GMC Motor Home Service

Dealer Service Information Bulletin

GMC TRUCK & COACH DIVISION GENERAL MOTORS CORPORATION

IMPORTANT-All Service Personnel Should Read and Initial

NUMBER: 77-IM-8
GROUP: 24-MISC.-4
DATE: July, 1977

SUBJECT: DUO-THERM FURNACE

MODELS: ALL MOTORHOMES EQUIPPED WITH DUO-THERM FURNACES

During the 1977 Model Year, the 30,000 B.T.U. Duo-Therm furnace (Figure 1) was installed as standard equipment in the GMC Motorhome. The furnace is located in the compartment, at floor level, under the kitchen sink. The identification plate is located at the front of the combustion chamber assembly. The furnace has no pilot light but is ignited by a direct spark ignition system.

The furnace utilizes a sealed combustion system. The combustion air is drawn in from outside the vehicle, passes through the combustion chamber, and returned to the outside. Air inside the vehicle is drawn through the front panel on the furnace and passed around the heat chamber then discharged into heat ducts located on the front and rear sides of the furnace casing.

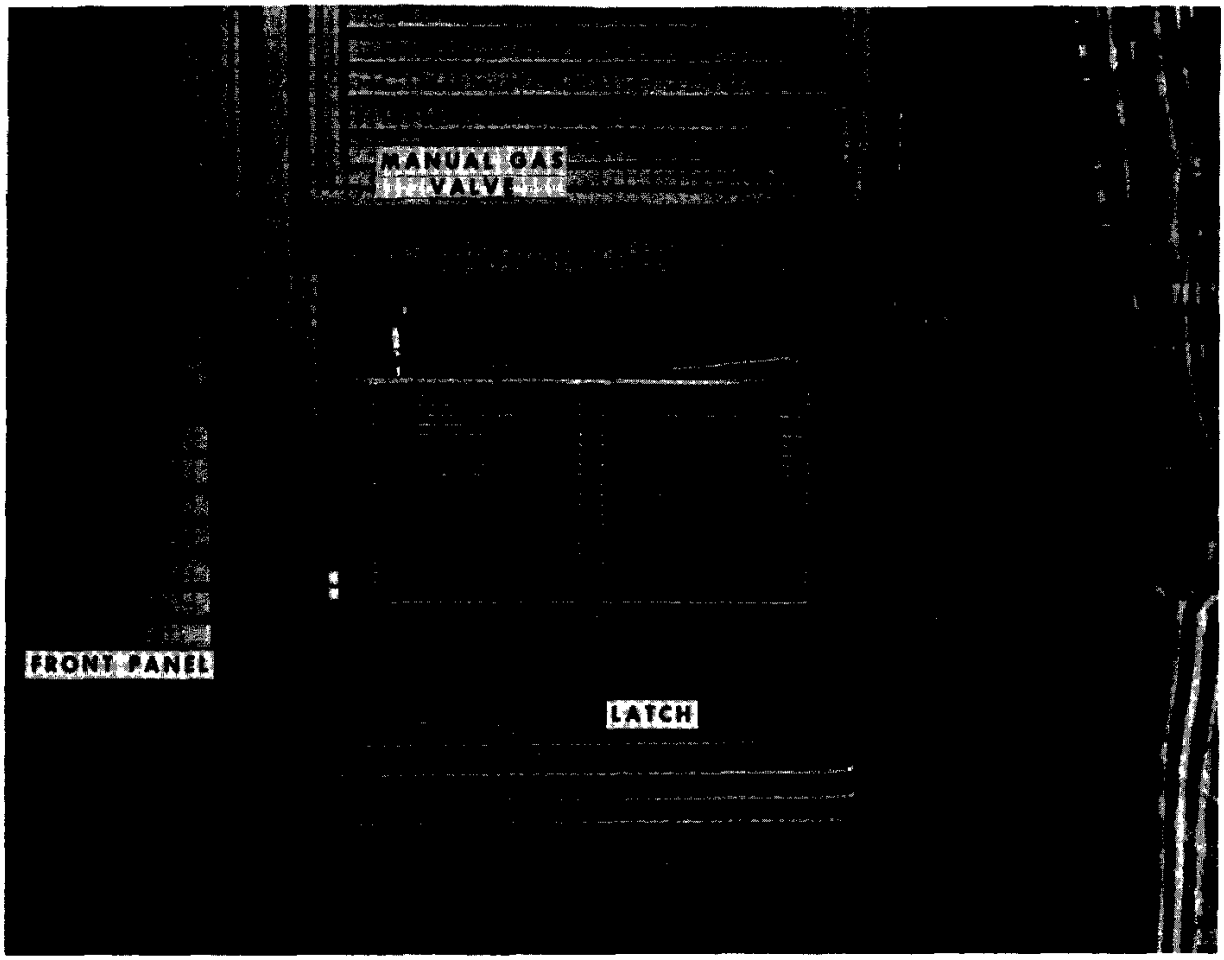


Figure 1 – Duo-Therm Furnace Installed

NOTE: An auxiliary furnace blower located behind the kitchen range/oven aids in conducting heated air to the bathroom module.

The furnace operates on 12-volts D.C., and its wiring diagram is shown in Figure 2.

COMPONENT DESCRIPTION

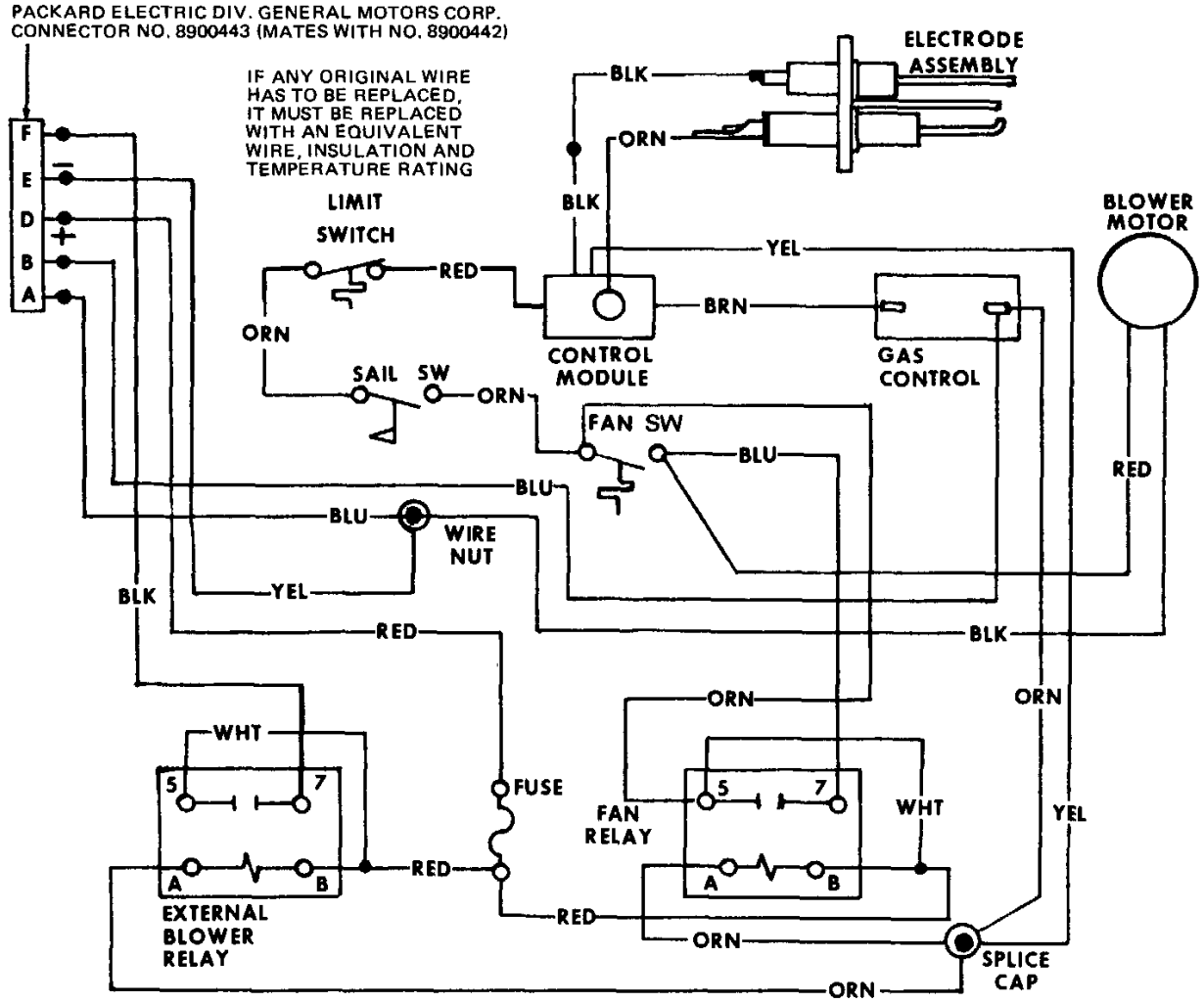
Gas Valve

The gas valve (Figure 3) contains a manual shutoff for the LP gas supply to the furnace. Also included in the valve is a pressure regulator which limits LP gas to the furnace between 10-1/2 and 11-1/2 inches of water pressure.

NOTE: This valve is in addition to the LP gas regulator valve located at the LP gas tank.

Gas Solenoid Valve

The gas solenoid valve (Figure 3) controls the flow of LP gas to the burner assembly. Opening and closing of this valve is controlled by the sail switch and the ignition system.



MODEL 65930-926 INCLUDES A RELAY TO POWER THE REMOTE BLOWER LOCATED WITHIN THE DUCT SYSTEM. THE OPERATIONAL SEQUENCE PERMITS THE REMOTE BLOWER AND THE FURNACE BLOWER TO OPERATE WHEN THE THERMOSTAT IS CALLING FOR HEAT. WHEN THE THERMOSTAT IS SATISFIED, THE REMOTE BLOWER WILL STOP AND THE FURNACE BLOWER WILL CONTINUE TO RUN UNTIL THE FAN SWITCH WITHIN THE FURNACE IS SATISFIED.

Figure 2 – Duo-Therm Furnace Wiring

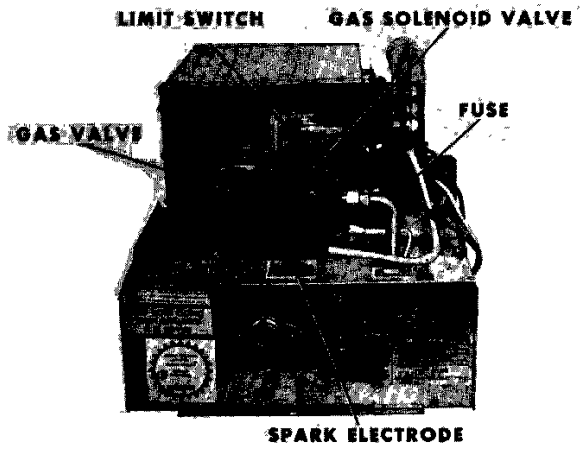


Figure 3 – Furnace Components (Front View)

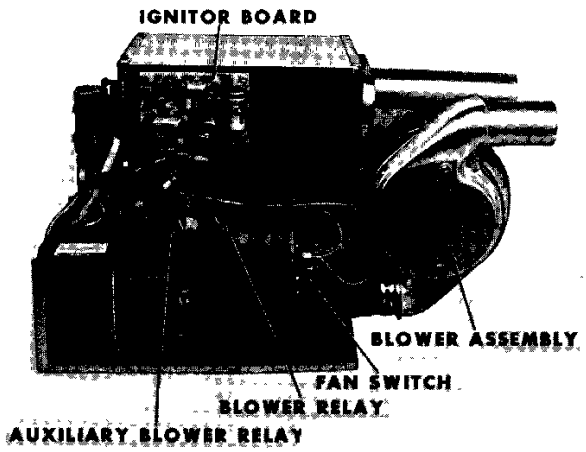


Figure 4 – Furnace Components (Side View)

Limit Switch

The limit switch function is to turn off the gas supply to the burner assembly if furnace temperature exceeds the high temperature limit of 200°F (93°C). If this temperature is exceeded during furnace operation, the limit switch will open causing the gas solenoid valve to close, thus shutting off LP gas to the furnace.

Blower Assembly

The furnace blower assembly contains one motor that is used to drive both the combustion air and circulating air blower wheels. The combustion air blower is sealed so as to allow no passage of air between it and the circulating air blower. The combustion air blower wheel draws air from outside the vehicle into the combustion chamber and forces combustion products out the exhaust tube. The circulation air blower wheel pulls air into the front of the furnace, forces it across the heat chamber, and discharges it to the heat ducts located on both sides of the furnace casing.

Relays

Two relays (Figure 4) are located on the right side of the furnace. The auxiliary blower relay is energized when the thermostat contacts close (calling for heat). When energized, this relay feeds current to the auxiliary blower motor located behind the range/oven. When the thermostat contacts open, the auxiliary blower motor will shut off.

The blower relay energizes the blower motor when the thermostat calls for heat. When the thermostat contacts open, the blower relay contacts open; thus, the ground circuit for the relay is broken. The blower will continue until the fan switch shuts off the blower.

Fan Switch

The fan switch (Figure 4) controls the sequence of blower operation. The fan switch is a two pole switch. When the bimetal disc in the switch is heated to operating temperature, the switch changes position. The blower will continue to run as long as the circulating air chamber is hot, even though the thermostat contacts are open and the gas solenoid valve is closed. When the chamber cools, the fan switch changes back to its original position and shuts the blower off.

Sail Switch

The sail switch is located on the bottom of the blower assembly. The switch operates in response to the flow of air generated by the blower. If for any reason the air from the blower is not sufficient, the switch will not operate. This may be caused by a slow motor due to low voltage, restricted return air, or lint accumulation on the blower wheel. Once the switch engages, the solenoid valve opens, gas flows to the burner, and ignition occurs.

Ignition System

The direct spark ignition system consists of a solid-state printed ignitor board, an ignitor assembly and connecting high and low voltage wires. The ignitor board is not field repairable.

The thermostat contacts when closed allow current to the ignitor board to open the gas solenoid valve, and provide the ignition spark. As soon as the flame is established, the spark ceases. Should the flame not be established within a period of 15 seconds, the system will close the gas solenoid valve.

Electronic flame sensing circuitry in the spark electrode detects the presence or absence of main burner flame. If the flame is extinguished during normal operation, the ignitor board will provide one re-try for ignition, then close the gas valve.

SEQUENCE OF OPERATION

When the thermostat calls for heat, the furnace blower motor is energized immediately. When the blower reaches minimum operating speed (approximately 1-2 seconds), the main burner of the furnace is designed to ignite. The furnace will continue to run until the thermostat is satisfied or is turned to a lower setting. Following approximately one minute of burner operation, a slight "snap" will be heard from within the furnace. This is the furnace fan switch changing to its normal run position. After this occurs and the thermostat is satisfied or is turned to a lower setting, the main burner flame will go out; but the blower will continue to run for a short period of time and then shut off. If thermostat is adjusted to a lower setting or to "OFF" before the furnace has operated for one minute, the blower and main burner will shut off at the same time.

OPERATING FURNACE

This furnace has no pilot light but is ignited by a direct spark ignition system. No manual lighting is required.

Start-Up

1. Set thermostat located in rear of motorhome living area to "OFF" position. Remove front panel from furnace. Turn gas valve on furnace to "OFF" position. Wait five minutes.

   This will allow any LP gas fumes in the combustion chamber to dissipate.

   NOTE: Be sure control valve at LP gas tank is fully open.

2. Open furnace manual valve fully. The manual valve is located just above the furnace. Do not attempt to operate furnace with valve partly opened as proper operation depends on valve being fully open.

3. Turn furnace gas valve to "ON" position. Do not attempt to operate furnace with valve partly opened as proper operation depends on valve being fully opened.

4. Set thermostat to "ON" position and adjust to the desired temperature setting. When furnace ignites, it will continue to run until thermostat is satisfied or is turned to a lower setting.

5. Allow 15 seconds for burner to ignite. Look for flame at furnace view port. Install furnace front panel when ignition is obtained. Furnace will now operate automatically.

6. If burner does not light, set thermostat on "OFF" position, wait 15 seconds, and repeat steps 4-5.

7. If ignition is not obtained after three tries, go to shutdown and determine the cause.

Shutdown

1. Turn gas valve to "OFF" position.

2. Set thermostat on "OFF" position.

FURNACE DIAGNOSIS

BURNER DOES NOT LIGHT		
PROBLEM	**POSSIBLE CAUSES**	**CORRECTION**
No Voltage to Furnace	1. Blown fuse living area fuse block 2. Blown fuse at furnace	1. Correct short and replace fuse 2. Correct short and replace fuse
Blower Does Not Operate	1. Defective blower relay	1. Replace blower relay
Blower Speed Inadequate To Close Sail Switch	1. Insufficient voltage – furnace operating voltage is 9 to 15 volts D.C.	1. Charge batteries or connect to shore power
Sail Switch Not Closing	1. Insufficient voltage 2. Loose connection 3. Defective switch	1. Charge batteries or connect to shore power 2. Repair connection 3. Replace switch
Gas Solenoid Valve Not Opening	1. Open or short in gas solenoid valve coil 2. Voltage not present at gas solenoid valve during ignition phase	1. Replace gas solenoid valve 2. Repair defective wiring to gas solenoid valve or replace ignitor board or replace sail switch
No Spark at Ignitor	1. Short or open in high voltage lead 2. Ignitor not grounded 3. Incorrect spark gap 4. Cracked ceramic on ignitor 5. Defective ignitor board	1. Replace high lead voltage 2. Correct ground 3. Set spark gap to 1/8" ± 1/32" 4. Replace ignitor 5. Replace ignitor board
Limit Switch Open	1. Limit switch is normally closed below 200°F.	1. Replace limit switch if there is no continuity across switch below 200°F

FURNACE LIGHTS BUT SHUTS DOWN AFTER A PERIOD		
PROBLEM	**POSSIBLE CAUSES**	**CORRECTION**
Furnace Lights But Shuts Down After a Few Seconds	1. Ground screw loose	1. Secure the green grounding wire to grounding screw located near the blower relays NOTE: On early furnaces, the green wire is grounded in the furnace junction box
	2. Burner assembly mounting screws loose	2. Tighten burner assembly mounting screws
Furnace Lights But Randomly Shuts Down During Duty Cycle	1. Check flame sensor electrode lead for continuity	1. Replace lead
	2. Flame sensing electrode not located properly	2. Position flame sensing electrode so that tip is in flame. The current should be 5-15 microamps through the electrode lead
	3. Air in L.P.G. line or regulator frozen	3. Purge L.P.G. tank and add methanol alcohol

COMBUSTION CHAMBER ASSEMBLY REPLACEMENT

WARNING: BEFORE ANY REMOVAL OR DISASSEMBLY PROCEDURES ARE PERFORMED ON THE FURNACE, BE SURE LP GAS IS COMPLETELY TURNED OFF AT THE LP GAS TANK AND REMOVE FURNACE FUSE FROM FUSE BLOCK TO AVOID PERSONAL INJURY.

WARNING: DUE TO THE POSSIBILITY OF PERSONAL INJURY ON SHARP SHEET METAL, CARE SHOULD BE TAKEN ANY TIME SERVICE IS PERFORMED ON THE FURNACE.

REMOVAL

1. Shut off LP gas at LP gas tank and remove furnace fuse from fuse block in living area electrical compartment.

2. Remove toe board in front of furnace at floor level (Figure 5) by removing two retaining screws. Then remove front panel from furnace.

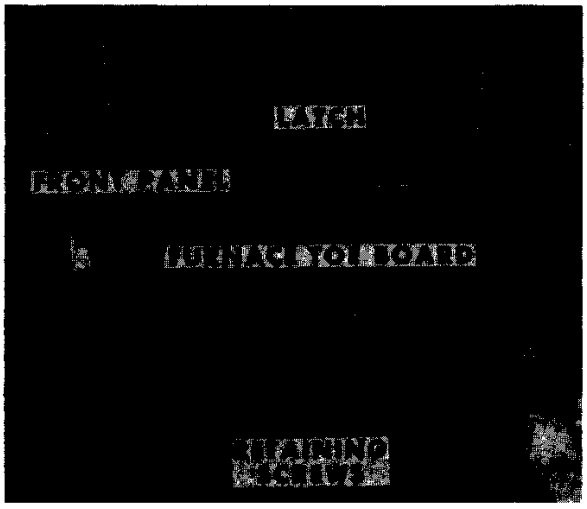


Figure 5 — Removal of Furnace Toe Board

3. Close manual gas valve. (NOTE: This valve is located just above furnace).

4. Disconnect gas line lower fitting from furnace gas valve (Figure 6). Loosen gas line upper fitting. Rotate gas line 90° to allow for removal of combustion chamber assembly (Figure 8)

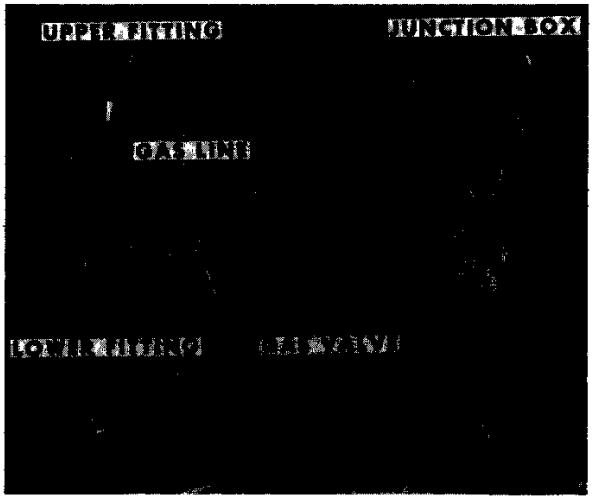


Figure 6 — Disconnecting Furnace Gas Line

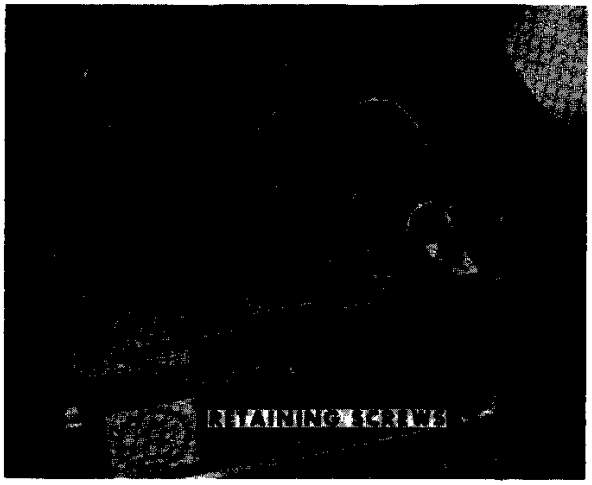


Figure 8 — Removing Combustion Chamber Assembly Retaining Screws

5. Remove cover from junction box (Figure 6).

6. Inside the junction box remove the wire nuts retaining wiring harness to furnace wiring. Carefully, separate wires in junction box. Using pliers, apply light pressure on special grommet. Pull grommet and furnace wiring from junction box (Figure 7).

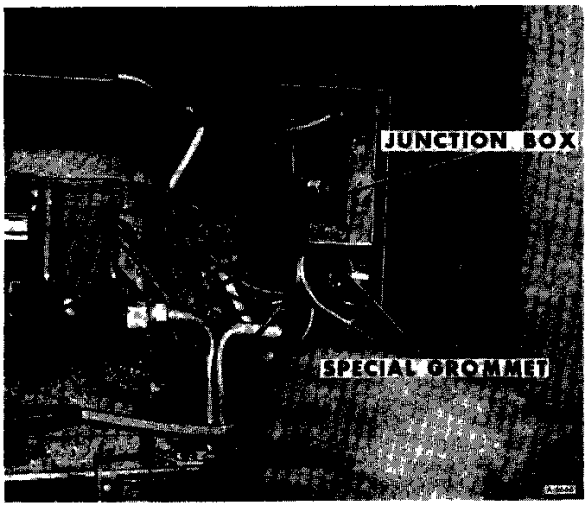


Figure 7 – Removing Wiring from Junction Box

7. Remove two combustion chamber assembly mounting screws (Figure 8).

8. Carefully pull combustion chamber assembly out of furnace casing (Figure 9). Remove from vehicle.

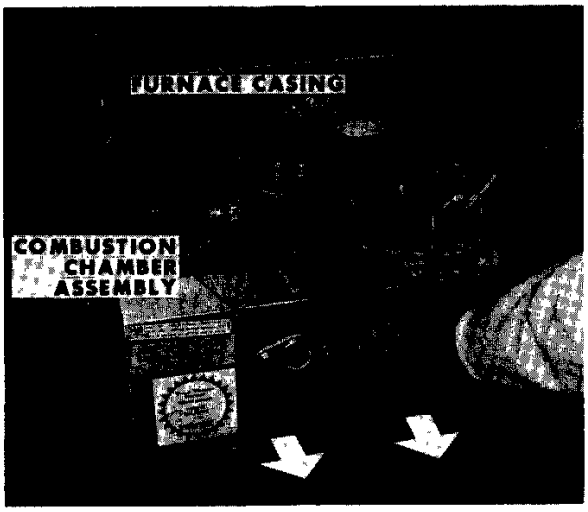


Figure 9 – Removing Combustion Chamber Assembly

INSTALLATION

NOTE: To aid in installation of combustion chamber assembly, remove inlet and outlet vent caps from outside of motorhome. (Figure 10).

1. Carefully slide combustion chamber assembly into furnace casing.

2. Install two combustion chamber assembly retaining screws (Figure 8).

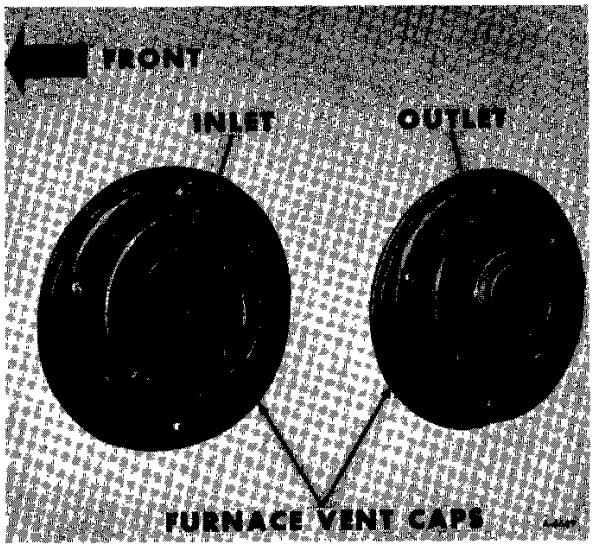


Figure 10 – Furnace Vent Caps

3. Install furnace wiring and special grommet into junction box (Figure 7).

4. With aid of wiring diagram (Figure 2), connect wiring harness to furnace wiring using solderless connectors in the junction box. Install junction box cover.

5. Connect gas line to furnace gas valve (Figure 6). Tighten upper and lower fittings on gas line.

6. Install furnace toe board with two retaining screws (Figure 5).

7. Carefully install furnace vent caps from outside of vehicle (Figure 10).

8. Move vehicle outside of service building to be sure of adequate ventilation while operating furnace. Check furnace for proper operation by performing furnace "Start-Up" and "Shutdown" as described earlier in this section.

COMPONENT REPLACEMENT

The following components (Figure 3) can be inspected and replaced without removing the combustion chamber assembly from the vehicle.

1. Gas Valve
2. Gas Solenoid Valve
3. Limit Switch
4. Furnace Fuse

Removal of the combustion chamber assembly is required for replacement of other furnace components.

WARNING: BEFORE ANY REMOVAL OR DISASSEMBLY PROCEDURES ARE PERFORMED ON THE FURNACE, BE SURE LP GAS IS COMPLETELY TURNED OFF AT THE LP GAS TANK AND REMOVE FURNACE FUSE FROM FUSE BLOCK TO AVOID PERSONAL INJURY.

WARNING: DUE TO THE POSSIBILITY OF PERSONAL INJURY ON SHARP SHEET METAL, CARE SHOULD BE TAKEN ANY TIME SERVICE IS PERFORMED ON THE FURNACE.

GAS VALVE REPLACEMENT

Removal

1. Close manual gas valve. (NOTE: This valve is located just above furnace).
2. Disconnect gas line from gas valve (Figure 6).
3. Remove gas solenoid valve from main burner gas line (Figure 11).
4. Separate gas valve from gas solenoid valve.

Installation

1. Connect gas valve to gas solenoid valve using nipple.
2. Connect gas solenoid valve to main burner gas line (Figure 11).

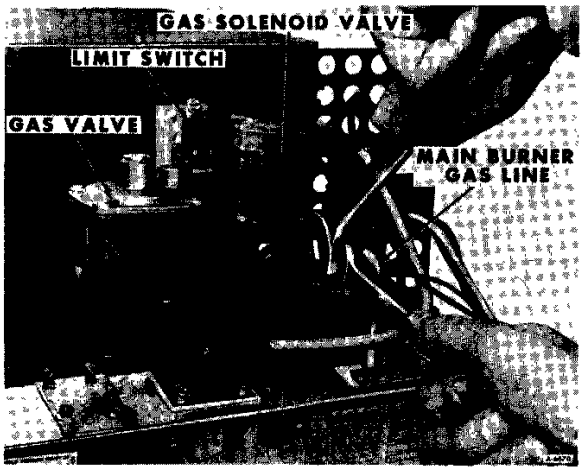


Figure 11 – Removing Gas Solenoid Valve

3. Connect gas line to gas valve (Figure 6).

GAS SOLENOID VALVE REPLACEMENT

Removal

1. Close manual gas valve. (NOTE: This valve is located just above furnace).
2. Disconnect gas line from gas valve (Figure 6).
3. Remove gas solenoid valve from main burner gas line (Figure 11).
4. Separate gas solenoid valve from gas valve.

Installation

1. Connect gas solenoid valve to gas valve using nipple.
2. Connect gas solenoid valve to main burner gas line (Figure 11).
3. Connect gas line to gas valve (Figure 6).

LIMIT SWITCH REPLACEMENT

Removal

1. Remove gas solenoid valve as described earlier in this section under "Gas Solenoid Valve Replacement".
2. Disconnect electrical leads from limit switch (Figure 12).

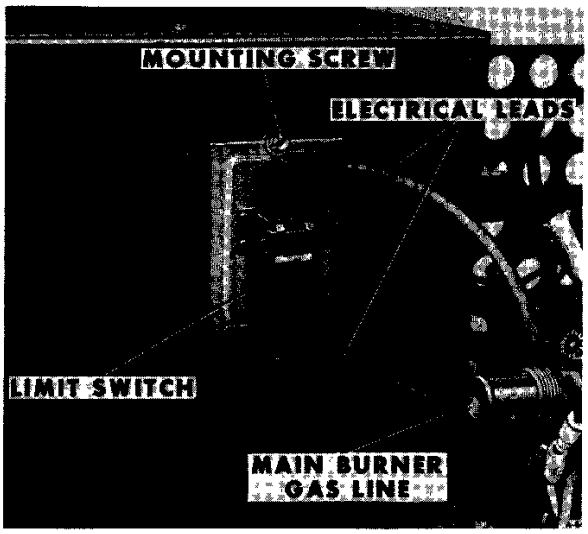


Figure 12 – Limit Switch Installed

3. Remove limit switch mounting screw. Carefully remove limit switch from combustion chamber assembly.

Installation

1. Carefully install limit switch into opening on front of combustion chamber assembly. Retain switch in position with mounting screw (Figure 12).
2. Connect electrical leads to limit switch.
3. Install gas solenoid valve as described under "Gas Solenoid Valve Replacement" earlier in this section.

FAN SWITCH REPLACEMENT

Removal

1. Remove the combustion chamber assembly as described under "Combustion Chamber Assembly Replacement" earlier in this section.
2. The fan switch is located on the right side of the furnace (Figure 4).
3. Disconnect electrical leads from fan switch (Figure 13).
4. Remove two mounting screws and separate fan switch from warm air housing.

Installation

1. Locate fan switch on warm air housing (Figure 13). Retain switch in position with two mounting screws.
2. Connect electrical leads to fan switch.
3. Install combustion chamber assembly as described under "Combustion Chamber Assembly Replacement" earlier in this section.

SAIL SWITCH REPLACEMENT

NOTE: The sail switch (also sometimes called combustion air switch) is located on the bottom of the blower assembly (Figure 14).

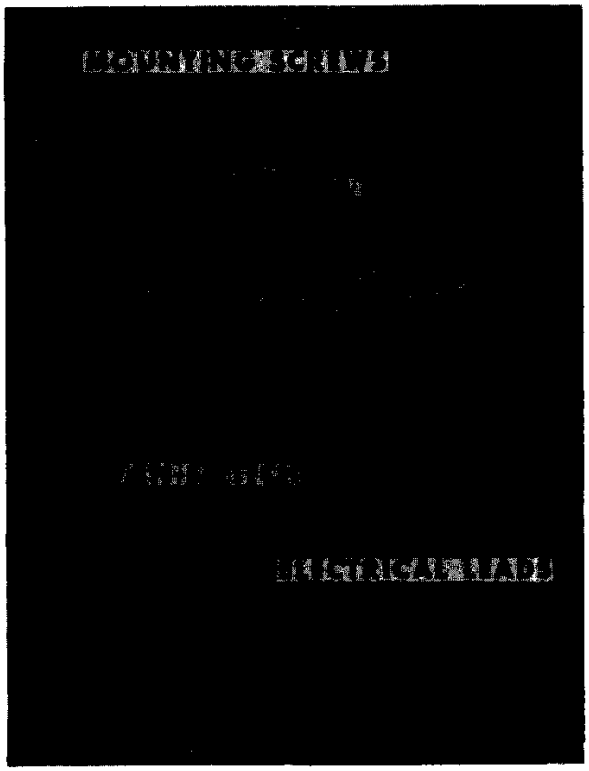


Figure 13 – Fan Switch Installed

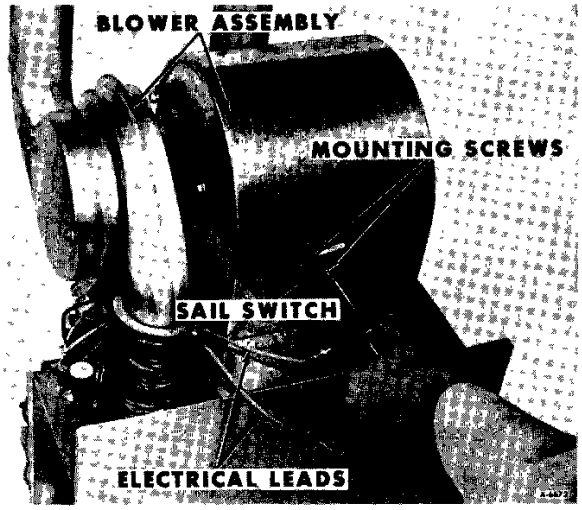


Figure 14 – Removing Sail Switch

Removal

1. Remove the combustion chamber assembly as described under "Combustion Chamber Assembly Replacement" earlier in this section.

2. Disconnect electrical leads from sail switch (Figure 14).

3. Remove two mounting screws. Carefully lift sail switch away from blower assembly.

Installation

1. Carefully position sail switch on bottom of blower assembly. Install two mounting screws. Check that sail arm on the sail switch does not contact sheet metal on blower assembly.

2. Connect electrical leads to switch.

3. Install the combustion chamber assembly as described in "Combustion Chamber Assembly Replacement" earlier in this section.

FURNACE RELAY REPLACEMENT

NOTE: Two relays are located on the right side of the furnace (Figure 4). The auxiliary blower relay, when energized, activates the auxiliary blower motor that is located behind the oven. The blower relay, when energized, activates the furnace blower assembly. Replacement procedures for either relay is the same.

Removal

1. Remove the combustion chamber assembly as described under "Combustion Chamber Assembly Replacement" earlier in this section.

2. Remove two relay panel mounting screws (Figure 15).

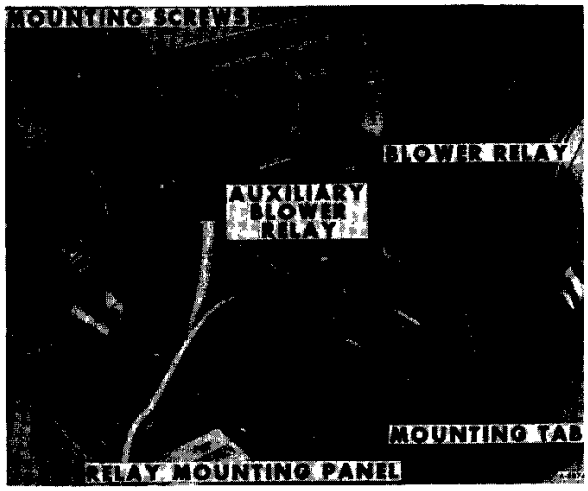


Figure 15 – Furnace Relay Mounting Panel Installed

3. Carefully raise relay mounting panel, sufficiently to allow access to relay mounting screw.

4. Remove relay mounting screw (Figure 16).

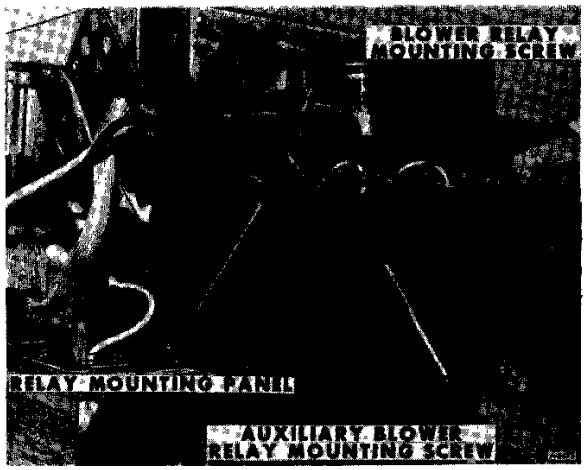


Figure 16 – Removing Blower Relay

5. Tag relay electrical leads to aid in proper location during relay installation. Disconnect electrical leads from relay. Remove relay.

Installation

1. Connect electrical leads to relay (Refer to Figure 2, if necessary).
2. Install relay mounting screw (Figure 16).
3. Be sure relay mounting panel engages mounting tab (Figure 15). Install two panel mounting screw.
4. Install the combustion chamber assembly as described in "Combustion Chamber Assembly Replacement" earlier in this section.

IGNITOR BOARD REPLACEMENT

Removal

1. Remove the combustion chamber assembly as described under "Combustion Chamber Assembly Replacement" earlier in this section.
2. Remove special shoulder bolt (Figure 17).

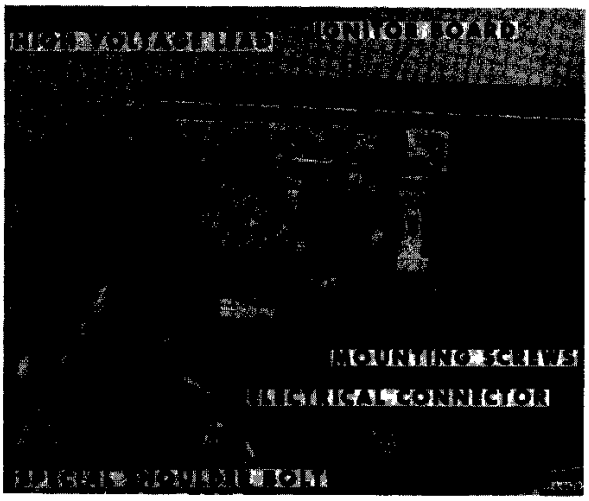


Figure 17 – Location of Ignitor Board

3. Remove electrical connector from ignitor board.
4. Remove high voltage lead from ignitor board.
5. Remove four mounting screws and remove ignitor board.

Installation

1. Position ignitor board on combustion chamber assembly.
2. Install four ignitor board mounting screws (Figure 17).
3. Attach electrical connector to ignitor board. Retain electrical connector in proper position by installing special shoulder bolt.
4. Connect high voltage lead to ignitor board.
5. Install the combustion chamber assembly as described in "Combustion Chamber Assembly Replacement" earlier in this section.

SPARK ELECTRODE ASSEMBLY REPLACEMENT

Removal

1. Remove combustion chamber assembly as described under "Combustion Chamber Assembly Replacement" earlier in this section.
2. Disconnect high voltage lead from spark electrode (Figure 18). Remove high voltage plate and gasket.

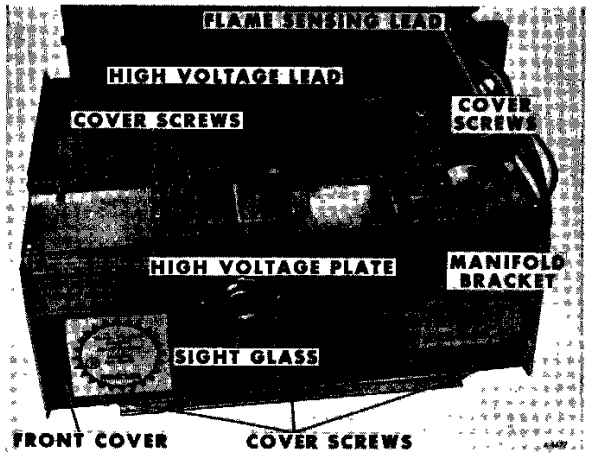


Figure 18 – Location of Furnace Front Cover

3. Disconnect flame sensing lead near manifold bracket.
4. Remove manifold bracket and gasket.
5. Remove sight glass and gasket.
6. Remove front cover screws and then carefully remove front cover.
7. Remove four spark electrode mounting screws (Figure 19).

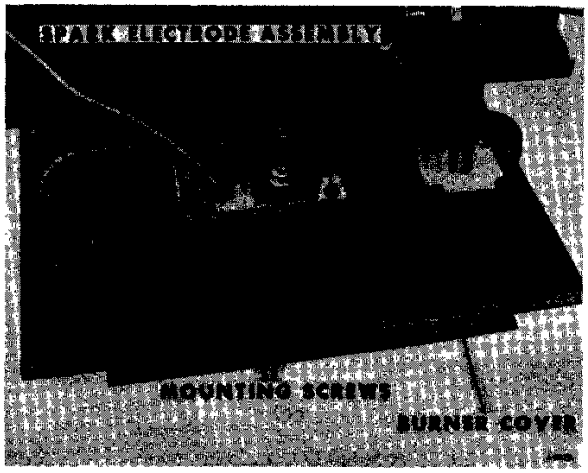


Figure 19 – Spark Electrode Installed

8. NOTE: Spark electrode must clear burner orifices during removal (Figure 20). Carefully move spark electrode assembly to the right. Gently tilt upward as shown, and remove from burner cover.

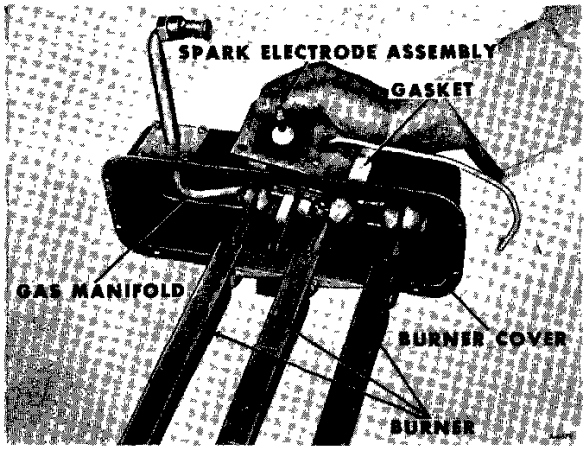


Figure 20 – Removing Spark Electrode Assembly

Installation

NOTE: Before installing spark electrode assembly, check the spark gap. The gap between the spark electrode and ground electrode should be 1/8" ± 1/32" (Figure 21).

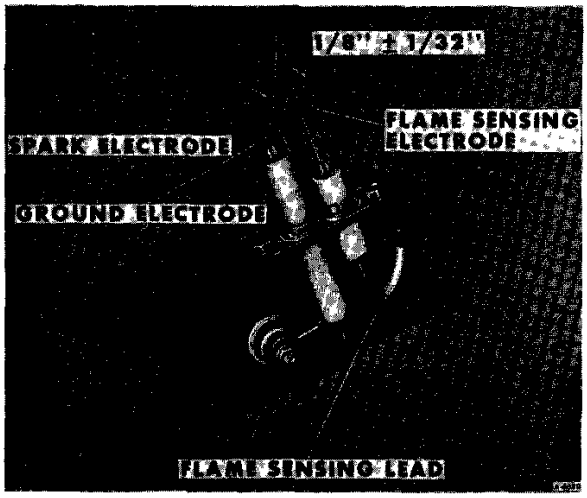


Figure 21 – Spark Electrode Assembly

1. Noting the location of burner orifices (Figure 20), carefully install spark electrode assembly and gasket. Secure spark electrode assembly with four mounting screws (Figure 19).

2. Install furnace front cover (Figure 18). Be sure flame sensing lead is located next to main burner gas line.

3. Install sight glass and gasket.

4. Install manifold bracket and gasket.

5. Connect flame sensing lead near manifold bracket.

6. Install high voltage plate and gasket. Connect high voltage lead to spark electrode.

7. Install the combustion chamber assembly as described in "Combustion Chamber Assembly Replacement" earlier in this section.

BURNER ASSEMBLY REPLACEMENT

NOTE: The burner assembly of the furnace is composed of three burners which are attached to the burner cover (Figure 20).

Removal

1. Remove spark electrode assembly as described earlier in this section under "Spark Electrode Assembly Replacement".

2. Remove burner cover and gasket from combustion chamber (Figure 19).

   NOTE: The burners are attached to the burner cover (Figure 22).

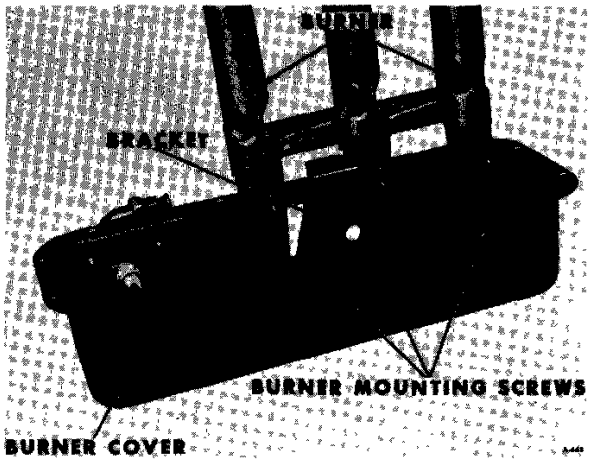


Figure 22 – Burner Mounting to Burner Cover

3. Remove burner mounting screws and then carefully remove burners from burner cover.

Installation

NOTE: Be sure any accumulated soot deposits are removed from inside the combustion chanber. If soot deposits are excessive, check for high LP gas pressure as necessary when assembly of furnace is complete. There is no main air adjustment on this furnace.

NOTE: At this time, the three burner orifices should be checked for obstructions. The orifices can be cleaned using a wooden tooth pick if required, or replaced if necessary.

1. Position burners and bracket in burner cover, and secure with the mounting screws.

2. Install burner assembly and burner cover and gasket in combustion chamber (Figure 19).

3. Install spark electrode assembly as described earlier in this section under "Spark Electrode Assembly Replacement".

BLOWER MOTOR REPLACEMENT

Removal

1. Remove sail switch as described earlier in this section under "Sail Switch Replacement".

2. Disconnect flexible air duct from blower assembly (Figure 23). Disconnect blower motor electrical leads.

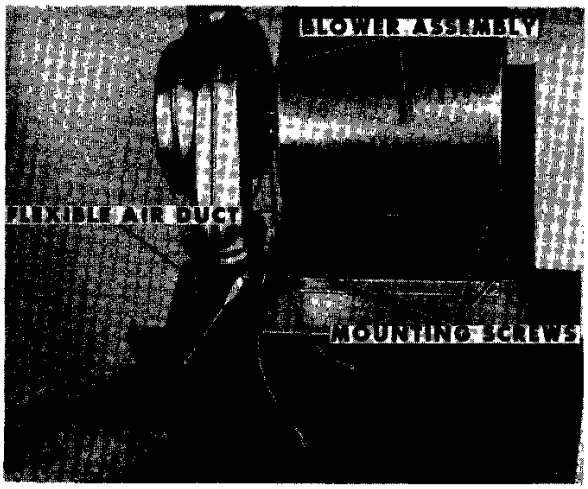


Figure 23 – Disconnecting Flexible Duct from Blower

3. Remove three blower assembly mounting screws. Remove blower assembly from furnace.

4. Remove outer combustion air housing attaching screws (Figure 24). Remove housing and metal plate located between inner and outer housing.

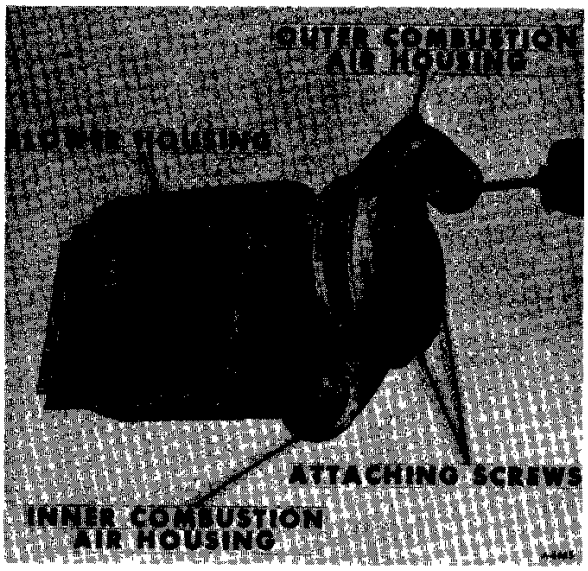


Figure 24 – Removing Outer Combustion Air Housing

5. Using a 5/64" hex wrench, remove combustion air blower wheel (Figure 25).

6. Remove two retaining nuts holding inner combustion air housing to blower motor (Figure 26). Remove housing.

Figure 25 – Removing Combustion Air Blower Wheel

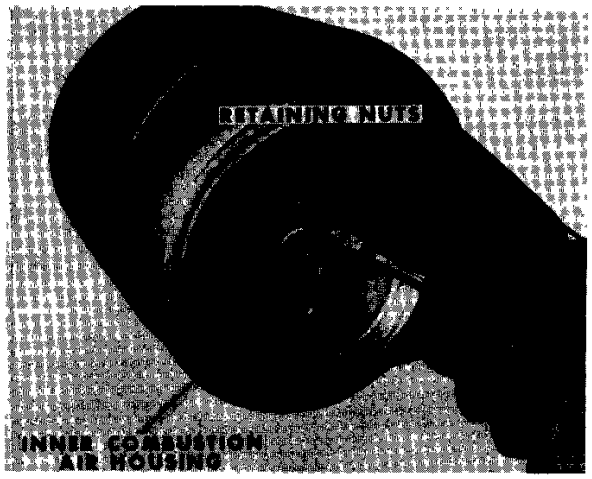


Figure 26 – Removing Inner Combustion Air Housing

7. Loosen the recirculating air blower wheel retaining screw using a 1/8" hex wrench (Figure 27).

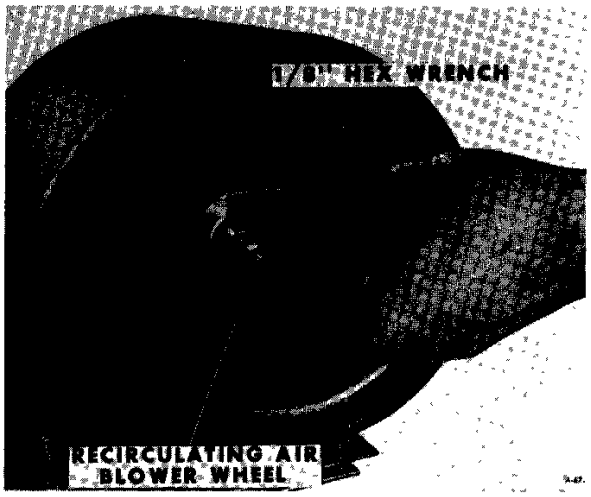


Figure 27 – Loosening Recirculating Air Blower Wheel Retaining Screw

8. Remove three blower motor retaining screws and washers (Figure 28). Carefully remove blower motor from blower housing.

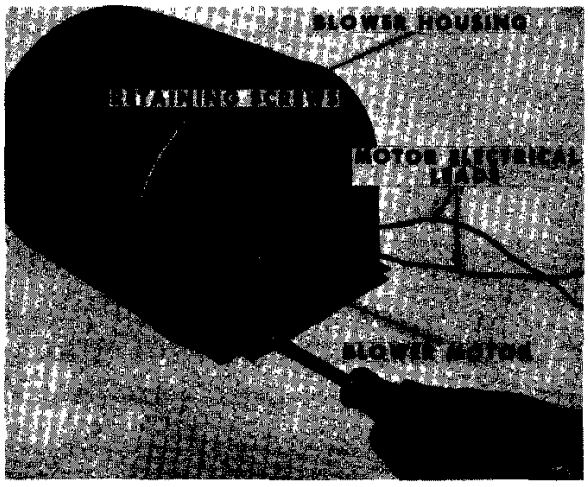


Figure 28 – Removing Blower Motor Retaining Screws

NOTE: When the blower motor has been removed from the blower housing, this will allow recirculating air blower wheel to be removed.

Installation

1. Position the recirculating air blower wheel in blower housing.

2. Install blower motor to blower housing using three retaining screws. Before installing the retaining screws, check to be sure the motor is positioned as shown in Figure 28, with motor electrical leads facing blower housing mounting flange.

3. Install recirculating blower wheel retaining screw (Figure 27). Before tightening retaining screw, be sure blower wheel is clearing both sides of blower housing. Also, be sure retaining screw is tightened onto flat surface on the blower shaft.

4. Install the inner combustion air housing to the blower motor (Figure 26). Be sure inner housing is aligned as shown in Figure 24 with blower housing.

5. Install combustion air blower wheel (Figure 25).

6. Position metal plate between inner and outer combustion air housings. Install outer combustion air housing (Figure 24).

7. Install blower assembly to furnace with three mounting screws (Figure 23). Connect blower electrical leads and flexible air duct.

8. Install sail switch as described earlier in this section under "Sail Switch Replacement".

SPECIFICATIONS

Duo-Therm Furnace	Model No.	65930-926
GM Part Number		2028332
Operating Voltage Range	Maximum	– 15 Volts D.C.
	Minimum	– 9 Volts D.C.
BTU Input		30,000
BTU Output		24,000
Furnace Fuse (Automotive Type)		15 Amp.