

RARITAN

Engineering Company, Inc.

Electric Water Heaters With or Without Optional Heat Exchanger

INSTALLATION AND MAINTENANCE INSTRUCTIONS

MOUNTING THE HEATER

The heater should be installed in a location where it will not be subjected to external water spray-especially salt water. The life of a heater will be greatly extended by choosing a protected location. A heater located in a sail locker for example, cannot be expected to last as long as one installed in a clean, dry engine room. Mount the heater so that the electrical cover plates, plumbing nipples and heat exchanger (if used) are accessible.

Using the three mounting lugs provided, securely mount the heater to the deck or other sturdy area. It is preferable that bolts, nuts and lockwashers be used but if wood screws or lag bolts must be used, they should be heavy enough to support the strain when the heater is filled with water and the boat is rocking. Raritan 20 gallon water heaters (R20, R20E, NP20) require auxiliary bracing to support the weight of the tank filled with water when the boat is in heavy seas. Likewise, it is desirable to add auxiliary bracing to the 6 and 12 gallon models, especially if the boat may be subject to excessive heeling and pitching in heavy seas.

PLUMBING

To connect the heater to the cold water supply, install a "tee" in the cold water supply line. From the branch of the "tee", connect a line to the lower heater connection marked COLD. A check valve MUST be in this line to prevent hot water backflow into the cold water lines. Also, it is a good idea to install a drain valve between the check valve and the heater.

The upper heater connection, marked HOT, is connected to the hot water faucets, shower, etc. Heat resistant flexible hose or poly tubing, suitable for the temperature and pressure limits of the safety relief valve (75 PSI and 210 degrees F.) may be used for both cold and hot connections. Secure all lines to the boat's structure at frequent intervals.

Avoid sharp bends and 90 degree elbows in the plumbing wherever possible, as they reduce water flow. Should copper fittings be desired, avoid applying heat to the 3/4" nipples protruding from the heater. Solder fittings first, then connect to the heater; the nipples contain a nonmetallic lining which will be destroyed by heat from soldering fittings. After all hot water lines have been completely installed, open the hot water taps and turn on the water pressure system. Allow the

water to run a few minutes to expel all air from water heater and lines. This is VERY IMPORTANT because if air remains in the heater and the electric heating element is not fully submerged, the element will burn out when the power is turned on.

The safety relief valve should be connected to hose or piping so that overflow can run unrestricted into the bilge. This will prevent any overflow or dripping from causing damage to the heater jacket or base.

ELECTRICAL

CAUTION: No 115 or 230 volt AC wiring should be done by other than a qualified electrician.

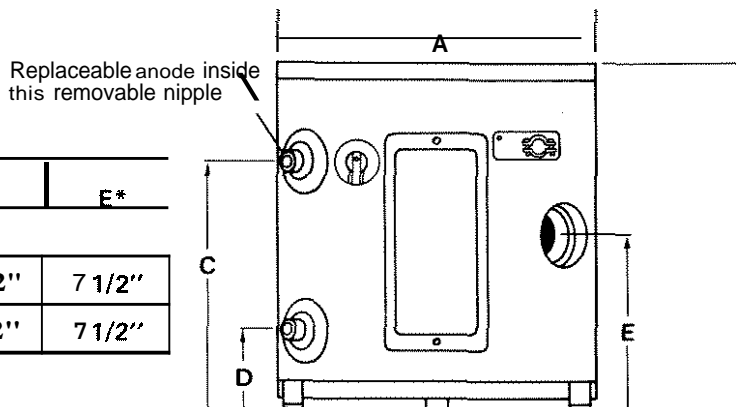
Protect the 115 volt shore line with a 15 amp fuse or circuit breaker (10 amp for 230 volt units); a Ground Fault Circuit Interrupter (GFCI) in the correct value may be included in the installation for additional safety. Use only STRANDED #12-3 cable to the heater. Never use solid wire (ROMEX-type) cable on a boat; vessel vibration can cause solid wire to break due to metal fatigue (U.S. Coast Guard). In running the cable to the heater, support it securely at frequent intervals. Do not run it in the bilge. Allow about 12" of extra wire to make necessary connections. Remove the large rectangular cover, which gives access to the electrical connection points. Strip 8" of the outer insulation from the end of the cable, exposing the three separate insulated wires. Loosen the strain relief connector in the smaller cover plate and insert the cable. Tighten the strain relief connector onto a portion of the cable that was not stripped. Strip the insulation from the three wires to bare about 1/2" of the stranded wire. Attach black and white wires to thermostat per installation diagram. Use crimp-on terminal ends for a secure installation. Do not use solder to connect wires as it, in effect, makes a solid wire of the strands, subjecting it to the possibility of breaking due to metal fatigue from vibration. Join the green wire to one of the four mounting bolts on the heating element using a crimp-on terminal end. Place the terminal protector in its correct position, replace the access cover and double check to be sure the tank is filled with water before turning on electricity. This can be verified if cold water runs out of any hot water faucet. After turning on the electricity, the water should be noticeably warm within 30 minutes. Twenty gallon models (R20, R20E, NP20) will take somewhat longer to initially heat the water.

TURNING ON THE ELECTRICITY WITH NO WATER IN THE TANK, OR WITH THE WATER LEVEL BENEATH THE IMMERSION HEATING ELEMENT, WILL BURN OUT THE HEATING

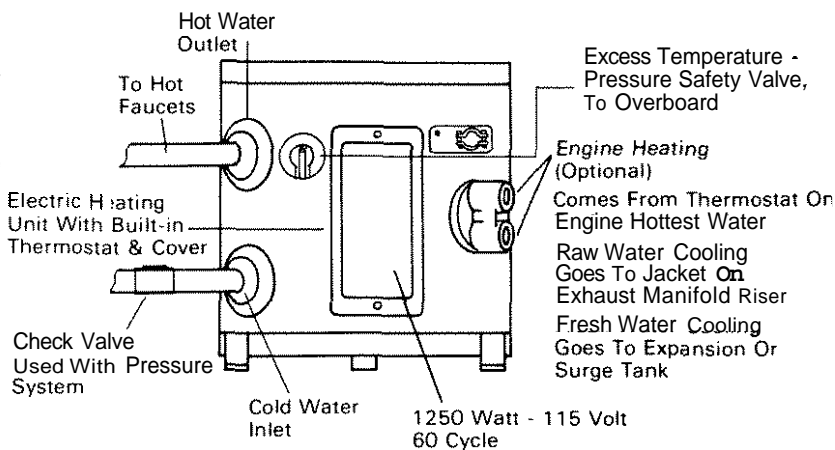
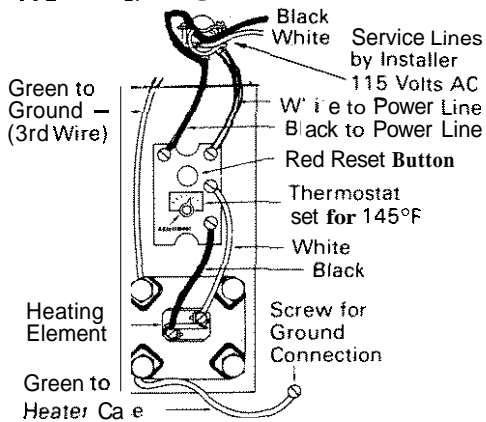
ELEMENT IN A VERY SHORT TIME. The preceding warning must also be remembered during springtime commissioning.

DIMENSIONS

MODEL	A	B	C	D	E*
12-gal.	18"	15 9/16"	10 1/8"	33/32"	7 1/2"
20-gal.	18"	25 5/16"	19 1/16"	33/32"	7 1/2"



INSTALLATION



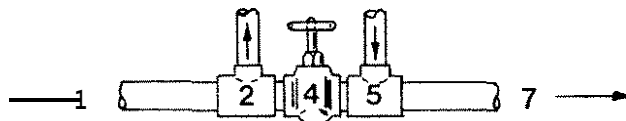
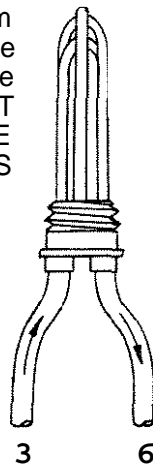
CAUTION Heater must be filled with water Before Power is turned on

HEAT EXCHANGER

The Raritan Heat Exchanger is furnished with a male 2" NPT thread to fit the opening provided in the tank. Two 3/4" NPT female threads are provided in the heat exchanger for connection to hoses or piping from engine coolant. Because of the diversity of marine cooling configurations, it is not possible to provide universal installation instructions; the installer MUST follow engine manufacturer's recommendations. THE FOLLOWING DIAGRAM IS INTENDED ONLY AS

A GENERAL GUIDELINE TO SHOW HOW A PORTION OF THE ENGINE COOLANT MAY BE DIVERTED TO THE OPTIONAL HEAT EXCHANGER:

NOTE: Some marine engines run at higher temperatures than the range of the pressure relief valve on the water heater. For use with these engines, an alternate location for source water will have to be selected. See safety valve problems, under Troubleshooting.



LEGEND:

1. Hottest Water from Engine (Full Flow)
2. Pipe Tee; Full Flow on Run, 3/4" NPT on Branch
3. Hose to Hot Water Heat Exchanger
4. Gate Valve Sited to Permit Full Flow of Coolant
5. Pipe Tee: Full Flow on Run, 3/4" NPT on Branch
6. Hose from Hot Water Heat Exchanger
7. Full Flow Return to Engine Cooling System

To determine the proper setting of the gate valve (4), the engine should be operated at full throttle with the gate valve wide open. When the engine temperature has stabilized, gradually close the valve until the engine temperature begins to rise. The valve should then be reopened enough to establish the proper engine operating temperature. Engine temperature should be monitored to verify that the entire cooling system is functioning correctly.

The information above is only a general guideline and any installation is made at the risk of the installer. No responsibility to Raritan Engineering Company, Inc. is to be presumed or implied from these general instructions.

ADDING A HEAT EXCHANGER TO AN EXISTING ELECTRIC-ONLY WATER HEATER

Adding a heat exchanger to Raritan Water Heaters to allow the water to be heated via the engine cooling system is only possible on "R-Series" water heaters (R6, R12, R20). "NP-Series" (NP6, NP12, NP20) do not have a threaded opening to accommodate the addition of a heat exchanger. We do not recommend attempting the addition of a heat exchanger to "R-Series" water heaters manufactured prior to 1980, as they utilize a metal plug that has been installed under high torque at the factory to eliminate possible leaks. Recent "R-Series" water heaters (1980 to date) utilize a special plastic plug that is installed only hand tight at the factory. The plastic plug is more readily removed when converting to the heat exchanger option. Metal plugs, installed before 1980, are virtually impossible to remove after years of repeated heating and cooling.

When ordering a replacement water heater, we suggest the "E-Series" be ordered (R6E, R12E, R20E). These units are shipped with a factory installed heat exchanger. This allows the heater to be installed in the electric-only configuration, with the heat exchanger available to be connected at a later date or, it may be installed in the dual configuration with no changes required later.

MAINTENANCE, WINTERIZATION AND TROUBLESHOOTING

Little maintenance other than proper winterization is required of the Raritan Water Heater. Periodic visual inspection should be done to insure that connections are tight, wires are not frayed and that grounding of the unit is sound. These checks should be incorporated into the annual commissioning and winter layup of the boat as a minimum, and should be done more often if possible.

A removeable magnesium anode is integral with the hot water outlet fitting. It should not be necessary to inspect or replace the anode unless discoloration, unusual smell or taste develop in the water. The anode is replaceable as a unit and may be ordered from Raritan dealers or from the factory. Specify 6, 12 or 20 gallon model.

WINTERIZATION

Before beginning winterization, be sure electricity is turned off to the water heater. The water heater is

best winterized together with the onboard water pressure system. This is accomplished by pumping all the water from the boat's fresh water tank(s), then pouring nontoxic antifreeze solution (propylene glycol, NOT ethylene glycol) directly into the fresh water tank(s). Turn on the water pressure pump and open all faucets. When the antifreeze solution comes out of all faucets, both hot and cold, the whole system is safe, including the pump. As a large quantity of antifreeze is required to get the correct ratio of antifreeze to water, it is not usually an economical method but it is by far the safest.

An alternate method is to shut off the electricity, open all hot water taps on the boat to relieve the pressure, then remove both lines from the heater and allow it to drain. After it has drained, blow it out with air pressure if available, then pour a quart of nontoxic antifreeze into the tank using a funnel and a length of hose. Be sure electricity remains off until spring. When recommissioning in the spring, run water long enough to insure that all antifreeze has been flushed out **BEFORE TURNING ON THE ELECTRICITY**. Optional heat exchangers are winterized in conjunction with the boat's engine cooling system.

TROUBLESHOOTING

PROBLEM: *Water does not get hot.*

1. No electric power to heater. Be sure circuit breaker or switch is turned on, fuses are intact and wiring is not broken or disconnected.

2. Bad heating element. Turn off power, remove access cover and depress red RESET button. Restore power. If no warm water after 30 minutes, check heating element and thermostat.

A. Shut off power and disconnect the two wires connected to the heating element. Check for continuity through the heating element with an ohmmeter. If no continuity, heating element is burned out and must be replaced. If continuity is indicated, element is good; check thermostat.

B. Replacing the heating element. Turn off power to heater, then turn off water pressure pump and open all hot water faucets. When water has stopped flowing, pressure has been relieved; drain water heater the rest of the way (through drain valve if installed, or by removing cold water inlet hose or pipe at bottom of tank between tank and check valve). Remove access cover, two wires connected to heating element and four heating element mounting bolts. Remove the heating element, discarding the cylindrical rubber gasket. Install the new element and rubber gasket (never reuse old gasket) with the arrows on the heating element flange pointing up and down. Be sure to reconnect the ground wire. Reconnect the black and white wires to the new heating element. Close drain valve or reconnect plumbing to cold water inlet of water heater. With hot water faucets open and **ELECTRICITY TURNED OFF** to the water heater, turn on water pressure pump. Allow pump to run a few minutes to expel air from the lines, then shut off faucets. Restore power. Check for leaks around the heating element while waiting for the water to heat. If no leaks, replace the cover plate. If a leak appears, turn off power, drain tank,

and check cylindrical gasket; be sure it is seated correctly.

3. Bad thermostat. If the ohmmeter shows continuity through the heating element but the water is not heated, a bad thermostat is indicated.

A. Turn off power to heater, depress red RESET button and turn thermostat to highest setting. Disconnect both wires to heating element. Check for continuity with an ohmmeter through the thermostat from black wire terminal to black wire terminal and from white wire terminal to white wire terminal. Each side must show continuity. If continuity is not registered on either side, the thermostat must be replaced. If thermostat tests good after heating element also tested good, recheck that power is available to unit. Check wiring for breaks, etc.

B. Replacing the thermostat. Turn off power, remove access cover to expose thermostat terminals. Disconnect both sets of wires from the thermostat. Snap the thermostat out of its mounting and insert new one. Reconnect both sets of wires to the thermostat. Wire the thermostat according to the Installation Diagram, ignoring additional terminals that may be on the new thermostat. Fill heater with water, then turn on electricity. Water should be noticeably warm within 30 minutes.

PROBLEM: Safety valve opens and releases hot water.

1. Take care to avoid scalding; safety valve is preset to open at 210 degrees F. Remove the access cover and check temperature setting on thermostat. Factory setting is 130-140 degrees F. If setting is higher, turn it all the way to the left. Allow heater to operate an hour and observe results. If lowering the temperature setting doesn't cure the problem, perform the following: Shut off electricity to the heater and observe if the water flow stops over the next few hours. If the water flow doesn't stop as the tank cools down, a defective pressure relief valve is apparent. Unscrew and replace it after turning off the electricity and draining the tank. If the water stops flowing as the temperature drops, a defective thermostat is indicated. Replace the thermostat following by earlier directions.

2. If the heater is equipped with an optional heat exchanger, and the relief valve opens while the engine

is running, the operating temperature of the engine may be in excess of the relief valve's rating. This will usually show up on the first major cruise or on a shakedown cruise. The situation described is possible with certain "fresh water" cooled engines that operate at over 200 degrees F. Engine coolant is normally tapped off just ahead of the coolant system's heat exchanger, where the water is hottest, then fed to the heat exchanger in the water heater. The cure is to tap the coolant DOWNSTREAM of the heat exchanger where the coolant is at a lower temperature. Check the temperature of the coolant piped to the water heater to be sure it is not over 170 degrees F.

PROBLEM: Constant dripping of the relief valve, regardless of temperature.

This is usually caused by foreign matter lodged in the seat of the pressure relief valve. Shut off fresh water pressure pump, shut off electricity and open hot water taps to relieve pressure in the system. Drain water from tank until it is beneath the level of the relief valve. Remove the relief valve and clean it thoroughly. Open the actuating handle and flush the valve with lukewarm water. Be sure no sediment remains on the seat of the valve plunger. Close valve and reinstall using tape dope or pipe joint compound. Refill tank, expel air from the lines, then turn on electricity. Observe the relief valve as the tank fills and as the water heats. It should remain closed and not drip. If dripping begins again, replace the valve.

If further help is required or if an unusual situation should develop, contact Raritan Customer Service in Millville, NJ or Ft. Lauderdale, FL for assistance. Any replacement part for a Raritan Water Heaters ordered from Raritan dealers or direct from the factory. When ordering heating elements, specify whether 115 or 230 volt. When ordering anodes or sheet metal parts, specify whether 6, 12 or 20 gallon unit. Relief valves, thermostats, heating elements, gaskets and heat exchangers are interchangeable between the three sizes.

SAVE THESE INSTRUCTIONS

To order replacement parts or to request additional information or assistance, contact Raritan Customer Service at:

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