

**INTERNATIONAL LTD
THERMAL RESEARCH**



Hurricane[®] SCH33[™]
Hydronic Heating System by ITR

Installation and Operating Manual

HURRICANE SCH33

**Diesel Heating System for
Marine Vessels**

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Read and save these instructions for future reference

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Overview

Thank you for purchasing the **Hurricane® SCH33™** diesel hot water heating system.

This section describes features of the Hurricane SCH33 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.

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

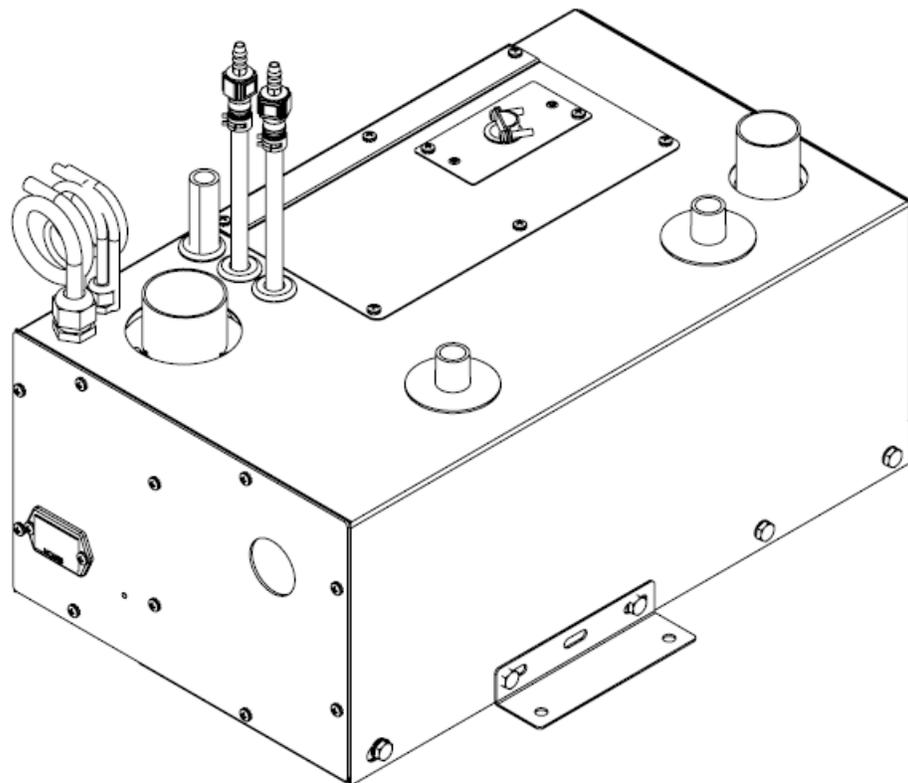


Figure 1-1: Hurricane SCH33 Heating System

1.1 Unpacking the Heating System

When you receive your Hurricane SCH33 heater:

- 1 Unpack it carefully.
- 2 Check each component against the provided parts list to ensure that you have everything and that all parts are 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 this Instruction and Operation Manual. It contains critical information for a proper installation.**

It's important to follow the installation procedures in this manual to ensure maximum performance of the heater and that you and/or your customers enjoy a warm, comfortable environment and plenty of hot water when needed.

1.2 Protect Your Warranty

This document reflects approved installation techniques, methods, and materials, and applies only to ITR equipment. The heater and supplied components are only guaranteed by ITR if the entire system has been installed according to the requirements and recommendations set forth in this manual.

NOTICE

Warranty coverage will not be extended to heaters and system components (supplied by ITR) used in an improper installation. Use of any unapproved materials, equipment, or installation procedures will void the warranty for the entire heating system. ITR does not accept liability for any damage or loss of service resulting from unapproved installations and/or modifications.

1.3 Heater Features

Hurricane SCH33 ADVANTAGES

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

The Hurricane SCH33 is an advanced and efficient hydronic heater with many advantages over older technology of forced-air systems. The Hurricane SCH33 provides space heating using a “heat-transfer fluid” pumped to remote mounted, fan equipped, radiator-style heat-exchangers. The same “hot” fluid can be circulated through an optional highly efficient, externally mounted, flat-plate heat-exchanger to provide a continuous supply of domestic hot water through a mixing valve. The heater runs on 12VDC power, using a diesel-fired burner to maintain the temperature of the heat transfer fluid. The Hurricane SCH33 heater can also use waste heat from the engine, using an optional external 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 (North America) electric element for a supplemental and backup heating source when the vehicle is connected to a power source.
- High-temperature stainless steel burner and water jacket to prevent premature warping or burnout.
- Internal circulation pump for heating loop and optional hot water heat exchanger
- Insulated enclosure retains heat and minimizes noise
- Easy to install, field serviceable, with hookups and connections easily accessible from 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
- No smoke or smell from the exhaust
- Fan assisted; sealed combustion chamber is designed to use outside air through a direct ventilation hook-up
- Simple, low amperage draw ignition
- Return fuel line to eliminate air and prevent nuisance shutdowns

NOTICE

A fuel return line is not necessary with the installation of an automatic fuel de-aerator. Call ITR for price and availability.

Section 1, Overview

- Electronically-controlled system with:
 - Automatic safety shutdown
 - Manual reset overheat sensor and a thermal cutoff for overheat protection
 - Basic or Touch screen control panel for remote operating control and diagnostics with audible alarm
- Heating control for up to four separate space heating zones, each with its own optional thermostat
- Optional on demand, continuous domestic water heating without the need for hot water storage (using an external heat exchanger and mixing valve)
- Optional use of engine waste heat to provide system heating (using an external heat exchanger)
- Engine heating (using an optional external heat exchanger and pump)

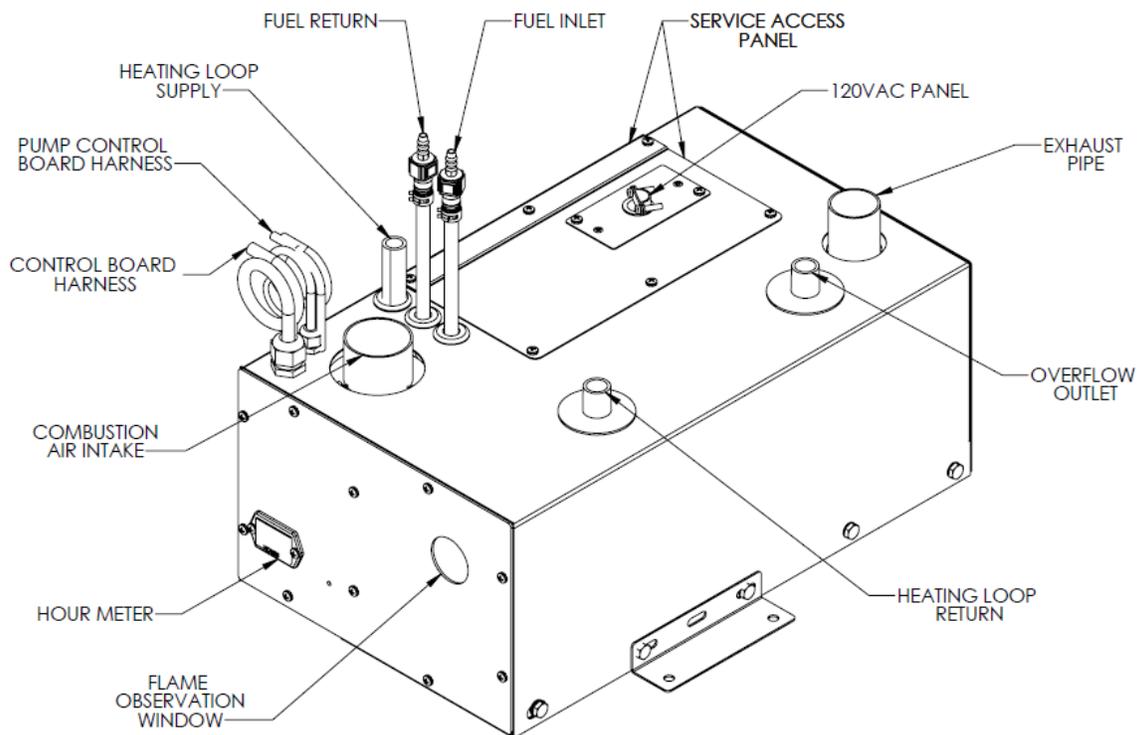


Figure 1-2: Hurricane SCH33 Heating System Overview

1.4 Critical Factors

THE INSTALLATION SHALL BE IN ACCORDANCE WITH THE REGULATIONS OF AUTHORITIES HAVING JURISDICTION

The key factors to keep in mind when planning and installing the heater are:

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

- Location restrictions for the heater, electrical control box, and exhaust outlet (to reduce noise, vibration, heat loss, etc.)
- Length, routing, and sizing of the hot fluid lines, fuel lines, air-inlet venting and tubing, exhaust piping, and wiring
- Outside air - direct, unrestricted air intake requires a draw of outside air for combustion
- Ability to easily access and service the product, especially fuel, plumbing, and electrical systems
- After installation, ability to purge water and fuel lines and inspect/test entire system using the ITR-supplied Inspection Check Sheet.

1.5 Equipment, Tools, and Skills

As the user and/or 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. Refer to *Section 1 - Overview, sub-Section 1.2, 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 (used with the supplied mounting hardware) for securely mounting the heater.
- Steel (or stainless steel) 1½" ID exhaust piping no longer than 12' with no bends (see *Section 3 - Installing the Exhaust System*, for details when bends are present).
- 2" combustion fan intake hose, exhaust thru-hull and clamps
- ¼" ID approved fuel supply and return lines

Section 1, Overview

- 10-micron fuel filter (supplied by ITR or appropriate aftermarket filter)
- #10 sheet metal screws or wood screws for mounting internal fans.
- Heater hose – enough to connect the Hurricane SCH33 to the interior fans. If engine heat is used, heater hose is required to connect the optional heat exchanger between the heater and the engine block (see *Technical Specifications and Standards* for details)
- Clamps to secure all heater hose and fuel hose connections
- Overflow bottle (min. 3 quarts) with clear plastic 1/2" ID hose; tank must be heavy-duty plastic, with a vented, screw-down cap, and sturdy enough to mount firmly to a vertical surface (ITR prt#60032)
- DC compatible thermostat(s) depending on the number of zones for temperature regulation of each zone (up to 4)
- A self-priming pump for filling the system with heat transfer fluid after installation
- Cabin fans or passive radiators for distributing heat to the living spaces

refer to *Figure 1-3*, for a typical series plumbed layout using the Hurricane SCH33 heater.

1.6 Testing and Inspection

After all components have been properly installed according to standard practices, ABYC standards and the recommendations of this installation and Operating Manual, the heating system should be test-operated and inspected for leaks and proper function.

For your convenience, you can use the pullout *Inspection Check sheet* in this manual. The check sheet is divided into progressive sections, allowing each phase of the inspection to be carried out systematically, and then signed off by authorized persons.

Section 1, Overview

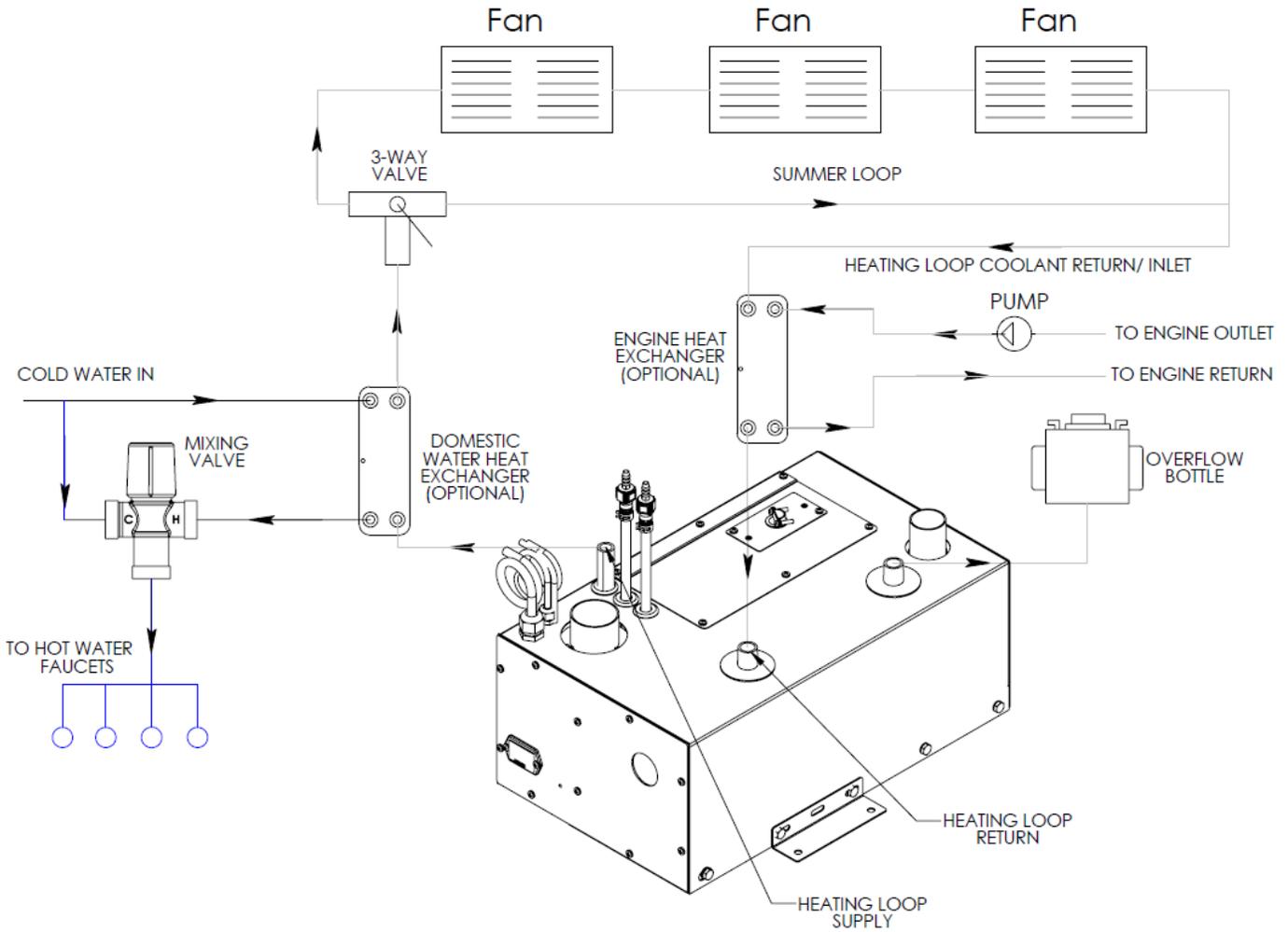


Figure 1-3: Hurricane SCH33 Typical Series-Plumbed Layout

Mounting – Hurricane SCH33 Heating System



2.1 Before You Begin

Plan the location of the Hurricane® SCH33™ Heating System and all its major components in advance to ensure the chosen locations are compatible with installation requirements and within the technical specifications.

Consider the following factors to help you decide exactly where best to mount the Hurricane SCH33 Heating System:

- Heater weight when full
- Ventilation requirements
- Exhaust outlet location and maximum acceptable length, including all 90-degree bends. Refer to section 3.2.
- 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 the Hurricane SCH33 including: control box, heat exchangers, overflow tank, batteries, etc.

WARNING

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 Mounting Location

- Mounting location must be able to support double the gross weight of the heater when full (i.e. 57 lbs. x 2 = 114 lbs./51.7 KG) and must be of a non-combustible material.
- The Hurricane SCH33 model is 7.5"H x 11" W x 18.8" D (19.1 cm x 27.9 cm x 47.8 cm). See *Figure 2-1: Dimensions*

DANGER

The Hurricane SCH33 heater must not be installed in any compartment with flammable gases.

- The Hurricane SCH33 heater must be isolated completely from all living spaces. Combustion air must be drawn directly from an outside source and cannot contain any combustible gases. Use the supplied air intake hose (part#8019) and the aluminum air intake collar (part#10089) if the air intake hose is not mounted to the combination exhaust/intake thru-hull. Securely clamp and seal all air inlet hose connections. Ensure the supply of combustion air to the appliance is not obstructed or cut off.
- The heater must be mounted in an area that provides unrestricted access to the front panel, side and top access panels and access to fuel, water, power and exhaust connections. There should be at least 12" of clearance on the top and left side of the heater for accessing and servicing the components. There should be at least 1" clearance to all other Hurricane SCH33 heater surfaces.
- The heater must not be installed in any compartment with flammable gases.
- The heater must be mounted horizontal and level using the two included mounting brackets that bolt to the side of the heater.

Section 2, Mounting the Heater Unit

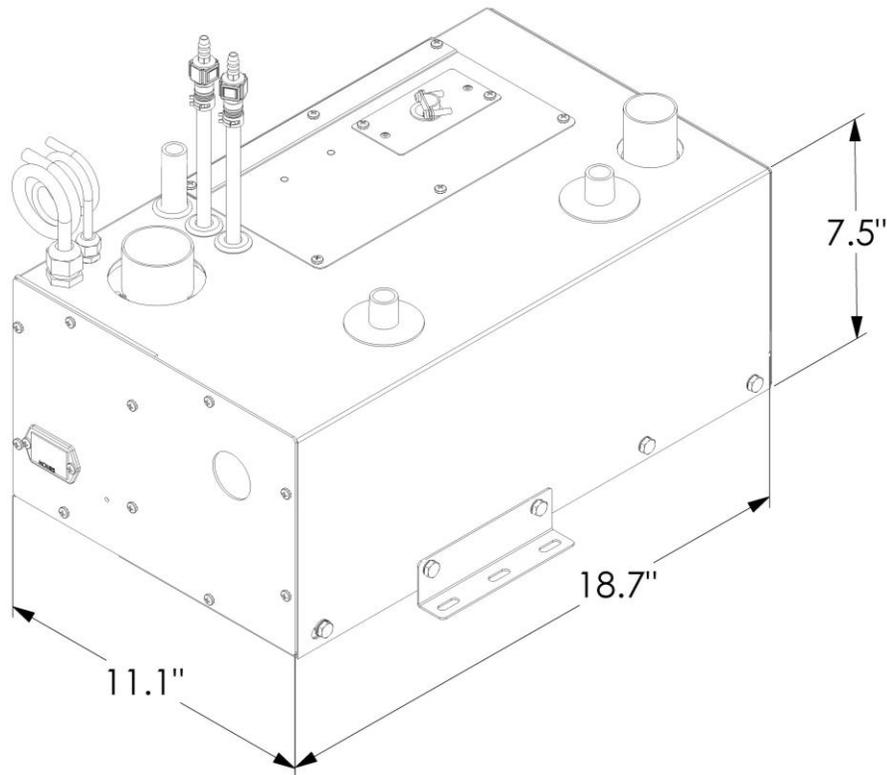


Figure 2-1: Hurricane SCH33 Dimensions

WARNING

If the Hurricane SCH33 is going to be mounted in the **diesel engine** compartment, check for adequate ventilation. Make sure there are no exhaust leaks and that all exhaust fittings are well-fastened to the heater and the muffler. Any 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 jarring.
- Mount the unit with the front panel facing out and accessible. Facing out simplifies installation, maintenance and servicing. There must be at least 12" of accessibility on top and left side of the heater for removal of the access panels and servicing of the internal components.
- Ensure that the exhaust tubing can be properly and safely routed to the outside. The maximum exhaust run with 1 90-degree bend is 12'. Any additional 90-degree bend will reduce the allowable exhaust length by 2 feet.



2.3 What NOT TO DO

Don't mount the heater without a direct connection to the combustion fan from an outside air source.

Don't mount the heater without exhaust fittings installed and the exhaust directed to the outside of the vessel.

Don't mount the heater in a location that restricts access to the service panels or creates interference with the top mounted connections.



2.4 Procedure

After choosing the mounting location for the heater unit:

1. Mount the unit horizontally

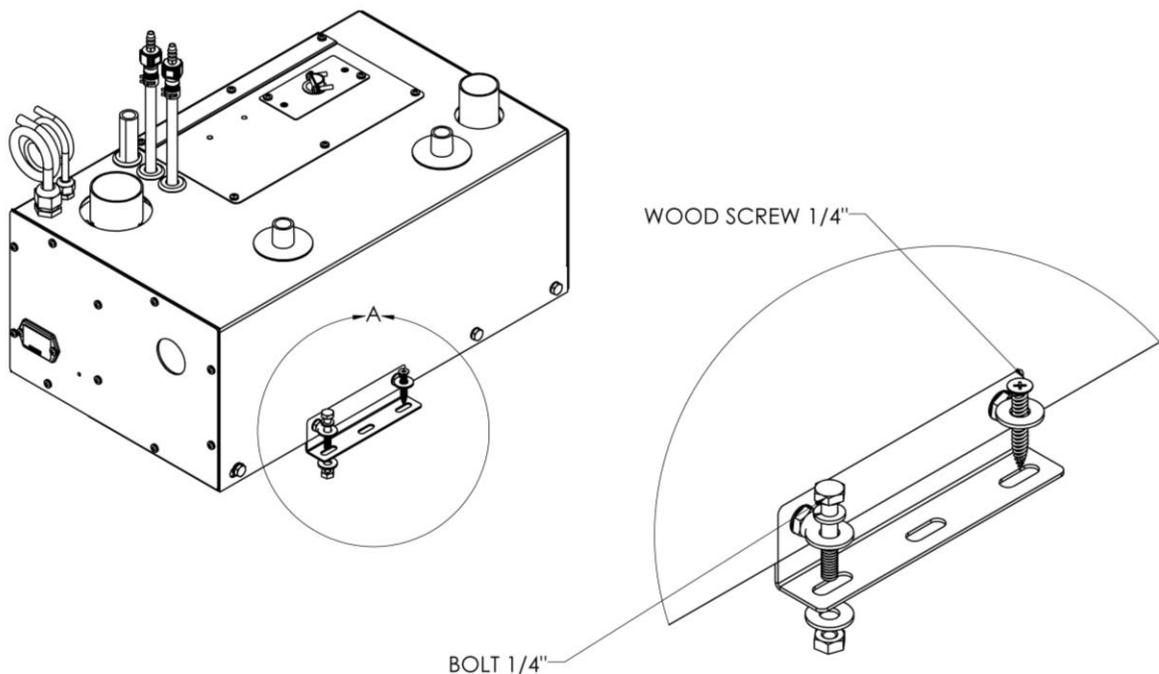


Figure 2-2: Heater Mounting Bracket Configuration

2. Secure the heater in place (against the wall, floor or a mounting platform) using the (2) supplied mounting brackets that are bolted to the heater (using the existing bolts) on each side of the bottom tray of the heater. The brackets are fastened to the mounting surface using 1/4" through bolts or wood screws with 1" diameter fender washers, lock washers and nuts. (see fig. 2-2)

2.5 Remote Operating Panel Mounting Procedure

The Basic or Touchscreen Remote Operating Panel is mounted inside the Coach, in an easy to access location. An opening for the remote panel must be cut in the wall or mounting panel. The Remote Operating Panel will be screwed in place using the 4 mounting holes.

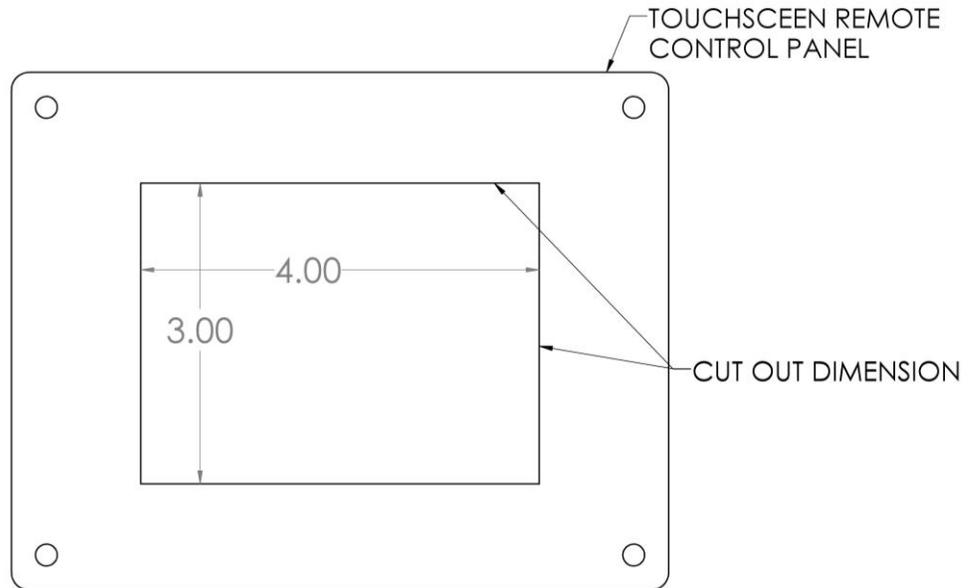


Figure 2-3: Basic and Touchscreen Operating Panel Mounting

Installing the Exhaust System



3.1 Before You Begin

For efficient and safe operation of the Hurricane SCH33™ follow all recommendations for properly installing the exhaust. Any deviations from these recommendations must be approved in advance by ITR.

! DANGER

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

- Do not operate the Hurricane SCH33 in an enclosed area unless there is adequate ventilation.
 - The Hurricane SCH33 is a direct vent system and must be installed in a compartment that is isolated from an occupied space. Combustion air must be drawn directly from the outside, without the possibility of drawing air from an occupied area. See section 3.4.
 - Heater exhaust can reach high temperatures; never install exhaust parts close to or through combustible materials without heat/fire rated protection. Heater exhaust must be directed to the outside of the vessel away from windows and inlet vents. The exhaust system must be installed following all specific ABYC standards.
-

3.2 Mounting Location

If all technical specifications for mounting the exhaust cannot be met, don't use the Hurricane SCH33 as it may perform poorly or be damaged.



Recommended Exhaust Outlet Locations

The following are recommended for exhaust outlet locations:

- Mount the exhaust outlet **outside** of the heater compartment. Be aware that exhaust fumes could infiltrate the vessel if the exhaust is not vented correctly.
- In a typical marine vessel installation, the exhaust runs from the top of the heater and exits via an exhaust thru-hull from the transom or the side of the vessel. The thru-hull is usually located 24 to 30 inches above the water-line. (various sizes and configurations of Thru-hulls are available from ITR)
- Excluding the 90° bend from the heater and without any additional 90° bends, the exhaust run cannot exceed 12'. A **min 2" radius** 90° bend within the exhaust run reduces the total allowable exhaust length by 2 feet. For example, if after the 90° bend exiting the heater, the exhaust run includes one 90° bend, the total exhaust run cannot be longer than 10 feet.
- The outlet of the exhaust pipe must be located so the exhaust exits directly out of the vessel and does not accumulate. Exhaust outlets cannot be located under an opening window or any outside air inlet vent.



Recommendations for Installation

- Combustion air must be drawn directly from outside the vessel using an approved air intake hose. An (optional) air intake silencer can be used (ITR prt#10455) see *figure 3.1*
- A muffler is recommended to limit exhaust noise. If an exhaust muffler is, used an ITR-manufactured muffler with a straight-through design (ITR prt#13008/13008L) should be used. No other muffler is acceptable.

! DANGER

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

Section 3, Installing the Exhaust System

- The exhaust must have a minimum of 3" (7.6 cm) clearance from all surfaces.
- Ensure that the exhaust cannot be plugged or restricted.
- If any part of the exhaust is run through the interior of the vessel, appropriate exhaust insulation must be used to cover the entire length of the interior exhaust run.
- The typical exhaust parts used for the Hurricane® SCH33 should include: 1.5" OD stainless steel flared exhaust elbow (ITR prt#5163), a muffler 12"/18" (ITR prt# 13008/13008L) 1.5" OD ridged stainless exhaust pipe (not supplied by ITR) or stainless flex exhaust tubing (ITR prt#5133). An exhaust thru-hull (various types available), exhaust thermal insulation (ITR prt#5135) and appropriate clamps.
- The exhaust must be supported at least every 3' of its installed length.
- Stainless U-bolt exhaust clamps (ITR prt# 8047) are recommended for joining the exhaust parts as they are able to apply enough force to seal flex tubing and pipe together.
- A small amount of sealing compound may be used in conjunction with clamps, do not overuse sealing compound, as it can clog the exhaust. Any part of the exhaust system that is damaged or deformed during the installation process must be replaced. ITR does not provide warranty coverage or claims resulting from an improperly installed heater exhaust system.
- When the heater is running, the connection points and the system must be checked for leaks. Do not operate the heater if there are any leaks in the exhaust system. Periodically, check exhaust fittings, clamped connections, exhaust tube/pipe, for leaks and integrity, also check the integrity of exhaust insulation if installed.

3.3 What NOT to DO

- Don't** mount the exhaust outlet pipe inside the heater compartment.
- Don't** mount the exhaust thru-hull in a position that will allow ingress of water
- Don't** disregard the total number of 90° bends when calculating the total allowable exhaust length (12' total, excluding the 90° bend exiting the heater)
- Don't** use any mufflers not supplied or approved by ITR.



3.4 Installation Procedure

To install the exhaust system:

Refer to Figure 3-1: Hurricane® SCH33 exhaust parts and typical configuration

- 1** Plan-out the best location for the exhaust run.
- 2** To trap water that might enter the exhaust/air intake tubing and prevent it from entering the heater, allow for a "Goose-neck" bend to be added into the exhaust and air intake run. It is best to place this as close as possible to the thru-hull.
- 3** Leave suitable air spacing to protect combustible materials. Use thermal insulation and metal shields where required.
- 4** Ensure the hot exhaust parts are isolated from any fuel lines and fuel storage.
- 5** Securely attach the exhaust fittings to the Hurricane SCH33 and align them in the appropriate direction according to the planned run.
- 6** Connect the exhaust piping in series with the muffler, using appropriately rated sealant if necessary and proper clamps. If vibration isolation mounts are used, they must be rated for high temperature. The exhaust must be supported at least every 3' of its installed length.
- 7** If using a combination thru-hull, attach flexible air-intake tubing (2" ID part# 8019) to the thru-hull. Isolate this tubing from any hot exhaust components. Ensure the run of tubing is as short as possible with large radius, non-restrictive bend(s) to ensure good air flow. (See *Figure 3-1*)
- 8** Connect the tubing to the combustion air-intake fitting on top of the heater. An optional air silencer can be used with the air intake tubing. (ITR prt#10455-1/10455-2)
- 9** Use #32 gear clamps to secure the ends of the air-intake tubing and prevent air leaks. If installing an air intake silencer make sure this is secured (clamped) as well.

Section 3, Installing the Exhaust System

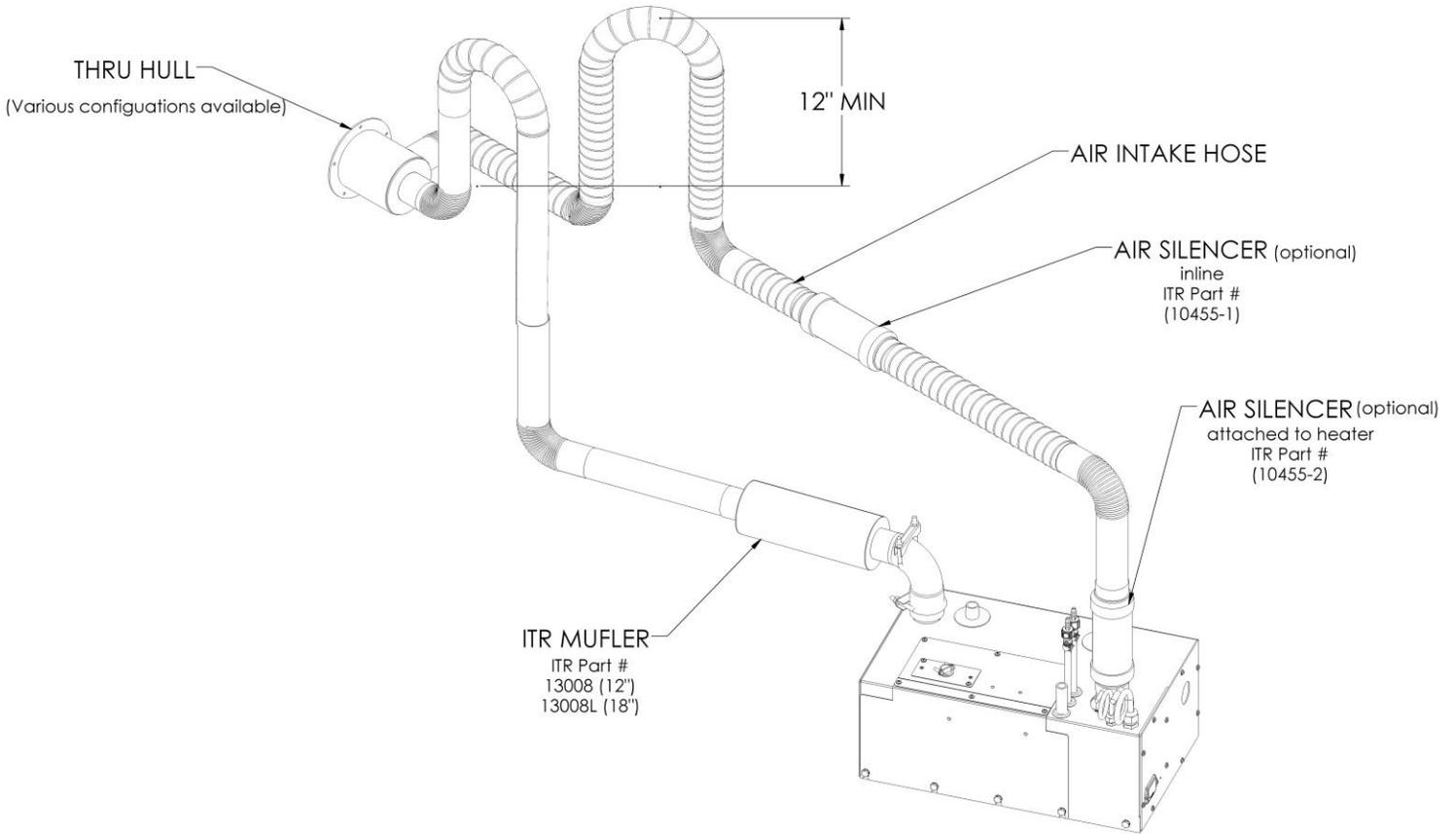


Figure 3-1: Hurricane SCH33 Exhaust Parts and Typical Configuration with optional air intake silencer

Installing the Fuel System



4.1 Before You Begin

For efficient and safe operation of the Hurricane SCH33, follow all recommendations for properly installing the fuel system. Any deviations from these must be approved in advance by ITR.

! DANGER

Use only diesel #1 and #2 in the Hurricane SCH33. DO NOT USE GASOLINE, CRANKCASE OIL, OR ANY OIL CONTAINING GASOLINE.

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

Keep gasoline and any equipment that uses gasoline away from the Hurricane SCH33 heater location. The Hurricane SCH33 is not rated for use in an explosive environment.

! WARNING

Never share the fuel supply to the Hurricane SCH33 with any other fuel-burning device.

4.2 Fuel System Installation

The fuel pump in the Hurricane SCH33 has a maximum flow capacity of 32 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.



Recommendations for Installation

The inlet/outlet, quick-connect fuel fittings are located on the top of the Hurricane SCH33 and labeled accordingly. These fittings are supplied with the male connectors already inserted into the quick disconnect fittings attached to the fuel lines on the heater. Remove the male connectors by pressing on the grey release button. They can then be attached to the vessel fuel supply and return lines.

The minimum recommended size for the fuel supply and return lines is ¼" I.D. The fuel return line should return directly to the fuel supply tank.

The following is recommended for the fuel system installation:

NOTICE

Fuel supply from the storage tank to the fuel inlet must be from a dedicated fuel pickup on top of the tank.

- The fuel supply line should be installed with minimal rise from the fuel tank. The total rise from the bottom of the pickup tube to the fuel inlet on the Hurricane SCH33 should not exceed 60". There are no minimum clearance requirements between the fuel tank and the Hurricane SCH33.

! CAUTION

The fuel line must be routed and secured to prevent damage, chafing and kinking during normal operation.

- All 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, UL and/or CSA approved fuel oil filter (not provided) must be installed inline on the fuel supply hose, between the tank and the Hurricane SCH33, in a manner that ensures easy access for maintenance. A secondary fuel filter is mounted inside the Hurricane SCH33, just behind the fuel nozzle. Both filters must be inspected and replaced as required as part of normal maintenance.
- Fuel line used must be properly rated as such and appropriate for your requirements.



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.



4.4 Procedure

To complete the fuel system installation:

- 1** Install an inline fuel filter. The optimal location is on a compartment wall next to the Hurricane SCH33, inline between the fuel tank and the Hurricane SCH33.
- 2** Connect the fuel line to the dedicated pick-up fitting on the main diesel fuel tank.
- 3** Inspect the supply fuel line for any loose connections or damage. Fittings must be airtight.
- 4** If desired, install a shut-off valve on the tank side of the fuel filter to allow shutdown and filter service.
- 5** Fuel line installation and all fuel line connections should follow ABYC standards.

Installing Fan Heaters



5.1 Before You Begin

ITR makes a variety of 12 VDC fans for heating separate or combined areas:

Small Space Cabin Fan (6095) - 0.5 Amp., 4000 BTU/h.

Low-Profile Cabin Fan (6132) - 1 Amp., 6000 BTU/h.

Standard Cabin Fan (6002) - 0.9 Amp., 8700 BTU/h.

High Output Cabin Fan (6093) - 1.6 Amps., 12000 BTU/h.

Defrost fan - 10 Amps., 20,000 BTU/h. This fan comes with a 3-speed switch. The maximum fan speed draws 10 Amps.

For best results, the fans should be mounted as close to the floor as possible. It is recommended that an individual temperature sensor (aquastat) be installed on the fans to prevent the fan from blowing cold air while the heat transfer fluid is being heated by the burner. (*Refer to Sec. 5.2-Features and Fig. 5.1 Wiring the Fan's Aquastat*)

Note: The total number of heating fans used with the Hurricane SCH33 is limited by combined BTU output and fan current draw.

NOTICE

Only the installation of ITR fan heaters is covered in this Manual. Prior approval from ITR is required if non-ITR heating fans are installed. Total fan amperage draw must be compatible with the Zone Control Board. Also, flow capacity of the heating fans must meet system requirements.

5.2 Fan System Operation

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

When the heating fan comes on, the fan draws ambient air from the interior, blows it across the heater coil and back into the interior through a vent. The movement of air into and out of the fan must not be obstructed. Reducing the supply air (draw) to the fan will proportionally reduce the flow of heated air.

Features

- ITR heating fans can be supplied with an aquastat, which prevents the fan from operating and blowing cold air when the system heat transfer fluid is below 120°F (49°C).

Figure 5-1 shows how to wire up the aquastat.

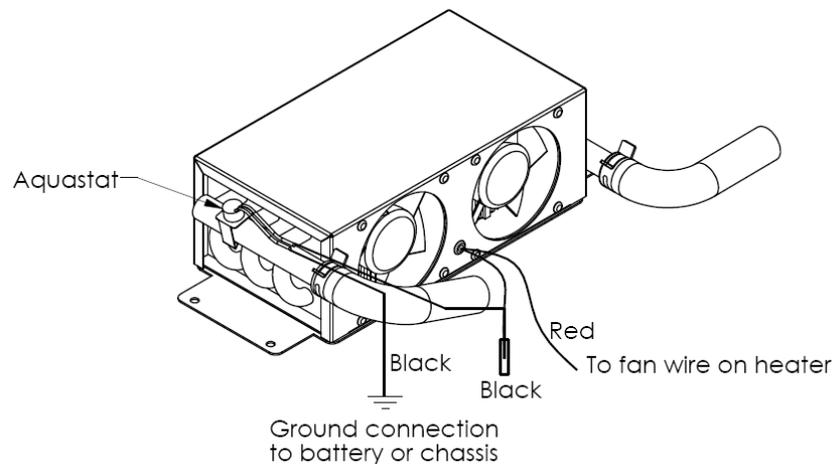


Figure 5-1: Wiring the Fan's Aquastat

- If a "passive" radiant heat system is desired (i.e., baseboard or fin and tube configurations), consult ITR for recommended installation procedures and design.

Multiple Zone Heating

Up to four thermostats (positive DC compatible) can be installed to allow separate temperature regulation of the four zones. The current draw for each zone is limited to 5 Amps. The Zone control board has a 10 Amp draw limit for all the fans across the four zones.

For larger current draw installations, contact ITR.

Accessories and Components Needed

In addition to the fans themselves, you will need at least some of the following optional accessories and equipment which is not supplied but which can be purchased separately.

- **Thermostats** — thermostats for interior installation. Digital or analog versions are available.
- **Air Outlet Vents** — Various decorative and protective covers and directional vents usually installed flush with the wall to vent heat from the heating fans.
- **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 fan blades.
- **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 coach; for use with a variety of ITR Cabin fans.
- **Three-Speed Fan Switches** — to enable low, medium and high-speed settings from inside the coach; for use with the ITR defrost heater.
- **Air Ducting** — to allow for installation of fans in a remote location (i.e., not directly adjacent to the space to be heated) and duct the heated air to its needed location. Also, **air outlet plates** to allow ducting for one, two or three separate outlets (e.g., one fan can be used 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 the Hurricane SCH33 can produce. Your system will not run effectively.
- **Don't** mount the return air outlet too close to the fan's air intake source.



5.4 Mounting Locations

Carefully choose the mounting locations of your fans:

- install the fans so heat is evenly spread throughout each zone.
- Provisions must be made to protect water lines from freezing.
- Install fan 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 compartment to allow sufficient intake of air.

ITR can suggest optimal fan locations if provided with an installation layout.



ITR's cabin heater fans come with loose or built in brackets. The fan can be mounted on the floor or on the wall, either flat or on its side.



The thermostat should not be mounted on walls outside the zone it is monitoring as this can cause false temperature readings. Mount the thermostat on an interior wall or bulkhead, away from windows, and heating fans.

5.5 Procedure



After choosing the appropriate mounting location and configuration:

- 1** Mount the fan using #10 sheet metal screws or wood screws, see *Figure 5-2: Mounting a low-profile Cabin Fan*.
- 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 the appropriate mounting location for the thermostat, as well as any fan speed switches. Instructions for wiring the thermostats to the heater are in *Sec. 6 - Electrical System*.
- 4** If an individual cabin fan draw is larger than the 5 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 (fused from the battery +'ve), not the heater's control board). See *Figure 5-3*.
- 5** To install plumbing lines to the fans, see *Section 7 - Plumbing the System*.

Section 5, Installing Fan Heaters

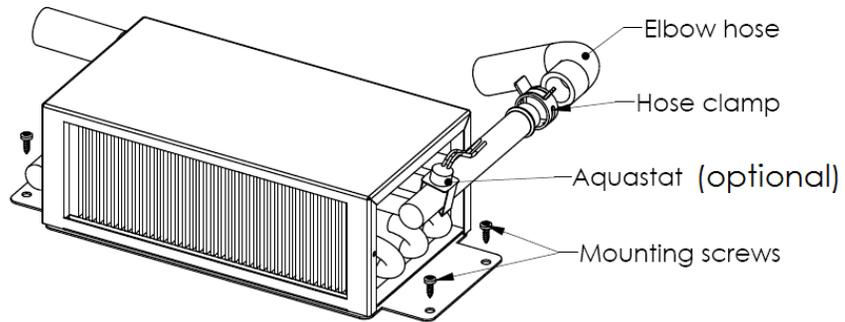


Figure 5-2: Mounting a Low-Profile Cabin Fan

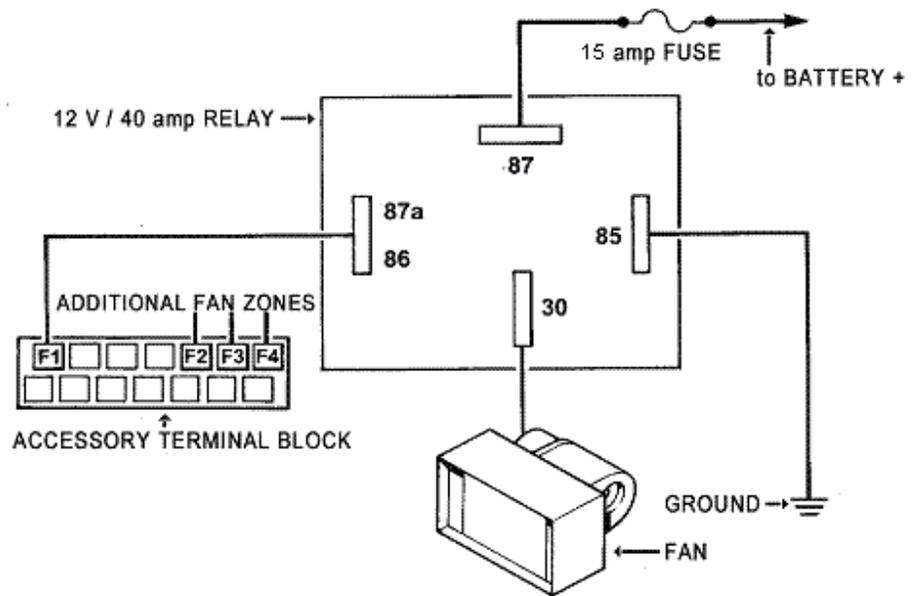


Figure 5-3: Installing a Relay for Additional Fan Amperage

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 schematic at the end of this section (*Figure 6-4.*)

! WARNING

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. All field wiring is to be in accordance with CSA Standard C22.1, Canadian Electrical Code Part I or the National Electric Code, ANSI/NFPA 70.

6.2 Hurricane SCH33 12 VDC

The following applies to the 12VDC power supplied to the Hurricane SCH33:

- There is one electrical terminal on the main control board for the primary 12 VDC power; positive (red) and negative (black). There are no direct 12 VDC power connections to the heater itself.

! WARNING

Primary DC power should originate from a dedicated connection on the house battery bank. A 25-amp fuse or breaker must be included close-to and inline from the battery to the positive connection on the control board. The gauge of the primary power wire must be sized so there is no more than a 3% voltage drop from the battery to the heater.

- The 12 VDC connections to the Hurricane SCH33 control board must be connected directly to the battery (through a fuse). There should be no battery disconnect switch between the battery and the Hurricane SCH33 control board. This is to prevent the burner from being shut down without first going through its appropriate purge period. Without a proper purge period to cool the combustion chamber, the internal components of the Hurricane SCH33 will become damaged.
- There are no switches on the control board or box that disconnect the power to the heater and/or control board once 12 VDC power has been supplied to the board.
- A properly-shielded power system is required for safe, trouble-free operation.

6.3 Hurricane SCH33 120/240 VAC

- The Hurricane SCH33 is equipped with one 1500-Watt 120 VAC (North America) or one 1500-Watt 240 VAC (Europe) electric immersion element. The connections for the electrical supply are on the top access panel, towards the back. The plate that covers the AC wiring includes a wire strain relief and is labelled AC power.
- There are three, 14-gauge, stranded copper leads that use standard AC color code (black-hot, white-neutral, green-ground). These are connected in the junction box using standard 120/240 VAC electrical connectors and terminals. These wires are to be connected to a switch and from there to a separate AC circuit breaker. The power supply wiring is secured to the AC cover plate with the strain relief.
- Power to the electrical heating element is provided through a separate, appropriately rated, switch. It is best to use a switch with indicator light to see when the element is activated as shown in figure 6-1.

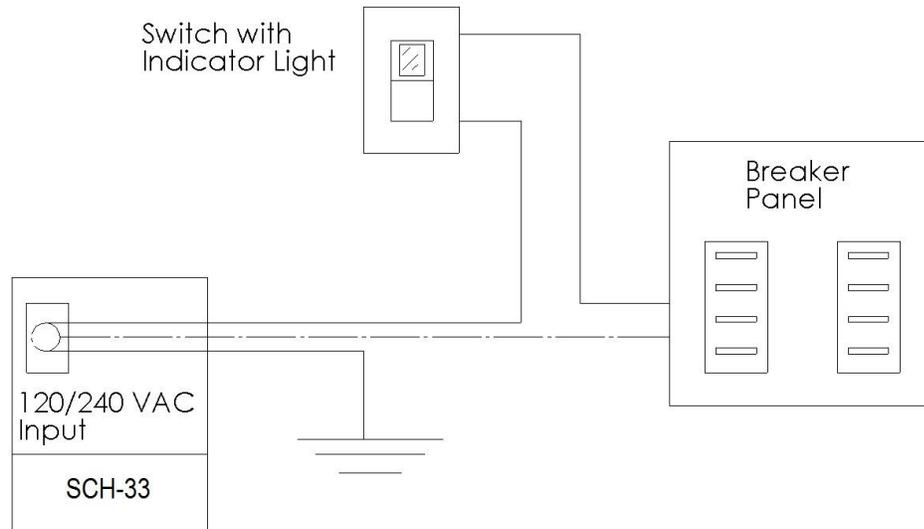


Figure 6-1: Sample Wiring Diagram for Electrical Elements

Procedure



To use only the electric heating element:

- 1** Turn ON, the switch shown in Figure 6-1. This will turn on the electric heating element and will heat the coolant inside of the tank. To ensure the electric element is activated, an amp meter can be used to check current flow through the element.
- 2** The circulating pump will turn on and circulate the heated coolant when there is a call for heat (thermostats or domestic water).
- 3** The circulating pump will continue to operate until there is no longer a call for heat.

NOTICE

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

6.4 Electrical Components

- **Control box and board** – The main control board is contained in a stainless-steel control box) and is connected to the heater via a 12' long, ½" diameter interface cable. All components in the heater unit are pre-wired to the main terminal block on the control board. *Figure 6-4 shows the connections*

- **Fuses** – The control board contains four fuse holders with fuses pre-installed. These are standard, automotive, spade type fuses available from most auto/marine parts stores.
- **Thermal Cutoff** - The heater burner box contains a non-resettable thermal cut-off that will provide protection against an overheat condition within the burner box. If activated, the thermal cut-off will stop the fuel flow to the burner nozzle. If the thermal cut-off is triggered, the reason for this must be investigated and resolved. The thermal cut-off must be replaced once it has been activated.
- **Accessory terminal block** – The following components need to be wired into the accessory terminal block on the control board:
 - Thermostats (up to four). Additional 4 zone board available for larger applications.
 - Fan heaters
 - Fan speed switches (between F1-F4 and the fans)
 - Internal Circulation pump (12 vdc)
 - Domestic water aquastat (optional)
 - Engine-heat aquastat (optional)
- **Fault bypass and reset buttons** – These buttons allow testing of the heating system by by-passing the fault-sensing circuit. This fault bypass feature is engaged by depressing and holding the top button, depressing and releasing the bottom button, and then releasing the top button. To reset the heater, turn the heater service switch OFF, then ON again.

! WARNING

Do not leave heater running unattended in bypass mode. Bypass mode runs for five (5) minutes.

- **Test points** –on the control board allow troubleshooting of the heating system. For detailed information on the use of each test point. *See Section 10, pg. 10-11.*
- **Diagnostic display** – is used to diagnose heater operating and fault conditions. The display also has signal lights for heater power and circulating pump operation.

- **Circulating pump jumper** – on the control board allows the circulating pump to operate without turning on the heater. This function is use to test the system circulation.
- **Battery connector** – is the connection points for the positive and negative power from the house battery to the heater.
- **Remote connector** – is the connection point for the cable from the Basic or Touchscreen remote panel.
- **Service switch** – allows full (service switch on) or partial (service switch off) operation of the functions of the heater control board. In the OFF position, it will only allow the circulating pump and cabin fan circuitry of the control board to run in response to both a call for heat (thermostat or domestic water aquastat) and the presence of an alternate heat source (engine or electric heating element) supplying adequate heat to the system. The operating circuitry of the burner in the heater itself is non-functional. In the ON position, all operations and features of the heater and control board are functional. In normal operation, the service switch is left ON.

NOTE: The service switch has an additional short circuit fault (# 3 - 4 - 5 - 6 - 8) reset function. This is performed by turning the service switch OFF, then ON.

- **Hour meter** – located on the front left corner of the heater, counts the accumulated operating hours for the 12Vdc burner components of the heater.
- **Basic Remote panel (option 1)** – enables the diesel burner and allows operational control and fault reset from inside the vessel; it also provides diagnostic information. The remote panel connects to the remote connector on the control board via a 25' or 50' cable.
- **Touchscreen Remote panel with Wi-Fi (option 2)** – enables the diesel burner and allows operational control and fault reset from inside the vessel; it also provides diagnostic information. The remote panel connects to the remote connector on the control board via a 25' or 50' cable. For operating instructions and Wi-Fi operation of the Touchscreen Remote refer to the "Quick Operations Guide" provided with the Touchscreen Remote.



6.5 What NOT to DO

NOTICE

Never shut off power to the heater 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.



6.6 Procedure

Consult the following table for required wire gauges and lengths. *Consult Figures 6-4 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 to Source – Feet

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

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- 1** Mount the control box as close to the heater as possible. Mount it vertically, not horizontally. Do not mount the control box where it is exposed to excessive heat.
- 2** Wire the positive terminal of the house battery through a 25-amp, heavy-duty rated fuse (using #10-gauge wire) to the positive terminal on the control board inside the main control box. Wire the negative terminal of the house battery to the negative terminal of the control board. Wire the heater ground wire directly to battery negative.

- 3** Using the recommended wire gauges, prepare all wire terminations for approved connections from the control board to each of the fan heaters and thermostats (and any optional switches).
- 4** Wire the fan heaters to the terminals in the control board using #16 wire (minimum) and a #8 fork connection on each fan. There are four terminals, F1 to F4, corresponding to the four zones. *See Figure 6-3 Wiring Diagram.*
- 5** Connect the fan grounds to the negative terminal of the battery or to an adjacent chassis ground location.
- 6** Wire the thermostats for the fan heaters to the terminals in the control board using #18-gauge wire (minimum) and a single #8 fork connection. *See Figure 6-3 for the correct terminals (T1 to T4, and T-C common).*
- 7** If domestic water heating, engine waste heat, or summer/winter loop functions of the heater are required. *See Sections 8 and 9 for details.*
- 8** If installing any optional fan speed switches, wire them to the vessels wiring system, not to the heater control board. Install the switch between the fan circuit and the positive DC fan connection using #16 wire (minimum) and a #8 fork connection. *See Figure 6-2 Wiring for Fan Speed Switch.*
- 9** Mount the Basic or Touchscreen remote panel in the living areas where it can be easily accessed. Any accessory switches should be mounted adjacent to the remote panel for ease of use.
- 10** Connect the remote cable from the control board to the remote panel.
- 11** Ensure that all pre-wired connections between the heater and control box are secure.

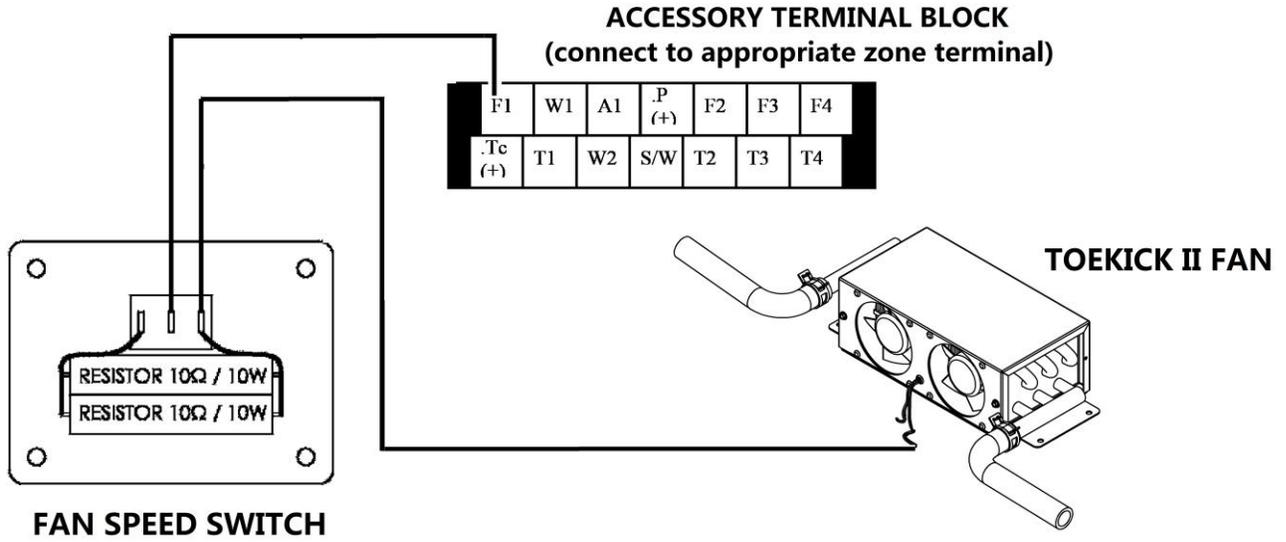


Figure 6-2: Wiring for a Fan Speed Switch

Section 6, Wiring the Electrical System

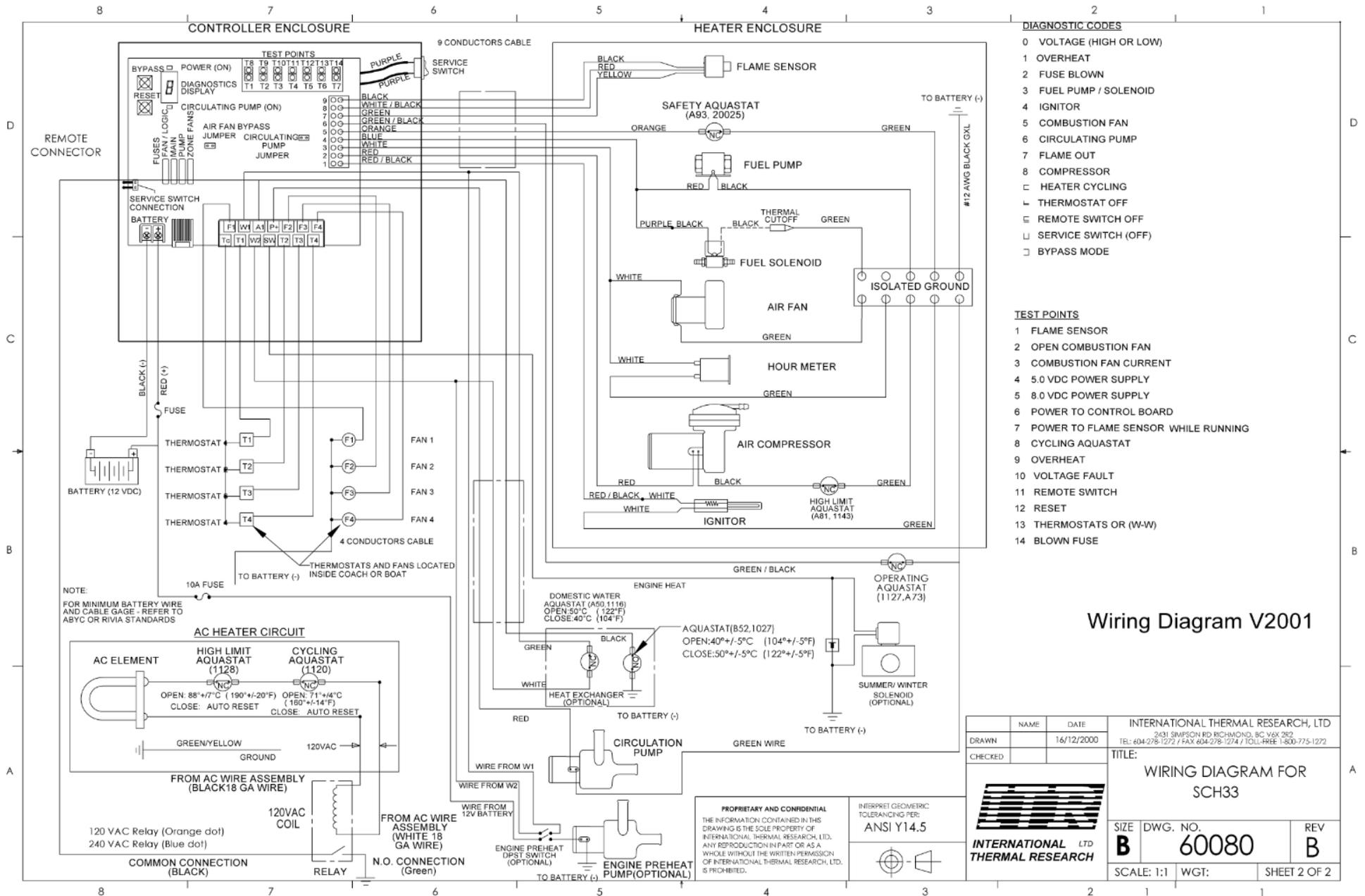
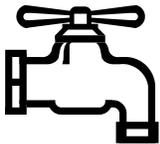


Fig. 6-3 Wiring Diagram V2001 SCH33

Plumbing and filling the System



7.1 Before You Begin

For efficient and safe operation of the Hurricane® SCH33™ Heating System, follow all of the recommendations in this section for proper installation of the plumbing system. Any deviations from these must be approved in advance by ITR.

! DANGER

The Hurricane SCH33 Heating System must use a non-toxic, propylene glycol-based heat transfer fluid (coolant) with additives generally recognized as safe" GRAS" by the FDA. Use of non-propylene glycol-based heat transfer fluid can be harmful if contamination of potable water occurs due to a leak in a heat exchanger, which can be caused if the fresh water in the system is allowed to freeze.

When there is a call for heat, the circulation pump in the SCH33 sends heated fluid to the cabin fans and potable water heat exchanger (optional).

For efficient Hurricane SCH33 Heating System operation:

- Minimize heat loss from the Hurricane SCH33 and hoses.
- Balance the heat output for each of the zones. Balancing can be done by adjusting the number and size of the cabin fans installed in each space heating zone. *Figure 7-2* shows a typical plumbing layout for circulating heat transfer fluid from the Hurricane SH33 to the cabin fans, in a single loop, and back to the Hurricane SCH33.

7.2 Heat Transfer Fluid (Propylene Glycol) Plumbing Installation Procedure

Refer to Figure 7-4: Approved Methods of Installing Heater Hose and Figure 7-1: Hurricane SCH33 Overview for the location of connection points.



1. Hose and/or tubing used to connect to the Hurricane SCH33 must be heavy duty heater hose, minimum 3/4" I.D, and or 5/8" Pex. Domestic water connections are usually made with 1/2" Pex.
2. The heat transfer fluid outlet and return connections are on top of the heater and labeled Heating Loop Supply and Heating Loop Return. The Heating Loop Supply connection is made by connecting a 3/4" ID heater hose to the 1/2" Heating Loop Supply hose via the supplied 1/2" to 3/4" hose barb adapter and hose clamps. The Heating Loop Return connection is made by connecting the 3/4" ID coolant return hose to the 3/4" MPT connection labeled "Heating Coolant Return" via the supplied 3/4" to 3/4" barb fitting and clamp. Ensure proper direction of flow.
3. All connections must be clamped (constant tension spring clamps are recommended as they do not damage the hose and retain clamp tension while the hose compresses). All connections must be tested to be leak free. ITR warranty does not cover damage caused by leaks from connections made during installation.
4. Install the cabin fans for the space heating loop by connecting the supply line to the lower port on the cabin fan and the outlet to the next fan in the series loop. Each cabin fan heater should be plumbed so that fluid supply enters the bottom of the heating core and exits from the top. This helps keep air from being trapped in the cabin fan core. Ensure proper direction of flow. Ensure there are no kinks or sharp bends that might restrict the fluid flow. All connections must be clamped.
5. Once the space heating loop has been set-up with the cabin fans, connect the space heating loop supply line to the "Heating Loop Supply" connection on the Hurricane SCH33. Connect the space heating return line to the "Heating Loop Return" connection. Refer to Figures 7-2 and 7-3

DANGER

Do not operate the Hurricane SCH33 Heating System until a proper anti-freeze (heat transfer fluid) solution has been added to the heating system and all trapped air has been bled. An inadequate mixture may cause system circulation problems and potential heating system damage and/or personal injury. Use only a non-toxic, propylene glycol-based coolant with additives recognized as safe "GRAS" by the FDA. Refer to the anti-freeze manufacturer recommendations for instructions for your application.

6. The Hurricane SCH33 and connected heating loop should be filled with water and flushed prior to operation to remove any foreign debris. At this time, the system can be inspected for leaks. The water can then be drained from the system and replaced with the proper heat transfer fluid.
7. Ensure that the coolant flow is adequate through the Hurricane SCH33 Heating System. The flow rate through the space heating loop should be at least 2.5 GPM. A large temperature difference between each subsequent fan in the space heating loop (when the Hurricane SCH33 is running and up to normal operating temperature) is an indication of inadequate flow. In a properly flowing system, each fan in the space heating loop will have an outlet temperature that is only a few degrees cooler than the preceding fan. The temperature difference will be larger if the fan has a higher BTU output.
8. Slip-on foam insulation coverings may be used over the hose fittings to reduce heat loss.

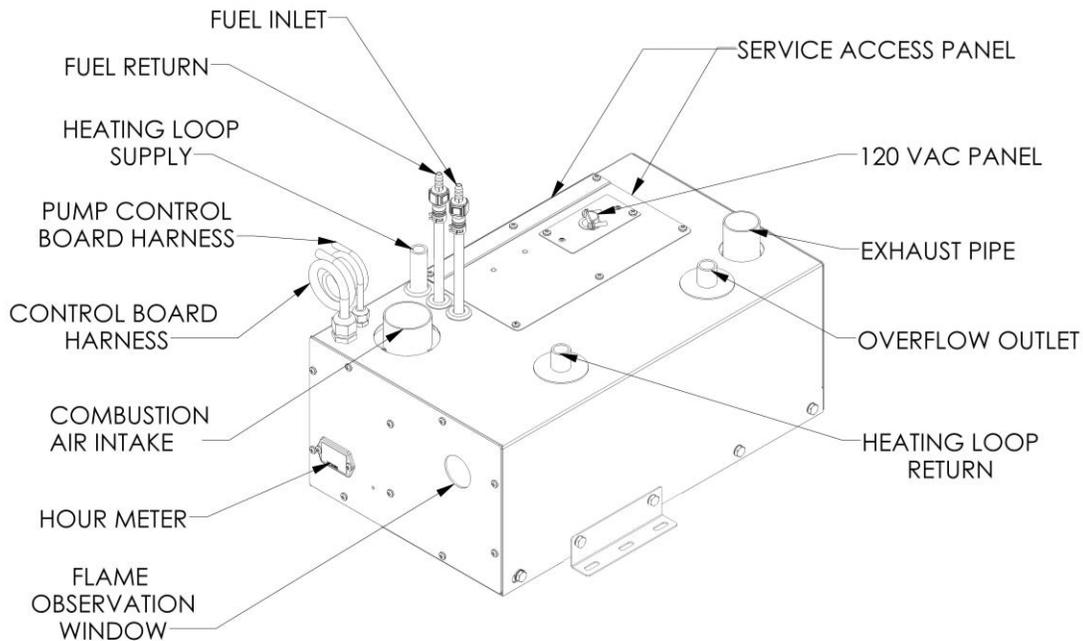


Figure 7-1 Hurricane SCH33 Overview

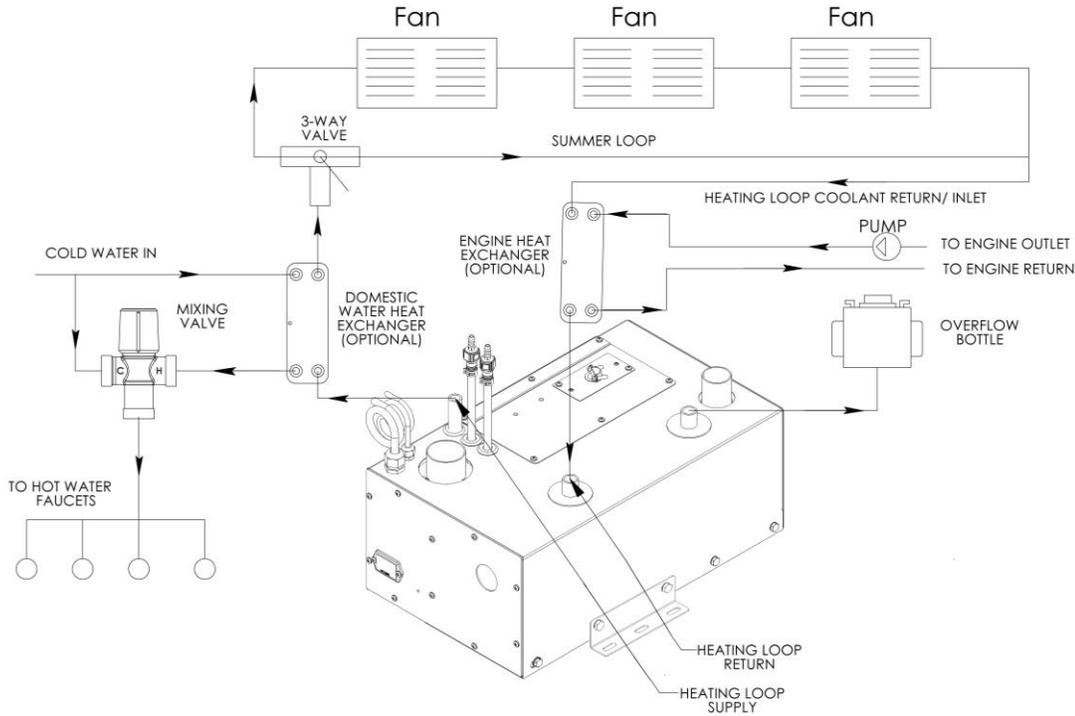


Figure 7-2: Plumbing Hurricane SCH33 with optional summer loop for potable water and engine waste heat/pre-heat options

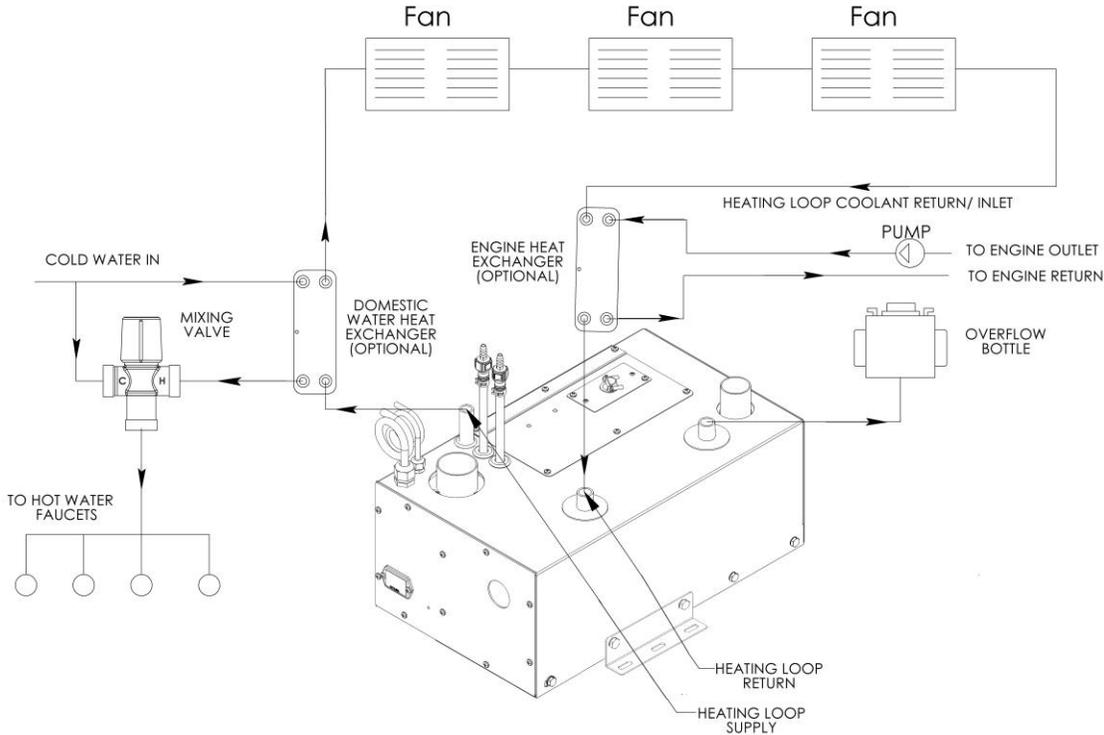


Figure 7-3: Plumbing Hurricane SCH33 with potable water and engine waste heat/pre-heat options



7.3 What NOT to DO

The Hurricane SCH33 Heating System's heat transfer fluid (coolant) distribution pump is one of the most critical parts of the system. Never let the pump run dry or damage will occur to the rotor. This is not covered under warranty.

Don't use low-quality heater hose for the space heating loop.

Don't let the space heating loop 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.

Don't let the hoses come in contact with any hot exhaust parts.

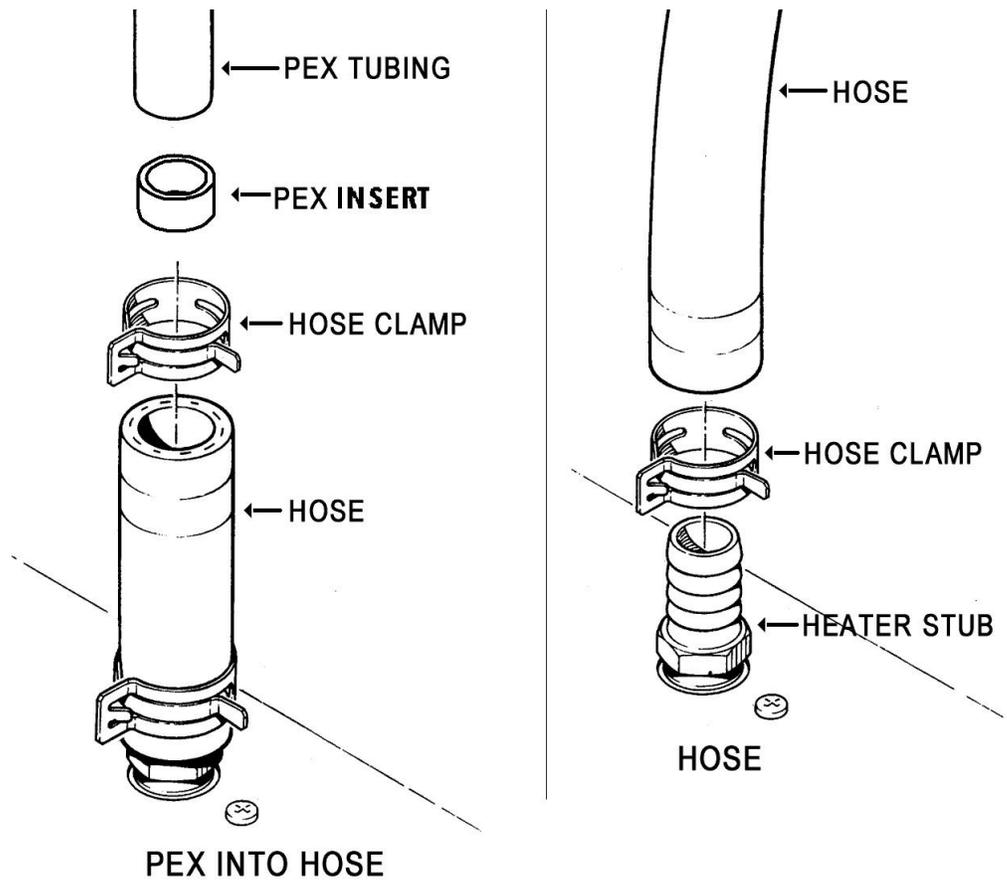


Figure 7-4: Approved Methods for Installing Heater Hose (consult ITR for alternative methods and products)

7.4 Potable Water Plumbing Installation (optional)

If a potable water heat exchanger is added to the system it should be installed in the heating loop before the first fan (see Figure 7-2). If a summer loop is being used, the potable water heat exchanger should be installed before the 3-way valve (see Figure 7-3).

The maximum water supply pressure to the heat exchanger is 150 PSI (10 bar). The Hot water outlet temperature must be regulated by an external mixing valve, factory set at 120F (49°C).

All potable water connections should be made with a crimped, Pex to Pex connection.

NOTICE

ITR warranty does not cover damage caused by leaks from connections made during installation.

WARNING

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

7.5 Engine Waste-heat and Engine pre-heat Plumbing (optional)

If the optional engine heat exchanger is used it should be plumbed into the heating loop as shown in Figures 7-2 and 7-3. The coolant in the engine loop should flow through the engine heat exchanger in the same direction as the coolant flowing through the heating loop. When the Hurricane SCH33 is connected to the engine, engine waste heat can be used to provide space heating and hot water. The Engine Heat Supply/Return connections can be made using 1/2" MPT x 1/2" hose-barb or 1/2" MPT x 3/4" hose-barb fittings.

Note: some heat exchangers are available with 1/2" FPT or 3/4" FPT connection ports. Contact ITR for availability.

If the pre-heat function is required an additional, externally mounted, pump needs to be installed. This pump circulates engine coolant through the engine heat exchanger, when the engine is not running. A separate Engine Pre-Heat switch is required to activate this pump. For engine heat/pre-heat electrical connections *refer to figure 6-3 wiring schematic in Section 6, Wiring the Electrical System.*

It is recommended to contact the vessel/engine manufacturer prior to proceeding with the engine plumbing installation.

WARNING

Prior to operating the engine pre-heat pump, the engine coolant loop must be connected to the engine heat exchanger, and the coolant lines purged of air. Failure to purge the engine coolant loop prior to operating the circulation pump, will damage the pump.

7.6 Procedure for Filling/Purging the Hurricane SCH33 Heating System

- 1** Do not operate the Hurricane SCH33 until the entire circulation system has been filled with the proper heat transfer fluid solution and all trapped air has been bled from the system. An inadequate mixture may cause system circulation problems and potential system damage and/or personal injury.

Use only a non-toxic, propylene glycol-based coolant with additives recognized as safe "GRAS" by the FDA. Refer to the anti-freeze/heat transfer fluid manufacturers recommendations and instructions for your application.

- 2** Remove the front cover of the Hurricane SCH33, also remove the cover of the control board to provide access to the circulation pump jumper on the circuit board *See diagram below*. Using a self-priming pump, fill the system through the filler port (3/4" hose barb connection) located at the bottom of the tank with the proper mixture of propylene glycol-based antifreeze/heat transfer fluid. Some manufactures refer to heat transfer fluid as boiler anti-freeze; the solution is often pre-mixed and should not be diluted. See the manufactures recommendations for dilution requirements if the fluid is not pre-mixed.
- 3** When the fluid starts to run into the overflow bottle, turn off filling pump and place the pump circulation jumper onto both pins on the control circuit board. The Hurricane SCH33 internal pump will run and circulate fluid through the entire system. The fluid level in the overflow bottle will drop as the air in the system is displaced with fluid. Turn on the filling pump and refill the overflow bottle to the "Minimum when cool" level.
- 4** When this level is reached, turn OFF the filling pump, and keep the jumper in place until the system is purged of air and the coolant level in the overflow bottle does not change.
- 5.** Once the system has been purged of air, remove the jumper from both pins and place it on one pin. The jumper is stored in this position. The pump Bypass should remain off during normal operation. It is only used to fill and purge the system. The shut-off valve on the filler hose must be in the closed position when the system has been filled

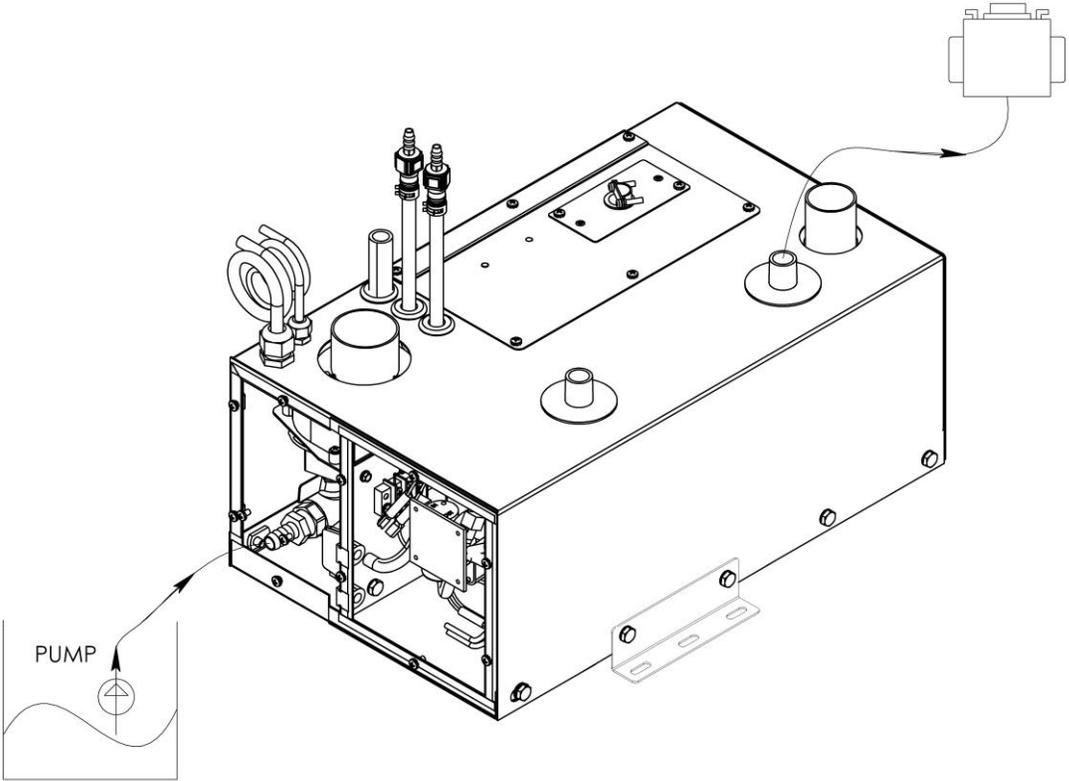


Figure 7-5 Filling/Purging Hurricane SCH33 Heating System

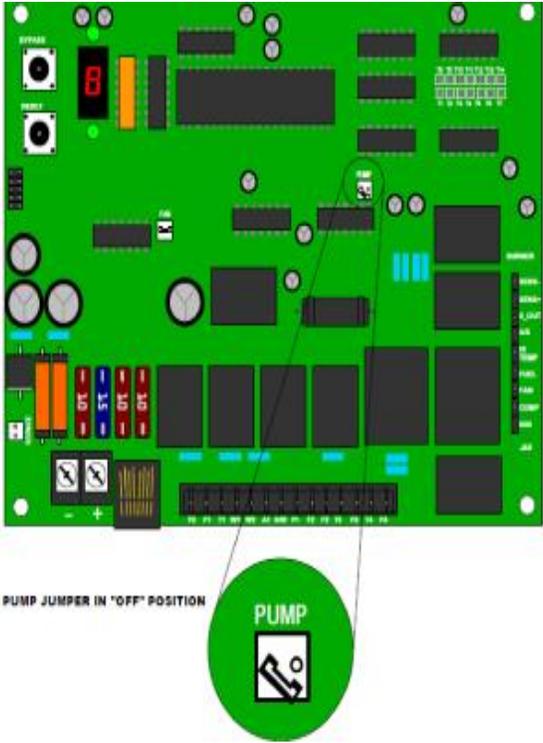


Figure 7-6 Hurricane SCH33 control board pump by-pass jumper location

Domestic Hot Water Heating Engine Heat Management



8.1 Before You Begin

The Hurricane® SCH33™ can provide domestic hot water by being plumbed to an optional external heat exchanger or a separate domestic water heater (with an internal heat transfer coil). An adjustable aquastat (ITR part # 1024) is usually fastened onto the water heater in a location where it can sense the temperature of the water in its storage tank. On an external heat exchanger, a pre-set, clip-on style aquastat assembly (ITR part #37219) is fastened to the cold-water inlet port of the heat exchanger. In both cases, the aquastat is wired to the W1 and W2 terminals on the main control board to control the burner and circulation pump. It is recommended that a manual switch be wired in series with the aquastat. *See sec. 8.2 Domestic water sensing switch.*

When the Hurricane® SCH33™ is used only for heating domestic water and space heating is not required, an optional three-way valve or electric solenoid can be installed. This configuration is referred to as a summer loop. *Refer to Fig. 8-1.* The valve/solenoid is intended to divert the heat transfer fluid through the heat exchanger but not the space heating loop. If a manual valve is used, it should be mounted in an accessible location. For details of the electrical connections for a solenoid. *Refer to Figure 6-3 wiring schematic in Section 6, wiring the electrical system*

Also, waste heat from the engine can be transferred to the heating loop for supplemental heat via an optional second heat exchanger. With the addition of an optional secondary circulation pump, this heat exchanger can also be used to pre-heat the engine.

For help with wiring the electrical components of the heat exchanger, *refer to Figure 6-3 wiring schematic in Section 6, Wiring the Electrical System.*

8.2 Domestic Hot Water System

A heat exchanger is located external to the Hurricane SCH33 to provide continuous hot water once the cycling temperature of the heater has been reached. The burner must be operating in order to supply hot water for more than a few minutes.

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

Heat exchanger — The ITR supplied stainless-steel flat plate heat exchanger is UL and CSA approved for domestic water heating. If a hot water heater with an internal heat transfer coil is used, this heat exchanger can be added to provide quick recovery and continuous hot water output after the hot water storage has been depleted.

Aquastat — An aquastat (temperature sensor) signals the burner to fire and maintain system cycling temperature when there is a call for hot water. The ITR heat exchanger uses a pre-set aquastat assembly (part #37219) an independent water heater uses an adjustable aquastat (part #1024).

Mixing valve — For temperature control of the domestic water and to prevent scalding (water temperature could reach 180°F (82°C)) a water tempering valve (part#24558) must be installed. It is recommended to install a water tempering valve (mixing valve) supplied by ITR pre-set to 120°F (49°C). The mixing valve works automatically to maintain the preset maximum temperature

Domestic water sensing switch — If desired, you can install a manual switch to turn the domestic hot water sensing circuit on and off. This switch is connected to the W1 and W2 terminals on the accessory terminal block. *Refer to Section 6, Pg. 6-9, Figure 6-3 Wiring Diagram*

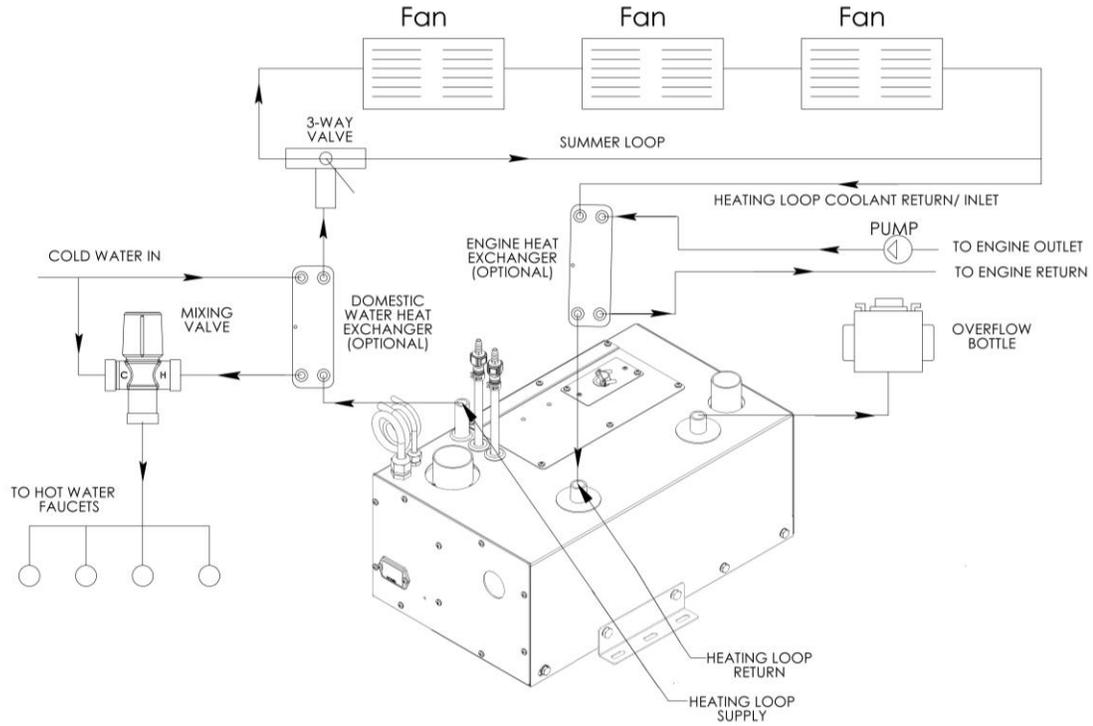


Figure 8-1: Single Loop System, three fans, optional summer loop

8.3 Engine Waste Heat Function

As outlined in section 7, the Hurricane SCH33 can be used to preheat the engine and to use waste heat produced by the engine using an optional engine heat exchanger.

While running, a liquid-cooled engine produces a large amount of heat; some of this heat can be captured by the Hurricane SCH33 and used to heat water and or provide space heating. An aquastat (part #1027) attached to the engine heat exchanger, wired to the A1 terminal, on the main board (see Section 6, Pg. 6-9, Figure 6-3 Wiring Diagram) will start the internal circulating pump if a thermostat or the domestic water aquastat is calling for heat.

NOTE: The engine heat function can be used with the control board service switch ON or OFF.

NOTICE

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 connections to the engine cooling system.

Procedure

To set up the engine waste heat reuse function:

- 1 Turn OFF, the ON/OFF control switch, located on the remote indicator panel. This will stop the burner from operating, but all other heater functions will operate normally. Start your engine.
- 2 When the engine aquastat heats up to its preset temperature, it will automatically switch on the circulating pump of the heating system (if any thermostats or domestic water aquastat are calling for heat). All other functions of the system will operate normally.
- 3 The circulating pump will continue to operate until the engine aquastat has cooled down or all thermostats or domestic water aquastat are satisfied. A manual switch can be wired in series with this aquastat to shut down the pump sooner if required.

8.4 Engine Pre-Heat Function

As an option, the externally mounted heat exchanger can also be used to pre-heat the engine before starting it. This requires a pump to be installed in-line with the engine side of the coolant loop. 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 with a manual switch (not supplied), while the engine is **off**. The switch turns on a separate (not included) engine pre-heat pump and is usually mounted in a convenient location near the heater remote control. The manual switch and engine pre-heat pump are wired to the vessels 12 Vdc electrical system.

Procedure

To set up the engine pre-heat function:

- 1 Mount a manual switch (SPDT - Single Pole Double Throw) in an appropriate place in the interior, usually near the dashboard.

Section 8, Domestic Hot Water Heating

- 2** Wire one set of contacts on the manual switch to the engine pre-heat pump by connecting it to the main feed on the control board that connects to the vessels power source (beside the battery connection). This circuit should include a 10 Amp fuse on the power side. Wire the other set of contacts on the manual switch to the W1 and W2 terminals on the control board. See Figure 6-3 in Section 6, "*Wiring diagram for SCh33*" for details.
- 3** Connect the ground-wire of the engine pre-heat pump to battery negative.
- 4** To test the engine pre-heat function, turn on the heater and allow it to come up to temperature (about 10 minutes). Turn on the manual switch to start the engine pre-heat pump function. Start the vehicle engine once it has had sufficient time to pre-heat to about 40°F (5°C) above ambient temperature.

Operating the Hurricane SCH33 heating System



This section describes the features, operation and maintenance of your new Hurricane SCH33™ Heating System. READ THESE INSTRUCTIONS AND SAVE FOR REFERENCE.

9.1 Features of the Hurricane SCH33 Heating System

The Hurricane SCH33 Heating System uses an 33,000 BTU (true output) diesel burner controlled by a 12 VDC, multi-functional electronic controller as the primary source of heating a heat transfer fluid (anti-freeze and water). Also, one 1500-Watt, 120 VAC immersion element is used as a secondary heat source to provide an additional 5,000 BTUs of heat when AC power is available. Through the use of an integral circulation pump, the heated transfer fluid is distributed to all space heating areas. The Hurricane SCH33 can provide domestic hot water using an optional external heat exchanger and mixing valve. The SCH33 can also be used with an optional engine heat exchanger to make use of engine waste heat. An optional engine preheat feature is provided using an additional, externally mounted engine coolant circulation pump. For a visual reference of the features of the Hurricane SCH33, refer to Chapter 7, figures 7-2 and 7-3 pg.7-4

Main features of the Hurricane SCH33:

- Built in coolant distribution pump for supplying coolant to multiple heating fans in a single loop, located in up to four different zones.
- The option of an external heat exchanger and mixing valve for heating domestic water using heat transfer fluid heated by the diesel-fueled burner and/or engine waste heat. A second optional heat exchanger can make use of engine waste heat and also provide vessel engine pre-heating with the use of an optional, externally mounted engine coolant circulation pump.

Section 9, Operation

- Continuous, on demand hot water, if optional heat exchanger and mixing valve are used. The system increases ground water temperature by 60F at a flow of 1 GPM (using only the diesel burner). An external, adjustable mixing valve (factory pre-set), will limit the temperature to 120F.
- One 1500-watt, 120 Vac electric immersion element for supplemental heat. When plugged into shore power, using the electric element decreases burner use frequency and provides a quieter environment inside and outside the yacht.
- Easy to install and field serviceable with hookups and connections easily accessible from the top of the heater.
- Easy to fill and purge and drain.
- Zero pressure system; no need for a separate expansion tank.
- A high-temperature, stainless steel burner and stainless-steel transfer fluid jacket. Marine grade stainless steel exterior enclosure.
- Unique, self-purging, 1.2 US gallon, welded and insulated stainless steel transfer fluid tank that minimizes heat loss and optimizes heat recovery.
- Quiet operation.
- Low pressure fuel system with built-in fuel pump.
- Fuel efficient burner capable of burning a wide variety of diesel-based fuels (CSA/UL certified for diesel #1 and #2).
- Exhaust has minimal smoke and smell.
- Fan assisted, sealed combustion chamber designed to use outside combustion air.
- Simple, low amperage draw ignition.
- Electronically-controlled system with automatic safety Shutdown
- Manual-resettable aquastat for safety overheat protection.
- Patented, proprietary flame sensor.
- Basic or optional Touchscreen remote control to operate the diesel burner and provide diagnostic information.
- System control panel with LED fault indicators, operational and diagnostic information.

9.2 Starting the Heater

The initial start of your **Hurricane SCH33** heater must be done by an authorized service person. Be sure that all components have been properly installed according to the instructions laid out in this manual before the initial start.

! DANGER

Never attempt to start the heater without the burner faceplate securely fastened to the burner box

! WARNING

Do not operate the Hurricane SCH33 Heating System until it is filled with a suitable heat-transfer (water/anti-freeze) solution and all trapped air has been bled or removed.

The major steps in starting the heater are as follows:

For TouchScreen Remote functions, refer to the "Touchscreen Remote (V2001) Quick Operation Guide" supplied with the touch screen.

1. Start the heater by switching the service switch to ON. This switch is located on the side of the electronic control box.
2. Turn up the zone thermostat to a setting higher than room temperature.
3. On the Basic or Touchscreen Remote, activate the burner.

9.3 Signs of Normal Operation

- When the service switch on the side of the control box is switched ON and the burner is OFF on the Basic or Touchscreen remote, the combustion air intake fan will run for two minutes together with the circulating pump. (Whenever the combustion fan runs, the pump will also run. The green LED, visible at the bottom of the display window on the control board, indicates the pump is running).
- When the burner switch is turned ON, and there is a call for heat in one of the space heating or domestic water heating zones, the ignitor will turn ON. After 10 seconds, the combustion fan will shut off for about a second, at which point the fuel pump, fuel solenoid, air compressor and combustion fan all turn ON at the same time. This results in atomized fuel being sprayed into the combustion chamber to be ignited to start combustion.

- After the ignition period (about 10 seconds), the igniter will shut OFF, and the burner will continue to operate. The heater will operate until the domestic water and all zone thermostats are satisfied, or until the heater reaches its normal cycling temperature of approximately 180°F. Once this happens, the burner will cycle off and the combustion fan will operate for an additional two minutes to purge the system.
- If normal cycling temperature is reached, but a zone thermostat or domestic water aquastat (temperature sensor) is not satisfied, the circulating pump will continue to operate. If the requirement for heat cannot be satisfied by the residual heat in the system, the burner will restart and cycle until the demand for heat is satisfied. At this point the heater will cycle OFF and the combustion fan will continue to run to purge the system for 2 minutes. The circulating pump will also run until the combustion fan stops.

9.4 Main Control Board Operation

Once the heater is operating normally, you must check the safety functions of the main board. To ensure these functions work properly, place a short piece of hose or a tube over the sintered bronze compressor inlet filter. Put your finger over the end of the hose/tube to stop the flow of air into the compressor. This will stop the flow of fuel through the nozzle and the burner will flame-out. If you continue to block the air inlet, the heater will try to restart two times; failing to do so, it will shut down, stopping the compressor and fuel pump. The control board will display a code 7 (flame-out). This verifies proper operation of the safety functions of the main control board. Reset the fault by turning the burner OFF and ON at the remote panel. After this reset, the burner will restart and the heater will continue with normal operation.

9.5 Stopping the Heater (for Seasonal Purposes)

NEVER shut off the power to the heater using the circuit breaker or a master switch, or disconnect the battery while the heater is running. Doing so will cause serious damage to the Heater, which will not be covered under warranty.

To turn the Heater OFF, turn OFF the burner on the Basic or Touchscreen remote control panel. Turn OFF the ON/OFF service switch on the main control board box. The heater will automatically run through the two-minute purge cycle. The heater will not start gain even if there is a call for heat from a thermostat or domestic water.

9.6 Using the Electric Heating Element

The electric heating element can be activated using the separate installed switch, the installation of which is described in Sec. 6 of this manual, pg. 6-2 and 6-3. If the switch has an indicator light, this light will come on. The electric heating element is operated independently from the control board. Sensors on the heater are monitoring the tank temperature and are controlling the activation of the heating element. When the tank reaches a certain temperature, the heating element will automatically shut off. The 1500-watt heating element provides about 5000 BTU and draws 12.5 Amps from the 120 VAC circuit.

9.7 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 and loop pump to be enabled. Once the room temperature has reached the temperature called for by the thermostat the cabin fan will turn off.

9.8 Activating the Domestic Hot Water

Burner or AC Heat or Engine Heat Source Available

Ensure that a heat source has been selected (i.e., Burner, AC, Engine). The production of potable hot water is **continuous** when the burner is operating and **limited** when using AC or engine heat.

NOTICE

The potable water pump is not a part of, nor controlled by the Hurricane SCH33 Heating System.

9.9 Domestic Water Temperature Adjustment

When the optional domestic water heat exchanger and mixing valve are installed, the Hurricane SCH33 will produce a domestic water temperature rise of 60°F at a flow rate of 1.0 GPM. The mixing valve is factory set to limit the maximum water temperature to 120°F (49°C).

NOTICE

The mixing valve will compensate for temperature variations of incoming supply water and maintain the temperature at which it is set. However, in some cases, the temperature of the incoming water and the flow-rate demand of multiple faucets may limit the ability of the Hurricane SCH33 to provide hot water at the temperature setting of the mixing valve, even if the mixing valve is set to its maximum. This is a normal operating characteristic of any on-demand, continuous hot water system that does not rely on heat retained within a stored volume of water. In this situation the temperature of the hot water may be increased by lowering the flow at the faucet and shower head.

9.10 Stopping the Heater (for Maintenance)

To shut down the heater totally, for maintenance purposes:

1. Turn OFF, the service switch on the electronic control box.
2. Wait until the heater has completed the purge cycle and turned OFF.
3. Disconnect the power supply.

9.11 Resetting a Fault

When a fault occurs and has been identified and corrected, the system can be reset by switching the service switch on the side of the main control box or the remote control switch OFF, then ON again. This will reset the fault and the diagnostic code.

Note: Component faults can only be reset using the service switch.

9.12 Electrical Noise

Noise is an unwanted electrical signal, which produces undesirable effects in the electronic circuits of the control system and we must be aware of techniques to minimize the electrical noise on these controllers. The majority of problems stem from crude wiring practices and techniques, which allow "coupling" or the transfer of electrical noise into the control circuit from the noise source.

A common symptom is the system behaves erratically, that is, evidence of a problem does not appear consistently. Even worse, it may give several different indications of a problem. Low power level controllers that use electronic logic, especially those using integrated circuits, are more sensitive to noise. A typical noise source is any piece of equipment that can cause or produce very rapid or large amplitude changes in voltage or current when turned ON and OFF. A single side band transmitter is an example of this type of equipment.

Noise sources:

- Loose connections
- Switches and relay contacts operating inductive loads, such as motors, coils, solenoids, and relays etc.
- All welding machinery
- Heavy current carrying conductors
- Fluorescent and neon lights

The sensor input and power output lines, as well as the power source line, all have the potential to couple or link the control circuit to a noise source.

Common Impedance Coupling occurs when two circuits share a common conductor. An example would be operating multiple, separate loads and the return lines from all are connected together and run back to the power source with one conductor. The best way to prevent this is to use independent leads for each return circuit and terminate them all at the same physical point.

Magnetic (Inductive) Coupling generally appears where there are wires running parallel or in close vicinity to each other. This is especially true when the wires from several different circuits are bundled together in order to make the system wiring appear neat.

Electrostatic (Capacitive) Coupling is a function of the distance the wires run parallel with each other, the distance between the wires and the diameter of the wire. The best way to eliminate these is to run separate leads from separate circuits in separate bundles, taking special care to keep AC* (high power lead) wires separated from DC (low power level) wires. If it is at all possible, twisted lead pairs and shielded cables should be used.

Electromagnetic (Radiation) Coupling occurs when the control circuit is very close to a high-energy source that is capable of magnetic or electrostatic induction of a voltage. A common source of such radiation is an inverter, alternator, generator, motor transformers, fluorescent lights, radio, TV, and navigation equipment.

*Note that special attention should be given to the AC power line because it is a source of unusual types of noise-related problems in control circuits.

9.13 Maintenance

Refer to section 11 of this manual for more detailed maintenance information

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, fuel fittings and connections, plumbing fittings and connections, for leaks and integrity.
- Exhaust and air-intake for obstructions.
- Fuel lines around fittings for leaks and integrity.
- External fuel filter for clogging/replacement.

Annual Service Requirements: Perform the following:

- **Prior to operation for the season, a factory service tune-up of the Hurricane SCH33 Heating System should be performed by a trained service technician.** Only personnel familiar with the equipment and its operation should perform the service tune-up. It is recommended that a certified dealer be contacted for this service; if a local dealer is not available contact ITR for information on service resources.
- As a general guide, the regular maintenance items such as the igniter, fuel filters (nozzle filter and external filter), and air compressor filter 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 serviced or 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 Hurricane SCH33 must be removed along with the burner box cover. The fuel block must then be removed from its mounting position. Finally, the burner and combustion tube must be taken out by removing the nuts holding the burner box and tube 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.

9.14 Protecting the Heating System

NOTICE

Protect the Hurricane SCH33 from temperature extremes and any dusty, dirty, corrosive environment.

! DANGER

Protect the Hurricane SCH33 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. Read and follow the anti-freeze manufacturer's instructions for the type of anti-freeze and mixture recommended for your application.

NOTICE

Note that potable water will freeze in cold temperatures and will damage the heat exchanger, mixing valve and associated fittings. For winterization, it is recommended that the potable water system be flushed with winterizing antifreeze that is safe for use in the potable water lines. Alternatively, the potable water lines can be blown out with air. Note that this method is not as reliable as using winterizing antifreeze.

Troubleshooting

10.1 Overview

The electronic board consists of a flash microcontroller programmed to monitor the timing and safety functions of the heater. Each time the board is energized by a call for heat, it will check its own circuits for any problems. Should a problem exist, the board will shut down.

You can easily monitor your Hurricane® SCH33™ heater's operation by checking the electronic control box. Any fault or problem will be immediately picked up by the control board and an LED diagnostic code indicator will light up to pinpoint the fault. Once the fault has been corrected, it can be reset by switching the service or remote switch OFF, then ON again. The diagnostic codes are described below.



10.2 Power On (Green)

The POWER ON indicator is lit whenever the service switch on the control box is ON and if the remote panel is switched ON, a small red LED near the lower right-hand side of the digit on the remote panel will also glow. If this light does not come on, check to see if the service switch is ON.

If the power on light does NOT come on:

- Check for a blown fuse.

10.3 Burner On

No diagnostic code will be displayed on the main board or the remote panel when the burner is ON and operating normally. A small red LED will glow near the lower right-hand side of the digit on the remote panel, indicating it is ON.

10.4 U – Service Switch Off

The service switch is switched OFF.

- The burner will shut down if it has been running.
- The diagnostic code U will be displayed.
- The control board will purge the system with the combustion fan and circulating pump for two minutes. At the end of the purge period, the system will power down and will go into a low power consumption mode (10mA max.). There will not be any display or LED's lit.

10.5 E Remote Switch Off

The remote panel is switched OFF.

- The burner will shut down.
- The diagnostic E code will be displayed.
- The control board will purge the system with the combustion fan and circulating pump for two minutes.

If the remote switch is put in the ON position, the control board will resume operation and a small red LED will glow near the lower right-hand corner of the digit. If there is no diagnostic code displayed or small LED glowing:

- Make sure the service switch is ON.
- Make sure the remote switch cable is plugged into the control box and remote switch.
- Make sure the remote rocker switch is working.
- Check the cable continuity.

10.6 C Heater Cycling (Normal Operation)

The operating (cycling) aquastat installed on the coolant tank of the heater has been satisfied.

- The burner will shut down.
- The diagnostic code C will be displayed.
- The control board will purge the burner with the combustion fan for two minutes and then stop. The circulating pump will run until the last thermostat is satisfied, then purge for two minutes and stop.

Section 10. Troubleshooting

- To maintain the system temperature the operating aquastat will cycle the burner off at 170° F (77°C) and on again at 149°F (65°C).
- If the heater cools and fails to resume operations and the diagnostic code **C** continues to be displayed, the aquastat is faulty or has an open connection.

10.7 E - Thermostats off (Normal Operation)

All thermostats and aquastats are satisfied.

- The burner will shut down.
- The diagnostic code **E** will be displayed.
- The control board will purge the system with the combustion fan and circulating pump for two minutes. When any thermostat or aquastat calls for heat, the heater will resume normal operation.
- If the heater fails to resume operations, check the thermostat and their connections.

10.8 0 - Voltage Low or High

The battery or power supply voltage is below 11Vdc or above 15Vdc

- The burner will shut down.
- The diagnostic code, 0 will be displayed.
- The buzzer will sound for 10 seconds.
- The control board will purge the system with the combustion fan and circulating pump for two minutes while it is checking if the voltage fault is still present.

If the voltage fault has cleared, the control board will reset the alarm and restart the burner. If the condition has not cleared by the end of the purge period, the diagnostic code 0 will remain displayed. The control board will continue to check the voltage every half hour until the voltage fault has cleared and then restart the burner. To manually reset the fault, switch the service switch or the remote panel switch OFF then ON again.

10.9 1 - Overheat

The high temperature limit has been reached.

- The burner will shut down.
- The diagnostic code, 1 will be displayed.
- The buzzer will sound for 10 seconds.
- The control board will purge the system with the combustion fan and circulating pump for two minutes while it is checking if the overheat condition exists. If the condition exists, the diagnostic code 1 will continue to be displayed.
- In order to restart the burner, first check the circulating pump, the level of the coolant, and the movement of the coolant while the circulating pump is running. Reset the high limit aquastat (inside heater) and the fault (turn the service or remote switch OFF then ON again). If the fault does not reset, check for a faulty aquastat and proper ground.

If diagnostic code 1 lights up and the heater is not in an overheat condition, check the connection from the heater ground wire to the battery. The ground wire should be a minimum 10 gauge and connected directly to the battery.

10.10 2 - Fuse Blown

One of the fuses on the control board has blown.

- The burner will shut down.
- The diagnostic code 2 will be displayed.
- The buzzer will sound for 10 seconds.
- The control board will purge the system with the combustion fan and circulating pump for two minutes while it is checking for a blown fuse.
- If a blown fuse exists, the diagnostic code 2 will continue to be displayed.
- In order to restart the burner, replace any blown fuses with one of the proper size. Then reset the fault by switching the service switch or the remote panel switch OFF then ON again.

10.11 3 - Fuel Pump/Solenoid

The fuel pump or fuel solenoid has shorted.

- The burner will shut down.
- The diagnostic code, 3 will be displayed.
- The buzzer will sound for 10 seconds.
- The control board will purge the system with the combustion fan and circulating pump for two minutes.
- In order to restart the burner, check the fuel pump and solenoid for a short circuit, then reset the fault by switching the service switch OFF then ON again.

The remote panel switch does not reset short circuit faults.

10.12 4 - Igniter

The igniter is open or shorted

- The burner will shut down.
- The diagnostic code 4 will be displayed.
- The buzzer will sound for 10 seconds.
- The control board will purge the system with the combustion fan and circulating pump for two minutes.
- In order to restart the burner, check the igniter and its connections. Then reset the fault by switching the service switch or the remote panel switch OFF then ON again. Note that diagnostic code 4 will be displayed if the ignitor is open or shorted.
- The remote panel switch does not reset a short circuit fault.

10.13 5 - Combustion Fan

- The combustion is shorted.
- The burner will shut down.
- The diagnostic code 5 will be displayed.
- The buzzer will sound for 10 seconds.
- The control board will purge with the circulating pump for two minutes.
- In order to restart the burner, check the combustion fan. Then reset the fault by switching the service switch or the remote panel switch OFF then ON again. Note that diagnostic code 5 will be displayed if the combustion fan is open or shorted.
- The remote panel switch does not reset a short circuit fault.

10.14 6 - Water Pump

The water pump is shorted.

- The burner will shut down.
- The diagnostic code, 6 will be displayed.
- The buzzer will sound for 10 seconds.
- The control board will purge with the combustion fan for two minutes.
- In order to restart the burner, check the water pump. Then reset the fault by switching the service switch OFF then ON again.
- The remote panel switch does not reset a short circuit fault.

10.15 7 - Flame Out

The flame went out or did not ignite.

- The burner will shut down.
- The diagnostic code, 7 will be displayed.
- The control board will try to restart the burner two more times. After two unsuccessful restart attempts, the buzzer will sound for 10 seconds.
- The control board will purge with the combustion fan and circulating pump for two minutes. The diagnostic code 7 will continue to be displayed.

The single most common reason for flame out faults is when air enters the fuel system. This is normally caused by low fuel levels or loose fittings. As air accumulates and passes through the nozzle, it interrupts the fuel supply and shuts down the burner. When this happens, it may be necessary to reset the fault a few times to ensure all air has passed through the system. The Hurricane SCH33 is equipped with a fuel manifold that helps to eliminate air in the supply line by allowing it to pass into the return line. Air may still, however, enter the nozzle and interrupt the fuel supply to the burner. If air continues to disrupt the flow of fuel into the nozzle it is likely there is a leak somewhere in the fuel system.

A flame-out may also be caused by a dirty nozzle or a dirty filter. When diagnosing a flame-out also check the condition of the nozzle and clean it or replace it if necessary. Also, check the condition of the nozzle O-ring and nozzle filter (see section 10.3).

If the external fuel filter is dirty, it could create restriction in the fuel line and cause flame faults. Inspect and replace as necessary. A flame fault can also be caused by starvation of fuel if the heater's fuel supply is shared with other equipment.

Section 10. Troubleshooting

- Check the connections on the fuel tank, fuel pump, and the regulator. Check all of the fuel lines for holes or cracks. Make sure the nozzle or fuel filters are not clogged or excessively dirty.
- Check the airline hoses for any restriction of airflow through the compressor. Restrictions may be caused by a crimped hose, clogged air filter, or a loose or leaking air hose from the compressor outlet to the nozzle. Check the air filter inlet for any obstructions.
- Check for negative pressure in the area around the heater. When the engine is running, it can draw air back through the heater's exhaust pipe. All intake air and exhaust connections must be tight.
- Check for restrictions or leaks in the combustion air in-take hose or exhaust pipe.
- Check for open circuit on fuel pump/solenoid and compressor.
- To restart the burner, check the fuel supply and clean the nozzle. Then reset the fault by switching the service switch or the remote switch OFF then ON again.
- If the conditions that caused the flame fault have been addressed and the heater does not ignite, the thermal cutoff may have been activated by an overheat condition within the burner box. Using a multimeter, check for continuity across the leads of the thermal cutoff. The thermal cutoff is located inside the burner box, and is mounted on the left side of the box. If there is no continuity, the heater **MUST** be inspected and the reason for the overheat condition determined and corrected before further use. A replacement thermal cutoff must be obtained from your dealer.

10.16 8 - Compressor

The air compressor has shorted.

- The burner will shut down.
- The diagnostic code, 8 will be displayed.
- The buzzer will sound for 10 seconds.
- The control board will purge the system with the combustion fan and circulating pump for two minutes.
- In order to restart the burner, check the air compressor. Then reset the fault by switching the service switch OFF then ON again.
- The remote panel switch does not reset a short circuit fault.

10.17]- Bypass Mode

The bypass mode is a service feature to be used by authorized service personnel only. The bypass mode overrides the operating aquastat, remote switch, voltage fault, fuse blown fault, flame out fault, open igniter fault, open fan fault, and thermostats. All these safety devices will be bypassed for five minutes.

- While in the bypass mode, the diagnostic code] will be displayed and the Power ON LED will flash rapidly.
- If the heater cycling aquastat is satisfied or the overheat limit is reached, the burner will stop and purge for two minutes while displaying the diagnostic codes, heater cycling **C** or **I** for overheat, and the Power ON LED will flash slowly. You will have to wait for the heater to cool down before continuing in bypass mode. The bypass mode will timeout in five minutes. After the first three minutes running, it will automatically purge for the last two minutes.

10.18 Water Pump On (Green)

The green light located directly under the LED digit on the main board will come on whenever the circulating water pump is energized.

10.19 Flame Sensor Module

The Flame Sensor consists of a sealed module with a photodiode aimed at the flame, a red LED indicator light and 3 wires, red (+), black (-), and yellow (signal) connected to the main board. Under normal operating conditions whenever the burner ignition begins, the red LED will flash once indicating the red and black wires are connected and the module is receiving power and working properly. Once the burner is ignited, the LED will begin to flicker like the flame. If for any reason the flame is extinguished, the flickering will stop and the board will shut down the heater.

If the yellow (signal) wire is disconnected, the board will shut down. If all the wires are properly connected with module flashing and the board still shuts down, diagnostic code 7 Flame Out, the board may be defective.

10.20 Test Points

The test points on the electrical control board allow for testing and troubleshooting of the ITR heater's electrical system. You will need a voltage meter to plug into the test points.

Test Point	Component	Results / Optimal Condition
TP1	Flame Sensor	A voltage meter should show a voltage of about 2 volts if the flame sensor detects a flame. If not, the voltage will be 0 volts. An oscilloscope will show a 0 to 5-volt square wave with a frequency of about 60 Hz, if the flame sensor is detecting a flame.
TP2	Combustion Fan	The voltage will be between 4 and 5 volts if the combustion fan is operating correctly; 1 volt if the combustion fan is not drawing any current (open).
TP3	Combustion Fan Current	The voltage will be between 1 and 5 volts if the combustion fan is drawing normal current, and 0 volts if the combustion fan is not drawing current.
TP4	5v Power Supply	The voltage should be between 4.8 and 5 volts. A lower voltage indicates a problem with the voltage supply to the logic of the control board.
TP5	8v Power Supply	The voltage should be between 7.9 and 8 volts. A lower voltage indicates a problem with the voltage supply to the logic of the control board.
TP6	Power to Control Board	This is the battery voltage supplied to the control board; it should be between 11 and 15 volts.
TP7	Power to Flame Sensor	The power to the flame sensor should read between 11 and 15 volts (same as battery voltage).
TP8	Cycling Aquastat	The voltage will be between 4.8 and 5 volts if the heater is cycling (cycling aquastat is open), and 0 if the cycling aquastat is closed.
TP9	Overheat Aquastat	The voltage will be 0 volts if an overheat condition is occurring or has occurred in the past two minutes (overheat aquastat is open). The voltage will be between 4.8 and 5 volts if the overheat aquastat is closed.
TP10	Voltage Fault	The voltage will be 0 volts if there is no voltage fault, and between 4.8 and 5 volts when there is a voltage fault.
TP11	Remote Switch	The voltage will be 0 volts when the remote switch is off, and between 4.8 and 5 volts when the switch is on.
TP10	Reset	The voltage will be 0 volts when the reset button is pressed, and between 4.8 and 5 volts when the reset button is not engaged.
TP13	Thermostats or Domestic Water	The voltage will be 0 volts when the thermostat or domestic water system calls for heat and between 4.8 and 5 volts when heat is not called for.
TP14	Blown Fuse	Blown fuses for the burner, pump, or cabin fans will show a voltage of between 4.8 and 5 volts. Good fuses will show 0 volts.

10.21 Reduced Output

The heater may run without faulting, but at a reduced output. If this is noticed, it could be caused by the following:

- High altitude
- Dirty nozzle
- Defective regulator
- Too small a nozzle
- Poor water circulation
- Ash deposit in combustion chamber

10.22 Smokey, Smelly Exhaust

The heater may run without faulting, but you may experience signs of soot, exhaust smoke and/or a pungent smell. This is usually caused by the wrong fuel to air mixture. This can be affected by the following:

- Low voltage
- High altitude
- Dirty compressor air filter
- Low compressor air output
- Restricted combustion air flow (fresh air intake hose / exhaust system / combustion chamber)
- Low combustion fan output (defective motor / wrong rotation / dirty fan blade)
- Dirty fuel nozzle, partially clogged grooves in nozzle distributor

Maintenance

11.1 The First Few Weeks

Once the Hurricane® SCH33™ heater has been installed to approved standards and workmanship, and you have test operated it a few times, the system will require little maintenance.



About two weeks after your Hurricane SCH33 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 SCH33 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 Heat Transfer Fluid (Antifreeze)

NOTICE

The Hurricane SCH33 Heating System must use a non-toxic, propylene glycol-based heat transfer fluid (coolant) with additives generally recognized as safe" GRAS" by the FDA. Use of non-propylene glycol-based heat transfer fluid can be harmful if contamination of potable water occurs due to a leak in a heat exchanger, which can be caused if the fresh water in the system is allowed to freeze.

Normal Boiler antifreeze (heat transfer fluid) is a 50/50 mixture of distilled water and propylene Glycol (nontoxic antifreeze) There are several manufactures of pre-mixed heat transfer fluid. It is important that fluids are not mixed in the Hurricane SCH33. Mixing heat transfer fluids can alter the chemical make-up and consistency of both fluids. Always use heat transfer fluid supplied by the same manufacture to top-up the system.

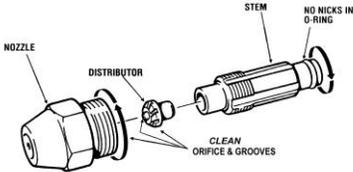
Check the level in the overflow bottle when the system is cold. If the fluid level is visible in the overflow bottle but below the recommended level and the proper fluid is not available, it can be brought-up to the correct point by adding distilled water. If fluid is not visible in the overflow bottle, appropriate heat transfer fluid should be added until the level is visible. At which point distilled water or heat transfer fluid can be used to bring the level to the correct point.

WARNING

If freezing is a concern the dilution of the heat transfer fluid should be checked with a refractometer and verified with the manufactures "Freeze Protection" specifications.

11.3 Nozzle

Nozzle problems such as clogging, will result in a poor, small blue flame. The nozzle should be taken apart and cleaned during routine maintenance. Be careful when handling the nozzle. The brass nozzle material is soft and can be damaged easily from mishandling and over tightening during reassembly. To disassemble the nozzle, use a large crescent wrench on the stem of the nozzle making sure it sits snugly over the grooves that run the length of the stem. Don't place the wrench on the rounded sections of the stem as this will allow the wrench to slip and rotate when force is applied possibly causing damage. Use a 5/8 combination wrench on the nozzle head and loosen it from the stem. **Hold the nozzle vertically with the nozzle-head up**, over a surface from which any dropped parts can be retrieved, carefully disassemble the two parts turning the nozzle head counter clockwise. Remove the fuel distributor from the stem, remove the O-ring from the stem and place the three parts into a container for cleaning. Use brake or carburetor cleaning solvent to thoroughly clean the parts. Spraying the cleaner through the individual parts will help clean them. Use a Q-tip or something similar to clean inside the nozzle head. Use high-pressure air to dry and blow the parts free of debris. Replace the O-ring; as with disassembly, hold the nozzle stem vertically, replace the fuel distributor into the stem and screw the nozzle head onto the stem. Tighten the two parts together **only slightly tighter than hand-tight**.

**11.4 Fuel Lines and Filter**

You should replace your filter annually; however, the frequency of fuel filter replacement depends on the quality of fuel being used.

11.5 Combustion Chamber

If the Hurricane SCH33 is operating properly, it should not produce soot/ash deposits in the burner chamber. A build-up of soot in the combustion chamber will create poor heater performance. During regular service, using a bright flashlight, inspect inside the combustion tube by looking through the combustion air holes in the burner box. If there are viable soot deposits in the combustion tube, they can be removed with a vacuum. If the deposits are significant, the tube should be removed and cleaned. When the combustion tube is removed, the combustion chamber can also be cleaned. The exhaust pipe should be checked at this time and cleaned if necessary.

11.6 Checking Hoses and Tubes

Annually, check water hoses and tubes for leaks or weak points. Check air and fuel lines, pay close attention to the condition of the hoses especially around clamps. Hoses, air lines and fuel lines will deteriorate over time and may crack. Replace any sections of worn hose together with the clamp.

11.7 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 and connectors especially if condensation is present.

11.8 Service Parts

The following is a list of service and maintenance items available for the Hurricane SCH33.

- Air compressor filter
- Fuel nozzle "O" ring
- Nozzle filter
- Igniter
- Flame Sensor
- Fuel nozzle

Section 11, Maintenance

Over a period of time, mechanical parts of the heater will wear out and need replacing. These items can be checked during routine service and replaced as needed.

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

<u>MAINTENANCE ITEM</u>	<u>MAINTENANCE FREQUENCY</u>	<u>SERVICE REQUIRED</u>
AIR/FUEL/WATER HOSES	ANNUALLY	INSPECT FOR LEAKS AND WEAK POINTS
HOSE CLAMPS	ANNUALLY	INSPECT FOR CORROSION TIGHTEN IF LOOSE
COMBUSTION TUBE AND EXHAUST	AS NEEDED	VACUUM CLEAN OR REMOVE AND CLEAN
FUEL FILTER	ANNUALLY	REPLACE
NOZZLE, FUEL DISTRIBUTOR, O-RING	ANNUALLY	CLEAN / REPLACE
EXHAUST SYSTEM	ANNUALLY	INSPECT FOR LEAKS AND CORROSION
COOLANT MIXTURE	11 MONTHS 36 MONTHS	CHECK PH LEVEL FOR ACIDITY REPLACE IF NECESSARY
ELECTRONIC CONTROL PANEL	ANNUALLY	VOLTAGE TEST / INSPECT FOR CORRODED WIRES/CONNECTORS
AIR COMPRESSOR FUEL PUMP COMBUSTION FAN MOTOR	ANNUALLY	INSPECT FOR LEAKS, POOR MECHANICAL OPERATION, CORROSION & WEAR

Figure 11-1 Maintenance Schedule

Warranty Information

Attention Purchaser and Installer

12.1 General Warranty

- ITR warrants the **Hurricane® SCH33™ (referred to as “heater(s)”**) and all other ITR accessories and components supplied with the original purchase, to be free of defects in materials and workmanship, when installed and operated as outlined within the Installation and Operating manual, following all servicing conditions, for two (2) years. This applies from the manufactured date indicated by the product serial number or installation (in-service) date, or 1000 hours of operation, whichever is first. Warranty replacement parts are covered for the remainder of the heater’s warranty.
- You must install the Product in compliance with the specifications, standards, and instructions in the *Installation Manual*.
- If you need to depart from the manual, you must first consult and obtain the written approval of ITR. Otherwise, your warranty may be voided or limited.
- Systems that are not installed to the published installation instructions (unless with prior written approval of ITR) will be ineligible for warranty coverage.
- Fill in the enclosed Warranty Card completely. It must be signed by the Owner and returned to ITR within 30 days of the date of the original installation. The Owner cannot transfer this warranty. Before mailing, make photocopies of the completed Warranty Card for your records. It will be a valuable reference if you need warranty repairs in the future.

12.2 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. Expressly excluded are all implied or statutory warranties or conditions of merchantability of fitness for a particular purpose, and those arising by statute or otherwise in law or from dealing or trade usage.

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 will 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 of the Product, or in connection with any services performed, even if ITR has been advised of the possibility of such damages, whether based upon warranty, contract, or negligence. ITR’s

maximum liability shall not in any case exceed the contract price for the Products claimed to be defective.

No one is authorized to increase, alter, or enlarge ITR's responsibilities or obligations under these warranties.

12.3 Owner's Responsibilities

If any warrantable failures occur before the expiration of the warranty, the Owner must give notice of such failures to ITR or to the authorized ITR dealer from which the Product was originally purchased, and obtain written approval for the warranty repair.

The Owner is responsible for the following costs in case of a warrantable failure:

- shipping and insurance costs to deliver the defective Product to the dealer or ITR (if necessary)
- all repairs made to equipment ancillary to the Product, including the coach, engine, and other associated components of the coach in which the Product is installed
- lodging, meals, and other incidental expenses incurred by the Owner as a result of a warrantable failure
- "down time" expenses and all business costs and losses resulting from the warrantable failure

12.4 Not Covered Under Warranty

Warranty will be voided or not extended in the following circumstances:

- Owner fails to notify ITR or the authorized ITR dealer from which the Product was originally purchased about a warrantable failure and to obtain prior written approval for warranty repair.
- Original serial number on Product or electrical control board has been removed, altered, or is unreadable.
- Product has been modified or uses non-standard parts not approved by ITR.
- Product has been abused (such as by dropping it), damaged, vandalized, or has received improper maintenance.
- Product has been run dry or operated without appropriate antifreeze, causing damage to the heat exchanger, pump seals, etc.
- Product has been exposed to an environment detrimental to its effective operation, such as excessively wet, dirty, or hot areas.

Also not covered under warranty:

- Parts or Products no longer within the manufacturer's warranty period.
- Parts or Products installed or used in a manner contrary to ITR's printed instructions without ITR's prior written permission.
- Normal wear and tear of parts, including but not limited to, fuel filter, air filter, nozzles, fuses, ignitor, electrical motors, fuel pumps, air compressors, and carbon brushes.

- Product malfunctions due to improper installation of parts or Products, including but not limited to malfunctions causing inadequacies in air, fuel, or coolant flow; voltage problems due to improper wiring; and shock or vibration.
- Progressive damage to the engine or coach caused by failure of the Product or an improper installation.
- Diagnosis or repairs to fix problems not directly related to the Product or due to empty fuel tanks or poor fuel quality, fuel additives, acidic water, electrolysis, or any chemical reactions.
- Travel time and expenses by an ITR dealer.
- Removal and re-installation expenses for the ITR heater.

12.5 Customer Service Calls

ITR warrants the ITR heater and the Dealer warrants the installation.

If you have a service problem, first check the *Troubleshooting* section of the *Owner's Manual* to determine if your problem is addressed. Also ensure you are familiar with the design and installation setup.

When calling ITR or the Dealer with a service problem, have the following information ready at hand:

- model number and serial number of the Product
- a detailed description of the problem
- your *Installation Manual* and *Owner's Manual*

Depending on your location, an authorized service person may be able to visit your boat or coach to help troubleshoot problems and repair your Product. Such service calls are at the Owner's expense. Regardless, you must obtain written approval from ITR or the Dealer for any warranty repair before it is undertaken. All repairs done under warranty are subject to the terms and conditions of the flat-rate manual.

12.6 Returns

If a service call by an authorized service person is not feasible, the Owner must do the following to obtain warranty service:

1. Immediately contact ITR (or your Dealer) and provide a full description of the problem.
2. Obtain (in writing) a Return or Repair Material Authorization (RMA) number from ITR for any warranty, return, repair, or service. ITR will refuse any return package and will not authorize service or repairs without a RMA number. (For repairs by authorized Dealers, the dealer must obtain an authorized RMA number from ITR before warranty work commences.)
3. When shipping your Product, pack securely, show the RMA and serial number of the Product on the outside of the shipping container, and ship prepaid and insured. 0
4. Provide written details of the problems, date of installation, proof of purchase, and a return address.

After repair or replacement of the Products still under warranty, ITR will pay return shipping charges. All repairs done under warranty are subject to the terms and conditions of the flat-rate manual.

12.7 Telephone / Email Service

Service information given over the telephone, by fax or by email is given only in good faith as an accommodation to the customer. Such information should not be relied upon without an independent verification of its applicability to the customer’s particular situation. For customer service or other information, contact:

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

IN THE UNITED STATES:

5305 NE 121st Ave, Suite 401
Vancouver, WA USA 98682
Tel: 1-800-993-4402 or 360-993-4877
Fax: 360-993-1105
Email: info@itrheat.com

Website: <http://www.itrheat.com>

OWNER’S SERVICE LOG:

Date	Service Performed	Service Center