SUBURBAN
RV FURNACES

SERVICE MANUAL

DD-17DSI
NT-12S/SE • NT-16S/SE • NT-20S/SE
NT-24SP • NT-30SP • NT-34SP
NT-40
SF-20 • SF-25 • SF-30 • SF-35 • SF-42
SF-20F • SF-25F • SF-30F • SF-35F • SF-42F

Suburban Manufacturing Company
Post Office Box 399
Dayton, Tennessee 37221

Form No. 288
11/99
### INSTALLATION REQUIREMENTS -- ALL CURRENT MODELS

<table>
<thead>
<tr>
<th>Models</th>
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<th>Clr Right</th>
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<th>L &amp; R Side Duct Sq Inch</th>
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<td>48&quot;</td>
<td>n/a</td>
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</table>

*1 - Special clearances for discharge grilles. Refer to Installation and Instruction Manual.

*2 - Return air should be 142° if 4 ducts are used. May be reducted to 88° if 5 ducts are used.

*3 - Bottom duct requires the bottom duct kit # 520753
RETURN AIR

![Diagram of return air system](image)

**Figure 1**

MOUNT A 3/4 INCH CLEARANCE WHERE DUCTS PASS THROUGH A CABINET WALL.

UNLISTED DUCT MATERIALS CAN BE 0 CLEARANCE.

*THE TOTAL FREE, UNOBSTRUCTED RETURN AIR OPENING TO THE FURNACE MUST NOT BE LESS THAN THE MINIMUM SPECIFIED IN TABLE 1*

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![Diagram of return air in living area of trailer](image)

**Figure 2**

RETURN AIR OPENING IN LIVING AREA OF TRAILER

HEATED AIR

---
VENT ASSEMBLY INSTALLATION

Figure 11

### Table: Vent Ass'y Dimensions

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>VENT LENGTH X DIMENSIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>266497</td>
<td>1.75&quot; 28&quot; - 24.3/4&quot;</td>
</tr>
<tr>
<td>266499</td>
<td>3.3/8&quot; 25 3/8&quot; - 25 5/8&quot;</td>
</tr>
<tr>
<td>266504</td>
<td>12 1/2&quot; 26.9/16&quot; - 29&quot;</td>
</tr>
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</table>

*NOTE: NEVER INSTALL VENT WITH LESS THAN 10° OVERLAP BETWEEN CHAMBER EXHAUST TUBE & VENT ASSY. EXHAUST TUBE.*

Figure 12
INTAKE TUBE KITS

VENT TUBE INSTALLATION

VENT TUBE EXTENDED 5' x 102" VENT TUBE INSTALLATION ON LEFT

VENT TUBE EXTENDED 5' x 102" VENT TUBE INSTALLATION ON RIGHT

FLAT TUBE INSTALLATION

EXTENDED TUBE INSTALLATION

VENT TUBE INSTALLATION ON LEFT

VENT TUBE INSTALLATION ON RIGHT
<table>
<thead>
<tr>
<th>Troubleshooting Guide</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Thermostat Closes</strong></td>
<td>No: Check Thermostat wire connections, contact points and the heat. Anticlock. Yes: Check 12vdc at blue wire, check the amp draw to Thermostat.</td>
</tr>
<tr>
<td><strong>Yes</strong></td>
<td>Replace Thermostat.</td>
</tr>
<tr>
<td></td>
<td>No: Check for shorts. Check component appearance. Yes: Check for 12vdc at furnace.</td>
</tr>
<tr>
<td><strong>Yes</strong></td>
<td>Replace Fuse/Reset Breaker.</td>
</tr>
<tr>
<td></td>
<td>No: Check fuse or circuit breaker.</td>
</tr>
<tr>
<td><strong>Yes</strong></td>
<td>Approximately 10-20 seconds blower is operating.</td>
</tr>
<tr>
<td><strong>Yes</strong></td>
<td>Replace the Time Delay Relay.</td>
</tr>
<tr>
<td><strong>No</strong></td>
<td>Check for 12vdc at Time Delay Relay and for 12vdc to red wire to the Motor.</td>
</tr>
<tr>
<td><strong>Yes</strong></td>
<td>Replace the Motor.</td>
</tr>
<tr>
<td><strong>No</strong></td>
<td>Check ground wire.</td>
</tr>
<tr>
<td><strong>Yes</strong></td>
<td>After 12-30 seconds the Module creates spark and opens valve.</td>
</tr>
<tr>
<td><strong>No</strong></td>
<td>Check for 12vdc between red and yellow wires at the Module Board. Check plug connection to the Module Electrode and wire (Spark gap 1.5 inch between probe and ground).</td>
</tr>
<tr>
<td><strong>Yes</strong></td>
<td>Replace the Switch.</td>
</tr>
<tr>
<td><strong>Yes</strong></td>
<td>Replace the Limit Switch.</td>
</tr>
<tr>
<td><strong>No</strong></td>
<td>Spark occurs for approximately 1 seconds and Main Burner Flame establishes.</td>
</tr>
<tr>
<td><strong>Yes</strong></td>
<td>No spark at the electrode.</td>
</tr>
<tr>
<td><strong>No</strong></td>
<td>Replace the Module.</td>
</tr>
<tr>
<td><strong>Yes</strong></td>
<td>Replace the Module.</td>
</tr>
<tr>
<td></td>
<td>Check for 12vdc at Gas Solenoid Valve.</td>
</tr>
<tr>
<td><strong>Yes</strong></td>
<td>Check Gas Pressure at the Manifold or for restrictions in the Burner Orifice.</td>
</tr>
<tr>
<td><strong>Yes</strong></td>
<td>Replace the Gas Valve.</td>
</tr>
<tr>
<td><strong>No</strong></td>
<td>Check for restriction in Combustion Air Brake (leaks, etc.).</td>
</tr>
<tr>
<td><strong>Yes</strong></td>
<td>Is Flame established.</td>
</tr>
<tr>
<td><strong>No</strong></td>
<td>Replace the Time Delay Relay.</td>
</tr>
<tr>
<td><strong>Yes</strong></td>
<td>System OK.</td>
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</table>

**NOTE:** On some models sail switch is before limit switch.
OPERATION INFORMATION

Figures 16, 17 and 18 illustrate a typical electrical circuit for direct ignition models. The room air blower must be operating at approximately 75% of the normal rpm at 12 volts DC before ignition can occur. This is unlike most residential furnaces which can have burner operation without the blower running.

The operation of a forced draft combustion furnace is controlled through a 12 volt thermostat (24 volt thermostat in the case of a park model furnace). When the thermostat is set above room ambient, the contacts close completing a circuit through the coil of the time delay relay. The contacts on the relay then close, completing a circuit through the windings of the motor and the motor comes on.

As the motor reaches approximately 75% of its normal rpm, the air flow generated by the room air blower pushes against the paddle on the sail switch (sometimes referred to as a microswitch or an air prover switch) salling it in and closing the contacts. A circuit is then completed through a high temperature limit switch to the module board on a direct ignition furnace.

On a direct ignition furnace, as current passes through the ignition module to the valve, a high voltage spark is produced at the electrode assembly located over the burner. Simultaneously, the valve opens, gas flows into the burner and is ignited by the spark.

All DYNATRAIL direct ignition furnaces must have a flame sensing circuit through the control module which senses the presence of main burner flame. If proper flame sensing is not obtained or if the burner fails to light, the furnace must go into 100% lock-out. When lock-out occurs, the valve closes and will remain closed until the thermostat circuit is broken. Re-ignition will not occur automatically.

While 100% lock-out is a safety feature, it can prove to be frustrating for the RV owner who has experienced lock-out problems. Not only can a lock-out problem be difficult at times to diagnose, it will result in continuous operation of the furnace blower (that is, until the thermostat circuit is broken) and can drain the battery.

The solution for this complaint is not to try and eliminate the lock-out function of the furnace, but rather to find the cause for lock-out (which will be covered later), and correct it.

The motor circuit contains a time delay relay (see wiring diagram). The purpose of a time delay relay is to provide a means of the blower operation on initial startup and after the thermostat is satisfied. When the thermostat contacts open, the circuit through the coil of the time delay relay is broken and the contacts open after approximately 3-5 minutes, depending on the furnace model.

MAINTENANCE

Preventive maintenance is essential if an RV owner is to have reliable, safe operation of his furnace. By far, the two most important areas to watch closely in order to assure safe, reliable operation, are the venting and the main burner.

An obstruction in the vent or main burner will reduce the intake of combustion air which results in incomplete combustion. Wherever incomplete combustion occurs, the by-products are carbon monoxide (CO) and soot. If the furnace outside exhaust vent shows black soot may be forming, the furnace should not be operated until the problem is corrected. Possible causes are restriction of combustion air, low gas pressure, dirty burner, slow flow if the motor is defective or voltage supply is low to the extent that it causes CO by design or furnace should not operate, recirculation of exhaust gases into intake due to improper vent installation, restriction in exhaust.

If operation of the furnace continues under these conditions, it could result in serious injury to the occupants of the RV or even death.

Cleaning of the main burner and an inspection of the venting system should be done at least once a year, preferably just before the beginning of the heating season. Some RV owners and service personnel have the false assumption that if a furnace has not been used, it will not require cleaning. NOT SO! A furnace which has not been used for some time could be more in need of cleaning than a furnace which has been used extensively.

Dust and lint should be removed from the room air blower wheel and sail switch. A build up of dust and lint on the blower wheel can cause the motor to drag and not generate enough air flow to engage the sail switch. Dust accumulation on the sail switch will restrict the travel of the actuator arm to where the air flow across the paddle will not sail it in and complete the valve circuit.

A yearly inspection should be made of all gaskets on the furnace. If any gasket show signs of leakage or deterioration, they must be replaced.
CAUTIONS

1. Never operate the furnace with the electrode wire disconnected nor with the electrode assembly removed from the furnace.
2. Never use a battery charger to power or test an electronic ignition furnace as they sometimes provide more than 14.5 DC volts that could damage the module board.
3. Never use a screwdriver on any part of the electrode assembly while the furnace is in operation.
4. Be certain that the spark from the electrode never reaches the flame sensor portion of the electrode assembly. (See Figure 21 for correct gapping.)

FURNACE REMOVAL

To replace parts or service the latter generation furnaces, the M and S series, it is necessary to follow these steps:

1. Disconnect gas and power supply.
2. Remove vent cap assembly by removing applicable screws and one 3" baffle screw. NOTE: A 3" baffle screw is not applicable on all models.
3. Remove the cabinet front.
4. Remove the shipping screw securing the chamber to the cabinet.
5. Pull chamber outward completely to gain access to all controls and parts for adjustment or replacement.

NOTE: Our service technicians are available to assist you in making repairs or parts replacements from 8:00 a.m. to 5:00 p.m. EST, Monday through Friday (except holidays), by calling 423-775-2131.
Furnaces with Direct Spark Ignition:

Each step in this operation must be completed in the listed order before the next function will occur. To properly diagnose a malfunction and correct it, it must be determined at what step the operation of the furnace failed.

1. When the temperature drops to a set temperature, the wall thermostat contacts close.
2. The fan relay coil is energized in the thermostat relay, completing the circuit to the blower motor. (Some models equipped with a time delay relay have a 5-25 second time delay after the thermostat contacts close).
3. The motor starts and after reaching 75% of its normal rpm; the room air blower wheel or blade activates the sail switch (microswitch), sending current to the temperature limit switch (a normally closed switch), and on to the module board.
4. When energized, the module board has a built-in 15-20 second delay, allowing the combustion air to purge the combustion chamber.
5. The module board supplies a high voltage spark through high tension wire to the electrode assembly, at the same time sending voltage to the gas valve, opening the valve.
7. The sensor probe signals the presence of flame and the spark stops. (If flame is not established within 7 seconds, the system closes the gas valve and goes into lock-out).
8. The fan switch (normally open) closes on temperature rise. This does not apply to models with the time delay relay. With time delay relay, models will keep the motor running for 3 - 5 minutes.
9. The gas valve closes when either the limit switch or thermostat contacts open.
10. The blower motor goes off when the fan switch or time delay relay opens.

NOTE: Refer to wiring diagram on each model for proper sequence of operation.

Do not use a battery charger to power or test the furnace, as they sometimes provide more than the 14.5 volts DC that will damage the control module board.

All testing and repair should be done by qualified personnel only. Do not use a screwdriver or touch any part of the electrode assembly while the furnace is running.

Do not operate the furnace with the high tension lead wire disconnected to the electrode assembly removed from the burner access plate.

Do not perform any high-pot tests on the furnace.
A. THERMOSTAT IS CALL FOR HEAT, BUT THE BLOWER DOES NOT RUN

1. Check all wiring for correct polarity (refer to wiring diagram). Loose connections and possible shorts.

2. Check for 12 volts DC at the furnace connection. Correct power source if 0" volts or below 12 volts DC.

3. Check the wall thermostat and wiring for continuity. Be sure thermostat points are contacting.

4. With thermostat points closed, check for circuit completion across terminals 2 and 4 of the thermostat relay. If no continuity, and wiring to the relay is okay, replace the relay.

5. If there is continuity across terminals 2 and 4, and the wiring to the motor is okay, replace the motor.

6. On time delay relay models, allow 3 - 10 seconds for the circuit to be completed to the motor, as the coil in the time delay relay must heat up to close the contacts.

B. BLOWER IS NOISY

1. Check for lint accumulation or debris on the blower wheels, or possible damage to the wheel.

2. Check for excessive voltage or correct, if present.

3. Check polarity. If reversed, the motor will whine and run backward. Air delivery will be too low to close the microswitch.

4. Wheel may be hitting the housing. Remove the combustion air housing and adjust the wheel with a T-handle 1/8" Allen wrench. On the room air wheel side, a 90° angle 1/8" Allen wrench will be needed to remove or adjust the wheel.

5. At times, insects such as mud daubers and wasps will build nests inside the combustion air housing, coming in from the fresh air intake. Remove any foreign materials and check the combustion air wheel for warpage.

6. If the bushings of the motor are worn and noise persists, replace the motor. Check both wheels for balance and, if not proper, replace the wheel or wheels.

C. BLOWER RUNS BUT BURNER DOES NOT LIGHT

1. Make sure the manual shutoff valve is in the "ON" position.

2. Possible air in the gas lines. Reset the thermostat and cycle the furnace several times to bleed the system.

3. Check the gas supply. Be certain 1" WC pressure is present while the furnace is operating. If not, adjust the pressure regulator.

4. Check the wiring for proper polarity.

5. Check each microswitch clearance down the sides and across the top for return air to feed the room air blower.

6. Check the dicing of the furnace to determine proper air flow away from the furnace. See the installation manual for correct duct requirements. If the ducts have severe bends or kinks in the hose, the air flow may be restricted enough to cause the microswitch to bounce back from the volume of air hitting the cabinet front. This again will not allow voltage to the module board. Many times, a furnace will operate satisfactorily on the bench or without the cabinet door on the unit. Check for microswitch engagement when this happens. Correct dicing for proper air flow and/or replace the microswitch (could be stiff).

7. If the furnace will ignite with the cabinet front off, but will not with the cabinet front secured, and the dicing is free, check the gaskets around the burner access door. If the burner access is not properly secured, air may be deflected from the cabinet front into the burner area, thus disturbing air and gas mixture for proper ignition.

8. Check for 12 volts DC on both sides of the limit switch. If there is voltage on one side of the switch, but not on the other, replace the switch. If voltage is present on both sides of the switch, proceed to Step 9.

9. Check for 12 volts DC at the power terminals on the module board (refer to the wiring diagram-red wire positive and yellow wire negative). If no voltage, check wiring from the limit switch. Correct wiring. Replace switch.

10. If sparking audible approximately 15 seconds after the blower starts, but no ignition, check the high tension wire for continuity, grounding and secure connections. Repair if necessary.

11. Make sure electrode is not grounding to burner, the gap between the spark probe and the ground probe is 18" (see Figures 19 and 21), and the ceramic insulator is not cracked, broken or sooted. Adjust, clean or replace as necessary.

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12. If sparking is not audible, check the module board and observe if the neon bulb on the circuit board is flashing during the trial for ignition. Remove the white plastic wire connector from the circuit board. Clean the board terminals on back with a soft rubber eraser. Check the little pin terminals in the plastic connector for good contact. Reinstall connector. If the tube does not flash, replace the module board.

13. Check for voltage at the gas valve during the trial for ignition. If no voltage, and connections are okay, replace the board.

14. If the valve does not open with 12 volts DC present, replace the valve.

15. If the electrode sparks and the valve opens but the burner will not light, check the gas supply for 11" WC pressure to the main burner orifice. If 11" is present to the valve but not to the orifice, replace the valve. Check vent and air intake installation. Check the main burner for correct relationship to the electrode assembly (burner should be 3/16" from the spark probe and sawports or charge ports directly under the spark gap). Check main burner for soot build-up in ports. (See Figure 19 for SF models correct electrode adjustment.) Clean cast iron burners by passing a hacksaw blade through the sawports, being careful not to enlarge the openings. Wirebrush stainless tube burners to remove build-up.

16. Check the combustion air wheel for proper rotation and proper air flow.

D. BURNER IGNITES BUT SHUTS OFF

1. Check to be certain that the flame sensor is over slots in the main burner and that the main burner flame is burning against the tip of the flame sensor - adjust by bending the sensor probe. NOTE: Sensor probe should be in the inner blue cone of the burner flame, approximately 1/4" to 5/16" above the burner. See Figure 19 for SF furnace electrode adjustment.

2. If wire connections are okay, check for continuity through the flame sensor wire.

3. If the continuity of the flame sensor wire is okay, adjust the position of the sensor probe, check air adjustment and check for carbon deposits on the sensor probe. Replace electrode if necessary.

4. When the flame sensor circuit is generating at least 7 microamps on NT Models or 2 to 4 microamps on SF Models, but the burner still goes off and into lock-out, replace the module board.

E. MAIN BURNER WILL NOT SHUT OFF

1. Make sure the thermostat and contact points are open.

2. Check voltage at the valve terminals - should be 0" voltage.

3. Disconnect leads from the valve. If it does not shut off, replace the valve.

F. CONTINUOUS SPARKING OF THE ELECTRODE

1. Check the sensor wire and high tension wire for good connections. Check for separations in either wire - repair or replace. Check to be certain that the flame sensor probe is over the slots in the main burner and that the main burner flame is burning against the tip of the sensor probe. Adjust by bending the probe into flame. The burner flame should be a hard blue flame, laying down on the burner.

G. ERRATIC BLOWER OPERATION

1. Check thermostat wires to furnace.

2. Check thermostat wires at thermostat.

3. Check thermostat points open/close on thermostat.

4. Check voltage at thermostat.

5. Check for shorts in wiring.


7. If blower runs after burner shuts down and thermostat is satisfied, replace relay delay.
H. UNIT GOING INTO LOCK-OUT ONLY ONCE IN A WHILE

1. Thoroughly check the electrode and burner air adjustments.

2. Lock-out can occur if the gas pressure fluctuates at the time the thermostat calls for heat. Pressure fluctuations can be caused by a malfunctioning gas bottle regulator, and obstruction or a kink in the gas line, or moisture in the gas bottle regulator or in the gas lines. It is difficult to check for these fluctuations that will not noticeable affect any other appliance in the coach. However, isolating the furnace from the coach gas system will determine if the gas system is responsible. This isolation procedure can be done by connecting a separate gas bottle, regulator and gas line directly to the furnace, eliminating the coach gas system. If the occasional lock-out still exists, then the furnace should be thoroughly tested to determine the cause; however, if the furnace works properly on this separate system, then the coach gas system should be checked.

3. Check the furnace return air and warm air discharge to be certain sufficient air flow is present to engage the microswitch every time.

4. Check the microswitch to be sure it moves freely.

5. Remove the electrode and burner and clean them thoroughly.

6. When moisture in the gas system is suspected as being the problem, especially where the horizontal type gas bottle is being used, the following steps should be taken to prepare the gas system against further moisture problems.

CORRECTION MEASURES

1. Disconnect gas bottle and drain it completely dry of all gas and all moisture.

2. Disconnect and blow out all gas lines completely dry.

3. Check pressure regulator on the gas bottle. Replace if necessary.

4. Add the drying agent. One half pint of methanol alcohol per 100 pound bottle capacity is recommended.

PRECAUTIONS

1. Never fill the gas bottle over 80%.

2. Do not use the gas bottle completely dry to avoid using up the drying agent.

We have found the above procedures to be effective in solving most occasional lock-out problems, especially where the horizontal type gas bottle is used. All of these steps must be performed as described for the preparation of a contaminated gas system to be 100% effective.

I. REPEATED MODULE BOARD FAILURES

1. Check to be certain that the electrode spark is not sparking against the flame sensor portion of the electrode assembly.

2. Check to be sure the module board or high voltage wires are not shorted to the chamber wrapper or other furnace parts.

3. Be sure the insulator covering the electrode wire connection on the coil of the module board is in place and the insulator behind the module board is in place.

4. Check the high voltage - 14.5 volts DC maximum! High voltage could intermittently produce volt surges or AC spikes which could damage the module board. Supply voltage to furnace should be checked if repeated module board failures occur. Converter voltage should be wired in parallel with battery to prevent momentary voltage supply and to filter AC spikes or vol surge. NOTE: Refer to Connecting Power Supply in manual.

5. Be sure duct connections to the furnace are airtight. Seal duct collar connections to the furnace cabinet with metal duct tape, if necessary, to prevent hot air leakage. No air leakage should exist anywhere in the duct system, especially at connections on the furnace cabinet.

6. The high voltage electrode wire should be routed away from any 12 volt wires (except at grommet for sensor wire). No wires should pass over the module board.

7. Be sure the sensor wire terminal is tightly affixed to the sensor probe.

8. Be sure high voltage electrode wire is in good condition and properly positioned onto pierce point electrode or spade terminal.
SERVICE CENTER INFORMATION

Suburban Manufacturing Company is always interested in adding qualified service agencies to our list of Recommended RV Service Centers. Our service centers receive substantial price breaks on all parts and units ordered from the factory. Their names, addresses and phone numbers then appear in our Recommended RV Service Center List, which is supplied with each new unit. Customers who write or phone our office are referred to the service agency nearest them and they receive the latest revision of the list for their convenience when traveling.

If you would like more information on having your agency listed as a Suburban Recommended RV Service Center, please contact our Service Department at:

Suburban Manufacturing Company
PO Box 399
Dayton, TN 37321
423-775-2131

WARRANTY REPAIRS

The following Flat Rate Labor Schedule shows our standard time allowances for labor on warranty repairs. In order to obtain reimbursement, the original work order or warranty claim form must be sub-mitted to our office and must include the furnace model number, serial number and date of purchase. In the event that the repair involved replacement of a module board, gas valve, motor or combustion chamber, the defective part must also be returned to our factory for inspection; the part and necessary paperwork should be returned together. Parts on approved claims will be replaced at no charge.

New factory-authorized replacement parts will be replaced at no charge if found to be defective within 90 days; labor is not paid for the part replacement. Defective parts must be returned to our factory for inspection, along with the Bill of Sale showing the purchase date of the part. Should our inspection reveal that the part is not defective, or was not the correct replacement, it will be returned to you and no further action will be taken.

NOTE: Any component part found to be defective must be replaced. Do not attempt to repair component parts. Use only factory-authorized replacement parts.

FOR IN-WARRANTY RECREATIONAL VEHICLE FURNACES ONLY

All Models Forced Air Furnaces

<table>
<thead>
<tr>
<th>Description of Replacement Part</th>
<th>Setup</th>
<th>Replacement</th>
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<tbody>
<tr>
<td>Replace Gas Valve</td>
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<td>.5</td>
</tr>
<tr>
<td>Replace Manual Shut-Off Valve</td>
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<td>.25</td>
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<tr>
<td>Replace Main Burner</td>
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<td>.5</td>
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<tr>
<td>Replace Microwave</td>
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<tr>
<td>Replace Motor</td>
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<tr>
<td>Replace Time Delay Relay</td>
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<tr>
<td>Replace Combustion Chamber (First Year Only)</td>
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<tr>
<td>Replace Blower Wheel</td>
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<tr>
<td>Replace Combustion Chamber</td>
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<tr>
<td>Replace Thermostat</td>
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<tr>
<td>Replace Transformer</td>
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<tr>
<td>Replace Electrode Wire</td>
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<tr>
<td>Replace Module Board</td>
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<tr>
<td>Replace Limit Switch</td>
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<td>.5</td>
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</tbody>
</table>

All other jobs that are listed contact Suburban factory Service Department for approval.

All flat rates include diagnostic/setup time and, when applicable, gas leak test.

NOTE: When more than one component is defective, compute the total of both replacement times but only one setup time.