INTERNATIONAL LTD
THERMAL RESEARCH

OASIS®
Zephyr™ HW

Installation and Operating Manual

Oasis® Zephyr™ HW

Diesel Heating System for Recreational Vehicles

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Read and save these instructions for future reference

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1

Overview

Thank you for purchasing the **Oasis® Zephyr™ HW** diesel hot water heating system.

This section describes features of the Oasis® Zephyr™ HW 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.

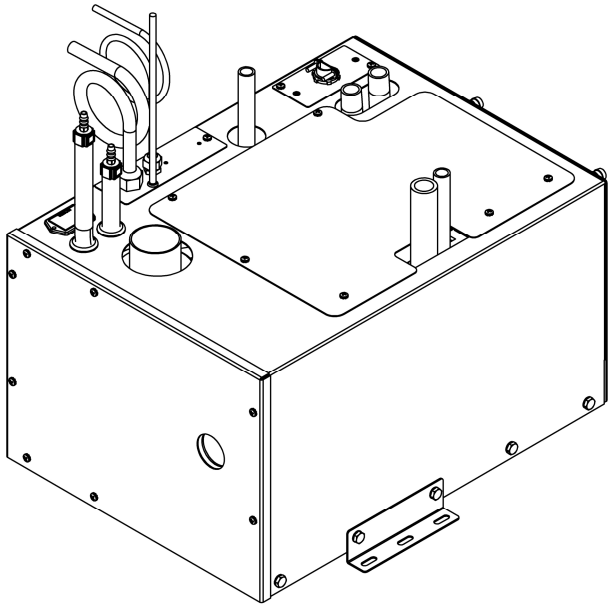


Figure 1-1: Oasis® Zephyr™ HW Heating System

1.1 Unpacking the Heating System

When you receive your Oasis® Zephyr™ HW 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

Oasis® Zephyr™ HW
ADVANTAGES

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

The Oasis® Zephyr™ HW is an advanced and efficient hydronic heater with many advantages over older technology of forced-air systems. The **Zephyr™** provides space heating using a "heat-transfer fluid" pumped to remote mounted, fan equipped, radiator-style heat-exchangers. The same "hot" fluid is circulated through a highly efficient, internally mounted, flat-plate heat-exchanger to provide a continuous supply of domestic hot water. The heater runs on 12VDC power, using a diesel-fired burner to maintain the temperature of the heat transfer fluid. The **Oasis® Zephyr™ HW** heater can also use waste heat from the engine, using the internal 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 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

- Electronically-controlled system with:
    - Automatic safety shutdown
    - Manual reset overheat temperature sensor and a thermal cutoff for overheat protection
    - Tactile, Touch screen control panel for operating control and diagnostics with audible alarm

- Heating control for up to four separate space heating zones, each with its own optional thermostat

- On demand, continuous domestic water heating without the need for hot water storage

- Use of engine waste heat to provide system heating

- Engine heating (using an optional external pump)

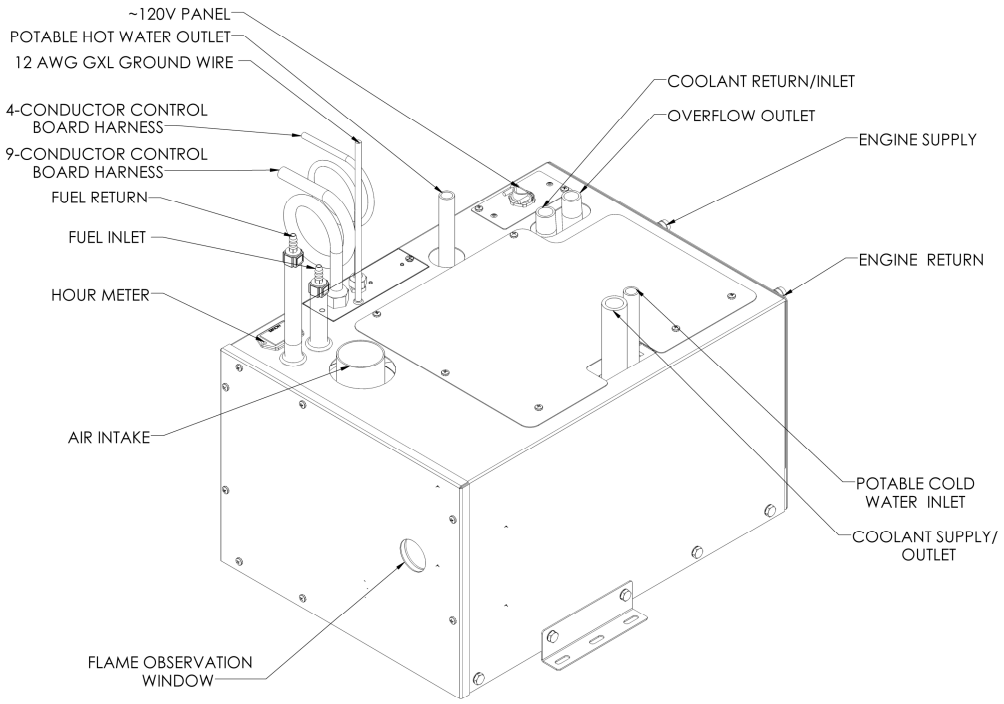


Figure 1-2: Oasis® Zephyr™ HW Heating System Overview

1.4 Critical Factors

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

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

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

- 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 RVIA 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, though-hull adapter and clamps

- Exhaust collar
- ¼" ID approved fuel supply and return lines
- #10 sheet metal screws or wood screws for mounting internal fans.
- Heater hose – enough to connect the Oasis Zephyr to the interior fans. If engine heat is used, heater hose is required to connect the heater to the engine block (see *Technical Specifications and Standards* for details)
- Clamps to secure all heater hose and fuel hose connections
- Overflow bottle (min. 2 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
- 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 **Oasis® Zephyr™ HW** heater.

1.6 Testing and Inspection

After all components have been properly installed according to standard practices, RVIA 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.

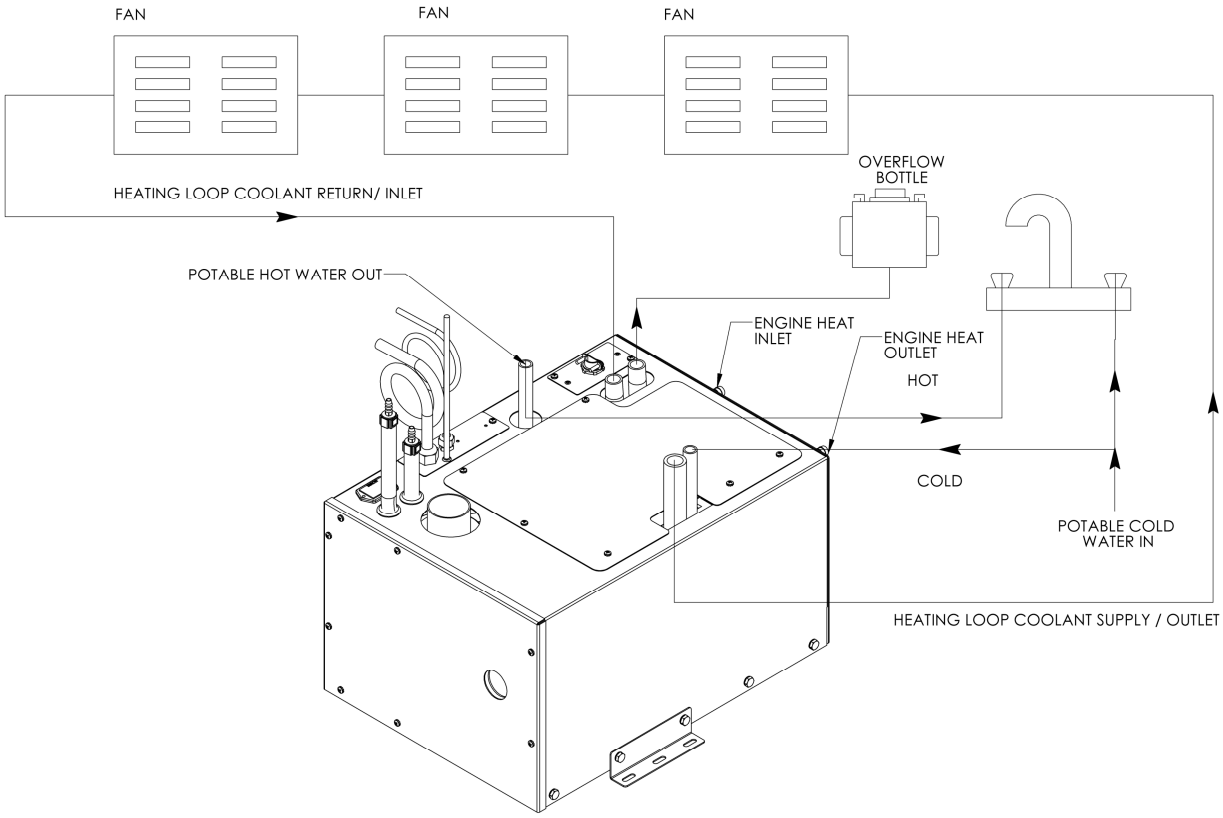


Figure 1-3: Oasis® Zephyr™ HW Typical Series-Plumbed Layout

Section
2

Mounting – Oasis® Zephyr Heating System

2.1 Before You Begin

Plan the location of the Oasis® Zephyr 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 Oasis® Zephyr 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 Oasis® Zephyr 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.70 lbs. x 2 = 140 lbs./63.5 KG) and must be of a non-combustible material.

- The Oasis® Zephyr™ HW model is 10.5"H x 14" W x 19" D (26.6 cm x 35.5 cm x 48.2 cm). *See Figure 2-1: Dimensions*

DANGER The Oasis® Zephyr™ HW heater must not be installed in any compartment with flammable gases.

- The Oasis® Zephyr™ HW 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). 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, top access panel and access to fuel, water, power and exhaust connections. There should be at least 12" of clearance on the top of the heater for accessing and servicing the components and water temperature adjusting valve. Available space for connection to the rear of the heater is necessary if vehicle engine heat management is connected to the Zephyr. There should be at least 1" clearance to all other Oasis® Zephyr™ HW 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.

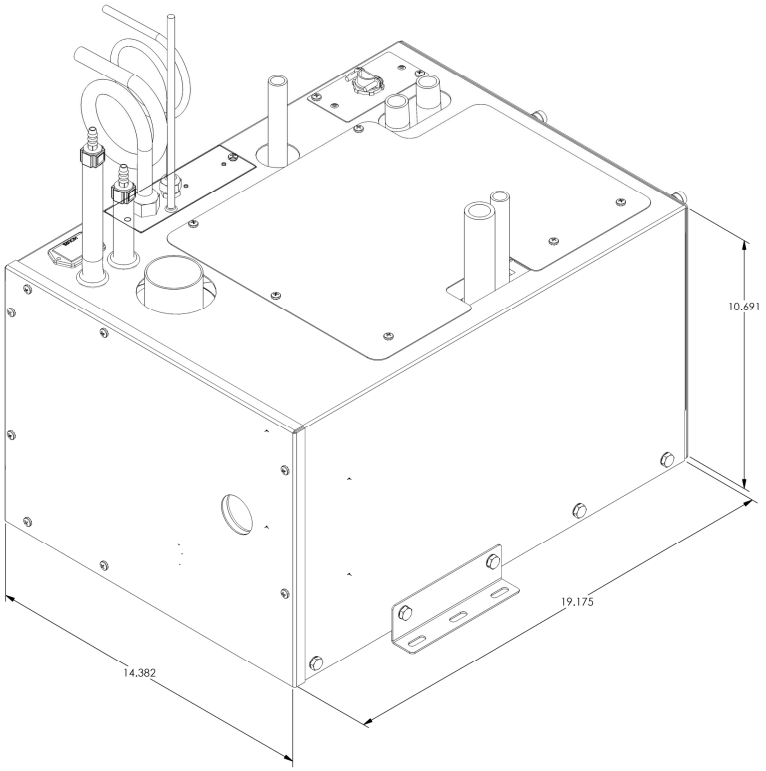


Figure 2-1: Oasis® Zephyr™ HW Dimensions

WARNING

If the Oasis® Zephyr™ HW is going to be mounted in the 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 the jarring of rough roads.

- 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 of the heater for removal of the panel 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 the supplied exhaust fittings installed and the exhaust directed out from under the vehicle.

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
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)

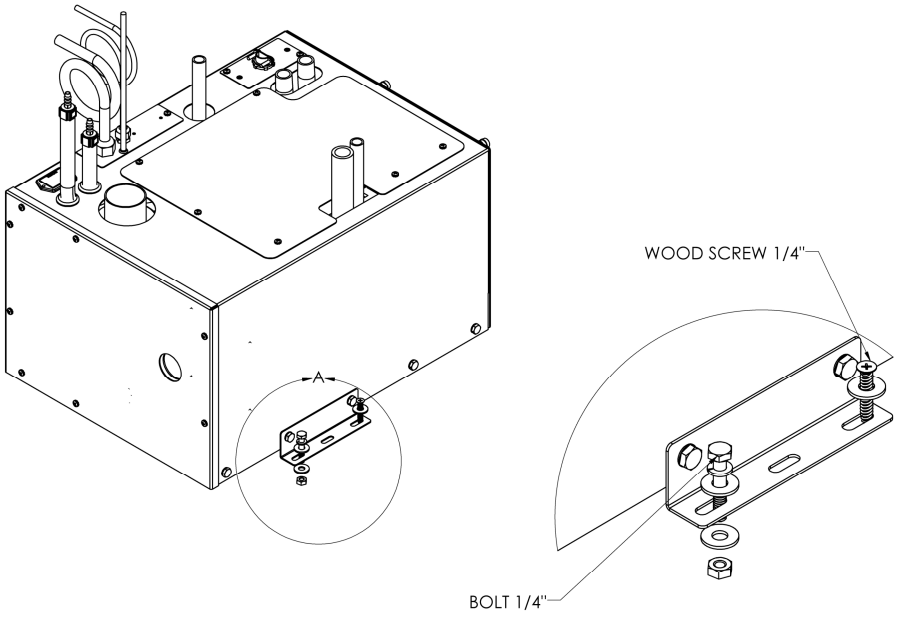


Figure 2-2: Heater Mounting Bracket Configuration

2.5 Remote Operating Touch Screen Panel Mounting Procedure

The 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.

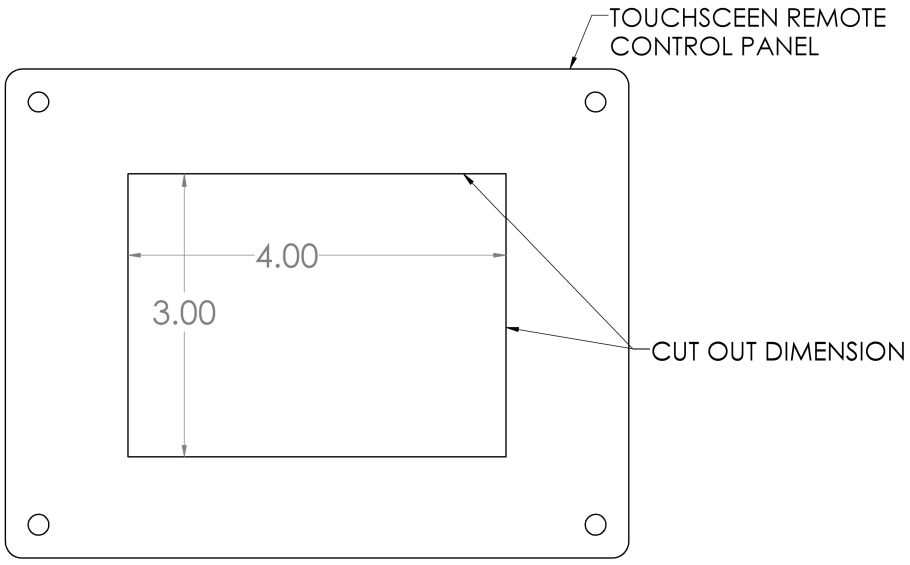


Figure 2-3: Touchscreen Operating Panel Mounting

Section
3

Installing the Exhaust System

3.1 Before You Begin

For efficient and safe operation of the Oasis® Zephyr™ HW 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 Oasis® Zephyr™ HW in an enclosed area unless there is adequate ventilation.
- Isolate the Oasis® Zephyr™ HW in a closed compartment. Air from this compartment must be allowed infiltrate any living areas of the vehicle.

Heater exhaust can reach high temperatures; never install exhaust parts close to combustible materials or through a combustible wall or ceiling without fireproof protection. Heater exhaust must be directed to the outside of the vehicle away from windows, inlet vents, and slider-outs. The heater exhaust system must be installed following all specific RVIA standards.

3.2 Mounting Location

If all technical specifications for mounting the exhaust cannot be met, don't use the Oasis® Zephyr™ HW. The heater may perform poorly or be damaged if it is not installed according to specifications.

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 vehicle if the exhaust is not vented correctly.
- In a typical vehicle installation the exhaust runs from the bottom of the heater, through the floor and exits from either side of the vehicle. Excluding the 90° bend from the heater and without any additional 90° bends, the exhaust run cannot exceed 12'. A 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 from under the vehicle and does not accumulate under the vehicle. Exhaust outlets cannot be located under an opening window, inlet vent or a slide-out.

Recommendations for Installation

- Combustion air must be drawn directly from outside the vehicle using the supplied air intake hose. An (optional) air intake silencer can be used (ITR part # 10455) *see figure 3.1*
- If an exhaust muffler is required, use an ITR-manufactured muffler (part # 10282) with a straight-through design. 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.

- Install an exhaust collar into the floor of the vehicle to isolate the hot exhaust fittings, attached to the heater, from the vehicle floor. (ITR part # 5164) Various exhaust collars are available to accommodate different floor thicknesses.

- 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 it is required that part of the exhaust is run through the interior of the vehicle, appropriate exhaust insulation must be used to cover the entire length of the interior exhaust run.
- The exhaust parts supplied with the Oasis® Zephyr™ HW include: a 3" x 1.25" MPT black-iron pipe nipple (part# 2342) that is threaded into the exhaust outlet on the bottom of the heater, a 1.25" FPT black-iron pipe elbow (part#2337) which is threaded onto the nipple and a 1.25 MPT x 1.5 OD pipe adapter. The adapter is threaded into the elbow and used to couple with flared 1.5 OD exhaust pipe or stainless flexible exhaust tube. If the optional muffler (part#10282) is used, the adapter is not used and the MPT end of the muffler screws directly into the elbow. Any exhaust fittings/pipe used to extend
- the assembly of supplied parts, must have a minimum of 1.25" ID.
- Solid steel exhaust tubing or other approved exhaust tubing is recommended. Stepped, bolt-style band clamps are recommended for joining the tubing as they apply firm, even pressure.
- The exhaust must be supported at least every 3’ of its installed length.
- All non-threaded exhaust connection points must use appropriate clamps to ensure that connections are tight and leak free. 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, clamp 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 pipe inside the heater compartment.

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: Oasis Zephyr™ HW exhaust parts and typical configuration

1 Plan-out the best location for the exhaust run.

2 Leave suitable air spacing to protect combustible materials. Use an exhaust collar and metal shields where required.

3 Securely screw the exhaust fittings to the Oasis® Zephyr™ HW and align them in the appropriate direction according to the planned run.

4 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.

5 Find a suitable location to mount the air-intake adapter (part# 10089). Drill a 2" hole through the floor. Insert the adapter through the floor from underneath, use 3 screws to secure the collar of the adapter to the floor. 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*)

6 Connect the flexible air-intake tubing (2" ID part# 8019) to the air-intake fitting on top of the heater. The other end of the air-intake hose can be installed in two different ways as shown in figure 3-2.

7 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.

9 If necessary, protect the air-intake entrance from water and dirt with a guard or shield.

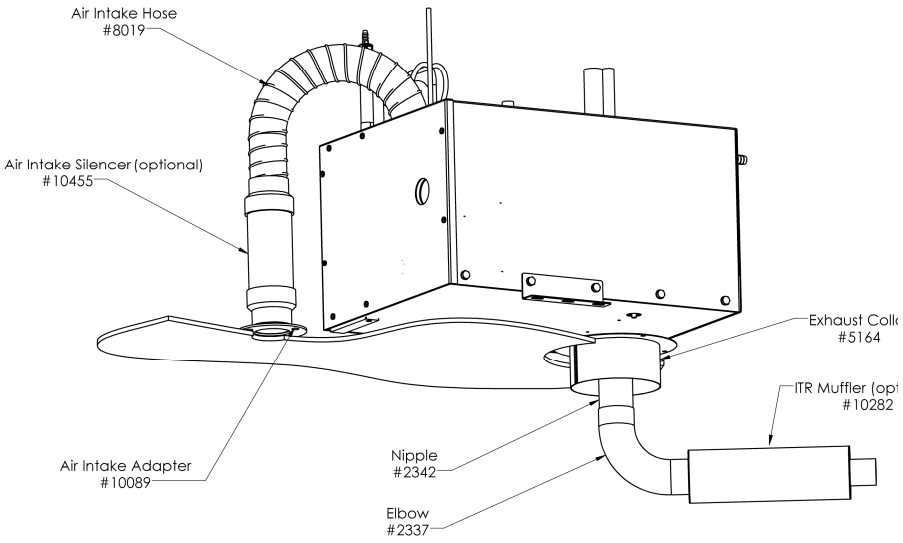


Figure 3-1: Oasis Zephyr™ HW exhaust parts and typical configuration

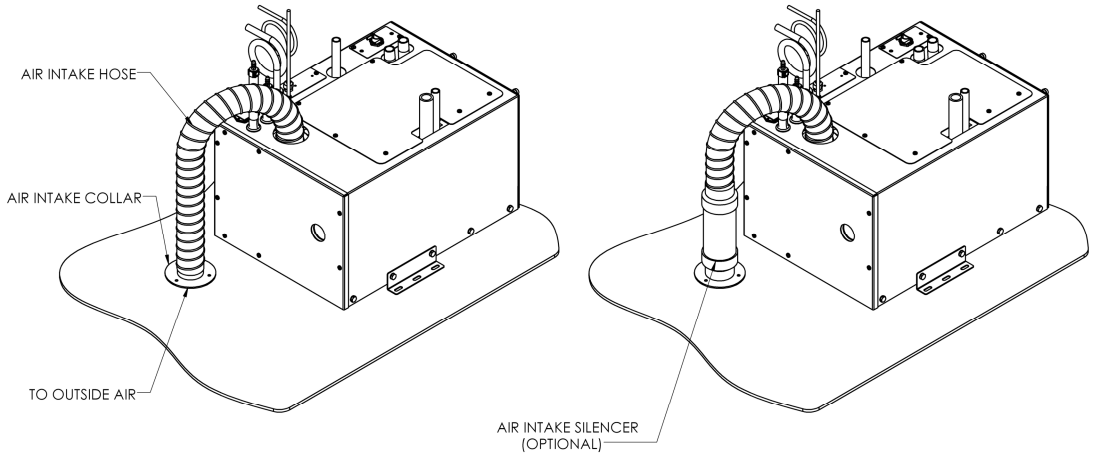
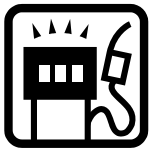


Figure 3-2: Oasis Zephyr™ HW typical fresh-air intake configuration and optional Air Intake Silencer

Section
4

Installing the Fuel System



4.1 Before You Begin

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

! DANGER

Although the Oasis® Zephyr™ HW will work with furnace oil, stove oil, and jet fuel, it is only certified to be used with diesel #1 and #2. 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 Oasis® Zephyr™ HW location. The Oasis® Zephyr™ HW is not rated for use in an explosive environment.

! WARNING

Never share the fuel supply line to the Oasis® Zephyr™ HW with any other fuel-burning device.

4.2 Fuel System Installation

The fuel pump in the Oasis® Zephyr™ HW 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 Oasis® Zephyr™ HW's fuel connections are accessed from the top of the heater. The fuel inlet/outlet connections are located on the top left of the Oasis® Zephyr™ HW and consists of quick connect fittings attached to the inlet and return hoses coming from the heater. The fuel lines are labelled for identification. Minimum recommended size for the fuel lines is ¼" I.D. The fuel supply line and the return

lines from the vehicles fuel supply are push fit onto the male end of the quick connect fittings. The fuel return line should return directly to the fuel supply tank.

The following is recommended for the fuel system installation:

NOTICE The fuel supply from the fuel storage tank to the fuel inlet must be from a dedicated fuel pickup on the 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 Oasis® Zephyr™ HW should not exceed 60". There are no minimum clearance requirements between the fuel tank and the Oasis® Zephyr™ HW.

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

- All fuel line fittings and hoses must use suitable sealant and clamps and must be checked for leaks upon initial installation and periodically as part of normal maintenance.
- A primary, UL and/or CSA approved, 10-micron fuel oil filter (not provided) must be installed in the fuel supply line, between the tank and the Oasis® Zephyr™ HW, in a manner that ensures easy access for maintenance. A secondary fuel filter is mounted inside the fuel block, behind the fuel nozzle. Both filters must be replaced as part of routine scheduled maintenance.
- Fuel line must be appropriate for the specific installation requirements. It is strongly recommended that all fuel lines have permanently installed end fittings.

4.3 What NOT to Do

- **Don't** allow fuel or the fuel lines to become contaminated with foreign material that may accumulate during installation.
- **Don't** allow the fuel lines to become damaged or constricted.

! CAUTION Ensure fuel lines are protected from contamination by foreign material. When installing or servicing fuel lines, seal off the ends to prevent contamination. After installing, you may also wish to flush the fuel line with clean fuel to rid it of air and foreign material.

4.4 Procedure

To complete the fuel system installation:

1 Install the inline fuel filter. The optimal location is on a compartment wall next to the Oasis® Zephyr™ HW, inline between the fuel tank and the heater.

2 Connect the fuel supply line to a dedicated pick-up fitting on the main diesel fuel tank.

3 Inspect the supply fuel line for any loose connections or damage. All fuel 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.

Section
5

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 Oasis® Zephyr™ HW 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 proportionality 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.

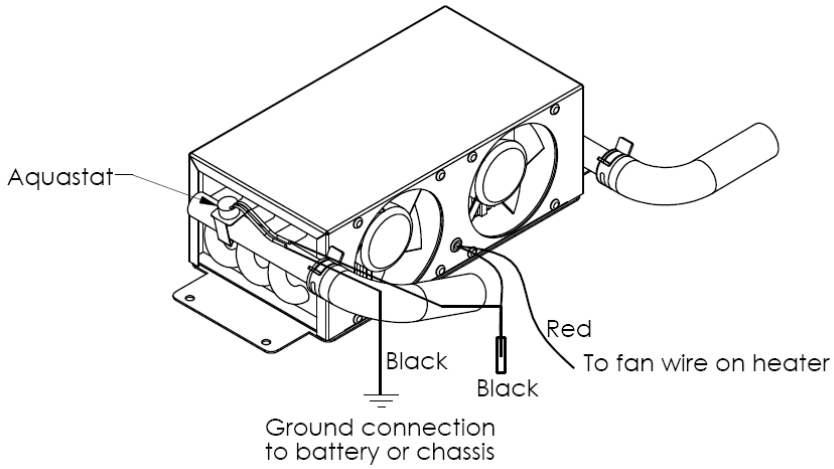


Figure 5-1: Wiring the Fan's Aquastat

- 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 Zone control board has an 18-amp draw limit for all the fans and the internal pump. Note: the internal pump of Oasis® Zephyr™ HW will draw approximately 2.5 amps.

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 Oasis® Zephyr™ HW 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 you provide a floor plan of your coach.

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 or 10-amp limit, you must install a separate relay to power the fan. This relay will use the existing fan circuit as a signal and must be wired to a secondary power source (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.*

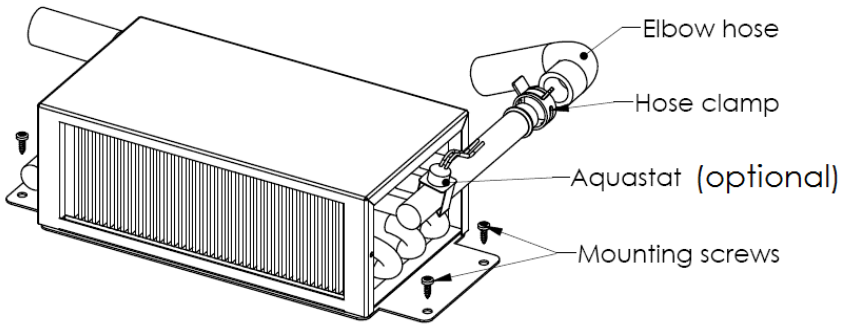


Figure 5-2: Mounting a Low-Profile Cabin Fan

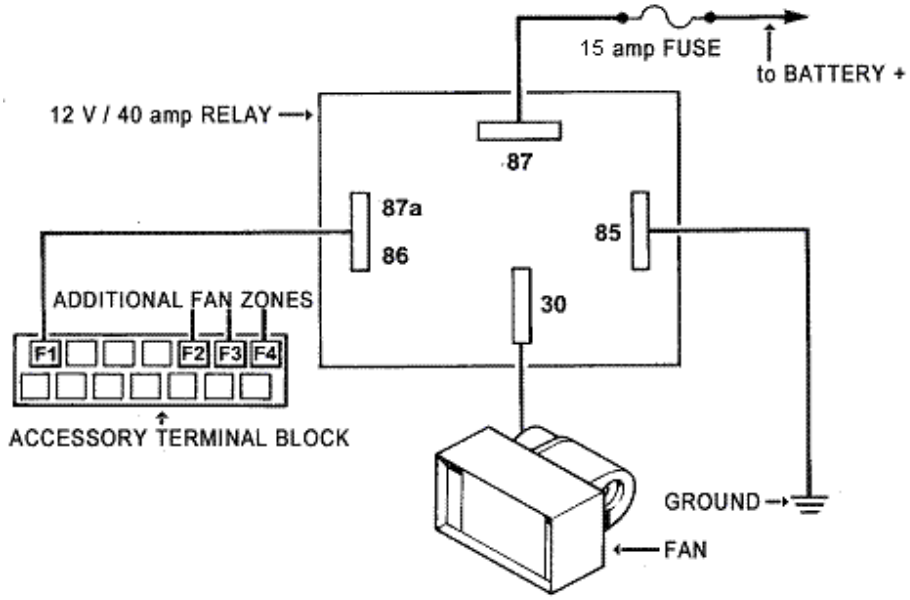


Figure 5-3: Installing a Relay for Additional Fan Amperage

6

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 RVIA 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 Oasis® Zephyr™ 12 VDC

The following applies to the 12VDC power supplied to the Oasis® Zephyr™:

- 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 Oasis® Zephyr™ control board must be connected directly to the battery (through a fuse). There should be no battery disconnect switch between the battery and the Oasis® Zephyr™ 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 Oasis® Zephyr™ 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 Oasis® Zephyr™ 120/240 VAC

- The Oasis® Zephyr™ HW 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 left side of the heater beside the heat transfer fluid overflow outlet. 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 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 inserted back into AC connection box the cover secured to the case.

- 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.

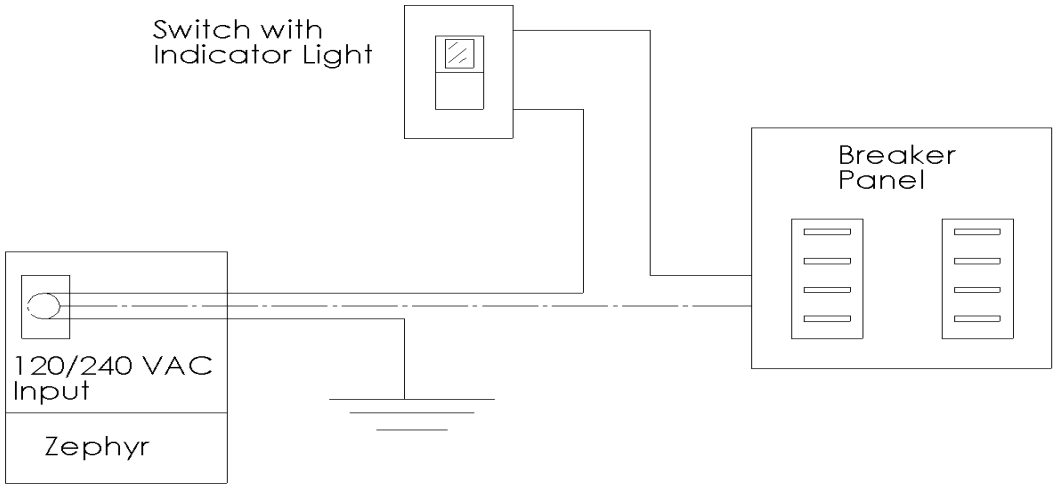


Figure 6-1: Sample Wiring Diagram for Electrical Elements

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 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
    - Engine-heat aquastat

- **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 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.

- **TouchScreen Remote LCD panel (with Wi-Fi) –** enables the diesel burner and allows operational control and fault reset from inside the vehicle; it also provides diagnostic information. The remote panel connects to the remote connector on the control board via a supplied 25’ RJ11 cable. A 50’ cable is available as an option. 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 ï Feet

AMPS	10	15	20	25	30	40	50	60	70	80	90	100
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

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 6-4.*

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 6-4 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 9 and 10 for details.*

8 If installing any optional fan speed switches, wire them to the RV's 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 switch wiring diagram.*

9 Mount the 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 RJ11 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.

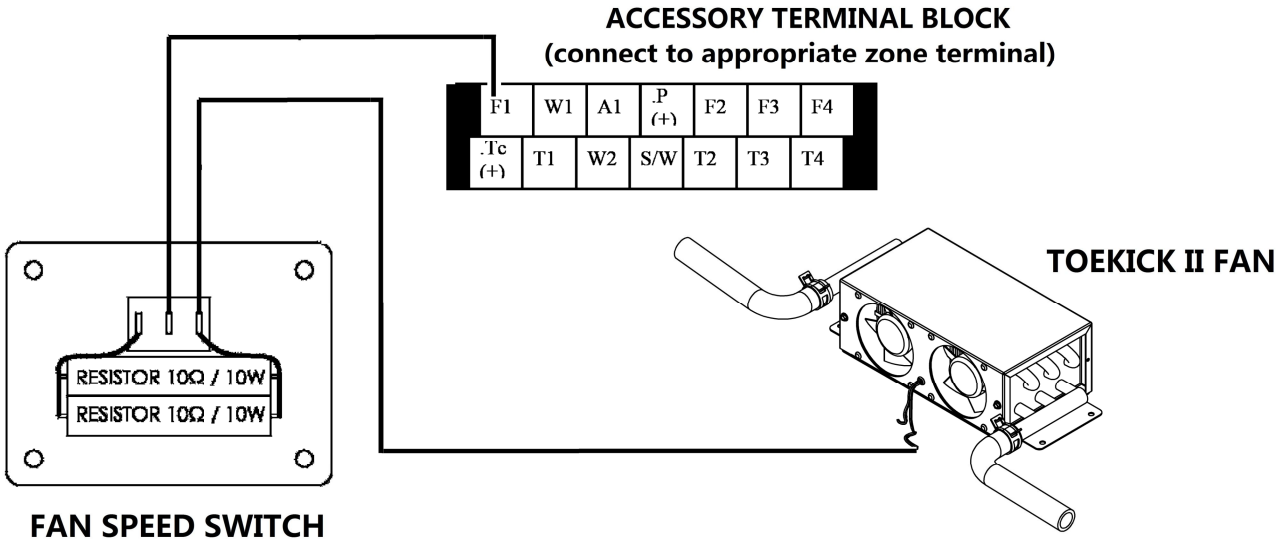
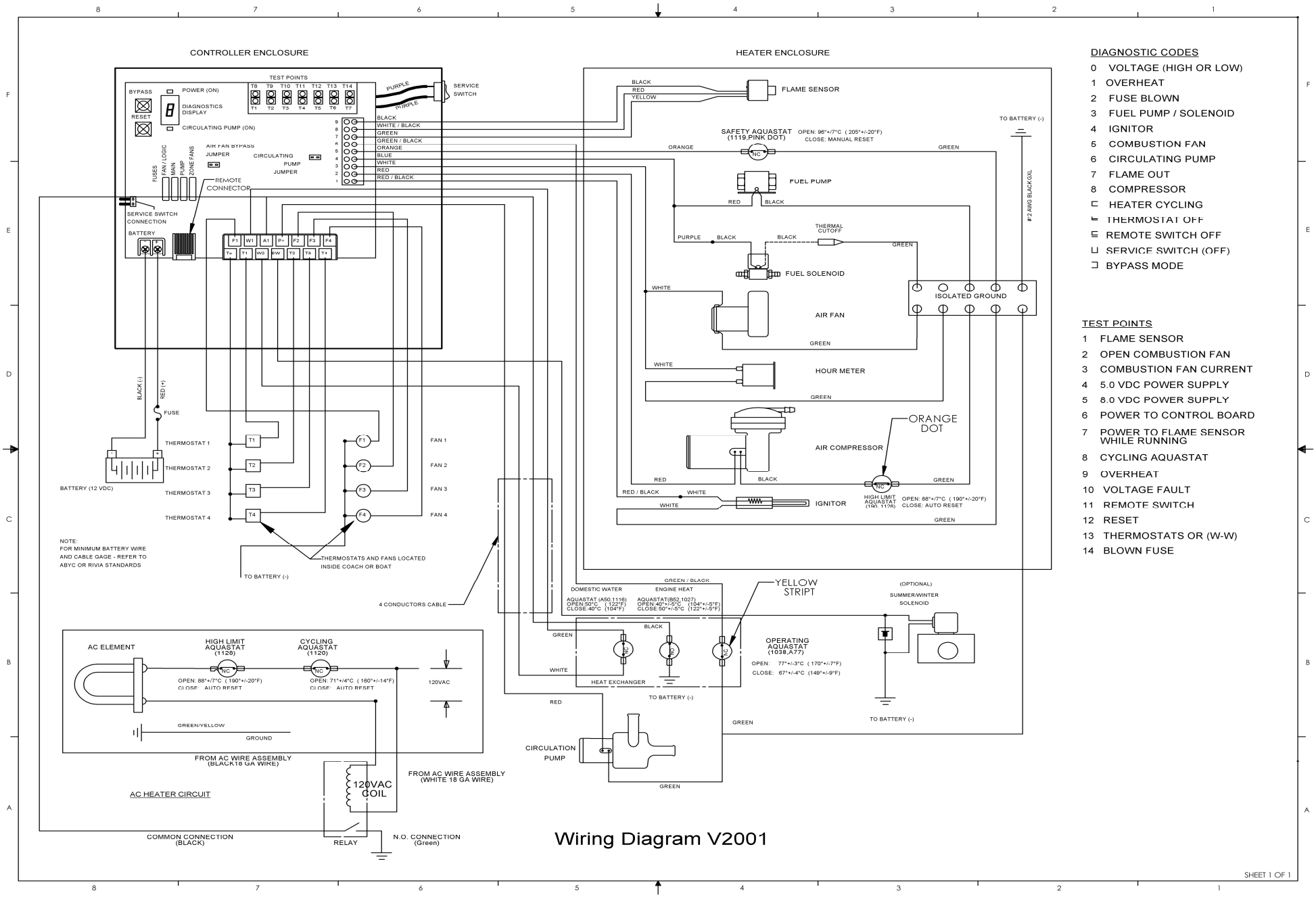
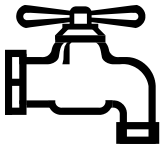


Figure 6-2: Wiring for a Fan Speed Switch


CONTROLLER ENCLOSURE
HEATER ENCLOSURE
TEST POINTS
BYPASS
RESET
POWER (ON)
DIAGNOSTICS DISPLAY
CIRCULATING PUMP (ON)
SERVICE SWITCH
AIR FAN BYPASS JUMPER
CIRCULATING PUMP JUMPER
FUSES
FAN / LOGIC
MAIN PUMP
ZONE FANS
REMOTE CONNECTOR
SERVICE SWITCH CONNECTION
BATTERY
BLACK
WHITE / BLACK
GREEN
GREEN / BLACK
ORANGE
BLUE
WHITE
RED
RED / BLACK
PURPLE
FLAME SENSOR
SAFETY AQUASTAT (1119,PINK DOT)
OPEN: 96°+/7°C (205°+/-20°F)
CLOSE: MANUAL RESET
TO BATTERY (-)
#2 AWG BLACK/GXL
FUEL PUMP
THERMAL CUTOFF
FUEL SOLENOID
ISOLATED GROUND
AIR FAN
HOUR METER
AIR COMPRESSOR
ORANGE DOT
IGNITOR
HIGH LIMIT AQUASTAT (150, 1128)
OPEN: 88°+/7°C (190°+/-20°F)
CLOSE: AUTO RESET
BLACK (-)
RED (+)
FUSE
BATTERY (12 VDC)
THERMOSTAT 1
THERMOSTAT 2
THERMOSTAT 3
THERMOSTAT 4
FAN 1
FAN 2
FAN 3
FAN 4
NOTE:
FOR MINIMUM BATTERY WIRE AND CABLE GAGE - REFER TO ABYC OR RIVIA STANDARDS
THERMOSTATS AND FANS LOCATED INSIDE COACH OR BOAT
4 CONDUCTORS CABLE
DOMESTIC WATER
AQUASTAT (A50,1116)
OPEN:50°C (122°F)
CLOSE:40°C (104°F)
ENGINE HEAT
AQUASTAT(B52,1027)
OPEN:40°+/-5°C (104°+/-5°F)
CLOSE:50°+/-5°C (122°+/-5°F)
GREEN / BLACK
YELLOW STRIPT
(OPTIONAL)
SUMMER/WINTER SOLENOID
OPERATING AQUASTAT (1038,A77)
OPEN: 77°+/-3°C (170°+/-7°F)
CLOSE: 67°+/-4°C (149°+/-9°F)
HEAT EXCHANGER
TO BATTERY (-)
CIRCULATION PUMP
AC ELEMENT
HIGH LIMIT AQUASTAT (1128)
OPEN: 88°+/7°C (190°+/-20°F)
CLOSE: AUTO RESET
CYCLING AQUASTAT (1120)
OPEN: 71°+/4°C (160°+/-14°F)
CLOSE: AUTO RESET
120VAC
GREEN/YELLOW
GROUND
FROM AC WIRE ASSEMBLY (BLACK18 GA WIRE)
FROM AC WIRE ASSEMBLY (WHITE 18 GA WIRE)
AC HEATER CIRCUIT
120VAC COIL
COMMON CONNECTION (BLACK)
RELAY
N.O. CONNECTION (Green)
Wiring Diagram V2001
SHEET 1 OF 1
DIAGNOSTIC CODES
0 VOLTAGE (HIGH OR LOW)
1 OVERHEAT
2 FUSE BLOWN
3 FUEL PUMP / SOLENOID
4 IGNITOR
5 COMBUSTION FAN
6 CIRCULATING PUMP
7 FLAME OUT
8 COMPRESSOR
⊏ HEATER CYCLING
⊨ THERMOSTAT OFF
⊑ REMOTE SWITCH OFF
⊔ SERVICE SWITCH (OFF)
⊐ BYPASS MODE
TEST POINTS
1 FLAME SENSOR
2 OPEN COMBUSTION FAN
3 COMBUSTION FAN CURRENT
4 5.0 VDC POWER SUPPLY
5 8.0 VDC POWER SUPPLY
6 POWER TO CONTROL BOARD
7 POWER TO FLAME SENSOR WHILE RUNNING
8 CYCLING AQUASTAT
9 OVERHEAT
10 VOLTAGE FAULT
11 REMOTE SWITCH
12 RESET
13 THERMOSTATS OR (W-W)
14 BLOWN FUSE

Section
7

Plumbing and filling the System



7.1 Before You Begin

For efficient and safe operation of the Oasis® Zephyr 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 Oasis® Zephyr 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 the 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 Zephyr sends heated fluid to the cabin fans and potable water heat exchanger.

For efficient Oasis® Zephyr Heating System operation:

- Minimize heat loss from the Oasis® Zephyr 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: Plumbing Oasis® Zephyr Heating System for Five Zones,* shows a typical plumbing layout for circulating heat transfer fluid from the Oasis® Zephyr to the cabin fans, in a single loop, and back to the Oasis® Zephyr.

7.2 Heat Transfer Fluid (Propylene Glycol) Plumbing Installation Procedure

Refer to Figure 7-3: Three Approved Methods of Installing Heater Hose. and Figure 7-1: Oasis® Zephyr Overview for the location of connection points.

1. Hose and/or tubing used to connect to the Oasis® Zephyr 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 also on top of the heater and labeled Heat Loop Supply and Heat Loop Return. The Heat Loop Supply connection is made by inserting the red 5/8" pex tube, extending from the heater, into the 3/4" ID heating loop supply hose. Note; make sure a brass "pex-insert" (included) is inserted into the pex to prevent the pex tube from deforming under tension from the hose clamp. The Heat Loop Return connection is made by connecting the 3/4" ID heating loop return hose to the 3/4" brass hose barb connection labeled "Heat Loop Return". 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 Oasis® Zephyr. Connect the space heating return line to the "Heating Loop Return" connection.

DANGER

Do not operate the Oasis® Zephyr 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. Ensure that the coolant flow is adequate through the Oasis® Zephyr 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 Oasis® Zephyr 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.
7. The Oasis® Zephyr should be filled and flushed prior to operation to remove any foreign debris.
8. Slip-on foam insulation coverings may be used over the hose fittings to reduce heat loss.

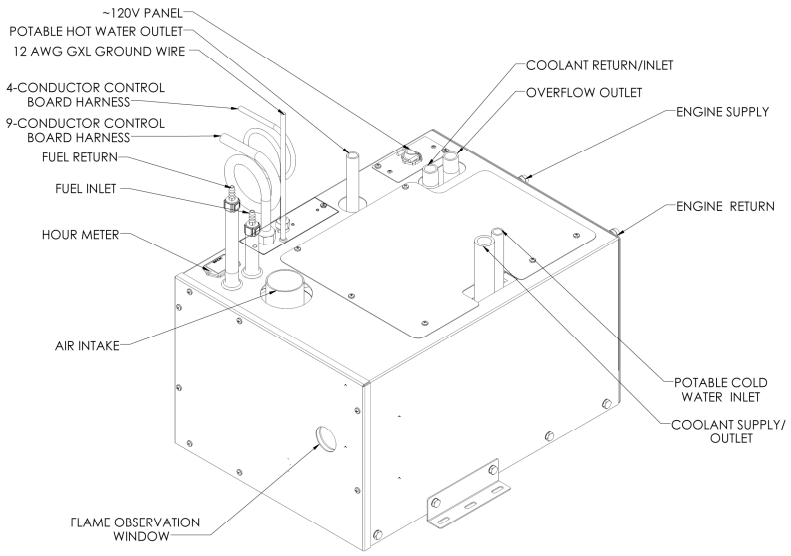


Figure 7-1 Oasis® Zephyr Overview

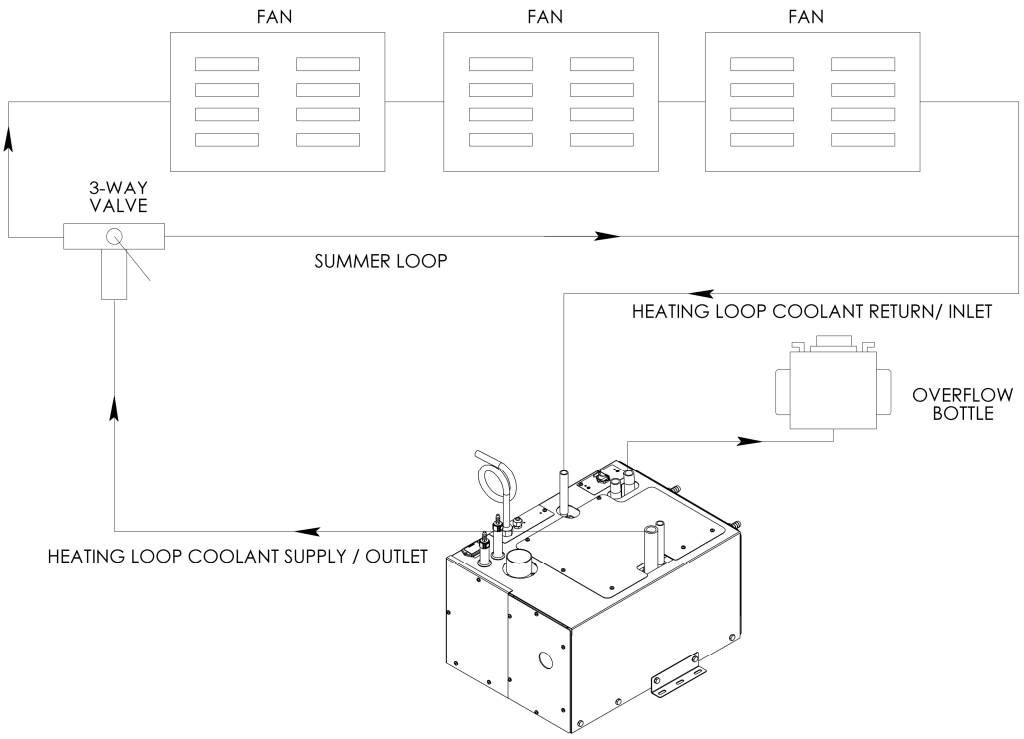


Figure 7-2: Plumbing Oasis® Zephyr for 3 Zones with (optional) summer loop

7.3 What NOT TO DO

NOTICE

The Oasis® Zephyr Heating System's 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.

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

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

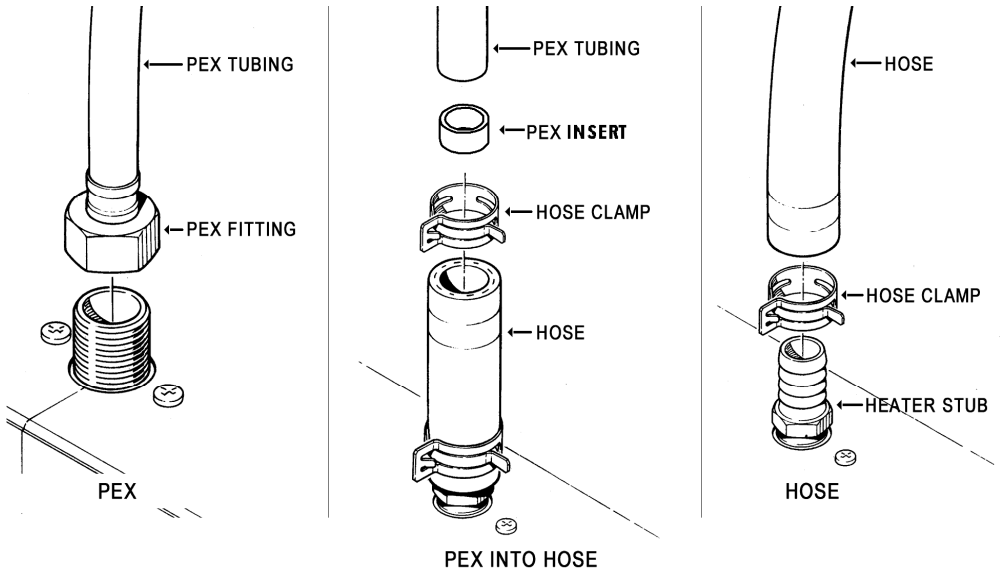


Figure 7-3: Three Approved Methods of Installing Heater Hose (consult ITR for alternative methods and products)

7.4 Potable Water Plumbing Installation

The Potable water connections are located on top of the Oasis® Zephyr. The Cold-Water Inlet and Hot-Water Outlet are be connected using PEX crimp fittings.

Both connections for Potable Cold Inlet and Potable Hot Outlet (labeled as such) are made with a crimped, Pex to Pex connection.

The maximum water supply pressure to the heater is 150 PSI (10 bar). The Hot water outlet temperature is regulated by an internal mixing valve factory set at 120F (49°C). If needed this valve can be adjusted between a range of 75F (24°C) to a maximum of 145F (63°C). See *Figure 7-4: Potable Hot water system plumbing.*

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.

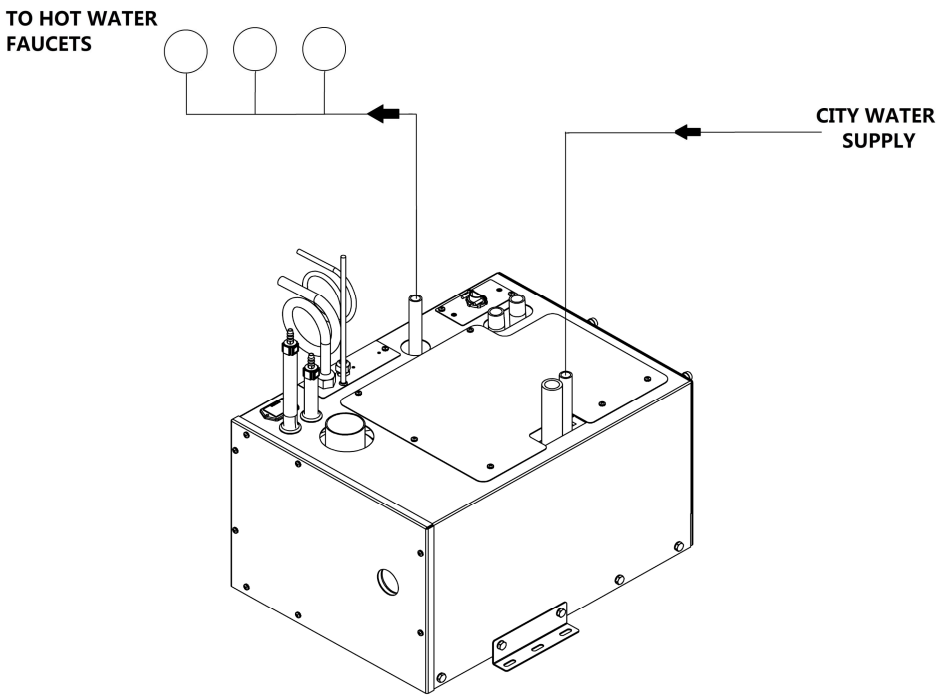


Figure 7-4 Potable Hot Water System Plumbing

7.5 Engine Waste-heat and Engine pre-heat Plumbing

Refer to figure 7-5: Engine heat/pre-heat system plumbing.

Hot coolant from the engine enters the Oasis® Zephyr at the connection labeled "Engine Supply" and returns to the engine from the connection labeled "Engine Return". When the Oasis® Zephyr is connected to the engine, engine waste heat can be used to provide space heating and hot water.

The Engine Heat Supply/Return connections are located on the back of Oasis® Zephyr and can be made using 1/2" MPT x 1/2" hose-barb or 1/2" MPT x 3/4" hose-barb fittings.

If the pre-heat function is required an additional, externally mounted, pump is installed. This pump circulates engine coolant through the Oasis® Zephyr engine heat exchanger, when the engine is turned OFF. A separate Engine Pre-Heat switch is required to activate this pump. For engine heat/pre-heat electrical connections *refer to figure 6-4 wiring schematic in Section 6, Wiring the Electrical System.*

It is recommended to contact the vehicle/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 Oasis® Zephyr and the coolant lines purged of air. Failure to purge the engine coolant loop prior to operating the circulation pump, will damage the pump.

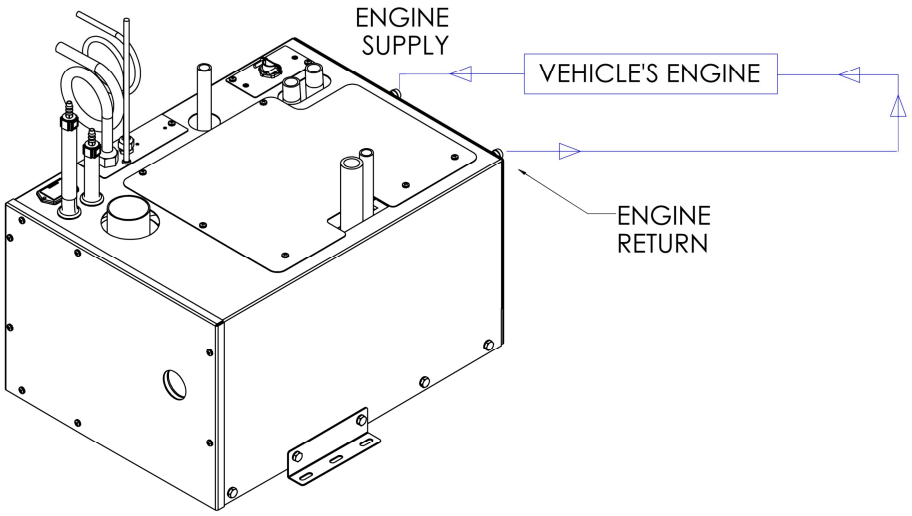


Figure 7-5 Engine Heat / Pre-heat System Plumbing

7.6 Procedure for Filling/Purging the Oasis® Zephyr Heating System

1 Do not operate the Oasis® Zephyr 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 Oasis® Zephyr, 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 (1/2" 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 on the control board circuit board onto both pins. The Oasis® Zephyr 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 filler 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. This Bypass Switch 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.

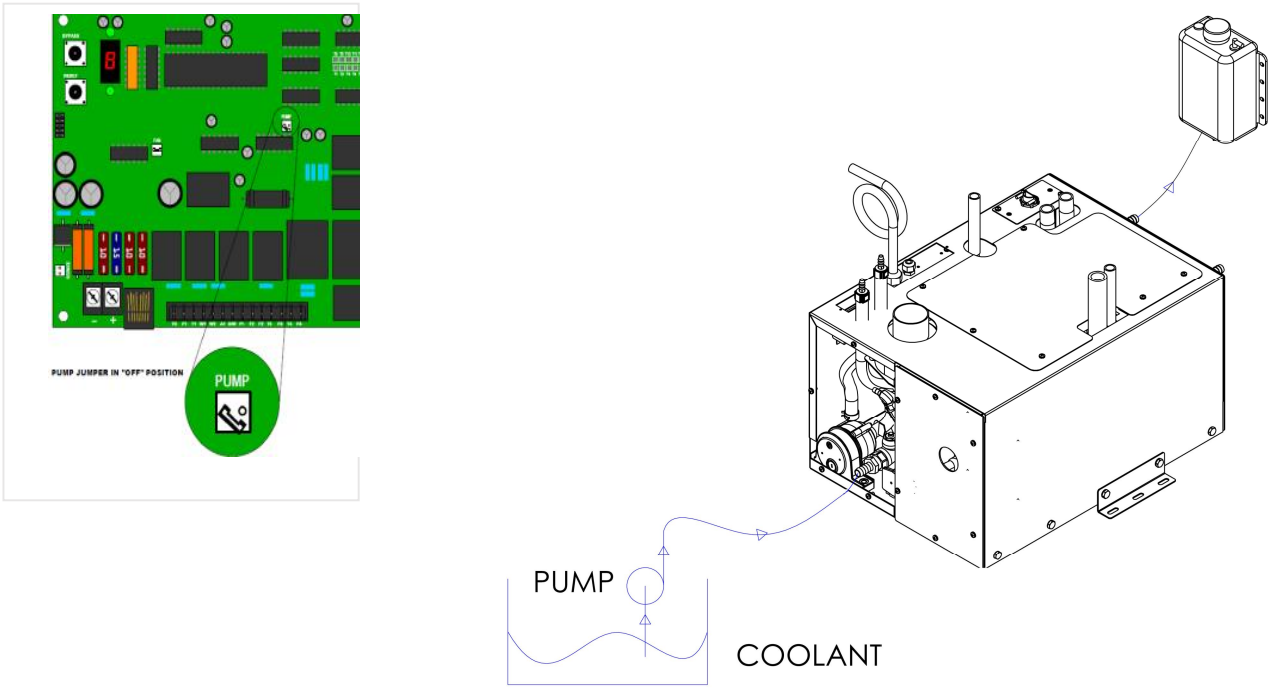


Figure 7-6 Filling/Purging Oasis® Zephyr Heating System

Section
8

Domestic Hot Water Heating Engine Heat Management

8.1 Before You Begin

When the heater is used only for heating domestic water and space heating is not required, a three-way valve or electric solenoid can be installed. This valve is intended to divert the heat transfer fluid through the heat exchanger but not the space heating loop *Refer to Fig. 8-1.* The selector valve should be mounted so it is easy to reach. *See Figure 6-4 for details of the electrical connections for a solenoid*.

Also, the heat exchanger has another heat transfer loop. Heat can be transferred from the heater to the engine for supplemental heat for engine pre-heat during cold weather.

For help with wiring the electrical components of the heat exchanger, *refer to Figure 6-4 wiring schematic in Section 6, Wiring the Electrical System.*

8.2 Domestic Hot Water System

A heat exchanger is located inside the Oasis® Zephyr™ HW 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.

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

Heat exchanger — The stainless-steel flat plate heat exchanger is UL and CSA approved for domestic water heating. This is installed inside the Oasis® Zephyr™ HW for hot water output once the heater reaches its cycle-off temperature (approx. 180ºF).

Aquastat — An aquastat (temperature sensor) signals the burner to fire and maintain system cycling temperature when there is a call for hot water.

Thermostatic tempering valve — For temperature control and to prevent scalding since the domestic water could reach 180°F (82°C). This is pre-set at the factory at 120°F.

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*

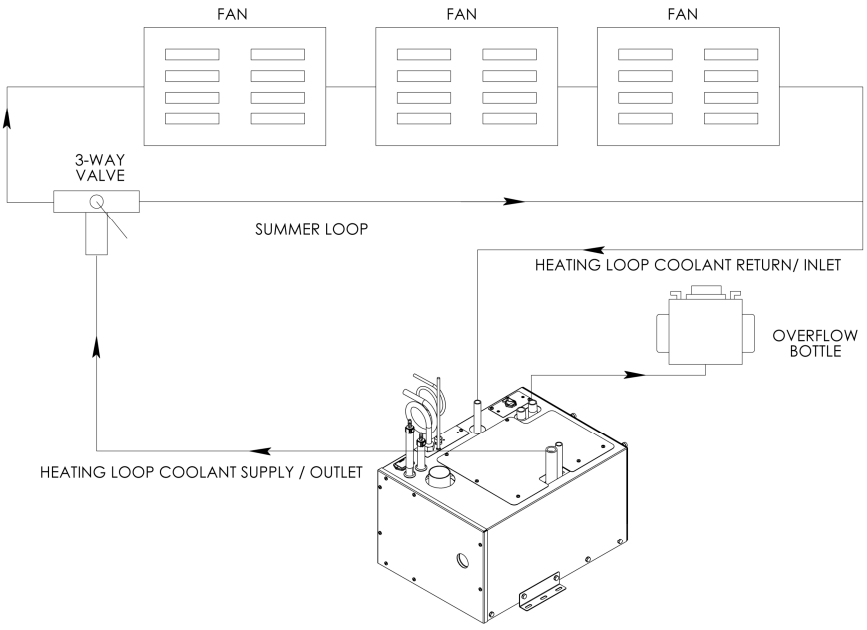


Figure 8-1: Single Loop System, three fans, optional summer loop

8.3 Engine Waste Heat Function

As outlined in section 7, the Oasis® Zephyr™ HW can be used to preheat the engine and to use waste heat produced by the engine.

While running, a liquid-cooled engine produces a large amount of heat; some of this heat can be captured by the Oasis® Zephyr™ and used to heat water and or provide space heating. An aquastat attached to the 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. Also, with the use of an extremally mounted pump, the Oasis® Zephyr™ can pre-heat the engine when engine coolant is directed through the engine heat loop section of the heat exchanger.

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 into 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 heat exchanger can also be used to pre-heat an engine before starting it. The Oasis® Zephyr™ HW contains two connections on the back panel to connect to the engine coolant system. It is recommended to use minimal ¾" ID hose for this connection. Pre-heating the engine makes it easier to start and it can be put under load immediately.

If installed, the optional engine pre-heat function is enabled by flipping a manual switch mounted inside the living area (not supplied), while the engine is **off**. This turns on a separate (not included) engine pre-heat pump.

The manual switch and engine pre-heat pump are wired to the vehicles electrical system via separate switches.

Procedure

To set up the engine pre-heat function:

1 Mount a manual switch in an appropriate place in the interior, usually near the dashboard.

2 Wire the manual switch to the engine water pump by connecting it to the main feed on the control board that connects to the vehicle's power source (beside the battery connection, see Figure 6-4 in Section 6, *Wiring the Electrical System*). The switch circuit should include a 5-amp fuse on the power side.

3 Connect the ground-wire of the engine water pump to battery negative.

4 To test the engine pre-heat function, turn on the heater and allow it to come to temperature (about 10 minutes). Turn on the manual switch to start the engine pre-heat pump. Start the vehicle engine, which should now be pre-heated to about 40°F (5°C) above ambient temperature.

Section
9

Operating the Oasis Zephyr heating System

This section describes the features, operation and maintenance of your new Oasis® Zephyr™ HW Heating System. READ THESE INSTRUCTIONS AND SAVE FOR REFERENCE.

9.1 Features of the Oasis® Zephyr Heating System

The Oasis® Zephyr 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 secondary heat source to provide an additional 5,000 BTU's 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 Oasis® Zephyr provides domestic hot water using an integral heat exchanger which also makes use of engine waste. 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 Oasis® Zephyr, see Figure 9-1, Oasis® Zephyr Heating System overview).

Main features of the Oasis® Zephyr:

• Built in coolant distribution pump for supplying coolant to multiple heating fans in a single loop, located in up to four different zones.

• An internal heat exchanger for heating domestic water using heat transfer fluid heated by the diesel-fueled burner and/or engine waste heat. The heat exchanger can also provide vehicle engine pre-heating with the use of an optional, externally mounted engine coolant circulation pump.

• Continuous, on demand hot water. The system increases ground water temperature by 60F at a flow of 1 GPM (using only the diesel

burner). An integral, adjustable water tempering valve (factory pre-set), will limit the temperature to 120F.

• Easy to install and field serviceable with hookups and connections easily accessible from the top of the heater. Engine coolant connections are made from the back 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.

• Unique, self-purging, 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 is 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.

• Touchscreen remote control with tactile operated ON/OFF buttons for the diesel burner, AC elements, and engine pre-heat, if installed.

• System control panel with LED fault indicators, operational and diagnostic information.

The initial start of your ***Oasis® Zephyr™ HW*** 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.

9.2 Starting the Heater

! DANGER

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

! WARNING

Do not operate the Oasis® Zephyr 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. On the Touchscreen Remote, touch the ON button.

2. Turn up the zone thermostat to a setting higher than room temperature.

3. Start the heater by switching the service switch to ON. This switch is located on the side of the electronic control box.

9.3 Signs of Normal Operation

When the heater is operating normally:

- When the service switch on the side of the control box is switched ON and the ON button is illuminated on the Touchscreen Remote, the combustion air intake fan will run for a brief period together with the circulating pump. (Whenever the combustion fan is running, the pump is also running, the green LED at the bottom of the LED display indicates the pump is running).

- The combustion fan will shut off briefly, the ignitor turns on, the fuel pump starts delivering fuel to the regulator, the compressor turns ON, the fuel solenoid opens, and fuel is drawn to the air aspirating nozzle. The atomized fuel is ignited while being sprayed into the combustion chamber to start combustion.

After the ignition period (about 10 seconds), the igniter shuts OFF, and the burner continues to operate. The heater will operate until all the zone thermostats are satisfied, or until the heater reaches its normal cycling temperature of approximately 180°F. Once the cycling temperature is reached, the burner will cycle off and the

combustion fan will operate for an additional two minutes to purge the system.

If 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, 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 touching the remote Burner ON button to restart the heater. After this reset 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 <u>while the heater is running</u>. Doing so will cause serious damage to the Heater, which will not be covered under warranty.

To turn the Heater OFF, touch the OFF button on the Touchscreen remote control panel. Turn OFF the ON/OFF service switch on the main control board box. The heater will automatically run through the purge cycle, which takes about two minutes. The heater will not start again 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 Oasis® Zephyr Heating System.

9.9 Domestic Water Temperature Adjustment

A thermostatic mixing valve located under the top access panel on the Oasis® Zephyr allows temperature adjustment of the potable hot water. This mixing valve is factory set to limit the maximum water temperature to 120ºF (49°C) with a hot water demand (flow-rate) of 1.0 GPM or less, and an incoming water temperature of 60ºF (15ºC) or higher. If needed this valve can be adjusted in a range from 75F (24°C) to a maximum of 145F (63°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 Oasis® Zephyr 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.

To adjust the mixing valve, the top cover of the Oasis® Zephyr must be removed. The mixing valve adjustment knob is shown in Figure 9-1.

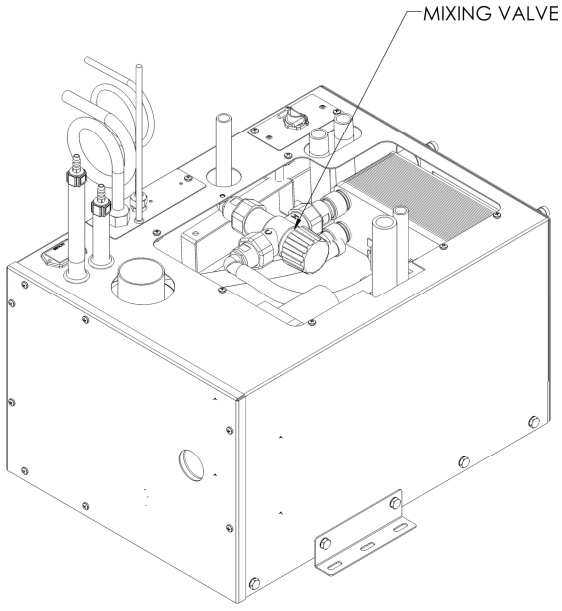


Figure 9-1 Mixing Valve Location

WARNING

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

Turning the mixing valve knob clockwise will decrease the hot water outlet temperature and turning the knob counter-clockwise will increase the temperature.

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 Oasis® Chinook 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 Oasis® 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 Oasis® Zephyr from temperature extremes and any dusty, dirty, corrosive environment.

! DANGER

Protect the Oasis® Zephyr 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

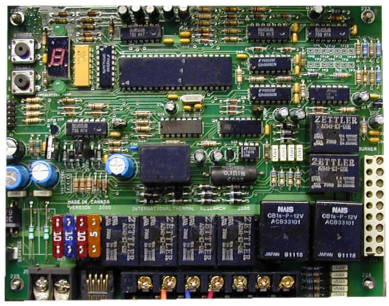
Note that any potable water in the Oasis® Zephyr will freeze in cold temperatures and will damage the internal parts (including the heat exchanger). For winterization, it is recommended that the potable water system be flushed with winterizing antifreeze that is safe for use in the potable water lines. Alternatively, the potable water lines can be blown out with air. Note that this method is not as reliable as using winterizing antifreeze.

Section
10

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 Oasis® ZephyrÊ HW 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 c Remote Switch Off

The remote panel is switched OFF.

- The burner will shut down.
- The diagnostic c 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.

- 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 s
- ize. 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.

10.10 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 fan or 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 Zephyr 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.

- 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 ¦ 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 ┐ 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.

Test Point	Component	Results / Optimal Condition
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

10.23 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 (intake hose / exhaust hose / combustion chamber)

Low combustion fan output (defective motor / wrong rotation / dirty fan blade)

Partially clogged grooves in nozzle distributor

10.24 A Silent Killer

The American Boat and Yacht Council Inc. (ABYC) states:

Section 5.111: "Where heater is installed in an engine or bilge space, 100% fresh air shall be supplied for combustion.

Section 6.1: "Burners shall be of the mechanical draft type which employs a power-driven fan, blower or other mechanism supplying air for combustion."

This means 100% fresh combustion air must be mechanically delivered through a sealed duct directly to the heater from outdoors. This is the recommended procedure no matter where the heater is installed. When combustion air is drawn from an unventilated heated space, the heater flame will become increasingly yellow as the oxygen in that space is consumed. An oxygen-starved flame produces excessive carbon monoxide (CO), some of which can easily escape the exhaust.
Carbon monoxide is a colorless, odorless, tasteless gas produced any time you burn a carbon-based fuel such as gasoline, wood, charcoal, kerosene, propane, or diesel. It disperses freely in the air and can accumulate in enclosed spaces or air pockets. RV owners and boaters are especially vulnerable to the dangers of CO because these vehicles have gas or diesel engines, as well as fuel-burning appliances, and their enclosed spaces can accumulate CO. CO is a cumulative poison; it can have fatal effects even at low concentrations. It is absorbed by your lungs like oxygen, and attaches to your red blood cells. When your blood can no longer transport sufficient oxygen to the brain and other tissues, you essentially asphyxiate.

A normal exhaust system is under constant attack from salt corrosion, gases, vibration, and impacts. It is important to inspect the exhaust system on a routine basis. Start with a visual

inspection for signs of damage and check each joint for discoloration from exhaust gas leaks, or other signs that may indicate a possible leak. Inspect all for corrosion and check that clamps are in good condition and secure.

Also, ensure that all ventilation systems are in good working order and not blocked. A poorly maintained heating system can produce excessive CO so it's important to keep your Oasis® ZephyrÊ HW clean, maintained on a regular basis and in proper running condition. Oasis® hydronic heating systems should never produce smoke or a detectable odor. If this occurs, the heater requires service.

Section 2.1: "All components including frames, fuel filters, solenoid valves, fuel pumps, blowers, shall be of a type suitable for the application., i.e., resistant to corrosion in salt atmosphere, capable of proper operation under conditions of vibration, shock, and the pitch and rolling action of the boat. Refer to applicable ABYC standards. Gravity hot water, gravity hot air and high-pressure steam systems are not recommended for boat use."

Make sure the heater you intend to buy is constructed of corrosion resistant material including the internal parts like the burner, combustion chamber, and water jacket. Parts made of steel or even painted steel will corrode and are very expensive to replace besides being dangerous to your health. All the major parts of the Oasis® Zephyr™ HW Heater are constructed of corrosion resistant materials.

Section
11

Maintenance

11.1 The First Few Weeks

Once the Oasis® Zephyr™ HW 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 Oasis® Zephyr™ HW 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 Oasis® Zephyr™ HW 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)

Once the system has been filled with water and purged of all air during the installation procedure, you need to operate the heater at normal temperatures and check for

leaks. If you do not find any, add antifreeze to lubricate the pump and prevent the water system from corroding or freezing in cold weather. See Sec. 7, Plumbing and filling the System -7.6 pg. 7-7.

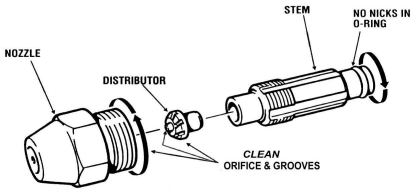
PRECAUTION: Where there is a chance of contamination of your domestic water when using a heating system, use antifreeze specifically intended for hydronic heating systems. Inhibited propylene glycol is recommended. Do not use automotive, ethylene glycol, or any undiluted or petroleum-based antifreeze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

IT IS VERY IMPORTANT TO NEVER USE WATER ONLY AS A HEAT TRANSFER FLUID.

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

A coolant conditioner can be added to the water system, to keep the coolant alkaline and not acidic, see page 3-14. These inhibitors also prevent the coolant from forming calcium scales. Conditioners are available from diesel engine manufacturers to maintain water stability and prolong heater life. If a conditioner is not installed in your system, check the pH level yearly. The components inside the heater should not normally require maintenance, except for periodic checks for obvious problems, such as leaks or overheating.

11.3 Nozzle



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

11.4 Fuel Lines and Filter

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

11.5 Combustion Chamber

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

11.6 Checking Hoses and Tubes

Every so often, check water hoses and tubes for leaks or weak points. Check air and fuel lines, pay close attention to the condition of the hoses at the point where they connect to a

fitting. 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.

11.8 Recommended Spare Parts

Like any piece of machinery, your Oasis® Zephyr™ HW heater will need servicing from time to time. A suggested maintenance schedule, page 11-4, lists suggested maintenance items and intervals. The following is a list of parts recommended to have on hand:

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

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

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

MAINTENANCE ITEM	MAINTENANCE FREQUENCY	SERVICE REQUIRED
Air/FUEL/WATER HOSES	SEASONALLY	INSPECT FOR LEAKS AND WEAK POINTS
HOSE CLAMPS	SEASONALLY	INSPECT FOR CORROSION TIGHTEN IF LOOSE
COMBUSTION CHAMBER AND EXHAUST	1000 HOURS	VACUUM CLEAN
FUEL FILTER	SEASONALLY	INSPECT FOR CLEANING OR REPLACEMENT
NOZZLES DISTRIBUTOR ORIFICE, AIR SLOTS & O-RINGS	SEASONALLY OR 2000 HOURS	CLEANING AND INSPECTION FOR WEAR AND DAMAGE
EXHAUST SYSTEM	SEASONALLY	INSPECT FOR LEAKS AND CORROSION
COOLANT MIXTURE	36 MONTHS 11 MONTHS	REPLACE Ph LEVEL FOR ACIDITY
ELECTRONIC CONTROL PANEL	SEASONALLY	VOLTAGE TEST / INSPECT FOR CORRODED WIRES
AIR COMPRESSOR FUEL PUMP COMBUSTION FAN MOTOR	SEASONALLY	INSPECT FOR LEAKS, CORROSION & WEAR

Figure 11-1 Maintenance Schedule

11.9 Protecting Hydronic Heating Systems

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

Regular maintenance and prompt repair of leaks, combined with a one-time application of appropriate inhibitors, can help you enjoy problem-free heating. Since it is difficult to guarantee that a hydronic heating system will never leak, corrosion inhibitors

and scale inhibitors added to "fresh" boiler fill water can act as low cost "insurance" for hydronic systems.

Causes of Scale

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

Acidity and Corrosion

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

Since most hydronic heating systems are comprised of different metals (e.g., iron, copper, etc.), and since boiler fill water is an electrolyte (that is, it will conduct electrical current), electro-chemical reactions ("galvanic" reactions) can take place. As the fill water stabilizes, however, it becomes a very weak electrolyte, so galvanic corrosion rarely becomes a problem - as long as the system remains leak-free.

Preventative Treatments

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

INTERNATIONAL LTD
THERMAL RESEARCH

Warranty Information

Attention Purchaser and Installer

General Warranty

- ITR warrants the **Oasis® Zephyr (referred to as "heater(s)")** and all other ITR supplied accessories and components with the original purchase to be free of defects in materials and workmanship under design usage and service conditions for one (1) year from the heater serial number label manufacturing date or installation 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.

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.

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

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.

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.

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.

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

Website: http://www.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

OWNER'S SERVICE LOG:

Date	Service Performed	Service Center