

**SEA FROST®**

148 OLD CONCORD TURNPIKE BARRINGTON, NH 03825 USA TEL (603) 868-5720 FAX (603) 868-1040 1-800-435-6708  
E-Mail: sales@seafrost.com www.seafrost.com

**ENGINE DRIVE R-12 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.

SEA FROST is a registered trademark

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

**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.




BREAK-IN PERIOD. DURING THE FIRST TWO HOURS OF OPERATION OF A NEW COMPRESSOR, LIMIT RUNNING TIMES TO THIRTY MINUTES (FOUR SEPARATE THIRTY MINUTE OPERATIONS WITH A REST PERIODS OF AN HOUR OR MORE) AND 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 gray metal can about 8 inches high and 2.5 inches in diameter, with brass fittings connecting it to copper tubing. (If you do not locate the RFD quickly, follow the route of 3/8" refrigeration copper tubing, the smaller diameter tube, 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, have a helper turn the 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 the refrigerant is present. This foam may disappear quite quickly, but IF NO FOAM IS EVIDENT, that is, if the sight glass does not show a presence of refrigerant within a minute of operation the system is dead 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:

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

<b>RFD SIGHT GLASS DETAIL</b>		
		
EMPTY OR CLEAR	STATIONARY BUBBLES	FOAM/LOW

6) Feel the SEA FROST Block or Plate in the ice box five minutes after engaging the timer switch. If the sight glass clears yet the Block temperature does not drop after 5 minutes of operation, CALL US AT 603-868-5720.

7) **The compressor in a Sea Frost R-12 Engine Drive system is designed for R-12 only. Use of any refrigerant other than R-12 will damage the seals in your compressor.**

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## **OPERATION ~ 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 Block or plate(s) 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.

## **OPERATION**

### STEP 1.

To operate the system, the engine must be running. This system is water-cooled and depends 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

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 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 by it's self. 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 plate getting cold. After about a half hour, the plate will become very cold and if the timer is on, the compressor may cycle on and off. The maximum cold storage is generally attained within an hour. However you might experiment with two shorter periods a day. There is no limit to "on" time.

**WARNING:** After 5 minutes of operation, check for a drop in the plate's temperature by feeling the plate with your hand. If no noticeable cooling has occurred, turn off the timer switch. Check the charge level and check the water flow from the exhaust. **TO PROTECT THE COMPRESSOR, DO NOT OPERATE** the system if this temperature drop is not noted.

## **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 (cools) 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 (be above freezing) and still not require running in refrigeration applications. Monitor the box temperature itself.

DEFROSTING will be required. A heavy layer of frost or ice will reduce cooling. Defrosting is very important in freezers.

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. Using this method the most rapid storage is developed, dissipated to the box and contents then regenerated.

Experimentation will provide the best instruction on how the SEA FROST should be operated on your boat.

## **ICE MAKING**

### **WITH THE BLOCK SYSTEM**

The best way to make Ice is by freezing the metal ice trays to the top of the block. Spill some water on top of the block before an insulating layer of frost builds up, and then place the trays on the block. This water under the trays provides the thermal contact necessary and freezes within minutes, holding the trays securely.

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 with out operating the compressor. By the same token ice making does not require compressor operation for the whole period ice is forming.

### **MAKING ICE IN PLASTIC**

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.

### **WITH VERTICAL TRAYS**

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 increase freezing ability).

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

### **HARVESTING VERTICAL TRAYS**

Plan to wait some time after the trays are frozen for them 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.

### **STORAGE OF ICE CUBES**

After ice has been made and harvested, store it in sealable plastic bags in the refrigerator or in the freezer. Leaving the ice in trays in contact with the block or 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. Check the refrigerant charge, **never operate the system without proper charge.**
2. Check belt tension and condition.
3. Check compressor mounting and compressor bracket bolts.
4. Maintain the condenser zinc. **Failure to maintain the zinc anode will cause damage to the system.**
5. Check all components and all 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 flushed and filled with an antifreeze solution to avoid damage from freezing. If the condenser is to be left dry flushing with a good amount of fresh water to remove salt deposits is recommended.

## CLEANING

The plate's surface protects itself with 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.

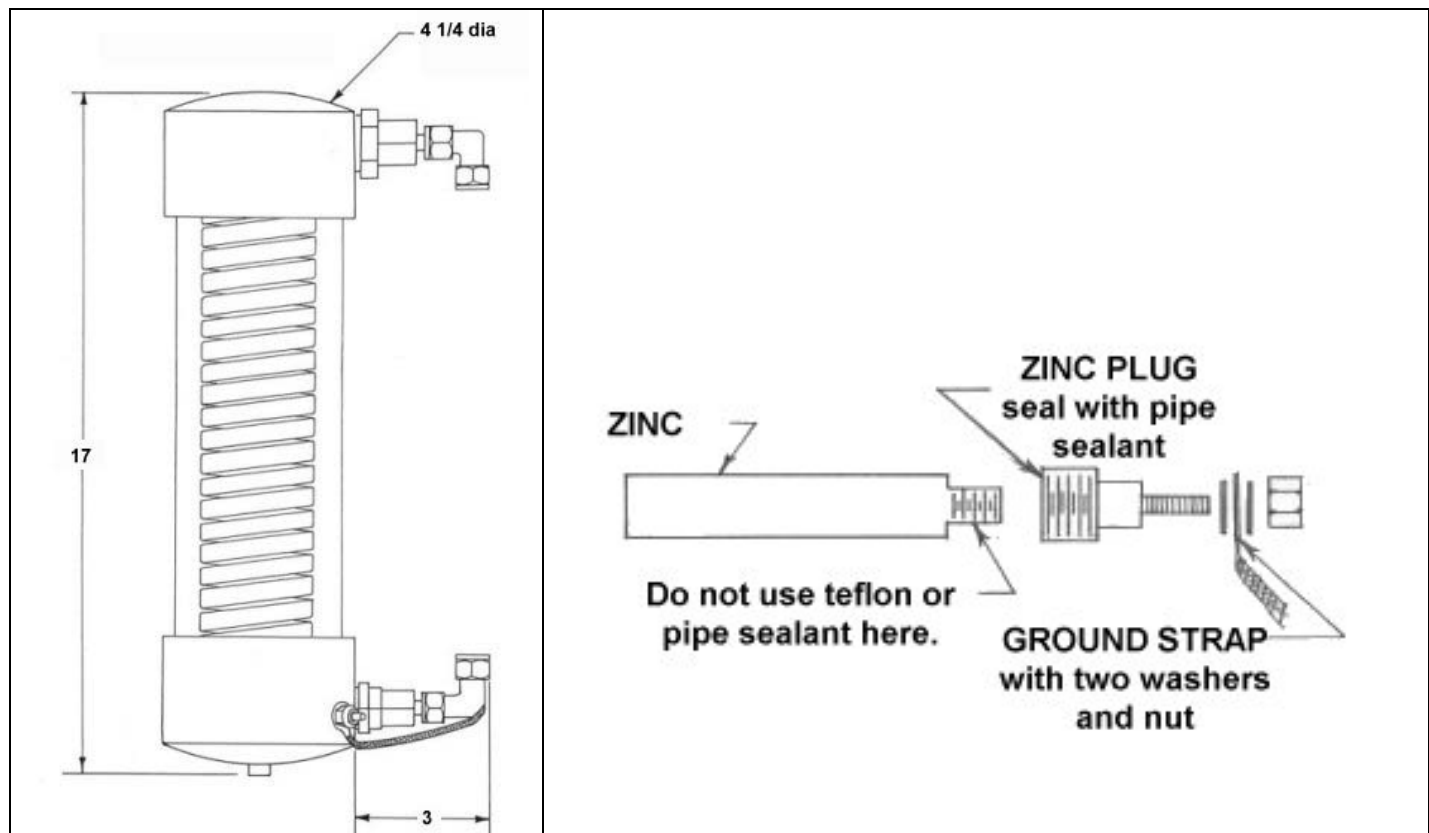
## TROPICAL OPERATION MAINTENANCE

A system that has operated for several years in the tropics or is in service in the tropics may need condenser cleaning with muriatic acid. Refer to the data sheet on page 37.



## DETAIL OF CONDENSER ZINC ASSEMBLY

To change the zinc, first close the engine seacock. Using two 7/16 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. Using pliers hold the zinc and unthread the plug. Should the zinc break in the holder, it may be cleaned by heating 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 STRESS THE CONDENSER HOUSING.** Open the seacock and check for leaks. Reassemble the ground strap and nut. **NOTE** that 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 with, 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 also. 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 cooling it. The alcohol is actually using the heat from your hand to boil and 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 and 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.

Let's look at Refrigerant-12. R-12 will boil at minus 21 degrees F at sea level. By evaporating liquid R-12 in the SEA FROST plate, heat is absorbed. To dispose of this heat, a condensing phase change is necessary. By increasing the pressure (compressing) we can raise the boiling point of the gas vapor at the condenser. Seawater passing the condenser coils removes the heat, forcing the gas to a liquid state again. Pressure is the key that allows passing the heat we have taken from the icebox to a warmer place (the sea water) and converting the gas to liquid to be re-evaporated again.

By causing R-12 to boil (evaporate) in the SEA FROST plate, we use the heat energy in the plate. This activity cools the liquid solution in the plate, causing it to change phase (freezing to a solid). By freezing this solution, we have increased its heat absorption capacity more than 100 times. When the cycle is stopped (the compressor is turned off) the 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, its performance and life are in the hands of the installer. To insure your work:

1. Read and understand this manual.
2. Follow Swagelok instructions carefully.
3. Install RFD last, the same day the system is charged.
4. Spend enough time leak-checking to be sure there are no leaks.
5. Thanks from all of us who have to guarantee your work.

There are two contaminants that will give you problems in a refrigeration system. They are WATER and DIRT. Moisture is always present and cannot be eliminated; water in this case refers to puddles and drops. Dirt is any solid. The installer's habits will be most 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 the valve.

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 tube must be done with the tube either taped or capped. Cap both tube ends after each cut. Spare caps have been included.

Work with only one line at a time, and uncap only one end at a time.

## TUBE CUTTING

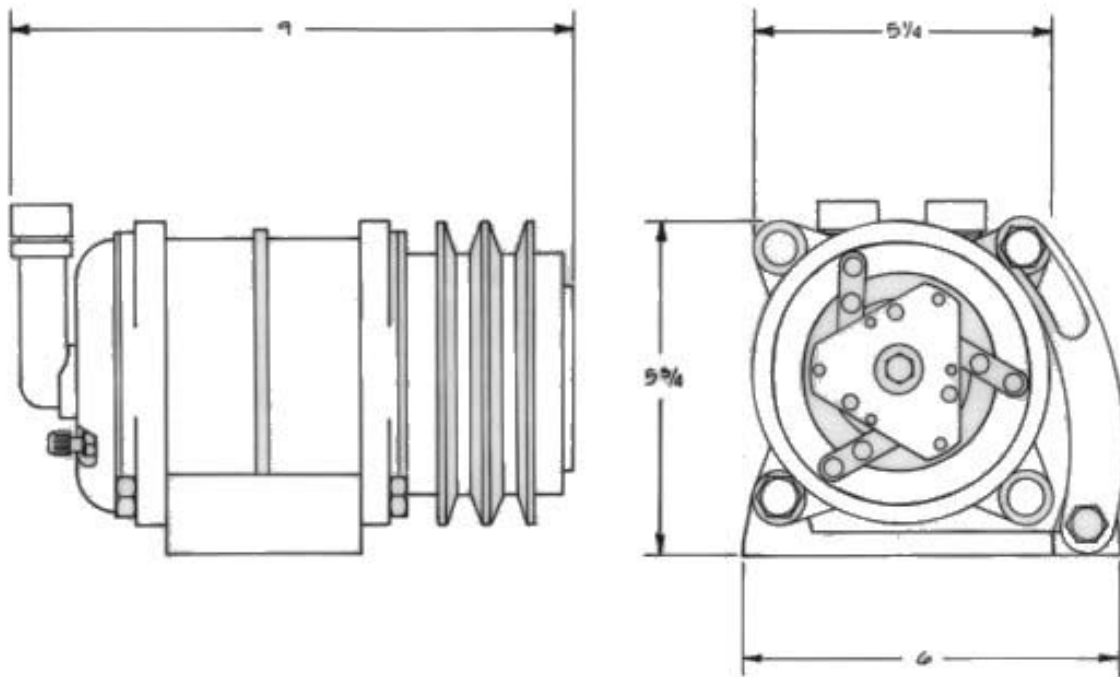
Use only a tube cutter, hacksawing or any other method will introduce chips to the system and distort the tube, making connections difficult and leak-prone. A small miniature cutter is essential for this work. CUT SLOWLY to avoid a ridge on the inside of the tube. We do not recommend reaming or dressing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

## TUBE BENDING

Make all but the long sweep bends with a spring bender; one kink and the line must be rerun. Don't add any more fittings than are absolutely necessary. Route all lines in such a way that they are most direct but out of the way. Several inches of the end of the tube going to a connector must be straight and round. Again, keep everything sealed until you are ready to make that connection.

## THE COMPRESSOR

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



In mounting the compressor, consider the following:

- ❖ When mounted, the compressor **must not lay over on its axle axis more than 45 degrees from vertical**. The port fittings, clutch coil wire, and the ground screw indicate the top of the compressor.
- ❖ The two service ports at the rear of the compressor must be accessible following mounting of the compressor; servicing the system requires attaching charge hoses to these ports. These ports are ¼" flare fittings with Schrader valves and sealed with caps. The caps must be installed on the port to prevent it from leaking.
- ❖ Allow clearance for compressor hose assemblies and belt adjustment if the compressor is mounted under the engine. An optional low profile head is available that requires no clearance and allows the hoses to exit straight back. Hoses with straight compressor fittings are available as an option.
- ❖ 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, so it must be ruggedly bolted.
- ❖ The extra pulley on the compressor may be used to drive a pump or alternator.
- ❖ 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. The compressor is not affected by side loads on the clutch pulley since the construction of the free wheel pulley puts all load on the compressor case. This protects the compressor bearing and shaft seal from failure and leaks from 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.
- ❖ 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.

## 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.

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

## COMPRESSOR BELTS

Various belts are available with an "A" section (1/2" 60 degree V). 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.

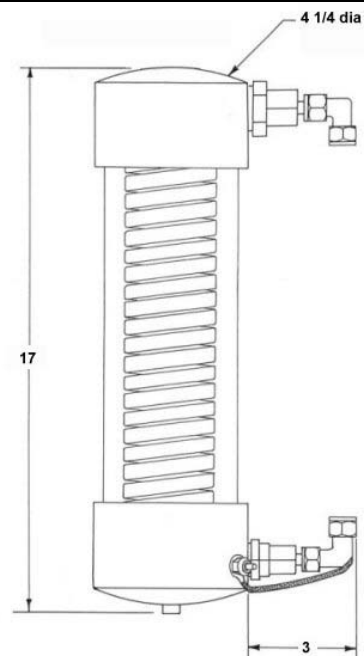
## CONDENSER

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 diameter from the through hull to engine.

It may be connected on the discharge side of the engine's raw water pump, but it must be connected before any recirculating loops to the engine to be certain it receives the full flow of the coldest water.

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



❖ **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 allowing the plastic plug and the zinc plug to be swapped.**

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

❖ The bracket is designed to clamp to the middle section.

❖ Be sure water fittings are made tight. A leaky water fitting may prevent engine pump priming by leaking air into the circuit.

## **BLOCK**

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

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

The block copper tubing should exit the icebox wall to a place where the valve control unit can be fitted, such as a hanging locker, sail locker, or the engine compartment. This may provide the cleanest easiest installation. There is some moisture created by the Valve/Control Unit if it is not properly insulated so accessibility for insulation application must be considered. However, if the ice box location is such that the Valve/Control Unit cannot be mounted outside, it is acceptable to install it on the inside of the box. Its temperature does not effect the operation of the VCU.

The Block must be installed in the horizontal mode.

Mounting tabs have been drilled and countersunk for 1/4" bolts. The tabs 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.

A cleat or shelf will also give good support. A shelf below the block may be used as a cold zone. However, keep in mind that airflow is required to cool all sections of the box, so don't constrict airflow with excessive shelving.

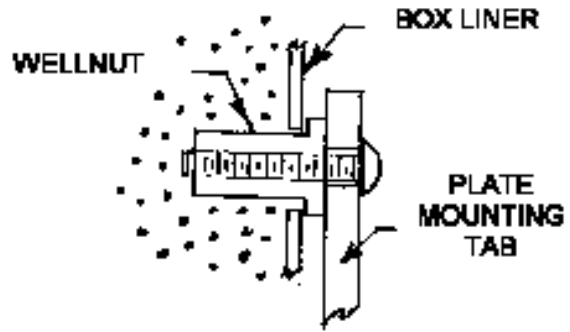
Be aware that a molded fiberglass liner has a sloped wall. Shimming or lowering Block mounting may be necessary in order to provide clearance for ice trays.

A drilling template should be made. Drill 1 1/4" holes for the refrigerant tubes completely through the icebox wall if the V/C/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 off the Swagelok nuts and ferrules. 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 that the fittings on 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.

### 809 PLATES

SEA FROST holdover plates mount with a "Wellnut" expandable neoprene blind hole fastener. 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 Wellnut 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.



## VALVE CONTROL UNIT

For appearance and convenience of installation, the valve control unit mounts outside the icebox. However, in certain applications it may be necessary to mount it inside. Two Swagelok fittings fasten it to the block tubing protruding through the icebox wall. Before cutting the tubing:

1. Leave a minimum of 1 ¼" of tube beyond the bulkhead.
2. Allow room for wrench access.

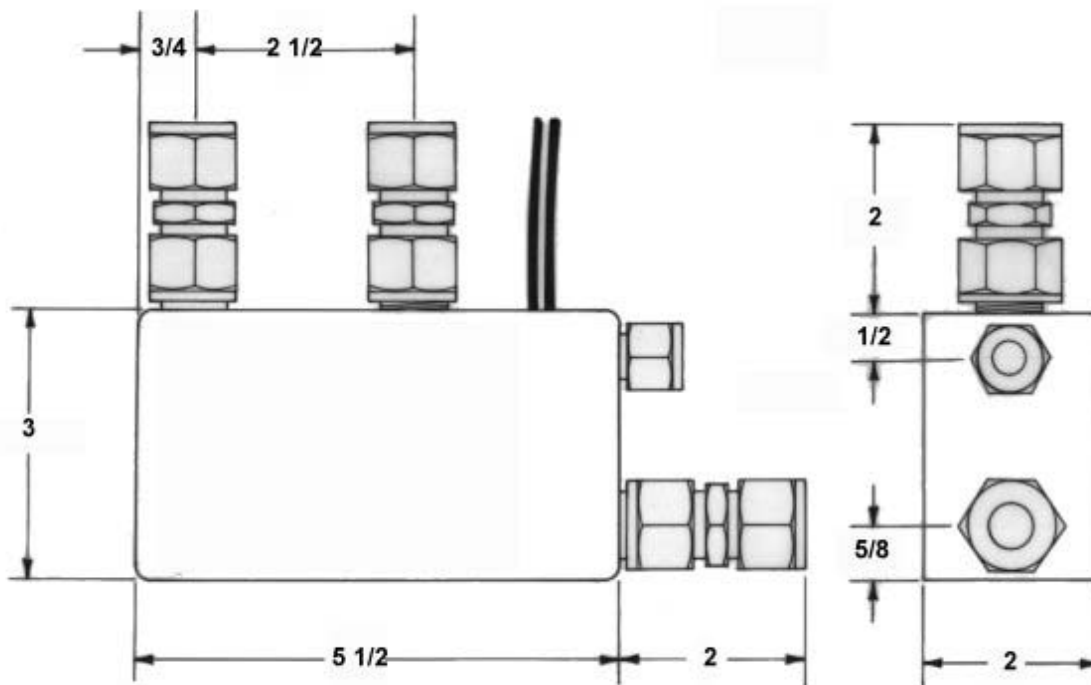
Ninety-degree elbows can be factory installed on the valve control unit to reduce the space requirements if necessary.

The tubing will support the valve control 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 VCU will attract moisture if not properly insulated. Be sure it is accessible for proper insulating after the system has been leak checked and operationally tested.

For final installation of this unit see the Swagelok instructions.



## 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. If disassembly is necessary, reassemble per drawing.

This is 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 pushing onto the tube, 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 Swagelok tube fitting, make a pencil mark one inch from end of tube as a guide. Prior to inserting 3/8" tubing, make a pencil mark 5/8" from the end of the tube as a guide.

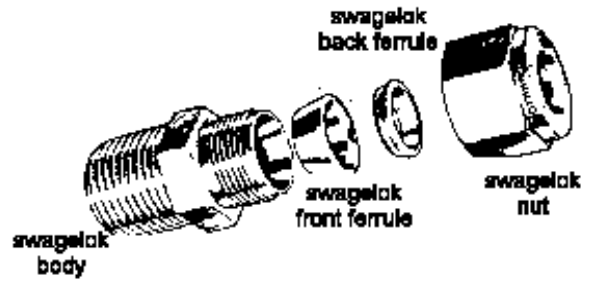
Step 3. Insert clean, smooth tubing with the pencil mark into the Swagelok tube fitting. You can be sure the tube is resting firmly on the shoulder of the fitting when the pencil mark is flush with the nut.

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, step # 2).

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

Step 5. 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, step #3).

DRAWING 1

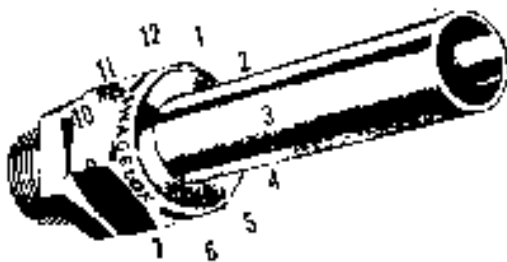
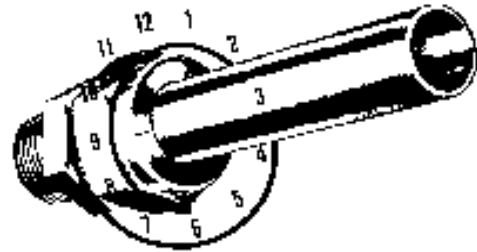


STEP 1

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 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. Rotate the nut about one-quarter turn with a wrench (or to original one-and-one-quarter tight position). Then snug slightly with the wrench.

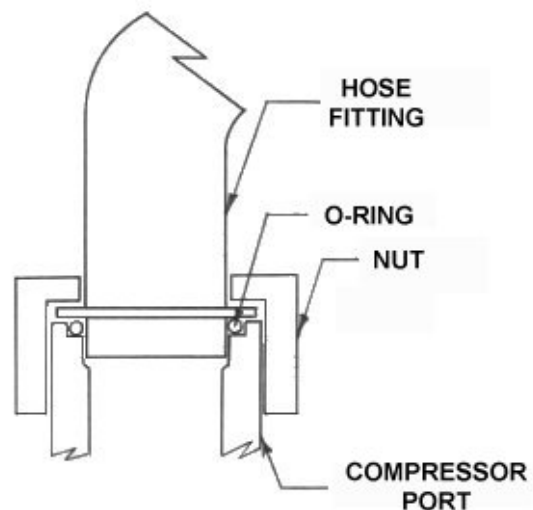
## SWAGELOK PERFORMANCE

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.

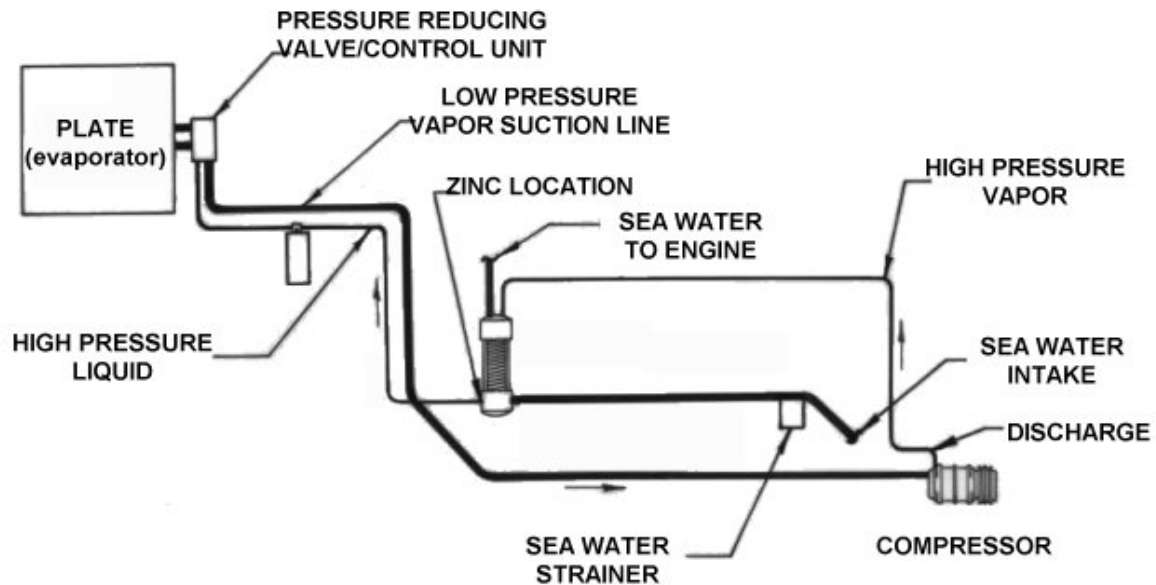
### HOSE TO COMPRESSOR FITTINGS

Remove the plastic caps and rubber plugs from compressor ports. Save these parts.

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. 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 move when tightening is complete.



## RUNNING THE LINES



## PLANNING

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 without having to disconnect the system. Leave some slack in the hoses and have them directed the same way to allow compressor movement as necessary for access to anticipated repair areas. Hose sets without adequate slack will stress the hose fittings at the compressor causing failure of the fitting.

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

**The RFD is fitted with a sight glass. This glass must be visible for charging and servicing the system.** It can be viewed from 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 visible!

Observe the inlet/outlet on RFD. It is labeled. The glass is offset toward the outlet.

The RFD should be installed only after all the lines are run and all other fittings are made.

## Helpful tools

- Coil spring-type tube benders are available for 3/8"-1/2" O.D. tube. These springs are slid over the tube. Bend is formed in the spring, and then the spring is removed by unscrewing.
- Ford wrench: Jaws at right angle to the handle for hard to access connections.
- 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. 3/8" tube runs 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, the 3/8" tube goes to the Valve Control Unit. Some systems use 1/4" tube from the RFD to VCU. The return line from the VCU is 1/2" tube. This line runs to a Swagelok-to-hose fitting. The compressor hose then returns to the elbow on the compressor suction port.

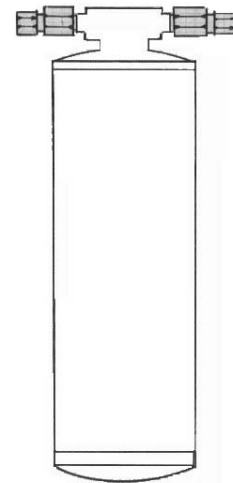
## RFD ~ RECEIVER FILTER DRYER

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. A pick-up tube extends from the bottom of the canister to the outlet. For proper function of the reservoir the RFD must be positioned as close to vertical as possible to ensure proper operation at various heel angles.

Observe the inlet on the RFD. The sight glass is offset on the RFD toward the outlet. The lines easily support the RFD. The tie wraps with screws will hold the tubes supporting the RFD.

Refrigerant flow is from the bottom of the condenser to the RFD, then to the Valve Control Unit.



## **INSULATING THE LINES**

Insulating should be the last step after leak checking 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 adding fittings. Insulation should be installed only on dry lines, and only after the acrylic spray procedure.

The suction return line is carrying the expanded vapor to the compressor. This line is cold and will attract moisture and frost when running. The suction return line includes all the exposed 1/2" tubing and the larger fittings. The entire valve control unit will also frost. It is important to insulate the line, the valve control unit and all 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. 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 the valve control unit.

## **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. Turning the timer to "O" or shutting off the 12v supply will shut off the unit. 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**

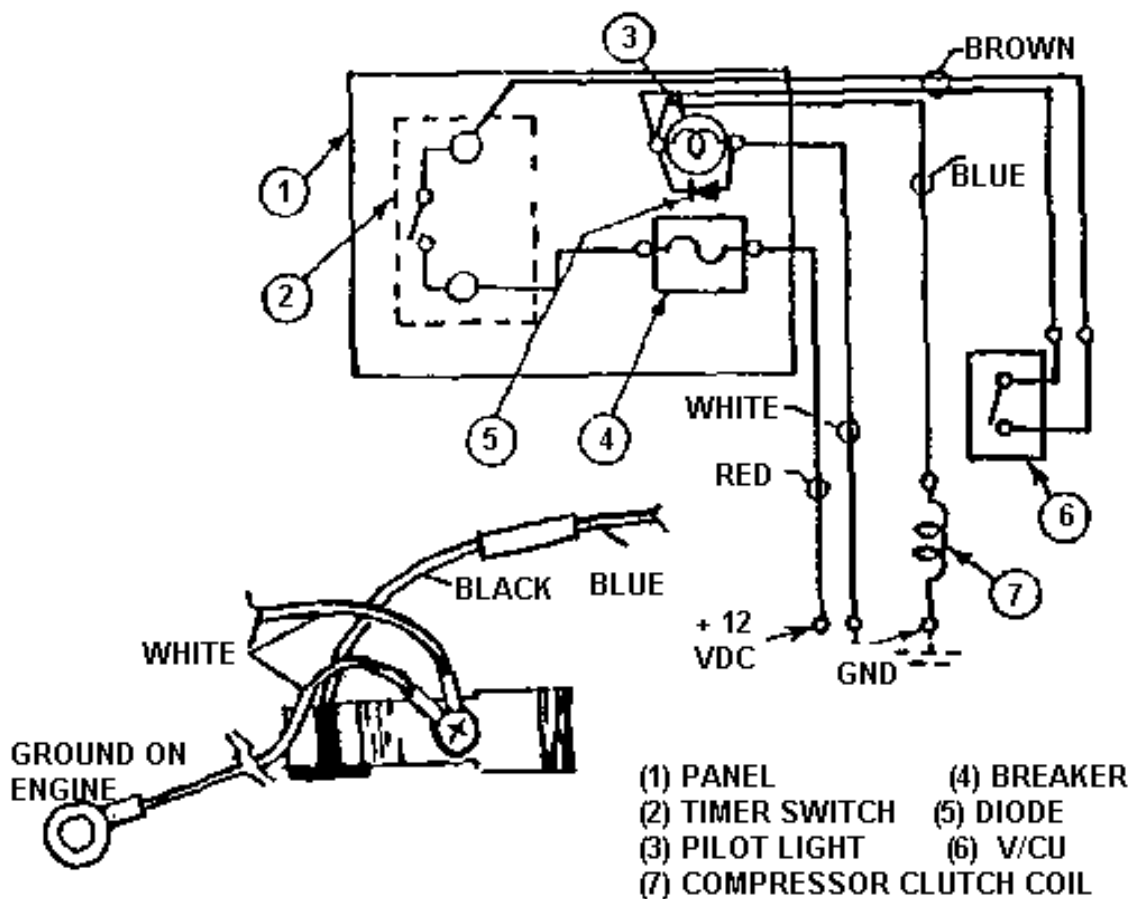
The compressor clutch will draw 3 to 3.5 amps per hour at 12 volts when the timer is operated. A 24-volt system will draw 1.5 to 1.75 amps per hour. The timer panel breaker is rated at 7-amps per hour and the wire is rated to about 20-amps per hour. The supply to the timer should have at least a 10-amp breaker.

Because the compressor is switched on only when the engine is on, no power is taken 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 pigtail on the compressor with a butt connector. The brown wires are connected to the VCU by using the insulated female connectors. Connect the white wire to the Phillips screw on the compressor along with the 3 ft. wire in the kit. This 3 ft. 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". Leave enough slack in the wire behind the panel to allow removal of the panel for service. 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 for 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 of the condenser.
2. Check to see that the RFD is installed observing the inlet-outlet.
3. Check that the RFD sight glass can be seen.
4. Check all the connections with wrenches to be sure they have been made up.
5. Check the belt and compressor bolts for tightness.
6. Check to make sure the compressor is mounted in an upright position.
7. Check the panel wiring by starting the timer switch. The pilot lamp should come on, and compressor clutch should click.
8. Check the neatness of the installation: sufficient service accesses, secure wiring, and make sure tubing is supported to prevent damage and chafing.
9. Check the condenser zinc access to see that it is serviceable.

## **REFRIGERANT HANDLING**

SEA FROST is charged with REFRIGERANT-12. R-12 is the common name and number given to the chemical composition DICHLORODIFLUOROMETHANE (CC12F2). It is almost odorless, nontoxic, non-corrosive, non-irritating, and non-flammable. Its boiling point is -21.F at sea level. It was used in most household refrigerators and in auto air conditioning systems. R-12 is now available in 30 lb cylinders.

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 top down. Be sure the can is handled carefully to ensure the correct refrigerant condition is supplied.

## **SAFETY**

R-12 is non-toxic, however, liquid R-12 will freeze skin. It's especially dangerous to the irreparable tissues of the eyes. --WEAR EYE PROTECTION--

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

WARNING. NEVER OPERATE A SYSTEM WITH THE HIGH SIDE (DISCHARGE) OPEN TO THE REFRIGERANT SUPPLY. Pressurization of the supply can beyond its normal pressure could cause it to burst.

## **ACCESS TO THE SYSTEM ~ SERVICE PORTS**

The service ports are two small, capped Schrader valves on the compressor. The ports are labeled "D" and "S", or "Discharge" and "Suction". The valves are the access to the system and the caps are to seal the system. Without the caps the valves may leak. Be sure the caps are installed tightly after charging or service.

## **TAPPING A CAN OF REFRIGERANT**

Be sure the can of R-12 is clean and dry. Any contaminants on the top of the can or in the hose will enter the system. First, install the clamp assembly on the top of the can. Next, screw the valve wheel into the valve body, closing the valve. The metal point will protrude from the gasket, but it will make its own seal while piercing the can. Be certain that the gasket is present and is smooth and elastic. Now, with the can upright, screw the valve body assembly into the clamp on the can, turning until the point pierces the can and the rubber gasket has sealed. The can is now tapped.

## VENTING THE CHARGE HOSE

To avoid pulling air or other contaminants into the system, it is necessary to vent the air out of the hoses that are used to carry R-12 into the system. To vent the hose, open the can tap valve with the can upright (vapor) to allow pressure to escape and then make the connection as this vapor is escaping. Follow this procedure when adding refrigerant to an evacuated system or to a system low on charge.

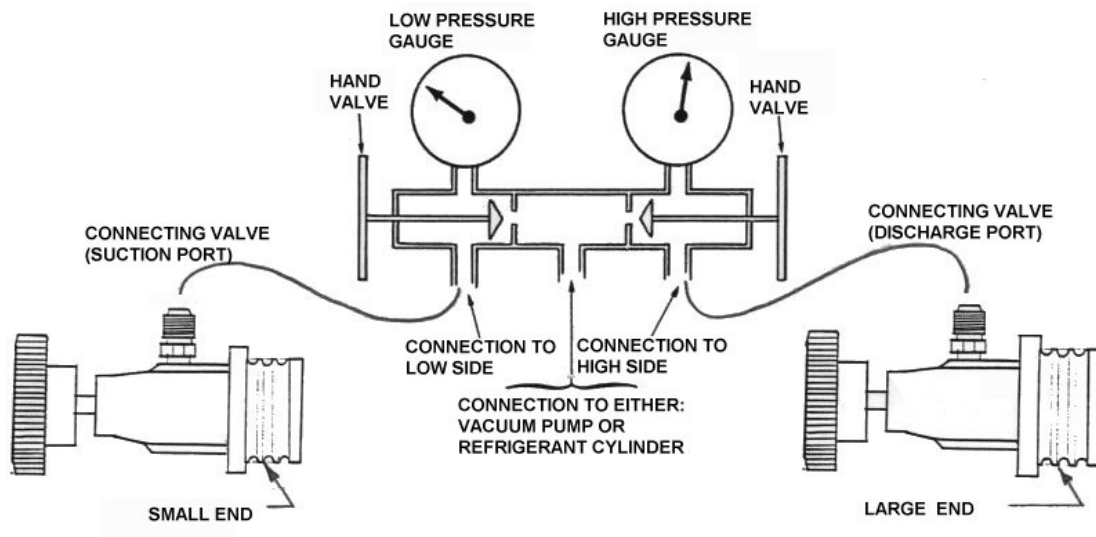
## CHANGING CANS

Close the valve on the empty can. Unscrew the can from the valve body. Some pressure may be present. Let this drop before completely removing the can tap. Switch the clamp to the other can, and rethread onto the valve body.

## GAUGES

Gauges must be used in the evacuation and charging. They will provide information on system performance.

Gauge sets consist of two gauges installed in a manifold with two valves. The left gauge (blue) is a compound device, it indicates pressure and also vacuum. The right gauge (red) indicates pressure only. The valves open a center port (yellow) to the left or right side respectively. Operation of the valve is only necessary when moving refrigerant or evacuating. With the valves closed, the gauges read the pressures of the connection points. The red hose is connected to the discharge side of the compressor; the blue hose is connected to the suction side.



Charging with the gauges should be done through the blue side. The center hose is connected to the can tap. Be sure to vent the hoses to displace any air that might be in them.

TO INSTALL GAUGES ON A CHARGED SYSTEM, with the system off, attach the hoses to the compressor. Vent the hoses at the manifold body by loosening the fittings for a few seconds.

TO REMOVE THE GAUGES, turn off the compressor, wait for the pressure readings to equalize, and then rapidly unscrew the hoses at the compressor. Re-cap the service ports.

Keep your gauges clean. Inspect the rubber gaskets on hoses, leak-check gauge valve packing and all hose connections. Prior to use, any oil should be blown out of the hoses. The end of the hose that contains the depressor core is the end, which attaches to the compressor service port. Check and reset the "O" on the low side gauge, if necessary.

## **LEAK CHECKING**

After all the equipment is mounted and connected, leak testing should be performed. This 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.

## **ABOUT PRESSURES**

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. Avoid leak checking in cold weather.

A refrigerant leak will show up under moderate pressure. A leak is not a function of pressure once the pressure is high enough to show up on leak-checking equipment.

To leak check a new system, install the gauges and a can of refrigerant on the suction port of the compressor. With the can in the inverted (liquid) position, open the valve and feed in about 1/2 of a can of refrigerant, shaking the can, adding more if needed. Close the valve and begin an inspection of all connections you have made.

In cold weather, it is possible to raise the pressure in the system by warming the plate with a light bulb.

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

1. Soap bubbles (a solution of dish soap and water works well).
2. Electronic leak detector (probe senses presence of halide refrigerant molecules).

### **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**

Slowly trace the area with the probe. Refrigerant is heavier than air; 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 SEA leak specifications. Be sure to test the operation of the detector.

### **IF A LEAK IS DETECTED**

Try tightening the fitting nut slightly more. If the leak is not stopped, it is possible that the fitting was assembled incorrectly. Discharge the refrigerant, and then disconnect the fitting for inspection.

### **SPECIAL NOTES**

- Be aware that 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.

After satisfactory leak testing, evacuate the system.

## **EVACUATION WITH A VACUUM PUMP**

Evacuation removes air, readying the system for charging.

Evacuate the system only after pressurizing and leak checking.

Connect a gauge set to the compressor service ports. If pressure is noted recover the refrigerant and when the gauge reads "0" psi, connect the center hose to a high vacuum pump. Start the pump and slowly open the gauge hand wheel. As the vacuum drops below 20 inches open the hand wheel fully.

EVACUATE to the highest vacuum. On a new clean, dry, system, this requires 30 to 45 minutes depending on the size of the system and the size of the pump. When evacuation is finished, close the gauge hand wheel and turn off the pump. Disconnect the center hose from the pump and connect it to a can of refrigerant. Vent the hose from can tap to gauge body.

## **NEW SYSTEM CHARGING**

This procedure must follow "Evacuation With A Vacuum Pump".

1. With the gauge set still attached to the compressor suction service port from the previous procedure and the gauge valves closed, attach the refrigerant can to the center hose of the gauge set (yellow). Open the supply valve and purge the yellow hose by cracking the hose end fitting at the gauge set. Open the low side gauge and add about 10 oz of R-12 to the system, then close the gauge wheel. Now perform a second complete leak check as before. If leak is found, correct the leak immediately, discharge system, re-evacuate, then begin this step "1" again. Pumping the system down, evacuating, with a leak in the system pulls air into the system, contaminating it.
2. Turn the compressor drive disk 5 times to displace the oil in the new compressor.
3. While closely observing the sight glass in the RFD, and with the engine running at 1000 to 1200 rpm, have a helper turn on the compressor at the Control Panel.
4. The sight glass will show a stream of bubbles, indicating a partial charge. When a sufficient amount of refrigerant has been added to the system the sight glass will clear, indicating sufficient charge. Install the charge as vapor shaking the can if needed to accelerate the flow. The timer panel should be turned off while changing cans.

When charging a system in temperatures over 80 degrees F. the sight glass will usually clear as the return line as the Valve Control Unit becomes frosted.

5. When the sight glass runs clear, top off with approximately 4 oz. (1/4 of can). Maximum charge for the system is approximately 18 oz of R-12.

6. On a new system, turn off the compressor for several minutes after charging, and then restart it. Run the engine at slow speed, less than 1200 rpm, with several on/off compressor cycles. Allow 1 to 2 minutes "off" periods between 2 to 15 minutes operating periods. This equalizes the oil distribution. When charging is complete, stop compressor and allow entire system to equalize and for the fittings to dry: an hour in most conditions.

7. When observation and test operations have been complete, disconnect the charge hose, and replace the service port caps. **WARNING:** When removing gauges, allow pressures to settle before removing the discharge side hose.

8. Re-check all the connection points for leaks.

9. Spray the acrylic rust 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 running times to thirty minutes with an hour rest period and engine speeds to below 1200 rpm. Monitor 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. Any time the compressor is started, a white stream of foam should appear in the sight glass indicating that refrigerant is present. This foam may disappear quite quickly, but **IF NO FOAM IS EVIDENT**, the system is empty. **DO NOT OPERATE THE SYSTEM** if empty. Operation in this mode will ruin the compressor. Turn off the main breaker to the control panel to prevent operation until system can be properly leak tested and recharged.

White fast moving 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 must be avoided. Air in the system may give a false sight glass reading, which could lead to overcharging. If in doubt, discharge a suspected overcharged system and charge. **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.

<b>RFD SIGHT GLASS DETAIL</b>		
		
EMPTY OR CLEAR	STATIONARY BUBBLES	FOAM / LOW

### **PROPER CHARGE AMOUNT**

PROPER CHARGE WILL BE MORE THAN 14 OZ, TOPPING OFF THE SYSTEM TO A CLEAR SIGHT GLASS ABOUT THE TIME THE PLATE REACHES 32 DEGREES F.

MAXIMUM CHARGE can be computed by multiplying liquid line length (the distance in feet of 3/8" tubing from bottom of condenser to VCU) by 1/3 ounce of R-12, and then adding 12 ounces. DO NOT EXCEED THIS AMOUNT.

### **GENERAL INFORMATION**

Operating pressures will vary with rpm, water temperature, and water flow. Generally, the high side will peak with a warm plate in two minutes. Increasing pressure indicates an overcharge or no water flow. The low side will drop to 25 psi rapidly, and will then drop two pounds per minute or faster to a slight vacuum. However, low side pressure will drop more rapidly when the seawater is cold. A deeper vacuum will be indicated. This reading will vary with rpm and line length. A deep vacuum indicates the valve is frozen or plugged. Failure to "pull down" indicates the valve is malfunctioning or flooding.

The temperature control will cut out the compressor clutch when evaporator is saturated, and will cut back in upon a rise in temperature. This cycling will be random from 30 seconds to 3 minutes. The plate will continue to gain some storage with compressor cycling. There is no limit to the "on" time of system, however the system may freeze the contents of a refrigerator. The timer may be reset.

The compressor case will feel warm due to its double head and internal discharge passage.

Every valve control unit has been operated prior to shipment. There are no field superheat adjustments.

## **SPECIAL NOTE**

If charging SEA FROST gear with BULK CYLINDERS, 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. To prevent this keep the feed pressure below 20 psi.

## **CHECKING THE REFRIGERANT CHARGE**

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 gray metal can about 8 inches high and 2.5 inches in diameter, with brass fittings connecting it to copper tubing. If you do not locate the RFD quickly, follow the route of 3/8" refrigeration copper tubing, the smaller diameter tube, 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 Control Panel. With the engine running at a fast idle (900 to 1200 rpm), and while looking at the sight glass in the RFD, have a helper turn the 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 presence of refrigerant within a minute of operation the system is empty. TURN OFF THE SYSTEM, and follow the procedure in the TROUBLESHOOTING 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 Refrigerant-12 with a properly vented charge hose to the compressor suction service port. Monitoring the sight glass continually, start compressor and add refrigerant until the glass clears. Top off with about 4 additional ounces.
- 6) Feel the SEA FROST plate in the icebox five minutes after engaging the timer switch. If the sight glass clears yet the plate's temperature does not drop after 5 minutes of operation, turn the system off and follow the procedure in TROUBLE SHOOTING.
- 7) If the proper charge is indicated, make ice go sailing.

## DISCHARGING THE SYSTEM

Before the connections can be disconnected, the refrigerant charge must be discharged. Connect a gauge set to the suction service port and slowly vent the refrigerant through the open hose regulating the gauge valve prevent oil or liquid from being discharged into the recovery machine. Recover all refrigerant until the system reads 10" of vacuum for 10 minutes.

## 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 cutout switch cycling due to overcharging.

STEP 1. Gather information as to the nature of the problem before continuing operation of the system. A leak often leaves a trace of oil. Inspect fittings, hoses, and tubing for wear, corrosion, and chafe. Operate the compressor as little as possible until the trouble is corrected.

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 water flow from the engine exhaust. If the water flow is not at fault recover some refrigerant. At one-minute discharge intervals, try to operate the compressor. Shut off the hand wheel valve on manifold gauge set before operating. Proceed until the compressor stays on without cycling during initial pull down. Check the sight glass for proper charge. Be sure sight glass still clears.

If icebox and SEA FROST plate is warm and pressure readings are below 50 psi with compressor off (in 50 degree F or higher ambient conditions), pressurize system with R-12 and leak-check. After leaks have been located, repaired, and tested, install new RFD (Receiver/filter/drier) - see instructions below in Step 3.

If pressure reading is over 50 psi with 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 a system continues to operate inefficiently 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.

If system is warm upon start-up, a DIRT-PLUGGED Valve will show an immediate deep vacuum reading on low side. Contact Sea Frost for cleaning techniques.

Moisture plugged valves are indicated by deep vacuum readings on low side after 1 to 5 minutes operation from warm, followed by any combination of these symptoms:

- High side compressor discharge fitting temperature drops from hot to warm
- Suction line from Valve Control Unit remains warm.
- Compressor load on engine drops.

Moisture enters either through a low side leak or during initial installation and will freeze at Valve Control Unit, reducing or eliminating refrigeration. Turning off system and allowing valve to warm above freezing, and then restarting may temporarily solve the problem. If not, change RFD.

STEP 3. To change a saturated RFD, allow system to warm to ambient temperature, preventing moisture from condensing in circuit upon opening. A light bulb in icebox will speed the warming of plate. Recover the refrigerant from the system through the suction service port SLOWLY to prevent liquid and oil from escaping. **WARNING: BEFORE DISASSEMBLY OF ANY PART MAKE SURE CHARGE 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 unit.

Install a new RFD, observing proper inlet ("IN") position. Refrigerant flow is from the condenser to the "IN" side. The sight glass is offset toward the "out" side. Remake the Swagelok fittings (1 ¼ turn from wrench snug. Leak check, evacuate and charge.

NOTE: 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.

MOISTURE IS A SYMPTOM. Carefully leak check the low side of the system if moisture becomes a problem. Moisture leaks in!

## **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.

