

# DUO-THERM

## OWNERS MANUAL FOR 66100 SERIES FURNACES



### Gas-Fired Fan Type Direct Vent Wall Furnaces For Recreational Vehicles

#### DIRECT SPARK IGNITION MODELS

##### FOR YOUR SAFETY

###### IF YOU SMELL GAS:

1. OPEN WINDOWS
2. DON'T TOUCH ELECTRICAL SWITCHES
3. EXTINGUISH ANY OPEN FLAME
4. VACATE PREMISES UNTIL VENTILATION IS COMPLETE AND GAS SOURCE IS FOUND AND CORRECTED.
5. IMMEDIATELY CALL YOUR SUPPLIER

##### FOR YOUR SAFETY

CLOTHING OR OTHER FLAMMABLE MATERIAL SHOULD NOT BE PLACED ON OR NEAR THE APPLIANCE.

DO NOT STORE OR USE GASOLINE OR OTHER FLAMMABLE VAPORS AND LIQUIDS IN THE VICINITY OF THIS OR ANY OTHER APPLIANCE.

CHILDREN AND ADULTS SHOULD BE ALERTED TO THE HAZARDS OF HIGH SURFACE TEMPERATURES AND SHOULD STAY AWAY TO AVOID BURNS OR CLOTHING IGNITION.

YOUNG CHILDREN SHOULD BE CAREFULLY SUPERVISED WHEN THEY ARE IN THE SAME ROOM AS THE APPLIANCE.

IF THE FRONT GRILLE IS REMOVED FOR SERVICING IT MUST BE REPLACED PRIOR TO OPERATING THE APPLIANCE.

**- IMPORTANT INSTRUCTIONS -  
MUST STAY WITH UNIT  
OWNER - READ CAREFULLY**

##### WARNING

THIS UNIT MUST BE SERVICED ONLY BY AN AUTHORIZED SERVICEMAN. MODIFICATION OF THE APPLIANCE CAN BE EXTREMELY HAZARDOUS AND COULD LEAD TO SERIOUS INJURY OR DEATH.

FUEL BURNING APPLIANCES GENERATE TOXIC FLUE PRODUCTS. MODIFICATION OR IMPROPER MAINTENANCE CAN CAUSE CARBON MONOXIDE IN DEADLY AMOUNTS. TO PREVENT THIS, MAINTAIN APPLIANCE IN SAFE OPERATING CONDITION.

- DO NOT** BLOCK OR MODIFY ANY COMBUSTION AIR OR FLUE GAS PASSAGEWAYS.
- DO NOT** ADD ANY DEVICES OR ACCESSORIES TO THIS APPLIANCE EXCEPT THOSE SPECIFICALLY AUTHORIZED BY DUO-THERM.
- ALWAYS** CONSULT YOUR AUTHORIZED SERVICEMAN FOR ANY PROBLEMS OR QUESTIONS YOU MAY HAVE PERTAINING TO THIS APPLIANCE.
- ALWAYS** INSPECT THE APPLIANCE BEFORE STARTING A NEW HEATING SEASON, PAYING SPECIAL ATTENTION TO COMBUSTION AIR, FLUE GAS PASSAGEWAYS AND FUEL LINES.

KEEP FOR FUTURE REFERENCE.

# 1 OPERATIONAL CHECKOUT Direct Spark Ignition

**IMPORTANT:** Failure to follow these lighting instructions exactly may result in damage to the unit.

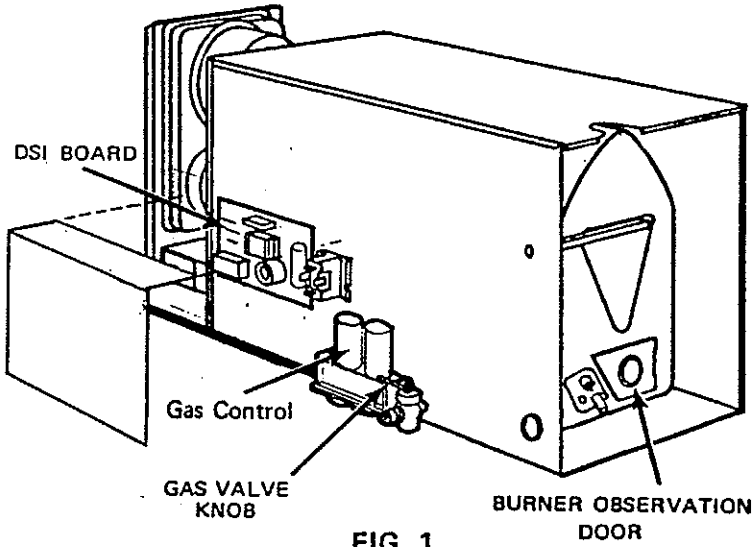
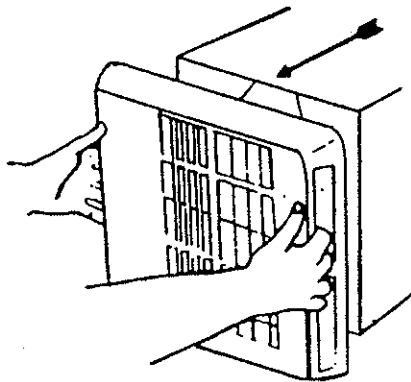
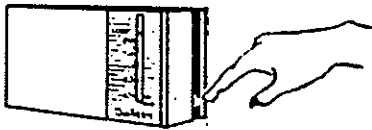
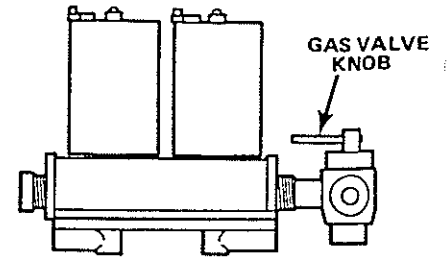


FIG. 1

1. Set thermostat to "OFF" position. Remove furnace front panel by pulling straight out.



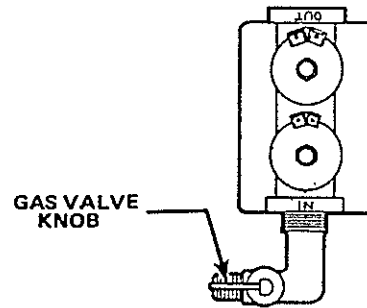
2. Turn gas valve knob to "OFF" position. Wait 5 minutes.



"OFF" POSITION

(SIDE VIEW OF GAS CONTROL)

3. Turn gas valve knob to full "ON" position. Correct operation of the unit depends on this valve being in the full "ON" position. Never attempt to operate the unit with valve partially closed.



"ON" POSITION

(TOP VIEW OF GAS CONTROL)

4. Replace furnace front panel.

5. Set thermostat at desired temperature. Furnace will now operate automatically.

When the thermostat calls for heat a delay of 15 to 30 seconds will occur before the fan motor is energized.

6. Allow 15 seconds for burner to ignite.

7. If burner does not light, set thermostat on "OFF" position. Wait 4 to 5 seconds and reset to "ON" position.

8. If ignition is not obtained after three tries, go to complete shut-down and determine cause.

**FOR COMPLETE SHUT-DOWN, TURN GAS VALVE KNOB TO "OFF". SET THERMOSTAT TO "OFF" SETTING.**

## 2 SEQUENCE OF NORMAL OPERATION

1. When the thermostat calls for heat a delay of 15 to 30 seconds will occur before the fan motor is energized.
2. As the fan motor reaches approximately 75 percent of its normal r.p.m. (within 1 to 2 seconds) the combustion air switch, in response to the air flow, will engage, allowing current flow to the gas valve.
3. The gas valve will open and allow gas to the main burner. The spark produced from the ignitor electrode ignites the main burner.
4. When the thermostat is satisfied or turned back, the gas valve will close and the flame on the main burner will go out. The blower will continue to run for a short period of time and will then shut off. The purpose of this is to remove most of the remaining gases and heat from the heat exchanger.

## 3 TIME DELAY FAN RELAY

This relay controls the sequence of the blower operation. When the bimetal disc of the relay is heated internally to the operating temperature, the switch closes. This completes the circuit to the motor. The blower will continue to run as long as the relay is hot even though the thermostat is satisfied and the main burner is off. When the relay sensor cools, after the thermostat is satisfied, the switch opens and the blower shuts off. See figure below for terminal orientation.

## 4 LIMIT SWITCH

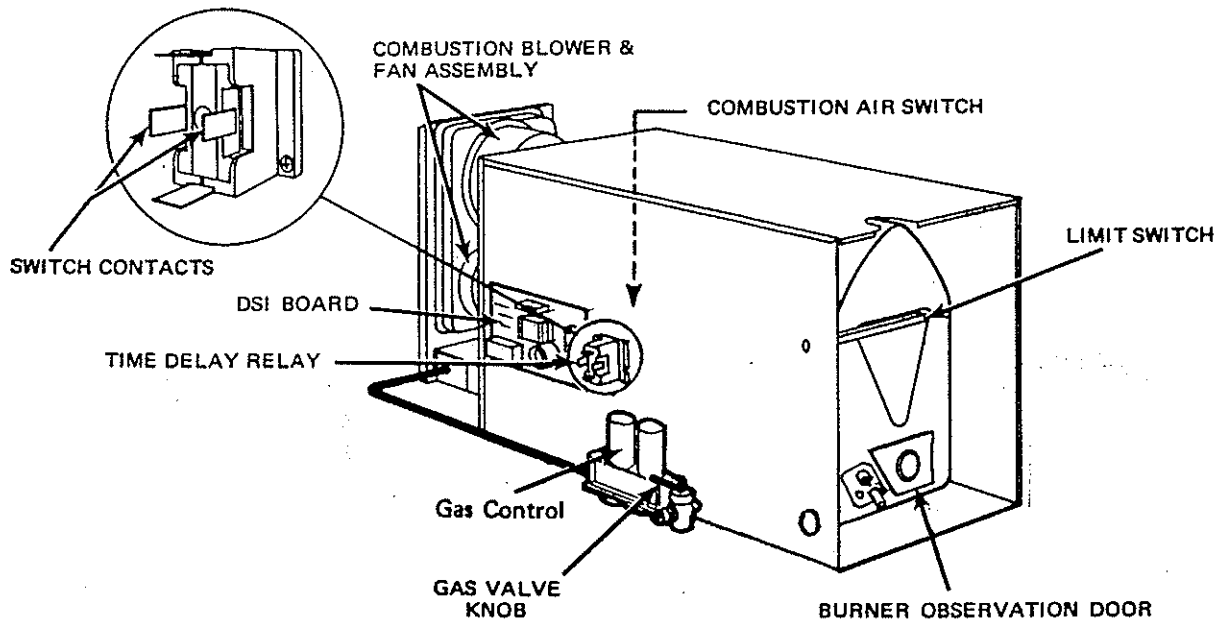
The purpose of the limit control is to turn off the gas to the main burner if for any reason the furnace becomes abnormally hot. If the circulating air is blocked, even partially, the limit control will function and cause the main burner to cycle. If cycling of the limit control occurs, the circulating air passage should be thoroughly cleaned.

If the limit control is damaged, it cannot be repaired. It must be replaced with a new one. **CAUTION: NEVER SHORT ACROSS OR BYPASS THE LIMIT CONTROL EVEN FOR ONLY TEMPORARY OPERATION.**

## 5 AIR SWITCH

The combustion air switch has two purposes:

1. It is an "air prover". It operates in response to the flow of air generated by the fan. Hence, if for any reason the air from the fan is not sufficient, the switch will not operate. One cause of insufficient air is a slow motor caused by low voltage.
2. The switch allows time for the blower to pull in a sufficient amount of air to support combustion before it engages. Once it engages, the gas valve opens, gas flows to the main burner and ignition occurs.



## 6 BLOWER ASSEMBLY

One motor is used to drive both the combustion air wheel and the circulating air fan blade. Although one motor drives both, the wheel and fan blade are separate. The combustion air blower is sealed so as to allow no passage of air between it and the circulating room air fan. The combustion air blower draws air from the outside atmosphere, discharges it into the combustion chamber, and forces the combustion products out the exhaust tube. The circulating room air fan blade pulls return air in and forces it across the heat chamber discharging it into the area to be heated.

## 7 MAINTENANCE AND CLEANING

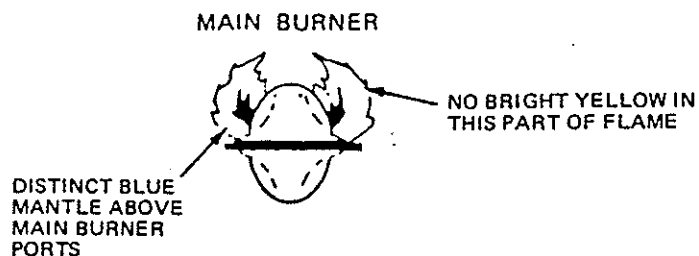
**NOTE:** For continued satisfactory performance of this unit it is necessary that the control compartment be kept clean. It is also important that the appliance area be clear and free of combustible materials, vapors and liquids.

If the main burner has been allowed to operate with a high yellow flame, a soot formation may be deposited inside the combustion chamber. The carbon deposit may be of such quantity that cleaning will be necessary. A vacuum cleaner is ideal to clean out any carbon deposit in the combustion chamber.

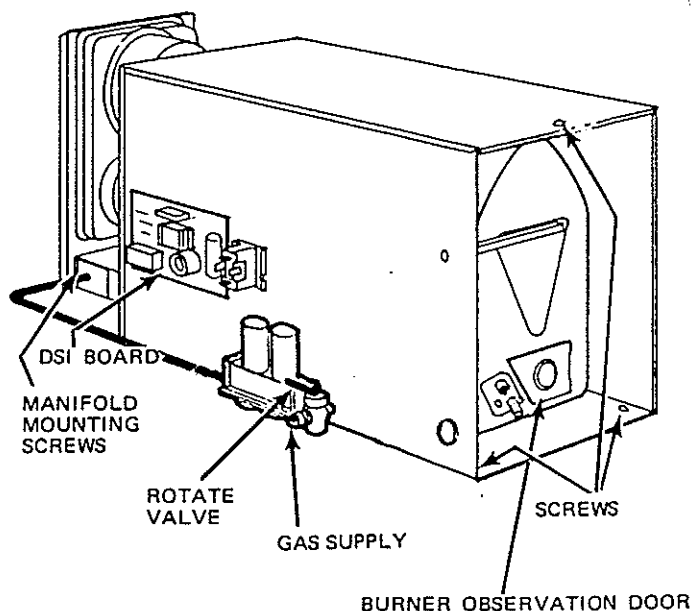
Routine inspection, maintenance and cleaning of burner, venting system and gas connections is recommended at least on a yearly basis.

This unit is equipped with sealed motor and requires no oiling.

The main burner should be examined periodically to be sure that a distinct blue mantle is visible and that bright yellow tips are not evident. See diagram below.



## FURNACE ASSEMBLY REMOVED



## 8 TO REMOVE FURNACE FOR SERVICE

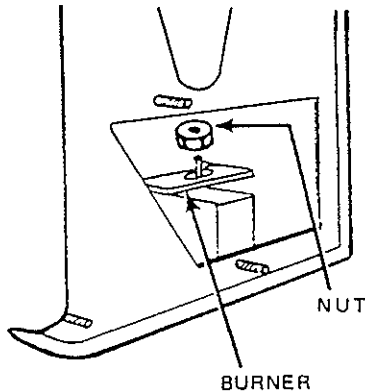
1. Remove the furnace front panel by pulling straight out.
2. Disconnect wiring.
3. Disconnect gas supply. (Be sure gas supply to the unit is turned off).
4. Remove screws securing furnaces to cabinet.
5. Remove the vent cap screws (outside) and remove vent assembly.
6. Pull furnace forward and remove.

## 9 TO REMOVE BURNER & GAS VALVE

1. Remove nuts holding front burner observation door and remove door.
2. Remove nut holding burner in place.
3. Raise burner off mounting pin and remove.
4. Burner orifice may now be serviced with long extension and 1/2" socket.
5. To replace gas valve, remove manifold mounting screws and remove manifold from furnace. Place manifold in a vise to remove gas valve.

## TO REPLACE BURNER

1. Center orifice end of burner over orifice, slide other end over burner mounting pin.
2. Reassemble nut over burner mounting stud until it is firmly against burner.
3. Replace close-off plate and secure with nuts.



## 10 SERVICE HINTS, DIAGNOSIS AND CORRECTIVE MEASURES

INSTALLATION SHOULD BE DONE BY A QUALIFIED SERVICE PERSON. THE APPLIANCE SHOULD BE INSPECTED BEFORE USE AND AT LEAST ANNUALLY BY A PROFESSIONAL SERVICE PERSON. MORE FREQUENT CLEANING MAY BE REQUIRED DUE TO EXCESSIVE LINT FROM CARPETING, BEDDING MATERIAL, ETC., IT IS IMPERATIVE THAT CONTROL COMPARTMENTS, BURNERS AND CIRCULATING AIR PASSAGEWAYS OF THE APPLIANCE BE KEPT CLEAN.

### A. COMPLAINT – NO HEAT

1. Check electrical supply to make sure that 12 volt D.C. is available at unit. Battery must be charged. If battery is low, there may be sufficient power to run the blower but not enough to run the blower at full speed. If blower does not run at it's prescribed speed, the combustion air switch cannot engage and gas will not flow to the main burner. Be sure the connections to the voltage lines in the terminal block are tight.
2. Manually rotate fan to make sure motor is free to turn.
3. Check for blown fuse in 12 Volt circuit to furnace.

### SHORT CIRCUIT CHECKOUT

4. If fuses are blown, a short is indicated and should be checked.
  - a. Turn off all appliances including furnace.
  - b. Install an ammeter on the positive (+) lead of the battery. Amperage reading should be 0. If an amperage reading is noted, a short exists in the vehicle electrical system.
  - c. Disconnect the red (+) DC lead at the furnace. If the amperage continues, the short is exterior to the furnace. If the amperage reading ceases, the furnace electrical system is shorted or miswired (see Section D-COMPLAINT - AMPERAGE DRAW THROUGH FURNACE WITH THERMOSTAT "OFF") and should be checked.

5. GAS SUPPLY: Be sure manual gas valve is in the open position.
6. THERMOSTAT OFF: Check to be sure thermostat is properly wired and is calling for heat.
7. MALFUNCTIONING COMBUSTION AIR SWITCH: Be sure the combustion air switch is moving far enough to close its contacts. If the switch is not closing, clean any dust or dirt from the actuator pin. Other reasons for switch not operating are:
  - a. Insufficient fan speed (slow motor due to low charged battery, faulty motor or line and dust accumulation restricting return air to furnace). Check wiring in accordance with unit's wiring diagram to assure that the proper polarity of the 12 Volt DC power supply is observed. On certain models this polarity must be observed so the motor will run the proper direction of rotation to insure correct air delivery.
  - b. Faulty Combustion Air Switch: Replace switch if valve does not open when switch is engaged. Switch should also be replaced if battery is fully charged and with the fan motor running at top speed the switch fails to engage within 3 to 4 seconds.

NOTE: To service switch, heating assembly must be pulled out.

8. GAS CONTROL VALVE: With test light check valve terminals. If voltage is present, but valve is not opening (when combustion air switch engages), replace control valve.
9. FAN NOT OPERATING: Check for burned-out motor or loose wiring terminals.
10. DEFECTIVE FAN RELAY: Relay may be at fault if motor fails to start when thermostat calls for heat. This can be suspected if the thermostat is raised and the motor fails to operate within 60 seconds.

### B. COMPLAINT – EXCESSIVE NOISE

1. Motor or blade out of balance. Replace motor or blade.
2. Motor hum. Replace motor.

### C. COMPLAINT – ERRATIC FAN OPERATION

A loose terminal or a defective relay may cause the motor to cycle off while the thermostat is calling for heat, an outage will occur because the blower is not purging the system of combustion products.

## D. COMPLAINT—AMPERAGE DRAW THROUGH FURNACE WITH THERMOSTAT "OFF"

1. Incorrect wiring at the terminal block. If 12 Volt and thermostat wires are not connected properly at the furnace a continuous circuit can be created through the heater of the fan relay. If this condition exists the blower will start as soon as the thermostat closes and will shut off when the thermostat opens, instead of having a delayed action. In some cases this will also burn out the heat anticipator in the thermostat.

Refer to the wiring diagram for correct connections.

2. Internal short to ground in gas control or motor. Disconnect all wiring to control or motor (disconnect ground screw on black motor lead from casing) and use an ohmmeter to check for shorts to ground. At no point should there be a reading between the electrical circuit of the motor or control and ground.

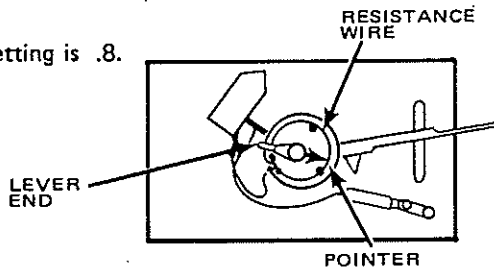
## 11 THERMOSTAT ADJUSTMENT

This unit is equipped with an adjustable thermostat. Improper setting of the heat anticipator can cause either abnormally short or long heating cycles resulting in discomfort.

For correct heating anticipator adjustment, proceed as follows:

Cycle system to determine if cycling rate is satisfactory. If adjustment is necessary, move pointer to a higher setting for longer "ON" cycle and to a lower setting for shorter "ON" cycle.

Suggested normal setting is .8.



## 12 HIGH ALTITUDE DERATION

These units are certified by the Canadian Gas Association for operation without modification at altitudes up to 4500 feet.

Operation at increased elevations require deration of 4% for each 1000 feet.

If the unit is not properly derated the following conditions will exist:

1. Due to the lack of sufficient oxygen for proper combustion, carbon monoxide will be produced and exhausted through the vent. Entry of these fumes into the vehicle (due to improper installation of the vent or through another opening in the vehicle exterior) could create a hazardous condition which could endanger the life of anyone exposed to these fumes for a prolonged period of time.
2. Due to incomplete combustion of LP gas at the burner, the actual heat output of the furnace will be considerably less than the rating of the unit. Fuel which is not burned will be wasted.

If the unit is properly derated, it will produce approximately the same amount of heat at higher elevations, but will do so with considerably less fuel.

The following chart lists recommended orifice sizes for various altitudes:

ALTITUDE IN FEET	66112 ORIFICE SIZE	66117 ORIFICE SIZE
0-4500	61	56
5000	64	57
6000	64	58
7000	65	58
8000	65	59
9000	65	59
10000	66	61
11000	67	61
12000	67	63

Also, check gas pressure when derating unit. First, check piping system pressure and adjust to 11" W.C. at tank regulator (NOTE: If this pressure check is made at cooktop or range be sure that there is no pressure regulator present, an incorrect reading will be obtained.) Then check manifold pressure at the pressure tap location on the outlet end of the gas control on the furnace. Adjust to 10.5" W.C. by rotating the adjustment screw (located under a screw cap, marked "Press Adj") on gas control.

## 13 DIRECT SPARK IGNITION SYSTEM

### DESCRIPTION

The direct spark ignition system consists of a solid state printed circuit control module, an electrode assembly, a 12 volt gas control and connecting high and low voltage wires.

To ignite the burner it is necessary only to set the thermostat. The thermostat, in series with the air prover switch, powers the ignitor to simultaneously open the main burner valve and provide the ignition spark. Should the flame not be established within a period of 15 seconds, the system provides safety shut-down.

Electronic flame sensing circuitry in the ignitor detects the presence or absence of main burner flame. If the flame is not established during the Flame Establishing Period, the system closes the gas valve and locks out. If the flame is extinguished during the ignition cycle, the ignitor will provide one retry for ignition, before going into lock-out. To reactivate or retry for ignition, if lock-out has occurred, set the thermostat to the "OFF" position for 4 to 5 seconds, then reset to the "ON" position.

## TROUBLE SHOOTING GUIDE

### CAUTION

SERVICING THIS DEVICE SHOULD ONLY BE PERFORMED BY A QUALIFIED SERVICEMAN WITH DUE REGARD FOR SAFETY AS IMPROPER ACTIONS COULD RESULT IN A HAZARDOUS CONDITION, RESULTING IN SERIOUS INJURY OR DEATH.

### WARNING

DO NOT APPLY POWER TO CONTROL MODULE UNLESS WIRING CONNECTIONS ARE COMPLETE AND ELECTRODE IS PROPERLY GROUNDED.

USE EXTRA CAUTION IN AREAS WHERE HIGH VOLTAGE IS PRESENT.

**A. Input Polarity:** If a spark is present and the gas valve opens but the system shuts down after the trial period, check input voltage for proper polarity.

**B. Grounding:** It is essential to proper operation that the system be properly grounded. If a spark is present and the gas valve opens but the system shuts down after the trial for ignition period, check for proper ground. The following items should be checked:

1. Ground screw connecting black motor lead.
2. The burner must be securely fastened to mounting pin in heat chamber.

**C. Wiring:** Check all wiring for proper and secure connections. Be sure the AMP connector is fully engaged on the control board. Check the high voltage wire for proper connection at both ends. Clean any corrosion that may interfere with good electrical contact.

**D. High Voltage Malfunction:** If during the trial for ignition, the spark is intermittent and the valve may or may not open, the following should be checked:

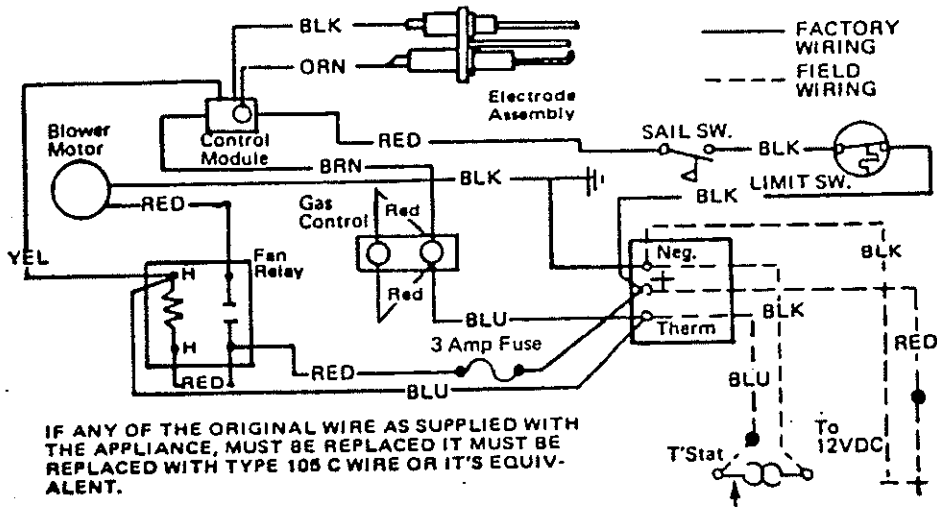
1. Electrode spark gap - should be  $1/8'' \pm 1/32''$ .
2. Ceramic housing - check for cracks.
3. Electrode lead wires - check for cracks or breaks.

**E. Valve Malfunction:** If there is power to the gas valve and a spark during the trial for ignition, but the valve will not open, check the valve for an open coil or other malfunction.

**F. Erratic Operation:** If the system operates properly for a period of time but randomly shuts down during the duty cycle, or will not operate during cold starts, check the flame proving circuit (sensor wire) with a D.C. Microamp Meter. The current should be 5 - 15 microamps. A low or marginal flame current may cause nuisance tripping. If this condition is experienced, the electrode location should be checked to make sure the sensor electrode is in the flame.

**G. The solid state control module is not field repairable.** Any modifications or repairs will invalidate the warranty and agency certifications.

## WIRING DIAGRAM Direct Spark Ignition Models



## WIRING SCHEMATIC Direct Spark Ignition Models

