



HURRICANE®

HEATING SYSTEM

OPERATOR'S MANUAL®



INTERNATIONAL LTD
THERMAL RESEARCH



Complies with the requirements
of UL 307A, Listing No. 00A02

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International Thermal Research Ltd.

Covered by U.S. Patent # 5,391,075
And other U.S. and foreign patents
and patent applications

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THE LATEST TECHNOLOGY IN A DIESEL HOT WATER HEATING SYSTEM

HURRICANE®

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

The HURRICANE heater utilizes a low pressure fuel system. The built in fuel pump draws fuel from the fuel tank up to a zero pressure regulator where it stops. An air accumulator is installed inline between the fuel pump and the regulator to trap any air bubbles from passing through the nozzle causing nuisance shutdowns. The accumulated air can be periodically bled off through the bleeder valve. For continuous bleeding, a return line can be run back to the fuel tank. A small compressor delivers air to an air aspirating nozzle. This nozzle draws fuel from the zero pressure regulator, mixing it with air through a venturi. This process produces a very fine mist of fuel into the burner providing complete combustion and very low emissions. This low pressure system allows the use of a larger fuel orifice, less clogging, less wear and less maintenance. Ignition is accomplished by a low draw ignitor, approximately 2 amps, for thirty seconds. A small fan provides outside air for combustion and a positive exhaust flow through a single thru-hull fitting. Combustion air is drawn from outside so the heater can be installed in an air tight compartment or in the engine room without the fear of starving the heater of air or back venting the heater with the engine running.

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

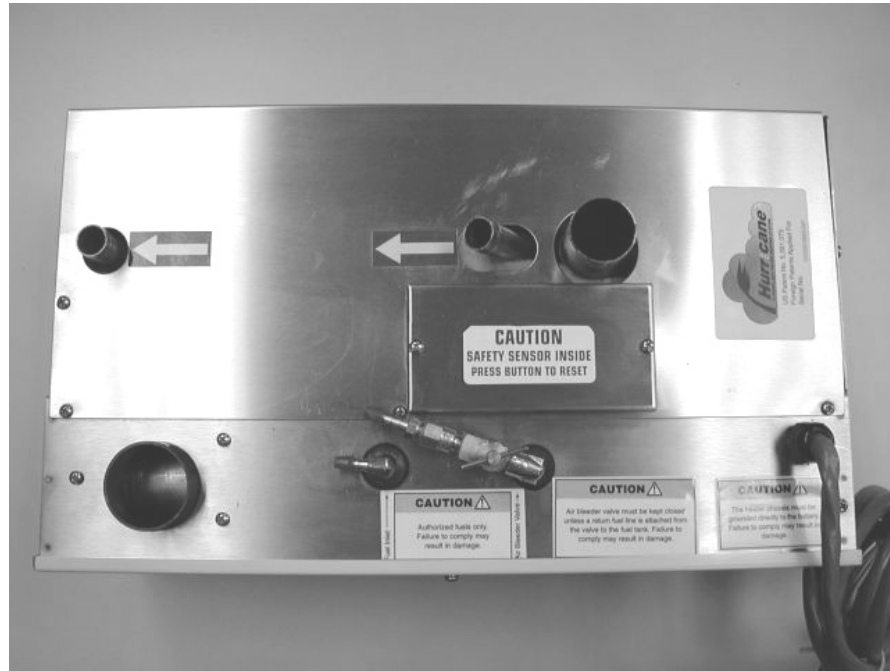
A remote control panel is provided as standard equipment. The remote panel has an on/off reset switch and a LED digital readout, for indication of normal or fault operations respectively. A signal beeper on the remote panel serves as an audible indication of a fault causing a shutdown situation.

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

| |
|--|
| <p>This publication was correct at the time of printing. ITR has a policy of continuous improvement in its products and reserves the right to amend any specifications or procedures without prior notice.</p> |
|--|

IMPORTANT NOTICE

The Hurricane heater now has an additional secondary safety shut off feature. A high temperature, overheat aquastat as shown in the pictures below. This aquastat is a manual reset only type, and if tripped, should not be reset until an authorized ITR dealer or service representative has examined the heater.



CHAPTER 1

INTRODUCTION AND TECHNICAL SPECIFICATIONS

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

This manual should tell you the basics of what you need to know for a proper installation, operation, and maintenance of your heater. **ITR** or your local **HURRICANE** dealer are available to help with installation and maintenance, and to answer your questions. Your local HURRICANE dealer can supply you with any accessories needed to install the heater. See Chapter 7 for information on our warranty and customer service, and how to contact us.

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

Technical Specifications

| MODEL | BTUH Input | WATER Connection | EXHAUST Outlet | US GAL Capacity | AMPS | FUEL GAL/H | MIN FLOW GPM | O.D. h x w x d (Wt - lbs) |
|---------------|------------|------------------|----------------|-----------------|------|------------|--------------|---------------------------|
| CO32D | 32,000 | 0.75" | 1.50" | 1.0 | 4.0 | 0.20 | 2 | 7"x11"x19.0" (37) |
| CO45D | 45,000 | | | | 6 | 0.30 | 3 | |
| CO65D | 65,000 | 0.75" or 1.50" | 2.0" | 1.25 | 6 | 0.45 | 4 | 10"x15"x29.0" (75) |
| CO85D | 85,000 | 1.50" | 2.0" | 2.50 | 11.0 | 0.60 | 6 | 10"x15"x29.0" (75) |
| CO105D | 105,000 | | | | 13.0 | 0.75 | 7 | |



MODEL CO45D



MODEL CO105D

1.1 FEATURES

Designed for the marine and RV environment, the **HURRICANE** heater features unique, state of the art technology. Special features of the **HURRICANE** heater include:

- Fuel efficient burner which burns all grades of diesel fuel, stove oil, furnace oil, and kerosene without any burner adjustments (not for use with gasoline)
- Zero smoke, no carbon build-up, no fouling or smell
- Copper and brass water jacket transfers more heat to the water and reduces the fuel consumption (three year warranty)
- High temperature 310 stainless steel burner and marine stainless steel jacket
- Quiet operation and low power consumption
- All heaters are designed to operate on 10.5 to 15.0 V.D.C.
- All heaters are electric ignition, which draws 2 amps for 30 seconds on startup
- Insulated enclosure for retaining heat and minimizing noise
- Sealed combustion – 100% outside air is fan assisted to the combustion chamber and then exhausted outside, avoiding back pressure
- Includes four zone heating control for up to four thermostats
- Completely modular and field serviceable (user friendly)
- Hookups and connections are easily accessible
- Electronically controlled. Safety features include four second shutdown in case of failure, LED digital readout on the electronic control panel for indicating faults, aquastats for monitoring water temperatures and a flame sensor to monitor the flame
- Complete with remote control panel with ON/OFF reset button, LED digital readout, and signal horn
- Jumper for constant pump circulation (Automatic cycling when off)
- All heaters cycle at an operating temperature of 180°F (82°C) with overheat cutout set at 195°F (90.5°C)
- Air accumulator installed in the fuel line to collect air bubbles and prevent them from reaching the burner and causing nuisance shutdowns

The **HURRICANE** Hydronic Heating Systems have been tested to UL 307A "Liquid Fuel-Burning Appliance for Manufactured Homes and Recreational Vehicles" and is listed by Testing Engineers International Inc. - Listing Services (TEI - LS) for Recreational Vehicle and marine use.

CHAPTER 2

2.1 COMPONENTS

Below is a description of the parts that come with the basic **ITR HURRICANE** heater. Before you start the installation, make sure you have all of the components and **ARE FAMILIAR WITH ALL ASPECTS OF THIS MANUAL**.

- **HEATER** – includes a fuel pump, air accumulator, combustion air fan, compressor, regulator, fuel and air nozzle, burner, combustion chamber, and water jacket. Figure 2-1 at the end of this chapter shows a cross-section of a heater, with all the component parts and includes an insulated water jacket and a complete wrap around stainless steel cover. A ten foot long multi-conductor cable is prewired to the heater and plugs into the electronic control board.



- **ELECTRONIC CONTROL BOARD** – consists of a service switch, a jumper for a constant circulation pump, fuses, terminal connections, circuit board, a fault indicator LED digital readout from which you can monitor the entire operation of the heater. The circuit board allows four zone hookup of four thermostat, one Domestic Water Aquastat, one Heat Exchanger Aquastat, one water pump (maximum 10 amps total), and Cabin Fan Heaters (maximum 10 amps total).



- **REMOTE PANEL INDICATOR** – An ON / OFF - RESET switch with a LED digital readout and signal horn. Includes a cable that allows you to connect the remote indicator panel up to 25' away from the heater itself.



- **AIR ACCUMULATOR** – A tube with a bleeder valve eliminates nuisance shutdowns due to air bubbles in the fuel line. A return air line can be run back to the tank for automatic bleeding. See page 3-4 for more information.



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



2.2 OPTIONS AND ACCESSORIES

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

- **WATER PUMP** - These pumps circulates water through the system. It must be sized to a flow rate and head capacity. See circulating water pump, page 3-9.



- **EXPANSION TANK** - This tank is required to fill the heating system and allow for expansion. An automotive type overflow tank, part # 20021, should be connected to the filler neck of the tank for larger system capacities. Part # 20002: vertical, 5"W X 5 1/2"D X 13"H (12.7cm X 14cm X 33cm) Part # 20001: horizontal, 12"W X 4 1/2"D X 7"H (30cm X 11.4cm X 17.8cm)



- **WATER TO WATER HEAT EXCHANGER** – this device recycles waste heat from your engine and transfers it to the *HURRICANE* heater. The heater can also be used to pre-heat your engine. A second heat exchanger can be used to boost the temperature of your domestic hot water supply. (part # 5130). A double wall unit is available for the heating of potable water.



- **MIXING VALVE** - This valve is an anti-scald, proportional thermostatic water mixing/diverting valve with temperature lock at any setting. Fittings are 1/2" NPT and the temperature rating of the valve is 90° to 120°F.

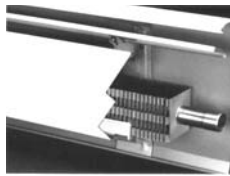


- **COPPER MANIFOLDS**

For larger installations, 2 or 3 loops are used to reduce the resistance of water flow and to distribute heat more evenly in each zone. See 3.21, circulating water pump, page 3-9.



- **BASEBOARD / FIN AND TUBE**



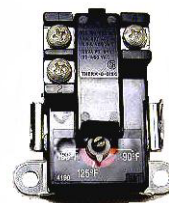
- **AIR VENTS / BLEEDER ASSEMBLY / VALVES**



- **FUEL FILTERS / FUEL LINE AND FITTINGS**



- **AQUASTATS** - Provides automatic control of domestic water heater (w-w terminals) and automatic utilization of waste engine heat.



- FAN HEATER** – Constructed of a copper core and stainless steel enclosure, these heaters provide up to 10,000 Btuh (2.9kW) of hot air. The Cabin and Spacesaver Heaters produces up to 140 cfm. and draws a minimal amount of current (.9 amps). The fan can be cycled thermostatically to allow regulation of the amount of heat delivered to a particular area. An integral aquastat prevents the fan from coming on until the heater has warmed up enough to eliminate the circulation of cold air. The Defrost Heater, provides up to 28,000 BTUH and uses a three speed fan, 200/275/450 CFM, 40/55/100 watts. All of the above fan heaters can also run directly off the engine and provide heat whenever the engine is running.

| | | | |
|-------------------|--------------|--------------------------|----------------------------|
| Cabin Heater | part # 6002: | 6”H X 10”W X 6”D | (15.5cm X 25.5cm X 15.5cm) |
| Spacesaver Heater | part # 6034: | 3 1/2”H X 9”W x 11 3/4”D | (9cm X 23cm X 30cm) |
| Defrost Heater | part # 6048: | 6”H X 10”W X 9”D | (15.5cm X 25.5cm X 23cm) |



CABIN



SPACESAVER



DEFROST

- AIR OUTLET PLATES** – These plates allows you to modify our cabin heater and the cabin defrost heater to permit ducting of warm air to one, two, or three separate outlets. Available in 3” and 4” combinations.



#1014



#1007



#1056

- AIR OUTLET GRILLS**



#1057



#1049



#6035



#1017



#1009



#1051

- **THERMOSTAT** – The *HURRICANE* heater can be controlled by up to four thermostats. They have a range of 50°F to 90°F with an OFF position.



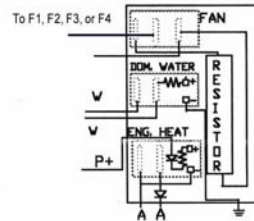
- **ZONE CONTROL BOARD** – gives you the option of running an additional 4 thermostatically controlled zones for fan heaters up to 10 amps maximum (part # 2014). Stainless Steel box for mounting is also available (part # 2012).



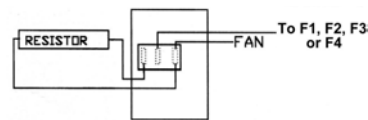
- **LCD READOUT REMOTE PANEL** - This panel will display the diagnostic explanation which will match up to the diagnostic code on the main board. A small buzzer will sound for 10 seconds to alert you of a fault (part # 2004).



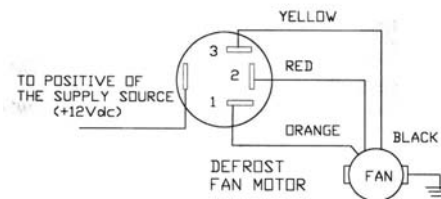
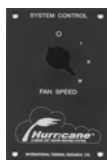
- **SYSTEM CONTROL SWITCH PLATE** - Combination, fan speed, domestic water and engine heat rocker switches (part # 5067)



- **TWO SPEED FAN SWITCHES** - Low and high speed fan switch for extra quiet operation in staterooms (part # 5068). For use with the Cabin Heater #6002 and the Spacesaver Heater #6034.



- **THREE SPEED FAN SWITCH** - Low, medium, high fan switch, part # 5106 for use with Defrost Heater #6048.



- **EXHAUST MUFFLER** – Constructed of stainless steel and packed with ceramic insulation. The straight through design eliminates any backpressure and reduces exhaust noise by up to 50% (part # 13008 - 1 ½”, 13009 - 2”). Also available in cold rolled steel. (part # 13006).



- **EXHAUST PIPE** – Flexible stainless steel exhaust pipe will allow you to connect the heater to the thru-hull exhaust fitting. The hose is flexible and allows you to easily route the exhaust around corners or other difficult situations. See page 3-2 for installation details. (part # 5134 - 2” (52mm) o.d., 5133 - 1 ½” (38mm) o.d. Insulating heat sleeve is available to prevent burns from contact **with the exposed hot exhaust pipe.** (part # 5136 - 2”, 5135 - 1 ½”). Good quality T clamps should be used on all exhaust connections



- **AIR INTAKE FLEXIBLE TUBING** – Allows you to connect the heater to the thru-hull fitting providing outside combustion air for a sealed combustion system. See page 3-3 for installation details. (part # 8019)

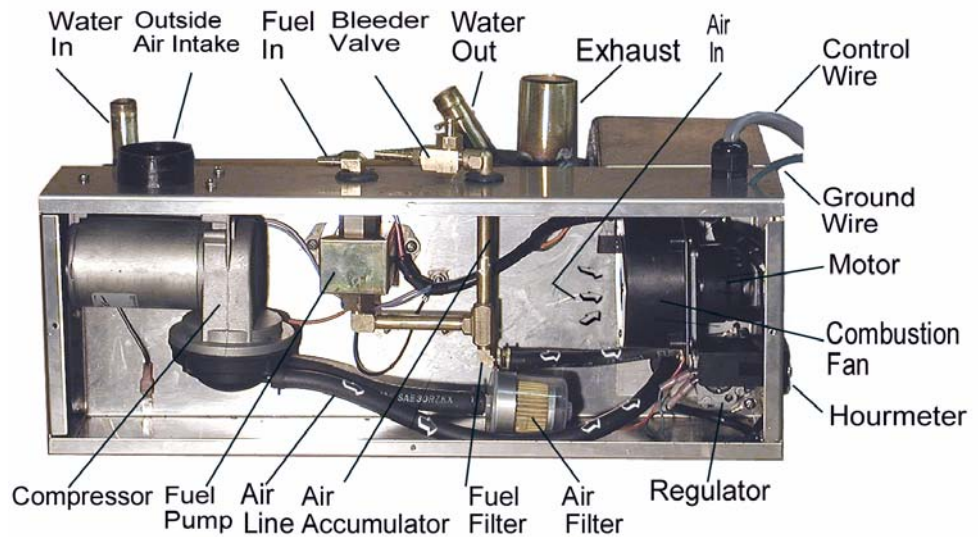


- **THRU-HULL EXHAUST /INTAKE FITTING** – Consists of a 2”(52mm) or 1 ½”(38mm) exhaust outlet and a 2” air inlet, providing a balanced system for the heater. Short and long sizes available for various hull thicknesses.

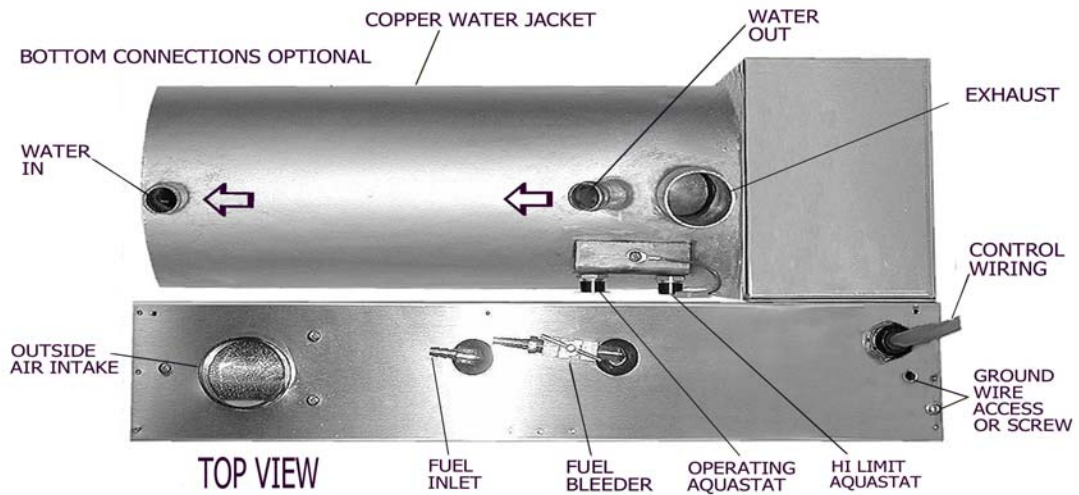


- **THRU HULL PLUG** - Stainless Steel to fit 1 ½" and 2" Exhaust / Intake Thru Hulls (page 6-1)





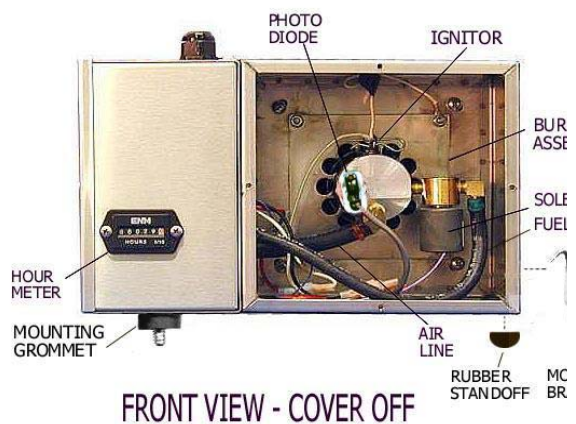
Left Side View - Cover Off



TOP VIEW

Figure 2-1
Component Parts
- CO Model

See Chapter 8 for complete
Parts Listing



FRONT VIEW - COVER OFF

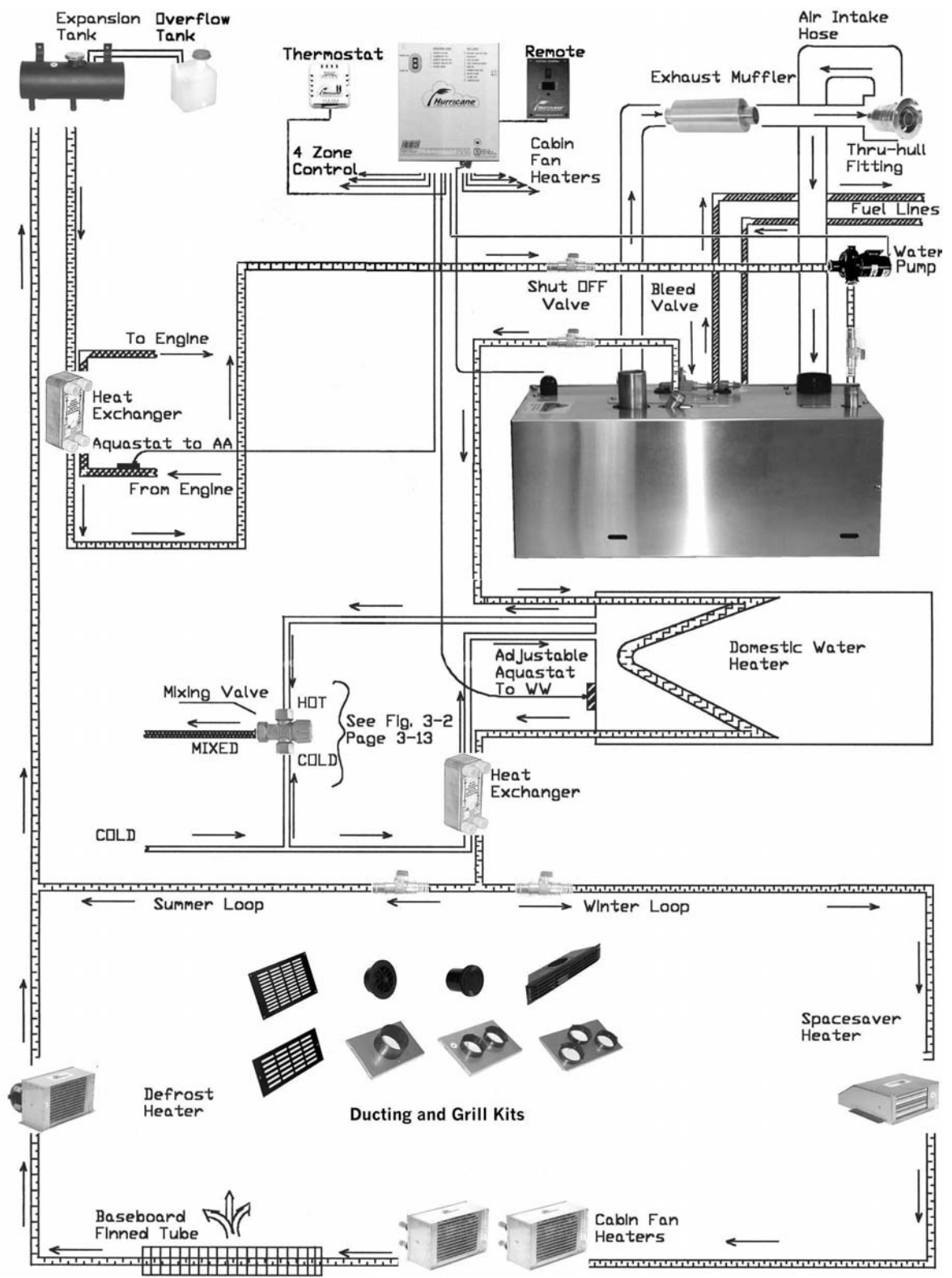


Figure 2-2 Typical Installation

CHAPTER 3

INSTALLATION

3.1 OVERVIEW



Installation of the *HURRICANE* heater is best done with some mechanical aptitude and electrical knowledge. It is a central hot water heating system, similar to what you might have in your home. Critical factors include sizing of the circulating pump, routing of the water lines, purging of water and fuel lines and installation of the electronic control box, among others. See fig. 2-2, page 2-8 for a typical installation.

A properly designed and installed system is essential to ensure that the customers receive satisfactory results, and a warm, comfortable environment. The following is a basic guideline to the entire heating system and will vary with every application.

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

Systems installed without dealer approvals will be limited to a 90 day or 250 hours of operation warranty. See Chapter 7 for warranty details before installing your system.

3.2 MOUNTING THE HEATER

The heater's physical size allows it to be mounted in a very small area that may be difficult or nearly impossible to access. For normal servicing, access to the front, left side, and top must be provided. The *HURRICANE* heater can also be ordered with bottom connections and/or front/right side access.

Choose a sturdy side wall or a mounting location that will not be affected by the heavy jarring and movement experienced by a boat in rough seas or a vehicle on rough roads.

You must consider the weight of the heater (full of water) when selecting a mounting location and mounting equipment. Keep in mind the exhaust run from the heater which may limit the mounting location. Ensure that the exhaust tubing can be properly and safely routed to the outside.

The heater comes with rubber mounting grommets installed, two installed in the bottom of the component enclosure box and one or two in separate brackets with self adhesive rubber standoffs. A screw or bolt with a washer (not included) must be used through the center of the grommet to secure the heater in place.

If the heater is going to be mounted in the engine compartment, check for adequate ventilation. When the engine is running, this area could be under a negative pressure. Make sure the air intake and exhaust hoses have no leaks and are well fastened to the heater, muffler, and thru-hull fitting. Assembly parts that may cause injury through accidental contact should be protected.

3.3 LOCATION/ELEVATION REQUIREMENTS

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

The expansion tank must be the highest elevation point in the system so that air can be easily expelled and water can flow directly down to the water pump. Mount the heater and all other parts of the system at a lower point than the expansion tank. An automotive type overflow tank is recommended off the expansion tank, part # 22001. This also provides a visual check of the coolant level.



The water pump must be mounted at the lowest point or in a location that ensures it will always be flooded and will not trap air. The pump must never be allowed to run dry. Check the manufacturer's recommendations. Make sure hoses can be installed without kinks which will restrict water flow.



3.4 EXHAUST SYSTEM

If the standards for mounting the exhaust system cannot be met, do not use this heater. Do not exceed these limitations. The exhaust system of this heater produces very little emissions of carbon monoxide, but caution must still be used. Do not operate the heater while in an enclosed shelter, unless there is adequate ventilation.

The exhaust system tube must be extended from the exhaust outlet of the heater to the thru-hull exhaust fitting located as high above the boat's water line as possible and preferably mounted on the transom of the boat. This location lessens the chance of the exhaust gases contacting combustible material such as a pier or rafted boat. On vehicles, the exhaust should be routed in the same direction as the engine exhaust. Never terminate the exhaust directly beneath the vehicle. Heavy duty exhaust clamps should be used to connect the exhaust tube to the heater, muffler, and the thru-hull exhaust fitting.



No more than 12 feet (3.7 meters) of exhaust tubing and no more than 360° of total bends, should be used on the exhaust system. Do not use mufflers that have any restrictions to flow.

Since the *HURRICANE* heater can produce exhaust temperatures in excess of 400°F (204°C), the exhaust system must be properly installed to approved ABYC standards, leaving suitable air spacing and using metal shields or insulation where required to protect combustible materials.

Never place any exhaust system parts close to combustible material or through a combustible wall or ceiling without fireproof protection.

3.5 EXHAUST INSULATION

If you wish to insulate the exhaust system, ask a qualified dealer for your options. Various high temperature insulation materials are available. If you do not insulate, an exhaust sleeve, can be used to protect yourself from burns due to accidental contact with the exhaust pipe (part # 5135, 5136).



3.6 EXHAUST MUFFLER

This muffler is a straight through design (part # 13008,13009) offering no resistance to exhaust flow. This is the only type that can be used in the HURRICANE heating system. It can effectively reduce exhaust noise by up to 50%. It must be tightly clamped in series with the exhaust piping.



3.7 THRU-HULL FITTINGS

According to American Boat and Yacht Council (ABYC) recommended practices and standards for installing boat heating systems, 100% fresh air must be available for combustion. To ensure a 100% fresh air supply, use a combination thru-hull exhaust outlet and air intake fitting. Make sure the fitting will not be installed where it could possibly take on water. If separate exhaust outlet and air intake fittings are used, ensure that they are located in the same side of the boat. This will ensure an equal pressure on both for a balanced system. In RV and truck applications where the heater is mounted in an airtight compartment, an intake air hose must be used, or an opening, of at least 3 inches in diameter, be cut to the outside to allow for combustion air.



3.8 AIR INTAKE TUBING

Air intake tubing of 2 inch diameter is for combustion air intake (part # 8019). The same rules apply as apply to exhaust runs, with a maximum of 12 feet.



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

DO NOT allow the combustion air intake and exhaust system tubing to touch as the exhaust system tubes can become very hot, and could melt the combustion air intake tube.

2. The air entrance for the air intake shall be guarded, shielded, or located to exclude rain, snow, debris and birds.
3. Secure both ends of the intake tube with properly sized hose clamps.

3.9 FUEL SYSTEM

NEVER use gasoline in your HURRICANE heater. The HURRICANE heater is designed to run on all grades of diesel fuel, furnace oil, stove oil, or kerosene. Do not install the HURRICANE heater in the same compartment where either gasoline is stored or gasoline equipment operates.

Fuel connections are on the top of the heater and consist of a supply and a bleeder valve located at the top of the air accumulator. This valve is used to bleed air out of the system after installation or after running out of fuel. The fuel supply must have a dedicated pickup on the main fuel tank. The pickup must allow the furnace to run out of fuel prior to the tank being empty.

The *Hurricane Heater* has a built-in fuel pump that is limited to the distance and lift it can handle. If the fuel line from the fuel tank to the heater is greater than 30 feet and the heater is installed more than 4 feet above the lowest fuel level, a second pump must be installed at the tank to assist in the fuel delivery. To extend the life of the fuel pumps a minimum 30-micron filter must be installed.

KEEP FUEL LINES AWAY FROM EXCESS HEAT

1. Use ¼" (5mm) copper or Coast Guard approved rubber fuel line to connect the fuel supply and filter to the heater. All fittings must be airtight and the lines purged of all air.



2. Install a high quality inline fuel filter (part # 6019).
3. Install an inline shutoff valve to isolate the system for filter service and to allow shutdown.
4. Flush the fuel line to rid the system of any foreign material.
5. Hook up the fuel line to the fuel pump built into the heater. The electrical wires for pump operation are pre-wired.

3.10 AIR ACCUMULATOR

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



A fuel bleed valve is located on top of the heater. You may add a short piece of hose so you can bleed the air into a bleed reservoir by opening the valve. Close the valve after the air is bled from the fuel line. Do not run the heater with the bleeder valve open. Constant bleeding is a sign of air leaks between the fuel tank and the heater.

3.11 FAN HEATERS

Where space is limited and for individual cabin or area control, use **ITR** fan heaters, Cabin Heater, #6002 or Spacesaver, # 6034. These heaters draw as little as 0.9 amps and deliver 140 cfm. They should be mounted as close to the floor as possible. They have a built in aquastat, which turns on the fan when the water running through it reaches 120°F (49°C), to prevent the blowing of cold air. See page 2-3 for sizes.



CABIN



SPACESAVER



DEFROST

The **HURRICANE** heater comes with a single zone hookup but can be used with an optional 4 zone (part # 2014) system to heat individual rooms or areas. Four thermostats control the fan heaters and the **HURRICANE** heater, allowing you to regulate the room temperatures in four different locations. The zone control board can control up to a 10 amp draw in total. **When using other than HURRICANE fan heaters, check the amperage draw for compatibility with the zone controller.**

Note: A limited number of fan heaters can be used with each of the HURRICANE heaters.

Care must be taken when connecting the hose to the inlet and outlet tubes of the heater. Use lubricant or soapy water in the end of the hose when making this connection. If too much force is used, the tube will break at the core and leak. This is not covered by warranty. Ensure that the fan heater's mounting compartments will be able to take in adequate air to the inlet of the heater. A minimum 16 square inch (100 square cm.) opening is required.



If two areas are located together, a dual air outlet plate will deliver heat for both areas. The fan heater can be mounted in a central location with one or two 3 inch or 4 inch ducts. Limit the length to 36 inches (92 cm.) for optimum air output.

3.12 BASEBOARD, FIN AND TUBE



If a long straight run of space is available, you may use baseboard heaters or build in fin and tube. This, however, will produce heat whenever the **HURRICANE** heater is operating and cannot be individually controlled by a separate thermostat.

3.13 ELECTRICAL SYSTEM

Your *HURRICANE* heater and electronic control board are tested and operated together before shipping. Refer to figure 3-1, page 3-7, to see how the system is pre-wired. The small remote panel contains a LED digital diagnostic display and signal horn, allows you to turn the heater on and off remotely, and to reset the heater if a fault occurs.

Note: Heaters manufactured after October 2003 utilize schematic B00157 shown above. For heaters manufactured prior to this date, please contact ITR for the appropriate electrical schematic. The first segment of the heater serial number found on the heater body identifies the heater model and manufacture date I.E. CO45D0803 denotes a model CO45D manufactured August 2003.

NEVER shut off the power to the heater using an inline battery or master switch, or disconnect the battery when the heater is running. Doing so will severely damage the heater and not be covered under warranty.

3.14 CONTROL BOX

Located on the side of the box is the service switch and inside, located on the main board, the jumper for constant pump circulation which allows you to run the circulating pumps, and test the system circulation, without turning the heater on. The service switch does not shut off the power to the control board. When disconnecting power leads from the board, turn off the power at the source, but not when the heater is running.

Mount the electronic control box close to the heater but not too close to excessive heat. Ensure that wire connections are easily accessible. The control box can be mounted in any position. Wire the control box, directly to the battery, through a fuse or breaker to ABYC or RVIA standards, using the following wire sizes. The negative connection must be made to the negative lug in the main control box. Make a separate additional ground from the shell of the heater directly to the battery using min #10 wire. Thermostat and fan heaters should be wired with a minimum #14 wire.

CONDUCTOR SIZES (GAUGE) FOR 3% DROP IN VOLTAGE

Length of Conductor From Source of Current To Device and Back To Source – Feet

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

AMPS

| | | | | | | | | | | | | | |
|-----------|---|----|----|----|----|----|----|----|----|---|---|---|---|
| 5 | - | 18 | 16 | 14 | 12 | 12 | 10 | 10 | 10 | 8 | 8 | 8 | 6 |
| 10 | - | 14 | 12 | 10 | 10 | 10 | 8 | 6 | 6 | 6 | 6 | 4 | 4 |
| 15 | - | 12 | 10 | 10 | 8 | 8 | 6 | 6 | 6 | 4 | 4 | 2 | 2 |
| 20 | - | 10 | 10 | 8 | 6 | 6 | 6 | 4 | 4 | 2 | 2 | 2 | 2 |

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3.15 FUSES

The control box contains four fuse holders. The top fuse (10 amp) is for the control board and combustion fan. The second fuse is for the main operating components. Models CO20, CO32, CO45, and CO65 are supplied with a 15 amp fuse and models CO85, CO105, are supplied with a 20 amp fuse. The other two fuse holders are for the circulating pump and the cabin fans and do not come with a fuse supplied. These fuses must be sized to the number and type of fans (maximum 10 amps total) and pumps (maximum 10 amps total) installed. All fuses must be installed for the heater to work. On previous main boards, the top two fuses were combined and were the glass tube type.



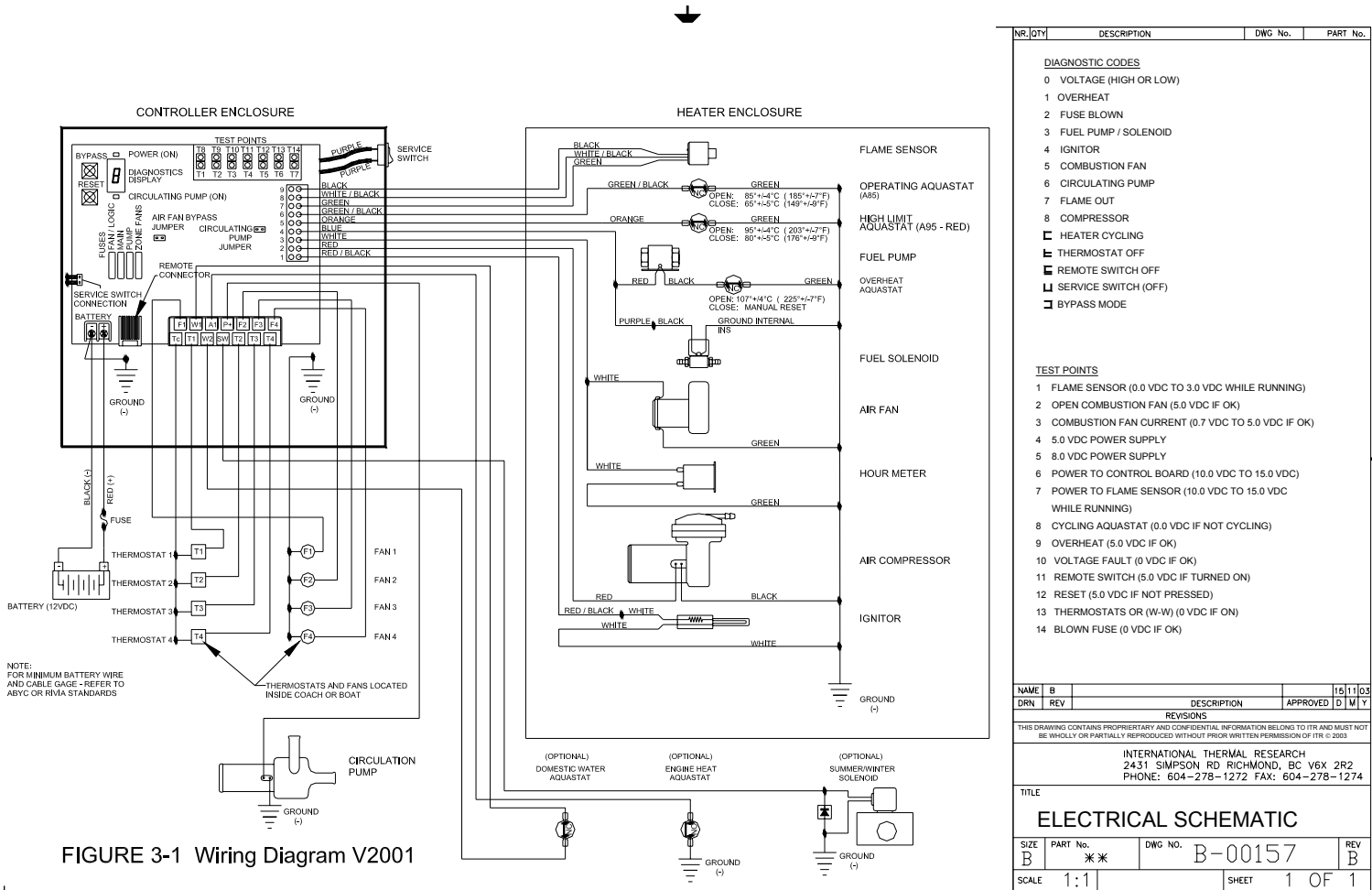


Figure 3-1

Wiring Diagram V2001

3.16 REMOTE PANEL



The remote panel controls the heater's operation. It has a combination ON / OFF - RESET switch, a LED digital diagnostic display and 10 second signal horn, which indicates system faults or shut-down. Check the diagnostic codes for the reason. By turning the switch OFF, then ON again, it resets the fault. The remote indicator panel is connected to the control box using the 25' (7.6m.) telephone type cable supplied.

The heater's electronic control system will automatically purge or cool the combustion chamber when the service switch, remote switch, or room thermostat is turned off. This will not occur if the power supply is disconnected which will cause severe damage to the heater.

3.17 THERMOSTAT WIRING

Terminals for four zone thermostats, circulating pump, and four cabin fan heater hookups are located inside the main electronic control box. There is an additional hookup for a switch and/or an aquastat from your domestic water heater and engine heat exchanger (see page 3-13). You are restricted to a maximum 10 amp total for fan heaters unless a relay is installed, with separate power, to switch larger loads.

The optional additional 4 zone control board (part # 2014) can be field wired. See Fig. 3-1, page 3-7. The 4 zone board allows for an additional 4 thermostats, controlling up to a maximum load of 10 amps in total.

3.18 FAN HEATER WIRING

Each of the thermostat zones mentioned above controls the corresponding fan heater hookup terminals. Once the number of fan heaters are established, the total amperage draw will determine the size of wire and the fuse used on the main control board. See Fig. 3-1, page 3-7.

NOTE: Fan heaters wired with the built in aquastat will only activate once the heater exceeds a water temperature of 120°F. This prevents fan heaters from blowing cold air causing drafts.

3.19 WATER SYSTEM

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

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

3.20 MOUNTING THE EXPANSION TANK

Refer to Fig. 2-2, page 2-6, to see how water flows in and out of the heater. The flow directions are properly labeled in this figure, so do not reverse them during installation.

1. Mount either the horizontal or vertical expansion tank at the high point of the system and pipe to the inlet of the circulation pump.
2. We recommend you install an overflow reservoir beside the expansion tank, connected to the collar at the top of the tank. The overflow reservoir will make it easier to fill the system with water and monitor water levels.

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

3.21 CIRCULATING WATER PUMP

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

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



Ensure the pump is at a lower point than your **HURRICANE** heater. Terminals are located inside the main control box which allow switching of pumps up to 10 amps maximum. Once the number and sizes of pumps are established, the total amperage will determine the size of wire and the fuse used in the main control board. See Fig. 3-1, page 3-7.

The most sensitive part of the heater system is the water pump. NEVER let the pump run dry or you will damage the seals and the pump will leak. This is not covered by the warranty.

3.22 RUBBER HOSE

Most heating specialists now install rubber hose for the heating systems. When properly selected and installed, rubber hose provides years of service with little or no maintenance. The insulation provided by rubber hose also helps to control heat loss. If slip-on foam insulation coverings are used, even less heat will be lost. Generally, a little heat loss is desired when the hose is run through closets, cupboards, and storage lockers to help keep things drier.



The typical installation is a single loop running from the heater, through each cabin heater, water heater, heat exchanger, expansion tank, all in series, to the inlet of the water pump then back to the heater. On larger installations, a main feed to a 2 or 3 loop manifold is used to split the load and reduce resistance to flow and distribute heat more evenly to each zone.

Each loop of the system should be a minimum of $\frac{3}{4}$ " I.D. (19mm.) and mains $1\frac{1}{2}$ " I.D. (38mm.). Avoid inexpensive heater hose, which can flatten out, collapse, or kink when subject to the normal operating temperature of the water. The low cost of poor quality hose will be negated by the time and material required to replace it.

Rubber hose must not come into contact with oil or fuel, which may cause it to soften and swell. If this is a possibility, insert it into PVC plastic tubing for protection.

1. Secure the hose to prevent sagging, kinking, or damage. When it passes through a bulkhead or opening, protect it from chafing or abrasion. If the hose is laid directly on the hull below the water line, it should be insulated.



2. If desired, to maximize heat retention, install slip-on foam coverings over the length of the hose.

3.23 AIR VENTS

Air vents must be installed at strategic points along the water system's piping where air might accumulate. An inline bleed assembly (part # 2215), is available for placement anywhere you may be required to bleed air from the system.



3.24 SHUT-OFF VALVES



Inline shutoff ball valves should be installed on either side of an item to isolate it so that it can be serviced or replaced without draining the system. When using a header and branching off with 2 or 3 loops, valves should be used at the start of each loop to balance the flow through each loop.

3.25 WATER FILLING PROCEDURE

After your system has been completely installed, filled with straight water, purged of all air, and operating for a period of time at normal operating temperatures, you should now double check all connections for leaks. If no leaks are found, the system can be drained and filled with a 50/50 mixture of antifreeze and water.



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.

To fill the system use a separate self priming pressure pump with a hose on the suction side. Put the hose into a 5 gallon container. Remove the systems hose from the outlet of the expansion tank, which is feeding the systems circulating pump and attach it to the outlet of the self priming pressure pump. Remove the hose from the inlet of the expansion tank and hang it into the 5 gallon container.

Make a final check to ensure all of the air vents and drains are closed. Pour a mixture of antifreeze and water into the container and start the pump. As the mixture is pumped out, slowly add more mixture keeping the level above the inlet of the suction hose until all air has been expelled and the mixture starts coming out of the return hose hanging in the container. This will flush the system of any debris and purge the lines of air. Continue to run the pump for about 15 minutes.

When no more air is being expelled, stop the pump and reconnect the lines to the expansion tank. Top off the expansion tank with the mixture and turn on the system's circulating pump with the jumper, located on the main control board just right of the pump fuse, marked "Circ. Pump Override". When the jumper is on, the pump will run continuously and the bottom LED will be lit.

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

CAUTION: Make sure you have a good, quiet circulation of water through the heater. Check the pump to make sure it does not run dry. If the heater has air pockets trapped in the water jacket when it is turned on, it could overheat and damage the unit. None of this is covered by warranty.

3.26 CHECKING WATER CIRCULATION

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

1. Listen for cavitations or a bubbling sound from the pump. This means that air is left in the system and circulation is poor. Purge the water system again.
2. If the water pump is quiet, use a flashlight to look inside the expansion tank. You should see water rushing out of the fitting, the force extending at least halfway across the tank. If water is just dribbling out, circulation is poor.
3. Remove the pump circulation jumper, which will return the pump to normal operational mode.
4. You should purge the air from the system again, through the air vents, after the pumps' first operational cycle, and once more after sailing your boat or driving your vehicle for a short period of time. This is because the rocking motion may loosen up small air bubbles that have not completely left the system. Once the water system has been completely purged of air, you will probably not have to purge it again.

3.27 DOMESTIC HOT WATER HEATING

The domestic water heater, with an internal heat transfer coil, piped as shown in Fig. 2-2 and using an adjustable aquastat (part # 1024), fastened to its storage tank, can be wired to the W-W terminals on the main control board to control the burner. We recommend a manual switch be wired in series with the aquastat.

During the summer months, when you need hot domestic water but don't need space heating, simply install a three way valve to short loop the water through the heat exchanger only and not through the heating system. See Fig. 2-2, page 2-6. The selector valve should be mounted so it is easy to reach.

3.28 USING A HEAT EXCHANGER

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

A fresh water cooled engine produces a large amount of waste heat while running. You can use this waste heat, to heat your boat or vehicle by adding an inline heat exchanger to your heating system (part # 5130). A manual switch, and /or an aquastat (part # 1027) attached to the water outlet of the engine, wired to A-A terminals, on the main board will start the circulating pump of your heating system, distributing waste engine heat to the entire boat or vehicle. The heat exchanger will also preheat your engine by transferring heat to it, from the *HURRICANE* heater.



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

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

For more information on operating the engine connected heat exchanger, see Chapter 4, page 4-3.

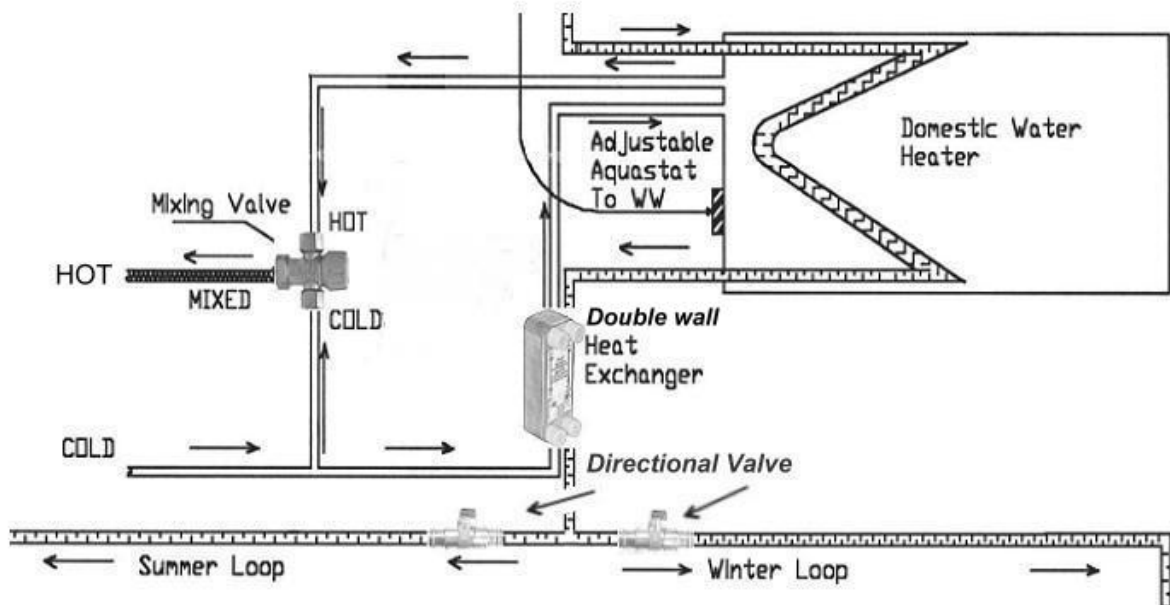


Figure 3-2

Optional Domestic Water Hookup using a double wall heat exchanger and mixing valve for a continuous supply of hot water

CHAPTER 4

OPERATION



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

4.1 STARTING THE HEATER

The major steps in starting the heater are as follows:

1. Turn on the ON/Off control switch, located on the remote indicator panel.
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.

4.2 SIGNS OF NORMAL OPERATION

When the heater is operating normally:



- The ignitor will glow and the combustion air intake fan and the circulating pump begin to run. Whenever the pump is running, the green LED at the bottom of the LED display will be on.
- A few seconds later, the fuel pump starts delivering fuel to the regulator, the compressor turns ON, the fuel valve opens, and fuel is drawn to the air aspirating nozzle. The fuel is atomized and sprayed into the combustion chamber to start combustion.

After the ignition period (about 10 seconds), the ignitor shuts OFF, and the burner continues to operate. The heater will operate until all the zone thermostats are satisfied, or until the heater reaches its normal water operating temperature of 180°F. Once the normal operating temperature is reached, the burner itself will cycle off and the combustion fan will operate for an additional two minutes to purge the burner. If a zone thermostat, domestic water heater aquastat, or engine heat exchanger aquastat is not satisfied, the circulating pump will continue to operate. If a thermostat cannot be satisfied by the residual heat in the system, and the water temperature drops, the burner will restart and cycle until all thermostats are satisfied. Once all thermostats are satisfied, the heater will go through the two minute purge, and the circulating pump will cease. The circulating pump will operate if the remote switch and any zone thermostat or the domestic water aquastat (W-W) are on. The circulating pump will be activated



independently by the engine heat aquastat (A-A). After the heater has been running for a little while, the water outlet of the heater case should become warm. If the water hose leaving the outlet of the heater does not warm up immediately after the pump comes on, water is not circulating properly and air may be in the system. Turn the heater OFF immediately and check water circulation, see page 3-12.

4.3 MAIN CONTROL BOARD OPERATION

Once the heater is operating normally, you must check the operating safety functions of the main board. To make sure the safety functions work properly, place your finger over the air filter inlet to the compressor, this will snuff out the flame. If you continue to block the air inlet, the heater will try to restart two more times and failing to do so will shut it down, stopping the compressor and fuel pump. This board will display a code 7. Reset the fault and the heater will continue with normal operation

4.4 STOPPING THE HEATER (FOR SEASONAL PURPOSES)

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



To turn the Heater OFF, turn OFF, the ON/OFF control switch, located on the remote indicator panel. The room thermostat or the remote indicator panel ON/OFF switch can be turned ON or OFF at any time, without harming the heater. The heater will automatically run through the purge cycle, which takes about two minutes.

4.5 STOPPING THE HEATER (FOR MAINTENANCE)

To shut down the heater totally, for maintenance purposes:

1. Turn OFF, the ON/OFF control switch, located on the remote indicator panel.
2. Turn OFF, the service switch on the electronic control box.
3. Wait until the heater has completed the purge cycle and turned itself OFF.
4. Disconnect the power supply.

4.6 RESETTING A FAULT

When a fault occurs and has been corrected, you can reset the fault 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.

4.7 HEAT EXCHANGER OPERATION

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

To pre-heat your engine:



Turn on the heater by a manual switch or timer wired to jumper the W-W terminal. If the heat exchanger is mounted upright, close to and near the bottom of the engine, it will transfer heat to the engine's cooling system through gravity circulation. A more positive solution is to install a pump on the engine side of the heat exchanger wired to the A-A pump terminals on the main board in series with a master switch.

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

1. Install a switch, and/or an aquastat (part # 1027), on the engine supply line to the heat exchanger, and wire to the A-A terminals on the main control board.
2. 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.
3. Start your engine.
4. When the engine aquastat heats up to its preset temperature, it will automatically switch on the circulating pump of the heating system. All other functions of the system will operate normally.
5. The circulating pump will continue to operate until the engine aquastat has cooled down. A manual switch can be wired in series with this aquastat to shut down the pump sooner if required.

4.8 DOMESTIC WATER OPERATION

If your water heater is connected to the *HURRICANE* heating system and its controlling aquastat (part # 1024) is wired to the W-W terminals on the main board, it will cycle the heater and the water pump. A manual switch can be wired in series with this aquastat to shut down the operation if desired. A bypass loop can be plumbed in for summer operation. See figure 2-2, page 2-6 and figure 3-2, page 3-13.

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

4.8 ELECTRICAL NOISE

Noise is unwanted electrical signals, which produce 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. One common symptom is that the system is erratic, 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.

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. Safety ground (chassis ground) should NEVER carry return currents.

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.

CHAPTER 5

TROUBLESHOOTING

5.1 OVERVIEW

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



You can easily monitor your HURRICANE heater's operation by checking the electronic control box. Refer to figure 3-1, page 3-7, to see how the electronic control box is wired. 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.

5.2 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:

1. Check for a blown fuse.

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 digital on the remote panel indicating it is ON.

5.4 **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.

5.5 - REMOTE SWITCH OFF

The remote panel is switched OFF.

-The burner will shut down.

-The diagnostic 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:

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

5.6 - HEATER CYCLING (NORMAL OPERATION)


The operating aquastat installed on the water jacket has being satisfied.

-The burner will shut down.

-The diagnostic code,  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 185° F (85°C) and on again at 150°F (65°C).

- If the heater cools and fails to resume operations and the diagnostic code  continues to be displayed, the aquastat is faulty or has an open connection.

5.7 - THERMOSTATS OFF (NORMAL OPERATION)

All thermostats and aquastats are satisfied.

-The burner will shut down.

-The diagnostic code,  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.

5.8 - VOLTAGE LOW OR HIGH


The battery or power supply voltage is below 10.5Vdc or above 15.5Vdc

-The burner will shut down.

-The diagnostic code,  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  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.


5.9 - OVERHEAT

The high temperature limit has been reached.

-The burner will shut down.


-The diagnostic code,  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  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. Then reset the fault after the water has cooled down by switching the service switch or the remote panel switch OFF then ON again.

If it does not reset, check for a faulty aquastat and proper ground.

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

5.10 - FUSE BLOWN


One of the fuses on the control board has blown.

-The burner will shut down.

-The diagnostic code,  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  will continue to be displayed.

-In order to restart the burner, replace any blown fuses with one of the proper size. Then reset the fault by switching the service switch or the remote panel switch OFF then ON again.

5.11 **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.

5.12 **4** - IGNITOR

The ignitor 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 ignitor and connections. Then reset the fault by switching the service switch or the remote panel switch OFF then ON again if the ignitor is **open** or by the service switch only if the ignitor is **shorted**.

The remote panel switch does not reset a short circuit fault.

5.13 **5** - COMBUSTION FAN

The combustion fan is open 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 if the combustion fan is **open** or by the service switch only if the combustion fan has **shorted**.

The remote panel switch does not reset a short circuit fault.

5.14 **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.

5.15 **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 three unsuccessful ignition 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 gets into the fuel system. This is normally caused by loose fittings or when your fuel supply is teed off a fuel line used by your engine or generator. As air accumulates and passes through the nozzle, it interrupts the fuel and shuts down the burner. When this happens, it may be necessary to reset the fault a few times to ensure all air has passed through the system. If the burner resumes normal operation, you must find the source of the air leak, otherwise, this fault will continue to occur. An Air Accumulator has been installed to collect the air before it reaches the nozzle. Check regularly and bleed if necessary. Air which is collected is an indication of a leak somewhere in the fuel system.

1. Check the fuel supply. The fuel pump will chatter if there is no fuel or when air is passing through the pump. Check the Air Accumulator for air and bleed if necessary. Check connections between the fuel tank and fuel pump and the regulator and nozzle for air leaks. Find source of air entry and repair. Make sure the nozzle or fuel filter is not clogged.
2. Check the air line hoses for any restriction of air flow 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.
3. Make sure the air pressure of the compressor with the nozzle installed, is at 8 to 9 psig for CO-20/32 models and 10 to 12 psig for CO-45/65, and 14 to 16 psig for CO-85/105 models.
4. 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.
5. Check for restrictions or leaks in the combustion air intake hose or exhaust pipe.
6. Check for open circuit on fuel pump/solenoid and compressor.

-To restart the burner, check the fuel supply, check for air in the fuel line, and clean the nozzle. Then reset the fault by switching the service switch or the remote switch OFF then ON again.

7. If when reset, the board shuts down without trying to restart the burner the board is defective.



5.16 **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.

5.17 **3** - BYPASS MODE

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

-While in the bypass mode, the diagnostic code, **3** 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 1, for overheat, and the Power ON LED will flash slowly. You will have to wait for the heater to cool before continuing in the 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.

5.18 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.

5.19 LED REMOTE PANEL

The remote panel consists of an ON/OFF reset switch, an LED diagnostic digit, and fault buzzer. The diagnostic digit matches the main control board which refers to the diagnostic codes as explained previously in this section. A small red LED will glow when the switch is on which also indicates that the service switch is ON. The small buzzer will sound for 10 seconds to alert you of a fault.



5.20 LCD READOUT REMOTE PANEL

This panel will display the diagnostic explanation, which will match up to the diagnostic code on the main board. A small buzzer will sound for 10 seconds to alert you of a fault.



5.21 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, white (+), black (-), and green (signal) connected to the main board. Under normal operating conditions whenever the burner ignition begins, the red LED will flash once indicating the white 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 green (signal) wire is disconnected, the board will shut down. If all the wires are properly connected with module flashing and the board still shuts down, diagnostic code 7 Flame Out, the board may be defective.



5.22 REDUCED OUTPUT

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

1. High altitude
2. Dirty nozzle (see page 6-2)
3. Defective regulator
4. Too small a nozzle
5. Poor water circulation (see page 3-12)
6. Ash deposit in combustion chamber (see page 6-2)

5.23 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:

1. Low voltage
2. High altitude
3. Dirty compressor air filter
4. Low compressor air output
5. Restricted combustion air flow (intake hose / exhaust hose / combustion chamber)
6. Low combustion fan output (defective motor / wrong rotation (see page 8-7) / dirty fan blade)
7. Partially clogged grooves in nozzle distributor (see page 6-2)

5.24 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. Even with one porthole barely open, air doesn't circulate enough.

Carbon monoxide is a colourless, odourless, 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. Boaters are especially vulnerable to the dangers of CO because boats typically have gas or diesel engines, as well as fuel-burning appliances, and their enclosed spaces tend to accumulate CO. Because 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. Any device that burns fuel creates CO, so your cooking stove and heater are both potential sources, especially if poorly ventilated.

The exhaust systems are under constant attack from salt water, gases, vibration, and normal wear. Inspect every exhaust system aboard your boat on a routine basis. Start with a visual inspection. Check each joint for discolouration, carbon buildup, stains, water leaks, or other signs of damage. Inspect all metal parts for corrosion. Check that clamps are in good condition and secure. Ensure that all ventilation systems are in good working order and not blocked. An untuned, poorly running engine or heating appliance produces excessive CO. Make sure it is tuned up, maintained, and runs smoothly. It should never produce black smoke.

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 "Hurricane Heater" are constructed of corrosion resistant materials.

CHAPTER 6

MAINTENANCE

6.1 THE FIRST FEW WEEKS

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



About two weeks after your HURRICANE heater 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.

6.2 ADDING ANTIFREEZE

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

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

IT IS VERY IMPORTANT THAT YOU NEVER USE WATER ONLY AS A COOLANT.



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

A coolant conditioner should 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.

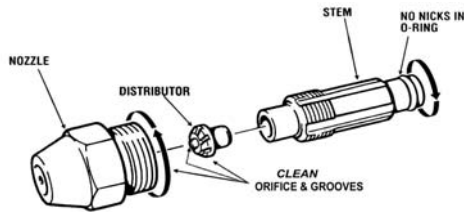
6.3 MARINE EXHAUST SYSTEM

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



While the exhaust system is made of a high quality stainless steel material, it is still affected by the marine environment. Check the general condition of the pipes every so often for possible leaks and corrosion. Service as required and replace corroded pipes immediately. On rough seas, there is a danger of water entering the exhaust outlet. Ask your dealer about a thru-hull plug that can be inserted into the exhaust outlet when the boat is moving through rough water. Obviously, the heater cannot be operated when the exhaust system is plugged.

6.4 NOZZLE



Nozzle problems such as clogging will result in a poor flame, small and blue. Carefully disassemble. Hold nozzle 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.

6.5 FUEL LINES AND FILTER



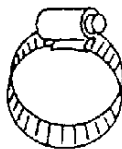
You should check your filter every season to determine if it needs replacement. The frequency depends largely on the quality of fuel you've been using.

6.6 COMBUSTION CHAMBER



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

6.7 CHECKING HOSES AND TUBES



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

6.8 ELECTRICAL SYSTEM

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

- Make sure that all your connections are secure.
- Periodically, do a voltage test to ensure that you are getting 12 volts from the battery.
- Check for corrosion of wires.

6.9 RECOMMENDED SPARE PARTS

Like any piece of machinery, your HURICANE heater will need servicing from time to time. A suggested maintenance schedule, page 6-4, lists suggested maintenance items and intervals. The following is a list of parts recommended to have on hand.

| <u>Description</u> | <u>Part No.</u> |
|--|-----------------|
| • Fuel filter cartridge | 6021 |
| • Air filter | 6018 |
| • Fuel nozzle (# for model CO 45) (See page 8-1 for the part # for other models) | 14017 |
| • Fuel nozzle "O" ring | 14025 |
| • Photocell (Board versions 5-10) | 16002 |
| • Photodiode (Board version 11/12) | 16003 |
| • Flame Sensor (Board version 2000 and 2001) | 16028 |

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

- Air compressor
- Fan Motor
- Ignitor
- Operating and High Limit Aquastat

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

Figure 6-1 Maintenance Schedule

6.10 PROTECTING HYDRONIC HEATING SYSTEMS

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

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

Causes of Scale

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

Acidity and Corrosion

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

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

Preventative Treatments

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

CHAPTER 7

WARRANTY AND SERVICE

7.1 WARRANTY

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

ITR warrants the *HURRICANE* water jacket to be free of defects in materials and workmanship under design usage and service conditions for three (3) years from the date of the completion of the installation or three thousand (3,000) hours of operation, whichever comes first. All other accessories, components supplied or installed in the heater shall be covered by the manufacturer's warranty for a period of two (2) years or two (2,000) hours from the date of the manufacture of that component. Warranty replacement parts are covered for the remainder of the Heater's warranty or ninety (90) days, whichever is greater.

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

7.2 INSTALLATIONS

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

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



Heaters installed without ITR's or an authorized Dealer's approval will be limited to a 90 day warranty measured from the date of the completion of the installation and so registered, or 250 hours of operation, whichever comes first.

7.3 LIMITED WARRANTY

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

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

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

7.4 OWNER'S RESPONSIBILITIES

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

ITR IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

7.5 NOT COVERED UNDER WARRANTY

This warranty will not apply to:

- Any parts or products which are no longer within the manufacturer's warranty period.
- Normal wear and tear of parts, including but not limited to, fuel filter, air filter, nozzle, fuses, ignitor, and carbon brushes.
- Parts or products which malfunction due to improper installation, including but not limited to malfunctions causing inadequacies in; air, fuel or coolant flow, voltage due to wiring, shock or vibration.
- Any progressive damage to the engine, vessel, or vehicle arising out of failure of the Heater unit.
- Heaters which have been modified or use of non-standard parts not approved by **ITR**.
- Heaters that have been abused, damaged, vandalized, or received improper maintenance.
- Travel time and expenses by an **ITR** dealer.
- Removal and re-installation expenses of the **HURRICANE®** Heater.

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

PLEASE FOLLOW THE RECOMMENDATIONS INCLUDED IN THIS MANUAL.

7.6 CUSTOMER SERVICE CALLS

Installation and service warranty is the joint responsibility of the ITR and the authorized Dealer. ITR warrants its products and the Dealer warrants the installation. Normal service calls are at the owner's expense.

Check the TROUBLESHOOTING CHAPTER of this manual to see if your problem is addressed.

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

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

7.7 RETURNS

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

1. Contact your dealer or ITR on instructions to repair and or return the warranty item.
2. Provide a full description of the problem.
3. Obtain 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 field repairs, an authorized dealer must obtain an authorized repair (RMA) number from ITR before warranty work commences.
4. When shipping your product, pack securely, show the RMA and serial number of the heater on the outside of the shipping container, and ship prepaid and insured.
5. Provide written details of the problems, date of installation, proof of purchase, and a return address. **After repair or replacement** of products still under warranty, ITR will pay return shipping charges. Factory repairs or replacement will be done as quickly as possible, with an estimated five working day turn around.

7.8 TELEPHONE SERVICE

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



- Call the Dealer from whom you bought the Heater, or call ITR

IN CANADA:

2431 Simpson Road

Richmond, BC, Canada V6X 2R2

Tel: 1-800-755-1272 or 604-278-1272

Fax: 604-278-1274

Email: itr@shaw.ca

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

IN THE UNITED STATES:

Suite 260, 600 SE Maritime Ave.

Vancouver WA USA 98661

Tel: 1-800-993-4402 or 360-993-4877

Fax: 360-993-1105

FILL OUT FOR YOUR REFERENCE

INTERNATIONAL THERMAL RESEARCH LTD.
Unit # 6 - 2351 Simpson Road, Richmond, B.C. Canada V6X 2R2
Ph 604-278-1272 Fax 604-278-1274

WARRANTY REGISTRATION CARD

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

HEATER

Serial No. _____

➔ SERIAL NUMBER **MUST** BE RECORDED FOR WARRANTY TO APPLY

Installed by: Owner Dealer

Date Installed: _____

TYPE OF INSTALLATION

Sailboat Powerboat RV Truck Bus

Commercial Pleasure Liveaboard

Heater location: _____

Length of exhaust: _____ Intake: _____

No. of zones: _____ No of fan heaters: _____

No. of circulating pumps: _____ Make: _____

Domestic water heater hookup: Yes No

Engine heating hookup: Yes No

OWNER

Name _____

Address _____

City _____ State / Province _____

Country _____ Zip / Postal code _____

Telephone _____

Signature _____ Date _____

AUTHORIZED DEALER

Name _____

Address _____

City _____ State / Province _____

Country _____ Zip / Postal code _____

Telephone _____ Fax No. _____

Signature _____ Date _____

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

PARTS LISTING

| ITEM | PART# | DESCRIPTION | ITEM | PART# | DESCRIPTION |
|------|-------|---------------------------------|------|-------|------------------------------|
| 1 | 9022 | BURNER BOX CO 20,32,45 | 32 | 2020 | BOLT |
| 1 | 9104 | BURNER BOX CO 65,85,105 | 33 | 23004 | WASHER |
| 2 | 9072 | MECHANICAL BOX, CO 20,32,45 | 34 | 23007 | WASHER |
| 2 | 9106 | MECHANICAL BOX, CO 65,85,105 | 35 | 23001 | WASHER |
| 3 | 20006 | WATER JACKET CO 20,32,45 | 36 | 19003 | SCREW |
| 3 | 20007 | WATER JACKET CO 65,85,105 | 37 | 23003 | WASHER |
| 4 | 9013 | FAN BRACKET | 38 | 23005 | WASHER |
| 5 | 2185 | BURNER CO 20,32,45 | 39 | 14029 | NUT |
| 5 | 2185 | BURNER CO 65,85, 105 | 40 | 2018 | BOLT |
| 6 | 6018 | AIR FILTER | 41 | 6015 | FAN MOTOR CO 20,32 |
| 7 | 8031 | HOURMETER | 41 | 6011 | FAN MOTOR CO 45,65,85,105 |
| 8 | 18001 | REGULATOR | 42 | 6009 | FAN BLADE (UNIT) |
| 9 | 16011 | FUELPUMP | 43 | 6009 | FAN BLADE SPRING CLIP (UNIT) |
| 10 | 3005 | AIR COMPRESSOR CO 20,32, | 44 | 6008 | FAN BLADE HOUSING |
| 10 | 3004 | AIR COMPRESSOR CO 45,65,85,105 | 45 | 19006 | SCREW |
| 11 | 9101 | ISOLATION MOUNTS | 46 | 9002 | IGNITOR |
| 12 | 2062 | ELBOW | 47 | 9001 | IGNITOR CLIP |
| 13 | 2059 | ELBOW | 48 | 14015 | NOZZLE BODY CO 20 (UNIT') |
| 14 | 2147 | BLEEDER VALVE | 48 | 14016 | NOZZLE BODY CO 32 (UNIT) |
| 15 | 2175 | ELBOW FILTER | 48 | 14017 | NOZZLE BODY CO 45 (UNIT) |
| 16 | 2127 | TEE | 48 | 14018 | NOZZLE BODY CO 65 (UNIT) |
| 17 | 2103 | NIPPLE | 48 | 14019 | NOZZLE BODY CO 85 (UNIT) |
| 18 | 2050 | COUPLING | 48 | 14020 | NOZZLE BODY CO 105 (UNIT) |
| 19 | 2067 | ELBOW | 49 | 14022 | NOZZLE DISTRIBUTOR (UNIT) |
| 20 | 1026 | AQUASTAT OPERATING | 50 | 14026 | NOZZLE SCREW PIN (UNIT) |
| 21 | 1028 | AQUASTAT HIGH LIMIT | 51 | 14025 | NOZZLE "O" RING |
| 22 | 5125 | STRAIN RELIEF (UNIT) | 52 | 14023 | NOZZLE FILTER |
| 23 | 5125 | STRAIN RELIEF NUT (UNIT) | 53 | 6039 | FUELBLOCK |
| 24 | 5125 | STRAIN RELIEF LOCKNUT (UNIT) | 55 | 16004 | PHOTODIODE |
| 25 | 9019 | BURNER BOX LID CO 20,32,45 | 56 | 2059 | ELBOW |
| 25 | 9107 | BURNER BOX LID CO 65,85,105 | 57 | 2101 | NIPPLE |
| 26 | 7019 | MECHANICAL BOX LID CO 20,32,45 | 58 | 19056 | SOLENOID |
| 26 | 9108 | MECHANICAL BOX LID CO 65,85,105 | 59 | 9103 | ISOLATION MOUNTS |
| 27 | 7019 | GROMMET | 60 | 19013 | SCREW |
| 28 | 7020 | GROMMET | 61 | 7003 | GASKET |
| 29 | 5006 | EYELET | 62 | 7010 | GROMMET |
| 30 | 19010 | SCREW | 63 | 16006 | PLASTIC WINDOW |
| 31 | 19009 | SCREW | 64 | 2237 | BARB FITTING |

NOTE: Parts listed as a unit must be purchased as a unit assembly

PARTS LISTING

| ITEM | PART# | DESCRIPTION | ITEM | PART# | DESCRIPTION |
|------|-------|--------------------------------|------|-------|---------------------------------|
| 20 | 1026 | AQUASTAT OPERATING | 26 | 9070 | MECHANICAL BOX LID CO 20,32,45 |
| 21 | 1028 | AQUASTAT HIGH LIMIT | 2 | 9072 | MECHANICAL BOX, CO 20,32,45 |
| 40 | 2018 | BOLT | 11 | 9101 | ISOLATION MOUNTS |
| 32 | 2020 | BOLT | 59 | 9103 | ISOLATION MOUNTS |
| 18 | 2050 | COUPLING | 1 | 9104 | BURNER BOX CO 65,85,105 |
| 13 | 2059 | ELBOW | 2 | 9106 | MECHANICAL BOX, CO 65,85,105 |
| 56 | 2059 | ELBOW | 25 | 9107 | BURNER BOX LID CO 65,85,105 |
| 12 | 2062 | ELBOW | 26 | 9108 | MECHANICAL BOX LID CO 65,85,105 |
| 19 | 2067 | ELBOW | 48 | 14015 | NOZZLE BODY CO 20 (UNIT) |
| 57 | 2101 | NIPPLE | 48 | 14016 | NOZZLE BODY CO 32 (UNIT) |
| 17 | 2103 | NIPPLE | 48 | 14017 | NOZZLE BODY CO 45 (UNIT) |
| 16 | 2127 | TEE | 48 | 14018 | NOZZLE BODY CO 65 (UNIT) |
| 14 | 2147 | BLEEDER VALVE | 48 | 14019 | NOZZLE BODY CO 85 (UNIT) |
| 15 | 2175 | ELBOW FILTER | 48 | 14020 | NOZZLE BODY CO 105 (UNIT) |
| 5 | 2182 | BURNER CO 20,32,45 | 49 | 14022 | NOZZLE DISTRIBUTOR (UNIT) |
| 5 | 2185 | BURNER CO 65,85, 105 | 52 | 14023 | NOZZLE FILTER |
| 64 | 2237 | BARB FITTING | 51 | 14025 | NOZZLE "O" RING |
| 10 | 3004 | AIR COMPRESSOR CO 45,65,85,105 | 50 | 14026 | NOZZLE SCREW PIN (UNIT) |
| 10 | 3005 | AIR COMPRESSOR CO 20,32 | 39 | 14029 | NUT |
| 29 | 5006 | EYELET | 55 | 16004 | PHOTODIODE |
| 22 | 5125 | STRAIN RELIEF (UNIT) | 63 | 16006 | PLASTIC WINDOW |
| 23 | 5125 | STRAIN RELIEF NUT (UNIT) | 9 | 16011 | FUEL PUMP |
| 24 | 5125 | STRAIN RELIEF LOCKNUT | 8 | 18001 | REGULATOR |
| 44 | 6008 | FAN BLADE HOUSING | 36 | 19003 | SCREW |
| 42 | 6009 | FAN BLADE (UNIT) | 45 | 19006 | SCREW |
| 43 | 6009 | FAN BLADE SPRING CLIP (UNIT) | 31 | 19009 | SCREW |
| 41 | 6011 | FAN MOTOR CO 45,65,85,105 | 30 | 19010 | SCREW |
| 41 | 6015 | FAN MOTOR CO 20,32 | 60 | 19013 | SCREW |
| 6 | 6018 | AIR FILTER | 58 | 19056 | SOLENOID |
| 53 | 6039 | FUELBLOCK | 3 | 20006 | WATER JACKET CO 20,32,45 |
| 61 | 7003 | GASKET | 3 | 20007 | WATER JACKET CO 65,85,105 |
| 62 | 7010 | GROMMET | 35 | 23001 | WASHER |
| 27 | 7019 | GROMMET | 37 | 23003 | WASHER |
| 28 | 7020 | GROMMET | 33 | 23004 | WASHER |
| 7 | 8031 | HOURMETER | 38 | 23005 | WASHER |
| 47 | 9001 | IGNITOR CLIP | 34 | 23007 | WASHER |
| 46 | 9002 | IGNITOR | | | |
| 4 | 9013 | FAN BRACKET | | | |
| 25 | 9019 | BURNER BOX LID CO 20,32,45 | | | |
| 1 | 9022 | BURNER BOX CO 20,32,45 | | | |

NOTE: Parts listed as a unit must be purchased as a unit assembly

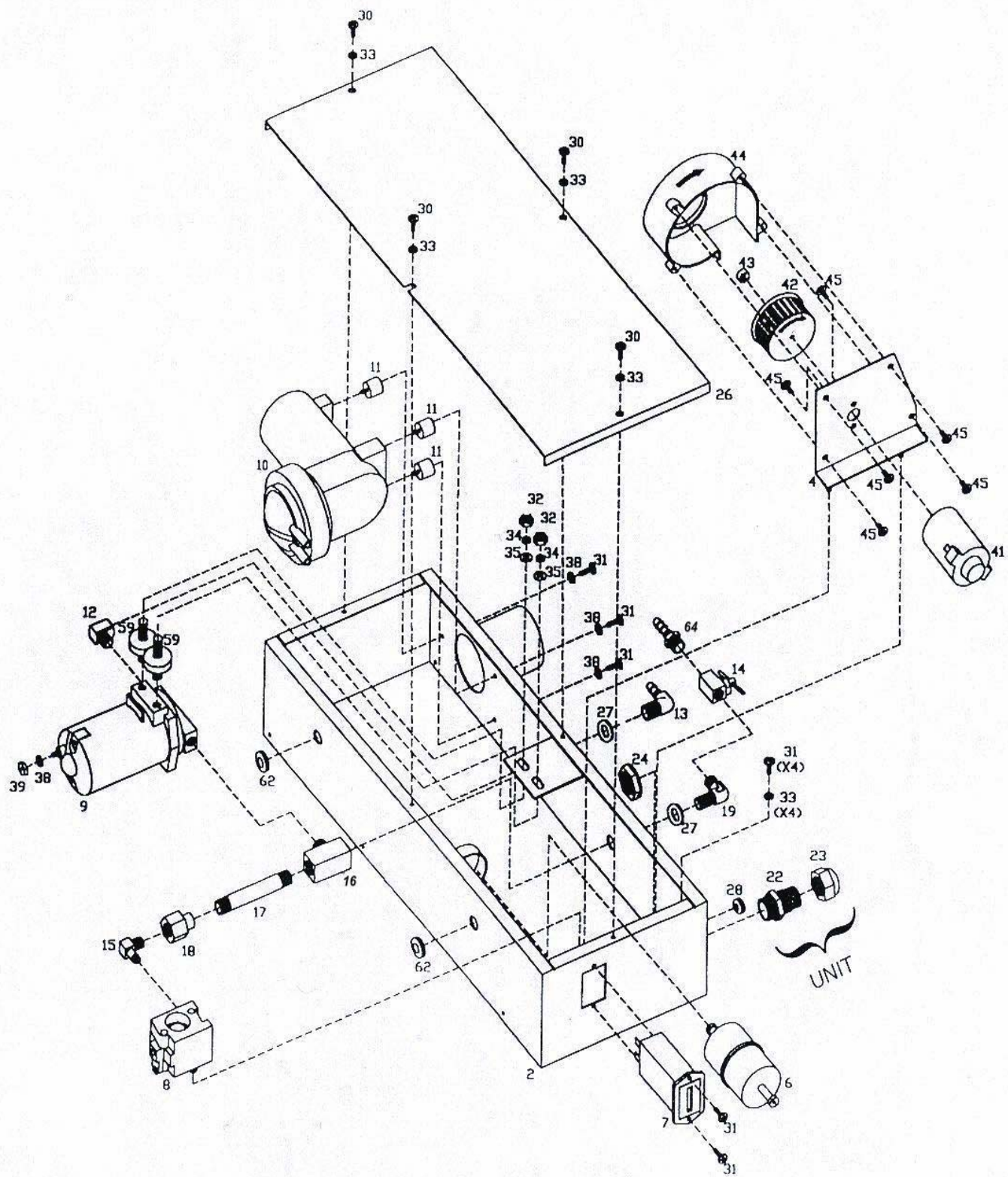


FIGURE 8-2 COMPONENT BOX ASSEMBLY

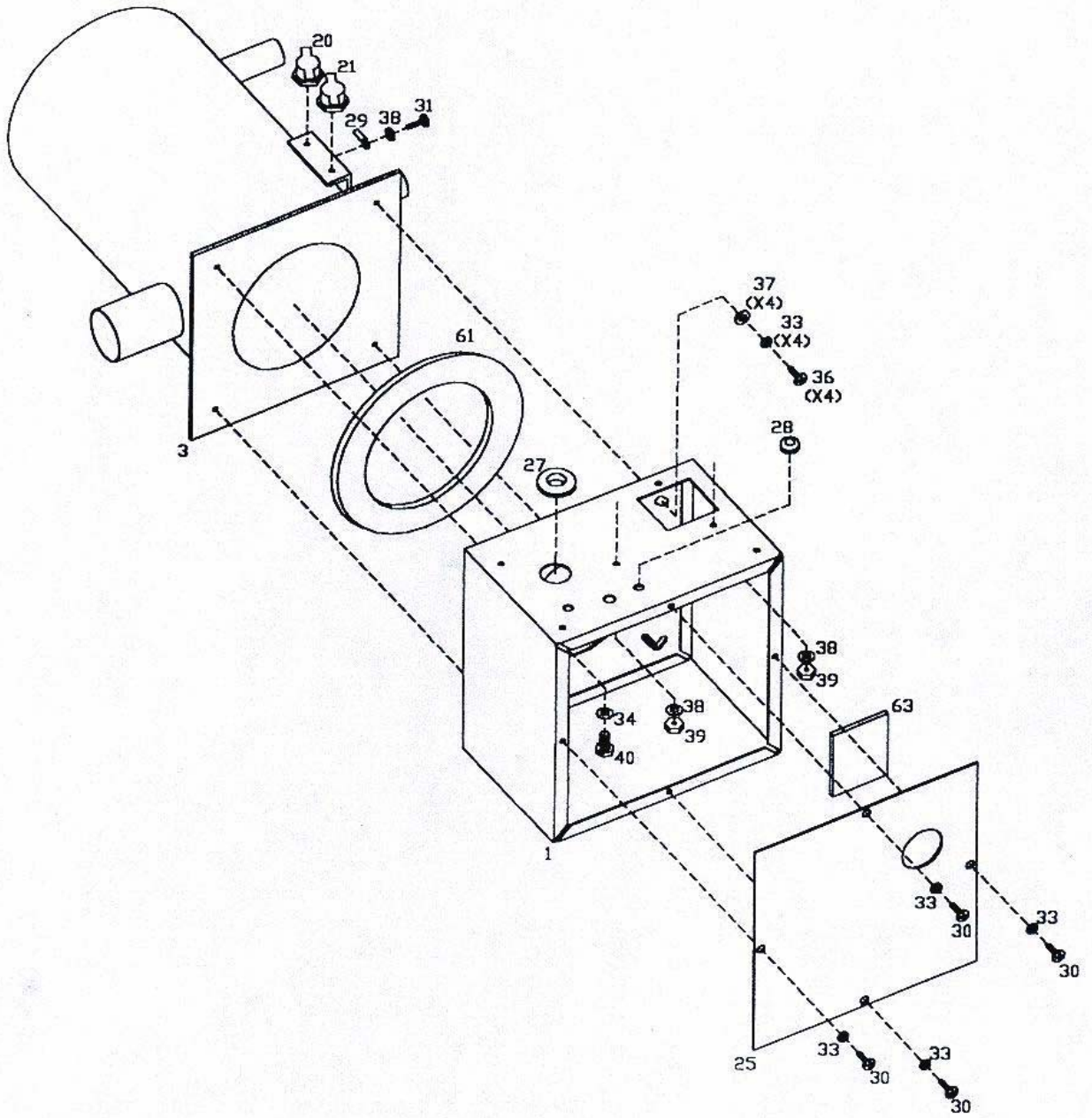


FIGURE 8-3

WATER JACKET AND BURNER BOX ASSEMBLY

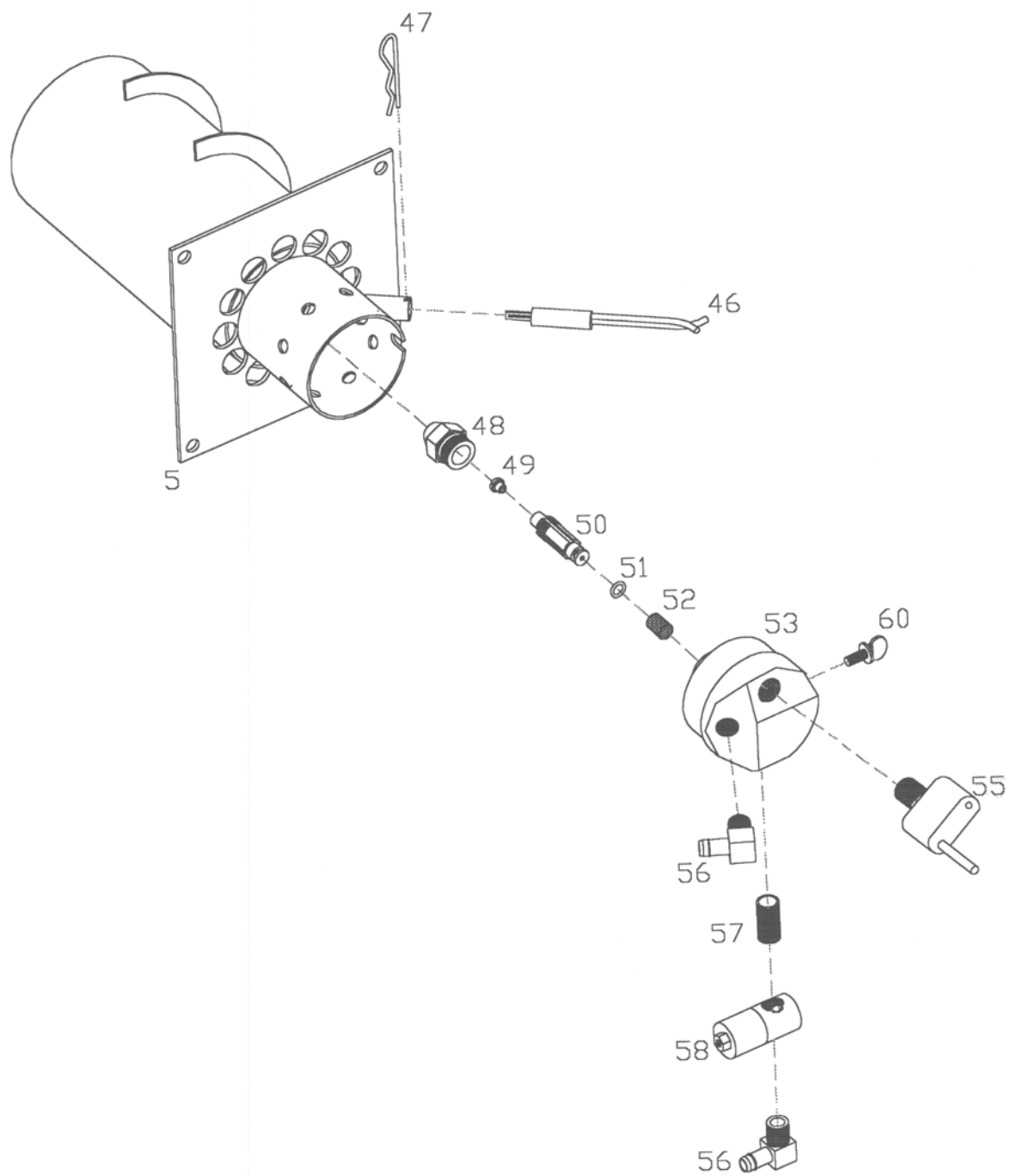


FIGURE 8-4 BURNER TUBE ASSEMBLY

FAN ROTATION

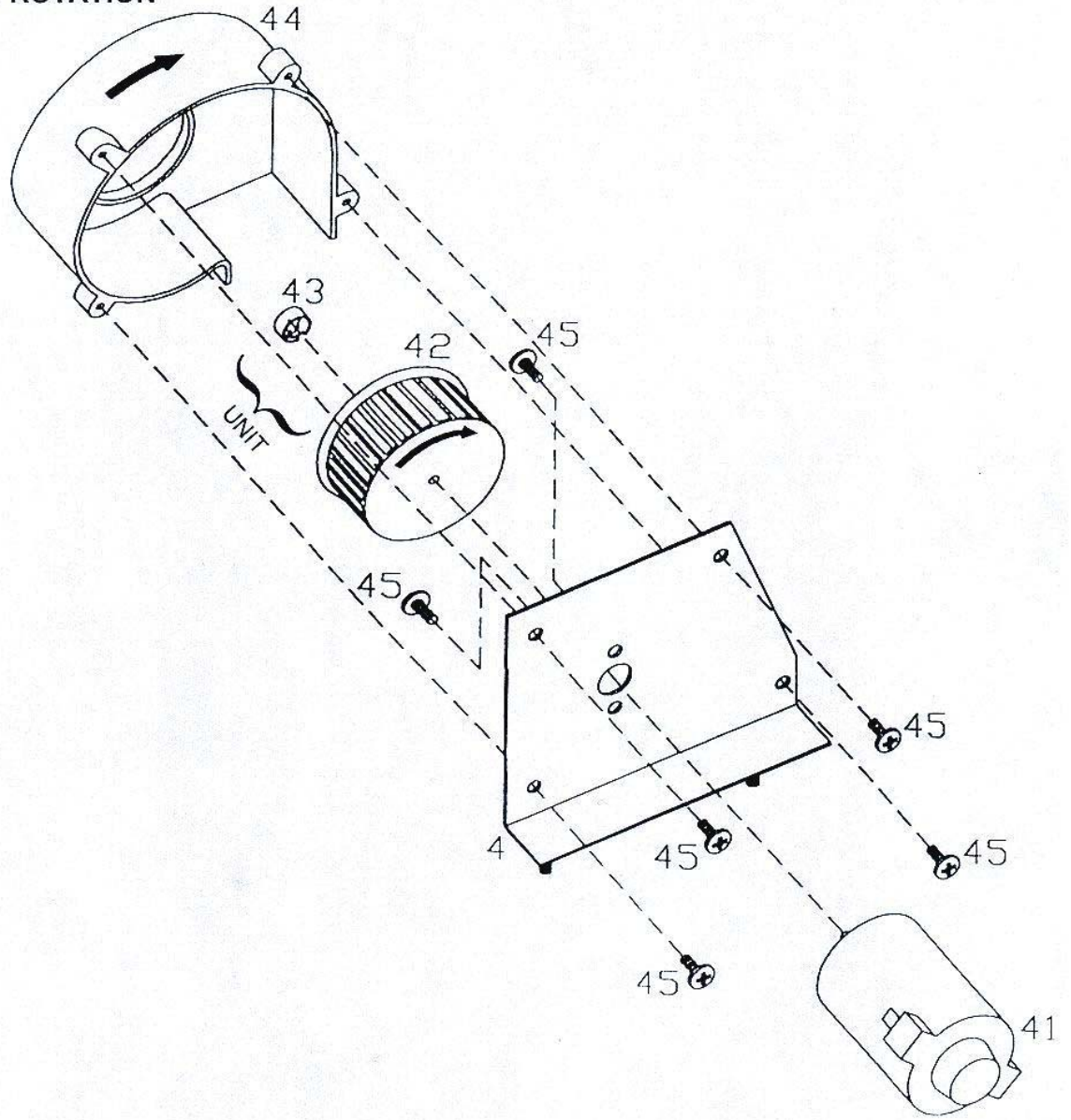


FIGURE 8-5 COMBUSTION FAN ASSEMBLY