SEA FROST®

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OPERATION & INSTALLATION INSTRUCTIONS
BG 1000 Series

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Aspects of the SEA FROST design are covered by
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BG 1000 OPERATION

The *SEA FROST BG 1000* system is an electrically driven refrigeration plant. Operation of the compressor will freeze the contents of the holdover devices in the boat's icebox providing refrigeration by cold holdover for an extended period after the compressor has been turned off. A boat without continuous power can benefit from this by operating the SEA FROST BG 1000 system when the generator plant is operated. Operation time will vary with each boat.

A little time-spent learning about your system and some experimentation will be best. Maximum holdover will be reached when the cabinet is at the desired temperature and the holdover plates are frozen. Running times beyond this have no advantage other than to delay warming the plate(s).

The system is water-cooled. Water should begin to flow from the discharge at the same time the unit starts. Be sure the water is flowing. If no water flows, stop the system and inspect the water pump and strainer for obstructions. See troubleshooting.

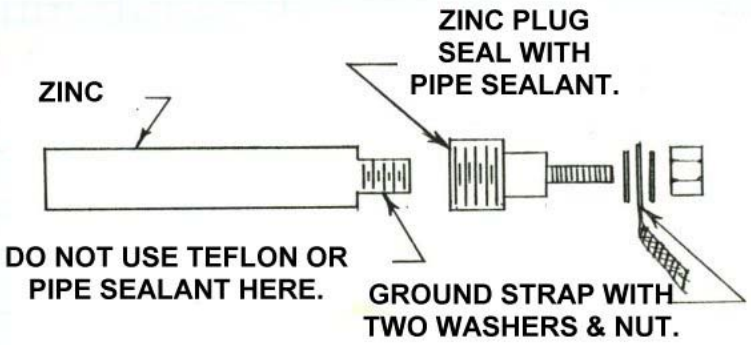
After starting a warm system, check the holdover devices for a temperature drop. If a temperature drop is not indicated, stop the unit and read; "Checking the Charge", and; "Reading the Sight Glass".

CONTROLS

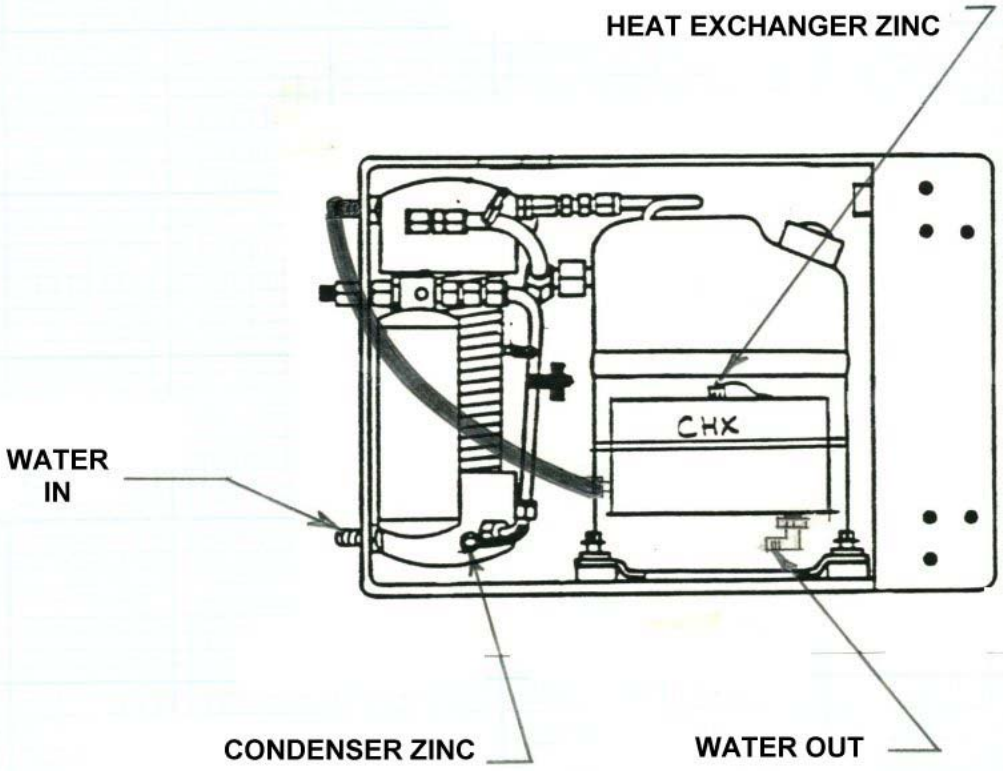
The BG 1000 thermostat control is labeled with "off", one, two, and three snowflakes. When the boats' breaker panel is switched on and 110-volt power is available, turning the knob from "off" to one snowflake will start the compressor. Turning the knob to three snowflakes will increase the time the compressor operates, making the temperature cooler. Experiment with the control position to obtain the best setting.

START DELAY

The BG 1000 has a delay circuit, that delays restarting, after the 110-volt supply has been interrupted for 30 to 45 seconds. Should the dock service be interrupted or the dock cord be connected or reconnected with the compressor switched on, the unit will delay starting. This delay will also occur when the panel circuit breaker is turned on.



ZINC / PLUG DETAIL



BG 1000 ZINC LOCATION

ICE MAKING

Your **SEA FROST 809** holdover plate(s) may be equipped with vertical ice trays. The ice trays are held in contact with the plate(s) by a stainless steel rod.

Fill the vertical trays with water and hang them on the face of the plate. Try to get some water between the tray and the plate surface to increase the thermal contact (increasing freezing ability).

Harvesting Ice

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 if so equipped in the freezer. Ice trays left in contact with the plate will melt rapidly if the plate goes above freezing.

DEFROSTING

It is important to defrost the holdover plate(s) regularly. This will maximize the efficiency of the system and ice making performance. It is not necessary to turn off the system to defrost. Scrape off any frost with a piece of wood or galley utensil. A noticeable drop in the cabinet temperature will occur.

BAG STYLE ICE MAKING

If your SEA FROST system is not equipped with the vertical tray kit, you can still make ice. One method is to use zip lock bags. When filled with water the bag can be held in contact with the plate by a clip binder or a clamp of your own invention.

BG 1000 MAINTENANCE

Like your engine, your SEA FROST needs periodic checking.

ROUTINELY CHECK:

1. The refrigerant charge (see "Checking The Refrigerant Charge" text NEVER OPERATE SYSTEM WITHOUT PROPER CHARGE)

2. The condenser zinc. FAILURE TO MAINTAIN THE ZINC ANODE WILL CAUSE EXTENSIVE DAMAGE TO THE SYSTEM AND NULLIFY THE WARRANTY.

3. All components, all tubing, fittings and hose clamps 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 petroleum rust inhibitor REGULARLY. Corrosion unchecked in the marine environment will severely reduce the life of your system.

CLEANING

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

WATER STRAINER

The water pump must be protected from damage and blockage by a seawater strainer. This strainer must be inspected and cleaned routinely.

ROUTINE SERVICE AND INSPECTION

We recommend sea strainer inspection before leaving the boat unattended dockside with the unit on. A visual inspection may be adequate depending on the type of strainer. To clean most types of strainers, close the seacock, open the strainer, remove the screen or basket, clean, reassemble and open the seacock. Operate the system and check for water flow and leaks around the strainer opening.

PUMP IMPELLER INSPECTION *(if pump is inoperative)*

The LC3 pumps are sealed liquid cooled magnetic drive centrifugal pumps. The impeller may be inspected for obstructions and wear by first closing the seacock. Drain the pump housing by removing a hose if necessary. It is **IMPORTANT** that **NO WATER** flows between the plastic housing and the pump body. The screws that hold the cover also seal the housing. Water behind the housing will ruin the motor bearings.

BE SURE THE PUMP HOUSING IS DRY BEFORE DISASSEMBLING.

Remove the Phillips screws holding the inlet fitting plate (larger hose size). The impeller may be removed with its ceramic seal and thrust washer. Reassemble in the reverse order. (An exploded diagram is in this manual.) Observe the "O" ring that seals the housing cover plate. Make sure it is in good condition. Open the seacock. Inspect for leaks.

NEVER OPERATE THE PUMP WHILE DRY. IF IT IS SUSPECTED THAT THIS CONDITION HAS OCCURRED, INSPECT THE IMPELLER AND HOUSING FOR WEAR.

CHECKING THE REFRIGERANT CHARGE

The BG 1000 system is fitted with a sight glass located in the top of the RFD. The charge level should be inspected to be sure refrigerant is of the proper amount and that there are no slow leaks. Switch the unit on and immediately inspect the sight glass. White foam with high velocity should be observed and after a minute or two show a black or clear condition. A clear glass and an empty glass will look the same. A transition must be seen to be sure refrigerant is present. Do not operate a low or empty system. See; "Leak Checking" and "Adding Charge".

LAY-UP (Winterizing)

Flush the pump and condenser with plenty of fresh water. Pressure water should be flushed through the inlet side of the water pump. In freezing climates, a 50/50 mix of antifreeze and water should be pumped through, after flushing, by operating the system for a very brief period. Connect a short hose to the suction side of the pump to draw from a bucket. Run the pump (switch on unit) until antifreeze is discharged. The pump is not self-priming and may require filling the hose and pump with a funnel. **DO NOT RUN THE PUMP DRY.** It is water lubricated.

CONDENSER ZINC MAINTENANCE

THE BG 1000 HAS TWO ZINCS. ONE IS IN THE CONDENSER. THE OTHER IS IN THE CHX-75 WATER JACKET ON THE COMPRESSOR.

Refer to the drawing in this section for locations of the **two zincs** in the system.

The condenser in the BG 1000 housing is fitted with a zinc anode to protect the copper nickel core from failure due to galvanic corrosion. This zinc wears out and must be inspected and replaced to maintain and protect the system. On a new system, check the zinc after two months of operation. Wear will be greatest in warm, salty waters. Wear occurs any time the boat is in the water regardless of the use of the compressor. Establish a wear rate and replace the zinc on a schedule. This maintenance will preserve the life of your system.

ZINC INSPECTION

To inspect the condenser zinc, close the seacock to the water pump. Remove a hose from the pump to let the water drain out of the condenser. When drained, remove 7/16" nut and washer from the plug. Remove the ground strap to allow the zinc plug to be removed. Compare the used zinc to the new spare. Replace the spent zinc by unscrewing from the base plug and threading in a new one. Should the old zinc break off in the plug, a propane torch may be used to melt out the old metal. Pipe thread sealant should be used on the plug threads to seal the plug in the condenser housing.

The second zinc is in the heat exchanger on the compressor marked CHX. Change this when the condenser zinc is being replaced.

WARNING: Pipe threads are tapered threads. Tighten only enough to seal the thread. Excessive tightening may damage the condenser housing.

Reassemble the ground strap and nut and washer assembly. Be sure that the grounding strap is clean and bright as is the end of the zinc plug. Proper zinc protection requires an excellent electrical connection here. Reinstall the hose and clamps and open the seacock. Start the system and check for leaks.

ALKALI SCALE

Condensers will scale after sometime in warm water causing higher that normal pressures due to scale interfering with the heat exchange. To de-scale the condenser follow the inspection procedure. Then; remove the hose from the condenser to the compressor-cooling jacket (CHX-75). Remove the condenser zinc. Plug the hole in the condenser with a pipe plug or the zinc plug with no zinc.

Note: Leaving the zinc in place and electrically bonded will make a big battery upon adding the acid. This will make heat and smoke.

Pour Muriatic Acid into the top hose fitting on the condenser until it boils out the top. It may be beneficial to make a hose and funnel arrangement to make this job easier.

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.

When boiling (foaming) stops (4 to 5 minutes), reassemble the hoses, open the through hull fitting and start the system. There is no danger of damage to the condenser. After a minute or two of operation to flush out the acid, the through hull and replace the zinc. Flush the local area that might have salt water or acid spilled on it with plenty of fresh water.

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 ice box (cooling it).

We all know that cold is the absence of heat. A practical example of heat absorption by evaporation is that of rubbing alcohol evaporating in your hand and cooling it. 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 degrees 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 degrees 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 (compression) we can raise the boiling point of the gas vapor. Heat is removed from the pressurized gas vapor at the condenser. Seawater passing the condenser coils removes the heat, forcing the gas 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 gas to a liquid to be re-evaporated again.

By causing R-12 to boil (evaporate) in the SEA FROST plate, we absorb the heat energy there. This activity cools the liquid solution within the plate(s), 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, (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

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 this manual.
2. Reread any aspect you don't understand.
3. Be careful about Swagelok fitting installation.
4. Do thorough leak checking.

Two contaminants will give you problems in any 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 dryer (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 when installing it to save time for something more fun.

TUBE HANDLING

Installation is quite simple. All the copper tube comes to you with the ends caped. Nitrogen gas is added inside the tubes to displace air and moisture. Any routing of the tube 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 only uncap 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, which 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 necessary. Route all lines in such a way that they are most direct but out of the way. Again, keep everything sealed until you are ready to make that connection.

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 mis-assembly of these fittings. Be 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 the end of the tube. Prior to inserting 3/8" tubing, make a pencil mark 3/4" from the end of the tube. With 1/4" tubing make the mark 5/8" from the end.

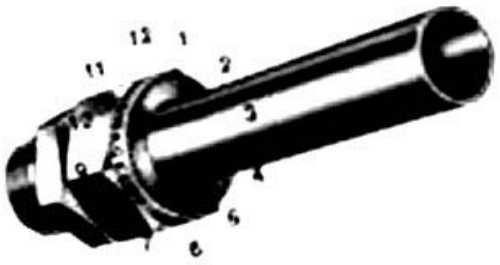
Step 3. Insert clean, smooth tubing with the pencil mark into the Swagelok tube fitting. You can be sure the tube is resting firmly on the shoulder of the fitting when the pencil mark is flush with the nut.

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 can not 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, 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. (SEE STEP 4.) A DISTORTED TUBE MIGHT GIVE A FALSE STARTING POINT.

* Swagelok fittings have a 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.

* 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. Tighten the nut one-quarter of a turn with a wrench (or to original one-and-one-quarter tight position). Then snug slightly with the wrench. No more than an additional 1/8 turn.

INSTALLATION

CONDENSING UNIT LOCATION AND MOUNTING

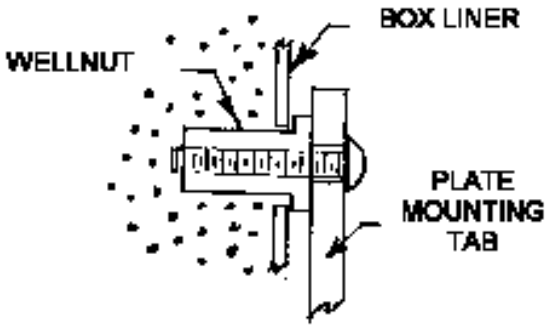
The design of the BG 1000 allows placement of the unit in an enclosed space such as a cabin locker, sail locker or engine area. Service access and installation require that the front and left end (water fitting end) be accessible.

Mount the BG 1000 level. The unit may be bulkhead or platform mounted. It may be hung from its case. Use the aluminum "L" brackets supplied. The 1/4-20 X 1-3/4 Stainless screw, thread into the Well-nut mounts at the back corners of the housing. Mount holes are also drilled in the forward edge of the bottom.

The BG 1000 is a high-powered unit. It produces some noise and vibration. Its duty cycle will be short however, consider that dockside operation may be noticed when the generator is not masking the sound. Bulkhead mounting is fine, but avoid mounting on a bulkhead that may resonate into the cabin area. If an under bunk installation is used, turning off the thermostat at night will avoid a startling sound should the unit start.

RECEIVER FILTER DRIER (RFD) VISIBILITY

LOCATION: The RFD (The gray canister on the upper left as you look at the front of the BG 1000.) is fitted with a sight glass in the top portion. Be sure that it can be viewed from an angle of less than 40 degrees. A mirror might be mounted above the glass to allow ease of inspection if the unit is to be mounted close to an overhang or under a deck.

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 mount onto the screw. Install the plate pushing the rubber mounts Into the predrilled holes. Tighten the screws firmly.	

VALVE CONTROL UNIT

For appearance and convenience of installation, the valve control unit (V/CU) may mount outside the icebox. The valve will attract moisture and drip if it is not well insulated with the valve blanket and additional insulation. Insulate the valve after installation and leak checking. In certain applications, it may be necessary and easier to mount the valve inside the cabinet. Refer to schematic drawings when connecting more than one plate.

Before cutting the tubing:

1. Leave a minimum of one inch of tube beyond a bulkhead.
2. Allow room for wrench access.

- 90-degree elbows can be installed on the valve control unit to reduce space requirements if necessary.
- The tubing will support the valve control unit.

- The tubing must bottom in the fitting. Refer to the Swagelok assembly instructions.

WARNING: *READ SAFETY SECTION BEFORE PROCEEDING*

Because the RFD contains desiccant to absorb moisture and the absorption is limited, it is important to open the compressor and RFD fittings after all other connections are made. The BG 1000 unit is shipped under some refrigerant pressure. Before removing the caps on the connection ports, remove the screw caps on the service valve covers and depress the cores with a fingernail to vent any existing pressure.

After depressurizing, working with one connection at a time, remove the Swagelok caps from compressor and RFD. Attach in the proper assembly sequence the front and back ferrules and the Swagelok nuts.

RUNNING THE TUBING

Connect 1/4" copper tube between the condensing unit and the Valve Control Unit (V/CU). Multiple plate hook-ups should be assembled as indicated by the specific diagram provided.

A 1/2" line connects the valve unit to the compressor.

If possible, run the 1/4" liquid line in contact with the 1/2" line. This will be insulated in proper sequence.

Support the tubing (every 12 to 18 inches) as necessary with tie wraps, after leak checking and insulating.

THERMOSTAT & WIRING

For the best looking job, the thermostat should be cut into a panel. We do not recommend installation in the insulation or in the icebox; the control is not moisture protected. A Cutting template is provided. Locate the thermostat close enough for the "bulb" tube to reach. It is only necessary that the bulb end of the sensing tube be installed on the plate(s). Use one of the mount screws for attaching the clip on the 809 plates. **The sensing tube is hollow and filled with refrigerant; avoid bending it into a kink that could cause it to crack and leak.**

THERMOSTAT WIRING

The thermostat electrical leads are low voltage for safety. Connect the red thermostat wires to the two terminal screws on the BG 1000. Use the # 10 ring terminals provided.

110-VOLT CIRCUIT

A separate 20-amp breaker is required for the 110-volt circuit. The BG 1000 is provided with a three wire male plug. A standard dedicated outlet mounted next to the unit is recommended. Secure all wiring as necessary.

PUMP INSTALLATION

This is a most important operation. Please understand this before beginning the installation. The BG 1000 uses a centrifugal pump. It is not self-priming. Air pockets caused by loops or descending lines from one component to the other may cause pump problems. This pump must never be run dry. It is water cooled and lubricated. The wet end may be destroyed if it is started dry.

A separate through hull fitting 3/4" or larger should be used. It should be as low in the boat as possible and away from head and cockpit drains. A forward facing scoop will prevent problems if the unit is operating underway.

A large seawater strainer should be mounted above the seacock.

The pump should be mounted horizontally. It should be higher than the strainer. The discharge should be on the top.

WIRING THE PUMP

The pump is connected by a three-prong plug to the compressor unit. **Be sure this plug cannot get wet.**

SAFETY ~ WEAR PROPER EYE PROTECTION

OBSERVE SAFETY REGULATIONS WHEN USING REFRIGERANT.

BE SURE YOU UNDERSTAND REFRIGERANT HANDLING AND GAUGE OPERATION TO PREVENT AIR FROM ENTERING THE SYSTEM.

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. 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.

REFRIGERANT HANDLING

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. 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.

THE CHARGE HOSE ENDS ARE DIFFERENT

The charge hose supplied with the SEA FROST system has a metal insert in the fitting on one end. This fitting installs on the compressor suction service valve.

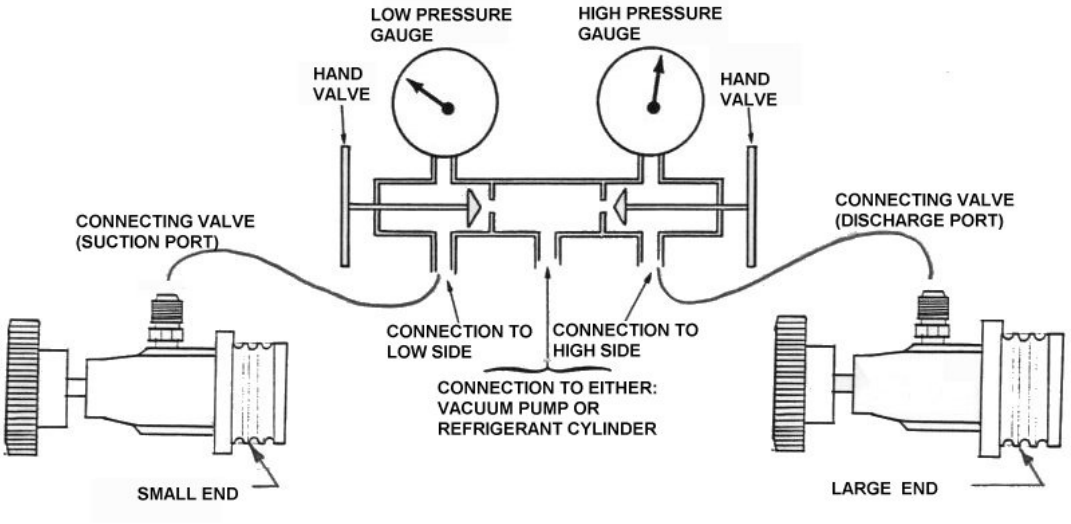
VENTING THE CHARGE HOSE

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 a wind pressure to escape. Make the connection as this gas is escaping. Follow this procedure when adding refrigerant to an evacuated system or to a low charged system.

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 are used in the evacuation and charging. They will provide information on the operation of the system.

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 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 valves 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. Again the high side need not be connected unless compressor problems are suspected.

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 gauges clean. Inspect 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 with refrigerant. The end of the hose that contains the depressor core is the end, which attaches to the compressor service port. Check and reset "o" on low side, if necessary.

ACCESS TO THE SYSTEM; SERVICE PORTS

The service ports are two small-capped Schrader valves (similar to tire valves). The suction port is on the compressor. It is a short tube with a cap and tube end painted blue. The discharge port is on the 3/8" copper line running vertically from the condenser to the Receiver Filter Drier (RFD). (It is the gray cylinder with the sight glass in the top.) The discharge port is painted red with a red cap. It should not be necessary to use the discharge port unless you are diagnosing a compressor problem. The discharge port is also called the high side. The suction side is also called the low side.

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 to be sure all connections are tight.

INITIAL PRESSURIZATION AND LEAK CHECKING

Attach clean, purged gauges to the suction service port on the compressor. This is the blue gauge. Pressurize the system with R-12. Check for leaks. Do this before evacuation with a vacuum pump. Do not rely on a vacuum leak check.

ABOUT PRESSURES

Refrigerant is 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 with moderate pressure. (A leak is not a function of pressure once the pressure is high enough to show up on leak-checking equipment). However, the pressure must be sufficient to leak enough R-12 to be detected.

PROCEDURE

TO LEAK TEST a new system, install the charge hose (or 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 a can of refrigerant. Shake the can and add 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(s) with a light bulb left on in the cabinet until the plates are warm to the touch.

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 strong 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, therefore, trace below the fitting. Most units can be calibrated to home in on a leak. (See detector instructions). 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.

IF A LEAK IS DETECTED...

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

SPECIAL NOTES

- Propellants and solvents in sprays and foams may upset electronic detectors.
- Electronic detectors do not function below 40.F.
- A good electronic leak detector is able to pick up leaks as low as 1/2 oz per year.

After satisfactory leak testing, proceed to "Evacuation with a Vacuum Pump".

EVACUATION WITH A VACUUM PUMP

Evacuation removes air, readying the system for charging. Evacuate only after pressurizing and leak checking. Connect gauges to the compressor ports (See: "Access to the System" and "Gauges"). It is not necessary to hook on to the high pressure (discharge) access port. If pressure is noted, slowly vent the system through the low side valve to the open center hose.

When pressure shows "O" psi, connect the center hose to a high vacuum pump. Start the pump and slowly open gauge hand wheel. Evacuated to best vacuum. On a new system, using a high vacuum pump this requires 15 to 25 minutes. When evacuation is finished, close gauge hand wheel. Turn off the pump. Disconnect the center hose from pump and connect it to a can of refrigerant. Vent the hose from can tap to gauge body

Proceed to "NEW SYSTEM CHARGING."

NEW SYSTEM CHARGING

This procedure must follow "Evacuation with a Vacuum Pump".

BE FAMILIAR WITH the sections "Access to the System: "Service Ports", "Tapping A Can", The Charge Hose", "Venting The Charge Hose", and "Changing Cans".

1. With the refrigerant supply still attached to the compressor suction service port from the previous procedure, open the can tap valve (or appropriate gauge wheel) wide open. Invert the can to the liquid position. Add about 1/2 can R-12 to the system, then close can tap (or gauge wheel). NOW PERFORM COMPLETE LEAK TEST AS BEFORE. If leak is found, correct leak immediately. If discharge is necessary to remedy leaks, re-evacuate the system, then begin this step again.

2. While closely observing the sight glass in the RFD, start the compressor by switching on breaker and then turning on the thermostat.

3. The sight glass will show a steam of foam indicating a partial charge. When a sufficient amount of refrigerant has been added to the system the sight glass will clear, indicating sufficient charge. (See "READING THE SIGHT GLASS" below). Compressor (Thermostat) should be turned off while changing cans.

Charging a hot system, (cabinet and plate(s) over 80 degrees F) sight glass will usually clear as the return line at the Valve Control Unit becomes frosted).

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

5. When observation and test operation have been completed, disconnect charge hose, replace service port cap (s). WARNING: if using gauges on the discharge, allow pressures to settle (equalize) before removing discharge side hose.

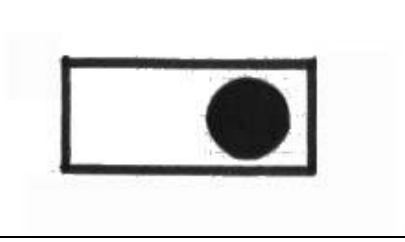
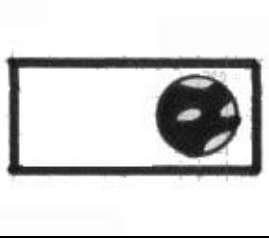
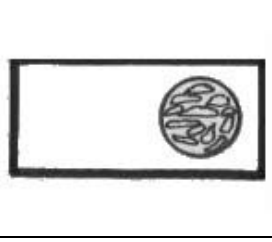
6. Re-check all connection points for leaks.

7. Spray an acrylic rust coating, or similar rust inhibitor, on all fittings and components when dry.

READING THE SIGHT GLASS

A clear sight glass signifies a sufficiently charged SEA FROST BG 1000 system when the compressor is operating. 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.

RFD SIGHT GLASS DETAIL

EMPTY OR CLEAR	STATIONARY BUBBLES	FOAM/LOW
		

White foam of high velocity, 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. In addition, 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 larger, 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 (see "DISCHARGING THE SYSTEM") and charge over again. MONITOR THE SIGHT GLASS CONTINUALLY since the glass will not indicate when the system is overcharged.

In a warm system, when the Block or Plates are 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.

PROPER CHARGE AMOUNT

MAXIMUM CHARGE can be computed by multiplying liquid line length (distance in feet of tubing from bottom of condenser to Valve/Control Unit) by 1/3 ounce of R-12, and then adding 10 ounces. Shaking the can is a good method of determining the amount of refrigerant remaining in the can. DO NOT EXCEED THIS AMOUNT.

GENERAL INFORMATION

OPERATING PRESSURES will vary with water temperature, and water flow. Generally, HIGH SIDE will peak with warm plate(s) in two minutes. Increasing pressure indicates overcharge or no water flow. 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. Deep vacuum indicates the valve is frozen or plugged. A running system with little or no charge will indicate a deep vacuum. The thermostat-sensing bulb must be attached to the plate or block in the system. The bulb is not meant to monitor box temperature. (See thermostat data sheet.)

Every Valve/Control Unit has been operated prior to shipment. There are no field superheat adjustments.

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 feed pressure below 20 PSI.

After operation has been checked, proper attention should be made to insulating the V/CU, the return line (the large diameter tube) and, any tube entering the cabinet. Closed cell insulation should be split and taped on the tubes. Install the insulation with the seam down and be sure all tube is covered to avoid unwanted moisture. The valve blanket should be cut and folded as needed to wrap the valve completely. This aspect of the installation makes the difference between a good job and an excellent job. Plan to spend the time needed to do it right.

CHECKING THE REFRIGERANT CHARGE

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

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 SYSTEM, and follow the procedure in the troubleshooting section.

1) If the white foam is evident, watch closely for the transition to "clear". If glass indicates insufficient charge level, additional charge will be needed. Before adding charge perform a thorough leak check.

ADDING CHARGE

BE FAMILIAR WITH the sections: "Access To The System", "Service Ports", "Tapping A Can", "The Charge Hose", "Venting The Charge Hose", and "Changing Cans"). Turn off 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 the compressor and add refrigerant (as vapor) until the glass clears. Top off with about 3 ounces (1/4 can).

2) Feel the SEA FROST plate(s) in the icebox five minutes after starting the compressor. If the sight glass clears yet the plate(s) or Block temperature does not drop after 5 to 10 minutes of operation, turn system off and follow the procedure in "TROUBLE SHOOTING".

3) If the proper charge is indicated. Make ice. Go sailing.

DISCHARGING THE SYSTEM

Before the connections can be disconnected, the refrigerant must be discharged. Connect a charge hose or gauge set to the suction service port. See "Access to the System" text. Slowly vent the refrigerant through the open hose regulating the gauge valve or charge hose fitting on the service port to prevent oil or liquid from being discharged. A few drops of oil escaping may be unavoidable.

TROUBLESHOOTING

The most common problems that can occur in a SEA FROST BG 1000 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. Overcharge disconnect of the high-pressure switch.
5. Cooling water flow loss, causing the high-pressure switch to disconnect.

STEP 1. Gather information as to the nature of the problem before operating the system. A leak often leaves a trace of oil that may be found by blotting the connection points and fittings with a dry paper towel. Inspect all the fittings and tubing for wear, chafe and corrosion. Operate the system as little as possible until the trouble is corrected. Damage may result from operation with low charge.

HIGH PRESSURE CUTOUT / MANUAL RESET BUTTON

The compressor is fitted with a MANUAL RESET high-pressure switch. The switch is located in front of the BG 1000 unit. (See drawing). This switch will disconnect the thermostat circuit switching off the compressor and water pump. **The switch may be reset** by pushing the soft Red Rubber Button after the unit has rested for a few minutes. A faint click will be heard when the button resets.

BEFORE RESETTING the switch, inspect the pump and strainer. Most installations have a line plug connection for the pump. If so fitted, plug the pump into a receptacle or extension cord to be sure it is operating. If the installation location of the through hull allows air to enter the system it may be necessary to bleed the air from a hose connection after the pump but below the waterline by loosening a hose connection. When water flows from the connection, retighten the connection.

*This switch will disconnect if the water flow stops.

*This switch will disconnect if the system is overcharged.

Overcharge may not appear until the boat moves into warmer water than it has been commissioned in. Discharge the system until the unit operates without disconnecting the high-pressure switch. Be sure that the sight glass still runs clear. Refer to "CHECKING THE REFRIGERANT CHARGE".

For further troubleshooting, attach purged gauges to compressor service ports or observe the temperature of lines as follows.

a) If the ice box and SEA FROST Block or plates are 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 (see "LEAK CHECKING").

b) If the pressure reading is over 50 psi with compressor off, operate the system and 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, closely observing gauge readings and Block or plate temperature, noting the following:

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

b) A MOISTURE-PLUGGED VALVE is indicated by deep vacuum readings on low

side, after 1 to 5 minutes operation from warm, with the system properly charged, FOLLOWED BY any combination of these symptoms:

- High side compressor discharge tube to the top of the condenser temperature drops from hot to warm.

- Suction line from Valve Control Unit remains warm or starts to get cold then warms.

Moisture enters either through a low side leak or during initial installation. The moisture will freeze at the Valve Control Unit, reducing or eliminating refrigeration. Turn off system and allow the valve/control unit to warm to above freezing and then restart. This may temporarily solve the problem. If not, change RFD as follows.

STEP 3. To change a saturated RFD, allow entire system to warm to ambient temperature, thereby preventing moisture from condensing in circuit upon opening. A light bulb in the icebox will speed warming of Block or plate(s). DISCHARGE refrigerant from the system through the suction service port SLOWLY, to prevent liquid and oil from escaping. See "Discharging the System." WARNING: BEFORE DISASSEMBLY OF ANY PART, BE SURE CHARGE IS COMPLETELY VENTED. With a back-up wrench holding the brass body of the Swagelok fittings, loosen and back off the nuts. Tubing may be pulled out of the fittings. Remove the RFD. If there is to be a delay in reinstalling an RFD, tape or cap the open connectors to make sure no air or dirt enters the system. Replace only with identical unit. The SEA FROST RFD is a drier and a receiver/filter. SEA FROST RFDs are oil compensated to cover oil removed in the old part.

Install a new RFD, observing proper INLET ("IN") position. The sight glass window is offset toward the output. Refrigerant flow is from the condenser to the "IN" side. The out side is to the V/CU. Follow "RECONNECTING PRE-SWAGED FITTINGS." Leak test. Evacuate.

Reminder: To ensure removal of moisture use high vacuum pump and evacuate the system with highest possible ambient and plate(s) temperature. A light bulb or heat lamp in contact with the plate(s) is a good technique. **Leaving a 100-watt bulb going in the box over night will also work. Recharge.**

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

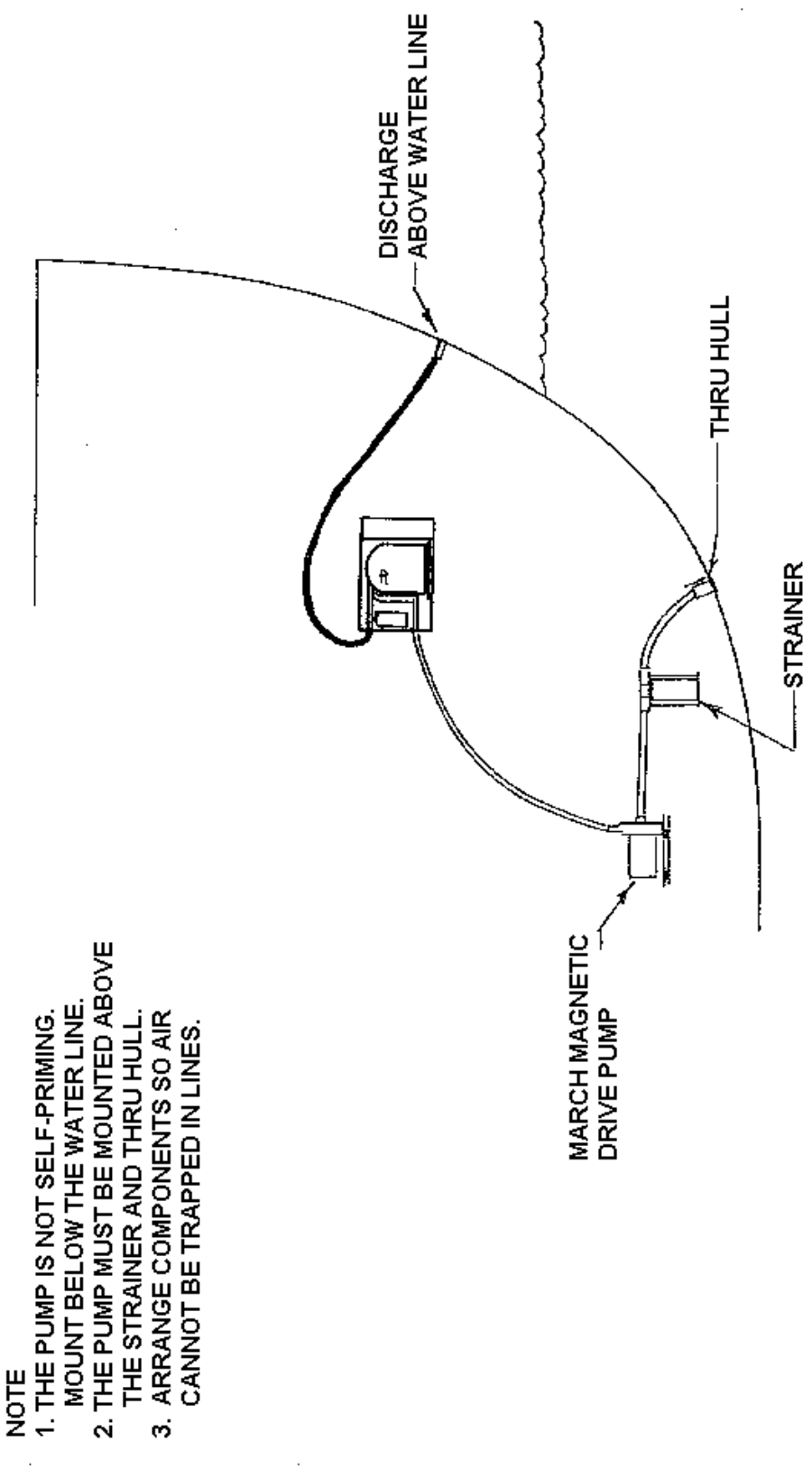
CALL US WITH ANY QUESTIONS

TEL (603) 868-5720

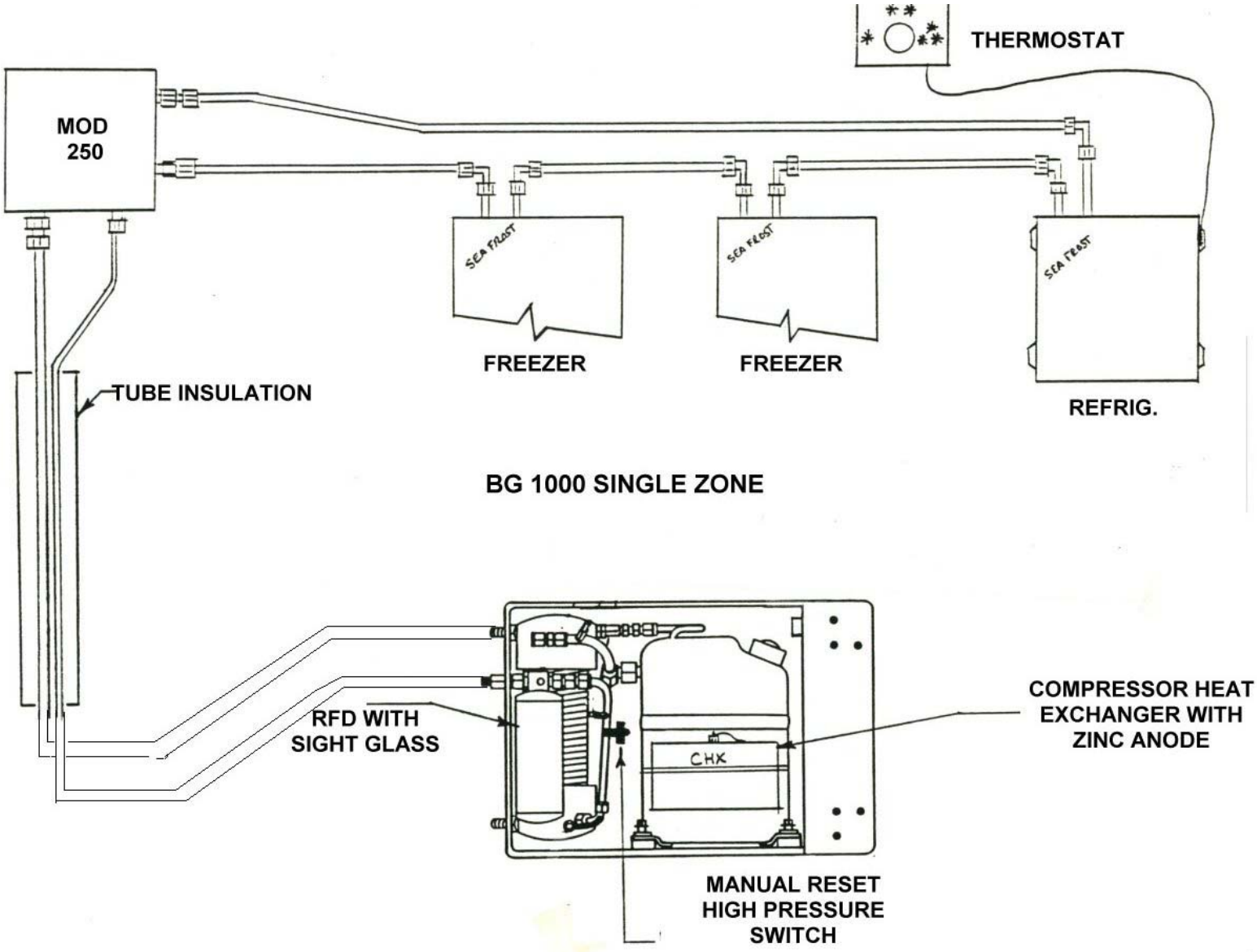
FAX (603) 868-1040

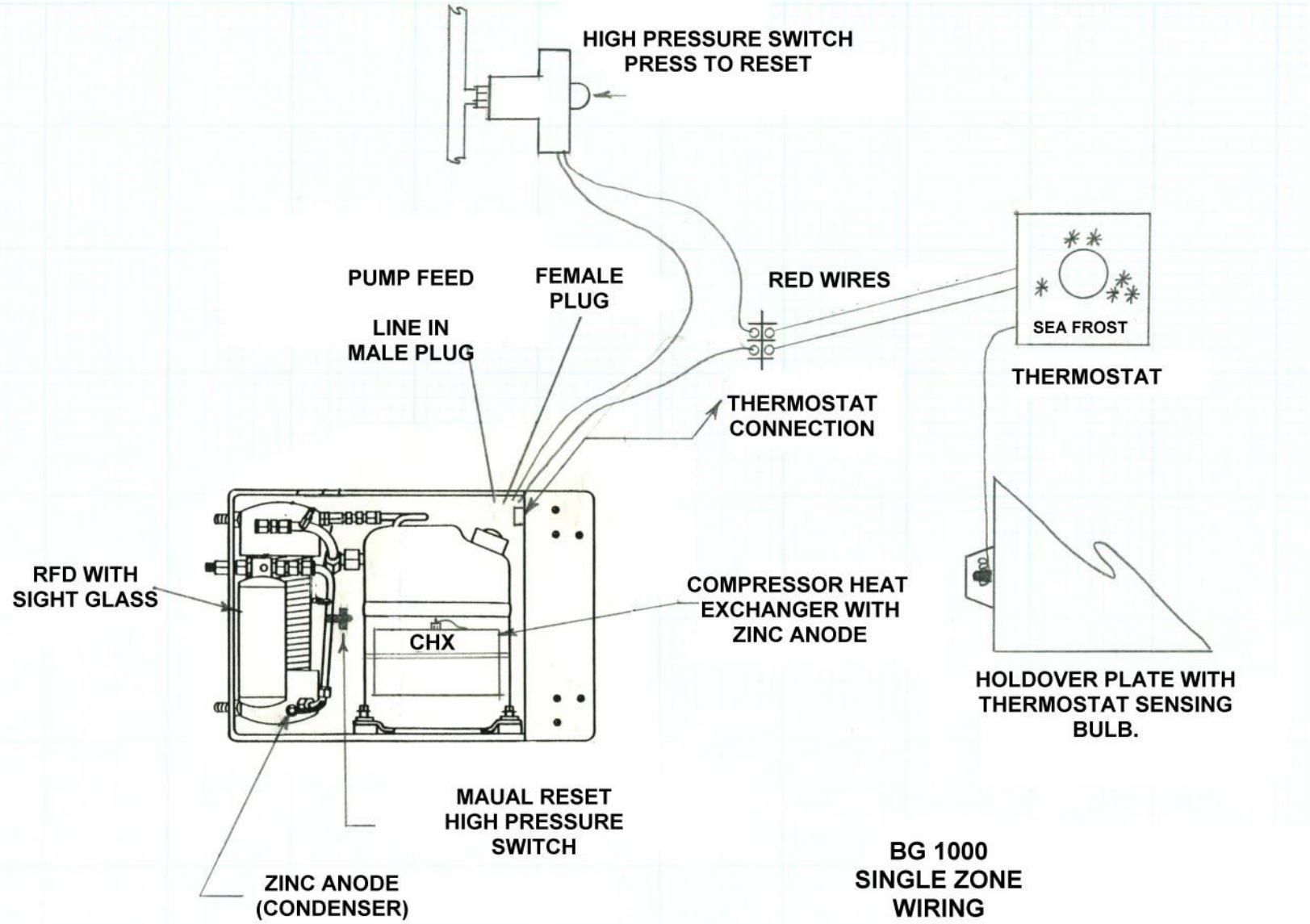
SPECIAL WARNING: A clear sight glass can also indicate a completely EMPTY system. Any time the compressor is started after a rest period, a white stream of foam should appear in the sight glass indicating that refrigerant is present. This foam may disappear quite quickly, but IF NO FOAM IS EVIDENT, the system is empty. DO NOT OPERATE THE SYSTEM if empty. Operation in this mode will ruin the compressor.

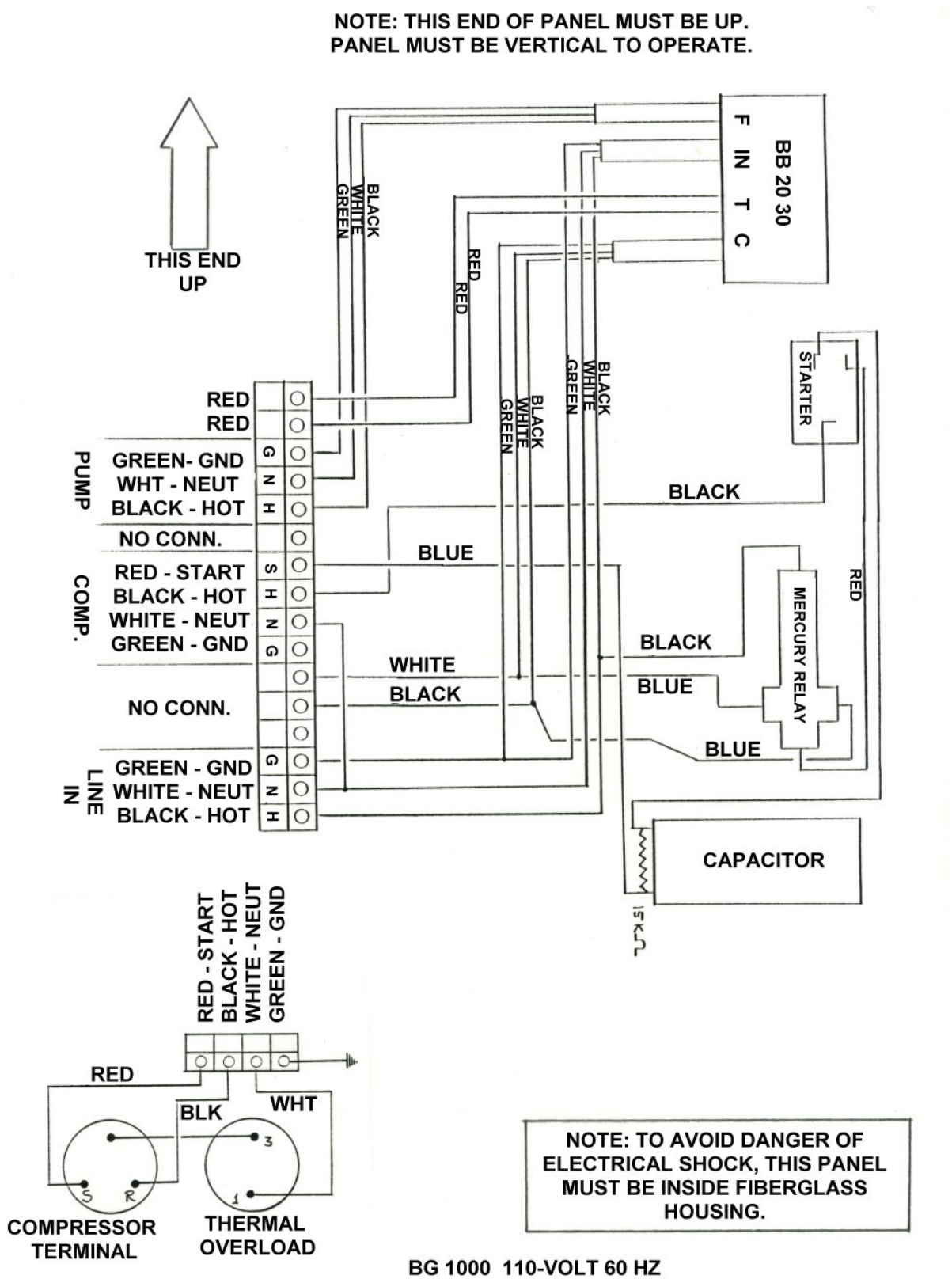
WATER CIRCUIT



NOTE
1. THE PUMP IS NOT SELF-PRIMING.
   MOUNT BELOW THE WATER LINE.
2. THE PUMP MUST BE MOUNTED ABOVE
   THE STRAINER AND THRU HULL.
3. ARRANGE COMPONENTS SO AIR
   CANNOT BE TRAPPED IN LINES.


THERMOSTAT
MOD
250
SEA FEAST
SEA FEAST
SEA FEAST
FREEZER
FREEZER
REFRIG.
TUBE INSULATION
BG 1000 SINGLE ZONE
RFD WITH
SIGHT GLASS
CHX
COMPRESSOR HEAT
EXCHANGER WITH
ZINC ANODE
MANUAL RESET
HIGH PRESSURE
SWITCH


HIGH PRESSURE SWITCH
PRESS TO RESET
PUMP FEED
FEMALE
PLUG
LINE IN
MALE PLUG
RED WIRES
SEA FROST
THERMOSTAT
THERMOSTAT
CONNECTION
RFD WITH
SIGHT GLASS
CHX
COMPRESSOR HEAT
EXCHANGER WITH
ZINC ANODE
HOLDOVER PLATE WITH
THERMOSTAT SENSING
BULB.
MAUAL RESET
HIGH PRESSURE
SWITCH
ZINC ANODE
(CONDENSER)
BG 1000
SINGLE ZONE
WIRING



BG 1000 110-VOLT 60 HZ
REVISED 12-2-91 S/N 91G1075 AND UP

SEA FROST®

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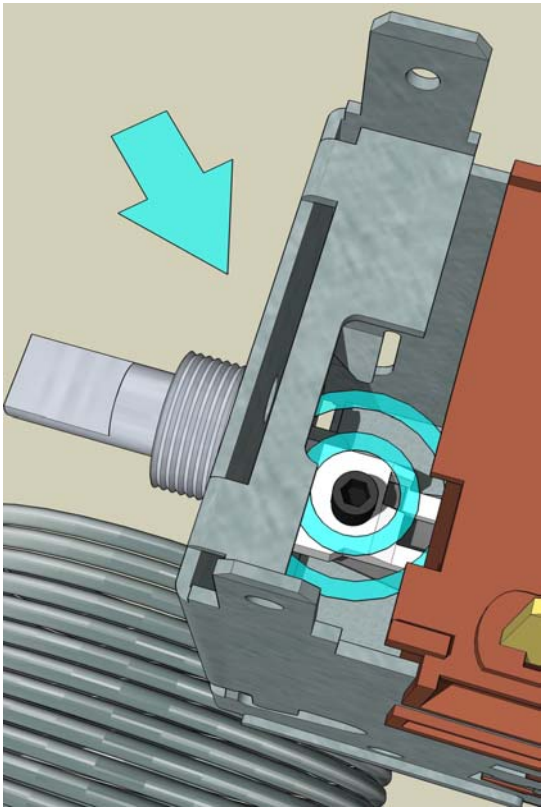
E-Mail:sales@seafrost.com www.seafrost.com

THERMOSTAT CALIBRATION INSTRUCTIONS

Note: Be sure that the unit is operating properly before making any thermostat adjustments. The sensing bulb must be in excellent thermal contact with the plate or block.

The range of this control may be changed. To access the adjustment screw, remove the four mounting screws on the thermostat panel. Tip the panel forward and remove the protective tape to expose a slot in the case. Make the adjustment with a torx or small phillips head screwdriver.



Make small adjustments. Record all adjustments.

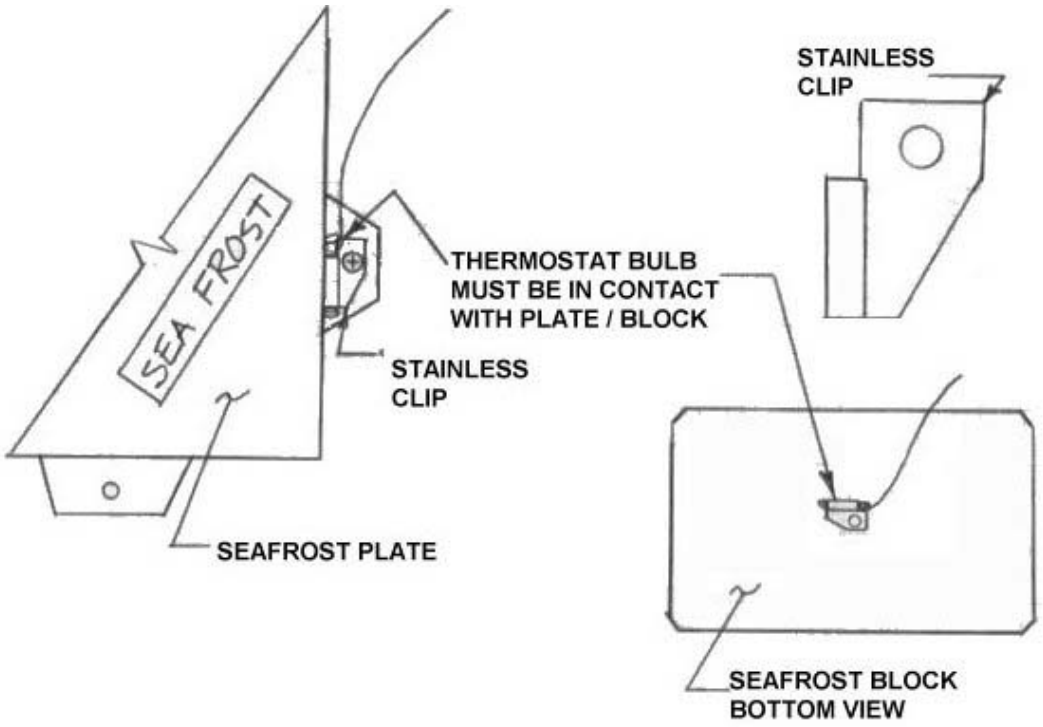
If the lowest setting on the thermostat panel (1-snowflake) is too cold:

- Turn the adjustment screw clockwise. One 360-degree turn will raise the box temperature approximately 6 degrees f.

If the highest setting on the thermostat panel (3-snowflakes) is too warm:

- Turn the adjustment screw counterclockwise.

HOLDOVER PLATES



STAINLESS STEEL
EVAPORATOR PLATES