



**INTERNATIONAL LTD**  
**THERMAL RESEARCH**



# Installation and Operating Manual

Diesel Hot Water Heating System for Yachts

Complies with ABYC A-7



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# Overview

Thank you for purchasing International Thermal Research's **HURRICANE®II** diesel hot water heating system.

This section describes features of the **HURRICANE®II** heater and explains what to do when you first receive your heater. It also covers critical information you need to know before beginning the installation, including how to protect your warranty, and tools and equipment needed.

Several diagrams are included at the end of this section—including one of a typical installation (other configurations are possible), a schematic of the heater's internal layout, and others.

Some of the figures in this manual represent a typical installation, but other configurations or methods may be acceptable. If in doubt, obtain approval from ITR.

## 1.1 Unpacking the Heating System

As soon as you receive your **HURRICANE®II** heater:

- 1 Unpack it carefully.
- 2 Check each component against the provided parts list to ensure that you have everything and that all parts arrived undamaged.
- 3 If you discover any missing or defective parts, call ITR immediately.
- 4 If you are not installing the heater right away, secure all components so none will be misplaced.
- 5 **Before installing the heater, read the rest of *Section 1 - Overview* of this manual. It contains critical information for a proper installation.**

A properly designed and installed heating system is essential for several reasons:

- To ensure that you and/or your customers receive satisfactory results and enjoy a warm, comfortable environment
- To ensure a trouble-free installation, a successful inspection and testing process, and ease of future maintenance
- To protect your warranty

## 1.2 Protect Your Warranty

This document reflects approved installation techniques, methods, and materials, and applies only to ITR equipment. The heater is only guaranteed by ITR if the entire system has been installed according to the requirements and recommendations set out here.

### NOTICE

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No warranty will be extended to improper installations. Use of any unapproved materials, equipment, or installation procedures will result in a voided warranty for the entire heating system. ITR accepts no liability for any damage or loss of service resulting from unapproved modifications.

---

- Efficient
- Clean
- Quiet
- Compact
- Safe
- Rugged
- Reliable
- Economical

## 1.3 Heater Features

The ***HURRICANE@II*** heater is a **hydronic** heating system that has many advantages compared to the older technology of forced-air systems. The hydronic system uses a solution of water and antifreeze to provide heating to fans in the interior space areas, as well as a continuous supply of domestic hot water for the sinks, shower, etc.

The heater runs on 12VDC power, using a diesel-fired burner to maintain the temperature of the heater fluid. The ***HURRICANE@II*** heater also can use waste heat from an engine, using a heat exchanger. The addition of an optional secondary water pump will also allow pre-heating of the engine.

Other features of the heating system include:

- 1500 Watt 120 VAC (optional 240 VAC) electric element for a supplemental and backup heating source
- High-temperature stainless steel burner and casing prevents premature warping or burnout
- Stainless steel water jacket for long life and durability
- Insulated enclosure retains heat and minimizes noise
- Easy to install, field serviceable, with hookups and connections easily accessible off the top of the heater
- Quiet operation and low power consumption
- Low-pressure fuel system with built-in fuel pump
- Fuel-efficient burner capable of burning a wide variety of diesel-based fuels
- Exhaust has minimal smoke or smell
- Fan assisted sealed combustion chamber is designed to use outside air
- Simple, low amperage draw ignition
- Return fuel line to eliminate air and prevents nuisance shutdowns
- Electronically-controlled system with:
  - Automatic safety shutdown
  - Resettable aquastats and a thermal cutoff for overheat protection
  - LED display on the control panel for diagnostics
  - Patented, proprietary flame sensor
  - Burner control panel with buttons for Power, Bypass, Reset, and indicator LED's for operational and diagnostic information.
- Remote operating panel with ON/OFF switches for the diesel burner and AC element.

- Heating control for up to five separate space heating zones, each with its own optional thermostat when used with the separate Zone Control Board.

## 1.4 Critical Factors

Pay attention to notices of "Danger" "Warning" "Caution" and "Notice" in this manual.

The installation shall be in accordance with the regulations of authorities having jurisdiction.

The key factors to keep in mind when planning and carrying out the installation are:

- Mounting location restrictions for the heater, electrical control box, and exhaust outlet (to reduce noise, vibration, heat loss, etc.)
- Length, routing, and sizing of fluid lines, fuel lines, air flow tubing, exhaust piping, and wiring
- Unrestricted vent intake required to draw in 100% outside air for combustion
- Ability to easily access and service the product, especially fuel, plumbing, and electrical systems
- After installation, requirement to purge water and fuel lines, establish flow rate, and inspect/test entire system using the ITR-supplied inspection check sheet

## 1.5 Equipment, Tools, and Skills

As the installer, you must be qualified and authorized to do the installation, which requires mechanical aptitude and electrical knowledge. Make sure you comply with existing ABYC industry practices, using the highest and most recent standards and codes. Good workmanship is essential. Please refer back to *Section 1.1, Protect Your Warranty*.

You will need the following equipment and tools (not supplied) to install the heating system. This does not include optional equipment and accessories:

- Standard tools normally available in a well-equipped shop
- Approved fasteners for mounting the heater unit

- Stainless steel 1½" or 2" ID exhaust piping (depends on model); maximum 12' long with no bends (see *Section 3 – Installing the Exhaust System*, for details when bends are present).
- Thru hull exhaust for a marine installation
- ITR muffler
- Minimum ¼" supply and return fuel lines, approved rubber or copper
- Heater hose (to connect heater hose fittings to interior fans, and to connect heater to coach engine block); see the *Technical Specifications and Standards* for details
- Clamps to secure heater hose
- Expansion tank with a maximum 7Lbs radiator cap
- Overflow tank to connect to expansion tank, with clear plastic 3/8" hose; tank must be heavy-duty plastic, with a screw-down cap, and sturdy enough to mount firmly to a vertical surface
- Up to five thermostats (DC compatible) to allow temperature regulation of the five heating zones when used with the separate Zone Control Board.
- A self-priming pump and a 5-gallon fluid container to fill the system with fluid after installation
- Cabin fans or passive radiators for distributing heat to the living spaces

See **Figure 1-1**, for a typical series plumbed layout using the **Hurricane®II** heater.

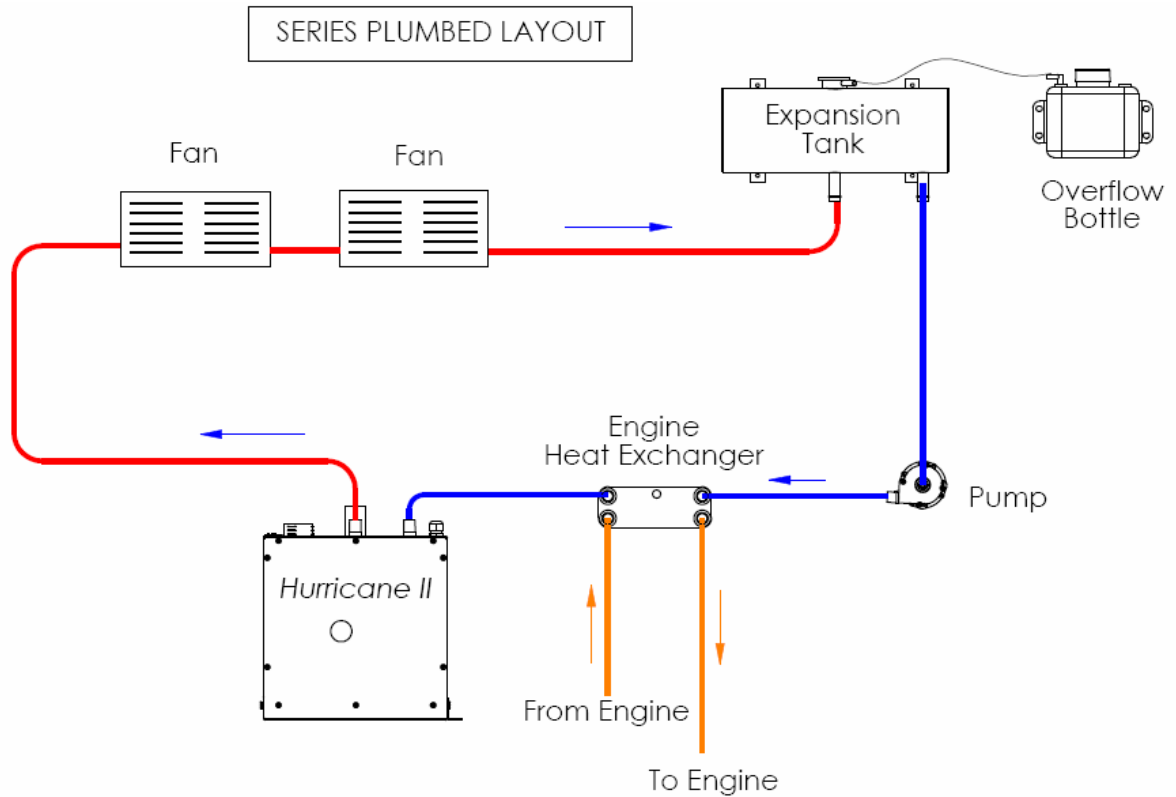
## 1.6 Testing and Inspection

After all components have been properly installed according to standard practices, ABYC standards, and the recommendations of this manual, the heating system should be test-operated for inspection purposes.

For your convenience, we have provided a pullout *Inspection Check sheet* in this manual. The check sheet is divided into

relevant stages, allowing each phase of the inspection to be carried out systematically, and then signed off by authorized persons. Please return this completed sheet with your completed warranty card to ITR.

**Figure 1-1: Typical Series Plumbed Layout**



# Mounting the Heater Unit



## 2.1 Before You Begin

Plan the location of the heater and all its major components in advance to ensure the chosen locations are feasible and within the technical specifications.

Consider the following factors to help you decide exactly where best to mount the heating system:

- Heater weight when full
- Ventilation requirements
- Exhaust outlet location and maximum acceptable length
- Thru hull location and water line
- Potential for vibration and jarring
- Fuel storage location
- Most efficient plumbing runs
- Safe and convenient access for maintenance
- Number and location of interior fans
- Location of other equipment to be installed or connected to heater, including Zone Control Box, heat exchangers, overflow tank, domestic hot water heater, batteries, etc.

### ! WARNING

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Make sure you are familiar with *Section 1, Overview* of this manual. If the system is not installed according to specifications and with the correct equipment, your heater may not operate properly, safety may be compromised, and your warranty may be voided.

---



## 2.2 Your Mounting Location

Your mounting location should take into account:

- Mounting location must be able to support double the gross weight of the heater when full (i.e. 95 lbs. x 2 = 190

lbs/86.4 KG) (H2: 95 lbs. / H2L: 156 lbs.) and must be of a non-combustible material.

- The **HURRICANE®II H2** model is 13"H x 13"W x 22.5"D (33.0 cm x 33.0 cm x 57.1 cm). See *Figure 2-1: Dimensions H2*
- The **HURRICANE®II H2L** model is 14"H x 14"W x 29.6"D (35.5 cm x 35.5 cm x 75.2 cm). See *Figure 2-2: Dimensions H2L*

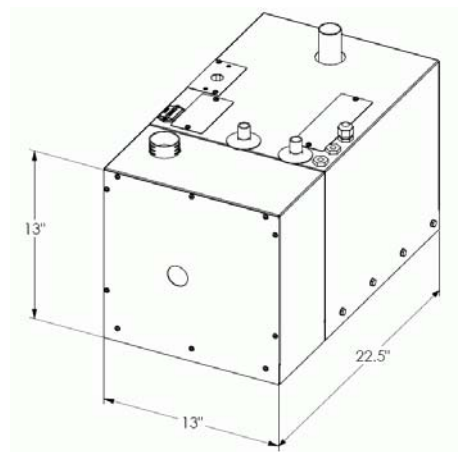
**! DANGER**

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**The HURRICANE®II heater must not be installed in any compartment with flammable gases.**

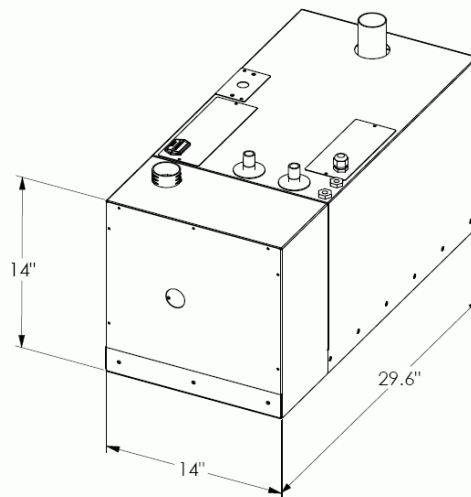
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- The **HURRICANE®II** heater must be completely isolated from living spaces. Combustion air must be drawn from an outside source and cannot contain any combustible gases.
- The heater must be mounted in an area that provides unrestricted access to the front panel mounted fuel and water connections, and top mounted power and exhaust connection (minimum of 10" top clearance – top exhaust version) and 1" clearance to all other **HURRICANE®II** surfaces.
- The heater must not be installed in any compartment with flammable gases.
- The heater must be mounted horizontal and level using eight (8) ¼" through bolts and 1" diameter fender washers, lock washers and nuts.



**Figure 2-1: Hurricane II Dimensions**

## Section 2, Mounting the Heater Unit



**Figure 2-2: Hurricane IIL Dimensions**

### WARNING

If the **HURRICANE®II** 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, muffler and thru hull fitting. Assembly parts that may cause injury through accidental contact should be protected.

Isolate the unit in the closed compartment so that no exhaust from the heater will infiltrate the living areas.

- Choose a sturdy surface in a location that won't be unduly affected by vibration and the jarring of rough roads or rough seas.
- Mount the unit with the front panel facing out and accessible. Facing out simplifies installation and maintenance.
- Open access is required to properly service the heater. Leave room at the **front**, and **top** of the unit.
- Ensure that the exhaust tubing can be properly and safely routed to the outside. The maximum exhaust run for the system is 12'.



## 2.3 What NOT to Do

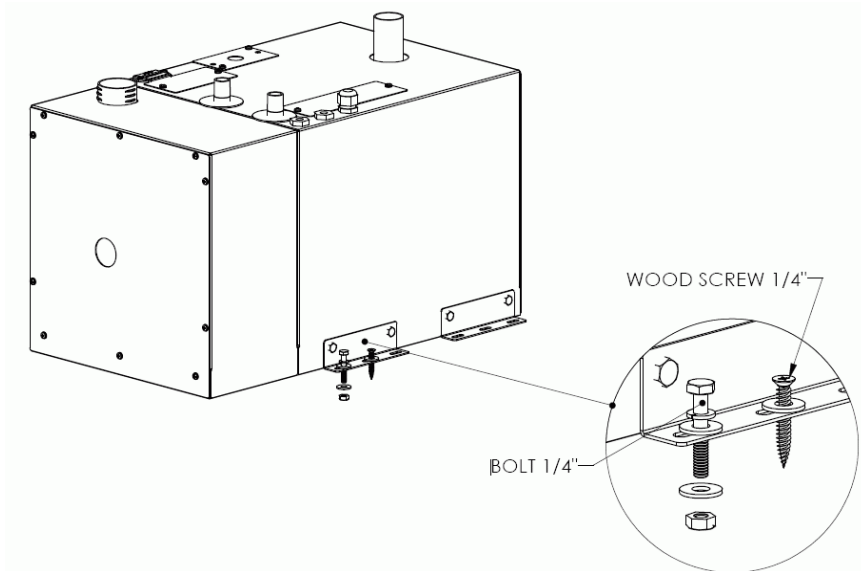
**Don't** mount the heater unit directly underneath the sleeping area. The sound of the heater cycling on and off may disturb light sleepers.



## 2.4 Procedure

After choosing the mounting location for the heater unit:

- 1 Mount the unit horizontally and level.
- 2 Secure the heater in place (against the wall, floor, or a mounting platform) using eight (8) 1/4" through bolts using 1" diameter fender washers, lock washers and nuts. (See Figures 2-3).



**Figure 2-3: Heater Mounting Brackets**

# Installing the Exhaust System



## 3.1 Before You Begin

For efficient and safe operation of the **Hurricane@II** heating system, follow all recommendations for properly installing the exhaust. Any deviations from these must be approved in advance by ITR.

**! DANGER**

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Although the heater's exhaust produces very low carbon monoxide emissions, caution is mandatory:

- Do not operate the heater in an enclosed area unless there is adequate ventilation.
- Isolate the heater unit in a closed compartment so that no exhaust from the unit will infiltrate the living areas.

Never place any exhaust parts close to combustible material or through a combustible wall or ceiling without fire protection. The exhaust can reach high temperatures. The products of combustion shall be ducted to the outside of the yacht. **Ensure that the exhaust gases do not re-enter the living areas through any means.**

---

## 3.2 Mounting Location

**If you can't meet the technical specifications for mounting the exhaust, don't use this heater. The unit may perform poorly or become damaged if not installed according to specifications.**



### Recommended Exhaust Outlet Locations

The exhaust of the heater must always exit **outside of the yacht**, not inside the heater compartment. Otherwise,

exhaust fumes could infiltrate the yacht from the heater compartment.

Exhaust outlets shall:

- Be positioned so that wind turbulence will not affect proper operation of the heater or allow the exhaust gases to re-enter the living areas
- Not be fitted within 12 inches (300 mm.) of a ventilator for the living area or an opening part of a window

Also, in a yacht installation, the following is recommended for the exhaust outlet location:

- Make sure that the thru hull is at least 30" above the water line with a goose neck rise on the exhaust to prevent water from getting to the heater through the exhaust. If the dual exhaust air-intake thru hull is used, ensure that the air-intake is placed between 10 o'clock and 2 o'clock and also goose-necked to avoid water ingestion, see Figure 3-1.
- There needs to be a 1/8" air gap around the exhaust thru hull. Make sure that the holes for the mounting screws have enough material left to properly bite. The fitting must be centered in the hole.



### Recommendation for Installation

- You may use sweep bends but each 90° 2" radius bend is equivalent to 1.5 feet of exhaust piping. The maximum recommended straight exhaust pipe length is 12' including one 90° bend. For additional bends, subtract 1.5 feet per bend. Do not exceed these recommendations.
- Combustion air must be drawn from outside the yacht.
- Use an ITR-manufactured muffler; no other muffler is acceptable.

- Exhaust outlet is on the top of the heater, towards the back.

**! DANGER**

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**The exhaust and outlet are HOT and the surrounding areas must be thermally shielded and protected from the hot surfaces and heat build-up by insulation. Nothing can come into contact with any part of the exhaust system**

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- Exhaust pipe must have a minimum of 3" (7.6 cm) clearance from all surfaces.
- Ensure that the exhaust cannot be plugged or restricted.
- The exhaust fitting on the H2 heater is 1.5" O.D. and the exhaust pipe used must have a minimum of 1.5" I.D throughout its length.
- The exhaust fitting on the H2L heater is 2" O.D. and the exhaust pipe used must have a minimum of 2" I.D throughout its length.
- All exhaust elbows must be of a large radius design (minimum radius 2.0").
- The exhaust must be supported a minimum of every 3' of its installed length.
- The exhaust pipe and the heater exhaust fitting point must use appropriate clamps and sealing compound. Be careful not to get any compound on the inside of the exhaust tube or pipe as restrictions can occur that will affect the operation of the heater. Ensure that the connections are tight and leak free. The heater exhaust outlet pipe and the exhaust pipe itself must not be distorted or damaged during this process.
- When the heater is running, the connection points and the system must be checked for leaks and any found must be corrected. Periodically, check the exhaust fittings, connections, exhaust tube and insulation for leaks and integrity and correct if required.
- Appropriate exhaust insulation must be used to cover the entire length of any interior exhaust run.

- Solid stainless steel exhaust tubing is recommended but an approved stainless steel flexible exhaust tubing can be used. If flexible exhaust tubing is used, the exhaust tubing must be inspected regularly for leaks and deterioration as this type of exhaust does not have the life expectancy of solid tubing. Stepped band clamps are recommended for joining flex and solid tubing as they apply firm, even pressure.



#### What NOT to Do

**Don't** use mufflers with any flow restrictions. Use ITR mufflers only.

**Don't** over tighten exhaust clamps or you may crush the heater's fitting.

**Don't** allow exhaust cement to accumulate inside any exhaust tubing.



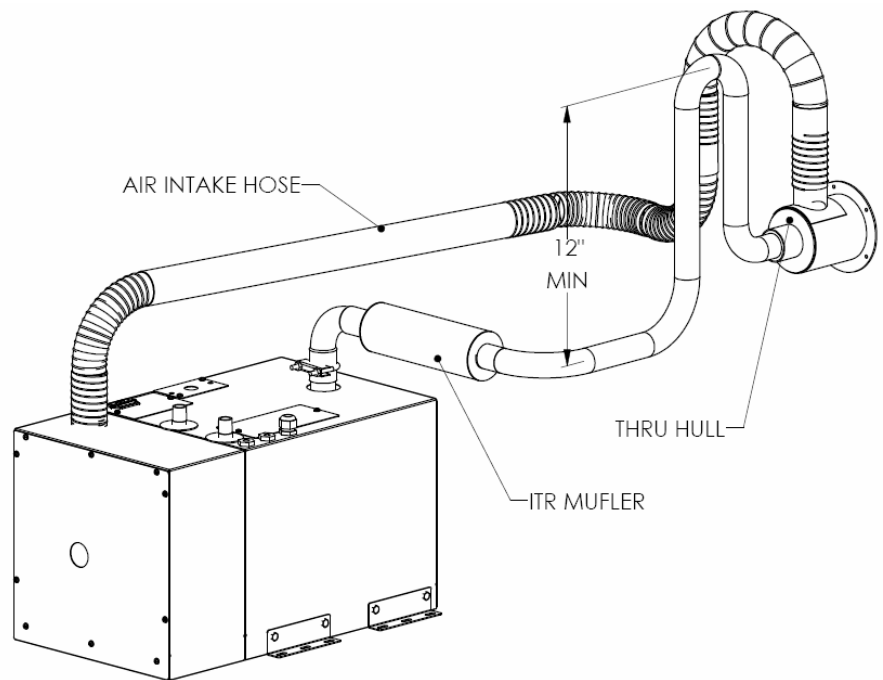
### 3.3 Procedure

Figure 3-1 shows a standard setup for the exhaust with a gooseneck configuration. To install the exhaust system:

- 1 Leave suitable air spacing to protect combustible materials; use an exhaust collar and metal shields where required.
- 2 Securely seal the exhaust piping to the heater fitting using an approved exhaust clamp. **If exhaust cement or high temperature silicone is used, care must be taken to ensure no extra cement or silicone enters the interior of the exhaust pipe, muffler, thru hull or heater fitting, otherwise the exhaust flow will be impeded and the heater operation compromised.**
- 3 Connect the exhaust piping in series with the muffler, using heavy-duty exhaust clamps. If you use vibration isolation mounts, they must be high temperature.
- 4 Connect the air intake tubing (2" ID) to the air intake fitting on top of the heater, and to an outside air intake fitting or dual thru hull (outside air only). Ensure the run of tubing is as short as possible to facilitate air flow.

### Section 3, Installing the Exhaust System

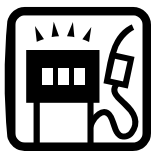
- 5 Secure both ends of the air intake tubing with properly sized hose clamps to prevent air leaks.
- 6 Make sure the air intake and exhaust hoses have no leaks and are not touching each other.
- 7 Make sure the thru hull is at least 30" above the waterline and the exhaust must be goose-necked (see Figure 3-1).



**Figure 3-1: The Exhaust Goose Neck Configuration**



# Installing the Fuel System



## 4.1 Before You Begin

For efficient and safe operation of the heater, follow all recommendations for properly installing the fuel system.

### ! DANGER

---

**Never use gasoline, crankcase oil, or any oil containing gasoline in the heater. Use only diesel fuel, furnace oil kerosene or stove oil.**

Keep fuel lines away from any heat source above 100°F (38°C).

Keep gasoline and any equipment that uses gasoline away from the heater location. The heater is not rated for use in an explosive environment.

### ! WARNING

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Never share the fuel supply to the heater with any other fuel-burning device.

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## 4.2 Fuel System Installation

The fuel pump in the heater has a maximum flow capacity of 25 GAL/hr. and a maximum pressure of 11.5 psi. A 10 micron fuel filter is recommended. Select a fuel filter based on these requirements.

### Recommendation for Installation

The heater's fuel connections are accessed from the top of the heater. The fuel inlet and fuel return are shown on the large label and located on the top right panel of the heater and are not interchangeable. These fittings consist of 1/8" female NPT that connect to the fuel pump inside the unit.

The following is recommended for the fuel system installation:

**The fuel supply requires a dedicated pickup line from the main fuel tank.** The pickup must allow the heater to run out of fuel before the tank itself is empty.

- The fuel supply from the fuel storage tank to the fuel inlet must be from a dedicated fuel pickup.
- The fuel supply line must be of minimal 1/4" ID.
- The fuel supply line should be installed with minimal rise from the fuel tank. In no event should the heater be more than 60" above the fuel tank.
- The fuel return line should be installed from the heater to the fuel tank.
- The fuel line must be run and secured so as to prevent damage, chafing and kinking during normal operation.
- The fuel line connection points and hoses must use suitable clamps and/or sealant and must be checked for leaks on the initial installation and also periodically as part of normal maintenance.
- A primary, 10 micron approved fuel oil filter (not provided) must be installed inline in the fuel supply hose between the tank and the heater, in a manner that ensures easy access for maintenance.
- Fuel line hose used must be appropriate for your requirements. It is strongly recommended that the hoses have permanently installed end fittings.



### 4.3 What NOT to Do

- **Don't** allow the fuel or the fuel lines to become contaminated with foreign material.
- **Don't** allow the fuel lines to become damaged or constricted.

**! CAUTION**

Ensure that fuel lines are always protected from contamination by foreign material. When installing or servicing, seal off ends to prevent contamination. After

installing, you may also wish to flush the fuel line to rid it of air and any foreign material.

Be sure that all fuel lines are secured and will not become pinched, kinked or damaged during normal operation.



## 4.4 Procedure

To complete the fuel system installation:

1. Install the inline fuel filter. The optimal location is on a compartment wall next to the heater inline between the fuel tank and the heater.
2. Connect the fuel line to the dedicated fitting on the main diesel fuel tank.
3. Inspect the supply and return fuel line for any loose connections or damage. **Fittings must be airtight.**
4. If desired, install an inline shut-off valve on the tank side of the fuel filter to allow shutdown and filter service.
5. **All fittings must be air tight and the lines purged of all air.**

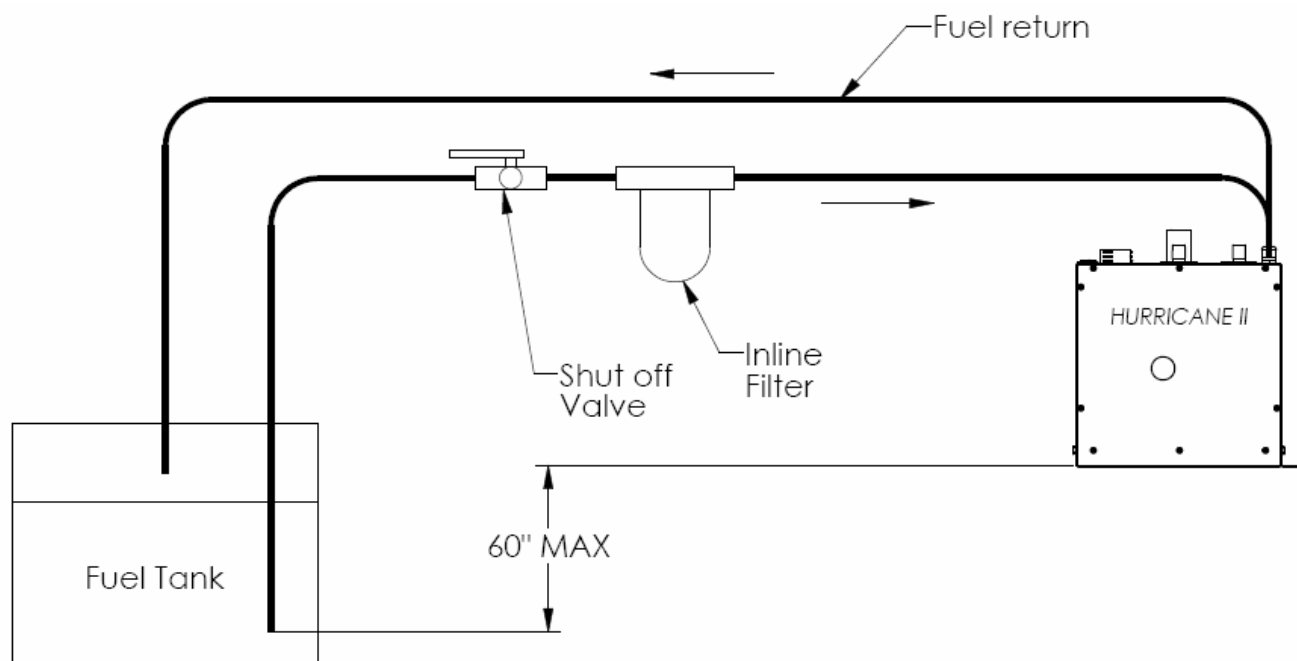


Figure 4-1: Fuel connection schematic



# Installing Fan Heaters



## 5.1 Before You Begin

ITR makes a variety of fan heaters that can be independently controlled by a thermostat. There are standard, high output, and spacesaver (where space is limited) cabin heaters. These heaters draw as little as 0.9 amps and deliver 140 cfm. They should be mounted as close to the floor as possible. Some cabin fans may have a built-in aquastat which turns on the fan when the coolant running through it reaches 120°F (49°C). These type of fans are evidenced by an additional set or black wires exiting the cabin fan case that are associated with this aquastat.

The Defrost Heater provides up to 28,000 BTU/h and uses a three speed fan switch for 200/275/450 cfm at 40/55/100 watts.

**Note: A limited number of fan heaters can be used with *HURRICANE®II* heaters.**

### NOTICE

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Only the installation of ITR fan heaters is covered in this manual.

If you are installing non-ITR fan heaters, you must obtain prior approval from ITR. You must check the fans' total amperage draw to ensure they will be compatible with the zone controller, as well as flow capacity to ensure that each fan meets system requirements.

---

## 5.2 Fan System Operation

ITR cabin fans consist of a 12VDC brushless fan and heater coil similar to a radiator.

When the heater unit comes on, the fan draws ambient air from the interior, blows it through the heater coil and back into the interior

through a vent. There must be a return and output vent for each fan unit.

## Features

ITR cabin fans do not operate until the heating system temperature has reached its minimum operating temperature.

If a “passive” radiant heat system is desired (i.e., baseboard or fin and tube configurations), consult ITR for recommended installation procedures and design. A different zone control system and additional equipment are required for a passive radiant heat system.

## Five Zone Heating System

The ***Hurricane®II*** heater is capable of heating up to five different areas of the yacht using separately-controlled fans in a five zone system.

Up to five thermostats (positive DC compatible) can be installed to allow separate temperature regulation of the five zones. The thermostats control both the fan heaters and the ITR heater itself. The Zone control board has an 18 amp draw limit for all the fans.

For larger installations, contact ITR.

## Accessories and Components Needed

In addition to the fans themselves, you will need at least some of the following accessories and equipment, which are not supplied:

- **Thermostats** — up to five thermostats can be installed in the interior.
- **Air Outlet Vents** — covers that are installed flush with the wall to vent heat for the installed heater unit.
- **Fan guards** — to protect the fan blades from damage, recommended for fans installed in storage areas or other accessible areas where something could contact the fans.
- **Screws** — #10 sheet metal screws or wood screws to mount the fan units. See *Figure 5-2, Mounting a Spacesaver Fan*.



- **Two-Speed Fan Switches** – to enable low and high-speed settings from inside the yacht; there are three models depending on the type of cabin fan selected; for use with the ITR cabin heater and Spacesaver fan.
- **Three-Speed Fan Switches** — to enable low, medium, and high-speed settings from inside the yacht; for use with the ITR defrost heater.
- **Air Ducting** — to allow you to install fans in a remote location (i.e. not directly adjacent to the interior space to be heated) and duct the heated air to its output location. Also, **air outlet plates** to allow you to install ducting for one, two or three separate outlets (e.g. you can use one fan to heat two different areas by installing a dual air outlet plate).



### 5.3 What NOT to Do

**Don't** install more fans that require more heat than a heater can produce, or a fan system that exceeds the total allowed draw of 18 amps. Your heating system will not run effectively. (If you choose to use a higher-draw fan motor, install a relay to handle the extra load; see Figure 5-3.)

**Don't** mount the return air outlet too close to the fan's air input source.



### 5.4 Mounting Locations

Carefully choose the mounting locations of your fans:

ITR can suggest optimal fan locations if you provide a floor plan of your yacht or coach.

- Distribute the fans evenly throughout the yacht to ensure that all interior areas will be adequately heated.
- Typical locations are: bedroom, kitchen/hall, and living room. You can locate fans in storage areas or cabinets or behind walls.
- You should install one fan in the water storage area to protect the water and holding tanks from freezing.
- Provision must be made to protect water lines from freezing.

- Install fans at floor level or very near floor level, in order to optimize circulation.
- Allow a minimum 16 square inch (100 cm sq) opening in the fan heaters' mounting compartments, to allow sufficient intake of air.



ITR's Spacesaver fan (pictured at left) has two mounting brackets welded to the side of the case. It is designed to be mounted horizontally on a flat surface.

ITR's standard and high output cabin fans can be mounted on the floor or on the wall, either flat or on its side. The high output version of the standard cabin fan is pictured at left.



Thermostats should not be mounted on walls outside their respective zones because that could cause false temperature readings. Mount the thermostats on interior walls and bulkheads, away from windows and heater vents.



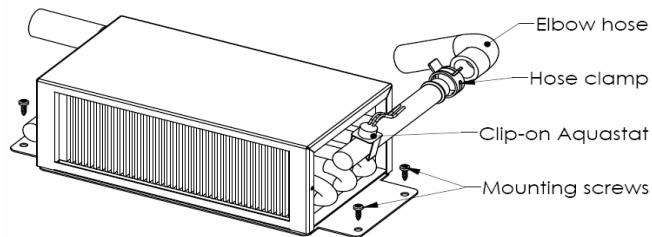
## 5.5 Procedure

After choosing the appropriate mounting locations and configurations:

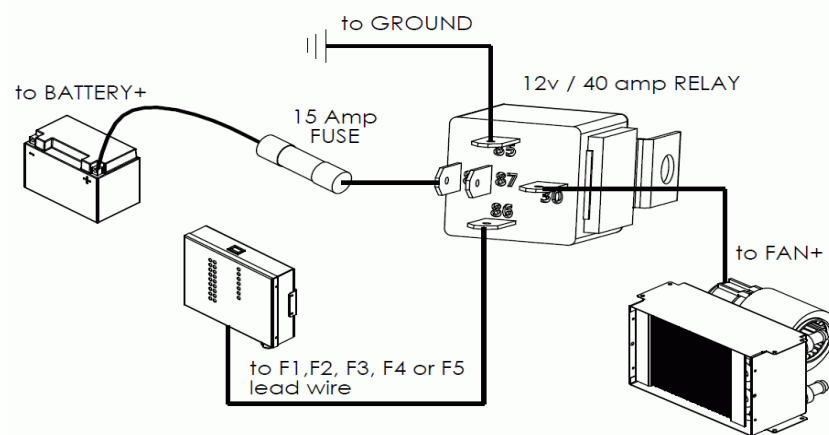
- 1 Mount the fans using #10 sheet metal screws or wood screws.
- 2 If you are using ducting and a dual air outlet plate for any fan, limit the total length of duct for both outlets to 36" for optimum air output.
- 3 Select appropriate mounting locations for the thermostats, as well as any fan speed switches. You will wire these up to the control board in Section 6, *Wiring the Electrical System*.

## Section 5, Installing Fan Heaters

- 4 The electrical system allows for the cabin fan associated with connection lead 1 to be a maximum of 10 amps. All other cabin fan lead connections (2 – 5) have an individual limit of 5 amps. In total, there is an allowed cumulative draw of 18 amps. If an individual cabin fan draw is larger than the 5 or 10 amp limit, you must install a separate relay to power the fan. This relay will use the existing fan circuit as a signal and must be wired to a secondary power source (not the heater's control board). See Figure 5-3.
- 5 To install plumbing lines to the fans, see Section 7, *Plumbing the System*.



**Figure 5-2: Mounting a Spacesaver Fan**



**Figure 5-3: Installing a Relay for Additional Fan Amperage**



# Wiring the Electrical System



## 6.1 Before You Begin

The heater and its electrical Control Board are pre-wired and have been thoroughly tested together as a unit.

To review the wiring system for the entire heating system, refer to the wiring diagram at the end of this section, *Figure 6-1: System Wiring*.

### ! WARNING

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All electrical connections and wiring must comply with normally-accepted 12 VDC and 120 VAC wiring practices, local regulations, and ABYC standards. Only a qualified electrical installer should complete the wiring.

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## 6.2 12 VDC

The following apply to the 12 VDC connections for the heater:

- There is one paired set of 12 VDC electrical connections on the top right of the heater. They consist of the primary DC positive (red) and negative (black) connection and are 14 gauge stranded copper wires.

### ! WARNING

---

Primary DC power should originate from a dedicated connection on the house battery bank. A 20 amp fuse or breaker must be included close to and inline from the battery to the positive (red) connection on the heater. The primary power wire gauge must be sized to permit no more than a 3% voltage drop from the battery to the heater.

---

- A properly-shielded power system is required for safe, trouble-free operation.

### 6.3 120/240 VAC (Optional)

- The heater is equipped with one 1500 watt, 120 VAC (North American) or optional, 240 VAC immersion element. The connections for the electrical supply are on the top left side of the heater, under a cover, labeled AC power.
- The power wires for the AC immersion element are three 14 gauge stranded copper leads that use standard AC color code (black-hot, white-neutral, green-ground). These are to be connected using standard 120 VAC electrical connectors and terminals.
- These power wires must be connected to a separate AC circuit breaker. Once the connections are completed (using standard 120/240 VAC electrical connectors and terminals), the wires are to be inserted back into their compartment and the cover secured.

#### NOTICE

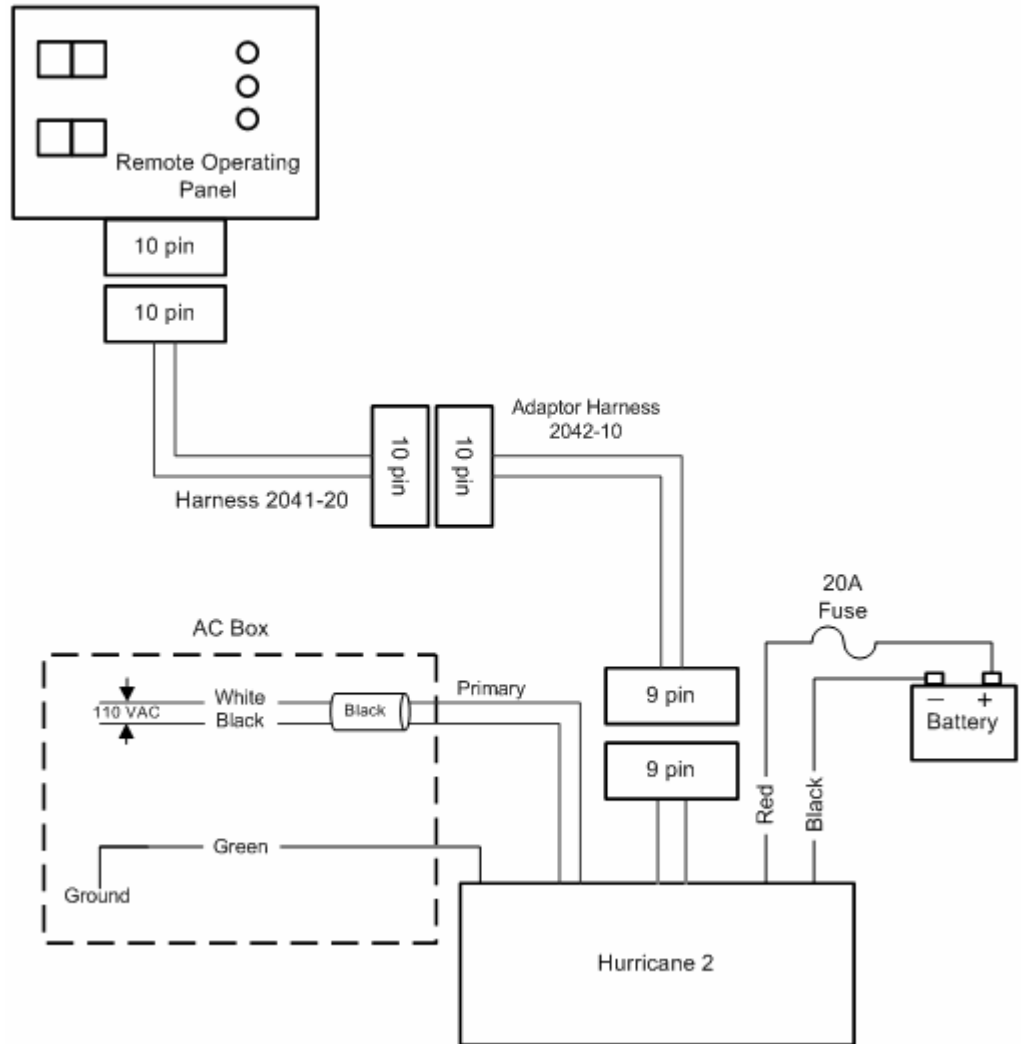
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Do not operate the electric immersion element until coolant is added to the heater and all trapped air has been removed.

---

### 6.4 Remote Operating Panel Cable

- One connection on top of the heater is a multi-wire, sheathed cable with a 9 pin connector. This connects to a matching connector on a short adapter cable. The other side of the cable has a 10 pin connector that connects to a 50' remote cord. This remote cord then plugs directly into the Remote Operating Panel. Refer to *Figure 6-1: System Wiring*.



**Figure 6-1 System wiring**

## 6.5 Main Electronic Control Board

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The main electronic Control Board is mounted onboard the heater itself. It has no user adjustable components.

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## 6.6 Zone Control Board

### Functions of Multi-Pin Connectors

**NOTICE**

The Zone Control Board has four, multi-pin connectors, see *Figure 6-2: Plumbing for Five Zones Using the Zone Control Board*, that are to be connected through connector cords (supplied) to the matching multi-pin connectors as follows:

- 10 pin connector to Heater Remote Operating Panel.
- 8 pin connector to Heater (connector cord transitions to a 9 pin connector for the Heater).
- 12 pin connector: *Option 1*: used without optional Distribution Module; connector cord with connections for transitions to engine preheat pump, summer pump, loop 2 pump, loop 1 pump, and domestic water temperature sensor (figure 6-2). *Option 2*: used with optional Distribution Module; 12 pin connector to connect to Distribution Module (figure 14-9).
- 14 pin connector to thermostat trailing leads and cabin fan trailing leads.

### **Cabin Fan trailing leads**

- The positive (red) lead from each cabin fan is to be attached to one of the trailing cabin fan leads, color coded for zones, from the thermostat and cabin fan connector plug.
- The negative lead from each cabin fan is to be attached to a ground terminal (not provided) that is connected to a battery ground.
- The cabin fan 1 leads (orange) can supply up to a maximum of 10 Amps. The other cabin fan leads, 2-5, can supply up to a maximum of 5 Amps each. The total current draw for all 5 cabin fan leads is not to exceed 18 Amps.
- If the system requires higher amperage draws, install a separate relay to power the fans. This relay will use the existing fan circuit as a signal and must be wired to a secondary power source (not the heater's control board). See Figure 5-3.

### **Thermostat Leads**

- The power lead to the thermostat is to be attached to a power terminal (not provided) that is connected to the battery.

- The return lead from each thermostat is to be attached to one of the trailing thermostat leads, color coded for zones, from the thermostat and cabin fan connector plug.

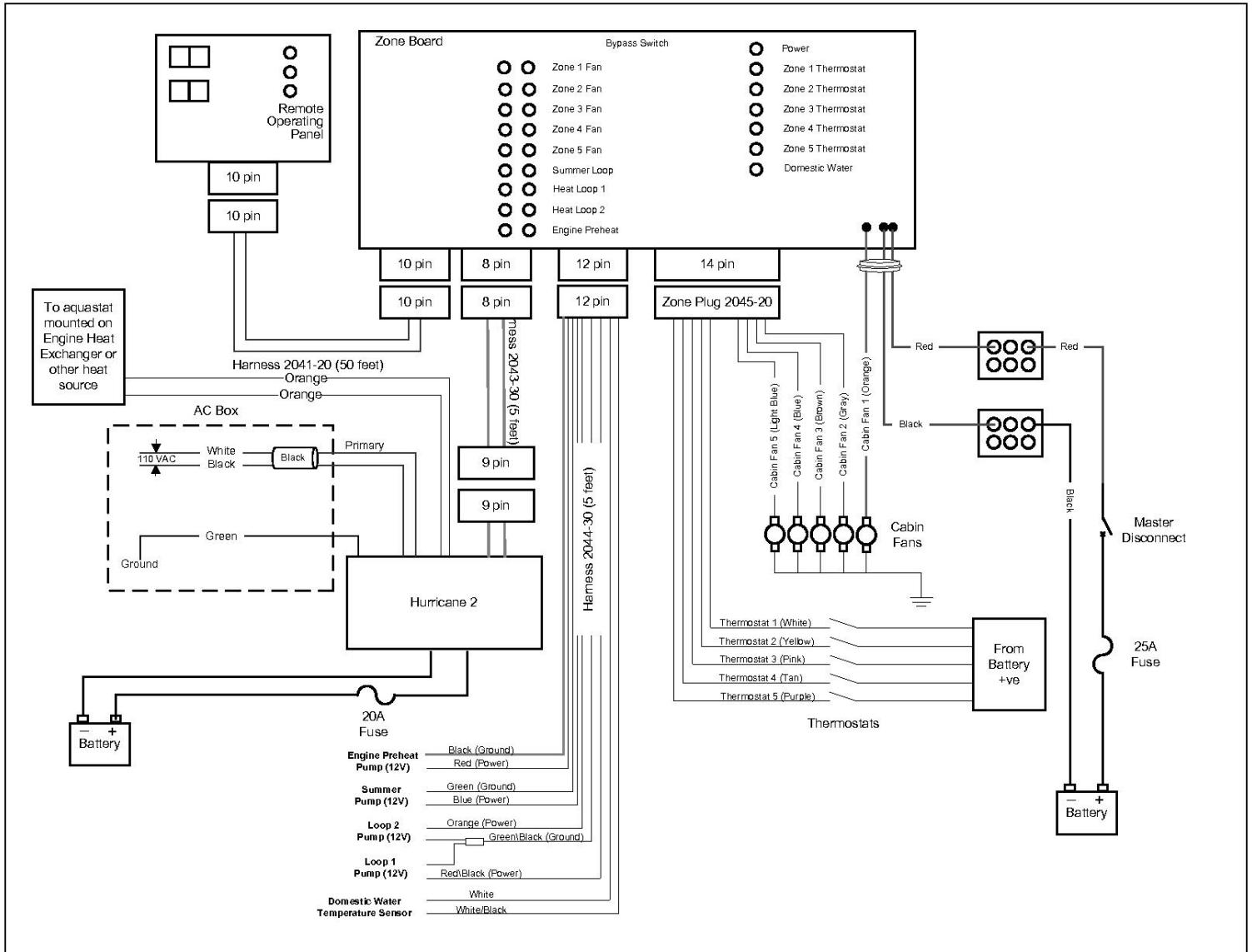


Figure 6-2: Wiring for five zones using the Zone Control Board

## 6.7 Electrical Components

- **Control box and board** – The main control board contains no serviceable components and is mounted on the front inside panel of the heater.
- **Thermal Cutoff** - The heater burner box contains a non-resettable thermal cutoff that will provide protection against an overheat condition within the burner box. If activated, the thermal cutoff is designed to stop the fuel flow to the burner nozzle.
- **Zone Control Board** – The following components need to be wired into the Zone control board:
  - Thermostats (up to five). Additional zone board available for larger applications.
  - Cabin fans
  - Cabin fan speed switches (if any)
  - Circulation Pump
  - Domestic water aquastat
- **NOTE:** if wiring a single loop system, ensure the jumper marked "series loop" on the zone board is bridged. This will allow zones one through five to activate both loop one and loop two pumps. Otherwise zones 1,2, and 3 will activate the loop one pump and zones 4 and 5 will activate the loop two pump.
- **Diagnostic display** – This is a set of LED indicators located on the front panel of the heater. It indicates the diagnostics of the heater. See chapter 10, functions of the heater control panel.
- **Circulating pump activation switch** – This OFF/ON switch located on the top of the Zone Control Board box allows you to run the circulating pump and test the system circulation without turning the heater on.
- **Hour meter** – Located on the top of the heater unit, the hour meter counts the accumulated operating hours for the heater.

- **Fan Speed switch** – Wired to the yacht’s wiring system and installed between the Zone Control board training lead and the positive DC fan connection using #16 wire. See figure 6-3, Wiring for a fan speed switch.



## 6.8 What NOT to Do

**NOTICE**

**Never** shut off the heater power via an inline battery or master switch while the system is running. Never disconnect the battery when the heater is running, and never disconnect the battery while the inverter is charging.

Doing either will severely damage the heater because it fails to automatically purge the combustion chamber. Such damage is detectable upon inspection and will *not* be covered under warranty. Always shut the system off using the normal system controls, after it has completed its purge.

When running in bypass mode, never leave the heater unattended.



## 6.9 Procedure

Consult the following table for required wire gauges and lengths. Consult Figures 6-2 to view how various components are connected.

CONDUCTOR SIZES (GAUGE) FOR 3% DROP IN VOLTAGE

Length of Conductor from Source of Current to Device and Back in Feet

	<u>10</u>	<u>15</u>	<u>20</u>	<u>25</u>	<u>30</u>	<u>40</u>	<u>50</u>	<u>60</u>	<u>70</u>	<u>80</u>	<u>90</u>	<u>100</u>	
<u>AMPS</u>													
<b>5</b>	-	18	16	14	12	12	10	10	10	8	8	8	6
<b>10</b>	-	14	12	10	10	10	8	6	6	6	6	4	4
<b>15</b>	-	12	10	10	8	8	6	6	6	4	4	2	2
<b>20</b>	-	10	10	8	6	6	6	4	4	2	2	2	2

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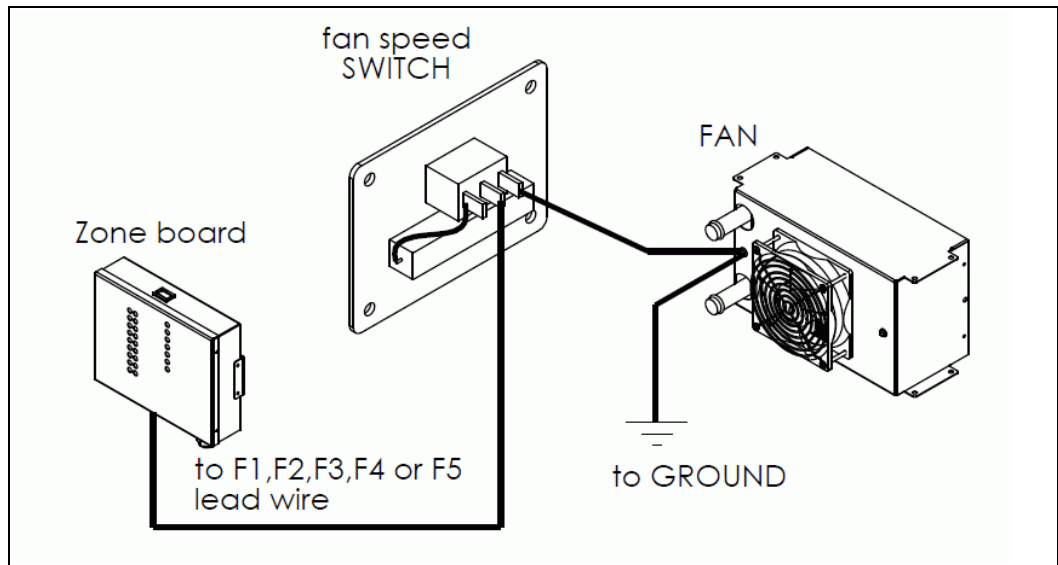
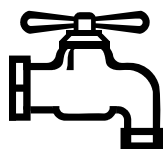


Figure 6-3: Wiring for a Fan Speed Switch

# Plumbing the Space Heating System



## 7.1 Before You Begin

For an efficient heating system, you must:

- Achieve an optimum of **1 GPM per 10,000 BTU/h**
- Minimize heat loss from the heater hoses
- Eliminate air from the system

If you use more than the maximum number of cabin 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 downstream. A supply and return manifold each with 2 or 3 series loops should be used to more evenly distribute heat in larger systems with more than 5 or 6 cabin fans. In addition, the heater can support one or two independently operating space heating loops with assorted cabin fans on each loop. See Figure 7-2 and Figure 7-3 for different configurations.

Alternatively, the Distribution module (optional) can ease the installation and plumbing work required by utilizing the built in circulation pumps and heat exchangers of the module itself. The two built in standard space heating loops can independently run two cabin fans and thermostats, and three cabin fans and thermostats respectively. The built in summer pump can See Section 13, Installing the Distribution Module (optional).

## 7.2 Plumbing Components

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



A flow rate of 1 G.P.M. (gallon per minute) for every 10,000 Btu/h of heater capacity is recommended which will provide approximately 20°F 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 the 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 (psi.) 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 (psi.) is the resistance. Using the head in feet and the flow in G.P.M., the manufacturer's flow charts will allow you to pick the right pump.

Ensure the pump is at a lower point than your **HURRICANE @II** heater. Refer to Chapter 6, Wiring the electrical system, for details on hooking the pumps.

**Expansion tank** — The expansion tank **must** be in the system as it allows the circulating fluid to expand in conjunction with the overflow tank. Mount either the horizontal or vertical expansion tank at the highest point of the system and pipe to the inlet of the circulation pump. Use a 7 Lbs pressure radiator cap maximum.

**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.**

**Overflow tank** — allows you to monitor fluid levels and fill the system with fluid. An approved overflow tank (available from ITR, pictured at left) must be heavy-duty plastic. You must be able to mount it firmly to a vertical surface.

**TIP →**

Reduce heat loss as much as possible by insulating the hose where it may be exposed to outside air. However, when you run hose through closets, cupboards, and storage lockers, a little heat loss is desirable to reduce moisture in these areas.



**Heater hose** — use heavy-duty heater hose or PEX tubing. Slip-on foam insulation coverings may be used over the hose fittings to reduce heat loss. Secure all hose connections with spring clamps.

Note: If long hose runs or other restrictions reduce the fluid flow to less than the recommended flow, installing a second circulating pump is recommended.

**Air bleeder vents** — Air vents should be installed at strategic points along the water system's piping where air might accumulate. An inline bleed assembly (part # 2266), is available for placement anywhere you may be required to bleed air from the system.

**Shut-off valves** — Inline shutoff ball valves should be installed on either side of an item to isolate it so that it can be serviced or replaced without draining the system. 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 flow through each loop.



**NOTICE**

### 7.3 What NOT to Do

The heating system's circulating water pump is the most critical part of the heating system. **Never** let the pump run dry or you will damage the impeller. This is not covered under warranty.

**Don't** use low-quality heater hose.

**Don't** let the hose come into contact with solvents, which may cause it to soften and swell. If there is any risk that solvents may contact the hose, insert it into PVC plastic tubing for protection.



### 7.4 Installation Procedure

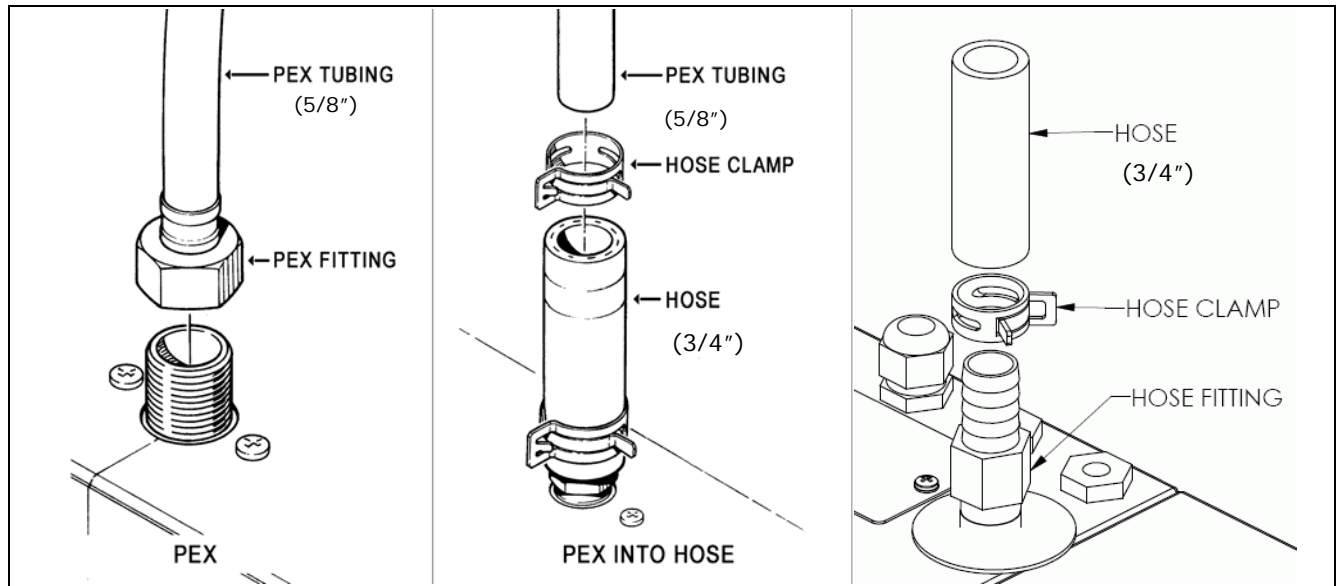
To install and connect the plumbing components and heater hose (see Figures 1-2, 7-2, and 7-3 for typical plumbing diagrams):

- 1 Mount the overflow tank adjacent to the expansion tank at about the same level, in a location that allows fluid to be added to it easily.
- 2 Connect the overflow tank to the expansion tank inlet fitting using a clear plastic 3/8" hose (supplied with the ITR overflow tank). Secure both connections with a clamp.
- 3 Lay out the heater hose horizontally through the yacht, linking each fan in a series loop or manifold layout. Keep high points to a minimum.
- 4 Ensure there are no kinks or sharp bends that might restrict the fluid flow. If bends are required for PEX tubing, fit the tubing into a plastic bend support (available for 1/2", 5/8", and 3/4" tubing). Heavy duty heater hose does not require bend supports, but they are available if required.
- 5 At the heater, carefully connect the heater hose for the heater's plumbing system to the threaded inlet and outlet tubes on the heater, using appropriate fittings. See Figure 7-1. **Ensure that all fittings are leak free and airtight.**
- 6 At each fan, connect the other end of the hose or tubing to the inlet and outlet tubes. **Ensure that all fittings are leak free and airtight.**

**NOTICE**

**If you use too much force when connecting the heater hose to the fans, the ends may break and leak—this is not covered by warranty. To avoid breakage, apply a soapy lubricant to the air fan hose connections before attaching the hose.**

Section 7, Plumbing the System



**Figure 7-1: Three Approved Methods of Installing Heater Hose (consult ITR for alternative methods and products)**

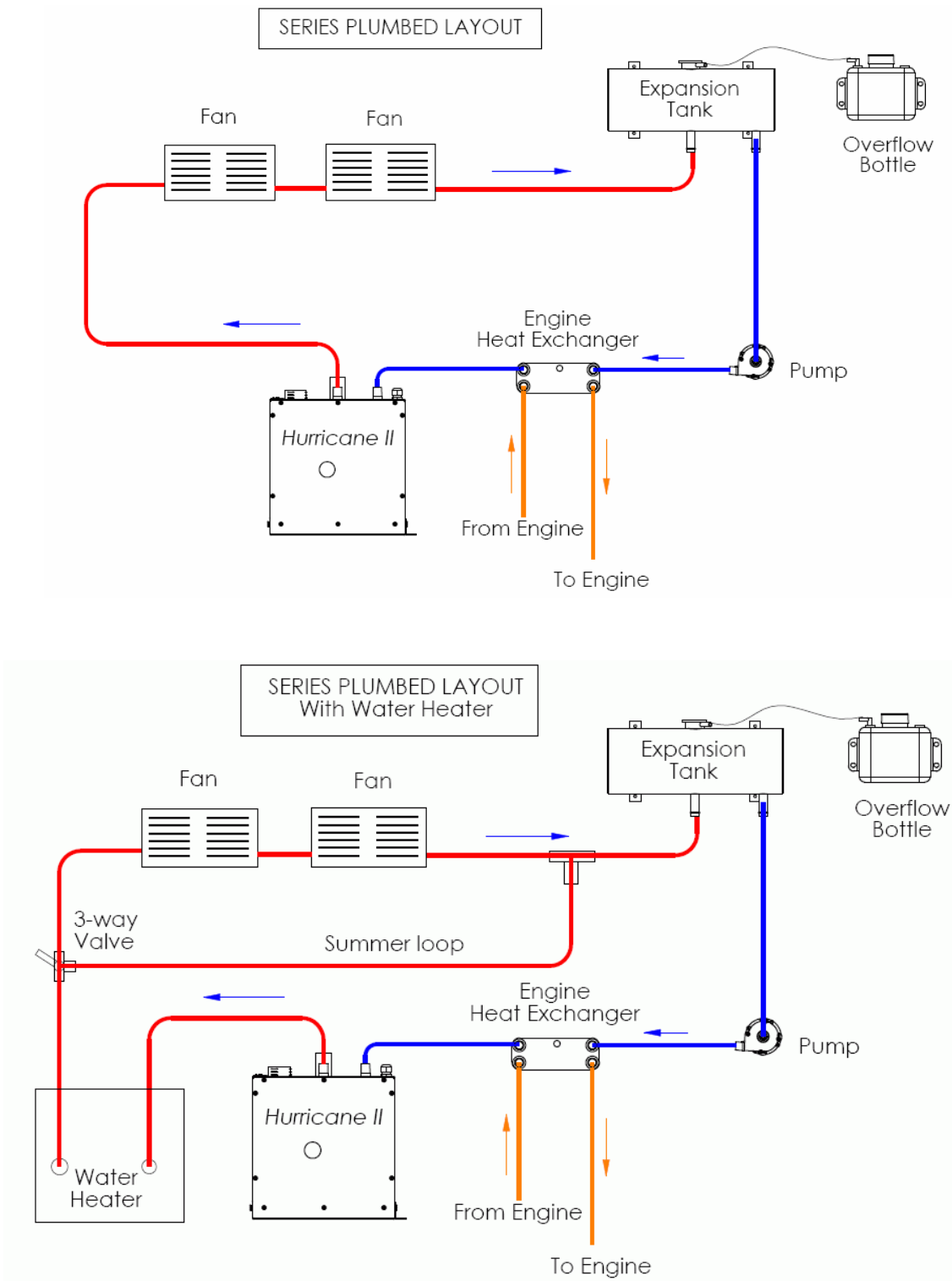


Figure 7-2: Generic Series Plumbed Systems without and with Water Heater

Section 7, Plumbing the System

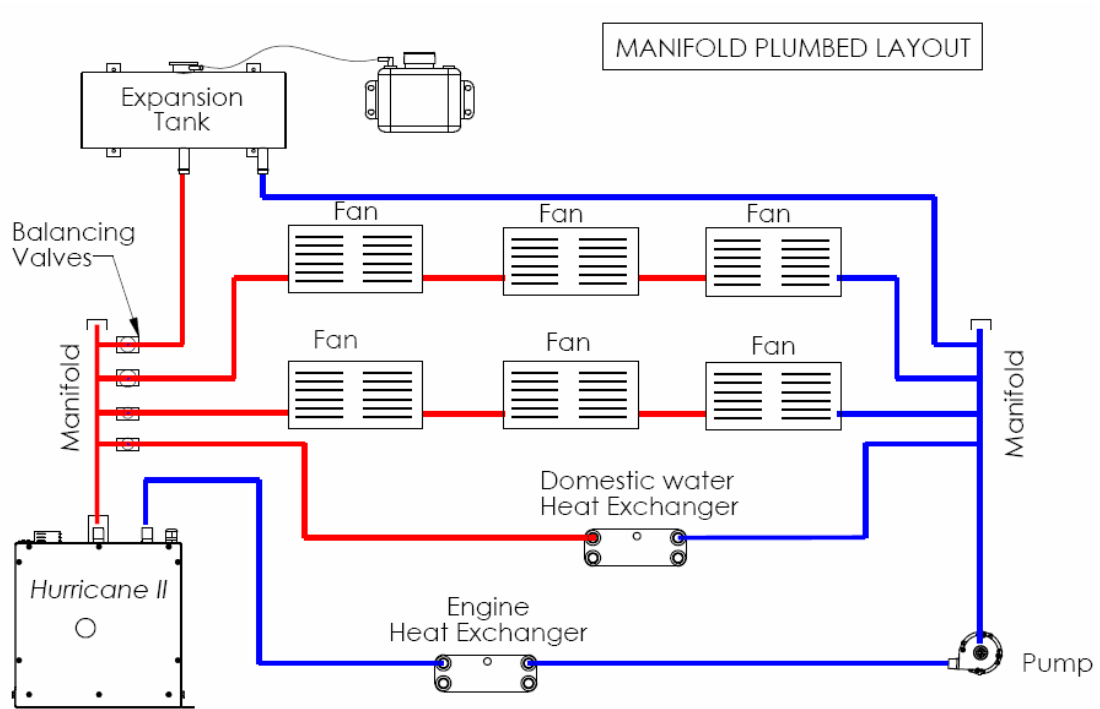


Figure 7-3: Generic Manifold Plumbed System.



# Filling and Testing the Circulation System

**TIP →**

If you fill the system with a 50/50 mix of antifreeze and water, this may save you from having to drain and refill the system.

However, if you are unsure of the installation, it's better to fill and test the system with water first.

## 8.1 Before You Begin

After the heating system has been installed, you are ready to fill the system with fluid for purging and testing purposes.

There are two recommended ways you can fill the heating system with fluid and purge it of air at the same time:

- Heater hose method
- Manifold method

These methods are described below. They are very similar, but the manifold method provides a permanent, built-in mechanism for filling and purging. For both methods, you will need a **separate self-priming pump**.

Alternatively, the Distribution module (optional) can perform this function with its built in manifold and pumps.

After the first 50 hours of operation, the yacht movement may cause more air bubbles to be dislodged. Monitor fluid levels carefully and add fluid if necessary. Check all clamps and connections for leaks and retighten if necessary.



## 8.2 What NOT To Do

**Don't** forget to turn OFF the circulation pump activation switch (see figure 10-4) on the Zone Control Board box after filling and purging. Otherwise, the pump will run continuously.

**NOTICE**

**Do not** attempt to purge the system without installing an expansion tank in the system. Do not bypass the expansion

tank when purging the system. Failure to install the expansion tank or bypassing the expansion tank prior to purging the system will result in permanently damaging the heater

---

Although the system can operate on any standard automotive antifreeze, for safety reasons ITR strongly recommends that you use non-toxic antifreeze.

---

**NOTICE**

**Never** let the system run dry during filling and purging. Also, never operate the pump without any fluid in the system.

After purging, continue purging until you hear no bubbling or pump noise to ensure that all air has been removed from the system. Leaving air in the system can overheat and damage the unit if not fixed—such damage is not covered under warranty. Purge the system again to correct the problem. After 10 hours of system operation, check fluid levels.

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**! DANGER**

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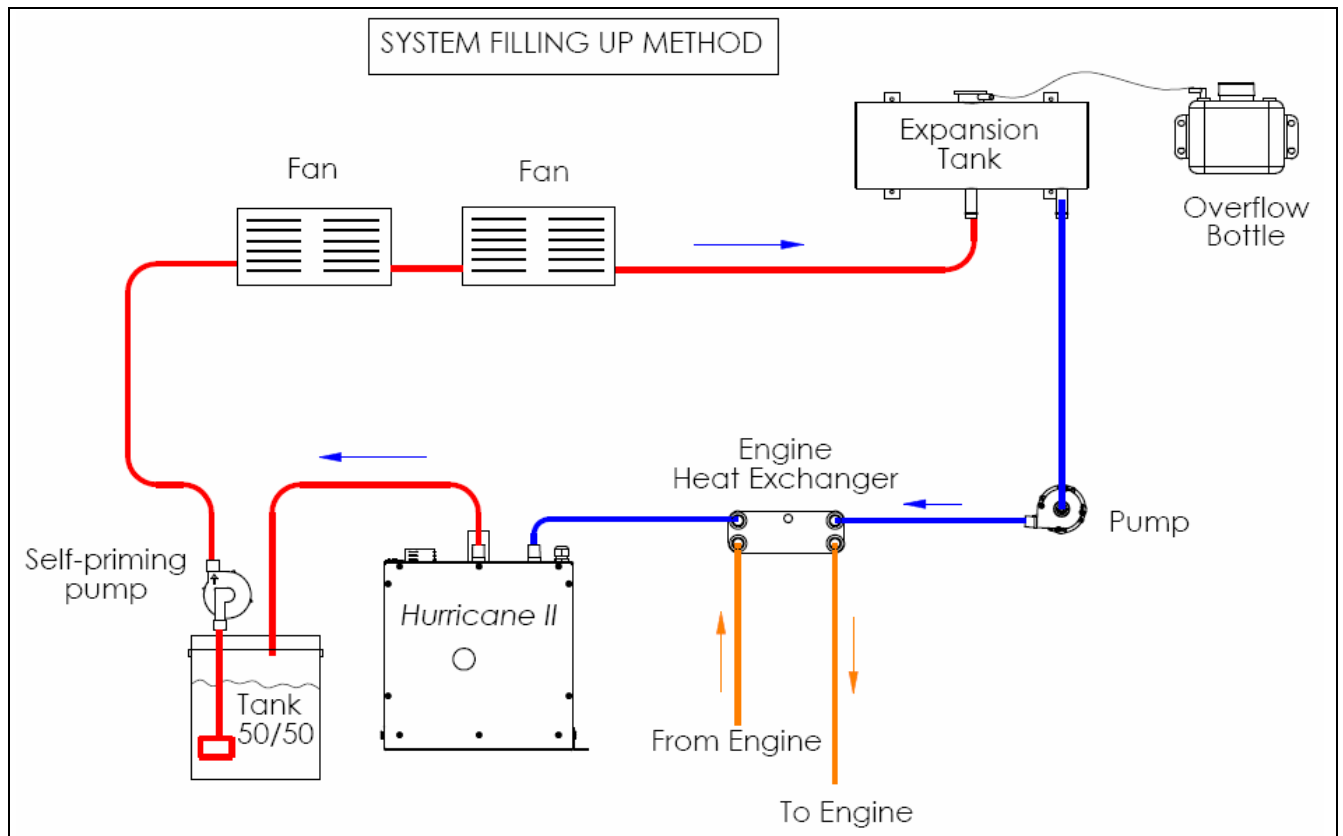
**Never** remove the cap on the expansion tank when the system is hot and running. Scalding hot water may be forcefully expelled.

---

### 8.3 Procedure for Diaphragm Pump Filling Method



To fill, purge, and test the heater's circulation system using the diaphragm pump filling method, use the following diagram (Figure 8-1) and procedure. Do not use this method if you have installed PEX tubing at the heater connections—use the more reliable manifold method instead (see Procedure 8.4).



**Figure 8-1: Filling System with Fluid Using “Diaphragm Pump Filling Method”**

- 1 Disconnect one of the heater hoses. Preferably the outlet.
- 2 Connect this hose to the outlet of a self-priming pump (for example a diaphragm pump) and use a spare hose to go from the inlet of the pump into a 5-gallon tank of straight water or 50/50 mix (antifreeze and water) equipped with a mesh screen to capture any debris.
- 3 Use another spare hose to go from the heater into the tank. Secure to heater with hose clamps
- 4 Check to ensure any air vents and drains are sealed. Also check if the radiator cap on top of the expansion tank is on tight.
- 5 Start the self priming pump.
- 6 As the fluid is pumped out of the 50/50 tank, make sure that the supply pump never sucks air.

## Section 8, Filling and Testing the Circulation System

- 7 Slowly add more fluid to the tank until all air has been expelled and the mixture starts coming out of the return hose in the 50/50 tank. (Keep the fluid level in the tank above the inlet of the suction hose.) This will flush the system of any debris and purge the lines of air.
- 8 Monitor the heating system during filling and purging to ensure:
  - all fittings remain secure
  - no leaks in any connections or hosing
  - good flow through the expansion tank
  - No pressure build up in excess of 7 PSI.
- 9 If you discover any leaks, temporarily stop the filling procedure to repair the leak.
- 10 Continue running the self-priming pump for about 10 minutes *after* it has purged all air from the system, and continue monitoring for leaks.
- 11 If you filled the system with straight water, drain it and refill it with a 50/50 mix of antifreeze and water.
- 12 Stop the pump, pinch off the hose at the pump outlet and the other spare hose running into the tank.
- 13 Remove the spare hose from the heater and reconnect the original heater hose.
- 14 Check and fill the overflow tank with fluid to the correct level if necessary.
- 15 Activate the circulating pump by turning on zone board's pump override switch and purge the system of any air.
- 16 Verify the flow rate with an inline flow meter if present.
- 17 Check that the circulating pump runs quietly and smoothly. If there is still bubbling or cavitation present, continue purging the system.
- 18 Double check the entire plumbing system for leaks. Open and close air vents (if present) to eliminate remaining air bubbles.
- 19 Recheck the fluid level and circulation in the expansion tank. Top up as necessary.

- 20 On the control board, remove the pump jumper. This returns the pump to normal operation.
- 21 The heater can now be started up.



## 8.4 Procedure for Manifold Method

This method involves permanently installing a priming manifold inline with the circulation loop, allowing the system to be purged and tested in the future (if desired). A priming manifold is available from ITR, part # 10173.

Use this method if you have installed PEX tubing for the heating system.

To fill, purge, and test the heater's circulation system using the manifold method, use this diagram and the following procedure:

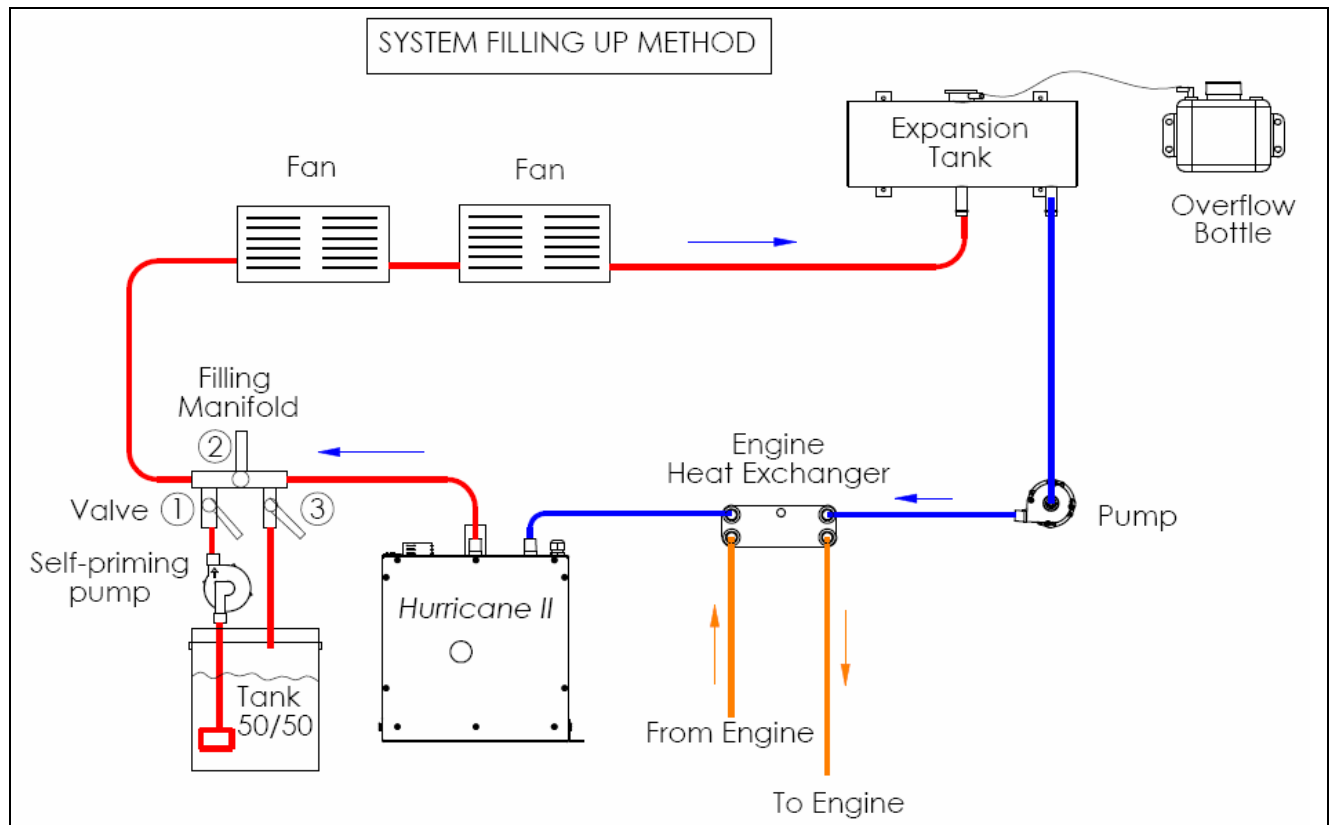


Figure 8-2: Filling System with Fluid Using "Manifold Method"

## Section 8, Filling and Testing the Circulation System

- 1** Put the pressure pump's suction hose into a 5-gallon tank of straight water or 50/50 mix (antifreeze and water), equipped with a mesh screen to capture any debris.
- 2** Attach the outlet of the self-priming pump to the manifold inlet and a spare hose from the tank to the manifold outlet. (see figure 8-2)
- 3** Close the middle valve (2) and open both in-outlet valves(1 & 3). This forces the fluid to circulate through the 50/50 tank
- 4** Check to ensure any air vents and drains are sealed.
- 5** Start the pressure pump.
- 6** As the fluid is pumped out of the 50/50 tank, make sure that the supply pump never sucks air.
- 7** Slowly add more fluid to the tank until all air has been expelled and the mixture starts coming out of the return hose in the 50/50 tank. (Keep the fluid level in the tank above the inlet of the suction hose.) This will flush the system of any debris and purge the lines of air.
- 8** Monitor the heating system during filling and purging to ensure:
  - all fittings remain secure
  - no leaks in any connections or hosing
  - good flow through the expansion tank
  - No pressure build up in excess of 7 PSI
- 9** If you discover any leaks, temporarily stop the filling procedure to repair the leak.
- 10** Continue running the pressure pump for about 10 minutes *after* it has purged all air from the system, and continue monitoring for leaks.
- 11** If you filled the system with straight water, drain it and refill it with a 50/50 mix of antifreeze and water.
- 12** Stop the pressure pump.
- 13** On the manifold, close valves 1 and 3 and open valve 2 to allow normal system operation.

## Section 8, Filling and Testing the Circulation System

- 14 Fill the overflow tank with fluid to the correct level.
- 15 Turn on the heater's circulating pump by switching ON the circulation pump activation switch on the Zone Control Board box.
- 16 Check that the circulating pump runs quietly and smoothly. If there is still bubbling or cavitation present, re-purge the system.
- 17 Verify the flow rate with an inline flow meter (see Figure 8-3 and Section 7-2).
- 18 Double check the entire plumbing system for leaks. Open and close any air vents to eliminate remaining air bubbles.
- 19 Recheck the fluid level and circulation in the expansion tank.
- 20 Turn OFF the circulation pump activation switch on the Zone Control Board box.

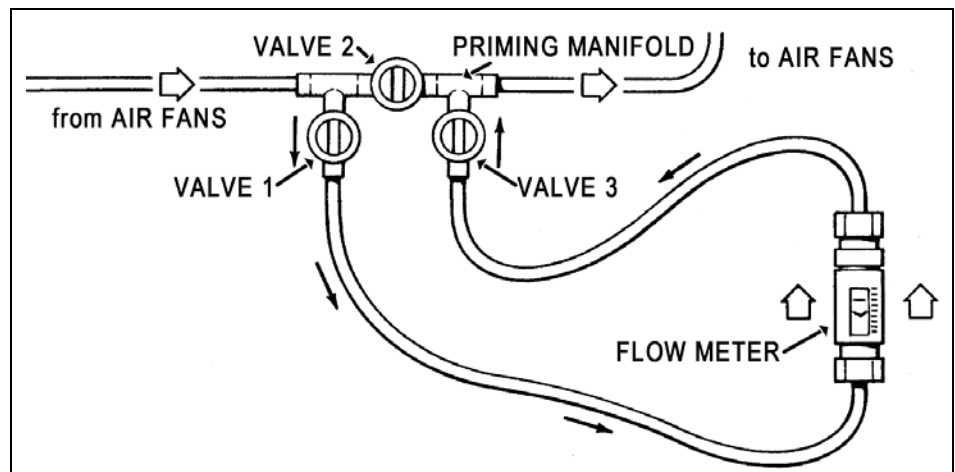


Figure 8-3: Flow Meter Inline with Circulation Loop

## 8.5 Procedure for Distribution Module (optional)

See Chapter 14, Installing the Distribution Module

## 8.6 Verifying the Flow Rate

After filling, you must verify the flow rate using an inline flow meter. The purpose is to ensure the installation has been done correctly and the heater will operate effectively. If you do not have a flow meter, measure the temperature of the input and output hoses of the heater they should be under 20°F difference.

In a series-plumbed system, water flows through a single heating loop that consists of all the heater's elements—the pipe, fittings, burner, fans, etc. The entire system should have a flow of no less than 2 GPM. A flow slower than 2 GPM may be an indication of excessive resistance in the circulation system. Larger systems with more than five air fans should use a manifold to provide evenly distributed heat.

# Domestic Hot Water Heating



## 9.1 Before You Begin

The Hurricane®II heating system can be used to heat your domestic water in two ways. Using the Hurricane system is particularly useful when there is no current available to heat the domestic water using the electric element in your water heater and you do not wish to run a generator. The first way is by using the Hurricane diesel burner itself to create heat and the other way is by circulating engine waste heat. This hot fluid in the heating system will flow through the coil inside your existing water heater and transfer its heat to your domestic water supply.

You can also use a plate heat exchanger if your water heater does not have an internal coil for on demand hot water. You may want to add a plate heat exchanger even if your water heater has a coil for quicker recovery and continuous hot water output as the stainless steel plate heat exchangers are much more efficient than the coils in a standard water heater. Alternatively, the Distribution Module (optional) can perform this function and no separate water heater is needed.

Waste heat is transferred from the engine to the domestic water supply via a second heat exchanger. The domestic water loop should be on the outlet of the heater so it has priority over space heating and the engine loop should be the final loop just before returning to the Hurricane at the coldest point. See Figure 9-1.

## 9.2 Domestic Hot Water System

The components needed for installation and operation of the domestic hot water system include:

A heat exchanger can be added to provide continuous hot water after the stored hot water in the water tank has been depleted. The burner switch must be on in order to supply any hot water.

**Heat exchanger** — The stainless steel flat plate heat exchanger is UL and CSA approved for domestic water heating. It can be installed for quick recovery and continuous hot water output after the hot water storage has been depleted.

**Aquastat** — An adjustable aquastat (part #1024) or fixed aquastat (part #1030) should be installed. This signals the burner to supply hot water particularly in the summer when space heating is unnecessary. Wire this aquastat to the trailing terminal leads from the 12 pin connector on the Zone Control Board, See figure 6-2. This aquastat also controls the operation of the system's circulation pump that will provide the systems hot fluid to circulate through the water heater coil and/or heat exchanger.



**Mixing valve** — For temperature control and to prevent scalding since the domestic water could reach 170°F (77°C), a three-way adjustable valve (part#22014) should be installed. The valve is pre-set at 120°F (49°C) for the domestic hot water temperature, but it can be reset from 100° to 145°F (38° to 63°C). Once the temperature is set, the valve works automatically.

**Domestic water sensing switch** — If desired, you may install a manual switch to turn the domestic hot water sensing circuit on and off. This switch should be connected in series to the aquastat connected to the trailing terminal leads from the 12 pin connector on the Zone Control Board. See Figure 6-2.

**Summer/winter loop** — During the summer months, when you need hot domestic water but don't need space heating, simply install a three way valve or electric solenoid to short loop the water through the heat exchanger only and not through the heating system. See Fig. 9-1. The selector valve should be mounted so it is easy to reach.

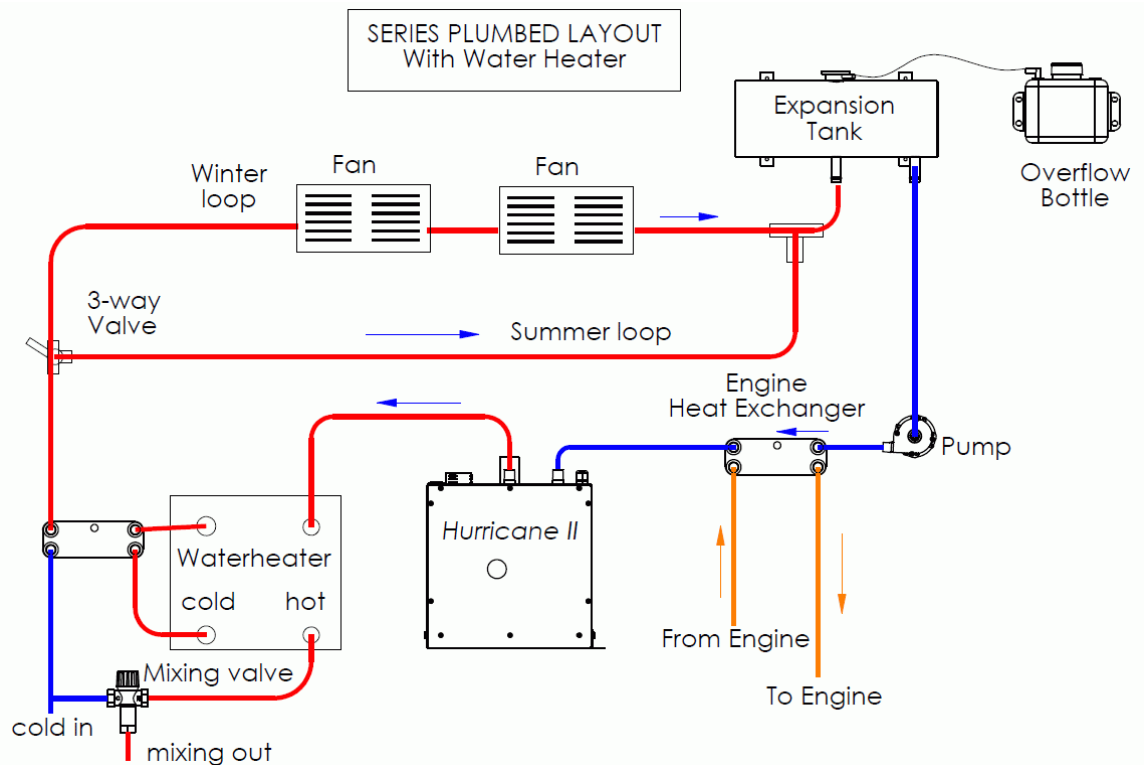


Figure 9-1: Generic Series Plumbed Hurricane®II Hydronic System and Components

Heat exchangers can be installed for engine waste heat, and preheat functions. You will need one heat exchanger per engine.

### 9.3 Using engine waste heat to supplement the Hurricane®II

Besides space and domestic water heating, your HURRICANE®II heater can be used to both preheat 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 heat, to heat your boat by adding an inline heat exchanger (or two if two engines) to your heating system as shown in Fig. 9-1. If any thermostat or if the domestic water aquastat is calling for heat the waste engine heat will be distributed to help heat the domestic water as well as the entire boat. The heat exchanger will also preheat your engine by transferring heat to it, from the *HURRICANE*®II heater.

**NOTE:** Coming out of the top electrical strain relief are two orange wires which will allow you to connect to an engine heat aquastat. This will allow the circulation pump to operate and distribute engine waste heat without having to turn the

burner or the electric element ON. The pump will run when there is adequate heat to activate the engine heat aquastat and there is a call for heat.

## NOTICE

**PRECAUTION:** Where there is a chance of contamination of your domestic water when using a heating system, use antifreeze specifically intended for hydronic heating systems. Inhibited propylene glycol is recommended. Do not use automotive, ethylene glycol, or any undiluted or petroleum based antifreeze as they can cause severe personal injury should antifreeze leak into your potable water supply. Double wall heat exchangers are available for potable water which will prevent contamination in the event of an internal leak.

It is not recommended to mix your engine cooling system with your heating system. A heat exchanger should be used. Before connecting anything to your engine, consult your engine owner's manual for any restrictions or plumbing into the engine cooling system.

### 9.4 Engine Pre-Heat Function

As an option, the heat exchanger can also be used to pre-heat an engine before starting it. Turn on the heater by a manual switch or timer wired to one of the thermostat leads. If the heat exchanger is mounted upright, close to and near the bottom of the engine, it will transfer heat to the engine's cooling system through gravity circulation. A more positive solution is to install a pump on the engine side of the heat exchanger wired to an external power supply in series with a master switch.

Pre-heating the engine makes it easier to start and it can be put under load immediately. If installed, the optional engine pre-heat function is enabled by flipping a manual switch mounted inside the living area (not supplied), while the engine is **off**. This turns on the secondary engine pre-heat pump. The manual switch and preheat engine circulation pump are to be wired to the yacht's DC power supply. To test the engine pre-heat function, turn on the heater and allow it to come to temperature (about 10 minutes). Turn on the manual switch to start the engine pre-heat pump. Start the yacht engine, which should now be pre-heated to about 40°F (5°C) above ambient temperature.

# Operating the Hurricane® II Heater

This section describes the features, operation and maintenance of your new **Hurricane®II** Heater. READ THESE INSTRUCTIONS AND SAVE FOR REFERENCE.

## 10.1 Features of Your Hurricane®II Heater

The heater uses a diesel burner (12 VDC) controlled by a multi-functional electronic controller as the primary source of heating coolant fluid (anti-freeze and water). A 1500 Watt, 120 VAC immersion element is used as a secondary heat source. The heater heats the coolant fluid to provide a source of heat for all hydronic space heating needs. When used with the Distribution Module (optional) and its integral distribution pumps, the heater has the ability to circulate the coolant fluid to all space heating areas. It can also provide a supply of domestic hot water using the integral heat exchanger in the Distribution Module (optional).

Other features of the Heater include:

- A high-temperature, stainless steel burner and stainless steel jacket.
- 4.8 (H2) or 8.5 (H2L) US gallon welded insulated stainless steel coolant tank that minimizes heat loss and optimizes heat recovery.
- Easy to install, completely modular and field serviceable with Heater hookups and connections easily accessible from the front and top of the heater.
- Quiet operation and low power consumption.
- Low pressure fuel system with built-in fuel pump.

- Fuel efficient burner capable of burning a wide variety of diesel-based fuels.
- Exhaust has minimal smoke and smell.
- Fan assisted sealed combustion is designed to use outside combustion air.
- Simple, low amperage draw ignition.
- Electronically-controlled system with:
  - Automatic safety shutdown.
  - Aquastats for safety overheat protection.
  - LED indicators on the Control Panel for diagnostics.
  - Patented, proprietary Flame Sensor.
- Heater Remote Operating Panel with ON/OFF switches for the diesel burner and AC element.
- Heater Control Panel with buttons for Power, Bypass, Reset, and indicator LED's for operational and diagnostic information;

**Available with the Optional Distribution Module:**

- Three distribution pumps, one heat exchanger for heating multiple zones, engine heat function, and also producing domestic hot water (mixing valve included). Also includes filling valves for easy filling/purging.

## 10.2 Your Heater

### NOTICE

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As the user, you must be fully aware of the controls and operating features particular to your model of the **Hurricane®II** heater. This is essential for the proper functioning and life of your heater as well as protecting your warranty.

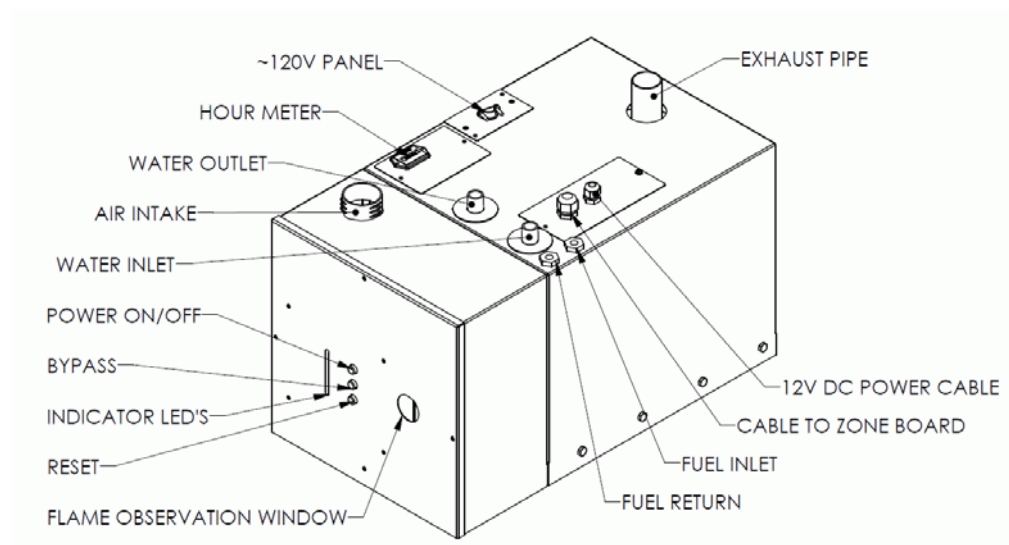
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## 10.3 Operating Instructions for the Heater

### NOTICE

The Heater must be installed and connections made in accordance with the recommendations in the Installation and Operating Manual prior to operation.

- The **Hurricane®II** Heater, *Figure 10-1: Hurricane®II heater*, heats the coolant to a preset temperature and will automatically cycle to maintain the temperature.



**Figure 10-1** Hurricane®II Heater

## 10.4 Turning the Power to the Heater ON

- The Heater's main Control Panel, *Figure 10-2: Heater Main Control Panel*, located on the front of the heater contains three push buttons: ON/OFF power, Bypass, and Reset. The power switch must be pushed ON (power LED will turn ON) to turn the DC electrical power to the main control board and heater ON and is required to be left ON during any period where heat is requested.

- When the heater is shut down for any extended period or the season, it is recommended that the power switch be turned OFF.

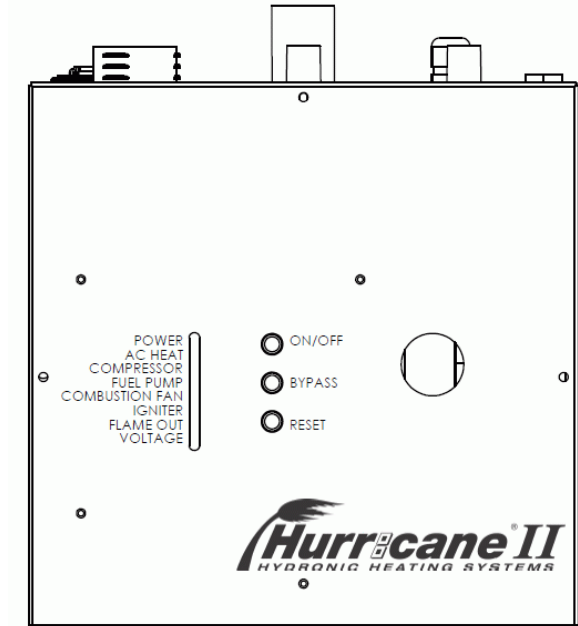


Figure 10-2 Heater Main Control Panel

**NOTICE**

Do not operate the Heater or Distribution Module (optional) until a suitable water/anti-freeze solution is in the modules and all trapped air has been bled or removed.

**! DANGER**

Use only a non-toxic propylene glycol based coolant with additives generally recognized as safe "GRAS" by the FDA in the Heater and Distribution Module (optional).

## 10.5 Activating the Burner (Primary) and AC Heat (Secondary) from the Remote Operating Panel

### Activating the Burner (Primary Heat Source)

- The burner switch on the Remote Operating Panel controls the ON/OFF of the diesel burner (primary heat source). When the burner switch is turned ON, the diesel portion of the Heater will turn ON after ten seconds. The Burner LED will turn ON

when the diesel burner has been activated. The LED stays on regardless if the burner cycles off. The burner will continue to operate until the coolant in the Heater reaches the set operating temperature range. At this point, the diesel burner will turn OFF. If the heater coolant should cool down below this temperature range, the burner will again commence firing and will continue until either the burner switch on the remote panel is turned OFF or the temperature range is again achieved. If the burner switch on the remote panel is turned OFF, the burner stops and the heater enters a two minute cool down stage prior to completely shutting down.

### **Activating the AC Immersion Element (Secondary Heat Source)**

- Place the AC power switch on the Remote Operating Panel to the ON position. The AC Heat (green) LED will turn ON indicating the AC element is energized and the coolant is being electrically heated. It will continue to operate until the coolant in the heater reaches the set operating temperature range. At this point, the element will turn OFF and the LED light on the remote as well. If the heater coolant should cool down below this temperature range, the AC element will again be energized and will continue until either the AC switch on the remote panel is placed in the OFF position or the temperature range is again achieved. If the AC element switch on the remote panel is turned OFF, the AC element is de-energized and the AC Heat (green) LED turns OFF.

### **Activating the Burner and AC immersion Element Jointly**

- Turn the burner switch ON and place the AC power switch on the Remote Operating Panel to the ON position. The Burner and AC Heat (green) LED's will turn ON indicating the diesel burner and AC element have been selected.

## 10.6 Activating the Cabin Fan Heaters through the Thermostats

### **(Burner or AC Heat or Engine Heat Source Available)**

- Any thermostat connected to the Zone Control Board and calling for heat will cause the cabin fan controlled by that thermostat to be enabled. The ITR cabin fans and circulation

pump will operate once the system temperature has reached its normal operating temperature and the thermostat calls for heat.

## 10.7 Activating the Domestic Hot Water

### (Hurricane®II heater only) (Burner or AC Heat On)

- As long as heat is available in the heater, the Zone Control Board will respond to a call for domestic hot water. Ensure that a heat source has been selected (i.e. Burner, AC, Engine). The production of the domestic hot water is **continuous** on the Burner operation and **limited** when using the AC element.

#### NOTICE

### (Hurricane®II heater and Distribution Module used in Tandem) (Burner or AC Heat On)

- As long as heat is available in the heater, the Distribution Module (Optional) will respond to a call for domestic hot water. Ensure that a heat source has been selected (i.e. Burner, AC, Engine). The production of the domestic hot water is **continuous** on the Burner operation and **limited** when using the AC element.

#### NOTICE

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The domestic water pump is not a part of, nor controlled by the Distribution Module (optional) nor the heater.

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## 10.8 Activating Engine Heat

### Engine Heat Used for Domestic Water or Space Heating

- Start the vehicle engine and let it come up to the normal operating temperature. A large amount of waste heat is produced during running and you can use this waste heat to heat your boat by adding inline heat exchanger(s) as shown in figure 10-1. Turn the burner switch on the Remote Operating Panel to the ON position. The heater will come up to the set operating temperature range and will cycle OFF. There are two orange wires on the top of the Hurricane heater and these will let the system know that there is another source of heat and activate the circulation pump. Hooking these up to an aquastat on the engine heat exchanger will circulate this waste from the vehicle engine(if there is a call for heat) and will be transferred from the engine to the

domestic water and space heating loop even if the burner and element switch is turned off. The heat exchanger will also preheat your engine by transferring heat to it, from the **Hurricane® II** heater as it heats the boat.

- **PRECAUTION:** Where there is a chance of contamination of your domestic water when using a heating system, use antifreeze specifically intended for hydronic heating systems. Inhibited propylene glycol is recommended. Do not use automotive, ethylene glycol, or any undiluted or petroleum based antifreeze as they can cause severe personal injury should antifreeze leak into your potable water supply. Double wall heat exchangers are available for potable water which will prevent contamination in the event of an internal leak.
- 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 or plumbing into the engine cooling system.

## 10.9 Functions of the Remote Operating Panel

- The **Hurricane® II** heater's Remote Operating Panel, *Figure 10-3: Remote Operating Panel*, contains one ON/OFF burner switch, one ON/OFF AC heat switch, and four LED's indicating Burner activation, AC element activation, module fault, and zone fault.

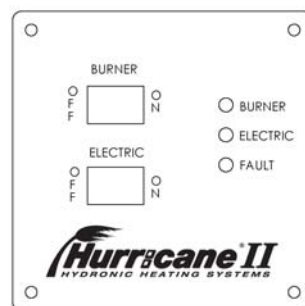


Figure 10-3 Remote Operating Panel

### Burner Switch (Primary Heat Source)

- The burner switch on the remote panel controls the ON/OFF of the diesel burner. The Burner LED will turn on when the diesel burner has been activated.

### **AC Element Switch (Secondary Heat Source)**

The AC heat switch controls the activation of a single 120 VAC immersion element only. The AC heat LED will turn ON to indicate when the element has been activated.

### **Burner LED (Green)**

- When ON, indicates the diesel burner has been activated. The light remains on if the burner cycles off.

### **AC Heat LED (Green)**

- When ON, indicates the 120 VAC immersion element is activated **and** is energized.

### **Module Fault LED (Red)**

- When ON, indicates **the Hurricane®II** heater has faulted. The specific fault can be identified by examining the heater Control Panel located on the front of the heater. There are indicator LED's on the panel that are used for diagnostics. Refer to the description of the heater Control Panel for further details, section 10.10.

### **Zone Fault LED (Red)**

- When ON, indicates the space heating zone(s) has faulted. The specific fault can be identified by examining the Zone Control Panel located beside the heater. There are indicator LED's on the panel that indicate the problem. Refer to the description of the Zone Control Panel for further details, section 10.11.

## 10.10 Functions of the Heater Control Panel

- The Heater Control Panel, Figure 10-2: Heater Main Control Panel, contains three push buttons: ON/OFF power, Bypass, and Reset. In addition, it contains nine LED's indicating Power, AC Heat, Compressor, Fuel Pump, Combustion Fan, Igniter, Flame Out, Voltage and Low Water.

### **Power Button**

- The power button turns ON/OFF the power to the control board. The Power LED (green) turns ON when the power to the control board is ON.

### **Bypass Button**

- The bypass button is for **authorized service personnel only**.

### **Reset Button**

- The reset button when pressed resets the control board.

### **Power LED (Green)**

- The power LED (green) turns ON when the power to the control board is ON. The LED flashes when the heater is in Bypass mode.

### **AC Heat LED (Green)**

- The AC Heat LED (Green) turns ON when the single AC immersion element has been activated.

### **Compressor, Fuel Pump, Combustion Fan, Igniter (Green)**

- The compressor, fuel pump, combustion fan, and igniter LED's (Green) turn ON when the component is ON, and will flash if the component is electrically open or shorted.

### **Flame Out (Red)**

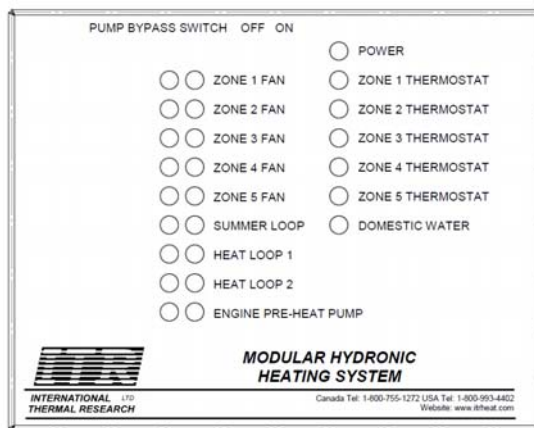
- The Flame Out LED (Red) turns ON when a flame fault has been detected.

### **Voltage Fault (Red)**

- The voltage fault LED (Red) turns ON when a voltage fault has been detected.

## 10.11 Functions of the Zone Control Panel

- The Zone Control Panel, *Figure 10-4: Zone Control Panel*, contains seven green LED's for *Power, Zone 1, 2, 3, 4 and 5 Thermostat(s), and Domestic Water*.
- It also contains nine matched pairings of red/green LED's for *Zone 1, 2, 3, 4 and 5 Fan(s), Summer Loop, Heat Loop 1, and Heat Loop 2*.



**Figure 10-4: Zone Control Panel**

### Power LED (Green)

- The power LED turns ON when the power to the Zone Control Board is ON.

### Zone 1, 2, 3, 4, 5 Thermostat LED's (Green)

- The Zone # LED turns ON when the thermostat in the zone is calling for heat.

### Domestic Water LED (Green)

- The domestic water LED turns ON when there is a call for domestic water heat.

### Zone 1, 2, 3, 4, 5 Fans, Summer Loop, Heat Loop 1, Heat Loop 2, Paired LED's (Red/Green)

- The nine paired LED's indicates the functionality of the devices. The green LED will turn ON when the device is

operating normally. The red LED turns ON if a fuse has been blown.

## 10.12 Maintenance

**Customer Monthly Maintenance:** Check the following and correct as required:

- Coolant hoses and fittings for leaks and integrity.
- Check coolant level in the overflow bottle (3/4 full when hot). **Fill only when the system is COLD and in small quantities only to prevent overfilling.**
- Exhaust fittings, connections, tubes for leaks, and integrity.
- Exhaust and air-intake checked for no obstructions.
- Fuel lines, fittings for leaks and integrity.
- External fuel filter for clogging.

**Annual Service Requirements:** Perform the following:

- **Prior to operation for the season, a factory service tune-up of the heating system should be performed by trained service personnel.** Only personnel familiar with the equipment modules should perform the service tune-up. It is recommended that the dealer be contacted for this service or if not available, contact ITR for information on service resources.
- As a general guide, the regular maintenance items such as the igniter, fuel filters (internal and external), and air filter (internal) should be replaced as opposed to inspected and cleaned. Their performance may be deteriorating and/or their remaining service life ending without any apparent visual signs or operating symptoms.
- The major components such as the air compressor, fuel pump, fuel nozzle, and combustion air fan should be examined for wear and should be replaced by the service technician as required.
- The combustion tube should be inspected by the service technician for wear and replaced if necessary. To access

the combustion tube, the front panel of the heater must be removed along with the burner box cover. The fuel block must then be removed from its mounting position. Finally, the burner and counter-flow tube must be taken out by removing the nuts holding the burner box in position. If the tube is satisfactory, a thorough cleaning of the tube and burner chamber should be performed by blowing out and vacuuming any ash and carbon buildup. Any build up on the surface of the burner chamber will cause the heater to lose efficiency.

- Regular inspection and maintenance is the only way to ensure safe, reliable and efficient operation of your heating system.

### 10.13 Protecting the Heater and the Distribution Module (optional)

#### NOTICE

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Protect the Heater and Distribution Module (optional) from temperature extremes and any dusty, dirty, corrosive environment.

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#### ! DANGER

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Protect the heater and distribution module (optional) and the system from cold temperatures and corrosion by using a proper mixture of anti-freeze and water. Use only a non-toxic propylene glycol based coolant with additives generally recognized as safe "GRAS" by the FDA in the Heater and Distribution Module (optional). Read and follow the anti-freeze manufacturer's instructions for the type of anti-freeze and mixture recommended for your application.

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#### NOTICE

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Note that any domestic water in the Distribution Module (optional) will freeze in cold temperatures and will damage the internal parts. The Distribution Module and all associated components must be completely drained and emptied of any domestic water before freezing temperatures are encountered.

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### 10.14 General Troubleshooting

***Ensure that your heater has both sufficient battery voltage and ground, and coolant level as the heater is designed not to allow operation if either are incorrect (indicated by***

*lit Voltage LED or Low Water LED on the Heater Control Panel) .*

### **Burner Does Not Start Up**

- Heater connected to 12 VDC power?
- Power button on the Heater Control Panel pushed ON? Power LED lit on the heater Control Panel?
- Burner switch on Remote Operating Panel ON? Burner LED lit on Remote Operating Panel?
- Main fuse or circuit breaker blown or tripped?

### **AC immersion element does not activate**

- Heater connected to 120 VAC power?
- AC switch on Remote Operating Panel switched ON? AC Heat LED lit on Remote Operating Panel?
- AC immersion element circuit breaker tripped?

### **Burner Starts but Flame Faults**

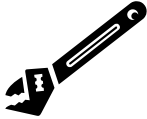
- Fuel supply present and adequate?
- Air-intake or exhaust not blocked or obstructed?
- Air in fuel line (white smoke from exhaust or popping sound from exhaust)?
- Fuel filter (external) dirty?
- Restrict the fuel return line with needle valve or pinch off completely.

### **Burner Starts but Zone Faults**

- Power LED on Zone Control Panel glowing green?
- Component matched LED pairings all glowing green on the Zone Control Panel?



# Maintenance



## 11.1 The First Few Weeks

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

About two weeks after your Hurricane®II heater has been 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.

**It is strongly recommended that the Hurricane®II heater be started and allowed to run through one complete heating cycle at least every 30 to 45 days to ensure its proper function and to verify the proper operation of all components.**

## 11.2 Adding Antifreeze

Once the system has been filled with water and purged of all air during the installation procedure, you need to operate the heater at normal temperatures and then check for water leaks. If you do not find any, add antifreeze to lubricate the pump and prevent the water system from corroding or freezing in cold weather. See Chapter 3, "Water filling procedures", page 3-11.

PRECAUTION: Where there is a chance of contamination of your domestic water when using a heating system, use antifreeze specifically intended for hydronic heating systems. Inhibited propylene glycol is recommended. Do not use automotive, ethylene glycol, or any undiluted or petroleum based antifreeze as they can cause severe personal injury.



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% antifreeze. NEVER use more than a 50/50 mixture, since the

added viscosity of the antifreeze solution will cause circulation problems. Your antifreeze/water mixture should be changed every three years. Antifreeze does wear out and can become very acidic.

A coolant conditioner can be added to the water system, to keep the coolant alkaline and not acidic, see page 3-14. These inhibitors also prevent the coolant from forming calcium scales. 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.

### 11.3 Marine Exhaust System

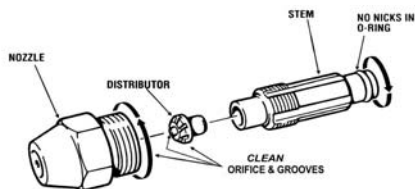
Always be careful that nothing combustible is placed adjacent to the exhaust pipes.

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. You should service as required and replace corroded pipes immediately. On rough seas, there is a danger of water entering the exhaust outlet. Ask your dealer about a thru-hull plug (shown on the left) that can be inserted into the exhaust outlet when the boat is moving through rough water. Obviously, the heater cannot be operated when the exhaust system is plugged.



### 11.4 Nozzle

Nozzle problems such as clogging will result in a poor flame, small and blue. Carefully disassemble. Hold nozzle vertically and turn stem counter clockwise. Clean distributor orifice and air slots of any debris using solvent and high pressure air. Check O-rings for nicks and replace if in doubt. A leaking O-ring will allow air into the fuel causing popping of the flame.



### 11.5 Fuel Lines and Filter

You should check your filter every season to determine if it needs replacement. The frequency depends largely on the quality of fuel you've been using.

## 11.6 Combustion Chamber



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

## 11.7 Checking Hoses and Tubes



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

## 11.8 Electrical System

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

Make sure that all your connections are secure.

Periodically, do a voltage test to ensure that you are getting 12 volts from the battery.

Check for corrosion of wires.

## 11.9 Recommended Spare Parts

Like any piece of machinery, your HURICANE heater will need servicing from time to time. A suggested maintenance schedule, page 12-4, lists suggested maintenance items and intervals. The following is a list of parts recommended to have on hand.

- Fuel filter cartridge
- Air filter
- Fuel nozzle for your model
- Fuel nozzle "O" ring
- Flame Sensor

Over a period of time, operational parts of the heater will wear out and need replacing:

- Air compressor
- Fuel Pump
- Water Pump or pump brushes
- Fan Motor
- Ignitor
- Aquastats

<b><u>MAINTENANCE ITEM</u></b>	<b><u>MAINTENANCE FREQUENCY</u></b>	<b><u>SERVICE REQUIRED</u></b>
FUEL/WATER HOSES	SEASONALLY	INSPECT FOR LEAKS AND WEAK POINTS
HOSE CLAMPS	SEASONALLY	INSPECT FOR CORROSION TIGHTEN IF LOOSE
COMBUSTION CHAMBER AND EXHAUST	1000 HOURS	VACUUM CLEAN
FUEL FILTER	SEASONALLY	INSPECT FOR CLEANING OR REPLACEMENT
NOZZLES DISTRIBUTOR ORIFICE, AIR SLOTS & O-RINGS	SEASONALLY OR 2000 HOURS	CLEANING AND INSPECTION FOR WEAR AND 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

**Figure 11-1 Maintenance Schedule**

## 11.10 Protecting Hydronic Heating Systems

The advantage of closed hydronic heating systems is that as long as there are no leaks, (i.e., no need for constant make-up water), the fill neutralizes (that is, it reaches equilibrium). The long term result is minimal scale build-up and insignificant corrosion since after operating for a period of time, most oxygen has been "starved" out of the boiler fill water. While boiler fill water treatments have their place, leak prevention is the single most important preventative maintenance item.

Regular maintenance and prompt repair of leaks, combined with a one time application of appropriate inhibitors, can help you enjoy problem-free heating. Since it is difficult to guarantee that a hydronic heating system will never leak, corrosion inhibitors and scale inhibitors added to "fresh" boiler fill water can act as low cost "insurance" for hydronic systems.

### **Causes of Scale**

Tap water is the most typical source selected for boiler fill water. Water contains dissolved solids such as magnesium and calcium which when heated becomes much less soluble and forms scale. Scale comes out of solution in the largest amounts where the temperature is highest in the system (i.e., the boiler heat exchanger). As the scale builds up, noise and cold spots develop since scales plug up water channels and acts as an insulator that impedes proper heater transfer.

### **Acidity and Corrosion**

Corrosion is the result of metal oxidizing (that is, metals reacting with oxygen-rich boiler fill water). The acidity of any liquid (including water) is a good indicator of how much corrosion will actually take place. As a rule of thumb, boiler fill water should have a pH greater than 7 and less than 10.5. The key to preventing corrosion is to make sure that the heating system is free of leaks and there is no need to replace it with fresh, oxygen rich boiler fill water. Corrosion inside a hydronic heating system stops quite quickly as the fill water stabilizes and becomes oxygen-starved. The pH should be measured at least annually.

Since most hydronic heating systems are comprised of different metals (e.g., iron, copper, etc.), and since boiler fill water is an electrolyte (that is, it will conduct electrical current), electro-

chemical reactions ("galvanic" reactions) can take place. As the fill water stabilizes, however, it becomes a very weak electrolyte, so galvanic corrosion rarely becomes a problem - as long as the system remains leak-free.

### **Preventative Treatments**

Corrosion and scale inhibitors are relatively inexpensive. Ideally, they should be applied, once only, at the time of a new installation or whenever a system has been completely drained. Boiler water treatment specialists almost unanimously agree that the prevention of leaks and the elimination of the need for frequent boiler water make-up are top priorities for hydronic systems.

# Warranty And Service

## 12.1 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.**

ITR warrants the **HURRICANE®II/IIL/COMBI, SCH25, Water Heater by ITR, (referred to as “heater(s)”) and all accessories or other supplied components with the original purchase to be free of defects in materials and workmanship under design usage and service conditions for two (2) years from the heater serial number label manufacturing date. Warranty replacement parts are covered for the remainder of the heater’s warranty.**

**This warranty does not apply to damage or failure of the heater, or the vessel or vehicle into which it was installed, due to improper installation, assembly, maintenance, or abuse, accident, or the use of parts not supplied by ITR.**

## 12.2 Installations

The purchaser and installer are advised that specific rules and regulations may be in effect with respect to the installation of the “heater”. It is the installer’s responsibility to review and comply with all such rules and regulations.

Non-standard installations, that is, those requiring a departure from published installation instructions, should not be undertaken without first having consulted and obtained 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.

**“Heaters” installed using non standard, industry accepted procedures and without ITR’s or an authorized Dealer’s approval will be limited to a 90 day warranty measured from the heater serial number label manufacturing date.**



### 12.3 Limited Warranty

**The following warranties are in lieu of all other warranties and conditions. ITR makes no other warranties, representations, or conditions, express or implied, and there are expressly excluded all implied or statutory warranties or conditions of merchantability of fitness for a particular purpose and those arising by statute or otherwise in law of 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. ITR warrants its products; ITR authorized dealers/service centers and installers provide warranty for installation. Any warrantable service and or labour is the responsibility of ITR and should be performed by an authorized dealer unless other arrangements are authorized.**

**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 or altered, or cannot be readily determined.**

## 12.4 Owner's Responsibilities

**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" to such dealer.** The Owner is responsible for all repairs made to the engine, equipment, vessel, or vehicle in which the "heater" is installed, other than the "heater". The Owner is responsible for lodging, meals, and other incidental costs incurred by the Owner as a result of a warrantable failure. The Owner is responsible for "down time" expenses, and all business costs and losses resulting from a warrantable failure.

**ITR IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.**

## 12.5 Not Covered Under Warranty

This warranty will not apply to:

- Normal usage, wear, and tear on parts, including but not limited to, fuel filter, air filter, nozzle, fuses, igniter, and carbon brushes.
- 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.
- Any progressive damage to the engine, vessel, or vehicle arising out of failure of the "heater".
- "Heaters" which have been modified or use of non-standard parts not approved by ITR.
- "Heaters" that have been abused, damaged, vandalized, or received improper maintenance.
- **Removal and re-installation expenses of the "heater" unless specific written permission has been obtained from ITR.**
- Travel time and expenses incurred by an ITR dealer or other personnel to perform warranty related work on the "heater"

- Diagnosis or repairs when caused by problems not directly related to the “heater” or due to empty fuel tanks or poor fuel quality, fuel additives, acidic water, electrolysis, incorrect vessel bonding leading to abnormal corrosion.
- Running the system dry or without appropriate preservatives (antifreeze), causing damage to the heat exchanger, pump seals, etc.
- Exposing the heater to an environment detrimental to its effective operation (such as excessively wet, dirty, or hot areas).
- Other products which ITR does not manufacture.
- Any products or parts which have been used in a manner contrary to ITR’s printed instructions.

**PLEASE FOLLOW THE RECOMMENDATIONS INCLUDED IN THIS MANUAL.**

## 12.6 Customer Service Calls

Normal service calls are at the owner’s expense.

**CHECK THE TROUBLESHOOTING CHAPTER OF THIS MANUAL TO SEE IF YOUR PROBLEM IS ADDRESSED.**

When calling with a service problem, please have the following information at hand:

- The model number and serial number of your heater and main electronic control board.
- If your heater is already installed, ensure you are familiar with the design and installation setup.
- Have ready a detailed description of the problem and keep the manual handy to refer to.

## 12.7 Returns

**To obtain warranty service, the owner must:**

- Provide a full description of the problem to your dealer and ITR. ITR will determine if the problem is covered under the ITR warranty.

- If ITR determines that the problem is covered under warranty, they will provide you with a Repair or Return Goods Authorization (RGA) number for any warranty return, repair or service.. ITR will refuse any return package without a proper RGA number.
- If ITR determines that “heater” repairs will be covered under warranty under in-field conditions, ITR will authorize the in-field warranty service personnel as to specific conditions and limits for parts and labor used in the repair. Any other incurred costs will not be covered under the warranty.
- When shipping your product, pack securely to prevent damage, indicate the RGA and serial number of the heater on the outside of the shipping container, and ship prepaid and insured to ITR.
- In the shipping container, provide written details of the problems, RGA number, manufacturing date as indicated by the serial number label, serial number, proof of purchase, and a return address.

**After repair or replacement** of products under warranty, ITR will return the product to the customer via standard (non expedited) delivery. Factory repairs or replacement will be done as quickly as possible, with an estimated five working day turn around.

## 12.8 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 the heater, or call ITR**

#### **IN CANADA:**

2431 Simpson Road,  
Richmond, BC Canada V6X 2R2  
Tel: 1-800-755-1272 or 604-278-1272  
Fax: 604-278-1274  
Email: [info@itrheat.com](mailto:info@itrheat.com)

#### **IN THE UNITED STATES:**

11915 NE 56<sup>th</sup> Circle Suite B  
Vancouver, WA USA 98682  
Tel: 1-800-993-4402 or 360-993-4877  
Fax: 360-993-1105  
Website: <http://www.itrheat.com>



# Installing the Distribution Module, DM12 (Optional)

The Distribution Module is the simplest and most convenient way to add both space heating and domestic water heating to the **Hurricane®II** heating system. It eliminates many of the separate circulation pump sizing, heat exchanger selection, plumbing, electrical wiring, and operating considerations associated with a conventional heating system installation. The Distribution module provides the following features:

1. Built in circulation pumps allow for support of independent functioning single or dual space heating circulation loops
2. Built in engine/heating system interface allows for use of waste engine heat
3. Built in domestic water heat exchanger and circulation pump allows for continuous hot water
4. Built in Automatic Winter/Summer loop control for more efficient use of heat
5. Built in domestic water temperature control to prevent scalding
6. Built in filling manifold and circulation pumps for easy and quick filling of the heater circulation system
7. One 9 pin connector and cable for electrical control to the heater system Zone Control board
8. Compact (11"h x 14"w x 6.5"d) self contained design for convenient placement

This section describes its installation.

## 13.1 Installing your Distribution Module

### Equipment, Tools and Skills

#### NOTICE

As the Installer, you must be qualified and authorized to do the installation which requires mechanical and electrical knowledge.

**The module is to be installed in accordance with the standards and regulations of authorities having jurisdiction.** Proper workmanship is essential to the proper function and life of your module as well as protecting your warranty.

## 13.2 Selecting the Module Location

The installation should consider the following:

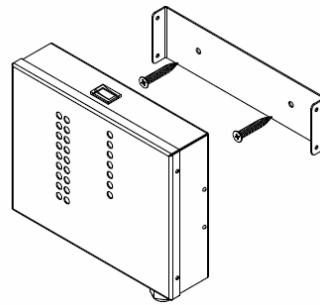
- Mounting location must be able to support double the gross weight of the Distribution Module (i.e. 33 lbs. x 2 = 66 lbs./13 KG x 2 = 26 KG) and must be of a non-combustible and non absorptive surface.
- The module must be mounted in an area that provides unrestricted access to the front panel (minimum of 6" top clearance) with 3" clearance to all other module surfaces.
- Module is 11"H x 14"W x 6.5" D. (27.9cm x 35.5cm x 15.2cm). Module must be mounted using four, 1/4" through bolts using 1" diameter fender washers, lock washers and nuts. The module must be mounted in the position as shown against a wall or on the floor.



Figure 13-1: Distribution Module, DM12

### 13.3 Selecting the Distribution Module Zone Box Location

- Mount the Zone Control Board Box (containing the Zone Control Board) vertically, close to the Distribution Module. Allow sufficient room to access the internal fuses as well as to view the display LED's on the board itself.
- Mount the bracket against a wall using 2 flat head screws. The zone control board box will then click onto the bracket.



**Figure 13-2: Zone Control Board Box**

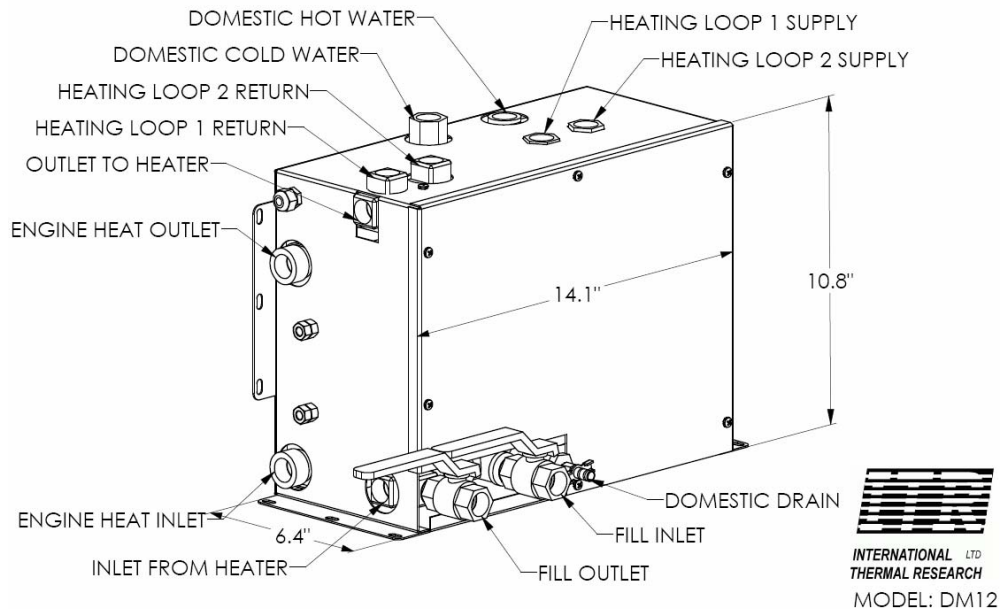
- The Distribution Module is connected to the Zone Control Board through the electrical connections located at the bottom of the Zone Control Board box. The distance apart is dictated by the length of the 9 pin connector cord used.

### 13.4 Plumbing Installation

The plumbing installation should consider the following:

- The Distribution Module, see Figure 13-3: *Distribution Module Fittings Location*. See the illustration for the location of the fittings.

## Section 13, Installing the Distribution Module, DM12 (optional)



**Figure 13-3: Distribution Module Fittings Location.**

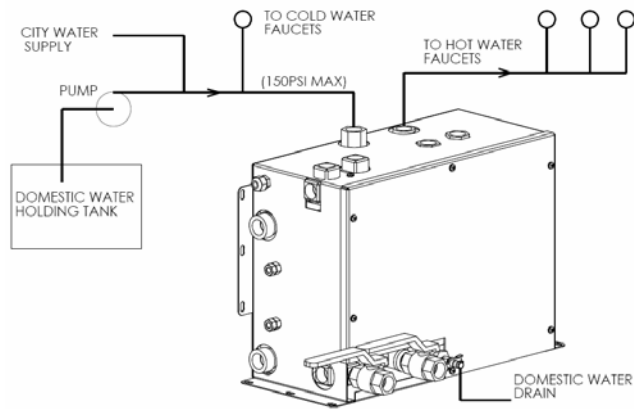
### NOTICE

All fittings on the Distribution Module require two wrenches when tightening. One wrench must be placed on the module fitting and held in place to prevent this fitting from being overstressed. The other wrench can be used to tighten the matching half of the fitting onto it. Failure to follow this procedure will damage the Distribution Module, and the fittings.

- The Domestic water connections are located on top of the module. The Cold water supply can be connected using a  $\frac{1}{2}$ " NPT fitting. The maximum water supply pressure to the module is 150 PSI (10 bar). The Hot water Outlet temperature is regulated by an internal mixing valve factory set at 120F (49°C). If needed this valve can be adjusted in a range from 100F (38°C) to a maximum of 145F (63°C). For more details about adjusting the temperature see chapter 14.9. A domestic water drain is provided for winterizing purposes. This will prevent damage to the internal heat exchanger due to freezing water. See *Figure 13-4: Domestic Hot water system plumbing*.

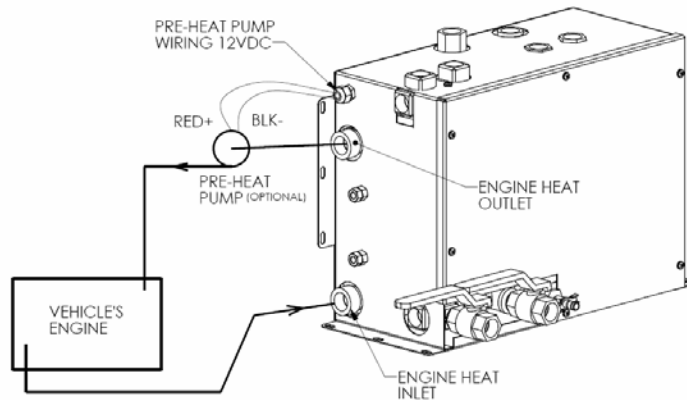
### WARNING

All fittings, hose, tube and fitting sealant involving the domestic water must be food safe and approved for use with domestic water and rated for the domestic water system pressure.



**Figure 13-4 Domestic Hot Water System Plumbing.**

- The engine heat/pre-heat connections are located on the side of the distribution module. Hot coolant from the engine enters the module at the “engine heat inlet”. The “engine heat outlet” returns the coolant back to the engine supply. When the pre-heat function is installed an additional pump is connected between the “engine heat outlet” and the engine supply. The distribution module contains a red and black wire to connect this pump. The pre-heat switch on the remote control panel will activate this pump. See *Figure 13-5: Engine heat/pre-heat system plumbing.*

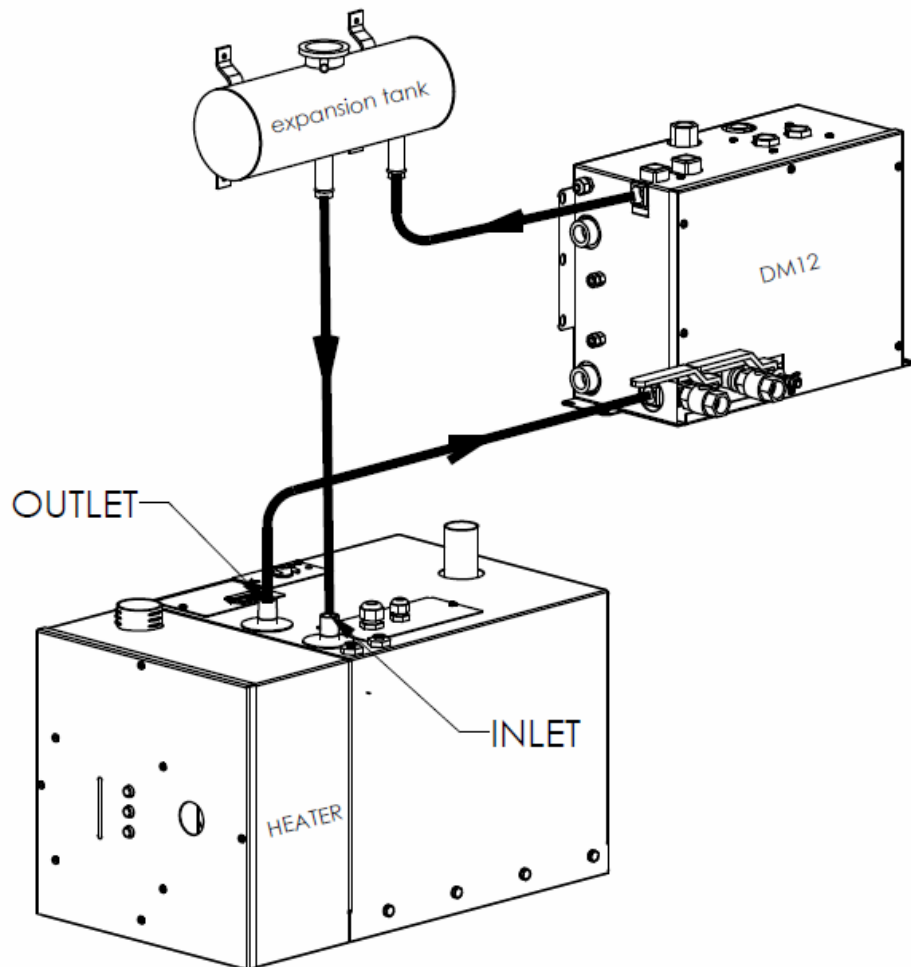


**Figure 13-5 Engine Heat / Pre-heat System Plumbing.**

- The pre-heat pump wires are capped off to prevent accidental shorting. The pre-heat switch on the remote will turn on power to the wires.

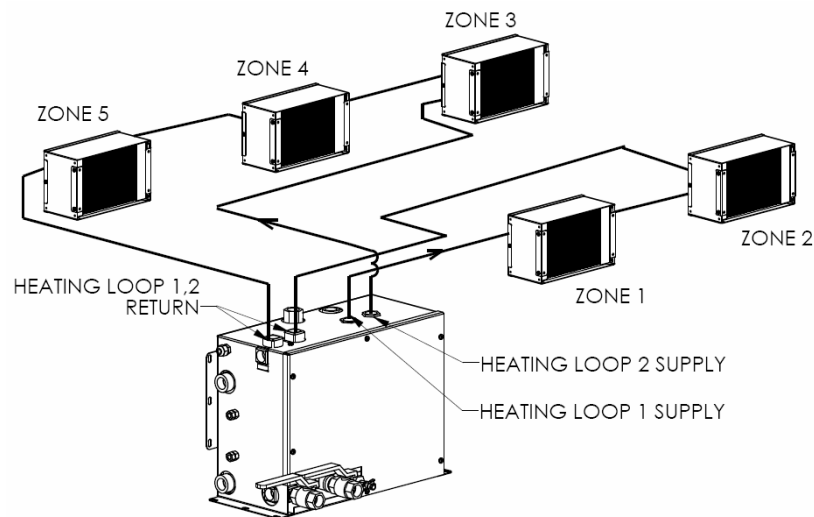
## Section 13, Installing the Distribution Module, DM12 (optional)

- The Distribution module contains two connections on the side panel to connect to the heater. The “Inlet from Heater” is connected to the hot coolant supply outlet on the heater. The “Outlet to Heater” is connected to the cold coolant return inlet on the heater. It is recommended to use minimal  $\frac{3}{4}$ ” ID hose for this connection. See *Figure 13-6: Connecting to heater*.



**Figure 13-6: Connecting to the heater**

- The Distribution module has the capability to supply heat for two separate heating loops labeled “Heating loop 1 supply” and “Heating loop 2 supply”. Each loop can contain several fans connected in series. The control board can regulate up to 5 zones. Zones 1 and 2 control the fans in heating loop 1 and Zones 3, 4 and 5 control fans in heating loop 2. See *Figure 14-7: Connecting two heating loops*.



**Figure 13-7: Connecting two Heating loops.**

**! DANGER**

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Use only a non-toxic propylene glycol based coolant with additives generally recognized as safe "GRAS" by the FDA in the coolant side of the Distribution Module. Refer to the anti-freeze manufacturer recommendations for instructions for your particular application.

---

**NOTICE**

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Do not operate the heater and Distribution Module, DM12 until coolant is in the heater and Distribution Module and all trapped air has been bled.

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All plumbing lines must be run and secured so as to prevent damage, chafing and kinking.

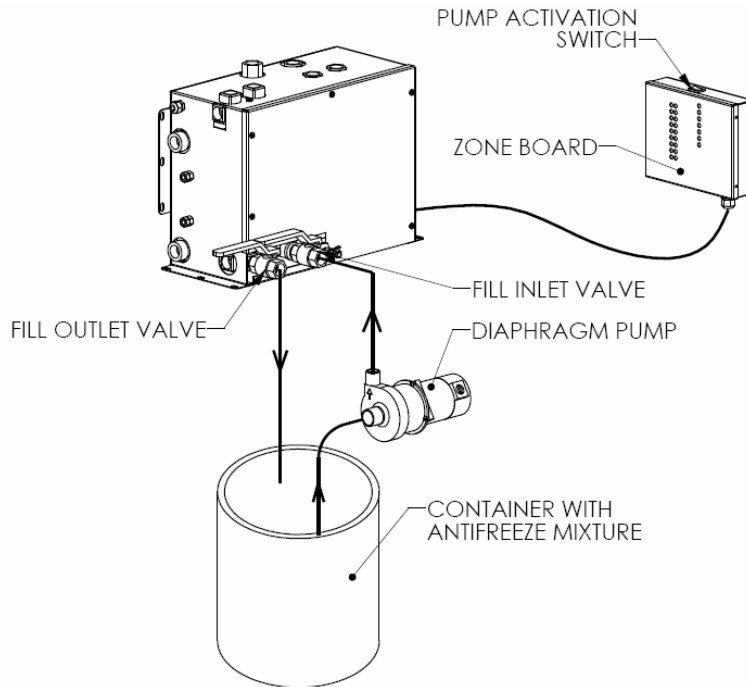
### 13.5 Filling/Purging the heating system

The Distribution module contains two valves with ½"NPT connections to be used for filling the heating loop. To initially fill up and bleed the air out of the system, do the following:

1. Connect a hose to the outlet of a diaphragm pump and to the "fill inlet valve" on the distribution module. Attach a hose to the inlet of a diaphragm pump and place the hose in a container filled with a 50/50 mixture of propylene glycol and water (see Figure 13-8, *Initial fill up of Heating system*).

## Section 13, Installing the Distribution Module, DM12 (optional)

2. Connect a hose to the “fill outlet valve” on the distribution module and place the other end of the hose in the same container.



**Figure 13-8: Initial fill up of heating system**

3. Open both valves on the Distribution module.
4. Turn ON the diaphragm pump. This will prime the pumps in the Distribution Module. It may be necessary to fill up the container with more coolant as the air is being bled from the system.
5. Turn on the pump activation switch, located on top of the zone box, this will activate the pumps inside the distribution module and fill up both heating loops.
6. Once the coolant in the container remains at the same level and there appears to be no air in the return stream from the fill outlet hose, close the valves on the distribution module and stop the diaphragm pump.
7. Turn off the pump activation switch.
8. The heating system is ready to be operated.

## 13.6 Electrical Connection

### WARNING

All electrical connections and wiring must comply with normally-accepted 12 VDC wiring practices, local regulations and ABYC standards. Only a qualified electrical installer should complete the wiring. All field wiring is to be in accordance with CSA Standard C22.1, Canadian Electrical Code Part I.

### 12 VDC

- Primary DC power to the module should originate after the master disconnect switch from a dedicated connection on the house battery bank.
- The power connection to the module from the power supply is through the Distribution Module Zone Control Board itself. A 25 amp fuse or breaker must be included inline from the power source to the positive connection on the zone board. The primary power wire gauge must be sized to permit no more than a 3% voltage drop from the power supply to the zone board. There are no direct 12 VDC power connections onto the Distribution Module itself. Refer to *Figure 13-9: Distribution Module Wiring*.

## 13.7 Distribution Module Zone Board

### Multi-Pin Connectors

The Zone Control Board has four multi-pin connectors, see *Figure 13-9: Zone Control Board wiring with Distribution Module present*, or *Figure 13-10: Zone control Board wiring without Distribution Module*, that are to be connected through connector cords (supplied) to the matching multi-pin connectors as follows:

- 10 pin connector to Heater Remote Operating Panel.
- 8 pin connector to Heater (connector cord transitions to a 9 pin connector for the Heater).

### Section 13, Installing the Distribution Module, DM12 (optional)

- 12 pin connector to Distribution Module (connector cord transitions to a 9 pin connector for the Distribution Module).
- 14 pin connector to thermostat and cabin fan connector plug.

#### Cabin Fan leads

- The positive (red) lead from each cabin fan is to be attached to one of the trailing cabin fan leads, color coded for zones, from the thermostat and cabin fan connector plug.
- The negative lead from each cabin fan is to be attached to a ground terminal (not provided) that is connected to a battery ground.
- The cabin fan 1 leads (orange) can supply up to a maximum of 10 Amps. The other cabin fan leads 2-5 can supply up to a maximum of 5 Amps each. The total current draw is not to exceed 18 Amps for all cabin fan leads.
- If the system requires higher amperage draws, install a separate relay to power the fans. This relay will use the existing fan circuit as a signal and must be wired to a secondary power source (not the heater's control board). See Figure 5-3.

#### Thermostat Leads

- The power lead to the thermostat is to be attached to a power terminal (not provided) that is connected to the battery.
- The return lead from each thermostat is to be attached to one of the trailing thermostat leads, color coded for zones, from the thermostat and cabin fan connector plug.

Section 13, Installing the Distribution Module (optional), DM12

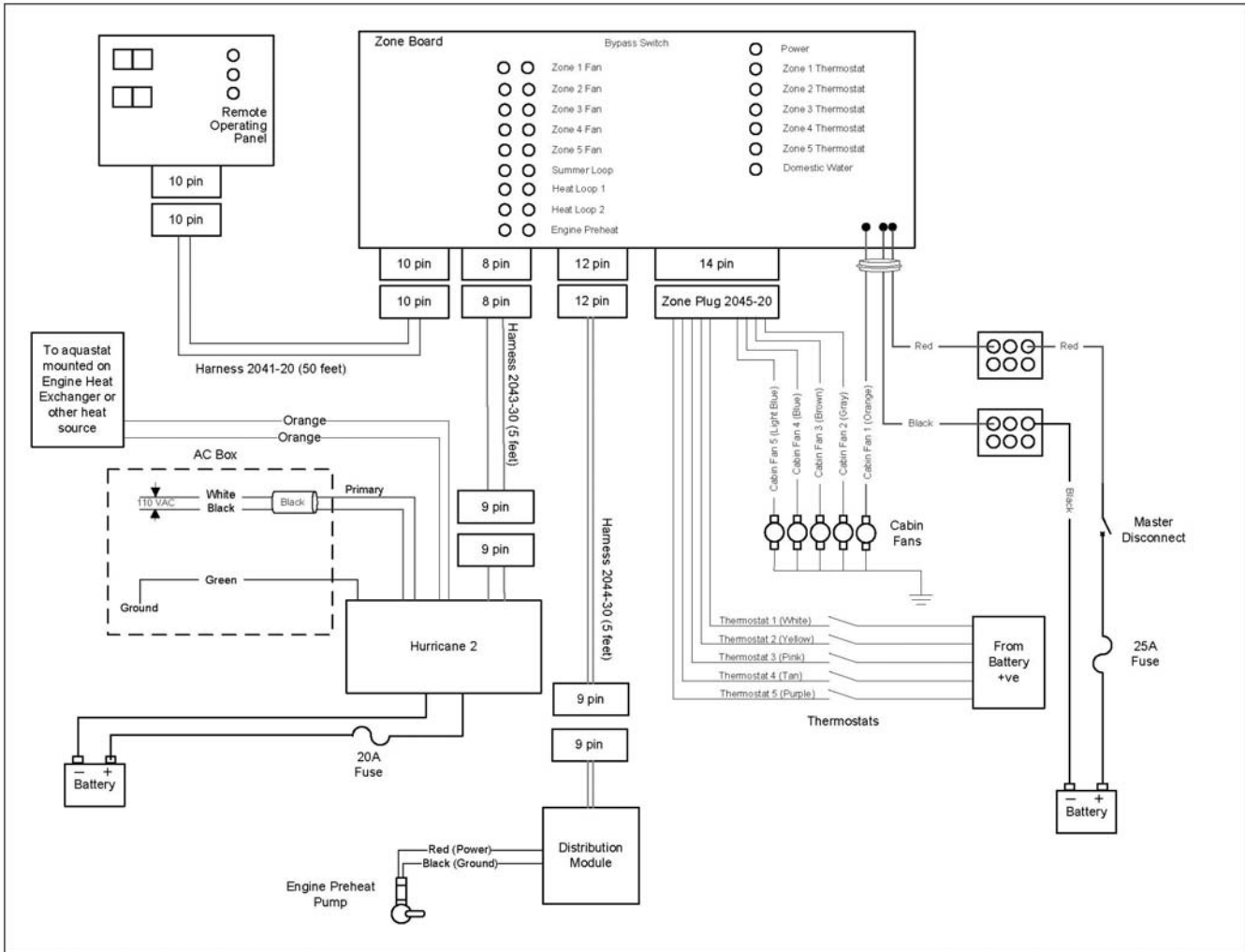


Figure 13-9: Zone Control Board wiring with Distribution Module Present

## Section 13, Installing the Distribution Module, DM12 (optional)

If the zone board is being used **without** the distribution module, use the following wiring diagram:

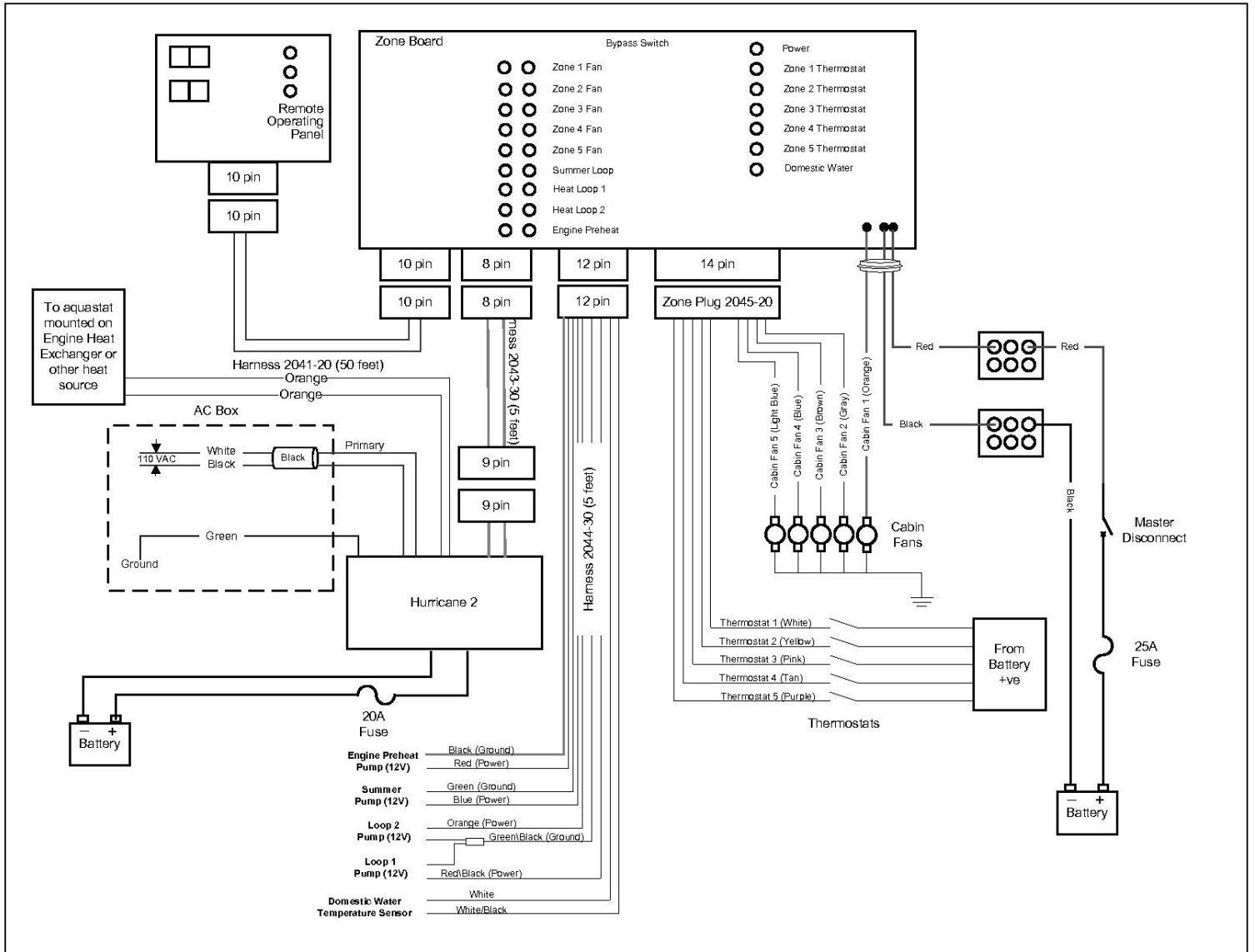


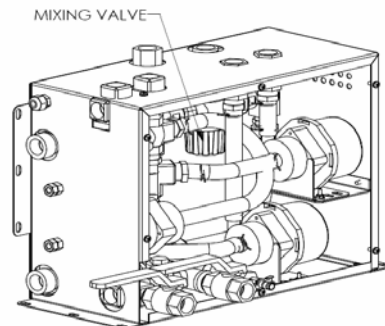
Figure 13-10: Zone Control Board Wiring without Distribution Module

## 13.8 Inspection and Testing

After all components have been properly installed according to ABYC Industry Standards and Practices and the recommendations of this Manual, the Distribution Module and heater should be inspected using the **Inspection Check Sheet** in this Manual. The **Inspection Check Sheet** is divided into relevant sections allowing each phase of the Inspection to be carried out systematically, and then signed off by authorized personnel.

## 13.9 Hot water temperature adjustment

The distribution module has the option to adjust the temperature of the domestic hot water outlet. Standard this temperature is set at 120F (49°C). In order to adjust the temperature, the front cover has to be removed. The front cover can be removed by removing the 6 Philips head screws. The mixing valve adjustment knob is shown in the figure below.



**Figure 13-11: Mixing valve location**

### WARNING

The parts inside the module are **HOT** when in operation. Use gloves when adjusting the mixing valve.

Turning the knob left (clockwise from top view) will increase the hot water outlet temperature up to a maximum of 145F (63°C). Turning the knob right (counter-clockwise) will decrease the hot water outlet temperature down to minimal 100F (38°C). Mount the cover back in place after the adjustment. Note that the mixing valve knob is secured by a center screw and the screw may have to be slightly loosened to allow for adjustment.

## Section 13, Installing the Distribution Module, DM12 (optional)