition is supplied.

CHANGING CANS

Close the can tap valve on the empty can. Unscrew the can from the valve. Some pressure may be present. Let this drop before completely removing the can tap. Switch the tap to the other can. The compressor should be turned off while changing cans.

COMMISSIONING PROCEDURE

Evacuation with a Vacuum Pump

Evacuation removes air, readying the system for charging.

Connect a gauge set to the S/P/U access ports.

Connect the gauge center hose to a high vacuum pump. Start the pump and slowly open the suction gauge hand wheel. As the vacuum drops below 20 inches open both hand wheels fully.

Evacuation Leak Test

Evacuate the system to the best vacuum (lowest pressure). Close the hand wheels to the pump. Observe the vacuum gauge and be sure the pressure remains constant for 5 minutes. If the pressure rises rapidly check all the connections again. Re-evacuate to the lowest pressure and test by holding a vacuum with the gauges closed. Be sure the system will hold this vacuum. Proceed by opening the hand wheels and continuing the evacuation process for 30 minutes or more.
The "Evacuation Leak Check" is a preliminary check and is not to be considered a system leak check. A micron gauge can be used to measure vacuum. Proper dehydration and evacuation should be in the range of 200 to 500 microns.

NEW SYSTEM CHARGING

Introducing Initial Charge

After the evacuation leak test and pump down shut off the hand wheels, disconnect the center hose from the pump and connect it to the refrigerant supply. Vent the hose from the can tap (refrigerant supply) to the gauge body. With the refrigerant can (12 oz) in the inverted (liquid) position, open the discharge hand wheel and feed in about 1/2 of a can of refrigerant (6 to 8 ounces). Close the hand wheel and begin an inspection of all the connections in the system. Begin leak checking.

LEAK CHECKING

Leak checking is a very important step, which should be done with diligence. A leak will cripple this system. Please take the time needed to be sure all connections are tight. Check every connection even the ones that were pre-made in manufacture.

The "Evacuation Leak Check" is a preliminary check and is not to be considered a system leak check.

Leak checking a Charged System

Refrigerant in a saturated condition, part liquid and part vapor will exert a pressure that is a function of its temperature. The higher the temperature the higher the pressure will be. Avoid leak checking in cold weather.

A refrigerant leak will show with moderate pressure. A leak is not a function of pressure. Pressure is only required to aid in detection.

In cold weather, it is possible to raise the pressure in the system by warming the plate with a light bulb left in close proximity to the plate for several hours.

There are two ways to leak-check a pressurized system:

1. Soap bubbles (a solution of dish soap and water works well).

2. R-134a electronic leak detector (probe senses the presence of refrigerant molecules). We recommend both procedures.

To Check with Bubbles

Soap each connection and observe all sides of the connection with a bright light and a mirror. A leak will blow bubbles. Without careful examination and plenty of pressure this test is not reliable.

To Check with an Electronic Detector

Use a detector designed for R-134a. Slowly trace the area with the probe. Refrigerant is heavier than air, therefore, trace below the fitting. Most units can be calibrated to home in on a leak. We use and recommend electronic detection. TIF brand detectors can accurately detect leaks as low as 1/2 oz loss per year. This sensitivity exceeds SAE leak specifications. Be sure to test the operation of the detector before and after you leak check the system

If A Leak is Detected

Try tightening the fitting nut slightly. (See Swagelok fitting instructions) If the leak is not stopped, it is possible that the fitting was assembled incorrectly. Discharge the system, and then disconnect the fitting for inspection. After reassembly, proceed to the leak check procedure.

SPECIAL NOTES

❖ Propellants and solvents in sprays and foams may upset electronic detectors.

❖ To confirm a leak detected with a detector use bubbles and be sure it is a leak and not some erroneous vapor that is upsetting the machine.

❖ Electronic detectors do not function below 40.F.

❖ A good leak detector is able to pick up leaks as low as 1/2 oz per year.

NEW SYSTEM CHARGING

1. Continue after a thorough leak check by opening the discharge hand wheel valve with the can inverted to introduce more refrigerant. The system is designed for 24 ounces or two cans of refrigerant. Shake the can to determine the amount remaining. If one can is accepted change cans. Install as much of the total charge as possible by this method. Close the discharge hand wheel.

2. Turn the compressor drive disk several times by hand. Refer to page 29. Displacing oil in newly installed compressor.

3. Operate the engine at 1000 to 1200 rpm. Turn on the compressor at the Sea Frost Control Panel by turning the timer clockwise.

4. The sight glass will show a stream of foam, indicating a partial charge. Install the balance of the total charge by opening the suction hand wheel with the refrigerant supply in the vapor position. The new system charge should be 24 ounces. (See READING THE SIGHT GLASS) On charging a system in temperatures over 80 degrees F. the sight glass will usually clear as the return line from the V/U becomes frosted.

5. When the sight glass runs clear, top off with approximately 4 oz. (1/4 of can), subject to the formula in "PROPER CHARGE AMOUNT: MAXIMUM CHARGE."

6. On a new system, turn off the compressor for several minutes after charging, and then restart it. Run the engine at slow speed (under 1200 rpm) with several on/off compressor operations. Allow 2 minute "off" periods between 2 to 15 minutes operating periods. This distributes the oil. When charging is complete, stop the compressor and allow the entire system to equalize and the fittings to dry, an hour in most conditions.

7. When observation and test operation have been complete, close the gauge connecting valves and disconnect them from the system. Re-cap the access ports on the SPU.

8. Re-check all the connection points for leaks with an electronic leak detector.

9. Spray the Krylon acrylic coating, or similar rust inhibitor, on all the fittings and components when they are dry.

10. BREAK-IN PERIOD. During the first four hours of operation of a new compressor, limit the compressor running times to thirty minutes with an hour rest period and engine speeds to below 1200 rpm. **Monitor the charge level.**

READING THE SIGHT GLASS

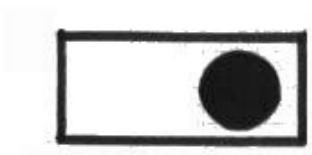
A clear sight glass, when the compressor is operating, signifies a sufficiently charged SEA FROST Engine Drive System. To determine the meaning of "clear", notice the appearance of the RFD sight glass when the system is at rest with the compressor off. This is a "clear" glass.

WARNING: A clear sight glass can also indicate a completely EMPTY system. Anytime the compressor is started, white foam should appear in the sight glass indicating that the refrigerant is present. This foam may disappear quite quickly but, IF NO FOAM IS EVIDENT and the system is not cooling, the system is empty. DO NOT OPERATE THE SYSTEM in this empty condition. Operation in this mode will ruin the compressor. Turn off the main breaker to the control panel or remove the compressor drive belt to prevent operation until the system can be properly leak tested and recharged.

Fast moving white foam with the compressor operating indicates an insufficient charge level. Watch closely for a transition from foam to total liquid, indicated by a clear sight glass. This transition point can be missed if proper attention is not given. Also, it is possible for the sight glass to show large bubbles even when the charge is sufficient, so it is important to differentiate between "foam" and "bubbles". The foam condition has velocity and direction; the bubbles are large, temporary, and nearly stationary. Do not try to chase away these larger bubbles with more refrigerant; overcharging will then occur. Air in the system may give a false sight glass reading, which could lead to overcharging. If in doubt, discharge a suspected overcharged system to continuous foam and slowly add refrigerant to clear the glass. MONITOR THE SIGHT GLASS CONTINUALLY since the glass will not indicate when the system is overcharged.

In a warm system when the plate is above freezing (32.F) upon start-up, the sight glass may take several minutes to clear. A cold system, in cold water, may show a clear glass within seconds of start-up.

RFD SIGHT GLASS DETAIL

CLEAR OR EMPTY	STATIONARY BUBBLES	FOAM (LOW CHARGE)
		

PROPER CHARGE AMOUNT

THE ENGINE DRIVE SYSTEM IS DESIGNED TO HOLD 24 OUNCES. THIS IS EQUAL TO 2 CANS OF R-134a AS SUPPLIED WITH THE SYSTEM. THIS IS THE ***MAXIMUM CHARGE***. The sight glass must clear by the time the return line (suction/large diameter line) goes below 32 degrees F.

GENERAL INFORMATION

OPERATING PRESSURES will vary with rpm, water temperature, and water flow. Generally, the discharge will peak with a warm plate in two minutes. Increasing pressure indicates an overcharge or no water flow. The suction pressure will drop to 25 psi rapidly, and will then drop two pounds per minute or faster to a slight vacuum. The 1/2" suction line will freeze and after extended operation the suction pressure will rest at a slight vacuum. Suction pressure will drop more rapidly when the seawater is cold. A vacuum will be indicated sooner. A deep vacuum indicates the V/U is frozen or plugged. Failure to "pull down" indicates the V/U is malfunctioning or flooding.

The compressor case will feel warm.

The V/U has been operated prior to shipment. There are no field superheat adjustments.

See pages 43-45 for operating pressure trend charts.

SPECIAL NOTE

WE DO NOT RECOMMEND charging SEA FROST gear with BULK CYLINDERS since it is hard to determine how much refrigerant has been installed. The feed pressure with a bulk cylinder can be higher which may cause skipping through the condenser, causing bubbles in the sight glass. However, if bulk cylinders are used, keep the suction feed pressure below 20 psi and add vapor only.

R-134a will become cloudy and indicate similar foaming in the sight glass as the pressure on the discharge side of the systems becomes too great. Adding charge to clear this condition will damage the compressor.

CHECKING THE REFRIGERANT CHARGE ~ PERIODIC INSPECTION

Checking the refrigerant charge must be incorporated into a routine maintenance schedule.

1. Locate the RFD (receiver filter drier). The location of this part varies from boat to boat, but it is often found in the engine compartment, in a locker, or beneath the cabin sole. It is a blue metal can about 9 inches high and 3 inches in diameter, with brass fittings connecting it to copper tubing. If you do not locate the RFD quickly, follow the tubing route from the engine compartment to the icebox. Along the route you will find the RFD along with other SEA FROST components. The RFD has a sight glass for viewing the flow of the refrigerant.

2. Start the boat's engine. Check to be sure the engine is pumping water.

3. Locate the SEA FROST timer panel. With the engine running at a fast idle (900 to 1200 rpm), and while looking into the sight glass in the RFD, have a helper turn the Panel Timer knob past "10" to cock the switch and start the compressor. The engine should load. An empty system will put very little load on the engine.

4. MONITOR THE SIGHT GLASS CONTINUALLY. If the sight glass does not show the presence of refrigerant within a minute of operation the system is empty. TURN OFF THE COMPRESSOR and follow the procedure in the "TROUBLE SHOOTING" section.

5. If the white foam is evident watch closely for the transition to clear. If the glass indicates insufficient charge level, additional charge will be needed. Turn off the compressor. Attach a can of R-134a with a properly vented charge hose to the suction access port. Monitoring the sight glass continually, start compressor and slowly add refrigerant vapor until the glass clears. Top off with about 4 ounces. **Do not overcharge the system.**

6. Feel the SEA FROST plate in the icebox five minutes after starting the compressor. If the sight glass clears yet the plate temperature does not drop after 5 minutes of operation, stop the compressor and follow the procedure in "TROUBLE SHOOTING".

7. If the proper charge is indicated, make ice and go sailing.

DISCHARGING THE SYSTEM

Before the connections or components can be disassembled, the refrigerant must be recovered. Connect a gauge set to the suction access port. Slowly recover the refrigerant, (keeping the pressure under 20 psi) into an approved reclaiming system. Do not loosen any connections until the system shows 10” vacuum for 10 minutes.

To discharging an overcharged system, discharge into a recovery machine at the same 20 psi rate for a minute at a time. Be sure the gauge hand wheel is off before starting the compressor.

TROUBLESHOOTING

The most common problems that can occur in a SEA FROST Engine Drive System are:

1. Loss of refrigerant charge resulting from leaks.
2. Moisture or dirt plugging the valve.
3. Compressor malfunction due to loss of refrigerant charge.
4. High-pressure switch cycling due to overcharge or lack of water flow.

STEP 1. Gather information as to the nature of the problem before operating the system. A leak often leaves a trace of oil. Inspect fittings, hoses, and tubing for wear, corrosion, and chafe. **Do not operate the compressor until the trouble is corrected.**

The high pressure switch cycling is indicated by the compressor and indicator lamp turning off when starting a warm system, or if the cooling water is not flowing. Determine the condition by checking the water flow from the engine exhaust. If the water flow is not at fault recover some refrigerant. (See DISCHARGING THE SYSTEM) The compressor should not be operated during recovery. This is a trial and error procedure until the compressor stays on without cycling during initial pull down. Check the sight glass for proper charge. Be sure the sight glass still clears.

For further troubleshooting, attach purged gauges to S/P/U access ports or observe the temperature of the lines. See pages 43-45 for operating pressure trends.

❖ If the icebox and SEA FROST plate is warm and pressure readings are below 50 psi with the compressor off (in 50 degree F or higher ambient conditions), pressurize the system with R-134a and leak-check.

❖ If the pressure readings are over 50 psi with the compressor off, proceed to check charge level via sight glass and charge if needed. CHARGE LOSS INDICATES A LEAK THAT MUST BE CORRECTED.

STEP 2. If the system continues to operate improperly after Step 1, check for moisture or dirt plugging the valve. Run the system, observing closely the gauge readings and plate temperature, noting the following.

A. If system is warm upon start-up, a DIRT-PLUGGED Valve will show an immediate deep vacuum reading on suction side. Consult SEA FROST for cleaning techniques.

B. A MOISTURE-PLUGGED VALVE is indicated by a deep vacuum reading on the suction side after 1 to 5 minutes of normal operation from warm, FOLLOWED BY any combination of these symptoms:

❖ The temperature at the compressor discharge fitting and the copper tube at the top of the condenser drops from hot to warm.

- ❖ The temperature of the suction line from the V/U increases.

Moisture enters either through suction side leaks or during initial installation and will freeze at the V/U, reducing or eliminating refrigeration activity. Turning off the system and allowing the V/U to warm to above freezing then restarting, may temporarily solve the problem. If not, change the RFD as follows.

STEP 3. To change a saturated RFD, allow the system to warm to ambient temperature, thereby preventing moisture from condensing in the system. A light bulb in the icebox will speed the warming of the plate. WARNING: BEFORE DISASSEMBLY OF ANY PART IN THIS SYSTEM BE SURE THE REFRIGERANT IS COMPLETELY RECOVERED. With a backup wrench holding the brass body of the Swagelok fittings, loosen and back off the nuts. The tubing may be pulled out of the fittings. Remove the RFD. Replace only with an identical RFD by size and color. THE SEA FROST RFD is a drier and also a receiver/filter. The desiccant and the oil in the Sea Frost RFD are special to this system and R-134a. **Installation of the wrong part or oil will destroy the system.**

NOTE: This system contains a measured amount of lubricating oil. Be sure the RFD being installed is a blue SEA FROST Engine Drive RFD. Record all component exchanges in the on-board owner's manual.

Follow the "re-make" instructions for Swagelok fittings.

Reminder: To ensure removal of system moisture use a high vacuum pump, and evacuate the system with the highest possible ambient and plate temperatures. A light bulb or heat lamp in contact with plate is a good technique.

Recharge. Refer to "New System Charging".

MOISTURE IS A SYMPTOM. Carefully leak-check the low side of the system if moisture becomes a problem. Moisture leaks in! Look for an oily fitting.

CALL US WITH ANY QUESTIONS
603-868-5720

MAINTENANCE FOR UNITS IN TROPICAL WATERS

ZINCS

THIS IS THE MOST IMPORTANT PROCEDURE. A FULL FLOW SEA FROST CONDENSER WITHOUT A ZINC OR WITHOUT THE BONDING STRAP CONNECTED WILL LAST A VERY SHORT TIME. BE SURE TO CHECK THE WEAR BY INSPECTION. REPLACE EVERY SIX MONTHS OR SOONER IF INSPECTION REVEALS EXCESSIVE WEAR.

IF THE ZINC BREAKS IN THE BRASS PLUG, REMOVE THE REMAINING ZINC BY MELTING IT WITH A PROPANE TORCH.

ALKALI SCALE

CONDENSERS WILL SCALE AFTER SEVERAL YEARS IN WARM WATER CAUSING HIGHER HEAD PRESSURES DUE TO THE SCALE INTERFERING WITH THE HEAT EXCHANGE. REMOVE THE ZINC AND PLUG THE HOLE IN THE CONDENSER WITH A 3/8" NPT PIPE PLUG. WARNING: LEAVING THE ZINC IN PLACE MAKES A BIG BATTERY UPON ADDING ACID. THIS WILL PRODUCE HEAT AND SMOKE. DON'T FORGET TO REMOVE THE ZINC. REMOVE THE TOP HOSE ON THE CONDENSER AND POUR *MURIATIC ACID INTO THE CONDENSER UNTIL IT BOILS OUT THE TOP.

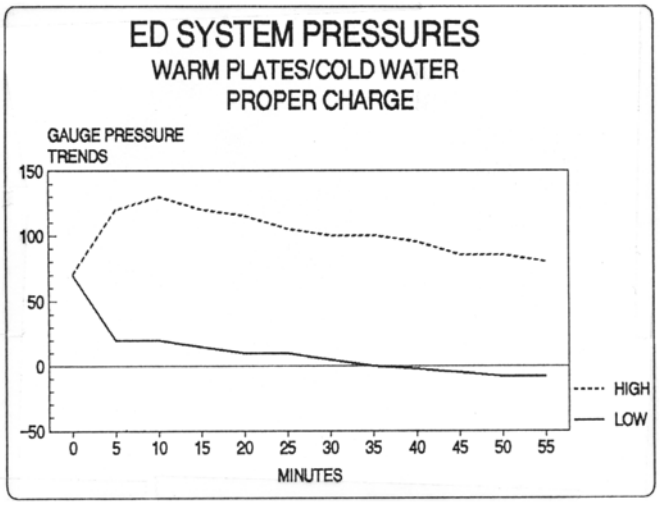
WARNING: BE SURE TO FOLLOW SAFETY PRECAUTIONS ON THE MURIATIC ACID CONTAINER.

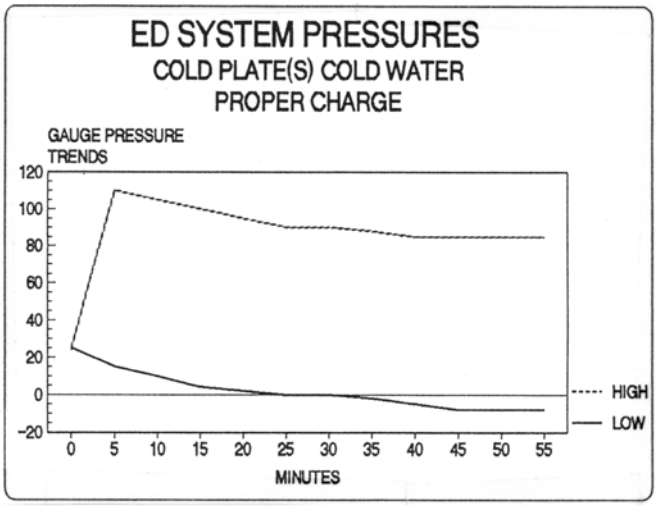
❖MOST MURIATIC ACID IS BOTTLED AT 5%-7%. THIS CONCENTRATION IS WHAT WE RECOMMEND.

BOILING (FOAMING) WILL STOP IN (4 OR 5 MINUTES. THERE IS NO DANGER OF DAMAGE TO THE CONDENSER. RECONNECT HOSE TO THE ENGINE AND START THE ENGINE WITH THE THROUGH HULL OPEN. AFTER A MINUTE OR TWO OF OPERATION TO FLUSH OUT THE ACID, SHUT OFF THE ENGINE AND THROUGH HULL AND REPLACE THE ZINC.

CLUTCH COILS

THESE FAIL FROM HEAT BREAKING DOWN THE WIRE INSULATION IN THE WINDING. DAMAGING HEAT CAN BE CAUSED BY OPERATION WITH TOO MUCH CHARGE AND BY SCALING. CLEAN THE CONDENSER. BE SURE THE CHARGE IS MINIMUM FOR A CLEAR GLASS. NO MORE THAN 24 ozs IS NEEDED FOR MOST SYSTEMS. A SINGLE PLATE OR BLOCK SYSTEM WILL NEED LESS THAN 24 ozs OF REFRIGERANT.


ED SYSTEM PRESSURES
WARM PLATES/COLD WATER
PROPER CHARGE
GAUGE PRESSURE
TRENDS
150
100
50
0
-50
0 5 10 15 20 25 30 35 40 45 50 55
MINUTES
HIGH
LOW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COLD PLATE(S) COLD WATER
PROPER CHARGE
GAUGE PRESSURE
TRENDS
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100
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40
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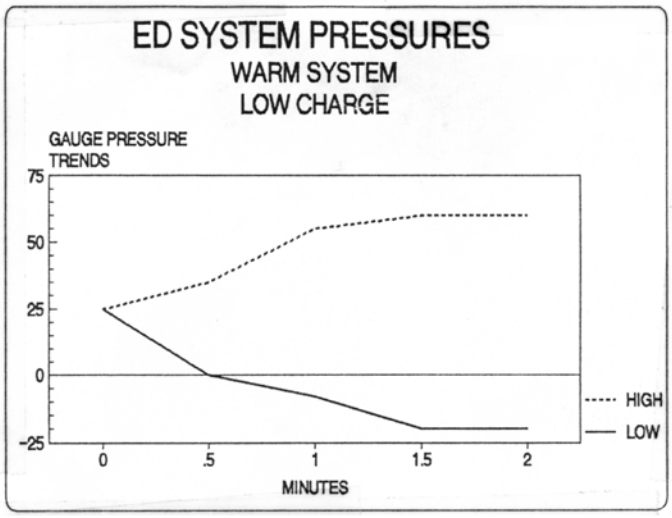
-20
0 5 10 15 20 25 30 35 40 45 50 55
MINUTES
HIGH
LOW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WARM SYSTEM
LOW CHARGE
GAUGE PRESSURE
TRENDS
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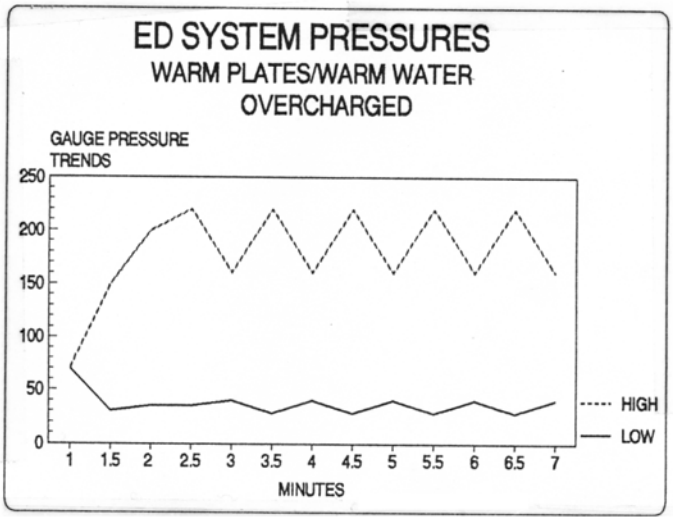
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WARM PLATES/WARM WATER
OVERCHARGED
GAUGE PRESSURE
TRENDS
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150
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7
MINUTES
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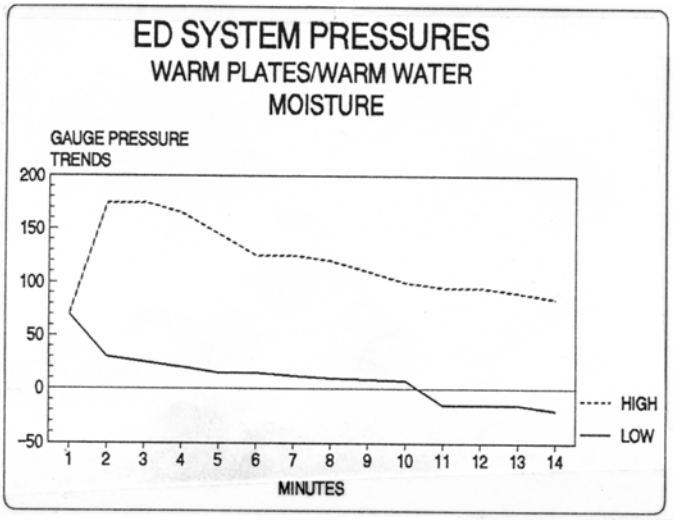
LOW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MOISTURE
GAUGE PRESSURE
TRENDS
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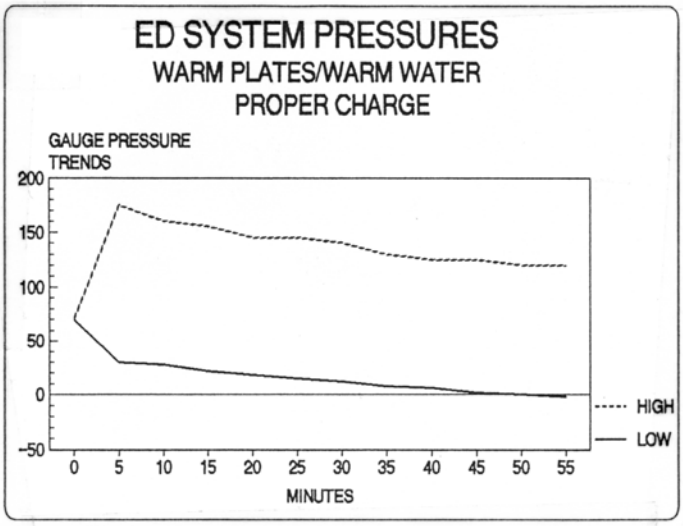
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WARM PLATES/WARM WATER
PROPER CHARGE
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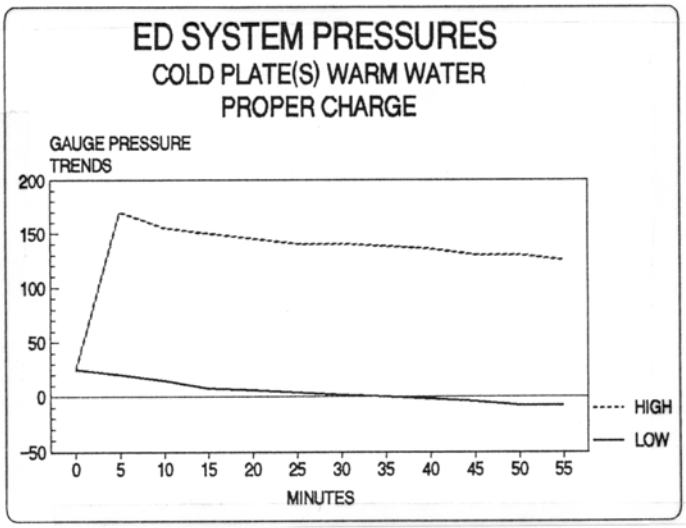
ED SYSTEM PRESSURES
COLD PLATE(S) WARM WATER
PROPER CHARGE
GAUGE PRESSURE
TRENDS
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0 5 10 15 20 25 30 35 40 45 50 55
MINUTES
HIGH
LOW