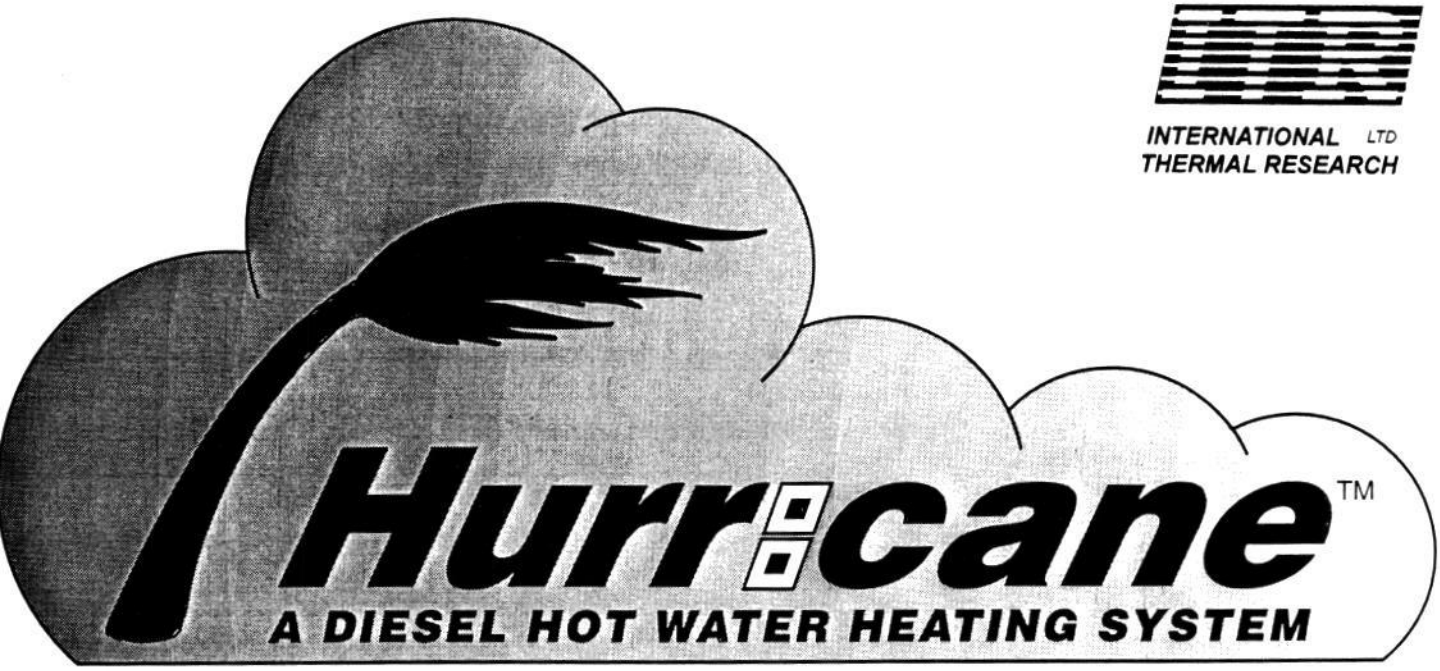

INTERNATIONAL LTD
THERMAL RESEARCH

Operation and Maintenance Guide

U.S. Patent # 5,391,075
Foreign Patents Applied for.

International Thermal Research Ltd (**ITR**)
4 - 1411 Valmont Way
Richmond, BC Canada
V6V 1Y3

Tel: (604) 278-1272
Fax: (604) 278-1274

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THE LATEST TECHNOLOGY IN A DIESEL HOT WATER HEATING SYSTEM

HURRICANE ™

The ***HURRICANE*** heater is constructed of a stainless steel case which houses all the working components. The water jacket is made of copper and brass for efficient heat transfer and brazed together for durability and long life. The deluxe model includes a fully insulated water jacket, for minimum heat loss, and extends the stainless steel casing for a completely enclosed heater. The burner and combustion tube are made of a special high temperature stainless steel to prevent premature warping or burnout.

The ***HURRICANE*** heater utilizes a low pressure fuel system. The built in fuel pump draws fuel up to a zero pressure regulator where it stops and does not require a return fuel line. An air accumulator is installed in line between the fuel pump and regulator to trap any air bubbles from passing through the nozzle causing nuisance shut downs. The accumulated air can be periodically bled off through the bleeder valve. A small compressor delivers air to an air aspirating nozzle. This nozzle draws fuel from the zero pressure regulator, mixing it with air through a venturi. This process produces a very fine spray of fuel into the combustion chamber. This low pressure system allows the use of a larger fuel orifice, less clogging, less wear and less maintenance. Ignition is accomplished by a low draw ignitor, approximately 2 amps for 30 seconds. A small fan provides outside air for combustion and a positive exhaust flow through a single thru-hull fitting. Combustion air is drawn from outside the boat so the heater can be installed in an air tight compartment or in the engine room without the fear of back venting the heater with the engines running.

A main control panel times all the heater functions, monitors the operation of each component and provides a safety shutdown of the heater should anything go wrong. It provides for a single space heating zone, a domestic water heating zone and a thermostat hookup when using a water to water heat exchanger. A heat exchanger will give you the ability to transfer waste heat from your engine to your heating system. Conversely, you can keep your engine warm when your heating system is operating. Extra space-heating zones are available for individual cabin control.

A remote control panel is provided as standard equipment. The remote panel has an on/off reset switch and single green and red indicator lights, for indication of normal or fault operations respectively. A signal beeper on the remote panel serves as an audible indication of a fault causing a shutdown situation.

The ***HURRICANE*** heater is very user friendly and easy to install. It is normally built with all connections (fuel, air, exhaust and water) off the top of the heater and the component box on the left side. The heater can also be ordered with bottom connections and or with right side components. If access to the heater is unrestricted, any part can be removed and replaced within 30 minutes.

1 Introduction

About the *HURRICANE* Heater

Congratulations on the purchase of your new ITR *HURRICANE* heater.

This manual should tell you everything you need to know for a proper installation, operation, and maintenance of your heater. **ITR** or your local ***HURRICANE*** dealer are available to help with installation and maintenance, and to answer your questions. Your local ***HURRICANE*** dealer can supply you with any accessories needed to install the heater.

See Chapter 7 for information on our warranty and customer service, and how to contact us.

The ***HURRICANE*** heater is currently available in six capacities:

- Model CO-105 105,000 Btuh, with 2.5 gallon copper boiler
- Model CO- 85, 85,000 Btuh, with 2.5 gallon copper boiler
- Model CO- 65, 65,000 Btuh, with 2.5 gallon copper boiler
- Model CO- 45, 45,000 Btuh, with 1 gallon copper boiler
- Model CO- 32, 32,000 Btuh, with 1 gallon copper boiler
- Model CO- 20, 20,000 Btuh, with 1 gallon copper boiler

Each of the above capacities are available as a deluxe model which includes insulation and a complete wrap around stainless steel jacket.

HURRICANE Heater Model CO-45, CO-32 CO- 20

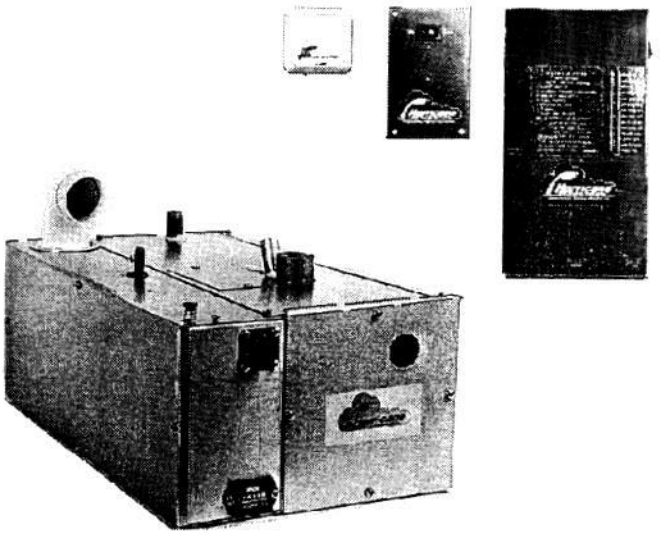


Figure 1-1

The *HURRICANE* Models CO-32 (32,000 Btuh) and CO-45 (45,000 Btuh) are most efficient on boats from 35' to 50'. Model CO-20 (20,000 Btuh) is suitable for boats smaller than 35'. If your boat is 50'-60', you should use the larger heater, Model CO-65 (65,000 Btuh) and for boats over 60', Models CO-85 or CO-105. These are merely guidelines, as interior volume and climate must also be considered. The most typically used unit for RV's is the CO-45 which would include domestic water heating and cover most climates.

HURRICANE Heater Model CO-105, CO-85 CO-65

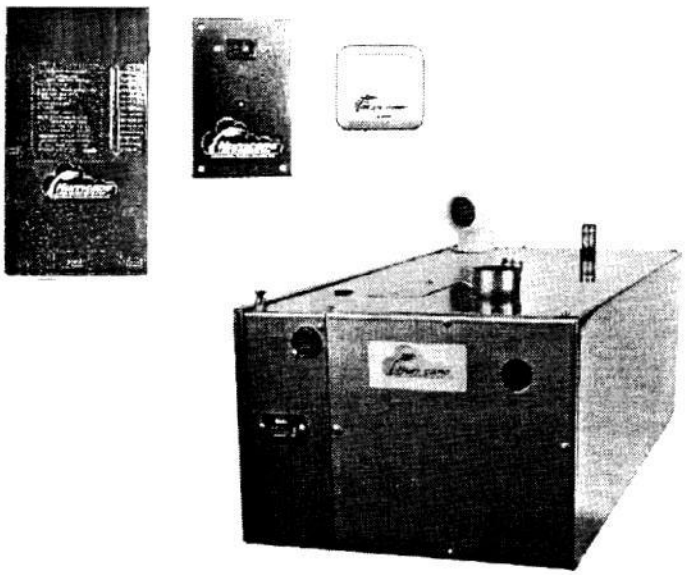


Figure 1-2

Features

Designed specifically for the marine environment, the ***HURRICANE*** heater features unique, state-of-the-art technology. **ITR**'s designed fuel-efficient burner system, has been under development for ten years.

Special features of the ***HURRICANE*** heater include:

- Fuel-efficient burner which burns all grades of diesel fuel without any burner adjustments
- Zero smoke, no carbon build-up, no fouling or smell
- Copper and brass water jacket which converts more of the fuel's energy to hot water and reduces the burner's fuel consumption
- Low power consumption
- High temperature stainless steel burner and type 304 marine stainless steel jacket
- Fan-assisted to avoid exhaust back pressure

- Quiet operation
- Insulated enclosure for retaining heat and minimizing noise
- Sealed combustion - outside air is ducted to the combustion chamber and then exhausted outside.
- Four-zone heating control for up to four thermostats (one thermostat included). As many zones can be mounted as required.
- Completely modular and field serviceable.
- Hookups and connections are easily accessible.
- Electronically controlled.
- Complete with remote control panel with on/off/ reset button, operation light, fault light, and signal horn.
- Constant circulation pump switch. (Automatic cycling when "off")
- Safety features include 4 second shutdown in case of failure, 11 red LEDs on the electronic control panel for indicating faults, and 3 aquastats for monitoring water temperatures.
- Air accumulator installed in the fuel line to collect air bubbles and prevent them from reaching the burner and causing nuisance shut downs of the burner.

2 Technical Description

Below is a description of the parts that come with the basic ***HURRICANE*** heater. Before you start the installation, make sure you have all of the components.

Components

- **Heater** - includes a fuel pump, air accumulator, combustion air fan, compressor, regulator, fuel and air nozzle, burner, combustion chamber, and water jacket. Figure 2-1 at the end of this chapter shows a cross-section of a heater, with all its component parts. These are typical of all models. The deluxe unit includes an insulated water tank and a complete wrap around stainless steel jacket.
- **Electronic control box** - consists of the main switch, a constant circulating pump switch, fuses, terminal connections, 10' cable, circuit board, a fault indicator panel of 14 LED's, from which you can monitor the entire operation of the heater. The circuit board allows hook-up of 1-Thermostat, 1- Domestic water aquastat, 1 - heat exchanger aquastat, 1 - Water pump (max. 10 amps) and 2 - ***HURRICANE*** Fan Heaters.

- **Remote indicator panel** - an on-off reset switch with a green operation light, a red fault light and signal horn. This panel uses standard telephone jacks for hook-up. It can be mounted in any convenient spot within 25' for remote operation of the heater. During normal operation, the green light glows when the heater is on. If a fault occurs, the red light will glow steadily and the horn will sound for 10 seconds. The reset switch can be turned off, then on again, to reset the safety control. If the fault continues to occur, you should check the main board for the reason. When the red light blinks, a bypass of all the safety features has been left on the main board. Do not run the heaters with the bypass on ! See Page 5-1.

- **Thermostat** - The ***HURRICANE*** heater comes with one thermostat but can be connected to up to four thermostats through the optional 4 zone control. Each thermostat can switch two ***HURRICANE*** cabin fan heaters.
- **Cabling** - comes with a cable that allows you to connect the remote indicator panel up to 25' away from the heater itself, and a 10 foot cable for connecting the heater to the electronic control box.

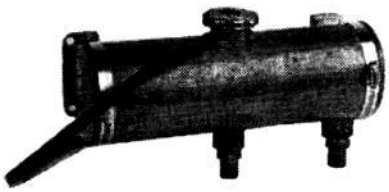
- **Air Accumulator** - A tube with a "Coin Air Vent" bleeder valve at the top, eliminates nuisance shut downs due to air bubbles in the fuel line. Periodically, the bleeder valve, should be opened and the accumulated air allowed to be released. The bleeder valve is surface mounted on the top of the stainless steel heater jacket as shown in figure 2-1 If air continues to accumulate, it is an indication of an air leak in the system.

- **Hour meter** - The hour meter will provide you with the accumulated operating hours of your Hurricane Heater. Regular inspection and maintenance of the heater and its associated components should be performed to keep it in peak operating condition.

Options and Accessories

***HURRICANE* options and accessories are available from selected ITR Dealers and Service Centers. Call ITR for an authorized Dealer near you.**

- **4 zone control box** (Part # 4069) - gives you the option of running up to 4 thermostatic controlled zones, up to 8 ***HURRICANE*** fan heaters and 2 circulating pumps (MAX. 10 AMPS). A 4 zone relay board (part # 4184) can be used for more or larger fan heaters (MAX. 10 AMPS/zone). All these boards can also be combined with and prewired in the main control box.

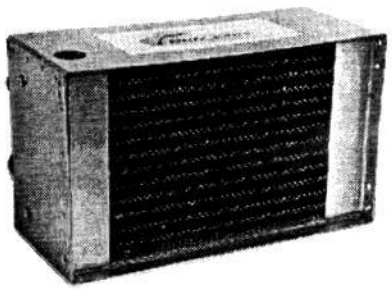


- **Water pump** - this pump circulates water through the heating system. It must be sized to a flow rate and head capacity. See water system Page 3-12.

- **Expansion tank** - this tank is required to fill the heating system and allow for expansion from heating the water. An automotive overflow tank is recommended, connected to the filler neck of the tank.

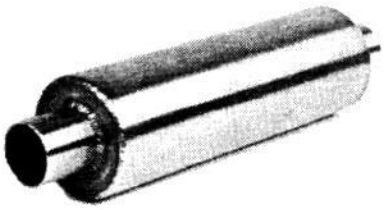
  Part # 4021: 6"W x 5½"D x 13"H (15 cm x 14 cm x 33 cm) (vertical)
  Part # 4020: 13"W x 5½"D x 6"H (33 cm x 14 cm x 15 cm) (horizontal)

- **Water-to-water heat exchanger** (Part # 4178, 4179, 4180) - this device recycles waste heat from your engine and transfers it to the ***HURRICANE*** heater. The heat exchanger can also be used to pre-heat your boat's engine. A second heat exchanger can be used to boost your domestic hot water supply.



- **Fan heater** (Part # 5014, 5074) - Constructed of a copper core and stainless steel enclosure, this heater provides up to 10,000 Btuh (2.9 kW) of hot air. The associated muffin fan produces up to 115 cu. ft. (3.25 cu. meters) per minute (cfm) and draws a minimal amount of current (.44 amps). The fan is zone-controlled thermostatically to allow regulation of the amount of heat delivered to a particular area. An integral aquastat prevents the fan from coming on until the heater has warmed up enough to eliminate the circulation of cold air. Each thermostatically controlled zone can handle 2 fan heaters.

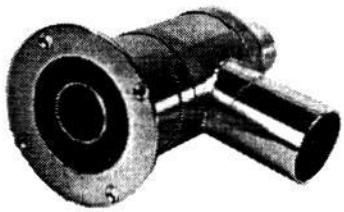
  Heater: 6" H x 10"W x 5½"D (15.5 cm x 25.5 cm x 14.0 cm)



- **Exhaust muffler** (Part # 4164 - 1½") (# 4165 - 2") - Constructed of stainless steel and packed with ceramic insulation. The straight through design eliminates any back pressure and reduces exhaust noise by up to 50%.

- **Exhaust pipe** (Part #'s 4048, 4162) - 2 " (52 mm) O.D. or 1½" (38 mm) O.D. flexible stainless steel exhaust pipe will allow you to connect the heater to the thru-hull or deck exhaust fitting. The pipe is flexible and allows you to easily route the exhaust around corners or other difficult situations. Maximum equivalent length (allowing for elbows) is 12' per system. See page 3-4 for details. Insulating wrap (Part # 4037) is available to prevent burns from contact **with the exposed hot exhaust pipe.**

- **Air Intake Flexible Tubing** (Part # 4065) - A maximum equivalent length (allowing for elbows) of 12' per system, allows you to connect the heater to the thru-hull fitting providing outside combustion air as a sealed combustion system.



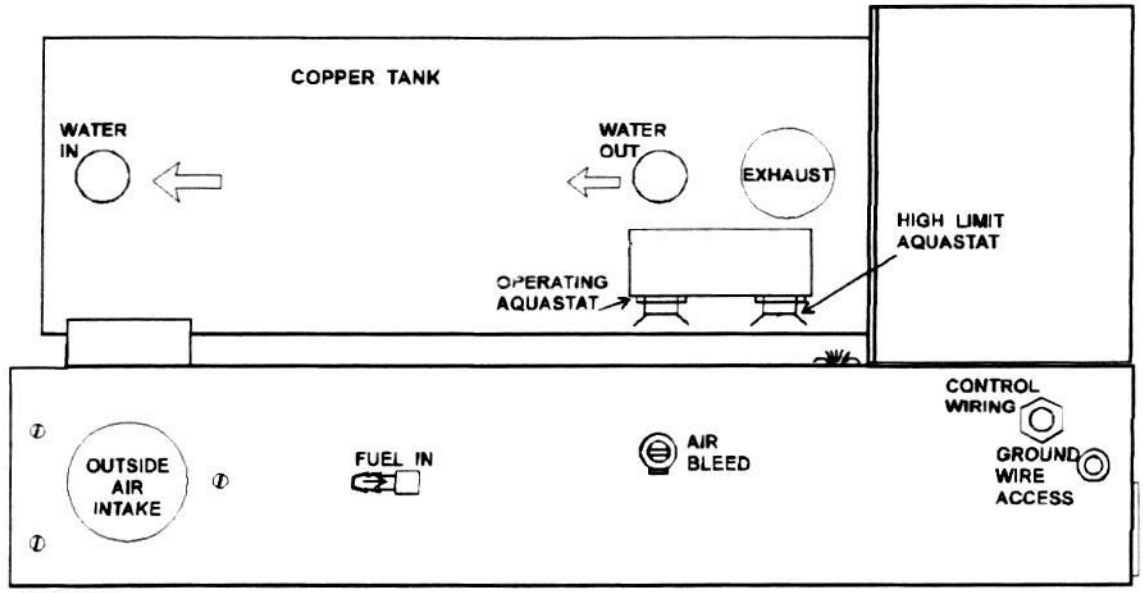
- **Thru-hull exhaust/intake fitting** (Part # 5008-short, 5009-long) - consists of a 2" (52 mm) or 1½" (38 mm) exhaust outlet and a 2" (52 mm) air inlet, providing a balanced system for the heater so it is unaffected by the surrounding environment. Short and long sizes are available.

- **Thru-deck exhaust/intake fitting** (Part # 5013) - 2½", Presently under development.

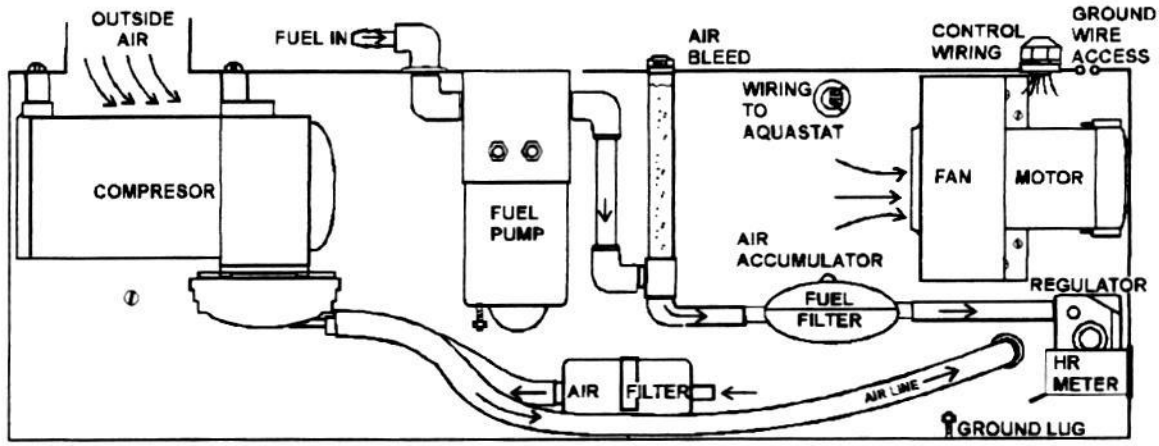
- **Dual Air Outlet Plate** (Part # 5058) - this allows you to modify our cabin fan heater (Part # 5014) to permit ducting of warm air to one or two separate outlets by means of plastic ducting. Up to 8000 Btuh (2.3 kW) of heat can be directed up to two locations. (e.g., State Room and head). In this application, the heater can be placed under a bunk or settee and appropriate openings for the ducted air provided. Four inch circular outlets are provided for ducting and runs should be limited to 3 feet in length, for optimum air output.

The following accessories are also available to assist you in your installation:

- Reducers for ducting
- Exhaust heat sleeve
- Filters
- Switches and relays
- Insulation wrap
- Round diffusers adjustable with or without dampers
- Kickspace grills
- Return air grills
- Hose and fittings (water)
- Hose and fittings (fuel)
- Domestic water heater aquastat



TOP VIEW



SIDE VIEW - COVER OFF

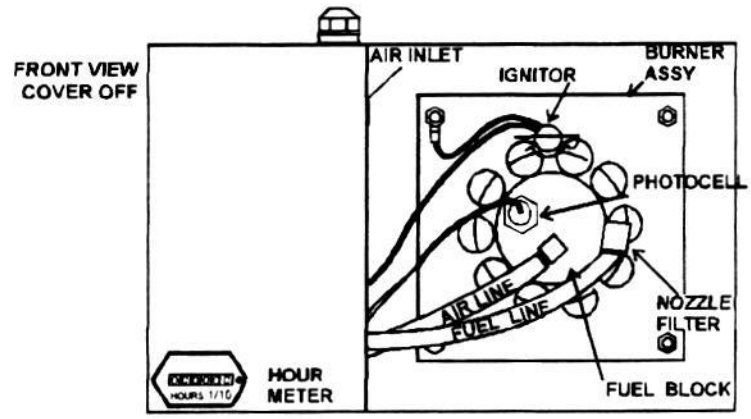


Figure 2-1
Component Parts
CO-20, CO-32, CO-45

3 Installation

Overview

Installation of the ***HURRICANE*** heater is best done with some mechanical aptitude and electrical knowledge. It is a central heating system—similar to what you might have in your home, but on a smaller scale. Critical factors include sizing of the circulating pump, routing of the water lines, purging of water and fuel lines and installation of the electronic control box, among others. See Fig.3-1 for typical installation - Page 3-2.

A properly designed and installed system is essential to ensure that the customers receive satisfactory results, and a warm, comfortable environment. The following is a basic guide line to the entire heating system and will vary with every application. It is therefore recommended that a professional dealer install or supervise the installation.

ITR can only guarantee the *HURRICANE* heater if the entire system has either been sized and installed by our approved service dealer, or alternatively, if the dealer reviews and approves the system design both prior to and after installation.

Systems installed without dealer approvals will be subject to a limited warranty. See Chapter 7 before installing your system.

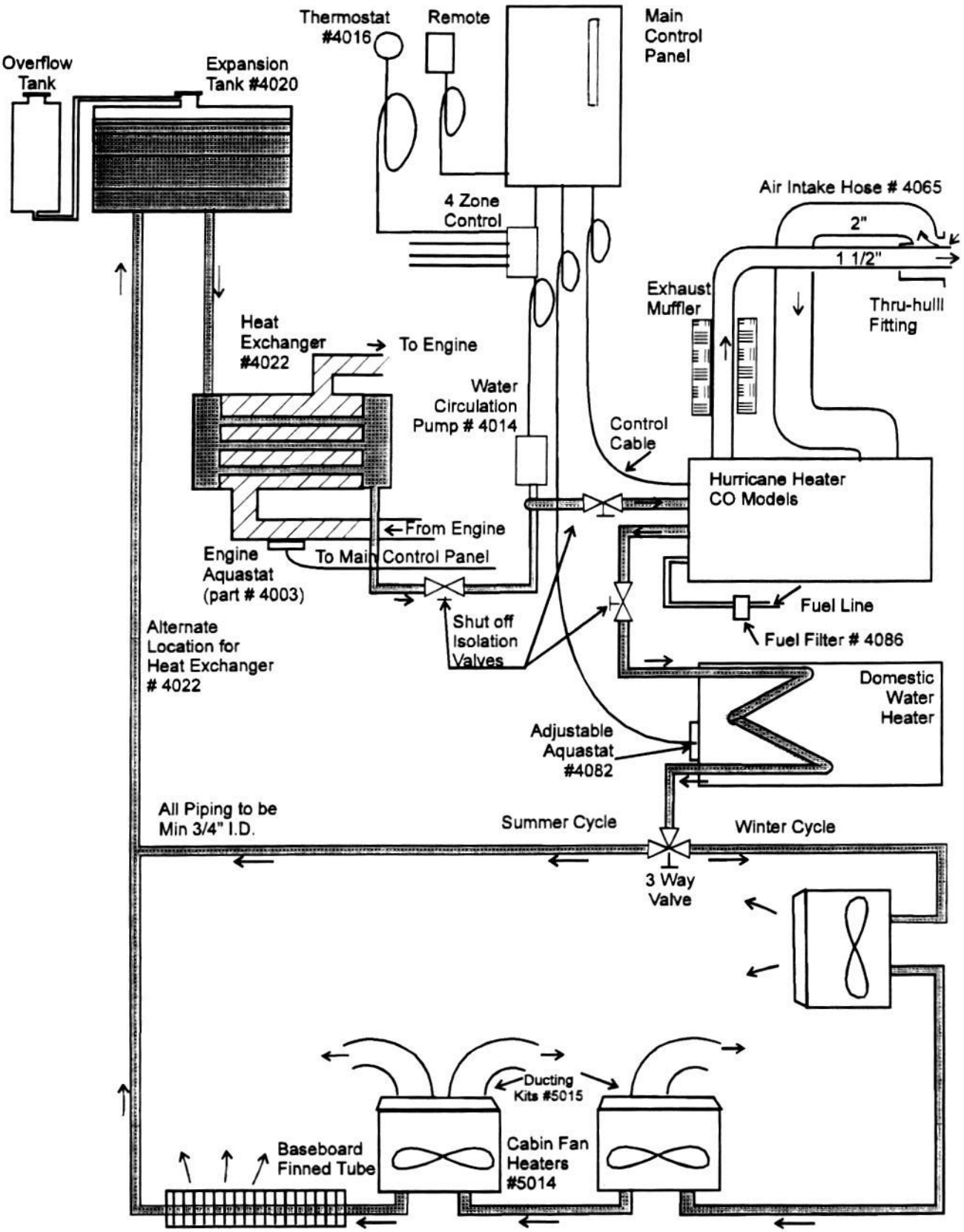
Overview of Procedure

The major steps in the installation process are as follows.

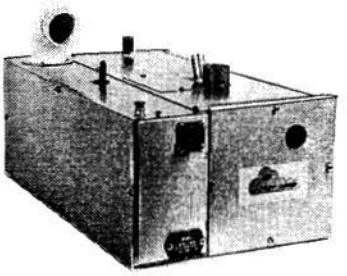
1. Mount heater in safe, convenient location.
2. Install correct size and length of exhaust and air intake system.
3. Install fan heaters and or baseboard heaters.
4. Install water hoses, expansion tank, and hook up water pump to heater.
5. Install fuel lines, fuel filter and purge lines of all air.
6. Mount electronic control box and remote indicator panel.
7. Connect power to control box and a SEPARATE GROUND TO HEATER CASE
8. Wire up the thermostat(s), 4 zone control (option), and fan heaters.
9. Install water-to-water heat exchanger if desired .
10. Fill system with water and purge system of all air.
11. For domestic hot water heating, if desired, connect the your hot water heater to the heating system.

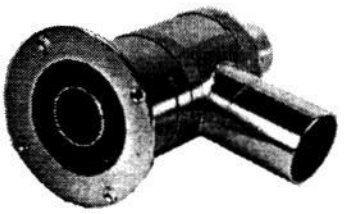
Make sure that all parts of the system are installed to approved standards and workmanship.

Fig.3-1 Typical Installation



Mounting the Heater

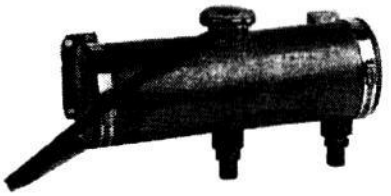


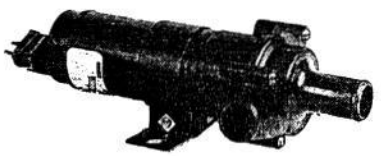


- The heater's size allows it to be mounted in a very small area that may be difficult or nearly impossible to access, so make sure you leave room for normal servicing.
- If you are installing the Hurricane Heater , access to the front, left side, and top must be provided. The Hurricane Heater can also be ordered with all bottom connections and /or front/right side access or a vehicle on rough roads.
- Choose a sturdy side wall or a mounting location that will not be affected by the heavy jarring and movement experienced by a boat in rough seas or a vehicle on rough roads.
- Make sure you consider the weight of the heater (full of water) when selecting a mounting location and mounting equipment.
- Keep in mind the exhaust outlet location of the heater, which may limit the mounting location. Ensure that the exhaust tubing can be properly and safely routed to the thru-hull fitting.
- If the heater is going to be mounted in the engine compartment check for adequate ventilation. When the engine is running, this area could be under a negative pressure. Make sure the air intake and exhaust hoses have no leaks and are well fastened to the heater and thru-hull fitting.

Location / Elevation Requirements

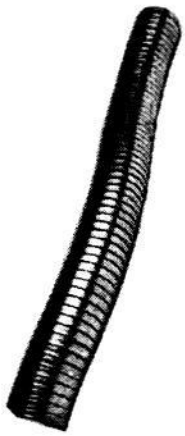
When planning space requirements for the ***HURRICANE*** system, remember:





- The expansion tank must be the **highest elevation point** in the system so that air can be easily expelled and water can flow directly down to the water pump. Mount the heater and all other parts of the system at a lower point than the expansion tank. Since this is a zero pressure system, an overflow tank is recommended off the expansion tank. This also provides a visual check of the coolant level.
- The water pump must be mounted at least even with the bottom of the heater. Allow enough space in your boat to install other parts of the system, including the cabin heater, electronic control box, and other optional parts, such as heat exchangers or additional fan heaters. Make sure hoses can be installed without kinks which will restrict water flow.

Exhaust System



Before installing the exhaust system, familiarize yourself with the necessary parts and make sure you read and understand the following information. The specifications given here must be complied with to ensure the proper and safe operation of the heater, and the safety of yourself, your guests, and your boat or vehicle. If you do not follow these specifications, the unit may perform poorly or be damaged.

The exhaust system must be properly installed to prevent any leakage of exhaust gas into the interior of the boat or area being heated. Do not operate the heater while the boat is in an enclosed boathouse or the vehicle in a garage, unless there is adequate air for exchange.

The exhaust system on this heater produces very low emissions of carbon monoxide, but caution should still be used.

If the standards for mounting the exhaust system cannot be met, do not use this heater.

Location and Routing

The external exhaust outlet should be mounted on the transom of the boat. This location lessens the chance of the exhaust gases contacting combustible material such as a pier or rafted boat.

The exhaust system tube can be extended from the exhaust outlet on top of the heater to the thru-hull exhaust fitting located as high above the boats water line as possible. For vehicles, the heater can be ordered with bottom exhaust outlet and routed in the same direction as the engine exhaust.

Heavy-duty exhaust clamps should be used to connect the stainless steel flexible exhaust tube to the heater, muffler and the thru-hull exhaust fitting.

No more than 12 feet (3.7 meters) of straight continuous stainless steel flexible tubing with no joints, or a combination with no more than 360 degrees of total bends, should be used for the exhaust system. Do not use mufflers in the exhaust system that have any restriction to flow .

Each 90° bend (maximum four) should be treated as one foot; so add one foot per elbow to the overall length, to a maximum length of 12 feet (e.g., if you have three bends, use 9 feet or less of tubing).

Do not exceed these recommended limitations, your warranty will be voided.

Exhaust Insulation

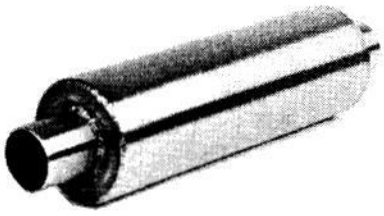
Since the ***HURRICANE*** heater can produce exhaust temperatures in excess of 400°F (204°C), the exhaust system must be properly installed to approved ABYC standards, leaving suitable air spacing and using metal shields where required to protect combustible materials. Use metal stand-offs to mount and route exhaust tubing to prevent movement and contact with combustible materials.

N e v e r place any exhaust system parts in direct contact or close to combustible material without metal shields or insulation.

If you wish to insulate the exhaust system, ask your qualified dealer for your options. Various high-temperature insulation materials are available.

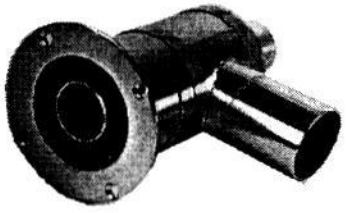
If you do not insulate, an exhaust heat sleeve (Part # 4062, 4163) can be used to protect yourself from burns due to accidental contact with the exhaust pipe.

Exhaust Muffler



(Part # 4164-1½") (# 4165-2"). This muffler is a straight through design offering no resistance to exhaust flow. This is the only type that can be used in the Hurricane heating system. It can effectively reduce exhaust noise by up to 50%. It must be tightly clamped in series with the exhaust piping.

Thru-Hull Fittings



According to American Boat and Yacht Council (ABYC) recommended practices and standards for installing boat heating systems, 100% fresh air must be available for combustion. To ensure a 100% fresh air supply, use a combination thru-hull exhaust outlet and air-intake fitting (Part # 5008, 5006, 5075). Make sure the fitting will not be installed where it could possibly take on water!

If separate exhaust outlet and air intake fittings are used, ensure that the outlet and intake are located in the same side of the boat. A strong wind on the large, flat side of a docked boat can create an extreme positive pressure zone, causing exhaust gas back-pressure and hindering combustion. By placing the combustion air intake and exhaust system in the same pressure zone, normal combustion will be ensured.

In RV and truck applications where the heater is mounted in an air tight compartment, an air intake hose must be used or an opening, of at least 3" in diameter, be cut to the outside to allow for combustion air.

Air Intake Tubing

Thermaflex air intake ducting (Part # 4065), 2" (5 cm) in diameter, is the recommended material for combustion air intake tubing, maximum equivalent 12' long. The same rules apply as apply to exhaust runs.

1. Install tubing from the combustion air intake fitting (located on the end of the heater), to the combination exhaust and air intake fitting. If possible, the air intake connection of the thru-hull fitting should be pointed up and the air intake tubing should follow a route parallel to the exhaust tubing.

DO NOT allow the combustion air intake and exhaust system tubing to touch. The exhaust system tubes can become very hot, and the combustion air intake tubes are constructed from a plastic-coated fabric material.

2. Secure both ends of the combustion air intake tube with properly-sized hose clamps to prevent air leaks.

Fuel System

NEVER **use gasoline in your *HURRICANE* heater. The *HURRICANE* heater is designed to run on all grades of diesel fuel, furnace oil, stove oil or kerosene.**

We strongly recommend that a separate fuel supply line be extended from your fuel tank to the heater fuel system. A check valve stops fuel from siphoning back to its source.

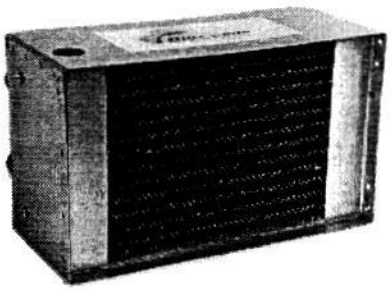
If you must use a tee, splice it in ***after*** your existing filter — do not tee directly off the engine or genset. If in doubt, contact your local dealer for more information. When coming directly off the fuel tank install an in-line fuel filter (Part # 5061) before the heater.

Keep fuel lines away from excessive heat.

1. Install a certified in-line shut-off valve to isolate the system for filter service and to allow system shut-down.
2. Install a high-quality fuel filter. (Part # 5061).
3. Flush the fuel line and filter to rid the system of any foreign material.
4. Use 1/4 " (5 mm) copper or Coast Guard approved rubber fuel line to connect the fuel supply and filter to the heater. All fittings must be air tight and the lines purged of all air.
5. An Air Accumulator is installed to help purge the fuel line of air. It is also a visual indicator of any air leaks in the fuel line.
6. Hook up the fuel line to the fuel pump built into the heater. The electrical wires for pump operation are pre-wired.

Air in the fuel line is the single most common cause of heater shut downs. An Air Accumulator is installed to prevent air from reaching the burner and shutting it down. It must be regularly checked and bled when necessary.

Fan Heaters



Where space is limited and for individual cabin or area control use ITR fan heaters (Part # 5014). These heaters draw as little as .44 amps and should be mounted as close to the floor as possible. Part # 5074 has a built on aquastat which turns on the fan when the water running through it reaches 120° F (49°C) to prevent the blowing of cold air.

The ***HURRICANE*** heater comes with a single zone hookup but can be used with an optional 4-zone (Part # 4069) system to heat individual rooms or areas. Four thermostats control the fan heaters and the ***HURRICANE*** heater, allowing you to regulate the room temperatures in four different locations. Each thermostat can control up to two ***HURRICANE*** fan heaters. For controlling more heaters or larger fan heaters, use part # 4184 which allows up to 10 Amp switching for each zone.

A limited number of *HURRICANE* fan heaters can be used with the *HURRICANE* heater (three for 20,000 Btuh model, four for 32,000 Btuh models, or six for 45,000 Btuh model). When using other than *HURRICANE* fan heaters, check the amperage draw to choose the proper *HURRICANE* zone control.

Ensure that the fan heater's mounting compartments will be able to take in adequate return air to the inlet of the heater. To take in enough air, a fan heater requires a minimum 16 square inch (100 square cm) opening into a mounting cabinet or locker. All fan heaters have built-in air vents and a pre-wired fan aquastat, to energize the fan after the heater has warmed up enough to so it does not blow cold air.

If two areas are located close together, you can buy a double outlet ducting kit to deliver heat for both areas for little extra cost. This fan heater can be mounted in a central location with one or two 4" (10 cm) ducts, up to 36" (92 cm) long for optimum air output.

For more information on fan heaters, and ducting and vent options for fans, see Chapter 2, page 2-2, under *Options and Accessories.*

Baseboard Tube Fins

If a long run of space is available, you may use baseboard fin and tube. They can NOT be controlled directly by the thermostat, barring the addition of a solenoid valve and bypass water lines.

Electrical System

Your ***HURRICANE*** heater is completely pre-wired and was test-operated before shipping. Refer to Figure 3-2 to see how the electronic control box is wired. The electronic control board has been pre-wired and mounted in a stainless steel mounting box. The small remote indicator panel, which contains the operation indicator lights and signal horn, allows you to turn the heater on and off remotely and to reset the safety control if a fault occurs.

The 4 zone control board can be ordered pre-wired in the main control box or in its own box for a separate mounting location.

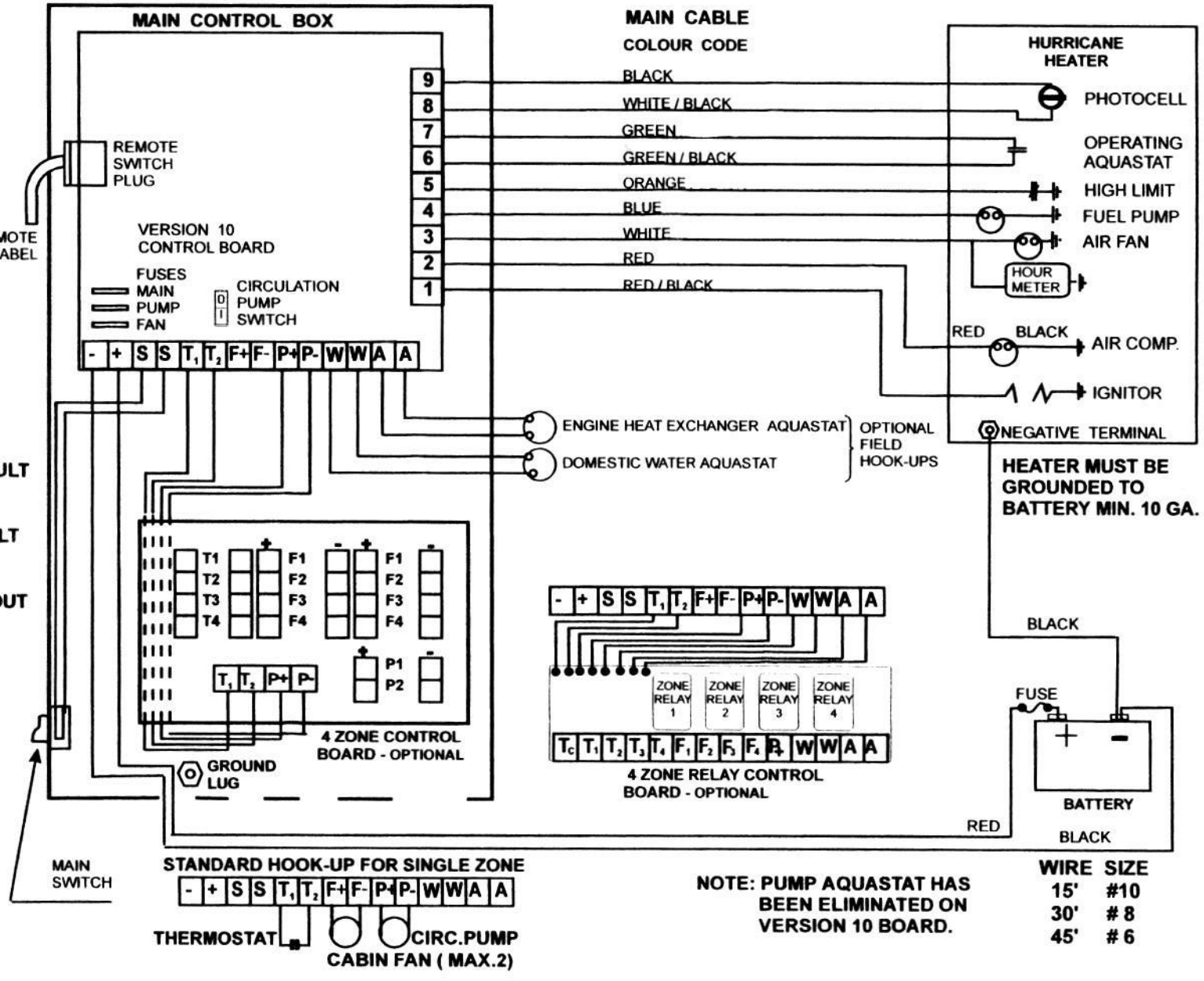
NEVER shut off the power to the heater using an in-line battery or master switch, or disconnect the battery while the heater is running. Doing so will cause serious damage to the heater, which will not be covered by the warranty.

Figure 3-2

NOTE:
This Wiring Diagram applies to the version 10 board only and is not typical of earlier versions.

LIST OF L.E.D. ON THE MAIN BOARD

- POWER ON
- BURNER ON
- IGNITION FAULT
- COMPRESSOR FAULT
- AIR FAN FAULT
- WATER PUMP FAULT
- HIGH LIMIT FAULT
- IGNITION FLAME OUT
- RUN FLAME OUT
- VOLTAGE FAULT
- BLOWN FUSE
- REMOTE OPEN
- BYPASS ON
- WATER PUMP ON



Control Box

Mount the electronic control box close to the heater, in a vertical position. Ensure that wire connectors are easily accessible. Do not mount the control box close to excessive heat.

The electrical connections between the heater and electronic control box are pre-wired and labeled for easy plug-in. Be careful when making these connections, do not damage or bend the connector pins.

Wire the control box, directly off the battery supply, through a fuse or breaker, using the following wire sizes. **Make a separate additional ground from the shell of the heater to the battery using min. # 10 wire.**

- Use a #10 wire for runs of up to 15 feet (3 m).
- Use a #8 wire for runs of between 15 and 30 feet (9 m).
- Use a #6 wire for runs of between 30 and 45 feet (12 m)
- If you need more than 45 feet of wire, contact your service dealer for recommendations compatible with ABYC standards.

The battery must also be properly protected to ABYC standards.

FUSES

The control box contains three fuse holders. One fuse holder is for the control board and main operating components. The fuse for this fuse holder is supplied and is dependant on the model of heater purchased. Models CO20, CO32 are supplied with a 6 amp fuse. Models CO45, CO65 are supplied with an 8 amp fuse and models CO85, CO105 are supplied with a 15 amp fuse. The other two fuse holders are for the cabin fans and circulating pump and do not come with a supplied fuse. These fuses must be sized to the number and type of fans and pumps installed.

Remote Indicator Panel

The remote indicator panel controls the heater's operation. It has an on-off reset switch, a green indicator light which indicates that the heater is operating, and a red light and 10 second signal horn, which indicates system faults or shut-down. By turning the switch off, then on again, it resets the safety control. If the red light is blinking, the by-pass is on, on the main control board. Refer to by-pass light Page 5-7. **Do not operate with the by-pass on.**

Located on the side of the box is the main switch and inside, located on the main board, the constant pump circulation switch which allows you to run the circulating pumps, and test the system circulation, without turning the heater on.

Connect the remote indicator panel to the control box using the 25' (7.6 m) telephone cable supplied.

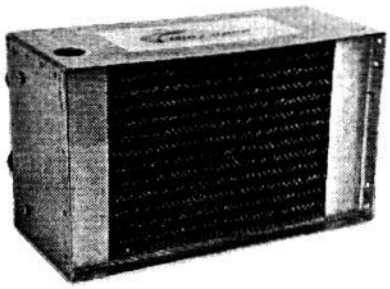
The heater's electronic control system will automatically purge or cool the combustion chamber when the on-off switch or room thermostat is turned off.

Thermostat Wiring

A single zone thermostat , circulating pump, and a cabin fan heater hook up is located inside the main electronic control box. There is an additional hook up for an aquastat from your domestic water heater and engine heat exchanger (See Page 3-16).

The optional 4 zone system (Part # 4069) can be field wired to the main control box using only 4 wires or can be pre-wired into the main control box. See Fig.3-2, Page 3-9. The 4 zone board allows for 4 thermostats, each of them controlling 2 fan heaters for a total of 8 fan heaters. A maximum load of 1 amp can be wired off each fan power supply terminal. Four zone (Part # 4184) must be used for loads larger than 1 amp.

Fan Heater Wiring



Each of the thermostat zones mentioned above provide electrical power to the corresponding fan terminals. This power supply should only provide power to the fan heaters. Once the number of fan heaters are established, the total amperage will determine the size of fuse used on the main control panel. See Fig 3-2 (Page 3-9).

If you exceed the 1 amp maximum for part # 4069 that can be wired off each fan power supply terminal, the thermostat may be damaged. It will not be covered by warranty.

Note: Fan heaters are available with or without a built in aquastat. Fan heaters with the built in aquastat will only activate once the heater exceeds a water temperature of 120° F. This prevents fan heaters from blowing cold air. If the fan does not seem to operate, check the power supply to the aquastat. These also prevent the heater's fan from operating when the heater is shut down and the thermostats call for heat.

Water System

The ***HURRICANE*** heater heats your boat or vehicle with a circulating hot water heating system (unrelated to your separate domestic hot water tank).

If you use more than the maximum number of fan heaters to heat your boat (depending on the heater model), you may get poor results. Fans located directly after the heater will starve the system, not allowing heat to reach the fans down stream. A supply and return header each with 2 or 3 series loops can be used to more evenly distribute heat throughout.

Read the instructions for installing the water system carefully. Poor circulation caused by air entrapment, or damage to the pump's shaft seal is possible if the pump is mounted incorrectly. See the pump manufacturers instruction sheet. DO NOT RUN THE PUMP DRY !

Mounting the Pump and Expansion Tank

Refer to Figure 3-1 (Page 3-2) to see how water flows in and out of the heater. The flow directions are properly labeled in this figure, so do not reverse them during installation.

1. Mount either the horizontal or vertical expansion tank at the high point of the system and pipe to the inlet of the circulation pump.

2. If desired, install an overflow reservoir beside the expansion tank, connected to the collar at the top of the tank. The overflow reservoir will make it easier to fill the system with water and monitor water levels.

Circulating Water Pump

Your water pump should be properly sized to circulate the water in your heating system.

A flow rate of 1 G.P.M. (Gallons per minute) for every 10,000 Btuh of heater capacity is recommended which will provide approximately 20°F (-6°C) temperature difference between the inlet and outlet of the heater. The slower the flow, the larger the temperature difference and the more time for heat transfer. The faster the liquid flows, the less temperature difference and the higher resistance to the system. A pump must also have the capacity to flow the water through the resistance of a single heating loop consisting of all the pipe, fittings, boiler, heaters etc., everything which makes up your heating system. On larger boats a number of loops may be run off a common header in which case only the loop with the highest resistance should be used to size the pump. Each item has a pressure drop (P.S.I.) across it and the total pressure drop x 2.3 equals pressure head in feet. If a pressure gauge is used on the inlet and outlet of a pump, the difference in pressure (P.S.I.) is the resistance.

Using the head in feet and the flow in G.P.M., the manufacturers flow charts will allow you to pick the right pump.

One of the most sensitive parts of the heater system is the circulating water pump. *NEVER* let the water pump run dry or you will cause damage to the water seals and cause the pump to leak. This is not covered by warrantee.

If you anticipate vibration noise from the pump, mount the pump to a 4" piece of rubber hose and screw the hose to the floor or bulk head. Ensure the pump is at a lower point than your ***HURRICANE*** heater.

On the single zone package, 2 terminals are located inside the main control box to switch a single pump up to 10 amps.

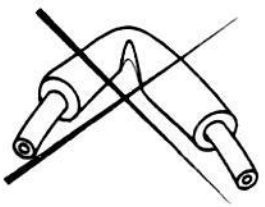
With the 4 zone control option, two water pumps, up to 5 amps each or one pump up to 10 amps, can be wired to the extra terminals labeled P+ and P- located on the 4-zone control board. Once the number and size of pumps are established, the total amperage will determine the size of fuse used in the main control panel. See Fig 3-2 (Page 3-9).

Rubber Hose

Most heating specialists now install rubber hose for boat heating systems. When properly selected and installed, rubber hose provides years of service with little or no maintenance.

The long sweeping bends that are possible with rubber hose are compatible with the curving lines of most boats and allow excellent water flow and circulation. On long straight runs, the insulation provided by rubber hose helps to control heat loss. If slip-on foam insulation coverings are used, even less heat will be lost. Generally a little heat loss is desired when the hose is run through closets, cupboards and storage lockers to help keep things dry.

Ensure that you use the correct size and type of rubber hose with an I.D. of 3/4" (19 mm) minimum. Avoid inexpensive automotive-type heater hose, which can flatten out, collapse, or kink when subjected to the normal operating temperature of the water. The low cost of poor quality hose will be negated by the time and material required to replace it.



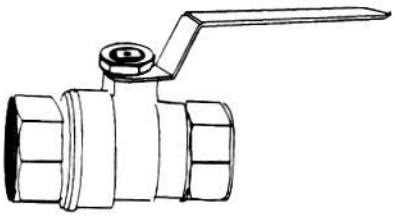
Rubber hose must not come into contact with oil, which may cause it to soften and swell. If you must pass it through an area where oil or fuel might leak, insert it into PVC plastic tubing for protection.

1. Secure the hose to prevent sagging or damage. When it passes through a bulkhead or opening, protect it from abrasion and chafing. If the hose is laid directly on the hull below the water line, it should be insulated.
2. If desired, to maximize heat retention, install slip-on foam coverings over the length of the hose.

Air Vents

Air vents must be installed at strategic points along the water system's piping where air might accumulate. The standard "coin air vent" valve is adequate for most installations if access is available to open the valve with a coin or screwdriver.

Shut-off Valves



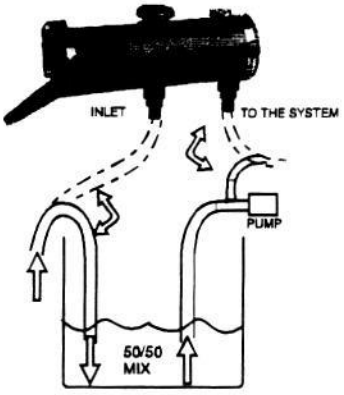
If desired, in-line shut-off valves can be installed near the water circulation pump intake and the heater outlet hose. These valves will isolate the heater and water pump, so that parts can be replaced without draining the water system, or purging the system of air. Installing a shut-off valve will ensure easy access to the heater, the water pump shaft seals, and other parts of the system. The shut-off valves should be placed in both the supply and return lines, close to and on each side of the pump and heater. You can also use clamps or needle nose vise grips, instead of installing valves, to clamp the hose on either side of the item you are servicing.

When using a header and branching off with 2 or 3 loops, valves should be used at the start of each loop to balance the system.

Water Filling Procedure

After your system has been completely installed, you are ready to fill it with a 50/50 mixture of antifreeze and water. After filling, it must be purged of all air.

> ***NEVER* operate the pump without water. The shaft seals require water, and may be damaged if they are not lubricated. Never exceed 7 lbs (3.15 kg) of pressure when filling the system.**



To fill the system use a separate self priming pressure pump with a hose on the suction side. Put the hose into a 5 gallon container. Remove the systems hose from the outlet of the expansion tank, which is the one feeding the systems circulating pump and attach it to the outlet of the self priming pressure pump. Remove the hose from the inlet of the expansion tank and hang it into the 5 gallon container. Make a final check to ensure all of the hoses are hooked up, clamps tightened and all of the air vents and drains are closed. Pour a mixture of antifreeze and water into the container and start the pump. As the mixture is pumped out, slowly add more mixture keeping the level above the inlet of the suction hose until all the air has been expelled and the mixture starts coming out of the return hose hanging in the container. This will flush the system of any debris and purge the lines of air. Continue to run the pump for about 15 minutes. When no more air is being expelled, stop the pump and reconnect the lines to the expansion tank. Top off the expansion tank with the mixture and turn on the system's circulating pump with the switch located on the main control panel.

Checking Water Circulation

Check for a good flow through the expansion tank and double check all joints for leaks. Open and close all air vents to eliminate any remaining air bubbles. Recheck the mixture level and circulation in the expansion tank.

You should purge the air from the water system again, through the air vents, after the pump's first operational cycle and once more after sailing your boat away from the dock for the first time. This is because the rocking motion may loosen up small air bubbles that have not left the system. Once the water system has been completely purged of air, you probably will not have to purge it again.

When the system has been purged of all air, water in the expansion tank should circulate properly and the pump should run smoothly and quietly. To determine whether water is circulating properly:

1. Switch on the pump circulation switch located on main control board. When this switch is on, the pump will run continuously.

2. Listen for cavitation or a bubbling sound from the pump. This means that air is left in the system and circulation is poor. Purge the water system again.

3. If the water pump is quiet, use a flashlight to look inside the expansion tank. You should see water rushing out of the fitting, the force extending at least halfway across the tank. If water is just dribbling out, water circulation is poor.

Never remove the expansion tank radiator cap when the system is hot and running. Scalding hot water may be forcefully expelled, seriously burning you. Only remove the cap when the system is cold.

CAUTION; Make sure you have a good, quiet circulation of water through the heater. Check the pump to make sure it does not run dry and leave it run for 10 minutes or more making sure all air bubble noises are gone before starting up the heater. If the heater has air pockets trapped in the water jacket when it is turned on it could cause over heating and could damage the unit beyond repair. This is not covered by warranty.

4. Turn off the pump circulation switch, which will return the pump to normal automatic operational switching.

5. Refer to the *Maintenance* chapter for information on how to add anti freeze and other water treatments. (Page 6-1)

Domestic Hot Water Heating

The domestic water heater, with an internal heat transfer coil, piped as shown in Fig 3-1 and using an adjustable aquastat (Part # 4082), fastened to its storage tank, and wired to the W-W terminals on the main control board to control the burner only.

During the summer months, when you need hot domestic water but don't need space heating, simply install a three-way valve to short-loop the water through the heat exchanger and not through the heating system. See Fig.3-1 Page 3-4. The selector valve should be mounted so it is easy to reach.

Using a Heat Exchanger

Besides space and domestic water heating, your *HURRICANE* heater can be used to both pre-heat your engine and to recycle waste heat produced by the engine.

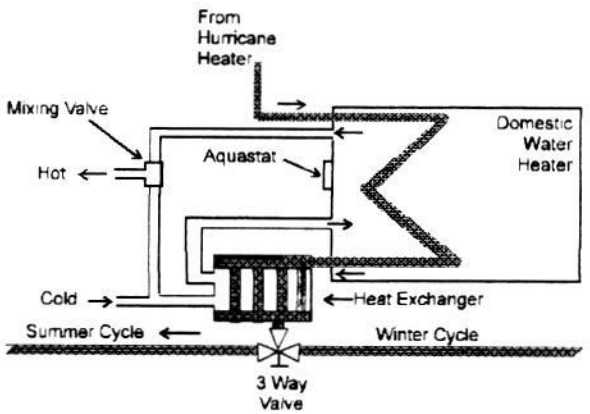
A fresh-water cooled engine produces a large amount of waste heat while running. You can use this waste engine heat, to heat your boat or vehicle by adding an in-line heat exchanger (Part # 4022) to your heating system.. An aquastat (Part # 4003) should be siliconed to the water outlet of the engine and wired to AA terminals on the main board. This will start the circulating pump of your heating system, distributing waste engine heat to the entire boat or vehicle. The heat exchanger will also pre-heat your engine by transferring heat to it, from the *HURRICANE* heater.

See Chapter 2, under *Options and Accessories*, for more information on the heat exchanger

It is not recommended to mix your engine cooling system with your heating system. Before connecting anything to your engine, consult your engine owner's manual for any restrictions on plumbing into the engine coolant system.

For more information on how to operate the engine-connected heat exchanger, see Chapter 4.

OPTIONAL DOMESTIC WATER HOOK-UP USING A HEAT EXCHANGER AND MIXING VALVE FOR AN CONTINUOUS SUPPLY OF HOT WATER



4 Operation

The initial start of your *HURRICANE* heater must be done by an authorized service person. Be sure that all components have been properly installed before the initial start.

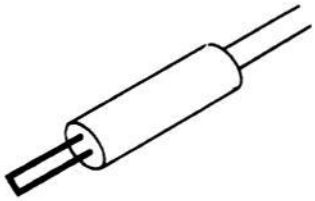
Starting the Heater

1. Start the heater by switching the master rocker switch to ON. This switch is located on the side of the electronic control box.
2. Turn on the on-off control switch, located on the remote indicator panel.
3. Turn up the zone thermostat to a setting a little higher than room temperature. You should hear a click as the heater starts.

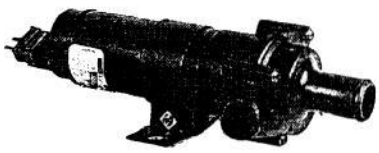
Signs of Normal Operation

When the heater is operating normally:

- The top two green indicator lights on the indicator panel should light up.
- Two separate relays inside the electronic control box will switch on. You may hear them if you are standing nearby.
- The ignitor will glow and the combustion air intake fan and the circulating pump begin to run. The fuel pump starts delivering fuel to the regulator.
- Shortly there after (about 10 seconds), the compressor turns on and draws fuel to the air aspirating nozzle. The fuel is atomized and sprayed into the combustion chamber to start combustion.



- After the ignition period (about 30 seconds), the ignitor shuts off and the burner continues to operate.
- The heater will operate until all the zone thermostats are satisfied, or until the heater itself reaches its' normal water operating temperature of approximately 180°F. Once the normal operating temperature is reached, the burner itself will cycle off and the combustion fan will operate for an addition three minutes to purge the burner. If a zone thermostat, domestic water heater aquastat, or engine heat exchanger aquastat is not satisfied, the circulating pump will continue to operate. If a thermostat cannot be satisfied by the residual heat in the system, and the water temperature drops, the burner will restart and cycle until all the thermostats are satisfied. Once all thermostats are satisfied, the heater will go through the three minute purge and the circulating pump will cease. The circulating pump will operate if the remote switch and any zone thermostat or the domestic water aquastat (W-W) are on. The circulating pump will be activated independently by the engine heat aquastat (A-A).



After the heater has been running for a little while, the water outlet of the heater case should become warm. If the water hose leaving the outlet of the heater does not warm up immediately after the pump comes on, water is not circulating properly and there may be air in the system. Turn off heater immediately and check water circulation.

☑ You can tell if the water circulation pump is running by looking into the expansion tank. There should be water movement.

Stopping the Heater

To turn off the heater (for seasonal purposes):

1. Turn off the on-off control switch, located on the remote indicator panel. The heater will go through a purge cycle before it shuts itself off.

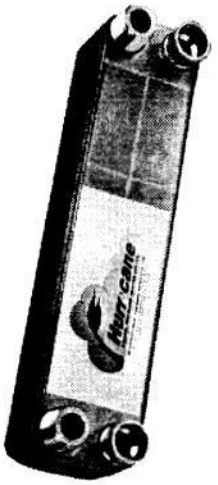
☒ **NEVER shut off the power to the heater using an in-line battery or master switch, or disconnect the battery while the heater is running. Doing so will cause serious damage to the heater, which will not be covered by the warranty.**

The room thermostat or the remote indicator panel on-off switch can be turned on or off anytime, without harming the heater. The heater will automatically run through its purge cycle, which takes about three minutes.

To shut the system down totally, (for maintenance purposes):

1. Turn off the on-off control switch, located on the remote indicator panel.
2. Turn off the main switch on the electronic control box.
3. Wait until the heater has cooled down and turned itself off.
4. Disconnect power supply.

Heat Exchanger Operation



If you've installed a heat exchanger to pre-heat your engine and recycle waste engine heat, follow these procedures.

To pre-heat your engine:

1. Turn on the heater, by turning up a thermostat, or a manual switch on one zone can be used if no space heating is needed, and wait until it reaches its operating temperature of 180° F (82°C) and cycles. The heat exchanger will transfer heat to the engines cooling system through gravity circulation.

To use waste engine heat for space and domestic water heating.

With an aquastat (Part # 4003) installed on the engine supply line to the heat exchanger, and wired to the A - A terminals in the main control board follow these steps:

1. Turn off the on-off control switch, located on the remote indicator panel. This will stop the heater from operating, but all zone controls will function normally.

2. Start your engine.

3. When the engine aquastat reaches 120°F (49°C) it will automatically switch on the circulating pump and when the fan heater aquastats reach 120°F (49°C), the fan heater will start blowing hot air, in the zones where the thermostats are calling for heat.

4. The circulating pump will continue to operate until the engine temperature drops below 120°F. A manual switch can be wired in series with this aquastat to shut the pump down sooner if required.

Domestic Water Operation

If your water heater is connected to the Hurricane heating system and its controlling aquastat is wired to the W-W terminals on the main board, it will operate as another zone of the system. A bypass can be plumbed in for summer operation. See Figure 3-1 Typical Installation, on page 3-2.

5 Troubleshooting

Overview

You can easily monitor your ***HURRICANE*** *heater*'s operation by checking the electronic control box. Refer to figure 3-2 in Chapter 3 to see how the electronic control box is wired. Any fault or problem will be immediately picked up by the control box and an LED indicator will light up to pinpoint the fault.

The purpose of each of the LED indicators is described below. When a fault is present, follow the instructions listed below for that indicator.

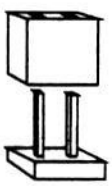
If a number of LED indicators flash a light up at one time (e.g. the high limit fault) or if the heater cycles on/off rapidly, check the ground from the heater to the battery.

Bypass Device

The ***HURRICANE*** heater features a bypass mechanism for maintenance and repair. This device is a jumper connection which allows you to bypass all the safety shut downs and operate the heater in order to set it up, test it, or troubleshoot it.

While the bypass is on, all safety devices on the heater are short circuited. If you accidentally leave the bypass on and the heater faults and you are not there to shut the heater off, it may flood the heater, or surrounding area with fuel.
Remember! If you use the bypass, remove it once you have tested or repaired the fault.

NEVER LEAVE THE HEATER AT ANY TIME WITH THE BYPASS LIGHT ON!!



If you have any doubts at all, ***please call a qualified service person*** to check or repair faults which involve connecting the bypass device.

1. To connect the bypass, place the jumper over the bypass terminals on the electronic control board.

2. To disengage the bypass, remove the jumper and place it over only half of the bypass terminals.

When the bypass is engaged, the bypass indicator on the main board lights up and stays on until the bypass is removed. The red light on the remote indicator panel also blinks as long as the bypass is on.

Power On (green)

The power ON indicator is lit when both the master switch on the control box and the on-off reset switch on the remote panel are on or during the purge period after the remote switch is turned off.

If the light does **NOT** come on:

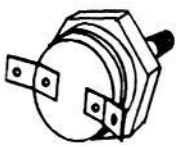
1. Check other indicator lights for blown fuse or remote switch open.
2. Check the power terminal on the control box with a volt meter (fuse holder to ground). The voltage should be between 11 and 15 volts. Check power source.

Burner On (green)

This indicator comes on during ignition and each time the burner starts running and stays on as long as the burner continues to run.

If the light is not on: The burner is not running or is in the off cycle of the operating aquastat.

1. Check other indicator lights.
2. Make sure the thermostat is turned on.
3. Check if there is continuity at the thermostat control or between T1 and T2 on the main terminal block in the main control panel.



4. Check the operating aquastat on the heater using a jumper across the two terminals. If the unit turns on, the operating aquastat is faulty.

Ignition Fault
Compressor Fault
Air Fan Fault
Water Pump

When these lights come on there is a dead short and it immediately shuts down the electronic board. However, if the fuse is old, or too closely sized to the load, it may blow before the light comes on and shuts down the board. The blown fuse light will come on. See description for blown fuse Page 5-6.

High Limit Fault

This indicator lights up when there is an open circuit or the high limit aquastat has been tripped or cycled off due to high temperature in the boiler.

If the light comes on:

1. Wait for the unit to cool. Reset units with manual reset aquastats by pushing in the red button on the aquastat and then resetting the fault by turning the remote or main switch off, then on again. Units with an automatic reset aquastat require only to reset the fault as described previously. Any unit that cannot be reset by the prior steps should be checked for proper grounding and the prodedure repeated.
2. Before resuming operation correct the reason for overheating. Check the water circulation for proper flow.

Ignition Flame Out

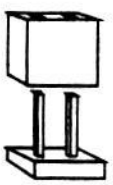
This indicator lights up when the flame is small, partial, or not there at all, or there is an open circuit in the photo cell wiring. The single most common reason for flame out ignition fault is when air gets in the fuel system. This is normally caused by loose connections or when your fuel supply is teed off a fuel line used by your engine or generator. As air accumulates and passes through the nozzle it interrupts the fuel and shuts down the burner. Reset the heater a few times to see if all air has passed through the system. If the burner resumes normal operation you must find the source of the air leak, otherwise this fault will continue to occur. An Air Accumulator has been installed to collect the air before it reaches the nozzle. Check regularly and bleed if necessary. Air which is collected is an indication of a leak somewhere in the fuel system. Check for the following:

A. If the light comes on after repeated restarts and there is a normal looking flame:

1. Check the wiring for an open circuit to the photo cell.
2. Install the bypass connector.
3. Check the photocell voltage using a digital meter, then turn the heater on. Voltage should be approximately 8 volts before the flame starts. While the heater is running, the voltage should fluctuate between 1.5 and 7.5 Volts. The higher the voltage, the smaller or bluer the flame will be.
4. Remove the bypass when the fault is corrected.

Remember ! If you use the bypass, remove it once you have tested or repaired the fault.

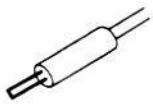
NEVER LEAVE THE HEATER AT ANY TIME WITH THE BYPASS LIGHT ON!!



B. If the light comes on and the flame is small, partial, or not there at all:

1. Install the bypass connector.

With the bypass on, the compressor will come on during the ignition period. If the ignitor does not light the fuel, raw fuel will be sprayed into the combustion chamber. To prevent this, disconnect hose from compressor to nozzle. All checks can now be made without fuel being sprayed into the combustion chamber.



2. Check the fuel supply. The fuel pump will chatter if there is no fuel or when air is passing through the pump. Check Air Accumulator for air and bleed if necessary. Check connections between the regulator and nozzle for air leaks. Find source of air entry and repair.
3. Check if ignitor is working - it should be glowing brightly, if not check wiring connections and voltage.
4. If power exists and ignitor is not working or dull in color, replace ignitor making sure the tip is horizontal.
5. Make sure the nozzle or fuel filter is not clogged.
6. Check the air line hoses for any restriction of air flow through the compressor. Restriction may be caused by a crimped hose, clogged air filter, or a loose or leaking air hose from the compressor outlet to the nozzle. Check the clearance at the filter inlet.
7. Make sure the air pressure of each compressor is at 5 to 6 psig for SS-32, CO-32 and CO-20, and 8 to 10 psig for SS-45, CO-45, CO-65, CO-85, CO 105.
8. Check for restrictions or leaks in the combustion air intake hose or exhaust pipe.
9. Check for negative pressure in the area around the heater. When the engine is running it will often rob the area of air and draw air down the heater's exhaust pipe.
10. Remove the bypass when the fault is corrected.

Remember ! If you use the bypass, remove it once you have tested or repaired the fault.

NEVER LEAVE THE HEATER AT ANY TIME WITH THE BYPASS LIGHT ON!!

Run Flame Out

This indicator lights up when the flame is small, partial, or not there at all, or there is an open circuit in the photo cell wiring. The single most common reason for flame out running fault is when air gets in the fuel system. This is normally caused by loose connections or when your fuel supply is teed off a fuel line used by your engine or generator. As air accumulates and passes through the nozzle, it interrupts the fuel and shuts down the burner. Reset the heater a few times to see if all air has passed through the system. If the burner resumes normal operation, you must find the source of the air leak, otherwise this fault will continue to occur. An Air Accumulator has been installed to collect the air before it reaches the nozzle. Check regularly and bleed if necessary. Air which is collected is an indication of a leak somewhere in the fuel system.

If the light comes on after repeated restarts:

1. Install the bypass connector.

2. Check the fuel supply. The fuel pump will chatter if there is no fuel or the fuel line has an air leak. Check Air Accumulator for air and bleed if necessary. Check connections between the regulator and nozzle for air leaks, Find the source of air entry and repair

3. Make sure the nozzle or fuel filter is not clogged.

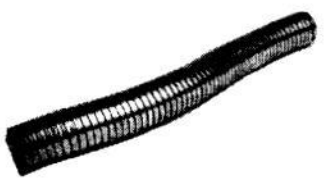
4. Check the air line hoses for any restriction of air flow through the compressor. Restriction may be caused by a crimped hose, clogged air filter, or a loose or leaking air hose from the compressor outlet to the nozzle. Check the clearance for the filter inlet.

5. Check wiring for an open circuit to the photocell.

6. Check the photocell voltage using a digital meter, then turn the heater on. Voltage should be approximately 8 volts before the flame starts. While the heater is running, the voltage should fluctuate between 1.5 and 2.5 volts. The higher the voltage, the smaller or bluer the flame will be.

7. Make sure the air pressure of each compressor is at 5 to 6 psig for SS-32, CO-32 and CO-20, and 8 to 10 psig for SS-45, CO-45, CO-65, CO-85, CO-105 .

8. Check for restriction or leaks in the combustion air intake hose and exhaust line.



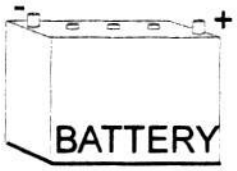
9. Check for negative pressure in the area around the heater. When there is negative pressure around the heater and the engine is running, the engine will often rob the area of air and draw air down the heater's exhaust pipe.

10. Remove the bypass when the fault is corrected.

Remember ! If you use the bypass, remove it once you have tested or repaired the fault.

NEVER LEAVE THE HEATER AT ANY TIME WITH THE BYPASS LIGHT ON!!

Voltage Fault



If this light comes on, check the voltage. Normal operating voltage should be 12 volts or slightly higher.

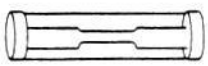
This indicator lights up when the voltage is too low, (below 10.5 V dc), or too high, (above 15V dc), and automatically shuts down the heater. If the voltage is too low it will be necessary to raise the voltage and reset the heater by turning the remote switch, off and on again. If the voltage is too high the heater will automatically restart when the voltage lowers below 15V dc.

Low voltage can be caused when another appliance, with high amperage draw, is running or comes on at the same time the heater starts up. Make sure the heater is wired directly to the battery with the proper wire, for the distance involved.

High voltage may be caused when your alternator, battery charger or inverter are putting out more than 15V dc. If the heater is wired directly to a terminal block, which is also wired to the charging system, this could cause high voltage spikes. Be sure the heater is wired directly to the battery with the proper size fuse & wire, the battery will act as a buffer. See wire size table on page 3-10.

MAKE SURE THAT THE CONTROL BOX AND THE HEATER GROUND ARE WIRED DIRECTLY TO THE BATTERY.

Blown Fuse



This indicator lights up when the fuse in the main panel is blown.

1. If this light comes on, check wiring and components for a short circuit, repair or replace.

Replace fuse with one of the proper amp rating.

Remote Open

This indicator lights up when the remote switch is off or not plugged in or an open circuit, as in a poor connection.

If this light comes on:

1. Make sure the remote switch is ON.
2. Make sure the remote switch cable is plugged into the control box and remote switch.
3. Make sure the remote toggle switch is working.
4. Check the cable continuity.

By Pass On

Remember! If you use the bypass remove it once you have tested or repaired the fault.

NEVER LEAVE THE HEATER AT ANY TIME WITH THE BYPASS LIGHT ON!!

Remote Panel Lights

The green light comes on during ignition and when the burner is running. The light will stay on only as long as the heater is running.

The red light comes on when there is a fault. The alarm sounds and the green light goes out. The red light stays on until the remote switch or the main power switch on the control box is turned off. Before resetting the switch, check which fault light is on, to determine why the unit shut down.

The red light will blink, whenever the bypass is on, to alert you to remove it when you are finished troubleshooting.

NEVER LEAVE THE HEATER AT <u>ANYTIME</u> WITH THE BYPASS LIGHT ON!!

6 Maintenance

The First Few Weeks

- Once your ***HURRICANE*** heater has been installed to approved standards and workmanship, and you have test operated it a few times, your ***HURRICANE*** heater requires little maintenance.

About two weeks after your ***HURRICANE*** heater is installed and running, you should conduct a general inspection of the entire system:

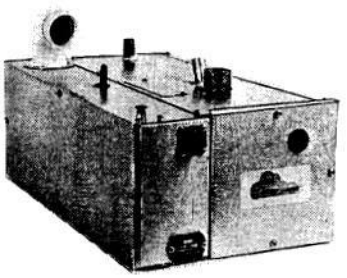
- Check for any leaks in the exhaust, fuel, or water systems.
- Tighten all clamps.

Adding Antifreeze

☑

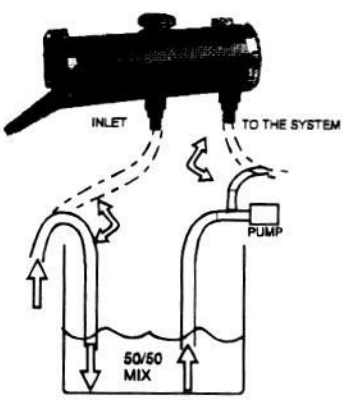
Once the system has been twice filled with water and purged of all air during the installation procedure, you need to operate the heater at usual temperatures a few times, and then check for water leaks. If you do not find any, add anti-freeze to lubricate the pump and prevent the water system from corroding or freezing in cold weather. See Chapter 3 "Water filling procedures" Page 3-14.

Heater



It is very important that you never use water only as a coolant!

We recommend that you add a mixture of 50% water and 50% anti-freeze. **NEVER** use more than a 50/50 mixture, since the added viscosity of the anti-freeze solution will cause circulation problems. Your anti-freeze water mixture should be changed every 3 years. Anti-freeze does wear out and can become very acidic.



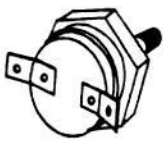
Coolant conditioners can be added to the water system, to keep the coolant alkaline and not acidic, at operating temperature. These inhibitors also prevent the coolant from forming calcium scales. Water conditioners are available from diesel engine manufacturers to maintain water stability and prolong heater life. If a conditioner is not installed in your system, check the pH level yearly.

The components inside the heater should not normally require maintenance, except for periodic checks for obvious problems, such as leaks or overheating.

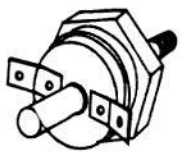
Aquastats

Mounted at the top of the heater are two or three aquastats, which serve to monitor the operation of the heater system. You can identify which aquastat is which by the color of the wires leading into them: Never bend or twist the terminals or housing of the aquastat as this causes internal damage and malfunctioning.

- Pump aquastat (blue/black - blue/white) - monitors your circulating pump to make sure it shuts off when the water temperature drops below 120°F(49°C). This will not be installed on later models as the pump control is built into the main board.



- Operating aquastat(green/white - green/black) - monitors the cycling of the heater to maintain water temperature between 150°F to 180°F (66° to 82°).



- High limit aquastat (orange/black - green/ground) - shuts the heater off if it starts to overheat. It is for 190°F (88°C). Some heaters are equipped with a manual reset button and some with an automatic reset, see page 5-2 (to be reset only after heater has cooled).

Hour Meter

An hour meter on the heater allows you to track the total usage of your heater over time. This meter operates whenever the fuel pump is running. Care must be taken not to short out the supply leads, of the hour meter, to ground as this could damage the control board.

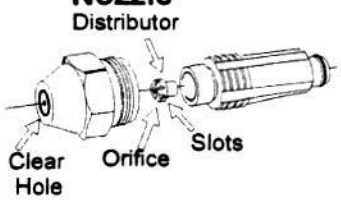
Marine Exhaust System

On rough seas, there is a danger of water entering the exhaust outlet. Ask your dealer about a thru-hull plug that can be inserted into the exhaust outlet when the boat is moving through extremely rough water. Obviously, the heater cannot be operated when the exhaust system is plugged.

Always be careful that nothing combustible is placed adjacent to the exhaust pipes.

While the exhaust system is made of a high-quality stainless steel material, it is still affected by the marine environment. Check the general condition of the pipes every so often for possible leaks and corrosion. Service as required and replace corroded pipes immediately.

Nozzle



Nozzle problems such as clogging will result in a poor flame, small and blue. Carefully disassemble and clean distributor orifice and air slots of any debris. Check o-ring for nicks and replace if in doubt. A leaking o-ring will allow air into the fuel causing popping of the flame.

Fuel Lines and Filter

You should check your filter every few months to determine if it needs cleaning or replacing. The frequency of replacement or cleaning depends largely on the quality of the fuel you're using.

Combustion Chamber

The quality of fuel varies and some ash is left in the chamber after combustion. The combustion chamber should be vacuumed clean every 1000 hours. The burner and combustion tube must be removed and the combustion chamber vacuumed clean. If this is neglected the exhaust will be restricted and will cause the combustion tube to burn out. The exhaust pipe should also be vacuumed.

Water System

If your heater is not producing enough heat, water may not be circulating properly. The heat output of the fan heaters and baseboard tube fins depends on the water temperature.

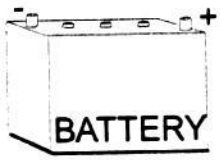
Checking Hoses and Tubes

Every so often, check all water hoses and tubes for leaks or weak points. Tighten all clamps and replace any selections of worn hose immediately.

NEVER let the water pump run dry or you may cause irreparable damage to the pump and void your warranty.

Electrical System

The electronic control panel should not normally require servicing, except:



- Make sure that all your connections are secure.
- Every so often, do a voltage test to ensure you're getting 12 volts from your battery.
- The fuses adjacent to the 3-zone terminal strip should not need to be replaced unless you have a large electrical fluctuation or surge.
- Watch for corrosion of wires.

Recommended Spare Parts

Like any piece of machinery, your ***HURRICANE*** Heater will need servicing from time to time. The instruction manual suggests servicing at different hourly intervals. The following is a list of parts recommended to have on hand. The parts are listed in the order of importance.

Description	Part No.
• Ignitor	4005
• Cycling Aquastat	4002
• Pump Aquastat	4003
• Photocell	4012
• Circulating Pump	4013
• Combustion Air Fan Motor 32 K	4028
• Conbustion Air Fan Motor 45 K	4029

Notes:

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MAINTENANCE ITEM	MAINTENANCE FREQUENCY	SERVICE REQUIRED
FUEL/WATER HOSES	SEASONALLY	INSPECT FOR LEAKS AND WEAK POINTS
COMBUSTION CHAMBER AND EXHAUST	1000 HOURS	VACUUM CLEAN
FUEL FILTER	SEASONALLY	INSPECT FOR CLEANING OR REPLACEMENT
NOZZLES DISTRIBUTOR ORIFICE, AIR SLOTS, AND O-RINGS	SEASONALLY OR 2000 HOURS	CLEANING AND INSPECTION FOR WEAR / DAMAGE
EXHAUST SYSTEM	SEASONALLY	INSPECT FOR LEAKS AND CORROSION
COOLANT MIXTURE	36 MONTHS 12 MONTHS	REPLACE Ph LEVEL FOR ACIDITY
ELECTRONIC CONTROL PANEL	SEASONALLY	VOLTAGE TEST / INSPECT FOR CORRODED WIRES
AIR COMPRESSOR FUEL PUMP COMBUSTION FAN MOTOR	SEASONALLY	INSPECT FOR LEAKS CORROSION, WEAR

7 Warranty and Service

Warranty

Warranty cards must be filled in completely, signed by the Owner and Dealer and returned to ITR within 30 days of the date of the original installation. This warranty is not transferable by the Owner.

ITR warrants the ***Hurricane*** Heater to be free of defects in materials and workmanship under design usage and service conditions for one (2) year or 2000 hours of operation, which ever comes first, on parts and on in factory labour from the date of the completion of the installation. Replacement parts are covered for the remainder of the Heater's warranty or ninety (90) days, which ever is greater.

This warranty does not apply to damage or failure of the Heater, or the vessel into which it was installed, due to improper installation, assembly, maintenance, or abuse, neglect, accident, or the use of parts not supplied by ITR. Accessories supplied, but not manufactured, by ITR shall be covered by the manufacturer's warranty only and not subject to this warranty.

Non-standard installations, that is, those requiring a departure from published installation instructions, should not be undertaken without first having consulted and gotten the written approval of ITR. Coverage for warrantable parts will, at the discretion of ITR, be made to the claimant in the form of repair, replacement or credit.

Marine Installations

The purchaser and installer are advised that specific rules and regulations are in effect with respect to the installation of Heaters in marine applications. These rules and regulations are enforced by the Department of Transportation and/or other agencies having jurisdiction. It is the installer's responsibility to review and comply with all such rules and regulations. In addition each marine installation must be installed, or inspected and approved, by an Authorized ITR Dealer. Only those installations which are approved, and so registered, will eligible for the warranty coverage deskribed above.

Systems installed without an authorized dealer's approval will be subject to a limited 90 day warranty measured from the latest date of the completion of the instalation.

Limited Warranty

The foregoing warranties are in lieu of all other warranties or conditions. ITR makes no other warranties, representation or conditions, express or implied, and there are expressly excluded all implied or statutory warranties or conditions of merchantability or fitness for a particular purpose and those arising by statute or otherwise in law or from a course of dealing or usage of trade.

The stated express warranties are in lieu of all liabilities or obligations for damages arising out of or in connection with the delivery, use, performance or licensing of the product or in connection with any services performed. In no event whatsoever shall ITR be liable for indirect, consequential, exemplary, incidental, special or similar damages including but not limited to lost profits, lost business revenue, failure to realize expected savings, other commercial or economic loss of any kind or any claim against ITR by any other party arising out of or in connection with the sale, delivery, use, performance or repair or in connection with any services performed, even if ITR has been advised of the possibility of such damages, whether based upon warranty, contract or negligence. ITR's maximum liability shall not in any case exceed the contract price for the products claimed to be defective.

No one is authorized to increase, alter, or enlarge ITR's responsibilities or obligations under these warranties Warranties are void if the original serial number has been removed, altered, or cannot be readily determined.

Owners Responsibility

Before the expiration of the warranty, the Owner must give notice to a registered ITR Dealer of failures, if any, considered to be warrantable and deliver the defective heater system to such Dealer. The Owner is responsible for the cost of all repairs made to the engine, equipment or vessel in which the Heater is installed, other than the ***HURRICANE*** Heater system. The Owner is responsible for lodging, meals and incidental costs incurred by the Owner as a result of a warrantable failure. The Owner is responsible for "down time" expenses, and all business cost and losses resulting from a warrantable failure.

ITR IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

Covered Under Warranty

This warranty shall apply to:

1. The basic Heater, including combustion chamber components, fuel system components, air compressor, ignition components and air blower. These warranties are the only written or expressed warranties given by ITR.
2. Electrical controls provided by ITR including remote mounted controls and electronic controller.
3. ITR supplied accessories and mounting hardware.

Not Covered Under Warranty

This warranty shall not apply to:

1. Any parts or products which are no longer within the warranty period.
2. Normal wear and tear of parts, including but not limited to, fuel filter, air filter, nozzle, fuses, ignitor, carbon brushes.
3. Parts or products which malfunction due to improper installation, including but not limited to malfunctions causing inadequacies in; air, fuel or coolant flow, voltage due to wiring, shock or vibration protection.
4. Any progressive damage to the engine or vessel arising out of failure of the Heater unit.
5. Heaters which have been modified or use of non-standard parts not approved by ITR.
6. Heaters that have been abused, damaged or vandalized or received improper maintenance.
7. Travel time and expenses by an ITR Dealer.
8. Diagnosis or repairs when caused by problems not directly related to the Heater or due to empty fuel tanks or poor fuel quality, acidic water and electrolysis.
9. Running the system dry or without appropriate preservatives (anti-freeze), causing damage to heat exchanger, pump seals, etc.
10. Exposing the Heater to an environment detrimental to its effective operation (such as excessively wet, dirty, or hot areas).
11. Other products which ITR does not manufacture.
12. Any products or parts which have been used in a manner contrary to ITR's printed instructions.

Please follow the recommendations contained in this manual!

Customer Service

Installation and service warranty is the joint responsibility of the Authorized Dealer and ITR.

- The Dealer provides labour and warranties the installation.
- ITR warranties its products and accessories.

Service Calls

Depending on your location, your authorized Dealer may be able to visit your vessel to help trouble shoot problems and repair your Heater. Service calls are at the customer's expense.

Returns

If you do not wish the authorized Dealer to remove and re-install a defective unit, you must return the defective product either to the Dealer you purchased your Heater from or to **ITR** as soon as reasonably possible after the defect is discovered as follows (see address below). However, the Owner must:

1. Obtain **ITR's** written or verbal authorization before returning any products.
2. Follow **ITR's** instructions for returns, and provide written details of the problems, date of installation, proof of purchase, and a return address.

Unless **ITR** states otherwise, the Owner is esponsible for shipping and insurance charges, if any, on products returned for repair under the terms of this warranty, **After repair or replacement** of products still under warranty, **ITR** will pay return shipping charges.

Repairs will be done as quickly as possible, with an estimated five working day turn around for replacing parts and an estimated ten working day turn around for repairing parts.

Telephone Service

There is no charge for help or service information given over the telephone or by Fax. Any recommendation or advice from ITR or any of its employees, or Dealers, is given only in good faith as an accommodation to the customer. Such information should not be relied upon by the customer without an independent verification of its applicability to the customer's particular situation. For customer service or other information:

- Call the dealer from whom you bought your Heater.

  OR

- Call **ITR** and ask for the name and phone number of an authorized **ITR** Dealer near you.

International Thermal Research Ltd.
 # 4 - 1411 Valmont Way
Richmond, B.C. Canada
V6V 1Y3

Tel: 604-278-1272
Fax: 604-278-1274

or

Rixen Enterprises Ltd.
2412 N. Hayden Island Drive
Portland, Oregon USA
97217

Tel: 1-800-925-6260
Fax: 503-286-5889

☑ **Before calling your dealer with a service problem, check to see if your problem is covered in the *Troubleshooting* chapter of this manual.**

Be Prepared

When calling with a service problem, please be prepared:

- Make a note of the model number and serial number of your heater.
- If your heater is already installed, ensure you are familiar with the design and installation setup.
- Have ready a detailed description of the problem.
- Keep this manual handy to refer to during the conversation.

NTERNATIONAL THERMAL RESEARCH LTD.
#4 - 1411 Valmont Way, Richmond, B.C. Canada V6V 1Y3
Ph 604-278-1272 Fax 604-278-1274

WARRANTY REGISTRATION CARD
Limited Warranty see section 7 of manual
(Please print or type)

EATER

Serial No. _____

Installed by: Owner ☐ Dealer ☐

Date Installed: _____

YPE OF VESSEL

Sail ☐ Power ☐ Length _____

Commercial ☐ Pleasure ☐ Liveaboard ☐

Name of vessel: _____

YPE OF INSTALLATION

Heater location: _____

Length of exhaust: _____ Intake: _____

No. of zones: _____ Cabin heaters: _____

No. of pumps: _____ Make: _____

Domestic water heater hookup: Yes ☐ No ☐

Engine heating hookup: Yes ☐ No ☐

OWNER

Name _____

Address _____

City _____ State / Province _____

Country _____ Zip / Postal code _____

Telephone _____

Signature _____ Date _____

AUTHORIZED DEALER

Name _____

Address _____

City _____ State / Province _____

Country _____ Zip / Postal code _____

Telephone _____ Fax No. _____

Signature _____ Date _____

OTE: *THIS WARRANY CARD MUST BE FILLED IN COMPLETELY, SIGNED BY THE OWNER AND THE DEALER AND RETURNED TO ITR WITHI 30 DAYS OF THE DATE OF INSTALLATION. THIS WARRANTY IS NOT TRANSFERRABLE BY THE OWNER.*

INTERNATIONAL THERMAL RESEARCH LTD.
#4 - 1411 Valmont Way, Richmond, B.C. Canada V6V 1Y3
Ph 604-278-1272 Fax 604-278-1274

WARRANTY REGISTRATION CARD

Limited Warranty see section 7 of manual
(Please print or type)

HEATER

Serial No. _____

Installed by: Owner ☐ Dealer ☐

Date Installed: _____

TYPE OF VESSEL OR VEHICLE

Sail ☐ Power ☐ Length _____

Commercial ☐ Pleasure ☐ Liveaboard ☐

Make: _____

TYPE OF INSTALLATION

Heater location: _____

Length of exhaust: _____ Intake: _____

No. of zones: _____ Cabin heaters: _____

No. of pumps: _____ Make: _____

Domestic water heater hookup: Yes ☐ No ☐

Engine heating hookup: Yes ☐ No ☐

OWNER

Name _____

Address _____

City _____ State / Province _____

Country _____ Zip / Postal code _____

Telephone _____

Signature _____ Date _____

AUTHORIZED DEALER

Name _____

Address _____

City _____ State / Province _____

Country _____ Zip / Postal code _____

Telephone _____ Fax No. _____

Signature _____ Date _____

NOTE: *THIS WARRANY CARD MUST BE FILLED IN COMPLETELY, SIGNED BY THE OWNER AND THE DEALER AND RETURNED TO ITR WITHIN 30 DAYS OF THE DATE OF INSTALLATION. THIS WARRANTY IS NOT TRANSFERRABLE BY THE OWNER.*

Please fold and tape for mailing

AFFIX
POSTAGE
HERE

INTERNATIONAL THERMAL RESEARCH LTD.
#4 - 1411 Valmont Way, Richmond, B.C. Canada V6V 1Y3