SEA FROST®

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OPERATION & INSTALLATION INSTRUCTIONS SA4-BFBB 220-VOLT(404-A) Series

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

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SA4 OPERATION

The SEAFROST SA4 system is an electrically driven refrigeration plant. Operation of the compressor will cool the cold plates in the boat's icebox providing refrigeration.

The SA4 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 sea strainer for obstructions. (See trouble shooting and maintenance sections.)

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

SA4 MAINTENANCE

Like your engine, your SEA FROST needs periodic checking.

ROUTINELY CHECK:

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

2. 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 rust inhibitor REGULARLY. Corrosion unchecked in the marine environment will severely reduce the life of your system.

SEA WATER STRAINER

The water pump is 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

The LC2 pump is a sealed liquid cooled magnetic drive centrifugal pump. The impeller may be inspected for obstructions and wear by first closing the seacock. Drain the pump housing by removing a hose.

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 ABSOLUTELY DRY BEFORE DISASSEMBLY.**

Remove the 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 they are in good condition. Open the seacock and 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 SA-IV 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. A high velocity white foam 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 the Leak Checking and Adding Charge sections.

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 Anti-freeze 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 pumped through the seawater circuit. 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.

INSTALLATION ~ WORK HABITS

Installer's care should be stressed. No matter how good SEAFROST 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. Follow Swagelok fitting instructions carefully.
- 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 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 <u>careful</u> 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, reevacuate 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. Any routing of the tube must be done with the tube either taped or capped. <u>Cap both tube ends after each cut.</u> (Spare caps have been included). 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 also 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 copper chips 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 absolutely 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). <u>They are ready for immediate use.</u>

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 incorrect assembly of these fittings. <u>Be absolutely sure</u> 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.)

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

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

<u>Step 3.</u> 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.

<u>Step 4.</u> Tighten the Swagelok nut to a <u>wrench snug</u>* 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).

<u>Step 5.</u> Now, while holding the fitting body with a back-up wrench, tighten the nut oneand-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	swagelok swagelok swagelok body
	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. (SEE STEP 4 IN THE SWAGELOK ASSEMBLY INSTRUCTIONS.) 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.

CONDENSING UNIT LOCATION AND MOUNTING

The design of the SA4 allows placement of the unit in an enclosed space such as a cabin locker, sail locker or engine area. Mount the condensing unit level. The compressor is at the bottom.

PLATE MOUNTING

The Sea Frost evaporator plate mounts with a Wellnut expandable neoprene blind hole fastener. A template or the plate itself should be used to locate the mounting holes. Drill a 3/16" pilot hole. Increase this hole to 3/8".



1. Place Well-nut insert all	2. Pass Machine screw	3. Tighten until snug.
the way into Pre-drilled hole	through part to be fastened	
until flange is firmly against	and the white spacer	
mounting surface.	washer.	

VALVE UNIT

For appearance and convenience of installation, the valve control unit (V/U) 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 unit to reduce space requirements if necessary.

- The tubing will support the valve unit.

- The tubing must bottom in the fitting. Refer to the Swagelok assembly instructions. Working with one line at a time, remove the Swagelok caps from compressor and condenser. Attach union fitting bodies. Make up 1/4 turn from wrench snug. This is a pre-Swaged connection.

RECEIVER FILTER DRIER (RFD)

LOCATION: The RFD is fitted with a sight glass in the top portion. Be sure that it can be viewed when mounted in an upright position (the sight glass is on the top). The RFD may be supported by the tubing or secured with a large tie wrap.

Because the RFD contains desiccant to absorb moisture and the absorption is limited, it is important to 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.



RUNNING THE TUBING

A 1/4" copper tube runs between the condensing unit and the RFD. Continue with 1/4" to the expansion valve.

A 3/8" line connects the valve unit to the compressor. If possible run the 1/4" liquid line in contact with the 3/8" suction line.

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

Thermostat Location

The thermostat is low voltage and is connected and powered by the transformer in the compressor cabinet. Mount the thermostat in a convenient location where the sensing bulb will reach a mounting screw on a plate. It is necessary that the bulb of the sensor have good thermal contact with the plate. Attach the bulb to the plate using the stainless clip. Use one of the existing plate mounting screws as an attachment point. **On multiple plate installations, the thermostat must sense the last plate in the series after the valve.** The probe temperature is displayed when 110-volt power is available. The probe temperature is not the cabinet temperature. The probe temperature is always colder than the cabinet.

Thermostat Wiring

The Electronic Temperature Control operates on low voltage (24VAC) supplied by the transformer in the compressor cabinet. A 15' wiring harness is fitted to the thermostat. Use red, blue, and white 16-gauge wire to extend this harness if a longer length is needed. Attach the wires to the terminal strip using #8 ring terminals, matching corresponding wire color.

BF Electronic Thermostat Operation

The thermostat is pre-set and locked at the factory. When locked the keypad is disabled and changes to the settings cannot be made. To change the settings the lockout switch must be placed in the unlock position.

To access the lockout switch:

- 1. Switch off the power.
- 2. Remove the four screws and cover.
- 3. Slide the lockout switch to the right to the unlock position.
- 4. Replace the cover.
- 5. Re-power the system.
- 6. To program refer to table below.

Step	Display	Description
1	F or C	Fahrenheit or Celsius Scale
		Press the set key once to access the Fahrenheit / Celsius scale. The
		display will show the current status, either F for degrees Fahrenheit or C
		for degrees Celsius. The thermostat has been pre-set at the factory for
		Fahrenheit. Press the up or down arrow key to choose between the F
		and C.
2	S1 (blinking)	Setpoint Temperature
		Press the set key again to access the setpoint. The display will show
		the current set point. The setpoint has been pre-set to 0 degrees F.
		Press either the up or down arrow key to change the setpoint to the
		desired temperature.
3	DIF 1 (blinking)	Differential Temperature
		Press the set key again to access the differential. The display will show
		the current differential. The differential temperature has been pre-set at
		5 degrees F. Press either the up or down arrow key to increase or
		decrease the differential setting.
4	C1 / H1	Cooling or Heating Mode
		Press the set key again to access the heating or cooling mode. The
		display will show the current mode. C1 for cooling or H1 for heating.
		The Thermostat has been pre-set for C1. <i>Do not change this setting.</i>
		The BF does not work in heat mode. Press the set key once more and
		programming is complete.

Note: Pressing the set key accepts the setting and brings you to the next step. You must push the **set** key through all steps to return to the temperature display to allow the compressor to operate.

TROUBLESHOOTING ERROR MESSAGES		
	Appears when either the up or down arrow key is pressed when not in the programming mode. To correct: If the E1 message appears even when no keys are being pressed, replace the control.	
E2	Appears if the control settings are not properly stored in memory. To correct: Check all settings and correct if necessary.	
EP	Appears when the probe is open, shorted or sensing a temperature that is out of range. To correct: Check to see if the sensed temperature is out of range. If not, check for probe damage by comparing it to a known ambient temperature between – 30 F and 220 F. Replace the probe if necessary.	
EE	Appears if the EEPROM data has been corrupted. To Correct: This condition cannot be field repaired, replace control.	
CL	Appears if calibration mode has been entered. To correct: Re-apply power. If the CL message still appears, replace the control.	

110-VOLT CIRCUIT

A separate 10-amp breaker is required for the 220-volt supply. This circuit powers the thermostat through a built in transformer. *For operation, it is necessary to have power at all times.*

With other thermostats connect the blue and red wires only to a make and break switch. This is normally closed. Do not apply power to the red, white or blue terminals. Do not connect the white terminal.

White = transformer common Blue= transformer 24-VAC Red= relay

PUMP INSTALLATION

Proper pump installation is important for pump operation. The SA4 uses a centrifugal pump, which is not self-priming. Air pockets caused by loops or descending lines from one component to the other may cause pump problems. The pump is water cooled and lubricated; it must never be run dry doing so will destroy the pump. 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 and should be higher than the strainer. The discharge should be on the top. Refer to the drawing at the back of this manual.

WIRING THE PUMP

A three-prong plug to the compressor unit connects the pump. *Be sure this plug cannot get wet.*

REFRIGERANT HANDLING AND SAFETY

Do not proceed with any aspect of a procedure if you do not fully understand the procedure and know what results to expect. Understand fully that pressure exists in refrigeration systems. Be careful.

REFRIGERANT

SEA FROST is charged with REFRIGERANT-404a. R-404a is a chemical compound of three refrigerants, HFC-125, HFC-143a, HFC-134a. It is almost odorless. Its boiling point is -50 degrees F. at sea level. R-404a is heavier than air and it's label and container color is orange. It must be charged as liquid to avoid separating the blend, fractionating.

GENERAL SAFETY THIS IS IMPORTANT. READ THIS!

R-404a is safe if handled properly. Avoid breathing vapors and prolonged skin exposure. Avoid using in areas of open flames. The vapor is heavier than air and may reduce oxygen available for breathing. Use with sufficient ventilation to keep exposure below recommended limits. **Do not mix with air for leak testing or use with air for any purpose above atmospheric pressure.** Liquid R-404a will freeze skin. It's especially dangerous to the irreparable tissues of the eyes.

--WEAR EYE PROTECTION--

Do not pressurize an empty system with R-404a without first evacuating the system with a vacuum pump.

DANGER! NEVER OPERATE A SYSTEM WITH THE HIGH SIDE (DISCHARGE) OPEN TO THE REFRIGERANT SUPPLY. PRESSURIZATION OF THE REFRIGERANT SUPPLY COULD CAUSE IT TO BURST.

PROCEDURES FOR WORKING WITH R-404a

1) A new uncharged system must be evacuated before adding R-404a.

2) An R-404a system must only be pressurized with R-404a or nitrogen.

3) Only service tools dedicated to R-404a are to be used. No parts, tubing, fittings, receivers, driers, service gauges, or any refrigerant carrying components may be fitted to a R-404a system from a used system or from a CFC based system. Damage caused by the use of parts not supplied by Sea Frost for a R-404a system will cancel all claims against Sea Frost.

4) No oil is to be added to the SA4 system but the polyoester oil supplied by Sea Frost, labeled and capped for SA4 use. No oil is to be added to a system with out prior consultation with Sea Frost.

5) The oils used in R-404a systems are extremely moisture sensitive (hydroscopic). Do not leave any tube end or component connection open to air while assembling the system. Be sure to use only new-capped copper tubing and be sure to cap the copper oil after cutting it.

ACCESS TO THE SYSTEM: SERVICE PORTS

The service ports are two small-capped valves mounted on the SA4 compressor. The blue fitting is the suction port. The red port is the discharge. These ports are the service access to the system and are covered with caps. Without the caps the valves may leak.

Be sure the caps are installed tightly after charging or service.

NOTE: THIS SYSTEM IS CHARGED WITH R-404a. IT MUST BE CHARGED WITH R-404a <u>ONLY</u>. ONLY DEDICATED R-404a GAUGES AND EQUIPMENT ARE TO BE USED. ANY CONTAMINATION FROM CFC BASED REFRIGERANTS WILL DESTROY THIS SYSTEM.

GAUGES

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

A gauge sets consist of two gauges installed in a manifold with two valves and hoses to connect the gauges to the system. The hoses should be fitted with shutoff valves with in 6" of the connection fitting to prevent excessive venting. The left gauge (blue) is a compound device; it indicates pressure and also vacuum. The right gauge (red) indicates pressure only. The gauge valves open a center port (yellow) to the left or right side respectively. Operation of the gauge valves is only necessary when moving refrigerant or evacuating. With the gauge valves closed, the gauges read the pressures of the connection points.

R-404a SERVICE PORT ACCESS FITTINGS

The R-404a service ports are standard ¹/₄" flare fittings with core valves. Hose ends must have depressor fittings.

CONNECTING GAUGES

Connect hose fittings to the system at the compressor service ports (See Access to the System). The high-pressure port is red; the low-pressure port is blue.

VENTING THE GAUGE SET ~ TO ATTACH TO A CHARGED SYSTEM

If the gauge set has not been purged with refrigerant, vent the hoses for a few seconds by slacking the connections at the manifold body after connecting to a charged system. This will prevent air from entering the system through the suction port. **DISCONNECTING GAUGES**

To disconnecting the gauge set after running the system, turn off the discharge hose valve first. Disconnect the discharge service hose and re-cap the port on the compressor. With the center port on the gauge set turned off at the refrigerant supply both hand wheels on the gauge set may be opened and the compressor operated to extract the refrigerant from the gauges. When the pressure in both gauges drops to the low side operating pressure turn off the gauge valves and the suction hose end valve. Turn off the compressor. Remove the suction hose and re-cap the service port. (This procedure will remove excess refrigerant from the gauges preventing an excessive discharge of refrigerant on the next job.)

Disconnecting the gauge set on a static system may be done by turning off the hose end valves and disconnecting them from the service ports. Re-cap the service ports.

Keep your gauges clean. Inspect the rubber gaskets on the hose ends, leak check gauge valve packing and all hose connections.

Check and reset the "O" on the low side gauge, if necessary.

R-404a Refrigerant must be charged as liquid only to prevent the three components from fractionating.

COMMISSIONING PROCEDURE

EVACUATION WITH A VACUUM PUMP

Evacuation removes air, readying the system for charging.

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

EVACUATION LEAK TEST

Evacuate the system to the best vacuum (lowest pressure). As the gauge reaches this low pressure close the valves to the pump. Observe the vacuum gauge and be sure the pressure remains constant for 5 minutes. If the pressure rises rapidly check all the connections again. Re-evacuate to the lowest pressure and test by holding a vacuum with the gauges closed. Be sure the system will hold this vacuum. Proceed by opening the valves and continuing the evacuation process for 30 minutes more. A micron gauge can be used to measure vacuum. Proper dehydration and evacuation should be on the range of 200 to 500 microns.

The evacuation leak check is a preliminary check and is not to be considered a system leak check.

NEW SYSTEM CHARGING ~ INTRODUCING INITIAL CHARGE

After the evacuation leak test and vacuum, pump down, shut off the manifold valves, disconnect the center hose from the pump and connect it to the refrigerant supply. Invert the R-404a refrigerant supply, to supply liquid. Vent the hose from refrigerant supply to the manifold. Weigh in the refrigerant. The compressor is off.

LEAK CHECKING

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

LEAK CHECKING A CHARGED SYSTEM

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 will be.

Avoid leak checking in cold weather or on a cold system. A refrigerant leak will show with moderate pressure. A leak is not a function of pressure. Pressure is only required to aid in detection. In cold weather, it is possible to raise the pressure in the system by warming the plates with a light bulb left in close proximity to the plate for several hours.

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

- 1. Soap bubbles (a solution of dish soap and water works well).
- 2. An R-404a electronic leak detector probe, which senses the presence of 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

Use a detector designed for R-404a. 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 S.A.E. leak specifications. Be sure to test the operation of the detector before and after you leak check the system.

IF A LEAK IS DETECTED

Try tightening the fitting nut slightly. (See Swagelok fitting instructions.) If the leak is not stopped, it is possible that the fitting was incorrectly assembled. Discharge the refrigerant, and then disassemble the connection for inspection. After reassembly, proceed with a leak check.

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.

FINAL CHARGING

This procedure must follow "Evacuation Leak Test" and "Introducing Initial Charge".

- 1. With the refrigerant supply still attached to the suction service port from the previous procedure, open the can tap valve (or appropriate gauge wheel).
- 2. While closely observing the sight glass in the RFD, start the compressor by switching on the circuit breaker and then turning on the thermostat.
- 3. The sight glass will show a stream of foam indicating a partial charge. When a sufficient amount of refrigerant has been added to the system (A new system holds 12-16oz.) the sight glass will clear, indicating sufficient charge. See READING THE SIGHT GLASS.
- 4. When charging a hot system, (cabinet and plates over 80 degrees F) the sight glass will usually clear as the return line at the Valve Unit becomes frosted).
- 5. When topping a low system when the sight glass runs clear, top off with approximately 4 oz. Remember maximum charge is 12-16oz.
- 6. When observation and test operation have been completed, disconnect the gauges and replace the service port caps.
- 7. Re-check all connection points for leaks.
- 8. Spray the acrylic coating, or similar rust inhibitor, on all the components and fittings while they are clean and dry.

READING THE SIGHT GLASS

A clear sight glass when the compressor is operating signifies a sufficiently charged SEAFROST SA-IV 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.

SPECIAL 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 prevent operation until system can be properly leak tested and recharged.

A white stream of 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 again. MONITOR THE SIGHT GLASS CONTINUALLY since the glass will not indicate when the system is overcharged.

In a warm system, when the 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

THE SA4 SYSTEM IS DESIGNED TO HOLD 12-16 OUNCES.

THIS IS THE *MAXIMUM CHARGE*. The sight glass must clear by the time the return line (suction/large diameter tube) goes below 32 degrees F.

VALVE UNIT

For appearance and convenience of installation, the valve control unit (V/U) 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 unit to reduce space requirements if necessary.

- The tubing will support the valve unit.
- The tubing must bottom in the fitting. Refer to the Swagelok assembly instructions.

ADJUSTING THE VALVE (CPV TYPE)

Before operating the compressor, unscrew the plastic cover on the valve body. Note the adjusting knob. Counter-clockwise rotation decreases the pressure. Clockwise rotation increases the pressure. One turn should equal a 2-psi pressure change.

Start the compressor. The valve must be adjusted to a 15 psi reading on the low side gauge port. Be sure your gauge is set at O before hook-up. Allow several minutes between each adjustment. Moisture may form on the adjusting knob side of the valve and freeze causing the valve to malfunction. To prevent this replace the cap after each adjustment. Be sure the valve is dry before final cap replacement. Operate for 30 minutes to confirm proper valve setting and operation.

The valve may need to be cleared of dirt or chips if adjustment is not possible. With the compressor running, turn the valve adjustment knob clockwise about 3 turns momentarily, and then back to the proper setting. Do not leave the valve in open

position allowing high backpressure, as this may cause the compressor to overload.

After satisfactory adjustment, turn off the thermostat and remove the gauges. Recap the service ports and replace the cover. When the valve has dried, insulate the valve body if it is externally mounted. Insulate the return line, the 3/8" tubing that exits the refrigerated cabinet to the compressor. The valve need not be insulated if it is in the refrigerated space.



Troubleshooting note: The operating pressure of the system **will not** indicate the amount of refrigerant in the system. The valve will not give proper operation or pressure if it is undercharged. Check the valve scribe line. It should correlate to gauge pressure.

The system requires enough refrigerant to supply liquid to the valve. If the valve has a steady

hissing sound then the charge is ok. If the valve is sputtering then it is low. If the valve is making a noticeable roar it is empty. If the low side pressure is properly set the high side pressure will be 180 to 260 psi depending on the seawater temperature (50 to 95 degrees F.) Almost immediately upon start up the valve body will begin to frost.

SPECIAL NOTE

R-404 refrigerant must be handled properly. If you do not have proper gauges, a charging scale or dial a charge cylinder, be careful to avoid over charge. Refrigerant condensing temperature should be between 15 and 25 degrees F. above water temperature. Refer to the R-404a pressure temperature charts.

SA4-Flat 220-volt Specifications		
Amp Start (LR)	19	
A.C. amp draw	4 @ 220 volts	
Horsepower	1/2	
BTU per hour	1600 @ -20 F. LBP	
Breaker	10 amp	
Height	10"	
Width	8"	
Length	20"	
Cooling	Water Cooled (remote water pump required)	
Compressor unit weight	42 lbs	
Refrigerant Charge (404A)	12-16 oz maximum	

CHECKING THE REFRIGERANT CHARGE ~ PERIODIC INSPECTION

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

- 1. Locate the RFD (receiver filter drier). It is a round metal can about 7" high and 2-1/2" in diameter, with brass fittings connecting it to copper tubing. The RFD has a sight glass for viewing the flow of the refrigerant.
- 2. Start the SA4. Check to be sure it is pumping water.
- 3. MONITOR THE SIGHT GLASS CONTINUALLY. See READING THE SIGHT GLASS. If the sight glass does not show a presence of refrigerant within a minute of operation the system is empty. TURN OFF THE SYSTEM, and follow the procedure in the TROUBLE SHOOTING section.
- 4. 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 until service can be done.
- 5. Feel the SEA FROST plates in the ice box 10 minutes after start up. If the sight glass clears yet the plates temperature does not drop after 10 minutes of operation, turn the system off and follow the procedure in TROUBLESHOOTING.
- 6. If the proper charge is indicated, make ice go sailing.

DISCHARGING THE SYSTEM ~ RECLAIMING / LEGAL REQUIREMENT

Before the connections or components can be disassembled, the system must be discharged. Connect a gauge set to the suction service port and slowly vent the refrigerant (keeping the pressure under 20 psi) into an approved reclaiming system. Do not loosen any connections until the gauge on the refrigeration system shows 10" vacuum for 10 minutes.

TROUBLESHOOTING

The most common problems that can occur in a SEA FROST SA4 System are:

- Overcharge or loss of water flow switching off of the manual reset high-pressure switch.
- Loss of refrigerant charge resulting from leaks.
- Moisture or dirt plugging the expansion valve.
- Compressor damage due to loss of refrigerant charge or damage due to overcharging the system.

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

The compressor is fitted with a MANUAL RESET high-pressure switch. This switch will disconnect the thermostat circuit switching off the compressor and water pump. After the unit has rested for a few minutes **the switch may be reset** by pushing the green rubber button. 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 location of the through hull allows air to enter the system it may be necessary to bleed air from a hose connection after the pump but below the waterline by loosening the connection. When water flows from the connection retighten.

*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. For further troubleshooting attach purged gauges to the compressor.

a) If the refrigerator box and SEA FROST plates are warm and pressure readings are below 100 psi with the compressor off (in 50 degree F or higher ambient conditions) pressurize system with R-404a and leak-check

b) If pressure reading is over 100 psi with compressor off, start the compressor and check the charge level via sight glass and add 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.

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

b) MOISTURE-PLUGGED VALVE on a properly charged system is indicated by deep vacuum readings on low side after a few minutes of 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 Unit remains warm.
- Compressor currents draw drops (running amperes).
- Moisture enters either through a low side leak or during initial installation and will freeze at the Valve Unit, reducing or eliminating refrigeration. Turning off system and allowing the valve to warm to above freezing, and then restarting, may temporarily solve the problem. If not, change RFD as follows.

STEP 3. To change a saturated RFD, allow the system to warm to ambient temperature, thereby preventing moisture from condensing in the circuit upon opening. (A light bulb in the refrigerator box will speed the warming of the plates. 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 IN THIS SYSTEM BE 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 by size and color: THE SEAFROST RFD is a drier and also a receiver/filter. **The DESICCANT and the oil in the Sea Frost RFD are special to this system and R-404a. Installation of the wrong part or oil may destroy the system.**

NOTE: This system contains a measured amount of lubricating oil. Be sure the RFD being installed is a SEA FROST SA4 R-404a RFD. Record all component exchanges in this on-board owner's manual.

Follow the "re-make" instructions for Swagelok fittings. Once Swaged the fittings should only be tighten in slight amounts to stop leakage. Overturning the Swagelok fittings will ruin the seal and spring action the fitting uses to compensate for vibration and temperature changes. Reminder: To ensure the total removal of moisture from the system use a high vacuum pump, and evacuate the system with the highest possible plate temperature (100 degrees F.). A light bulb or heat lamp in contact with the plates is a good technique.

Recharge. Refer to "Recharging section"

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

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WATER CIRCUIT

