Application Installation Manual
Suburban & Atwood RV Furnaces

Plenum System

Ducted Plenum

8500 Series AT-10 Plenum

RVComfortSystems
www.rvcomfortsystems.com

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Installation and Operation Instructions

READ INSTALLATION INSTRUCTIONS COMPLETELY BEFORE STARTING

Thank you for choosing RV Comfort Systems CheapHeat™ for your heating needs. You can feel confident in your selection of the CheapHeat™ because the same pride in craftsmanship and engineering that goes into other RV Comfort Systems products has been incorporated in the CheapHeat™.

This manual is designed to help with installing, operating and maintaining the unit. It is CRUCIAL that the installation instructions be followed to prevent damage to the CheapHeat™ and existing gas furnace.

Before starting work on any high voltage (120/240V AC) project, turn off power to affected areas. To accomplish this shut down all shore power sources, including generators and inverters. In addition, adhere to all U.S. electrical codes.

It is also important that the compatibility applications chart be followed, especially airflow and shore power requirements. To operate the CheapHeat™ efficiently, the installer needs to read this installation manual completely.

Please retain this manual for future reference and send in the warranty card.

Furnace manufacturer's name/model is to assist our customer in selecting the correct CheapHeat™ kit and does not indicate approval or endorsement by that furnace manufacturer.

ELECTRICAL DATA
1. All wiring must comply with local and national electrical codes and be installed by a qualified electrician.
2. All wiring/cabling that passes through electrical boxes and panels MUST have cable clamps installed to prevent wire chaffing.
3. Contact a qualified electrician with any questions about the following instructions.
4. Check the available power supply and resolve any wiring problems BEFORE installing or operating this unit.
5. The CheapHeat™ is designed to operate from a 30 amp, 120V AC, 60Hz shore power supply for the 1800 watt configuration and a 50 amp, 240V AC, 60Hz shore power supply for the 3750 watt and 5000 watt configurations.
6. The wiring diagrams and specifications with respect to wire size, fuse/breaker size, and grounding requirements must be followed.
7. Do not immerse in water.
8. To provide continued protection against risk of electric shock, connect to properly grounded outlets only.

INSTALLATION REQUIREMENTS

CAUTION: THIS DUCT HEATER SHOULD BE INSTALLED IN SUCH A MANNER AS TO PERMIT REMOVAL WITHOUT SERIOUS DAMAGE TO THE BUILDING STRUCTURE, SERVICES, OR FINISH OF THE DUCT HEATER ITSELF
1. The CheapHeat™ Duct Heaters plenum is to be placed between the Air Handler/Furnace and the structures duct work.
2. Inlet side of Duct Heater plenum MUST be attached to Furnace.
3. Do not operate Duct Heater without ductwork attached to the discharge side of the duct heater plenum (see Appendix “A” at the end of this manual).
4. Discharge side of Duct Heater plenum MUST not have any single supply air duct run less that 30” or 750 mm in length.
5. Only one Duct Heater is allowed per given heating system. If second Duct Heaters is needed then there must be a second heating system.
6. There can be no more that two Duct Heaters per given structure
7. This Duct Heater is only intended to be use with a warm air HVAC system and a notation on the installation safety manual will point that out.
8. Airflow through plenum shown below with red arrow:

Note: Vertical mounted Duct Heater requires auto temp limit upgrade to 200 F degrees.

SEQUENCE OF OPERATION

The CheapHeat™ is a fairly simple system that is designed to operate with our CH-50 12 VDC controller and a 12 VDC blower motor. The system uses the same thermostat to operate the Duct Heater as does the Gas Furnace. So the only thing the customer needs to become familiar with it the new Gas/Electric changeover switch.

When the thermostat calls for heat, it sends the +12 VDC signal to the center tap on the changeover switch. If the switch is in the “GAS” position, the signal goes directly to the gas furnace and the furnace operates as if the CheapHeat™ system is not even installed. If the switch is in the “ELECT” position the +12 VDC signal is sent directly to TB1-Pin 4 on the CH-50 Controller.

When +12 VDC is applied to TB1-Pin 4, it travels through an interlocked hard wire circuit that energizes both CR-1 (Fan Relay) and CR-2 (control relay for Heater Contactor MC-1) simultaneously. The CR-1 relay then sends +12 VDC directly to the Red wire on the blower motor, which start the Fan. At the same time the CR-2 relay sends power to the MC-1 Contactor which energizes sending the high AC voltage to both TB3-common terminal and the installer selected heater TB-3 terminal (1800 watt 120VAC, 3750 watt 240VAC, or 5000 watt 240VAC). With that the Duct Heater is up and running; then when the thermostat signal is removed every thing shuts down immediately.

2- STAGE GAS FURNANCES (contact RV Comfort Systems for DPDT switch and installation instructions)

Atwood 2-Stage Series
- This system requires our DG-8900 adapter, which connects between the Atwood digital thermostat and CheapHeat controller and we DO NOT support that.

Suburban SHD 2542 Series
- This system requires our SHD 2542 adapter, which replaces the current SPST override switch with a DPDT override switch and 5 wire Harness.
Duct Heater and Controller Installation Standards

Electrical Specifications

<table>
<thead>
<tr>
<th>Heat Range Configuration</th>
<th>Voltage</th>
<th>Current</th>
<th>Wattage</th>
<th>Fuse/Breakers</th>
<th>UL Rated, Wire Size Max length 100 ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1800</td>
<td>120 VAC</td>
<td>15 Amp</td>
<td>1800</td>
<td>(1) Single 20 Amp</td>
<td>(2) 12 Gauge W/Ground</td>
</tr>
<tr>
<td>3750</td>
<td>240 VAC</td>
<td>15.6 Amp</td>
<td>3750</td>
<td>(2) Dual 20 Amp</td>
<td>(2) 12 Gauge W/Ground</td>
</tr>
<tr>
<td>5000</td>
<td>240 VAC</td>
<td>20.8 Amp</td>
<td>5000</td>
<td>(2) Dual 30 Amp</td>
<td>(2) 10 Gauge W/Ground</td>
</tr>
</tbody>
</table>

Fan Specifications (Third party Air Handler)

Vertically Mounted Furnaces Require Auto Temp Limit Upgrade to 200°F
(Contact RV Comfort Systems LLC for correct Auto Temp Limit upgrade part)

Air Flow Specifications 4” Round Duct
UL 2158A Rated-Max temp rating 285°F, Max Static 1.0 in.

<table>
<thead>
<tr>
<th>Heat Range Configuration</th>
<th>Max Voltage</th>
<th>Max Current</th>
<th>Minimum CFM</th>
<th>Minimum Velocity</th>
<th>Static Pressure</th>
<th>Max inlet Air Temp Energized</th>
<th>Max Air Temp De-Energized</th>
</tr>
</thead>
<tbody>
<tr>
<td>1800 Watt</td>
<td>15 VDC</td>
<td>12.6 Amps</td>
<td>120</td>
<td>400 fpm</td>
<td>.01-0.5” wc</td>
<td>75 F Degrees</td>
<td>250 F Degrees</td>
</tr>
<tr>
<td>3750 Watts</td>
<td>15 VDC</td>
<td>12.6 Amps</td>
<td>180</td>
<td>400 fpm</td>
<td>.01-0.5” wc</td>
<td>75 F Degrees</td>
<td>250 F Degrees</td>
</tr>
<tr>
<td>5000 Watts</td>
<td>15 VDC</td>
<td>12.6 Amps</td>
<td>240</td>
<td>400 fpm</td>
<td>.01-0.5” wc</td>
<td>75 F Degrees</td>
<td>250 F Degrees</td>
</tr>
</tbody>
</table>

Air Flow Specifications Rectangle Duct
28 Ga. Sheet Metal

<table>
<thead>
<tr>
<th>Heat Range Configuration</th>
<th>Min Total CFM</th>
<th>Max Total CFM</th>
<th>Min # Supply Runs</th>
<th>Min # 4X8 Supply Registers</th>
<th>Min # 4X10 Supply Registers</th>
<th>Min # 2 1/4x10 Supply Registers</th>
<th>Min # 2 1/4x12 Supply Registers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1800 Watt</td>
<td>120</td>
<td>300</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3750 Watts</td>
<td>180</td>
<td>400</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>5000 Watts</td>
<td>240</td>
<td>500</td>
<td>6</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

Clearance Around Duct Heater Plenum

<table>
<thead>
<tr>
<th>Heat Range Configuration</th>
<th>Top</th>
<th>Bottom</th>
<th>Left Side Without Power Head</th>
<th>Left Side With Power Head</th>
<th>Right Side Without Power Head</th>
<th>Right Side With Power Head</th>
<th>Model PL-7 Front</th>
<th>Model SA-7 Front</th>
</tr>
</thead>
<tbody>
<tr>
<td>1800 Watts</td>
<td>1”</td>
<td>0”</td>
<td>1”</td>
<td>2 ½”</td>
<td>1”</td>
<td>2 ½”</td>
<td>1”</td>
<td>N/A</td>
</tr>
<tr>
<td>3750 Watts</td>
<td>1”</td>
<td>0”</td>
<td>1”</td>
<td>2 ½”</td>
<td>1”</td>
<td>2 ½”</td>
<td>1”</td>
<td>N/A</td>
</tr>
<tr>
<td>5000 Watts</td>
<td>1”</td>
<td>0”</td>
<td>1”</td>
<td>2 ½”</td>
<td>1”</td>
<td>2 ½”</td>
<td>1”</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Multiple Systems
Setting up multiple systems in one coach requires the following configurations and a separate CH-50 controller for each system.

<table>
<thead>
<tr>
<th>Shore Power</th>
<th>CheapHeat™ Heater Configurations</th>
<th>Ducting</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 Amp</td>
<td>1@ 1800W &amp; 1@ 1800W</td>
<td>Each system requires its own ducting with no common connections to the other system.</td>
</tr>
<tr>
<td>50 Amp</td>
<td>1@ 1800W &amp; 1@ 3750W</td>
<td></td>
</tr>
<tr>
<td>50 Amp</td>
<td>1@ 3750W &amp; 1@ 3750W</td>
<td></td>
</tr>
</tbody>
</table>
OPERATION INSTRUCTIONS

Operating the CheapHeat™ is very simple since there is only one additional control, a gas/electric changeover switch. The temperature is still controlled by the manufacturer-supplied thermostat, so the only thing the owner needs to decide is whether to run the heating system with gas or electricity.

To maintain the best comfort-level, it is recommended that the owner use the CheapHeat™. Also, to reduce temperature hunting (too hot then too cool), it is suggested that the owner only set the thermostat once for the duration of the heating cycle.

Lastly, to maintain a long system life and a comfortable environment, make sure that:

1. Minimum unrestricted airflows are compliant with the compatibility chart.
2. The system is hooked up to the manufacturer-recommended shore power connections when using the CheapHeat™ without adapters.

CONTROLLER

The CheapHeat™ CH-50 controller has been designed to work with all CheapHeat™ electric elements and plenum. The only time changes need to be made inside the controller are when it is used with the 1800 watt heater coil. When used with the 1800 watt electric coils, move the fan speed jumpers to change the fan speed to match the heating capacity.

The CheapHeat™ controller casing needs to be able to dissipate heat that is generated by its internal components. It does not get anywhere close to hot enough to cause a fire hazard. DO NOT mount the CheapHeat™ controller on the existing gas furnace, plenum or connecting ductwork. DO NOT mount the controller directly above the gas furnace or associated ductwork.

ELECTRIC HEATER COIL

There are three electric heating capacities and model numbers for the electric heater coil even though there is only one heater coil. This is because the coil was designed in a multi-tap configuration (two voltages and three heating outputs), which helps dealers reduce inventories and control costs. The most important thing to remember when installing the heater is that the heater assembly should be installed so that the FUSIBLE LINK (looks like a diode) is physically located on the bottom of the heater assembly. In a Vertical configuration the power head must be mounted on the top of the plenum.

PLENUM

Manufacturers install forced-air heating systems in one of two configurations: ducted system with individual duct runs or plenum system with trunk lines and registers in the floor. This means the CheapHeat™ installer needs to choose from a one of two plenums and be mindful that the plenum selected must have enough clearance around the existing gas furnace that match’s the compatibility chart for that model furnace and ducting system.

There is one plenum style for the ducted systems and one style for a plenum system, and both have been manufactured so the electric heating element can be installed from either side of the plenum.

The most important thing for the installer to remember is to make sure to plug all unused duct openings on the gas furnace so that all air feeding the living space passes through the new plenum before entering the ductwork or plenum.
Tools Required
- AC/DC Volt-Ohm-Amp Meter
- Wire Cutter/Stripers/Crimpers
- 3/8” Drive Drill Motor
- Sheet Metal Snips
- ½” and ¾” Wood Bit
- 1/4” Drill Bit
- 3/16” Drill Bit
- 1/8” Drill Bit
- 1/4” Nut Driver
- 5/16” Nut Driver
- 1/4” Hex Nut Drive Drill Bit
- #2 Flat / #2 Philips Screwdriver Bits
- 6 1/8” Square Head Screwdriver
- 6” Flat Blade Screwdriver
- 6” Philips Screwdriver
- 13/16” Open End Wrench
- 3/4” Black Electrical Tape
- 1/4” Hex Nut Drive Drill Bit
- #2 Flat / #2 Philips Screwdriver Bits
- 6 1/8” Square Head Screwdriver
- 6” Flat Blade Screwdriver
- 6” Philips Screwdriver
- 13/16” Open End Wrench
- 3/4” Black Electrical Tape
- 2” Wide 3M High Temperature Metal Tape

PARTS
Remove controller, electric heater coil, accessories, and plenum from packaging. Verify that all parts are present, in good condition and correct for this installation.

Package #1
- 1 – CheapHeat™ Controller
- 1 – 10’ 4-Conductor Controller to Furnace wire harness (Not with OEM)
- 1 – Rocker Style SPDT Changeover Switch with Backing Plate
- 1 – 25’ 3-Conductor change over switch Wire Harness (Not with OEM)
- 2 – 8 x 1” Phillips Oval head BLACK Screws (For Mounting Switch) (Not with OEM)
- 3 – Orange Wire Nuts (Not with OEM)
- 2 – Red Wire Nuts (Not with OEM)
- 8 – 6” Nylon Wire Ties (Not with OEM)
- 2 – 8 x 1” Phillips Oval Head Taper Point Screws (For Securing Controller to Wall) (Not with OEM)
- 4 – 6 x 3/8” 1/4” Hex Drive Mounting Screws (For Securing Add-On Cabinet to Furnace) (Not with OEM)
- 4 – 6 x 3/8” 1/4” Hex Drive Mounting Screws (For Electric Element and Panels) (Not with OEM)
- 2 – 1/2” Romex Cable Clamps (Not with OEM)
- 1 - 3/4” Romex Cable Clamp (Not with OEM)

Electric Element
- 1 – Electric Heater Element (Model DH18-37-50 Works for All Configurations)

Package #2
**Option #1 – Ducted Heater Cabinet**
- 1 – Plenum for individual Ducts
- 1 - Atwood AFMD/AFLD - 8900 Series Plenum Adapter 1/2”x 1” x 9” Galvanize “L” Bracket
- 1 – Heater Support Blank Plate Cover for Plenum
- 6 – 4” Starter Collars for Flex Ducts (Not with OEM)

**Option #2 – Plenum Heater CABINET**
- 1 – Plenum Down Discharge
- 1 - Atwood AFMD/AFLD – 8900 Series Plenum Adapter 1/2”x 1 1/4” x 9” Galvanize “L” Bracket
- 1 – Heater Support Blank Plate Cover for Plenum

**Option # 3 – AT-10 Combination Ducted/Plenum Heater CABINET**
- 1 – Atwood 8500 Series Plenum Adapter
- 1 – Heater Support Blank Plate Cover Plenum
- 6– 4” Starter Collars for Flex Duct (Not with OEM)
INSTALLATION

SITE PREPARATION
- Make sure all high voltage is disconnected.
- Check existing gas furnace installation to see that it meets all clearance requirements necessary to complete CheapHeat™ installation.
- Identify and mark 12 V DC wires connected to existing gas furnace (See below for label recommendations).
- After labeling 12 V DC wiring remove fuse that powers gas furnace.
- Turn off gas supply to gas furnace.

MOUNTING COMPONENTS

Controller
- Find an accessible location within 10’ of the gas furnace and mount controller with 4 – 8 x 3/4” screws provided. Do not mount controller on the gas furnace or its associated ductwork.

Override Switch
- When picking a location for the override switch, remember two things: it needs to be located inside the coach in a place easily accessible by the owner (preferably as close to the thermostat as possible) and the wiring harness that connects it to the controller is 25’ long.

Disconnect
- Find a location within 10’ of the transfer switch or shore power input socket and accessible by the owner after installation. Make sure that there is a clear path of no more than 15’ between the disconnect and CheapHeat™ controller.

<table>
<thead>
<tr>
<th>Discharge Function</th>
<th>Suburban</th>
<th>Atwood</th>
</tr>
</thead>
<tbody>
<tr>
<td>(+) 12 V DC</td>
<td>Red</td>
<td>Red</td>
</tr>
<tr>
<td>(-) 12 V DC</td>
<td>Yellow</td>
<td>Black</td>
</tr>
<tr>
<td>12 V DC Feed to Thermostat</td>
<td>Blue</td>
<td>Blue</td>
</tr>
<tr>
<td>12 V DC Back from Thermostat</td>
<td>Blue</td>
<td>Blue</td>
</tr>
</tbody>
</table>

To determine which blue wire is the feed wire and return wire:
1. Turn thermostat off or at least 10º F below inside temperature.
2. Connect DC volt meter from each wire to ground (negative 12 V DC).
3. The wire that reads 12 V DC is the thermostat feed wire and the wire that reads 0 V DC is the return wire from the thermostat back to the furnace.

Note: Make sure the 12 V DC furnace fuse is installed during this test.

Plenum

Ducted System: Prior to installing the new plenum, count the current number of 4” duct runs being supplied by the gas furnace. Then, before installing the electric heater coil, remove the same amount of 4” hole blanks (see figure 1 to determine correct location of holes) and install starter collars (figure 2) in the new plenum as described below. SPECIAL NOTE: It takes four 2 inch ducts to equal one 4 inch duct.
1. For each 4" hole with blank plate removed, insert offset section of flange on starter collar opposite the 3/8" tab on collar.

2. Match up tab on collar with notch in add-on cabinet and spin collar ½ turn to lock in place.

3. For **Atwood AFMD/AFLD and/or 8900 Series furnace only**, screw the “L” adapter to short side of furnace opposite the side the power head is on (see figure 3). This will make the furnace cabinet wider and match to the add-on cabinet opening.

4. Slide electric heater element into cabinet (making sure the FUSIBLE LINK is located at the bottom of the heater coil) and fasten using 2 – 6 x 3/8” screws (see figure 4). Before installing element into cabinet make sure to pick the side that will allow the easiest access to the electrical connections after the add-on cabinet is connected to the gas furnace. On VERTICALLY mounted furnace power head is on top of plenum.

5. Install blank plate using 2 – 6 x 3/8” screws on the add-on cabinet opposite the opening that the electric element was installed in. Make sure that the electric element support rod fits through the hole in the blank plate.

6. Disconnect all 4” duct runs form gas furnace (save the 4” hose clamps) and block off any 4” openings left open on the sides of the furnace. (This may require some sheet metal patchwork.)

7. On the Suburban remove large access panel that covers firebox opposite the door on the outside. **Atwood AFMD/AFLD and/or 8900 Series only there is no access cover to remove so the end of the furnace cabinet needs to be cut out, see figure 5A & 6A.**

10. Replace the access door that was just removed with the new plenum (see figure 5B) and secure in place with at least 3 of the 6 – 8 x 3/4” sheet metal screws (this may require that the flange on the sides be crushed flat along the sides of the furnace).

11. Reconnect 4” flex duct (with the old 4” hose clamps) to new add-on plenum starter collars, which were previously installed in cabinet.
Plenum System: Before starting the installation process for the plenum system configuration, make sure that there is at least 5 3/4" of clear space between the furnace access panel and the wall of the existing gas furnace. In addition, make sure that there is clear access through the floor to the trunk line under the plywood with no structural cross supports (see figure 6B).

1. Verify that gas supply to furnace has been shut off and disconnect gas line.
2. Verify that fuse that supplies 12 V DC to power the furnace has been removed and disconnect the power wires to the furnace.
3. Remove the furnace firebox and components from its cabinet and then remove cabinet.
4. Plug 4 x 14” or 6 x 14” hole in bottom of furnace with sheet metal blank and seal with high temperature tape (see figure 7).
5. Measure 1 1/2” out from access panel opening and cut 4 ¼” x 17 ¾” hole in floor to access furnace plenum (see figure 8).
6. Cut an opening 1” smaller hole all around in the exposed duct under the floor. Now fold the excess sheet metal back up and tack it to the exposed edges of the plywood left over the previously cut hole in the floor.
7. Install the 4’ X 17 ½” end of new heater plenum then reach down inside Plenum and use the 3M High Temperature Metal Tape to seal the opening from the trunk line to the 4” x 17 ½” opening on the new plenum.
8. Electric heater element can be slide in from either side of plenum.
9. After installing heater element (see figure 4) be sure to insert support rods in to blank plate on the opposite side of the plenum using the and secure in place with 6 x 3/8” sheet metal screws (be sure to install element so access to electrical connections is possible)
10. Reinstall furnace cabinet and slide backside of furnace into new plenum flange (be sure access door to firebox is removed). It will be a tight fit and you may have to flatten the flanges on the furnace sides, plus some help from another person, one outside the furnace and one reaching inside, to guide it in place (see figure 6).
11. Use 3M High Temperature Metal Tape to tape all joints and 8 x 3/4” sheet metal screws to fasten the top and sides of the add-on plenum to the furnace.
12. Reinstall the gas furnace firebox and its components back into its furnace cabinet.
13. Reconnect gas line, but leave it turned off.

**Atwood AT-10 Add-On Cabinet**

**Hydro Flame 8500 Series**
The Atwood furnace is built with a 2-piece sheet metal cabinet, section one is for the fan and controls, while the second section surrounds the firebox.

1. To install the add-on cabinet for the CheapHeat™ system the complete furnace must be removed from the RV (The furnace must be removed from inside the RV).
2. Disconnect all electrical power, duct work and gas piping from the furnace and remove furnace.
3. After removing the furnace the factory firebox cabinet section must be removed and the new cabinet installed (see figures 9 thru 12).

**8500 Series Ducting Runs:**
After installing the new cabinet section over the firebox:

1. Cut the appropriate number of 4” holes on the end cap (figure 13) as shown in (figure 14).
2. Install the starter collars (Figure 7) as needed by bending (4) four taps (one at 12, 3, 6, and 9 o’clock) outward at a 90-degree angle.
3. Bend the remaining tabs inward about 20 degrees and then insert collar in to the previously cut 4” holes in the end cap and bend the tabs back outward against the end cap to hold the collar in place.
4. Install the electric heater support Blank Plate (figure 9) on the outside of the new cabinet to the opposite side that you’re going to slide the electric heater coil in.
5. Slide the electric heater coil (refer to Heater Coil Instruction Manual) in the open side of the new cabinet, making sure that the support rods are slid in to their 2-3/16” holders on the previously installed end Blank Plate.
6. Using the two machine screws provided bolt the heater coil in place at the top and the bottom.
7. At this point you may want to hook up the high voltage (see heater wiring section in this manual) to the Heater coil before you reinstall the furnace.
8. Reinstall the Furnace back into its original location form inside the coach.
9. Reconnect all of the previously attached 4” Ducts to the new started collars.
10. Reconnect all power, ducting, and gas piping previously disconnected.
8500 Series Plenum System:
After installing the new cabinet section over the file box:

1. Cut 4” X 15 ½” hole in the bottom of the new cabinet (Figure 15). The hole has to be cut to the dimensions shown to be sure that enough air can pass cross the electric coil without its over heating and shutting down *(recommend the end cap be left on during this process to keep the metal from deforming)*.
2. Install the electric heater support Blank Plate (figure 16) on the outside of the new cabinet to the opposite side that you’re going to slide the electric heater coil in.
3. Slide the electric heater coil (refer to Heater Coil Instruction Manual) in the open side of the new cabinet, making sure that the support rods are slide in to their 2-3/16” holders on the previously installed end Blank Plate.
4. Using the two screws provided bolt the heater coil in place at the top and the bottom.
5. At this point you may want to hook up the high voltage (see heater wiring section in this manual) to the Heater coil before you reinstall the furnace.
6. Reinstall the furnace and match up the hole in the bottom of the furnace with the exiting hole in the floor that allows the air in to the Plenum. During this process there will be some modification need to match up the two holes. (This will be easier to do before the end cap is reinstalled).
7. When matching up the two holes the existing hole may need top be enlarged to match the hole in the bottom of the furnace.
8. The passage of air between the furnaces must match the same amount of square inches as the hole previously cut into the bottom of the new cabinet (62 sq. inches).
9. Line the new hole passageway from the cabinet to the Plenum with 3M 300-degree metal tape.
10. Inspect the electric coil to make sure no damage was done during this process and reinstall the end cap.
11. Reconnect the Power and Gas line that was removed when the furnace was removed.
**Combination Ducting Runs/Plenum System:**
After installing the new cabinet section over the file box:
1. Complete items 1 thru 9 in the Plenum System section first
2. Cut the appropriate amount of holes as described items 1 thru 3 and item 9 in the Ducting Runs Section.
3. Reconnect all power, ducting, and gas piping previously disconnected.

**WIRING SYSTEM:** All high voltage wiring should be 300 V NEMA rated and meet all national, state and local electrical codes. All wiring/cabling that passes through electrical boxes and panels MUST have cable clamps installed to prevent wire chaffing.

**Disconnect Wiring**

**NEC (National Electrical Code) “10 foot rule”**
In accordance with the NEC (National Electric Code) it is acceptable to have the same gauge (size) of wire FEEDING a fused Disconnect as the wire LEAVING the Disconnect as long as (See Wire Size Chart Below):
1. That wire is large enough to handle the size of the circuit ampacity protection inside that disconnect.
2. The feed in wire is NO LONGER than **10 feet**.
3. As long as the fused rating of the disconnect is in excess if 10% of the total feeder ampacity line it is attaching to.

FOR ANY ADDITIONAL QUESTIONS SEE THE ATTACHED EXCERPT (last pages of installation manual) FROM THE NATIONAL ELECTRICAL CODE BOOK Section 240.21 (B)(1)
High Voltage Wire Size Chart

<table>
<thead>
<tr>
<th>Elect Heater Configuration</th>
<th>Disconnect to Shore Power Wire (10 ft rule)</th>
<th>Disconnect to Controller</th>
<th>Controller to Heater Element</th>
</tr>
</thead>
<tbody>
<tr>
<td>1800 Watt</td>
<td>12 Ga.</td>
<td>12 Ga.</td>
<td>12 Ga.</td>
</tr>
<tr>
<td>3750 watt</td>
<td>12 Ga.</td>
<td>12 Ga.</td>
<td>12 Ga.</td>
</tr>
<tr>
<td>5000 watt</td>
<td>10 Ga.</td>
<td>10 Ga.</td>
<td>10 Ga.</td>
</tr>
</tbody>
</table>

Shore Power Socket Guide

When connecting to shore power polarity is very important be sure to follow the color code of the wires the Factory has hooked up when they installed the shore power wires to the socket and transfer switch.

Disconnect Switch Wiring:

If your not using the optional high voltage kit, make sure to use the correct wire as shown in the wiring chart above.

1. When running wire from disconnect switch to shore power, the shore power connection can be made at the receptacle were the power feeds inside or where the power connects to the transfer switch for the generator. Be sure to connect to the shore power side of transfer switch (see figure 9). Make sure to follow the color code for both the 50 and 30 amp services.

2. Run wire from shore power to input side of breaker in disconnect switch making sure that wire is not impinged or supported in a way that would allow insulation to chaff. Make sure to follow the color code for both the 50 and 30 amp services.

3. Run wire between disconnect switch and controller, and connect wires (see figure 10). Make sure to follow the color code for both the 50 Amp service and 30 amp service.

4. Double check all connections to make sure there tight and connected correctly Disconnect L1 to Controller TB2-L1, Disconnect L2 to Controller TB2-L2 and Disconnect ground to TB2-Controller ground.
Electric Heater Element Wiring:
(see high voltage wire size chart)
There are three different heater elements ratings and only one physical coil. That being said, it is the heater element heat rating that determines the wire size.

1. Run Romex wire between controller and electric heater element (Make sure to install cable clamp in to ½” knock out hole on heater panel to prevent wire from chaffing) located in add-on cabinet (see figure 11).
2. Connect wires from controller TB2 terminal 4 to element ground (NOT NETURAL), TB2 terminal 5 to element L1 (COMMON), and TB2 terminal 6 to element L2 (see Electric Heater Diagram).
3. Double check all connections for tightness and proper support to prevent chaffing.

The Neutral wire is NOT USED when connecting the 3750 & 5000 Watt 240 VAC heater configuration, it is only used with the 1800 Watt 120 VAC

Controller Wiring:
The controller has both low (12 VDC) and high voltage (120/240 VAC) running inside its cabinet, so make sure that all power is turned off before starting working on the controller. The high voltage terminal block is marked TB2, and the low voltage terminal block is marked TB1. Ensure that the correct wires are connected to the correct terminal blocks (see figure 11).

Controller Wiring Chart

<table>
<thead>
<tr>
<th>Wire Connected</th>
<th>TB1 Term #</th>
<th>Wire connected</th>
<th>TB2 Term #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Voltage</td>
<td></td>
<td>High Voltage</td>
<td></td>
</tr>
<tr>
<td>NEG (-) 12 V DC from furnace (Black)</td>
<td>1</td>
<td>(L1) input from Disconnect</td>
<td>1</td>
</tr>
<tr>
<td>POS (+) 12 V DC from furnace (Orange)</td>
<td>2</td>
<td>(L2) input from Disconnect</td>
<td>2</td>
</tr>
<tr>
<td>POS (+) 12 V DC to fan motor (Red)</td>
<td>3</td>
<td>(Ground) feed from Disconnect</td>
<td>3</td>
</tr>
<tr>
<td>POS(+) 12 V DC from changeover switch (Blue)</td>
<td>4</td>
<td>(Ground) output to Electric Element</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(L1) output to Electric Element</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(L2) output to Electric Element</td>
<td>6</td>
</tr>
</tbody>
</table>
By this time in the installation, the high voltage wires should have already been run, so take a minute to confirm that the correct high voltage wires are connected to the correct terminal block (TB2) and the correct terminals as shown in the controller wiring chart above. Then, follow the steps below to connect the low voltage wiring.

1. Remove the 10’ 4 conductor (2 – 12 ga., 2 – 18 ga.) wire from the shipping carton.
2. Run the 4 conductor wire harness between controller and gas furnace terminating the 3” ends at the controller and 12” ends at the gas furnace.
3. Remove outside access door to gas furnace.
4. Take the loose 12” RED wire from the wire harness and feed it through the opening in the gas furnace, where the existing wires pass through the furnace cabinet.
5. Locate red wire that feeds directly to the fan motor from the gas furnace PC board. DO NOT confuse this wire with the red wire that connects to the blower wheel air switch, the fan wire is usually a darker red (see figure 12).
6. Using the yellow scotch-loc splice connector provided with wiring harness, attach the RED 14 ga. wire in the 4 conductor wiring harness to the red fan wire (see figure 13).
7. Fasten loose wires with nylon ties so they do not get sucked into fan or chaff on cabinet, and reinstall gas furnace outside access panel.
8. Connect (wire nut) the other 12 ga. wire (ORANGE) coming out of the 4 conductor wire harness to the (+) 12 V DC wire that feeds the furnace power from the 12 V DC power system. After this connection, there should now be three wires connected together with a red wire nut: one ORANGE wire from the controller, one red wire from the furnace and one wire from (+) 12 V DC power supplied from the fuse block. Controller TB1 Terminal 2
9. Connect (wire nut) the black 18 ga. wire coming out of the 4 conductor wire harness to the (-) 12 V DC wire that feeds the furnace power from the 12 V DC power system. After this, there should now be three wires connected together with a red wire nut. One black wire from the controller, one yellow (Atwood is black) from the furnace and one wire from the (-) 12 V DC power supplied from the fuse block ground system. Controller TB1 Terminal 1
10. Connect (wire nut) the blue 18 ga. coming out of the 4 conductor wire harness to the WHITE wire in the three conductor wire harness coming from the changeover switch (see figure 14). (Controller TB1 Terminal 4)

(For Suburban SHD 2542 refer to SHD 2542 Thermostat Wire Diagram)
Changeover Switch Wiring: *(For Suburban SHD 2542 refer to SHD 2542 Thermostat Wire Diagram)*

This switch should have already been mounted at the beginning of this installation process. That being said, find the three conductor wire harness that came with the controller *(should already have its green wire hooked up to one of the controller wires at the gas furnace)*. This wire should have three quick connectors already attached to one end of the wire, and this is the end that should be run from the furnace back to the switch and connected as follows:

1. As shown in figure 14, connect the green, white and black wires to the appropriate terminals on the switch.
2. Before connecting the other wires at the furnace, test the switch to make sure that the correct wires are connected to the correct terminals on the switch as shown in the wire diagram. **Make sure that the Green wire is on the center terminal.**
   - Put the rocker on the switch to the ELECT position, and measure the resistance between the green and white wires. The resistance should be (0) ZERO.
   - With the switch still in the ELECT position, measure the resistances between the black and white wires. The resistance should be infinity.
   - Put the rocker on the switch to the GAS position, and measure the resistance between the Black and Green wires. The resistance should be (0) ZERO.
   - With the switch still in the GAS position, measure the resistance between the Black and White wires. The resistance should be infinity.

If the readings specified above were not obtained, exchange the black and green wires and do the test again. If there is still a problem, make sure that the wires on the other end of the wire harness by the furnace are not touching each other or anything else.

3. After completing the test process, go to the furnace and find the blue wire that feeds back from the thermostat to the gas furnace (see SITE PREPARATION section to determine the proper wire).
4. Remove the wire nut that connects the thermostat wire to the furnace wire.
5. Now that the wire nut has been removed, take the wire that physically comes back from the thermostat and connect it to the Green wire on the three conductor wire harness.
6. Now take the other disconnected wire (coming from the gas furnace) and connect it to the black wire in the three conductor wire harness.

**Run Test**

Before starting the run test, make sure that the shore power is turned off and proceed with the following checks.

1. Make sure that the 3/8” gas line has been reattached and that the flare nut is tight.
2. Leave the gas off.
3. Turn the thermostat to at least 10° F below the inside temperature.
4. Replace the 12 V DC fuse for the gas furnace.
5. With a volt meter, check for 12 V DC at the gas furnace.
6. Place the changeover switch in the Elect position.
7. Turn the thermostat up to 10° F above the inside Temperature (the fan should start immediately).
   - If the fan does not start immediately, check the connection of the three conductor wire harness at the gas furnace.
8. Turn the thermostat back down 10° F below inside temperature (the fan should stop immediately).
   - If the fan does not shut off immediately, reverse the black and green wires on the changeover switch.
9. Put the rocker switch in the gas position.
10. Turn the thermostat up to 10° F above the inside temperature (the fan should start immediately).
11. Turn the thermostat back down 10° F below inside temperature (the fan should continue to run for one to two minutes).
12. If the fan does not continue to run after the thermostat is turned down for one to two minutes, check for correct wiring, where the three conductor wire harness connects at the gas furnace.

13. Make sure that the thermostat is set 10° F below inside temperature, turn on the shore power and disconnect the breaker to the CheapHeat™ system.

14. Remove the access panel to the controller, and check the voltage on TB2 at terminals 1 & 2.
   - If hooked to a 30 amp shore power system, the reading should be 115-120 V AC.
   - If hooked to a 50 amp shore power system, the reading should be 230-240 V AC.

15. Remove the access panel for the electric heating element.

16. Attach amp probe meter around one of the wires hooked to the heater.

17. Turn thermostat up 10° F above indoor temperature and read amp reading at electric heater (see chart below for correct readings).

18. Verify that there is heat coming out of all of the registers.

19. Let system run for at least 20 minutes to make sure that there are no problems.

20. Turn thermostat back down to 10° F below indoor temperature.

21. Turn gas line on to furnace, and check for leaks.

22. Turn changeover to GAS.

23. Turn thermostat up to 10° F above indoor temperature (fan should start immediately and heat should start with in three to four minutes).
   - If heat does not come out of registers after three to four minutes, check to make sure that the propane tanks are turned on and full.

24. Turn thermostat off, replace all panels and inspect wiring.

25. YOUR DONE. GOOD JOB!

 Troubleshooting
This system is pretty straightforward. If you have any problems, redoing the RUN TEST section should help resolve any problems except for burnt up parts. The schematic shown below should help you resolve any diagnostic problems.

(For Suburban SHD 2542 refer to SHD 25423 Thermostat Wire Diagram)
Appendix – A

All ductwork must be attached to the discharge side of the enclosure to make sure all of the air has to go through the electric heater element before it goes out into the ductwork.

Red arrow denotes the correct airflow ducted model enclosure.

(SA) Style Ducted Enclosure With Ducting Attached

(PL) Style Plenum With Ductwork Attached
Each 4 inch has 12 1/2 Sq. In of free air space. 3 - 4 inch duct equal 37 1/2 Sq. Inches

2 1/4" X 14" equals 30 Sq. Inch's or 20% loss of air flow

2 1/4 X 12 Inch feed by Two 4 Inch round

2 1/4 X 20 Inch feed by Three 4 Inch round

The examples above is the wrong way to connect 4 inch round duct to rectangular duct

The examples above is the Correct way to connect 4 inch round duct to rectangular duct

All heater settings are managed by wiring connections of our single multi-tap heater coil Model # DH18-37-50

<table>
<thead>
<tr>
<th>SUBURBAN MODELS</th>
<th>Minimum 30 Amp Shore Power</th>
<th>Minimum 50 Amp Shore Power</th>
<th>Minimum 50 Amp Shore Power</th>
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<tr>
<td></td>
<td>DH18 Setting</td>
<td>DH37 Setting</td>
<td>DH50 Setting</td>
</tr>
<tr>
<td>DH18</td>
<td>Ducted System <strong>(3) 4&quot; Run Min</strong></td>
<td>Plenum Sys. (3) 4x8 Register Min</td>
<td>Plenum Sys. (4) 4x8 Register Min</td>
</tr>
<tr>
<td>SF Series-20 mbtu</td>
<td>YES</td>
<td>YES</td>
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<tr>
<td>SF Series 25 mbtu</td>
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<tr>
<td>DH37</td>
<td>Ducted System <strong>(5) 4&quot; Run Min</strong></td>
<td>Plenum Sys. (5) 4x8 Register Min</td>
<td>Plenum Sys. (6) 4x8 Register Min</td>
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<tr>
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<tr>
<td>DH37 or DH50</td>
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<td>Plenum Sys. (5) 4x8 Register Min</td>
<td>Plenum Sys. (6) 4x8 Register Min</td>
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<tr>
<td>SF or SH Series 35 mbtu</td>
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<td>YES</td>
<td></td>
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<tr>
<td>DH50 Setting</td>
<td>Ducted System <strong>(6) 4&quot; Run Min</strong></td>
<td>Plenum Sys. (6) 4x8 Register Min</td>
<td>Plenum Sys. (7) 4x8 Register Min</td>
</tr>
<tr>
<td>SF or SH Series 42 mbtu</td>
<td>YES</td>
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</tr>
<tr>
<td>DH50</td>
<td>Ducted System <strong>(7) 4&quot; Run Min</strong></td>
<td>Plenum Sys. (7) 4x8 Register Min</td>
<td>Plenum Sys. (8) 4x8 Register Min</td>
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<tr>
<td>SH Series 25/42 mbtu</td>
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<td>YES</td>
<td></td>
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<tr>
<td>ATWOOD HYDRO FLAME MODELS</td>
<td>Ducted System <strong>(3) 4&quot; Run Min</strong></td>
<td>Plenum Sys. (3) 4x8 Register Min</td>
<td>Plenum Sys. (4) 4x8 Register Min</td>
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<tr>
<td>AFMD, AFDL, 8500, 8900</td>
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<td>DH18</td>
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<td>Plenum Sys. (3) 4x8 Register Min</td>
<td>Plenum Sys. (4) 4x8 Register Min</td>
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<tr>
<td>Atwood 20 mbtu</td>
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<td>YES</td>
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<tr>
<td>DH18</td>
<td>Ducted System <strong>(5) 4&quot; Run Min</strong></td>
<td>Plenum Sys. (5) 4x8 Register Min</td>
<td>Plenum Sys. (6) 4x8 Register Min</td>
</tr>
<tr>
<td>Atwood 25 mbtu</td>
<td>YES</td>
<td>YES</td>
<td></td>
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<tr>
<td>DH37</td>
<td>Ducted System <strong>(5) 4&quot; Run Min</strong></td>
<td>Plenum Sys. (5) 4x8 Register Min</td>
<td>Plenum Sys. (6) 4x8 Register Min</td>
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<tr>
<td>Atwood 30 mbtu</td>
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<td>DH37 or DH50</td>
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<td>Plenum Sys. (5) 4x8 Register Min</td>
<td>Plenum Sys. (6) 4x8 Register Min</td>
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<tr>
<td>Atwood 35 mbtu</td>
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</tr>
<tr>
<td>DH50</td>
<td>Ducted System <strong>(5) 4&quot; Run Min</strong></td>
<td>Plenum Sys. (5) 4x8 Register Min</td>
<td>Plenum Sys. (6) 4x8 Register Min</td>
</tr>
<tr>
<td>Atwood 40 mbtu</td>
<td>YES</td>
<td>YES</td>
<td></td>
</tr>
</tbody>
</table>

*Note: Suburban 2-Stage furnaces requires special Change-over switch (Call Ph# 425-408-3140)

**Note: Atwood Hydro Flame 2-Stage furnace **WILL NOT** work with this system

***Note: These 4 inch duct runs are individual ducts originating at the furnace and 2 inch duct runs do not count

****Note: In most cases the 6h duct run will have to be added and it is suggested that it be an open duct running in the basement towards the back of the coach extending back 6 to 8 feet.

*****NOTE: Vertical installed Furnaces require that our DH18-37-50 Heater Coil be upgraded with a 200 F degree TOD (Call Ph# 425-408-3140)
Although basic Code requirements dictate the use of an overcurrent device at the point at which a conductor received its supply, subparts (A) through (H) effectively present exceptions to this rule in the case of taps to feeders. That is, to meet the practical demands of field application, certain lengths of unprotected conductors may be used to tap energy from protected feeder conductors.

These “exceptions” to the rule for protecting conductors at their points of supply are made in the case of 10-, 25-, and 100-ft (3.0-, 7.5-, and 30.0-m) taps from a feeder, as described in 240.21, parts (B)(1), (B)(2), and (B)(4). Application of the tap rules should be made carefully to effectively minimize any sacrifice in safety. The taps are permitted without overcurrent protective devices at the point of supply.

240.21(B)(1) says that unprotected taps not over 10 ft (3.0 m) long (Fig. 240-15) may be made from feeders, provided:

1. The smaller conductors have a current rating that is not less than the combined computed loads of the circuits supplied by the tap conductors and must have ampacity of—

   Not less than the rating of the “device” supplied by the tap conductors,

   (which formerly included the bus structure of a main lug only panelboard but given changes in 408.36, an overcurrent device is now generally required) or

![Diagram showing rating of feeder protective device and tap conductor ampacity.](Image)
# Product Warranty

## CheapHeat™

RV Comfort Systems products offer no warranty directly to the end user. The warranty for the CheapHeat™ product is through the installing dealer or OEM manufacture. This warranty is subject to proper installation and operation and only covers the product workmanship with regards to component operation as rated for a period of 1 year on aftermarket installations and 2 years on OEM installations, from the date of the installation.

### Gas Furnace

**OEM Coach Manufacturers**

For 2 years RV Comfort Systems will reimburse the OEM coach manufacturer for the cost of any failed part not covered by the furnace manufacture to which the CheapHeat™ System is attached.

**After Market installation**

For 1 year RV Comfort Systems will reimburse the installing Dealer for the cost of any failed part in the furnace caused by the addition of the CheapHeat™ System.

IN NO EVENT, REGARDLESS OF CAUSE, SHALL RV COMFORT SYSTEMS BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, PUNITIVE OR CONSEQUENTIAL DAMAGES OF ANY KIND.

The form below must be filled out and mailed to RV Comfort Systems within 30 days of the installation (OEM with in 30 days of the RV being sold, leased, or rented to its first customer) for this warranty to be honored.

To initiate warranty cut on black line and mail to address shown at the bottom

<table>
<thead>
<tr>
<th>Date Installed</th>
<th>OEM Date Sold</th>
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<td>Customer Name</td>
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<td>City</td>
<td>State</td>
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<tr>
<td>Furnace Brand</td>
<td>Mod #</td>
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<tr>
<td>For Ducted System:</td>
<td>Number of Duct Runs</td>
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<tr>
<td>For Plenum System:</td>
<td>Number of Registers</td>
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<tr>
<td>Controller Serial #</td>
<td>Shore Power 30 amp 50 amp</td>
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<td>Heater Serial #</td>
<td>Setting (KW)</td>
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<td>Dealer/OEM:</td>
<td>Ph</td>
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<tr>
<td>Street Address</td>
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<td>City</td>
<td>State</td>
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<tr>
<td>Tech (Print)</td>
<td>(Signature)</td>
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</tbody>
</table>

**Mail to:** RV Comfort Systems  PO Box 1554  Bothell, Washington 98041