TOYOSTOVE®

TROUBLE SHOOTING GUIDE

MODEL LR450
LR350

MODEL IDENTIFICATION

1984 LR-350A (UL approved)

1985 LR-350B (UL approved)

1986 LR-350B (UL approved)

1987 LR-350B (UL approved)

1985 LR-450C (UL approved)

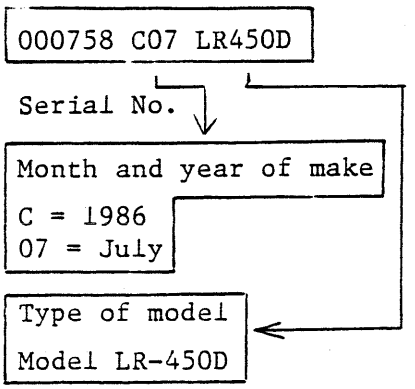
1986 LR-450D (UL approved) - Revisions include:

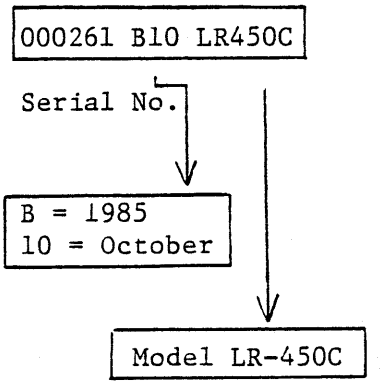
- Circuit boards
- Flame sensors
- Burner
- Top chimney band
- Prolonged burner thermistor start time
- Sheath heater was eliminated

1987 LR-450D (UL approved) - Revisions include:

- Preheating time
- Post purge time
- Flame sensor start time

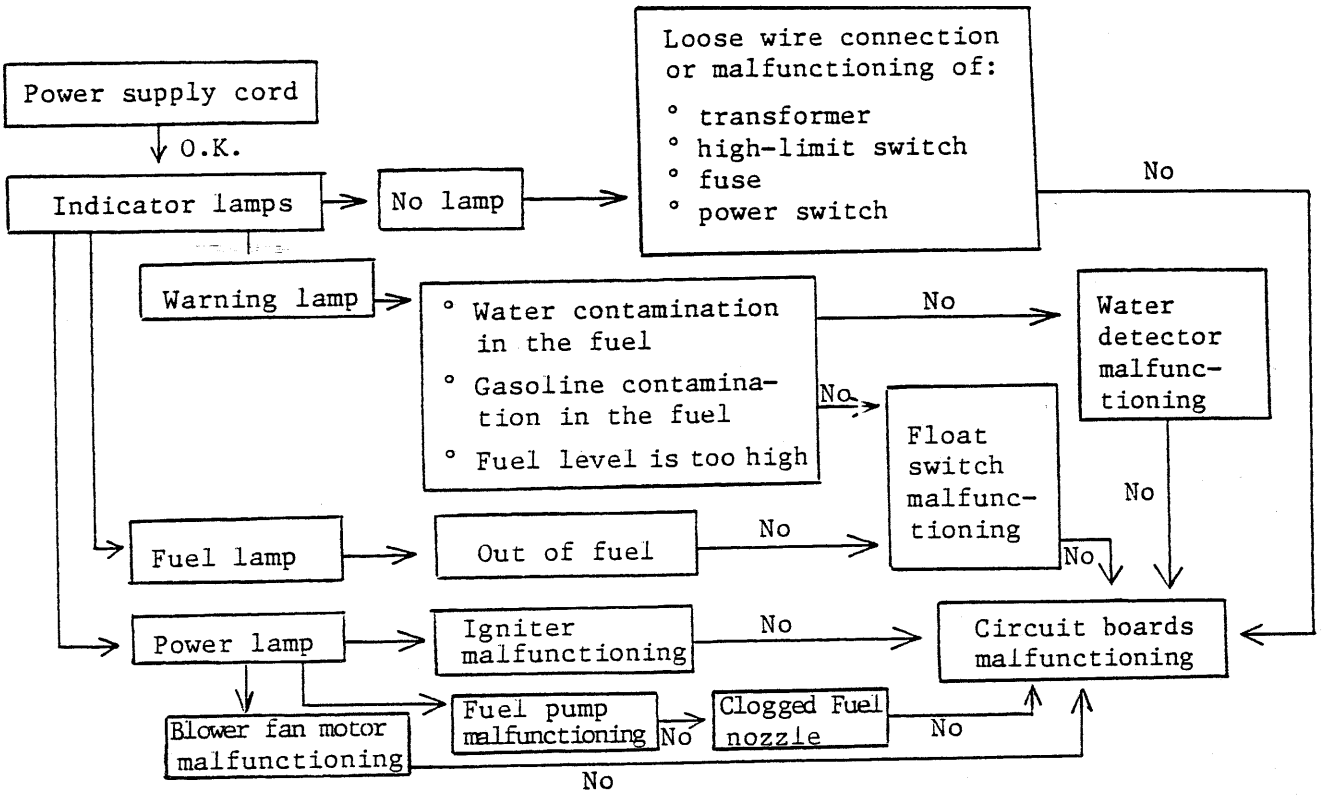
Type of the model and year of make can be identified from the serial number and lot number on the side of the heater.



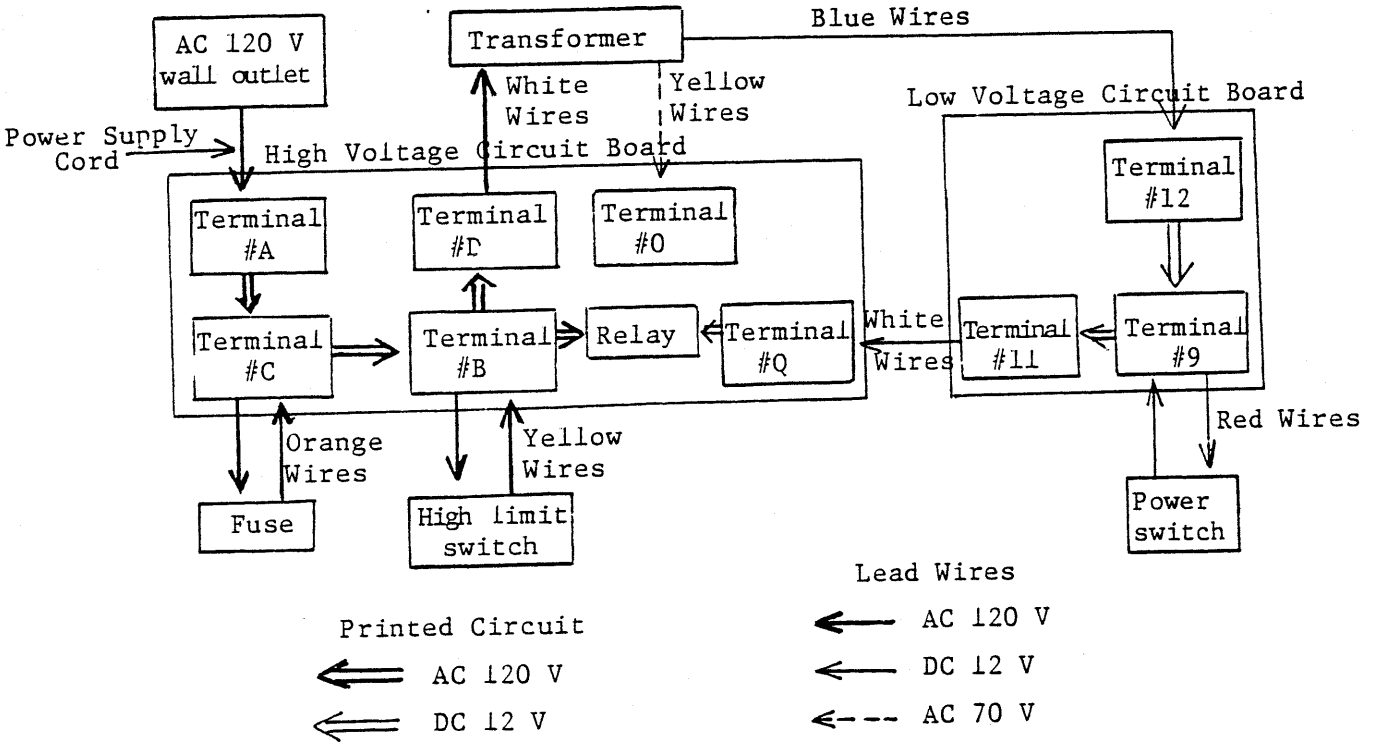


MODEL LR-350, LR-450C & LR-450D
TROUBLESHOOTING GUIDE

I. Heater does not start when power switch is on.



If no indicator lamp is observed, there is a failure in the circuit shown below. Check voltage at terminals and the lead wires as well as continuity of the lead wires.



A. Warning Lamp

When the warning lamp comes on, check below. If no lamps are observed, the low voltage circuit board is malfunctioning and should be replaced.

a.) Water Contamination of the Fuel in the Sub-Tank.

Empty the sub-tank and clean it completely. If warning lamp still comes on, check to see if the water detector is in contact with the sub-tank bottom.

b.) Fuel Level in the Sub-Tank becomes too High.

1. When the fuel in the sub-tank is contaminated with a high-volatility fuel (like gasoline, paint thinner, etc.), the fuel level becomes too high.

   Empty the sub-tank and clean it completely. If warning lamp still comes on, replace the float switch.

2. When the heater is moved from a cold room to a warm room, air in the cartridge tank expands and pushes out extra fuel to the sub-tank and raises the fuel level. Remove extra fuel with small siphon.

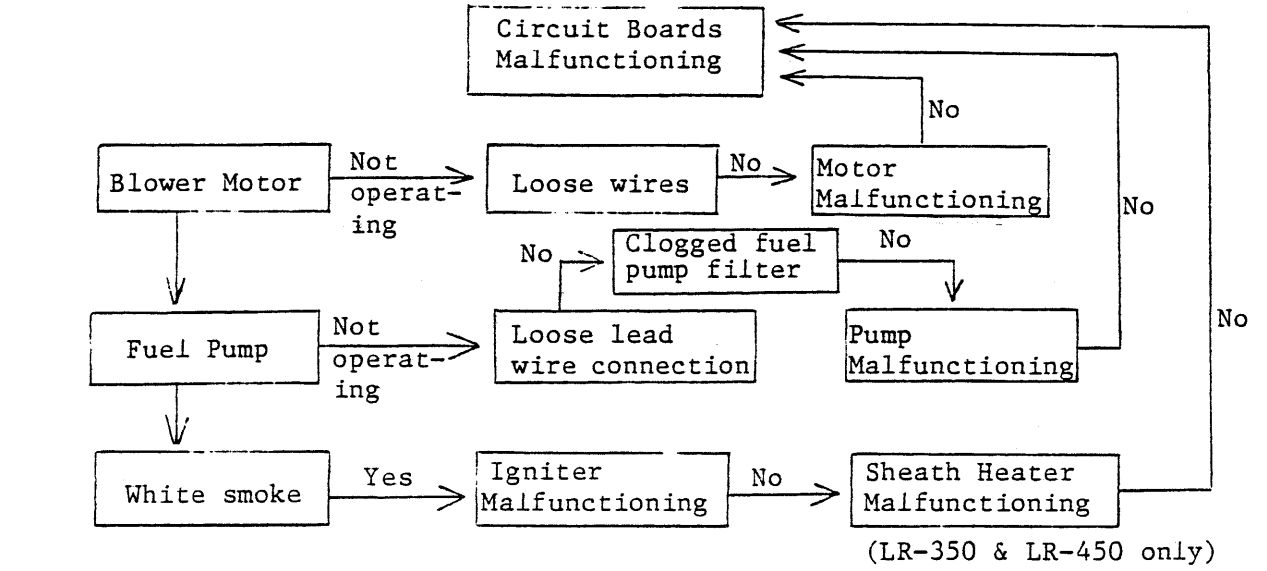
B. Fuel Lamp

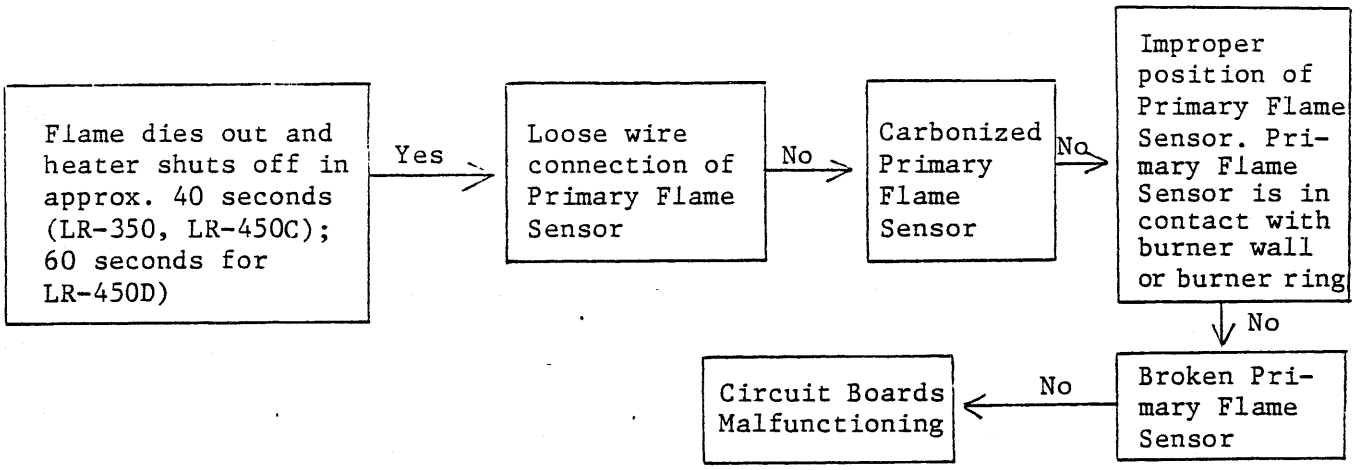
Fuel lamp comes on when the fuel level becomes low or runs out.

If the fuel lamp comes on while fuel remains in the cartridge tank, check for water in the fuel acceptance fitting. The element of the fuel acceptance fitting does not let the water pass through it. Therefore, the fuel in the cartridge tank cannot be delivered to the sub-tank and the level in the sub-tank becomes low or runs out.

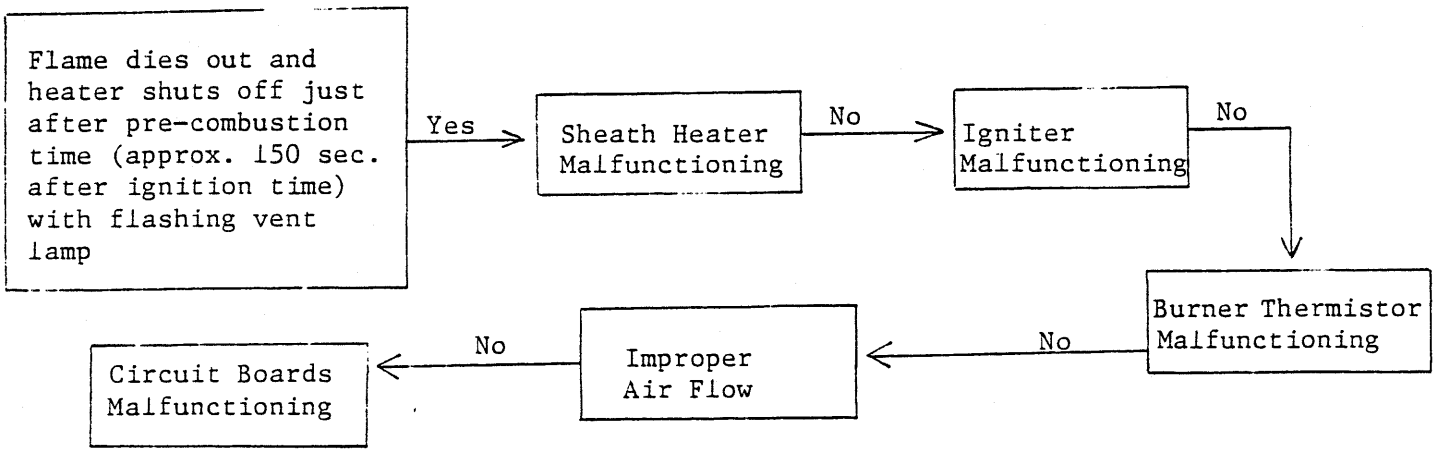
Clean the fuel acceptance fitting completely; replace it if necessary.

II. Ignition failure or heater shuts off within the pre-combustion time.





(LR-350 & LR-450C)



Ignition Sequence

When the power switch is turned on, the operation lamp and room temperature indicator lamps light and the igniter comes on. The igniter glows red in approximately 30 seconds. The blower motor starts approximately 120 seconds (for LR-350), 150 seconds (for LR-450C) or 240 seconds (for LR-450D) after the power switch is turned on. The fuel pump starts approximately 5 seconds after the blower motor starts. The solenoid valve closes one of the intake holes 7 seconds after the fuel pump starts.

A. Blower Motor Does Not Operate

a.) Loose Screw

If the securing screw is loose, the blower fan blades may touch the blower case and the motor may become stalled.

b.) Loose Lead Wire Connection

Check to see that the lead wire connection is secure. Check the lead wire continuity.

c.) Motor Malfunctioning

Disconnect the timer lead wire socket from Terminal #G. Disconnect the lead wire socket from Terminat #H and connect plug (blower motor wire socket) to Terminal #G (live terminal) on the high voltage circuit board.

If the motor does not operate, replace it. If the motor operates, the circuit board(s) is (are) malfunctioning. Replace one circuit board at a time to define which circuit board is malfunctioning (or both!).

B. Fuel Pump Does Not Operate

a.) Loose lead wire connections. Check continuity of the lead wire. Check the connection of Terminal #K on the high-voltage circuit board and the terminal on the fuel pump controller.

b.) Fuel Pump Malfunctioning

Disconnect the timer lead wire socket from Terminal #G on the high voltage circuit board. Disconnect the fuel pump lead wire socket from Terminal #K and connect it to Terminal #G.

If the fuel pump does not operate, replace it. If the fuel pump operates, the circuit board(s) is (are) malfunctioning. (See Item A above, "Blower Motor Does Not Operate," #c, for details.)

C. White or Black Smoke and Heavy Odor

a.) Insufficient preheating

1. Igniter Does Not Glow

° Check to see if the igniter glows red in approximately 30 seconds.

° Check the resistance of igniter (15.3 - 18.7 at 73°F).

° If the igniter does not glow, disconnect the igniter lead wire socket from Terminal #E and connect it to Terminal #G. If glowing still cannot be observed, the igniter is malfunctioning and should be replaced. If the igniter glows, the circuit board(s) is (are) malfunctioning. (See page 5, Item A, "Blower Motor Does Not Operate," #c, for details.)

2. Sheath Heater Does Not Operate (LR-350 & LR-450C only)

° Check the continuity of the lead wire and sheath heater high-limit switch.

° Check the resistance of the sheath heater.
Resistance should be: 22.7 ± 10% for LR-350
22.5 ± 10% for LR-450C
at 73°F

° Disconnect sheath heater lead wire socket from Terminal #F and connect it to Terminal #G. If the sheath heater is not heated, the sheath heater is malfunctioning. Replace it. If the sheath heater is heated, the circuit board(s) is (are) malfunctioning. (See page 5, Item A. "Blower Motor Does Not Operate," #c, for details.)

3. Low Voltage Circuit Board

Check the preheat timing. If the preheat timing is too short, the temperature in the burner may not reach to ignition and white smoke may be observed, or the heater will shut off (with flashing vent lamp) after the pre-combustion period.

Preheat timing:
120 seconds for LR-350
150 seconds for LR-450C
240 seconds for LR-450D

If the preheat timing is more than 20 seconds shorter than above, replace the low voltage circuit board.

D. Flame dies out and heater shuts off in approximately 40 seconds (for LR-350 & LR-450C) or 60 seconds (for LR-450D) after ignition

For initial ignition when the heater is brand new or if the room temperature is very low (approx. 10°F-20°F) or if low-quality fuel is used, the heater may fail to ignite. Try to start it a second time.

a.) Primary Flame Sensor

The flame sensor starts approximately 40 seconds (LR-350, LR-450C) or 60 seconds (LR-450D) after ignition. If the flame sensor does not detect the flame after that time, the heater is completely shut off.

° Check the connection of the lead wire.

° Check to see if the primary flame sensor is in contact with any other metal parts. Correct the position if it is bent.

° Check to see that the edge of the primary sensor is positioned in between the burner wall and the burner ring and in between the combustion holes on the fourth row (from the top) on the burner wall (LR-350 and LR-450C only). See Figures 1 and 2.

LR-350 & LR-450C

Figure 1

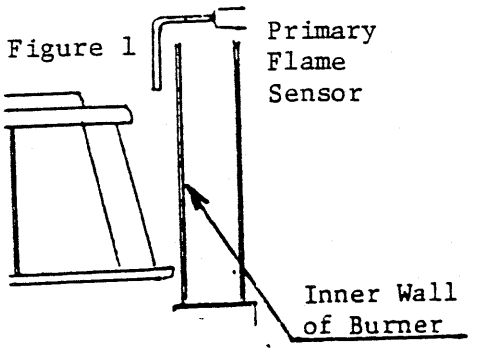
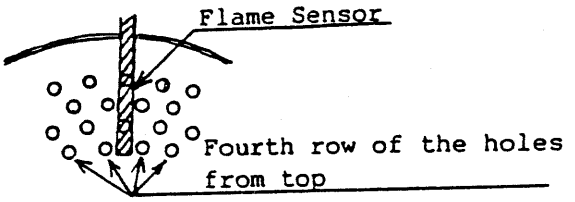


Figure 2



° Check that the burner ring is in place and properly positioned.

° (LR-450D) Check to see that the edge of the primary flame sensor has a 2.0-3.0 mm clearance to the burner ring as shown in Fig. 1 and make sure that the edge of the primary flame sensor is facing to the back of the heater as shown in Figure 2.

LR-450D

Figure 1

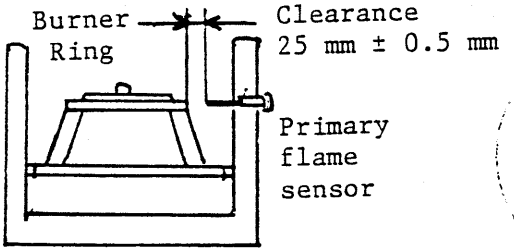
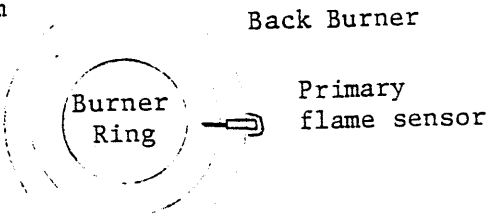


Figure 2



° Check to see if the primary flame sensor has carbon buildup. Remove the carbon and clean the flame sensor completely.

b.) Transformer

The potential between the yellow wires should be 70 V. If not, replace the transformer.

E. Flame dies out and heater shuts off just after pre-combustion time period (with flashing vent lamp)

a.) Insufficient preheating

Check the igniter and sheath heater (see page 6, Item c, White Smoke & Heavy Odor, "Igniter Does Not Glow" and "Sheath Heater Does Not Operate."

b.) Burner thermistor malfunctioning

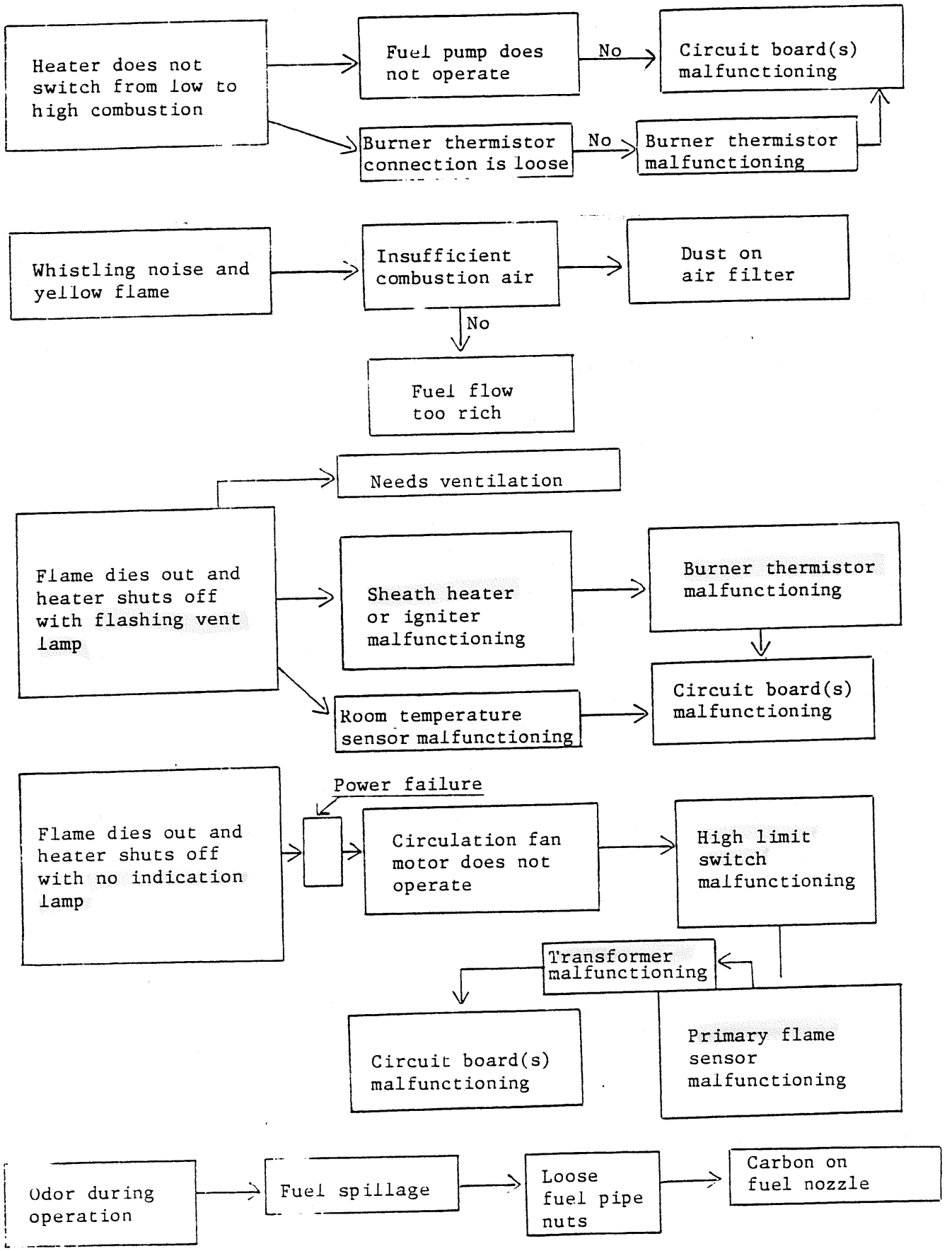
° Check the connection of the lead wire socket and Terminal #4 on the low voltage circuit board.

° Check to see that the burner thermistor is secured tightly into the holder on the burner bottom. Tighten screws if necessary.

° Replace it if the problem is not solved.

° When replacing the burner thermistor, be careful not to break the lead wires.

III. Abnormal combustion



A. Heater does not switch from low to high combustion

a.) Fuel Pump Malfunctioning

° Check the connection of the fuel pump lead wire (white wire) and Terminal #P.

° Check the continuity of the fuel pump lead wire.

b.) Burner Thermistor Malfunctioning

See page 8, Item E.

B. Whistling noise and yellow flame

a.) Insufficient Air

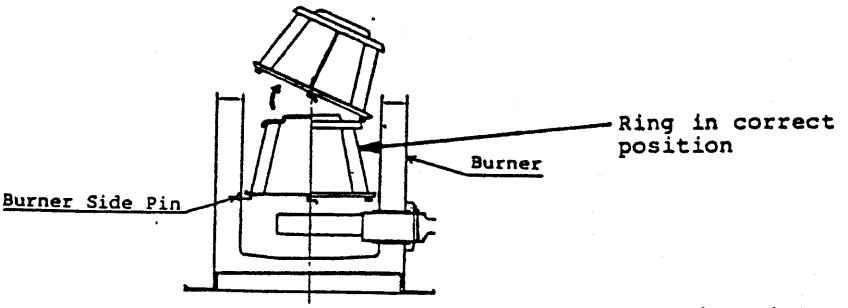
° Check to see if the air filter sponge and mesh element are covered with dust, hair, etc.

b.) Blower Motor Does Not Operate

See page 5, Item A, "Blower Motor."

c.) Burner Ring Out of Position

Make sure that the burner ring is correctly set and all three burner side pins are engaged correctly.



A bent burner ring may cause an abnormal combustion with uneven and yellow flame. If it is bent, replace it.

C. Heater changes to low combustion mode from high combustion mode with lighting vent lamp

a.) Insufficient Ventilation

° Check to see that the room is well ventilated. Do not operate the heater in closed basement or in a confined area.

b.) Insufficient Combustion Air

See "B" above, "Whistling noise and yellow flame."

c.) Burner Ring Out of Position

See page 10, Item B, "Whistling noise and yellow flame."

D. Flame dies out and heater shuts off with flashing vent lamp (see page 10, Item C).

a.) Insufficient Ventilation

b.) Insufficient Preheating

See page 6, Item C, "White or Black Smoke and Heavy Odor."

c.) Sheath Heater Does Not Operate (LR-350 & LR-450C)

See page 6, Item C, "White or Black Smoke and Heavy Odor."

1. Insufficient preheating

d.) Igniter Failure (does not glow)

See page 6, Item C, "White or Black Smoke and Heavy Odor."

1. Insufficient preheating

e.) Burner Thermistor

In most instances, the heater is shut off when the burner thermistor starts to sense the burner temperature.

Burner thermistor starting time:

° 150 seconds after ignition for LR-350 and LR-450C.

° 16 minutes (960 seconds) after ignition for LR-450D. (See page 8, Item E, "Flame dies out and heater shuts off just after pre-combustion time period (with flashing vent lamp)" for burner thermistor malfunctioning.

E. Flame dies out and heater shuts off with no indication lamp

a.) Overheating

° Check to see if the circulation fan guard is clean and not covered with dust, a curtain, pet hair, etc.

° Check that the circulation fan motor operates properly.

Circulation fan starting time:

LR-350	120 seconds after power switch is turned on
LR-450C	150 seconds after power switch is turned on
LR-450D	240 seconds after power switch is turned on

If circulation fan motor does not operate:

° Check the continuity of the lead wires.

° Disconnect the lead wire socket from Terminal #I on the high voltage circuit board and connect it to Terminal #G. If the fan motor still does not operate, replace it. If the fan motor operates, the circuit board(s) is (are) malfunctioning. See page 5, Item A, "Blower Motor Does Not Operate" #c.) "Motor Malfunctioning" for details.

b.) High-Limit Switch

° Check the continuity of the high-limit switch and lead wires. If continuity is found, the circuit board(s) is (are) malfunctioning. See page 5, Item A, "Blower Motor Does Not Operate" #c.) "Motor Malfunctioning" for details.

c.) Primary Flame Sensor Malfunctioning

1. Flame Sensor Out of Position

First check the lead wire continuity and connections.

Check to see if the primary flame sensor is not bent, in contact with any other metal parts or has carbon buildup. See page 7, Item D, "Flame dies out and heater shuts off in approximately 40 or 60 seconds after ignition" for details.

If the problems indicated above are not found, replace the circuit board(s). See page 5, Item A, "Blower Motor Does Not Operate," #c.) "Motor Malfunctioning" for details.

d.) Insufficient Combustion Air (LR-450D only)

The primary flame sensor on Model LR-450 prepares an additional safety feature which shuts off the heater completely if ventilation is insufficient or if abnormal combustion is observed (such as a high yellow flame or a whistling noise).

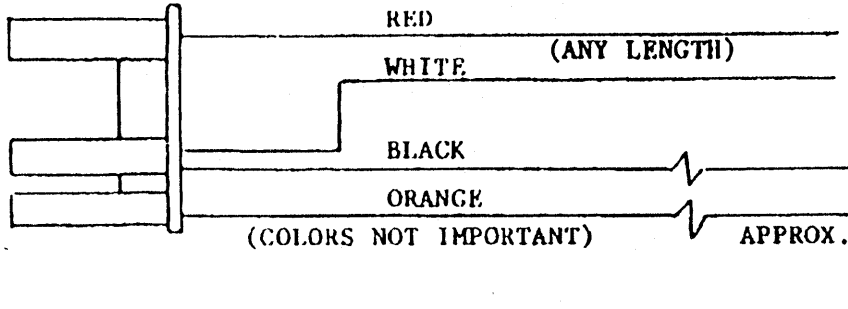
° See page 7 for details of the primary flame sensor position.

° See page 10, Item B, "Whistling Noise and Yellow Flame" and page 10, Item C, "Heater changes to low combustion mode from high combustion mode with lighting vent lamp" for details of the causes.

e.) Transformer Malfunctioning

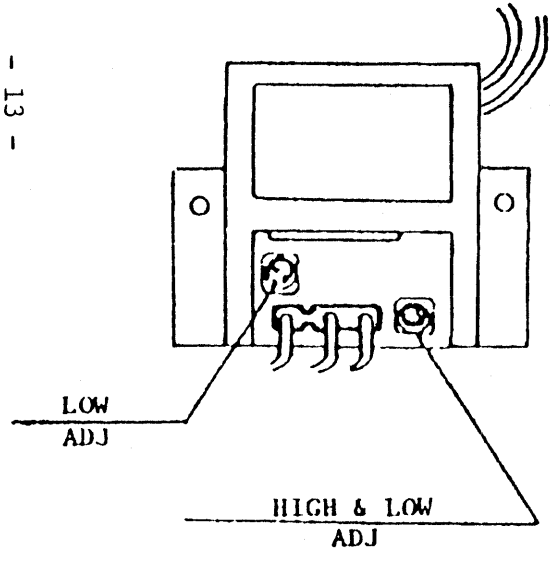
See page 8, Item b.) "Transformer."

JUMPER FOR CALIBRATION OF FUEL PUMP



RIG JUMPER OR ALLIGATOR CLIP FOR CONNECT/DISCONNECT.
CONNECTED: PUMP ON "HIGH"
OPEN: PUMP ON "LOW"

FIT CONNECTOR TO PLUG OR TO HOT (USUALLY "G") TERMINAL

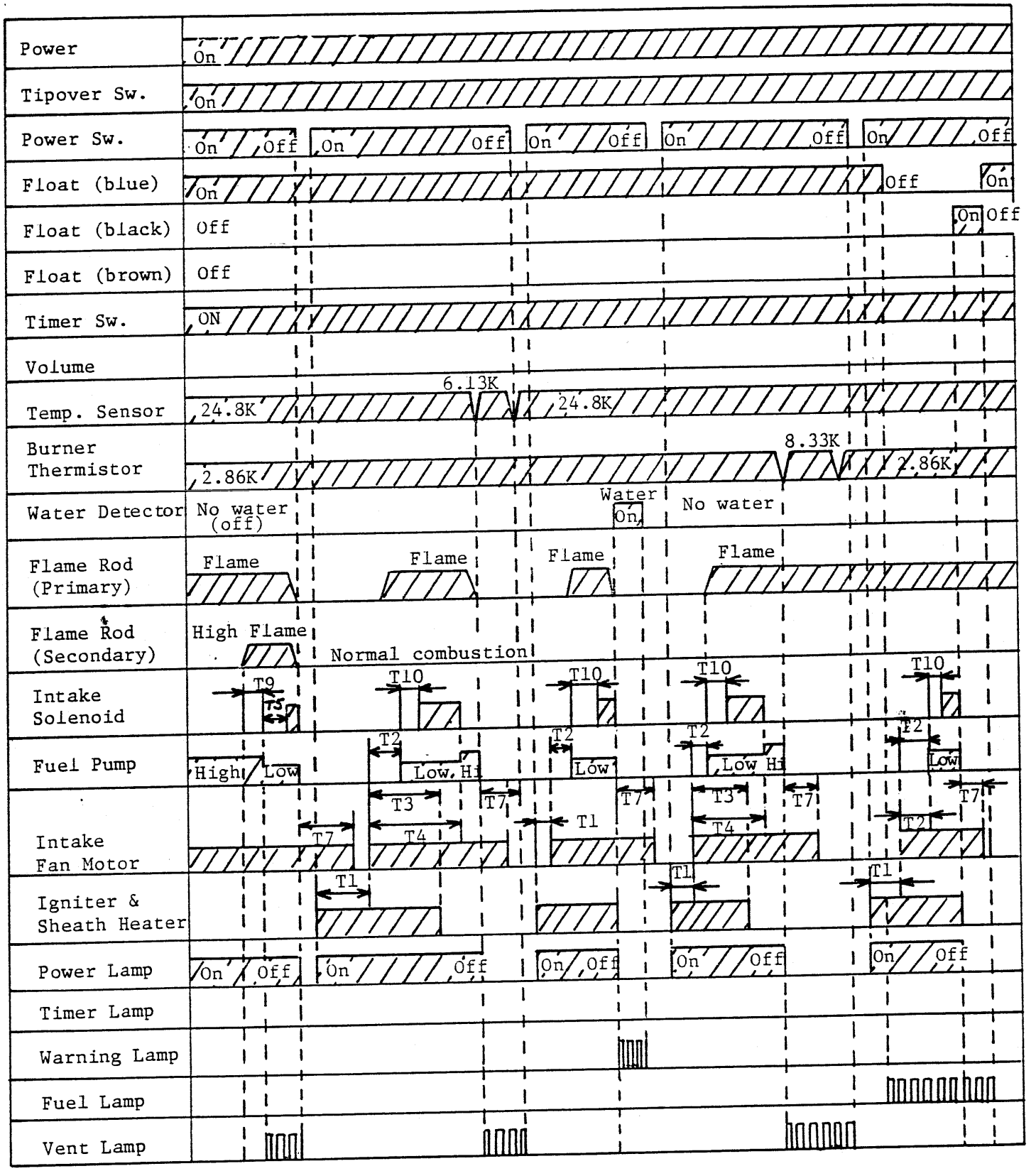


	350	450	
HIGH	5.7-6.2 (6.0)	11.5-12.8 (12.5)	RATE IN ML/MINUTE
LOW	2.9-3.2 (3.0)	5.8-6.4 (6.0)	RUN FOR 4 OR 5 MIN. & TAKE AVG.

ADJUST "HIGH" RATES FIRST, THEN "LOW"

TURNING: ADJUST SCREWS CLOCKWISE--
DECREASES FUEL FLOW;
COUNTERCLOCKWISE INCREASES
FUEL FLOW

LR-350, LR-450(TYPE B and C)TIME CHART

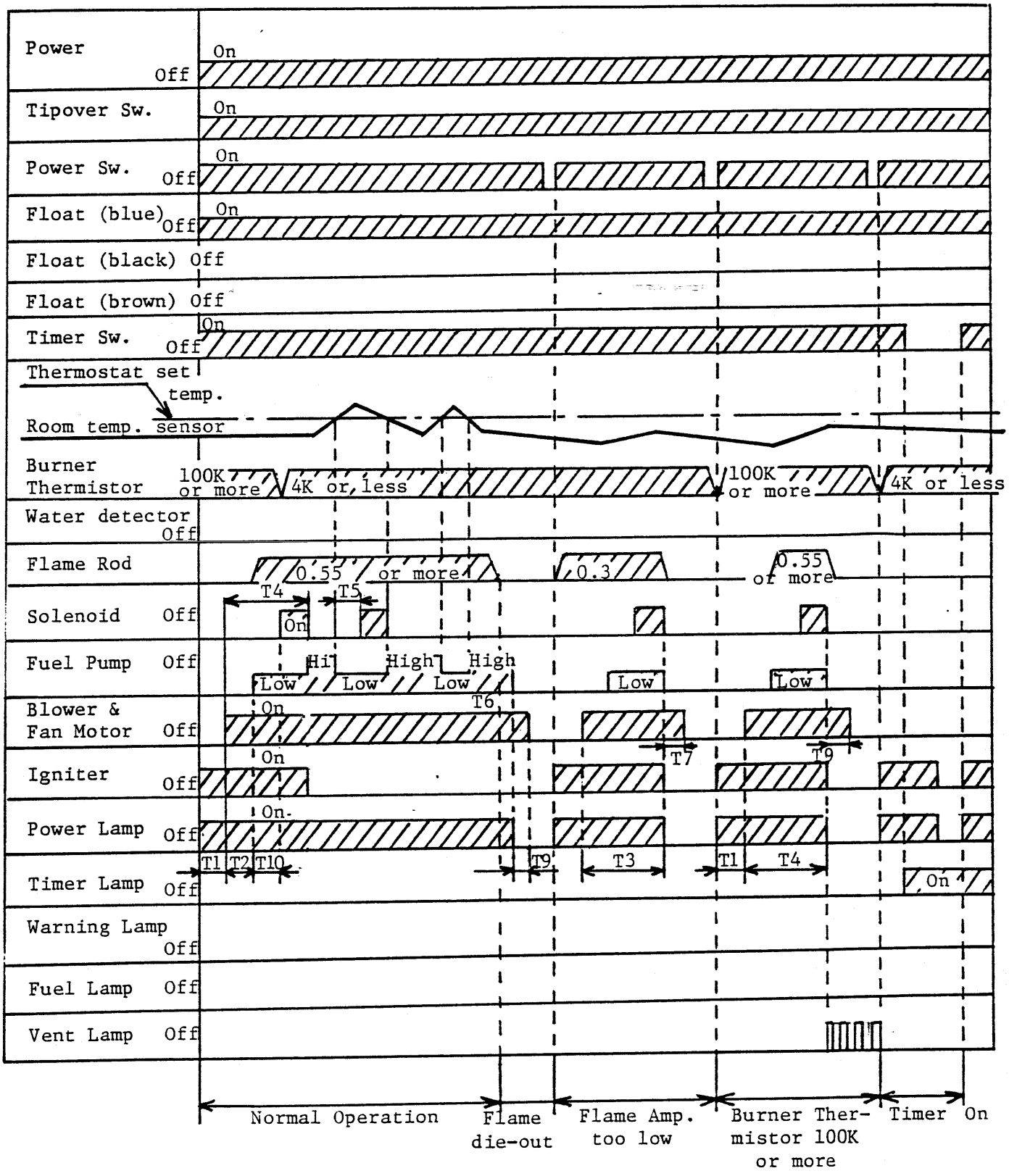


T1 = Preheat time: 100 sec. (LR-350); 150 sec. (LR-450)
T2 = Prepurge time: 5 sec.
T3 = Flame Sensor start time: 40 sec.
T4 = Precombustion time: 150 sec.
T5 = Solenoid Delay time: (High ⟶ Low) 21 sec.
T7 = Post purge time: 15 sec.

T9 = Burner Thermistor 4K Pickup time: 20 minutes

T10 = Solenoid Delay time (at starting): 7 sec.

LR-450(TYPE D)TIME CHART



T1 = Preheat time: 240 sec.
T2 = Prepurge time: 5 sec.
T3 = Flame Sensor start time: 60 sec.
T4 = Precombustion time: 150 sec.
T5 = Solenoid Delay time (high→low): 21 sec.

T6 = Fuel pump shutoff when flame dies out: 6 sec. or less
T7 = Postpurge time: 30 sec.
T9 = Burner thermistor 4K pickup time: 20 minutes
T10 = Solenoid Delay time (start): 7 sec.

MODEL LR-350 (Type B)

CHANGE	BENEFIT
° Circuit Board - Startup timing for air regulator change	Reduce startup odor
° Fuel Nozzle - internal diameter of nozzle changed	Even fuel delivery; Reduce shutdown odor
° Fuel Feed Pipe - redesigned feed pipe to retain any excess fuel at shutdown	Reduce secondary shutdown odor
° Secondary Flame Rod - loop at tip of rod removed	Reduce excessive sensitivity of flame rod and stop vent lamp flashing
° Radiant Chamber - removal of horizontal holes around lower cone	Stop back pressure odor

LR-450 (Type D)

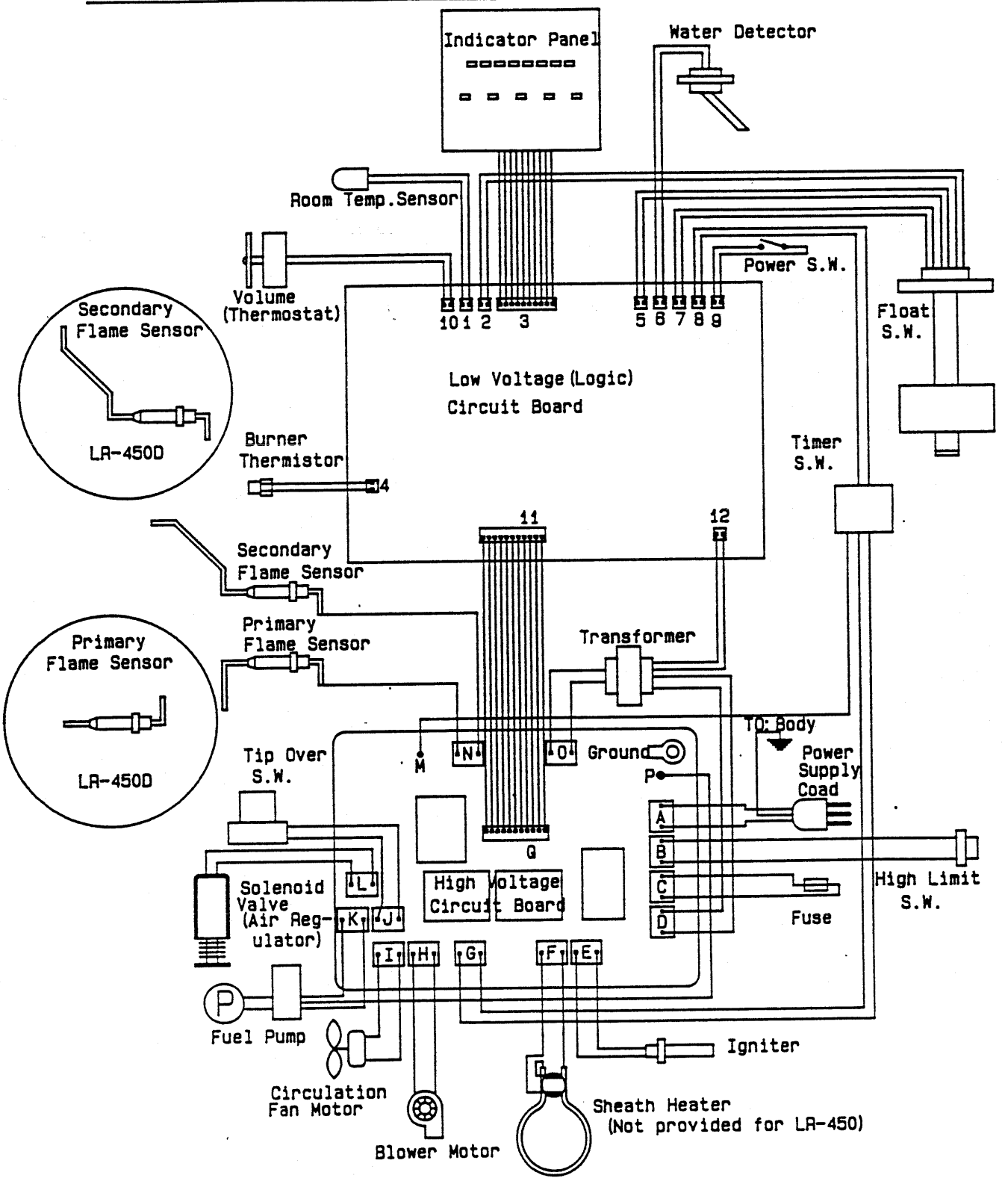
There will be certain changes in the component parts of the low voltage circuit board of the LR-450 for the 1987/88 season. These changes will be made to correct the shutdown problem we have experienced with a number of Type "D" models during the past season.

Our investigation revealed that the cause of the shutdown problem was the use of heavy kerosene with higher viscosity. As the LR-450 Model D was designed and adjusted to work with quality kerosene, when the low grade (high viscosity) fuel is used in the unit, the operation sequences controlled by this circuit board do not work as they were intended to. Kerosene with higher viscosity requires longer preheating time for vaporization. Flames grow much slower after ignition due to slow kerosene vaporization. Before flames grow high enough to be sensed by the flame sensor in the burner, the unit shuts down by the safety mechanism.

To correct this problem, we changed the timings of the low voltage circuit board as follows:

1.	Preheating Time:	From:	150 sec. (2 min. 30 sec.)
		To:	240 sec. (4 min.)
2.	Flame Sensor Start Time:	From:	40 sec.
		To:	60 sec.
3.	Postpurge Time:	From:	15 sec.
		To:	30 sec.

CONNECTION OF LEAD WIRES



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