



**VENTED HEATER  
SERVICE MANUAL**

**Laser 60AT (Type A, B, C)**

**Laser 60AT (W) (Type A)**

# L A S E R   H E A T I N G   S Y S T E M S

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# L A S E R   H E A T I N G   S Y S T E M S

## Section 1

## Description

### 1-1 INTRODUCTION

The Laser Heating System is a completely new type of sophisticated and fuel-efficient vented system featuring its own housing, combustion and air circulation systems and a micro computer control system.

In addition to superior design and technology, rigorous testing for quality and safety have made the Laser Heating System unmatched for efficiency, convenience, economy and flexibility. Plus, the Laser is easy to maintain and requires minimal service.

The following section outlines the Laser Heater and its various components.

### 1-2 PHYSICAL SPECIFICATIONS

Listed below, are the physical specifications that apply to the Laser:

Laser 60AT

W × D × H (inches):	30" × 24" × 19" (760 × 608 × 483 mm)
Weight:	77 lbs. (35kg)
Flue Pipe Hole:	2-3/4" to 3" diameter (70 to 75 mm)

### 1-3 DESCRIPTION OF FUNCTIONS

See Fig. 1-1.

The heating cycle begins with a purge of any existing fuel vapors along with a pre-heat period. The fuel and air are then delivered to the heated burner, resulting in ignition.

After several minutes of low and medium mode combustion, the circulation fan starts to blow air through the heat exchanger and automatically maintains the proper burn rate. An easy to use selector allows for regulation of room temperature while the indicator panel allows monitoring of the Laser's heating condition. When the room temp. increases sufficiently, the heater shuts down and goes through a post-purge mode for approx. 3 minutes.

Laser 60AT is equipped with a programmable set-back timer which allows for fully automatic operation 24 hours a day. The heater will run at four stages "HIGH", "MEDIUM", "LOW" and "OFF" cycle to maintain the desired temperature setting.

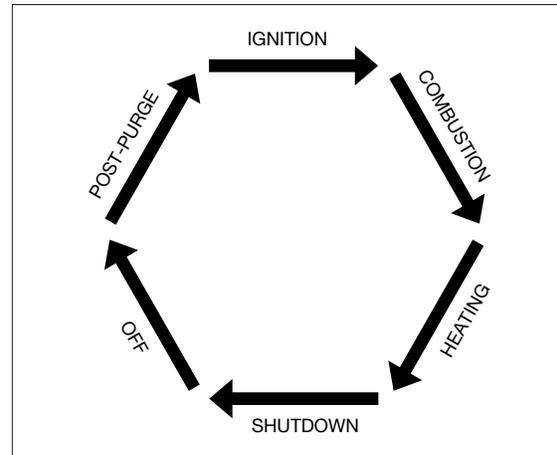


Figure 1-1 SIMPLIFIED OPERATIVE CYCLE

### 1-4 DESCRIPTION

The Laser 60AT is composed of the following:

- A drip tray
- A cabinet
- A forced flue venting system
- A combustion system
- An air circulation system
- A fuel delivery system
- Electrical and electronics systems
- A variety of safety mechanisms

### 1-5 COMBUSTION SYSTEM

In the combustion system a mixture of fuel and air is burned to produce heat. Air is drawn from outside the dwelling to the burner. At the same time, fuel is metered from a storage tank into this same burner. Within the burner, the air/fuel mixture is ignited to produce heat.

The Laser combustion systems are safeguarded by an overheat protector switch that will shut down the heater (to protect it from damage) in the event of excessive heat build-up. The error code "EE-6" or "EE-2" will be displayed on the digital indicator at this time. The overheat protector switch will be reset after the cooling down period. Turn the ON/OFF switch to "ON" again to restart.

# L A S E R H E A T I N G S Y S T E M S

## Section 1

## Description

### 1-6 HEAT CHAMBER

The combustion chamber consists of two main parts; one is the heat chamber and the other is the heat exchanger. The heat chamber is secured to the top of the burner. The heat chamber is made of a heatproof glass. The exhaust vapors pass through the heat exchanger. While exhaust vapors are moving through the heat exchanger, the heat is extracted from the heat exchanger by the air circulation fan. The heat exchanger is connected to the top of the heat chamber.

### 1-7 BURNER

The burner is positioned on the cabinet base.

The burner has a double wall construction and contains an igniter tube, a fuel inlet fitting and a series of air holes on the inner wall.

Connected to the burner are the igniter (located within the burner), a fuel line and a flame sensor. Within the burner is the burner ring. An airway in the cabinet base channels air from the intake fan of the combustion blower to the base of the burner. The flame rod sensor is mounted through the wall of the burner.

### 1-8 BURNER RING ASSEMBLY

This assembly is designed to promote efficient burning.

The burner ring assembly is held by spring clips to mounting posts within the burner.

### 1-9 BURNER COATING

The textured burner coating insures the even vaporization of fuel for proper combustion.

### 1-10 FLAME ROD SENSOR

The flame rod sensor checks the condition of the flame for proper burning.

The flame rod sensor is mounted through the wall of the burner.

### 1-11 IGNITER

The ceramic-type igniter is designed to pre-heat the burner pot and to vaporize and ignite the air/fuel mixture to start the combustion process.

### 1-12 FORCED FLUE VENTING SYSTEM

The forced flue venting system channels air to and from the heater. Outside air is drawn into the heater by the combustion blower through the flue pipe and is blown into the bottom of the burner. It then combines with the vaporized fuel and ignites.

As the heated air passes through the heat exchanger, a room air circulation fan blows air past the heat exchanger and out again into the room from the front of the heater. Exhaust vapors are vented out of the room through the flue pipe.

### 1-13 FLUE PIPE

The wall thickness which the flue pipe can be installed is from 4 in. to 9 in. The extension flue pipe (option) is available for installation in wall thickness from 9 in. to 13 in. This provides the flexibility to meet the installation requirements of dwellings of various wall thicknesses up to 13 inches (330 mm).

The flue pipe assembly is a "pipe-within-a-pipe" design which consists of two concentric tubes. Outside air is drawn through the cylindrical space between the tubes. Combustion by-products are vented through the inner tube.

As cool air enters the flue pipe, it is heated by the hot air that is exiting the system.

### 1-14 BLOWER MOTOR ASSEMBLY

The blower motor assembly on Laser 60AT is a dual function fan with the intake air and exhaust air fans mounted on a common shaft. Inside they are separated into two compartments by a sealed plate. One side is the intake air and the other is the exhaust air. The intake fan draws in outside air through the flue pipe for internal combustion. The exhaust fan, which runs on a common shaft with the intake fan, expels all combustion by-products through the flue pipe.

The Laser 60AT blower motor has a 2-stage, 3-speed intake/exhaust fan. The larger diameter exhaust fan keeps the air pressure within the combustion/exhaust system lower than the room air. A magnetic sensor insures proper fan speeds for each burning mode.

The blower motor will keep running for 180 seconds after the heater is turned off to exhaust vapor in the system and cool off the unit.

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## Section 1

## Description

### 1-15 AIR CIRCULATION FAN

The air circulation fan forces room air through the heat exchanger, then out of the front panel to be distributed throughout the room. The Laser 60AT circulation fan motor has three speeds. The circulation fan will keep running for 180 seconds after the heater shuts down. This cools the heater.

### 1-16 FUEL DELIVERY SYSTEM

Fuel moves by gravity from the external fuel storage tank to the fuel sump.

Fuel must be maintained at the level corresponding to the burn mode so that combustion can be conducted efficiently.

The fuel pump meters the flow of fuel from the fuel sump to the burner through a copper fuel pipe and a fuel nozzle.

### 1-17 EXTERNAL FUEL TANK

The external tank (which generally is dealer installed) should contain at least one shutoff valve, a fuel filter and a vent. Installation of the tank should conform to local regulations.

### 1-18 FUSIBLE LINK VALVE

The fusible link valve is mounted as a standard item. Located inside on the base of the heater cabinet, it is connected to the fuel sump. The fusible link valve is a spring-loaded device that cuts off the supply of fuel to the heater when the temperature level (at the valve) exceeds a predefined maximum limit.

### 1-19 FUEL SUMP (FUEL CONSTANT LEVEL VALVE)

The constant level valve has an automatic shutoff safety mechanism that prevents fuel from flooding or overflowing from the fuel sump.

A manual reset button allows the valve to resume operation after the heater has been moved.

Fuel enters the constant level valve through an inlet at the bottom. As the level of fuel rises, it passes through a fuel inlet strainer which removes most particles and foreign matter from the fuel and then it flows up through an open inlet valve and enters the tank. See Fig. 1-2.

**IMPORTANT:** Within the valve, a float mechanism controls the level of fuel in the sump. As the fuel level drops, the float drops down to increase the inlet valve opening to admit more fuel into the sump. When the fuel level reaches its maximum volume, the float rises to shut the valve.

In the event that fuel within the sump rises to an abnormally high level, the float within the sump rises. A trip magnet pulls the float up and closes the valve to prevent fuel from entering into the sump.

Should a foreign substance cause the inlet valve to stick (or prevent it from opening), the reset button is utilized to free the mechanism and to admit fuel to the sump.

The fuel inlet strainer should be cleaned or replaced periodically. Time intervals will depend on purity and quality of fuel.

**CAUTION:** Care must be taken to prevent dust, dirt or other debris from clogging or blocking the inlet valve.

### 1-20 FUEL PUMP

The fuel pump is mounted on top of the fuel sump. The pump assembly consists of the pump solenoid and the control circuit.

### 1-21 ELECTRICAL SYSTEM

All electronic diagrams, such as the wiring diagram, the circuit board layout, and the electrical schematic can be found in Section 6 of this Service Manual.

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## Section 1

## Description

### 1-22 CONTROL CIRCUIT BOARD

The control circuit board provides safety timings, controls relays and provides clock and thermostat functions for the Laser Heater. A component layout of the printed circuit board is found in this Service Manual.

### 1-23 ROOM TEMPERATURE SENSOR (THERMISTOR)

The room temperature sensor, which is capable of sensing room temperature within range of 50°F (10°C) to 90°F (32°C), can be wall mounted.

Approx. 8 feet (2.5 m) of wire is supplied with the sensor to facilitate wall mounting in a favorable location. You can also use radio wire or speaker wire to extend the mounting location up to 20 feet (6m).

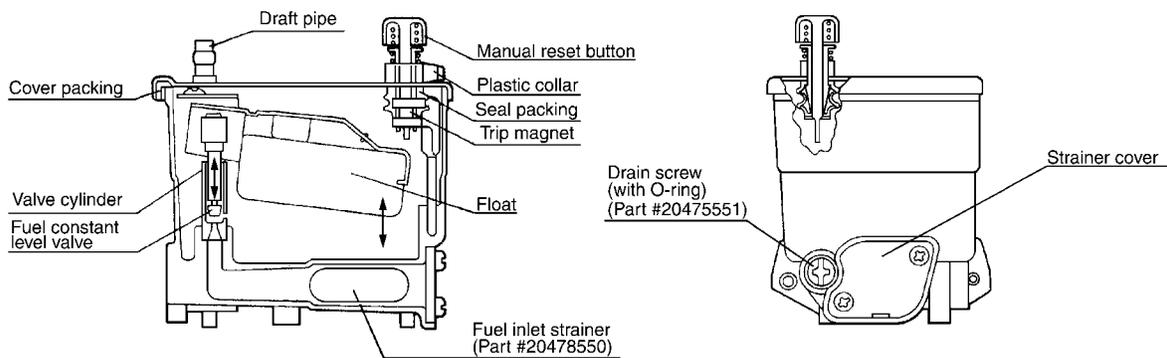


Figure 1-2 FUEL SUMP (FUEL CONSTANT LEVEL VALVE) (Part #20478534)

# L A S E R   H E A T I N G   S Y S T E M S

## Section 1

## Description

### 1-24 SAFETY MECHANISMS

Several safety mechanisms have been built into the Laser Heating System. These devices protect the user against personal injury, protect the heater against damage, shut down the heater and display an error code on the digital indicator if a malfunction occurs.

### 1-25 POWER FAILURE RECOVERY SYSTEM

When an electric power failure occurs while the heater is in operation, the heater will automatically re-start and run in "NORMAL" mode after the power is restored.

### 1-26 CLOTH COVERED EXHAUST PIPE

Insulating cloth covers are to be placed over all metal surfaces of the exhaust line during installation. Since combustion by-products are vented at elevated temperatures, the exhaust pipe will become hot during operation. The insulating cloth covers protect the user from accidental contact burn with these heated metal surfaces.

**IMPORTANT:** Do not operate the heater without the insulating covers. During installation make sure that all exhaust lines are tightly connected.

### 1-27 AIR CIRCULATION FAN COVER

This fan cover is an integral part of the fan assembly and protects the user against physical injury which could occur from accidental contact with the revolving metal fan blade.

### 1-28 FUSE

In the event of a power surge or an internal wiring hazard, the fuses will open and power to the heater will be cut off. The fuses are rated at 125 V AC, 10-amps and 125 V AC, 3-amps.

The electrical outlet into which the heater connected should be protected by at least a 15-amp. fuse or circuit breaker.

### 1-29 OVERHEAT PROTECTOR SWITCH

Overheat protector switch is rated at 195°F (90°C). Should a heater overheat (internal temperature rises beyond 195°F (90°C)), the overheat protector switch (also called a high limit switch) will open to shut off the heater. Error code "EE12" will be displayed on the digital indicator at this time. The overheat protector switch will automatically reset after the heater has cooled down.

Once the heater has cooled to 150°F (65°C), the system can be restarted manually as follows:

1. Press ON/OFF switch to "OFF".
2. Allow heater to cool down.
3. Resolve the cause of the overheat.
4. Press ON/OFF switch to "ON" to start.

The heater will start with normal operation.

### 1-30 IGNITER CLEANING SYSTEM

#### **Automatic igniter cleaning system**

The heater will automatically turn to the "OFF" cycle at 2:00 AM everyday and the igniter will be on for self-cleaning for ten (10) minutes. "CL:10" will be shown on the digital indicator at this time.

**IMPORTANT:** The digital clock on the heater must be set to the correct time.

#### **Manual igniter cleaning system**

you can clean the igniter manually for ten (10) minutes as follows:

1. Press both the "HOUR" button and "MINUTE" button at the same time for more than three (3) seconds when ON/OFF switch is "OFF".
2. "CL:10" will be shown on the digital indicator. Cleaning will begin and end without any additional input.

**IMPORTANT:** Cleaning the igniter is important to prolong igniter life. It is recommended that the igniter be cleaned at least once a week.

3. Disconnect the heater from power source during the off season.

# L A S E R H E A T I N G S Y S T E M S

## Section 1

## Description

Model Laser 60AT

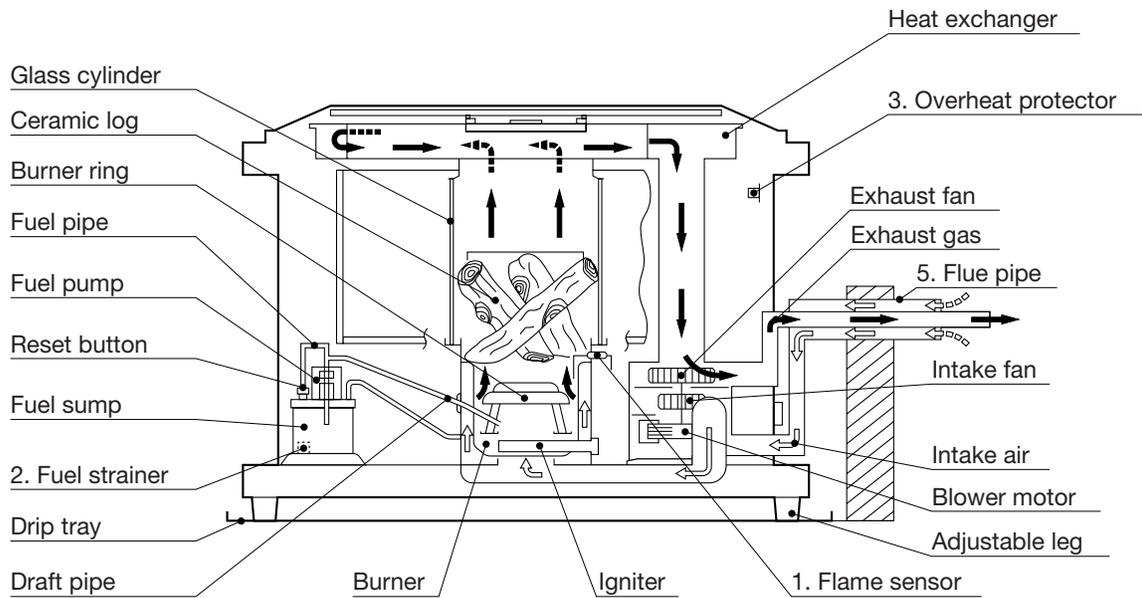


Figure 1-3 CONSTRUCTION

## Section 2

## Installation

### 2-1 INTRODUCTION

Installing the Laser System at the user's location can be performed quickly and economically.

Laser 60AT is strictly an externally fueled system, is fully vented and will need the installation of an external fuel storage tank.

By completing each step of the easy-to-follow installation instruction (each step should be completed in the exact order specified), the technician is directed through the installation process.

This section contains all relevant installation information including:

- Installation specifications
- List of installation tools
- Alternative types of venting systems (and installation procedures for each)
- Basic requirements for fuel tank installation
- Instructions to install the Laser System

The heater can be located almost anywhere within the dwelling provided that electrical, fuel, and exhaust specifications are met.

**IMPORTANT:** Before beginning installation of the Laser Vented Heating System (including any electrical wiring and fuel supply equipment), check local building, electrical, mechanical and fire codes. The requirements of these codes must be followed to insure lawful installation and use.

**IMPORTANT:** The heater is designed to be used no more than 3000 FT. (1000 m) above sea level. If using at a altitudes higher than 3000 FT. (1000 m) above sea level, follow the procedure on paragraph 2-13.

### 2-2 PHYSICAL PLACEMENT OF HEATER

In addition to the space taken up by the heater, interior space must also be reserved for free air circulation. Remove all combustibles from the heating area.

Unless building or fire codes dictate otherwise, the Laser System can be placed on any floor surface (including carpeting or other combustible material) and provide safe operation. Check clearances as instructed in Figure 2-1.

### 2-3 DRILLING REQUIREMENTS

Through-the-wall flue pipe installation requires that a 2-3/4" to 3" (70 to 75 mm) hole be drilled through the dwelling wall (interior or exterior). The hole must be pitched downward toward the outside at an approx. angle of 2 degrees.

The appropriate wall area (in which hole will be drilled) must contain no internal obstacles such as piping, wiring, air ducts or studs.

### RECOMMENDED TOOL KIT FOR SERVICE TECHNICIANS

- 1) #2 Phillips Head Screwdriver
- 2) Steel Tape Measure
- 3) Felt Tip Pen or Pencil
- 4) Caulking Material (exterior grade)
- 5) Electrical Drill (reverse capability recommended)
- 6) Hole Saw, Saber (Jig) Saw or other appropriate tool for cutting a 2-3/4" to 3" (70 to 75 mm) diameter hole for flue pipe
- 7) Long Drill Bit-1/2"
- 8) 1/4" x 6" Standard Screwdriver
- 9) Adjustable Wrenches (various sizes)
- 10) Copper Tubing Cutter
- 11) Copper Tubing Flaring Tool
- 12) Volt, OHM, Meter with shielded probes
- 13) Level (small circular type)
- 14) Plumber's Pipe Thread Tape
- 15) Small Assortment of Self-Tapping Screws
- 16) Assorted Pliers (Slip Joint, Needle nose, Cutting, Lock Joint)
- 17) Phenolic Probe or Insulated Screwdriver
- 18) Floor Mat to cover carpeting
- 19) Quart Size Pan for draining fuel

# L A S E R   H E A T I N G   S Y S T E M S

## Section 2

## Installation

### 2-4 POWER REQUIREMENTS

Line current to the system should be 120 V AC at 60 Hz. The electrical system should be protected against current overload by means of at least a 15-amp. fuse or circuit breaker.

**WARNING:** The Laser power cord must be plugged into a directly accessible wall outlet. Do not use an extension cord to make this electrical connection.

**NOTE:** The wall outlet should supply electricity for the Laser System only. Do not connect any other electrical appliance to it.

### 2-5 FUEL TANK REQUIREMENTS

Heater fuel (ASTM D3699 1-K Kerosene or ASTM D396 No.1 Fuel Oil) can be stored in externally located storage tanks ranging from 55 gallon (200 ℓ) drums to 275 gallon (1000 ℓ) tanks. When using large tanks a pressure regulator with a max. of 2.5 PSI should be installed near the heater inlet.

**WARNING:** Installation of any externally located fuel tanks must comply with all local standards and/or building codes.

### 2-6 ROOM TEMPERATURE SENSOR WIRING REQUIREMENTS

A wall-mounted temperature sensor gauges room temperature to automatically regulated the heating cycles of the Laser System. The standard sensor wire is 8 feet (2.5 m) long and can be mounted on a wall. You can also use radio wire or speaker wire to extend the mounting location up to 20 feet (6m).

**CAUTION:** Choose a location for the sensor that is not in the path of direct sunlight, draft or the flow of warm air from the heater, as this will cause an inaccurate temperature reading.

### 2-7 BUILDING CODES

Fire regulations, as well as electrical and other local building codes, may govern the installation and use of a vented heater and related fueling systems. Prior to installation, check and comply with all codes. Additional requirement may be met for Mobile Home installation.

### 2-8 UNPACKING

Save all shipping materials until the Laser has been completely installed and is working properly.

- A. Remove or cut the two plastic straps that hold the shipping carton together.
- B. Lift off the carton top.
- C. Remove the template and the Owner's Manual from the shipping carton.

**NOTE:** The dealer should complete the registration card at time of customer purchase and return it to TOYOTOMI U.S.A., INC. as soon as possible.

- D. Remove the flue pipe kit from shipping carton.
- E. Remove the shipping carton.
- F. Remove the plastic bag covering the heater.
- G. Remove the plastic bags containing the heater parts and set it aside.
- H. Firmly grasp cabinet handles (one on each side of heater cabinet) and lift heater from the cardboard shipping base.
- I. Remove the flue pipe from the cardboard shipping base.
- J. Check for parts as listed in Laser Owner's Manual.

**IMPORTANT:** Only the standard-size flue pipe is shipped with the heater. The TOYOSTOVE Distributor/Dealer will also stock the long flue pipe, the window kits, extension pipe kits, and other accessories that may be required for non-standard installation.

# L A S E R H E A T I N G S Y S T E M S

## Section 2

## Installation

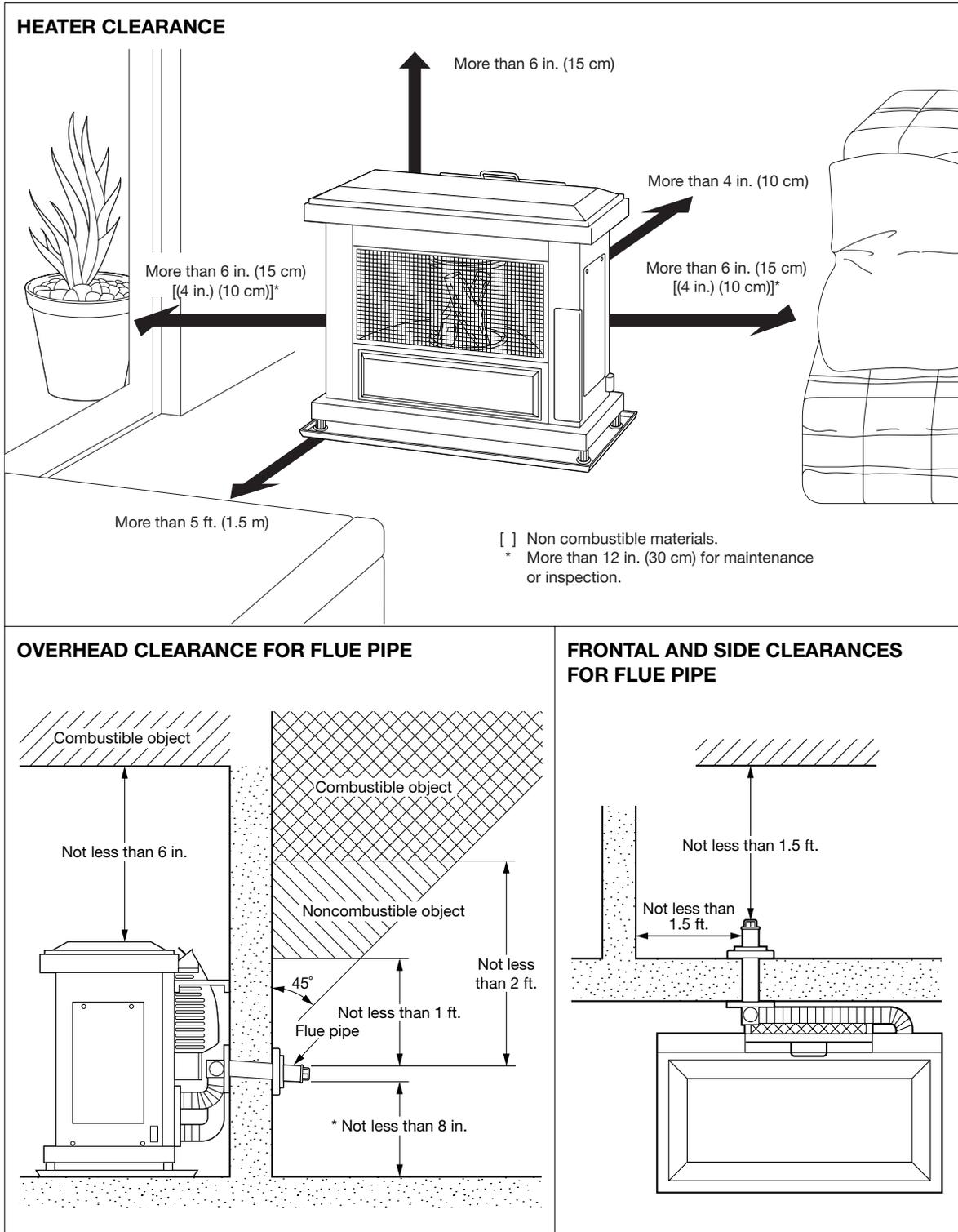


Figure 2-1 HEATER/FLUE PIPE CLEARANCE

# L A S E R   H E A T I N G   S Y S T E M S

## Section 2

## Installation

**IMPORTANT:** In open areas with strong wind, a wind break may be necessary.

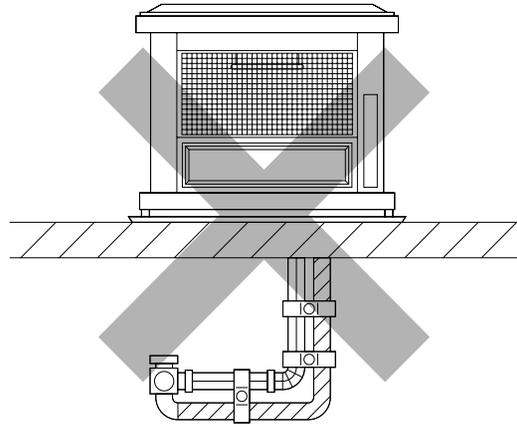
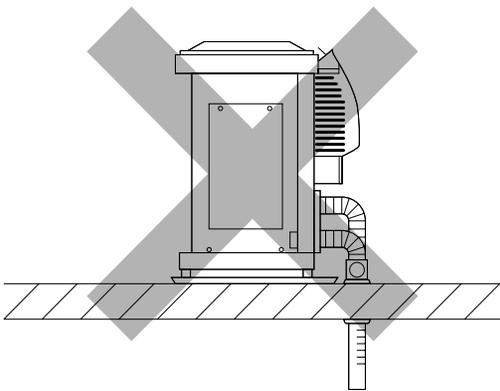
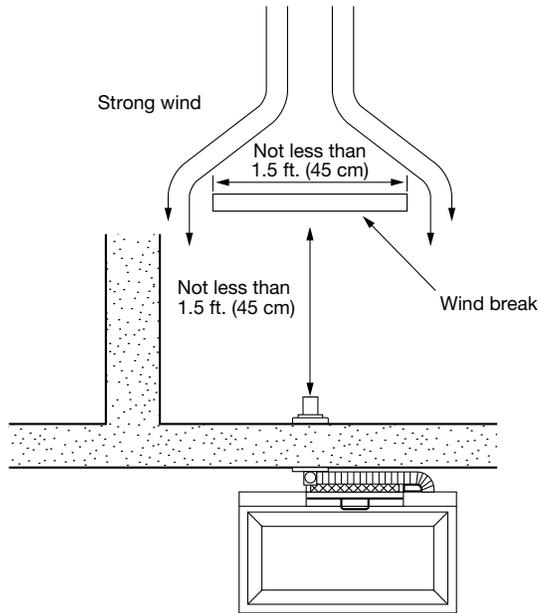


Figure 2-2 WIND BREAK

# L A S E R H E A T I N G S Y S T E M S

## Section 2

## Installation

### 2-9 HEATER INSTALLATION

In choosing a location for your Laser Vented Heater, the following safety tips must be considered.

- Intake and exhaust flue pipe openings must be fully exposed to outside air. Do not vent into garage, basement, under the floor, or into any enclosed area.
- Do not install flue pipe in close proximity to other objects or materials. See Figure 2-1.
- Before making a hole in your wall for the flue pipe, make sure the area is free of electrical wires, gas pipes and other obstacles.
- Do not install flue pipe where it will be exposed to heavy snow, collected leaves or strong drafts. See Figure 2-2.
- Do not install the flue pipe down from the heater.
- Do not install the flue pipe into a chimney.

**NOTE:** After using the installation template as a guide for drilling the flue pipe hole, the Laser flue pipe can be normally installed according to the illustration procedure in the Owner's Manual.

If the template was misplaced or the unit is to be relocated, the approx. flue pipe hole location measurements are as follows:

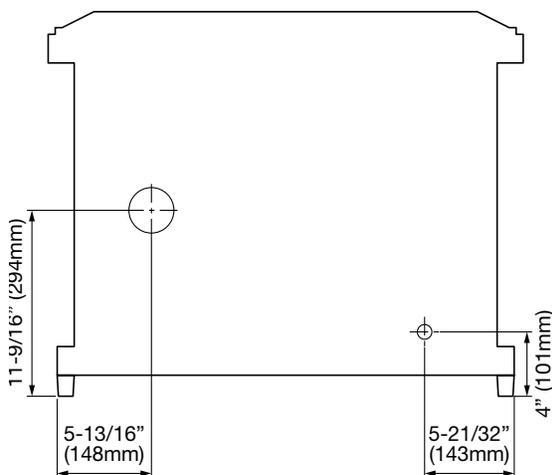


Figure 2-3 TEMPLATE

### 2-10 INSTALLING CERAMIC LOG

- a. Remove four (4) screws from top plate and remove the top plate.

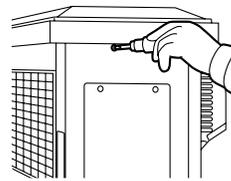


Figure 2-4

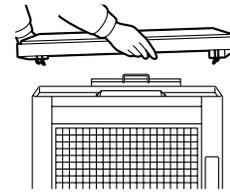
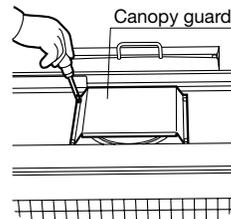


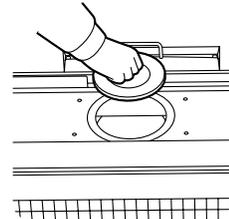
Figure 2-5

- b. Remove four (4) screws from canopy guard and remove the canopy guard. Remove the heat chamber lid from the heat exchanger.



<Canopy Guard>

Figure 2-6



<Heat Chamber Lid>

Figure 2-7

- c. Gently insert the ceramic logs into three (3) brackets inside of burner properly. After inserting the ceramic logs, install log supporter on the upper holes of the ceramic logs. Adjust the log supporter so as to place the logs at the center of the burner.

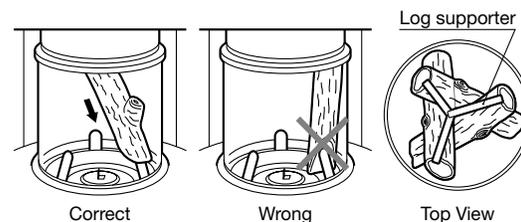


Figure 2-8

## Section 2

## Installation

### 2-11 INSTALLING AN EXTENSION KIT

Extension pipe kits are available in three different lengths. For exact dimensions refer to Table 2-1. Installing an extension pipe kit requires the construction of an intake pipe and the exhaust pipe. The intake pipe is connected between the L-shaped hose at the rear of the heater and the air inlet port on the flue pipe.

Similarly, the exhaust pipe is connected between the bent joint at the rear of the heater, and the exhaust port on the flue pipe.

Extension Kit	Length	Part #
Extension Kit (S)	12-5/8" – 19-5/8" (32 cm – 50 cm)	20479896
Extension Kit (M)	22-1/2" – 39-3/8" (57 cm – 1 m)	20479897
Extension Kit (L)	61-3/4" – 78-3/4" (175 cm – 2 m)	20479898

Table 2-1 EXTENSION PIPE KITS

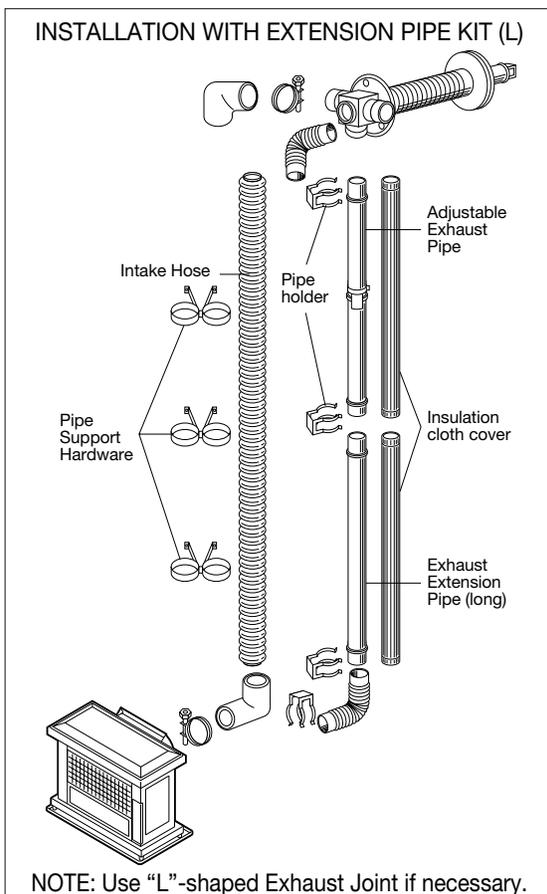
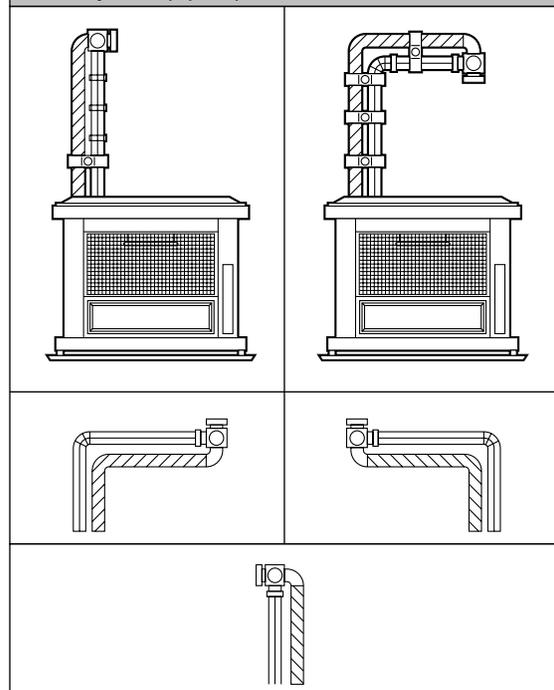


Figure 2-9 EXTENSION PIPE KIT

**IMPORTANT:** The intake hose is longer than the exhaust pipe and may need to be cut to size.

**IMPORTANT:** Total length of extension pipe between heater and flue pipe must be no longer than 10ft. (3 m), and no more than three(3) bends may be used.

• Always set pipes parallel



**IMPORTANT:** Do not run pipes down from heater. (Through floor, for example)

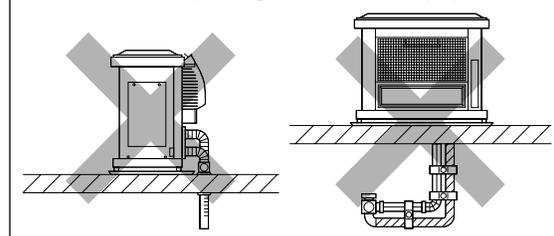


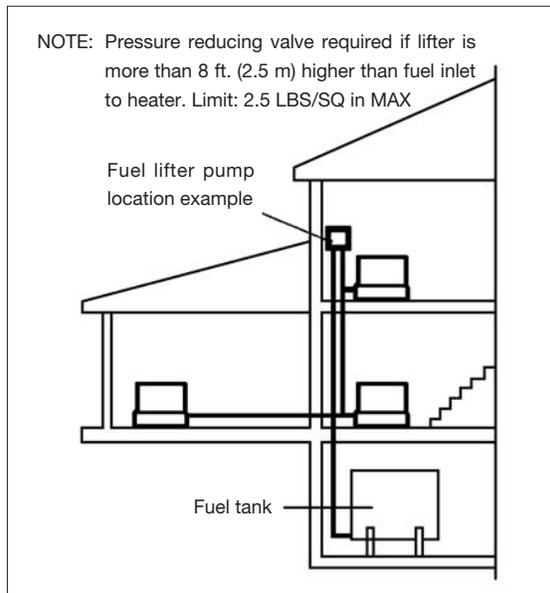
Figure 2-10 INSTALLATION EXAMPLE

## Section 2

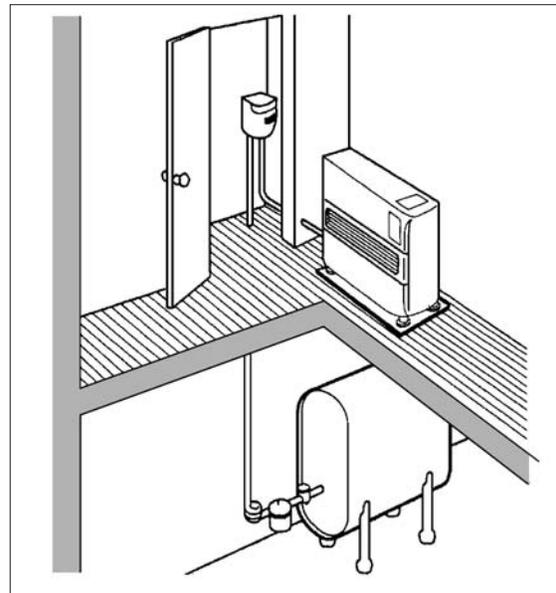
## Installation

### 2-12 TYPICAL FUEL LIFTER PUMP INSTALLATION

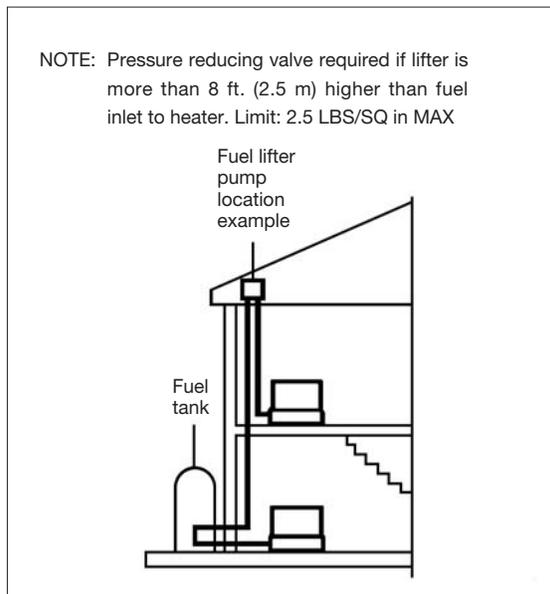
For more detailed information, see a fuel lifter pump manual.



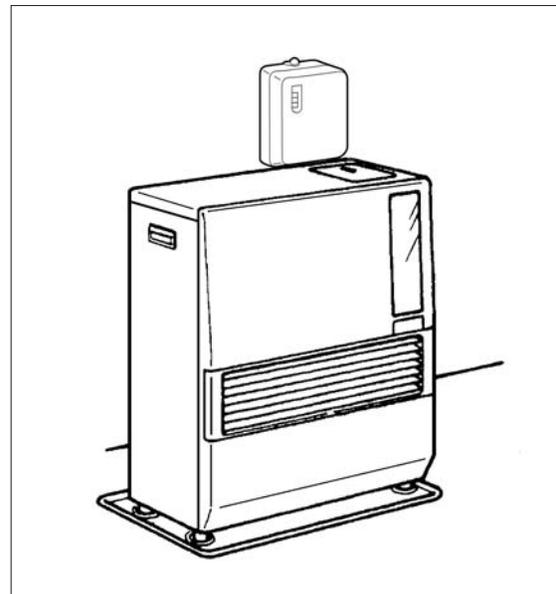
**FUEL LIFTER PUMP**



**FUEL LIFTER PUMP**



**FUEL LIFTER PUMP/GRAVITY**



**FUEL LIFTER PUMP**  
(Can be located behind the heater)

Figure 2-11

## Section 2

## Installation

### 2-13 FUEL TANK INSTALLATION

Fuel tank installation is illustrated (Figure 2-5). Since fuel tank installation techniques vary from place to place (often dependent upon applicable codes), a particular installation procedure cannot be specified. However, certain criteria govern the fuel hook-up of the heater. Use the following check list as a guide to the fuel storage facilities.

**WARNING:** Use only ASTM D3699 1-K Kerosene or ASTM D396 No. 1 Fuel Oil. Never use gasoline, white gas, camp fuel or other flammable liquids. Use of such fuels can result in an explosive fire and cause severe injury.

#### Fueling Options Available

Fueling of the Laser Heating Systems can be accomplished in one of two ways:

1. Gravity-fed large capacity external tank:

Practical for large heating needs where bulk delivery of fuel is available. This system should be installed by a qualified plumber or fuel supply technician.

2. Large capacity external tank with pump (\*):

For large heating needs where a gravity-fed system is not practical, an electric pump (the fuel lifter pump) may be used.

(\*) The inlet pressure to the heater must not exceed 2.5 psi. Use a pressure reducing valve with a 2.5 psi max. rating.

To install a large capacity, gravity-fed external tank, follow the instructions below. Use of a qualified installer is recommended.

- Installation height of the bottom of the fuel tank should be 16 inches (40 cm) or more above the floor surface on which the heater stands. This insures that inlet fuel pressure will be sufficient. The top of the fuel tank should be no higher than 8-1/2 feet (2.6 m) above the floor under the heater. This insures that inlet fuel pressure will not be excessive.

- The horizontal length of piping should not exceed 100 feet (30 m) and should be free of sharp bends or obstructions.
- Piping should include no inverse U-type bends (to avoid air locks, which could block the fuel supply).
- A water block filter recommended for use on the fuel line near tank, and a shutoff valve should be installed on the tank.
- Flare connections should be used at the fusible link valve connection on the heater and at the fuel filter to be installed at the tank.
- Use of a shutoff valve just before line enters building will minimize fuel to be drained should heater require service.
- If fuel line inside building is more than 3 ft. (90 cm), use another shutoff valve for the above reason.
- The fuel tank should be located no closer than 6 feet (1.8 m) to a source of heat.
- The fuel tank should have an opening for filling on the top and a vent with a weather-proof cap on the side. On some tanks the vent and fill spout use the same opening.

**IMPORTANT:** Make sure that fuel line is free from any particles from cutting the fuel pipe. Otherwise it may cause trouble in the fuel sump.

- 3/8" OD copper tubing should be used for fuel line.
- External tank installation must comply with National Fire Protection Association Code NFPA31 or locally applicable codes. Check with local building officials.

# L A S E R H E A T I N G S Y S T E M S

## Section 2

## Installation

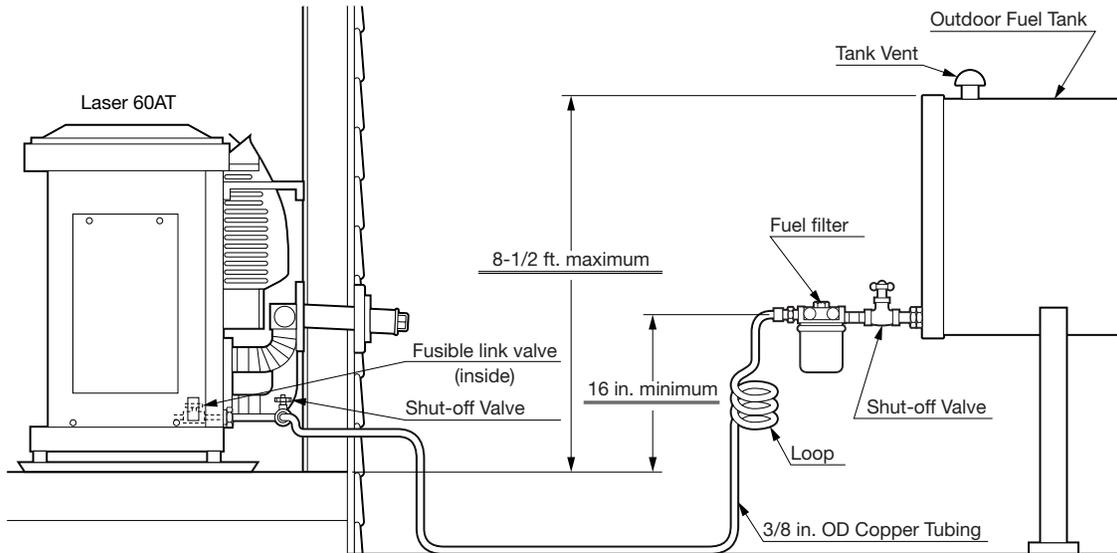


Figure 2-12 FUEL LINE CONNECTION

### 2-14 FOR HIGH ALTITUDE USE

The heater is designed to be used no more than 3000 FT. (900 m) above sea level. No restrictions other than a maximum length of extension pipes of 10 FT. (3m) with three (3) bends up to 3000 FT. (900m) above sea level.

For between 3000 FT. to 6000 FT. (900 m to 1800 m) use, the following procedure should be used:

- Straight - through installation only (no extension pipe).
- Change jumper wire "JX2" (See Fig. 2-13) from "Lo" position to "Hi" position, this will result in reduction of fuel flow of approximately 10% or change wire position to High Altitude post.

**NOTE:** All installations over 3000 FT. (900m) above sea level may require a trimming adjustment of the fuel flow rate on fuel pump.

When you adjust the fuel flow rate, wait until unit has been in high burn mode for 20 min. and follow instructions in this manual.

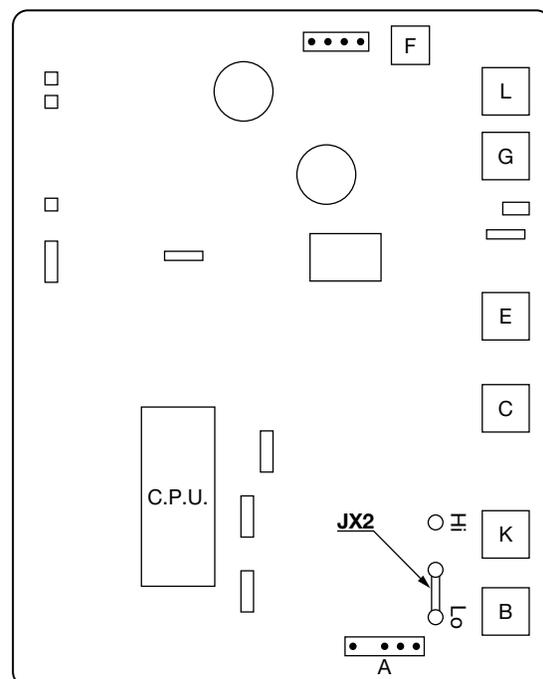


Figure 2-13 MAIN CIRCUIT BOARD

# L A S E R H E A T I N G S Y S T E M S

## Section 3

## Operation

### 3-1 INTRODUCTION

The Laser 60AT is an easy-to-operate vented heater. Routine operation features high BTU output, automatic adjustment of room temperature, low fuel and power consumption, and choice of automatic or manual heater operation.

The section provides all information necessary to operate the Laser Heating System. All operation procedures specified should be performed in the order in which they are described.

### 3-2 OPERATING SPECIFICATIONS

The following specifications apply to the operation of Laser 60AT.

- Rated Efficiency (as applied to kerosene heaters): 93% (\*)
- Rated Efficiency (as applied to central heating system): 86% (\*)
- Power Consumption: as follows.

IGNITION	HIGH BURN	MEDIUM BURN	LOW BURN	OFF
280 watts	76 watts	53 watts	46 watts	4 watts

- Circulation Fan Output: 350/270/185 cubic feet/min. (9.9/7.6/5.2 cubic meter/min.)
- Fuel Source: external tank
- Potential Heating Area: 630 - 2000 SQ. FT. (59 - 186 m<sup>2</sup>).

(\*) The energy from the combustion process is released in the form of heat and vaporized water. Normally, heating systems discharge water from combustion to the atmosphere without condensing it. The 93% efficiency rating means that, assuming the water cannot be condensed, 93% of the heat produced by the combustion process is recovered. Assuming the water can be condensed, the efficiency is 86%.

**NOTE:** Actual effective heating area depends upon numerous factors such as type and severity of climate, type of dwelling construction, condition of dwelling, and thickness and effectiveness of dwelling insulation.

Table 3-1 lists Laser 60AT performance specifications at user-selected heat output settings.

**Table 3-1 HEATER PERFORMANCE SPECIFICATIONS**

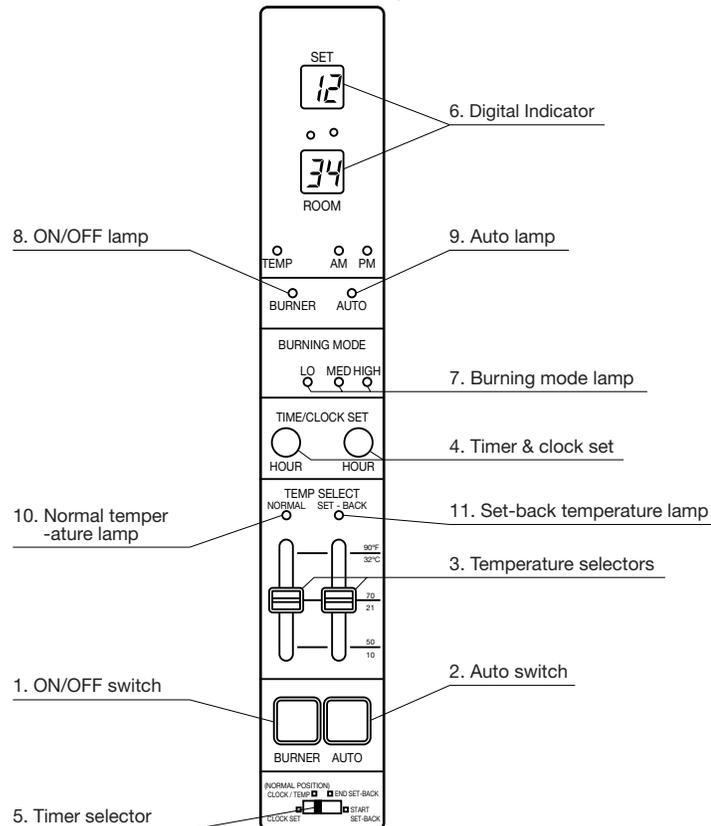
Specifications for Laser 60AT	Setting		
	Low	Medium	High
Rating (BTU/hr)	12,000	21,000	30,000
Fuel consumption (gal/hr)	0.095 (0.36 L/hr)	0.161 (0.609 L/hr)	0.23 (0.871 L/hr)
8-hrs/day burntime (5-gal.tank) (18L tank)	6.6 days	3.9 days	2.7 days
Continuous-use burntime (5-gal.tank) (18L tank)	52.6 hrs	31.1 hrs	21.7 hrs
8-hrs/day burntime (55-gal.tank) (200L tank)	72.4 days	42.7 days	29.9 days
Continuous-use burntime (55-gal.tank) (200L tank)	24.1 days	14.2 days	10.0 days
8-hrs/day burntime (275-gal.tank) (1000L tank)	361.8 days	213.5 days	149.5 days
Continuous-use burntime (275-gal.tank) (1000L tank)	120.6 days	71.2 days	49.8 days

## Section 3

## Operation

### 3-3 OPERATING CONTROLS AND INDICATORS

The following operating controls are used to run the heater and you monitor its performance by indicator lamps.



**Figure 3-1 CONTROL PANEL**

#### 1. ON/OFF switch:

Main switch to turn heater burner on and off. When pressed "ON", the heater begins operation and combustion starts after 3 - 9 minutes preheat period. Heater will run at 4 stages "High", "MEDIUM", "LOW" and "OFF".

#### 2. Auto switch:

The switch turns automatic operation mode on and off which have been programmed into timer.

#### 3. Temperature selectors:

"NORMAL" and "SET-BACK" temperature selectors allow user to select desired temperature during manual or automatic operation. And it's easy to adjust.

#### 4. Timer & clock set:

Timer and clock set modes can be set by pressing hour or minute buttons.

#### 5. Timer selector:

When you program the timer, you have to slide timer selector at each position and always return it to "CLOCK" position for timer indicator.

Start time and end time of "SET-BACK" are also set by this switch.

#### 6. Digital indicator:

Displays clock, set temperature, room temperature and error code.

#### 7. Burning mode lamps:

Indicate whether heater is operating at "HIGH", "MEDIUM", or "LOW" combustion. All burning mode lamps will be off in the "OFF" cycle.

#### 8. ON/OFF lamp:

Lights on when heater is in operation and flash when heater is in prepurge or postpurge.

#### 9. Auto lamp:

Lights on when automatic operation is in use.

#### 10. Normal temperature lamp:

Lights on when heater runs with manual or in "NORMAL" mode of automatic operation.

#### 11. Set-back temperature lamp:

Lights on when heater runs with "SET-BACK" mode of automatic operation.

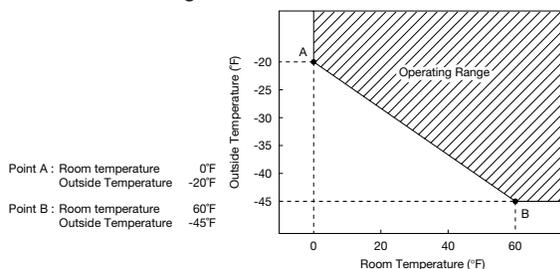
## Section 3

## Operation

### 3-4 PRE-OPERATION CHECK LIST

After heater installation, but prior to the Laser Heater start-up, inspect the system for operational readiness. The following check list specifies those items that should be inspected on a routine basis:

- Check that the Laser Heater is plugged into correct electrical outlet.
- Verify that adequate supply of fuel is available in fuel tank.
- Confirm that fuel is free of water or other contaminants.
- Check fuel tank for good operating condition; it must be free of rust, corrosion, and/or leaks.
- Inspect fuel line for signs of leaks, loose connections, cracks, air pockets or blockages.
- Confirm that fuel valves on fuel tank and fusible link valve are open so fuel can flow freely.
- Outside dwelling, check area immediately around flue pipe for combustibles or obstructions to free air circulation.
- Inspect intake air line for cracks, loose connections or blockage.
- Check exhaust air line for cracks, loose connections or blockage.
- At rear of heater, verify that the air flow to the air circulation fan is not blocked.
- Inspect dwelling interior and confirm that immediate area near heater is free of combustibles and objects that might interfere with free air flow.
- Make sure that room sensor is not exposed to drafts, direct sunlight, or direct heat from the Laser.
- Use the heater only with in the range of temperatures indicated in Fig. 3-2.



**Figure 3-2 OPERATING TEMPERATURE RANGE**

If this inspection reveals any system deficiencies, correct the problems before operating the heater.

### 3-5 BEFORE OPERATION

#### STEP1: Open the Valve(s)

Open the valve(s) for the external fuel tank and fusible link valve of the heater.

#### STEP2: Start the Fuel Flow

Gently press the red reset button one time for a period of one second in order to release the float of the fuel sump.

**NOTE:** Resetting the fuel sump is necessary only if the heater is being started for the first time, or after heater has been out of fuel, or if it hasn't been used for an extended period of time. It may also be required if fuel inlet pressure exceeds 2.5 psi. In this case a pressure reducing valve must be installed.

#### STEP 3: Plug in the Heater

Plug heater into an electrical outlet.

Do not connect to an outlet shared with other appliances.

**NOTE:** In areas of frequent power outages or lightning strikes it is advised that a surge suppressor be used.

#### STEP4: Set Clock

**IMPORTANT:** Clock on the heater always must be set to current time.

- A. Position timer selector to "CLOCK SET".
- B. Press "HOUR" and "MINUTE" button of TIMER/CLOCK SET to correct time.

**IMPORTANT:** Be sure to clock for the AM or PM indicators, to insure the correct time.

**NOTE:** "HOUR" or "MINUTE" button will change the time every one (1) unit. Holding the button continuously will cause the time to change rapidly.

**NOTE:** In the event of a power failure over ten (10) seconds, all clock and timer setting are cancelled. Digital indicator will flash "PM12:00" when heater is on off, "AUTO" lamp will flash when heater is on and in automatic operation, after power is restored. However, no indications when heater is in manual operation mode. At this point, all time and "SET-BACK" functions must be reset. Otherwise the heater will automatically restart and run at "NORMAL" mode.

- C. Position timer selector to "CLOCK/TEMP (NORMAL POSITION)" after clock setting is completed. Current time will be shown on the digital indicator.

## Section 3

## Operation

### 3-6 OPERATION

Operation of Laser Heater can be controlled manually by the user; — “MANUAL” operation (NORMAL mode only) or run automatically by the programming. — “AUTOMATIC” operation (“NORMAL” mode and “SET-BACK” mode). Paragraphs 3-7 through 3-10 provide the details of heater start-up, operation and shutdown. The controls and indicators illustrated by Figure 3-1 are used to operate the system and Laser Heater’s performance.

### 3-7 MANUAL OPERATION

**NOTE:** “MANUAL” operation means that the set back will not be in use but in “NORMAL” mode.

Operation of the heater is under the direct control of the user (“AUTO” switch is off). Heat output will, however, be automatically adjusted in accordance with the room temperature registered by the temperature sensor.

#### STEP1: Select Manual Operation

If heater operation is in “AUTO” operation, pressing the “AUTO” switch to “OFF” position will change heater to “MANUAL” operation.

#### STEP2: Turn Heater ON

Push in ON/OFF switch to “ON” position. The current room temperature and the set temperature will be shown on digital indicator. ON/OFF lamp will start to flash and then blower motor and ignition will start.

**NOTE:** Heater will not start when room temperature is higher than the desired temperature setting.

Burning mode lamp “MED” will start to flash after approx. 3 - 9 minutes. (\*) Fuel pump will start at this time. After ignition, burning mode lamp “MED” will change from flashing to continuous. And, after 10 seconds, burning mode lamp will turn to “LOW” and heater will start “LOW” burning mode. Circulation fan will turn on after approx. 3 minutes.

**NOTE:** (\*)Pre-heating time depends on the room temperature.

Room temperature:  
 below 34°F (0°C) — 9 minutes  
 34°F to 61°F (0°C - 15°C) — 6 minutes  
 over 61°F (15°C) — 3 minutes

**NOTE:** If flame is not detected after the pre-heating time, the heater will stop and then restart automatically one more time. At this time, if

flame is not detected, the heater will turn off and must be manually restarted.

Heater will operate at “LOW” or “MED” burning mode for approx. 6 minutes after ignition, regardless of temperature control setting. Heater will not get into “HIGH” burning mode while the prepurging is in effect. After this period, output can be adjusted as desired, by using the “NORMAL” temperature selector.

#### STEP3: Adjusting Room Temperature

Slide “NORMAL” temperature selector to set the room temperature desired.

**NOTE:** Desired temperature setting will be displayed on the digital indicator when you set the room temperature. The scale on temperature selector is just for your reference. The figures on the digital indicator and on the scale may not match exactly; this is normal.

Burning mode will be regulated automatically in accordance with the room temperature registered by the room temperature sensor. Heater will operate at “HIGH” burnig mode until room temperature reaches the selected temperature level.

When room temperature reaches the selected setting, heater will automatically shift to “MED” or “LOW” burning mode to maintain the desired temperature.

When room temperature exceeds the selected setting by approx. 4°F (2°C), the heater will automatically shut off. As room temperature drops, the heater will automatically re-start to maintain the desired temperature.

**NOTE:** Burning mode lamps indicate at which burning mode the heater is operating at any given time. The heater shifts automatically between “HIGH”, “MED” and “LOW” burning modes to maintain the desired temperature.

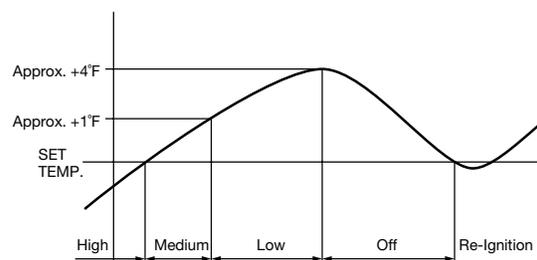


Figure 3-3

## Section 3

## Operation

### 3-8 AUTOMATIC OPERATION

Automatic operation is established by programming the time/temperature settings for specific time.

“SET-BACK” mode operation will be programmed in a 24-hour period. It is designed for energy efficiency by using a lower temperature setting, generally at night.

Ex.

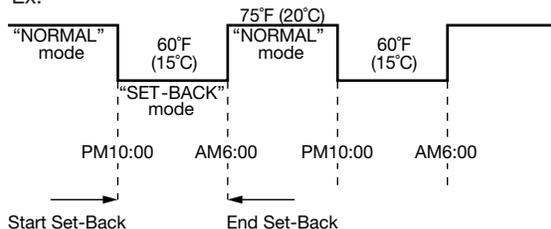


Figure 3-4

Proceed with the automatic mode operation in the following manner:

#### STEP 1: Set Start Time of “SET-BACK” Mode

- Slide the timer selector to “START SET-BACK”.
- Press “HOUR” and “MINUTE” to set desired start time.

**IMPORTANT:** Be sure to set clock for AM or PM as appropriate.

**NOTE:** When setting “SET-BACK” time, the “MINUTE” button will advance time by ten (10) units. (Ex. 10:00, 10:10, 10:20, etc.)

- Start time of “SET-BACK” mode will be shown on digital indicator. (Ex. PM 10:00)

#### STEP 2: Set End Time of “SET-BACK” Mode

With the timer selector slide switch in the “END SET-BACK” positions, program the end time as described above. (Ex. AM 6:00)

**IMPORTANT:** Always return timer selector to “CLOCK/TEMP (NORMAL POSITION)” after settings.

#### STEP 3: Set Room Temperature

- Slide “NORMAL” temperature selector and “SET-BACK” temperature selector at the position you desire. (Ex. “NORMAL” - 75°F(20°C), “SET-BACK” - 60°F(20°C))

**NOTE:** The temperature setting currently being used is displayed on the digital indicator. To view and set the Set-Back temperature setting, press the “MINUTE” button for more than three (3) seconds. The display will go back to the Normal temperature setting after ten (10) seconds.

- Push in AUTO switch to “ON” position.

#### STEP 4: Turn Power ON

Press ON/OFF switch to “ON” position. ON/OFF lamp will start to flash and AUTO switch lamp will light. And then blower motor and ignition will start.

**NOTE:** “SET-BACK” OPERATION IRREGULARITIES

If a heater is switched “OFF”; if the “AUTOMATIC” operation is switched off; or there is a power interruption while the unit is operating in the “SET-BACK” mode, the “SET-BACK” mode may be temporarily disabled until the next Start Set-Back time.

### 3-9 REPROGRAMMING THE LASER HEATER

On occasion, it may be necessary to reprogram the Laser. In reprogramming of timer, follow the steps described above. For adjusting the temperature, slide the temperature selectors at the positions you desire on both “NORMAL” and “SET-BACK” temperature selectors.

## Section 3

## Operation

### 3-10 ROOM TEMPERATURE SENSOR (THERMISTOR)

A room temperature sensor is provided with approx. 8 feet (2.5 m) of extension wire. It is located on the rear of the cabinet. Make sure that the extension is not touching the exhaust pipe. The room temperature sensor can be installed with the self adhesive tape on the back or with the wood screw provided with the sensor, depending on the type of surface chosen for installation.

**NOTE:** Choose an installation location for the sensor that is not in the path of direct sunlight, drafts or the flow of warm air from the heater.

### 3-11 TURNING HEATER OFF

Press ON/OFF switch to "OFF" position. (Auto lamp, temperature lamp will go out. Burning mode lamp will flash until flame disappears. Circulation fan and blower motors continue to run for approx. three (3) minutes to cool down the heater. Make sure ON/OFF lamp goes out when the fan stops.

**NOTE:** If ON/OFF switch is pressed to "ON" position during the cool down period, the heater will automatically re-start at the end of cool down period.

**NOTE:** Disconnect the heater plug from the electrical outlet after the power lamp has turned off if the heater will go unused for a prolonged period. The plug should also be disconnected during electrical storms.

### 3-12 MANUAL COMBUSTION SYSTEM FOR TESTING PURPOSES

The Laser 60AT can also be kept burning at designated burning mode (HIGH, MEDIUM or LOW) manually, regardless of room temperature. This feature will be used mainly for the purpose of testing the heater.

**STEP 1:** Press both the "HOUR" and "MINUTE" buttons at the same time for more than three (3) seconds when ON/OFF switch is "ON".

**STEP 2:** P1, P2 or P3 will be displayed on the digital indicator:  
P1 = Low burning mode  
P2 = Medium burning mode

P3 = High burning mode

Then change the desired burning mode manually pressing either "HOUR" or "MINUTE" button.

**STEP 3:** To clear the manual function, press both the "HOUR" and "MINUTE" buttons at the same time for more than three (3) seconds until setting and room temperature display will be shown on the digital indicator.

### 3-13 POWER FAILURE RECOVERY SYSTEM

When an electric power failure occurs while the heater is in operation, all electrical systems will be automatically shut off. However, when the power is restored, the heater will automatically be re-ignited and operated to maintain the "NORMAL" thermostat setting temperature.

**NOTE:** The clock setting and set-back timer program will be erased if the electric power failure exceeds 10 seconds and AUTO lamp will flash when the power is restored. The clock setting and set-back timer should be reprogrammed for use when the power is restored. Follow the same procedure as described on pages 18 and 20.

**NOTE:** If a short brown-out occurs and the flame sensor continues to detect a flame, when power is restored only the blower and circulation fans will restart. The "HIGH", "MED" and "LOW" burning mode lamps will flash simultaneously. (The igniter will not be activated.)

### 3-14 RECOVERY FROM OVERHEAT CONDITION

The Laser 60AT is protected against damage resulting from an overheat condition by an automatic thermostat.

This will occur if the temperature inside the cabinet exceeds 195°F (90°C).

**STEP 1: Switch OFF Heater**

**STEP 2: Allow Laser Heater to Cool Down**

**NOTE:** Be sure that heater is cool to touch. A period of 30 to 45 minutes should be sufficient to permit the heater to cool completely.

# L A S E R   H E A T I N G   S Y S T E M S

## *Section 3*

## Operation

### **STEP 3: Unplug Heater**

Disconnect heater plug from outlet.

### **STEP 4: Check for Cause of Overheating**

**NOTE:** Over heating is usually caused by objects that impede free air circulation.

Look for debris and other obstructions in front of heater; near the circulation fan at rear of the heater; and at the flue pipe top just outside the dwelling.

### **STEP 5: Clean Circulation Fan Cover**

### **STEP 6: Remove Front Panel Assembly and Top Plate**

### **STEP 7: Clean Heater Interior**

**WARNING:** Before proceeding to clean heater, be sure that the heater interior is cool enough to touch.

With a clean, lint-free, damp rag or other appropriate cleaning material, wipe all dust, dirt and debris from exterior of cabinet, including the exterior of the heat chamber and the heat exchanger.

### **STEP 8: Replace Front Panel Assembly and Top Plate**

### **STEP 9: Reconnect Laser Heater Power Plug to the Electrical Outlet**

### **STEP 10: Switch ON Heater**

### **STEP 11: Reprogram**

### **STEP 12: Re-set the Timer**

**CAUTION:** Upon the completion of recovery procedure, if the heater overheats again, something is wrong!  
Do not operate heater until condition has been corrected.

# L A S E R   H E A T I N G   S Y S T E M S

## Section 4

## Maintenance

### 4-1 INTRODUCTION

Heater maintenance is divided into two classifications; routine maintenance, which is required to keep the heater in good operating condition; and corrective maintenance, which is necessary in repairing any malfunctions.

At the time of the demonstration or installation, heater maintenance should be discussed with the user; emphasize that a clean heater and proper fuel are the keys to optimum heater operation and performance.

**CAUTION:** Be sure to unplug the heater before checking or cleaning the unit.

### 4-2 ROUTINE MAINTENANCE

The maintenance schedule provided in Table 4-1 describes the tasks that must be performed periodically for optimum heater performance.

**CAUTION:** Allow the heater to cool completely before cleaning or maintaining.

**Table 4-1 SUGGESTED ROUTINE MAINTENANCE**

ACTIVITY	MATERIAL	REMARKS
Check all fuel lines for leaks and loose connections.	3/8" OD copper tubing	Fuel lines must be secure and free of leaks. Replace tubing if necessary.
Inspect exhaust lines for leaks or loose connections.		All exhaust pipes must be covered by an insulating cloth cover.
Check fuel for water and/or other contamination.		Fuel filter or water block filter on the fuel line is recommended.  If fuel contaminated, see corrective maintenance procedure, paragraph 4-7.
Inspect the fuel pipe for obstruction.		The piping should be free of sharp bends or obstructions. Air locks could block the fuel supply.
Inspect the electrical wiring for cracks, signs of deterioration, bare wires and/or loose connectors.		
Clean the grille. (once a week)	Use a clean, lint-free cloth and a non-abrasive household cleaning agent. USE ONLY NON-PETROLEUM DISTILLATE CLEANERS.	Wipe off grille. Vacuum inside of heater if necessary.
Clean the room air circulation fan and the circulation air filter. (once a week)		Vacuum filter. Wipe off fan blades.
Check the flue pipe area. (once a week)		Check the flue pipe joint to make sure connection is firm. Use a vacuum cleaner to remove any dust or pet hair. Also make sure that the top flue pipe will not be covered by any obstacles.
Clean fuel inlet strainer of fuel sump. (once a week)		Refer to paragraph 4-5.

# L A S E R H E A T I N G S Y S T E M S

## Section 4

## Maintenance

ACTIVITY	MATERIAL	REMARKS
Inspect the burner ring, and the flame sensor. (at least every year)		Clean all carbon deposits. Replace if excessively warped or cracked.  NOTE: If any gaskets are torn when components are removed, the gasket must be replaced.
Clean the heat chamber and the burner assembly. (at least every year)		Brush scrape and vacuum all carbon deposits from the interior of the heat chamber and burner air holes. Clean all carbon on the burner bottom. Use a small, stiff brush or a short piece of soft copper wire to clean any blocked air holes.
Clean the igniter.		Gently scrape any carbon deposits from igniter.  WARNING: Be careful when you remove igniter, it may be difficult to loosen and may crack.
Check air line and blower motor assembly. (at least every year)		Replace the air line if it is worn or broken. Also, clean the exhaust fan if necessary.
Check for carbon build-up on or inside fuel nozzle. (every year)		Disconnect the fuel pipe assembly from the fuel nozzle. Clean inside the nozzle with the proper sized iron straight wire.  CAUTION: If any obstruction is felt, remove fuel nozzle before proceeding.

### 4-3 INSPECT INTAKE/EXHAUST AIR LINES

Verify that all intake/exhaust air lines are free of leaks and that there are no loose connections, as specified below:

#### STEP 1: Remove Insulating Cloth Cover

Remove the insulating cloth covers from all exhaust lines.

#### STEP 2: Inspection of Intake/Exhaust Air Lines

- A. Visually inspect both the intake air and exhaust lines for obvious cracks, leaks or loose connections. Black carbon deposits may be evidence of leakage.
- B. Be sure that all lines are installed tightly and securely, especially at the joints.

C. Turn heater to "ON".

D. Carefully apply a small amount of soapy water (with a paint brush) to the surface areas and joints of the intake/exhaust air lines.

Any leaks that may exist will be readily identified by the appearance of bubbles.

#### STEP 3: Return to Operating Condition

- A. Turn heater to "OFF".
- B. Dry all lines with paper towels.
- C. Repair any leaks that have been found (if necessary, replace the tubing or O-ring).
- D. Replace insulating cloth covers.

## Section 4

## Maintenance

### 4-4 VERIFY IGNITER OPERATION

Visually inspect igniter operation.

**WARNING:** Heater is operational during this inspection, Avoid direct contact with any heated or electrical component.

#### STEP 1: Prepare for Inspection

Remove grille and front panel assembly.

#### STEP 2: Visual Inspection

- A. Remove the igniter half way.
- B. Turn heater to "ON".
- C. Igniter should start to glow red within 30-40 seconds.  
If the igniter does not glow red, check for power at 120V AC and resistance 17 to 19Ω at room temperature of 73°F (23°C).

**CAUTION:** If igniter malfunctions, do not turn the heater to "ON" repeatedly. Otherwise, excess fuel may drain in the burner pot.

#### STEP 3: Reassembly of Heater

Turn the heater to "OFF" and replace the front panel assembly and the grille.

### 4-5 CLEAN FUEL INLET STRAINER

Contaminants are trapped by the fuel inlet strainer to prevent them from clogging the fuel constant level valve (fuel sump).

The fuel inlet strainer, itself has a great number of small pores. Whenever a strainer is torn or disfigured (enlarged pores), it should be replaced immediately.

Check and clean the fuel strainer (once a month).

The strainer of the fuel sump should be cleaned once a month and before storing heater at the end of each season.

**WARNING:** Close the fusible link valve on the heater or close the shut-off valve of the external fuel tank to avoid draining all the fuel from the tank.

**NOTE:** Power should be "OFF" during the performance of this procedure.

#### STEP 1: Disassembly

- A. Loosen the two screws from the strainer cover and remove.

**NOTE:** To catch the fuel which will drain, set the oil catch or the pasteboard below the cover, with a small container under it.

- B. Carefully remove the strainer gasket which is located behind the strainer cover.

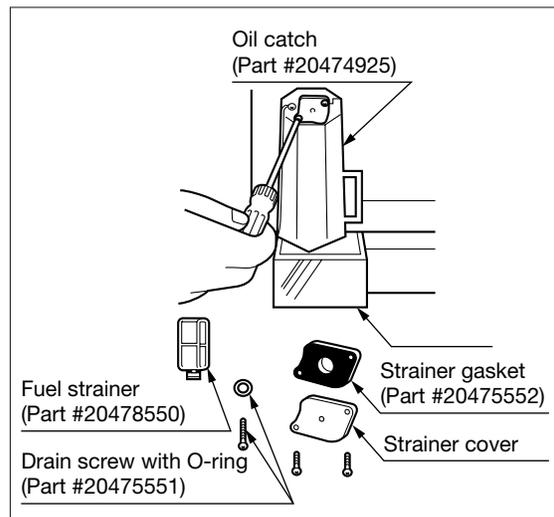


Figure 4-1 CLEAN FUEL INLET STRAINER

#### STEP 2: Inspection and Cleaning

- A. Pull the fuel strainer out of the fuel sump.
- B. If the strainer is dirty (but undamaged), rinse the fuel strainer in fresh, clean kerosene to remove all particles. Replace the fuel strainer if necessary.
- C. To drain the upper portion of the fuel sump, carefully unscrew the drain screw (phillips head screw) which is located slightly above and to the left of strainer cover.  
(See Fig. 4-1.)

## Section 4

## Maintenance

### STEP 3: Reassembly

- A. Push the new cleaned fuel strainer back into the bottom of the fuel sump.
- B. Replace both the strainer gasket and the strainer cover if necessary.

**NOTE:** Take care to properly align the screw holes in the gasket and strainer cover.

- C. Wipe up any spilled fuel.

**NOTE:** Be sure to unscrew the drain screw to remove all the remaining fuel from the fuel sump at the end of each season.

### 4-6 REPLACEMENT OF FUSES

A short circuit or similar electrical malfunction could cause a fuse to blow. Troubleshoot the cause of the blown fuse.

Replace the fuse as follows:

**WARNING:** Do not replace fuses while power is "ON".

### STEP 1: Removal of Fuse

- A. Unplug the heater. Remove the access panel.
- B. Remove the fuse from fuse holder, located on the main circuit board.

### STEP 2: Installation of New Fuse

- A. Install new fuses into the fuse holder. The fuses must be a 125V, 10 amp type and a 125V, 3 amp type as marked on the main circuit board. Do not use oversized fuses.
- B. Replace the front panel assembly and plug the heater into the electrical outlet.

**IMPORTANT:** Whenever the heater is unplugged, the timer must be reprogrammed after the power is restored.

### 4-7 FUEL CONTAMINATION

Fuel contamination is often difficult to diagnose, even though it will adversely affect the heater operation and performance. The best course of action to take when fuel contamination is suspected is to examine all of the system's fuel filters, beginning with the fuel storage tank. If a fuel lifter pump is part of the fueling system, examine and clean the unit's filter, as well as the strainer located in the fuel sump.

When it has been determined that water or some other contaminant has infiltrated the fuel, the following procedure should be used:

**WARNING:** Before proceeding further, unplug the heater.

### STEP 1: Remove Contamination

- A. Close the fuel valve of the tank and the fusible link valve on the heater.
- B. Drain the contaminants from the external tank. Refill with fresh, clean fuel.

### STEP 2: Clean the Heater

- A. Clean the fuel inlet strainer inside of the fuel sump.
- B. Remove the grille, the front panel assembly and the fuel pump on the fuel sump. Clean the fuel pump filter.
- C. Using clean paper towels, thoroughly wipe the bottom of the burner, the burner ring, the flame rod sensor, and the combustion chamber.

### STEP 3: Reinstall Cleaned Components

- A. Replace the components correctly and install a new gasket, if necessary.
- B. Open the fuel valve on the external tank and the fusible link valve; replace all covers and supply power to the heater.

If the problem still exists and contaminated fuel is suspected, check the fuel filter. The fuel filter or the water block filter in the fuel line is always required to minimize any fuel contamination.

Test run the heater to see if the problem clears up, using new clean fuel.

## Section 5

## Servicing

### 5-1 INTRODUCTION

Servicing is required when the Laser 60AT is not running at proper efficiency. This section covers the possible causes and the corrective procedures for efficiency losses. Signs of improper heater efficiency and performance would be:

- A yellow, high flame.
- A whistling noise.
- Smoke from the flue pipe exhaust .
- Heavy soot and carbon build up in burner, heat chamber or exchanger.
- Lowered heat output.
- Failed ignition.
- Failure to maintain combustion.
- Noise from the blower motor.

### 5-2 CLEANING THE GLASS CYLINDER AND BURNER

Under normal running conditions, very little soot will be formed inside the burner. A light covering of soot will not affect the performance of the heater. Thus the heater should not need cleaning. If a heavy soot build up occurs, follow the outlined steps for opening and cleaning the heater.

The burner is assembled using gaskets to maintain its air-tightness. If these gaskets are damaged, the air may cause soot and/or cause noise.

**NOTE:** When cleaning the burner, it is recommended to slide the heat chamber gasket onto a piece of cardboard. Or replace the gaskets, if necessary, carefully remove the gaskets because they are easy to break.

1. Remove top plate.
2. Remove top heat shield.
3. Remove heat exchanger.
4. Remove glass cylinder.
5. Remove ceramic logs.
6. Remove reflector.
7. Remove flame rod sensor.
8. Turn burner ring counter-clockwise to remove. Burner ring is secured on three burner side pins. If burner ring does not turn, pull it up slightly to loosen spring clips.

9. Clean inside of glass cylinder by using a cloth. Use wire brush to clean burner air holes. Clean all carbon on the burner bottom by using a flat-bladed screw driver or wire brush. Vacuum all carbon deposits and wipe clean.

**NOTE:** Make sure that all air inlet openings are clear.

10. The burner ring may deform and deteriorate after several years of use and should be cleaned and inspected before reinstallation. If burner ring is badly warped, cracked or deteriorated, it should be replaced.

**NOTE:** A bent burner ring may cause abnormal combustion with uneven and/or yellow flames extending into the chamber.

When replacing the burner ring, carefully ensure that all three burner side pins are correctly engaged inside the burner.

11. Reinstall the glass cylinder and the flame rod sensor in the correct position.

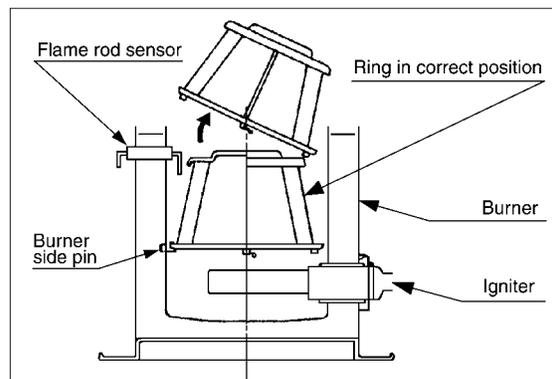


Figure 5-1

### 5-3 REMOVAL OF WATER DEPOSITS AND CONTAMINANTS FROM FUEL SUMP AND FUEL LINES

Unplug the Laser 60AT from the power supply before proceeding.

1. Shut off the fusible link valve and the shut-off safety valve. Also, shut off the valve of the external tank.
2. Remove the fuel pipe from the burner and the fuel pump, and drain the fuel into a pan.
3. Once the lines are clear, reconnect the fuel pipe, open all valves and turn the ON/OFF switch to "ON". Proceed with a test run.

**NOTE:** A water block fuel filter is recommended on the fuel line from the tank.

## Section 5

## Servicing

### 5-4 MEASUREMENT OF FUEL FLOW RATE

The fuel pump for the Laser is the electro-mechanical (solenoid) type. Great care should be taken to clean the pump thoroughly. (Even barely visible particles can affect the fuel flow.) Disconnect the lead wires from the pump controller and remove the fuel pump from the fuel sump. Clean the intake mesh filter and the outlet opening with clean kerosene.

**NOTE:** Do not take the fuel pump apart. If the fuel pump malfunctions, replace the pump.

#### STEP1: Measuring the Fuel Flow Rate

- Disconnect the fuel pipe from the fuel nozzle and leave. Rotate the pipe 180 degrees so that the fuel outlet of the pipe can be exposed. See Figure 5-2.
- insert the fuel outlet of the fuel pipe into the measuring cylinder (100 or 250 ml.), keeping the fuel outlet at the same level as the original (fuel inlet of the fuel nozzle). See Figure 5-2.

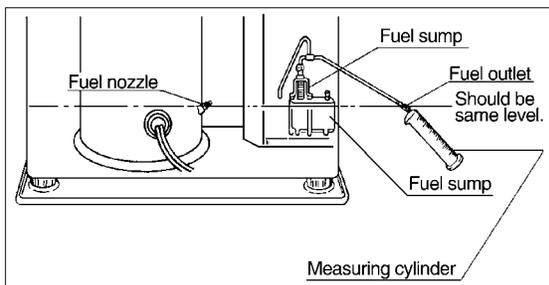


Figure 5-2

- Disconnect the igniter lead wire terminal (G) from the main circuit board.
- Press the ON/OFF switch to "ON" (do not turn on "AUTO" operation). The fuel pump will start in approx. 3-9 minutes after the ON/OFF switch is turned to "ON". The burning mode lamp "MED" will start to flash when the pump starts.
- Connect equivalent flame circuit between flame sensor (at the burner) and ground (metal part of the heater). Use alligator clips at this time. See Figure 5-3.

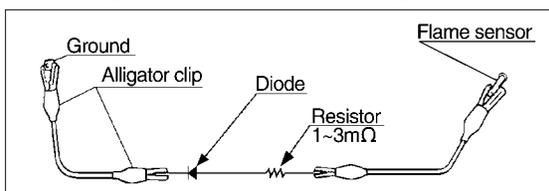


Figure 5-3

- Burning mode lamp "MED" will change from flashing to continuous. After this period, heater will operate at "LOW" or "MED" burning mode for approx. 6 minutes regardless of temperature control setting. Then pump will be switched to the "HIGH" mode and burning mode lamp "HIGH" will light.

- Select the desired fuel flow mode with manual combustion system.

Press and hold "HOUR" and "MINUTE" buttons, at the same time, for 2-3 seconds.

"P-1", "P-2" and "P-3" will appear in display (1- Low; 2-Medium; 3-High).

Advancement can be made by pushing "HOUR" button.

**NOTE:** Always check "P-1" (Low burning) first. This will eliminate 20 minutes adjusting period.

- Wait (for approx. 2-3 minutes) until the pump becomes stable before checking the fuel flow rates. Take the average fuel flow rates by the minute. For example, if the high fuel flow rate for five minutes is 52cc, the average of the high fuel flow rate per minute becomes 10.4cc.

$$52\text{cc} \div 5\text{min.} = 10.4\text{cc/min.}$$

Table 5-1 FUEL FLOW RATE (cc/min.)

Low	Medium	High
6.0	10.2	14.5

- Pushing "HOUR" and "MINUTE" buttons for 2-3 seconds will return heater to normal operation.

#### STEP2: Readjustment of the Fuel Flow

**IMPORTANT:** This should be performed only when required.

First check to see that the correct air damper is used or the flue pipe system is properly installed before readjusting the fuel flow.

The heaters start and run for 20 minutes at a reduced output level of approximately 90% of the maximum. This is to allow the burner to reach the highest possible temperature for thorough combustion. In order to skip this 20-minute adjusting period, always get "P-1" first after pre-combustion timing.

## Section 5

## Servicing

Fine tuning of the fuel pump is often required to compensate for widely varying fuel qualities (i.e., density), temperatures and local operating conditions such as altitude.

The small adjustment screw on the left controls the "LOW" burn mode fuel flow. The screw on the right controls fuel flow for "HIGH/MED/LOW" burn.

Turn clockwise - decrease fuel flow

Turn counterclockwise - increase fuel flow

If the fuel flow rate on "HIGH" is reduced after adjusting "HIGH/MED/LOW" screw on right, "LOW" burn adjustment screw is to be turned same amount. but in opposite direction. Measure fuel flow on "P-1" and "P-3" at this point.

Adjustment of the screw on the right side of the controller is not recommended. See Figure 5-4.

**NOTE:** The pump should be adjusted only after checking for air delivery problems (clogged flue pipe, exhaust/intake fans, leaking gaskets) and cleaning the fuel inlet pipe.

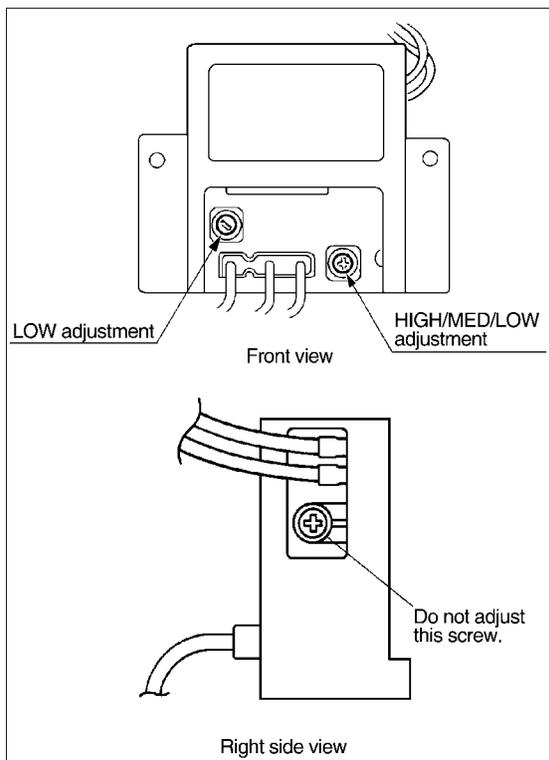


Figure 5-4

### 5-5 CLEANING BLOWER MOTOR

Usage of low-quality kerosene (High sulfur, high viscosity, etc.) or fuel other than No. 1-K kerosene, will cause heavy carbon to build up on the exhaust fan or the blower motor assembly. This may cause the exhaust fan to stick or the blower motor to malfunction. These will result in noise in the blower motor assembly. The blower motor assembly must be disassembled according to the following procedure. Clean the fan or replace the blower motor (and other parts), if necessary.

#### STEP 1: Cleaning the Exhaust Fan

- Remove the blower motor case from the heater base. Remove the top cover.
- Loosen the set screw that secures the exhaust fan to the motor shaft. Remove the retaining nut.

**NOTE:** 2.0 mm hex key and 7 mm socket are required.

- Remove the exhaust fan. Clean the fan and the housing.
- Re-assemble the exhaust fan and test for proper operation before re-installation.

#### STEP 2: Replacing the Blower Motor or Intake Fan

- Remove the spacer from the shaft.
- Remove the base from the blower motor case.
- Remove five (5) screws from the blower motor bracket.
- Remove the motor wire bushing and then the blower motor from the housing.
- Loosen the set screw and remove intake fan.

### 5-6 CLEANING FUEL FILTER OR WATER BLOCK FILTER

A water block filter is recommended for installation in the fuel line to trap condensation.

The water block filter should be checked for condensation every 2 to 3 weeks. This is especially important in the autumn and spring because of temperature fluctuations.

# L A S E R   H E A T I N G   S Y S T E M S

## Section 5

## Servicing

### 5-7 ERROR MESSAGE

ERROR CODE	PROBLEM	CAUSE	SOLUTION
	POWER LAMP FAILS TO LIGHT	Disconnected power plug. Circuit board, fuse or transformer malfunction.	Plug into 120V AC outlet. Refer to 6-5 Trouble Shooting Guide.
EE2 EE2 EE2 EE2	NO IGNITION	Out of fuel. Contaminated flame sensor. Fuel tank valve closed. Air pocket in fuel line.	Check fuel gauge on fuel tank; refuel. Clean flame sensor. Open valve by turning counterclockwise. Push reset button on the fuel sump, located on right inside, once.
EE2 EE2 EE2		Clogged fuel pipe. Clogged fuel strainer.	Clean fuel pipe. Clean fuel strainer.
EE2 EE2		Igniter, circuit board or fuel pump malfunction.	Refer to 6-5 Trouble Shooting Guide.
EE8		Blower motor malfunction.	Refer to 6-5 Trouble Shooting Guide.
EE6 EE6 EE6	EXTINGUISHED AFTER IGNITION	Air pocket in line.  Out of fuel. High limit switch activated.	Push reset button on the fuel sump, located on right inside, once. Check fuel gauge on fuel tank; refuel. Clean circulation fan cover, remove any obstructions.
EE6 EE6 EE8 EE10	DOES NOT EXTINGUISH	Fuel flow obstruction. Flame sensor malfunction. Blower motor malfunction. Excess of fuel in burner.	Refer to 6-5 Trouble Shooting Guide. Refer to 6-5 Trouble Shooting Guide. Refer to 6-5 Trouble Shooting Guide. Refer to 6-5 Trouble Shooting Guide.

Hi		Room temperature is over 95°F (35°C). Incorrect location of room temperature sensor.	Correct the location of the room temperature sensor.
Lo		Room temperature is lower than 14°F (-10°C). Room temperature sensor malfunction or disconnected.	Check room temperature sensor.
Low/Med/High lamps flashing at the same time	DOES NOT EXTINGUISH	Possible excess fuel in the burner or flame sensor malfunction (miss detection).	Refer to 6-5 Trouble Shooting Guide.

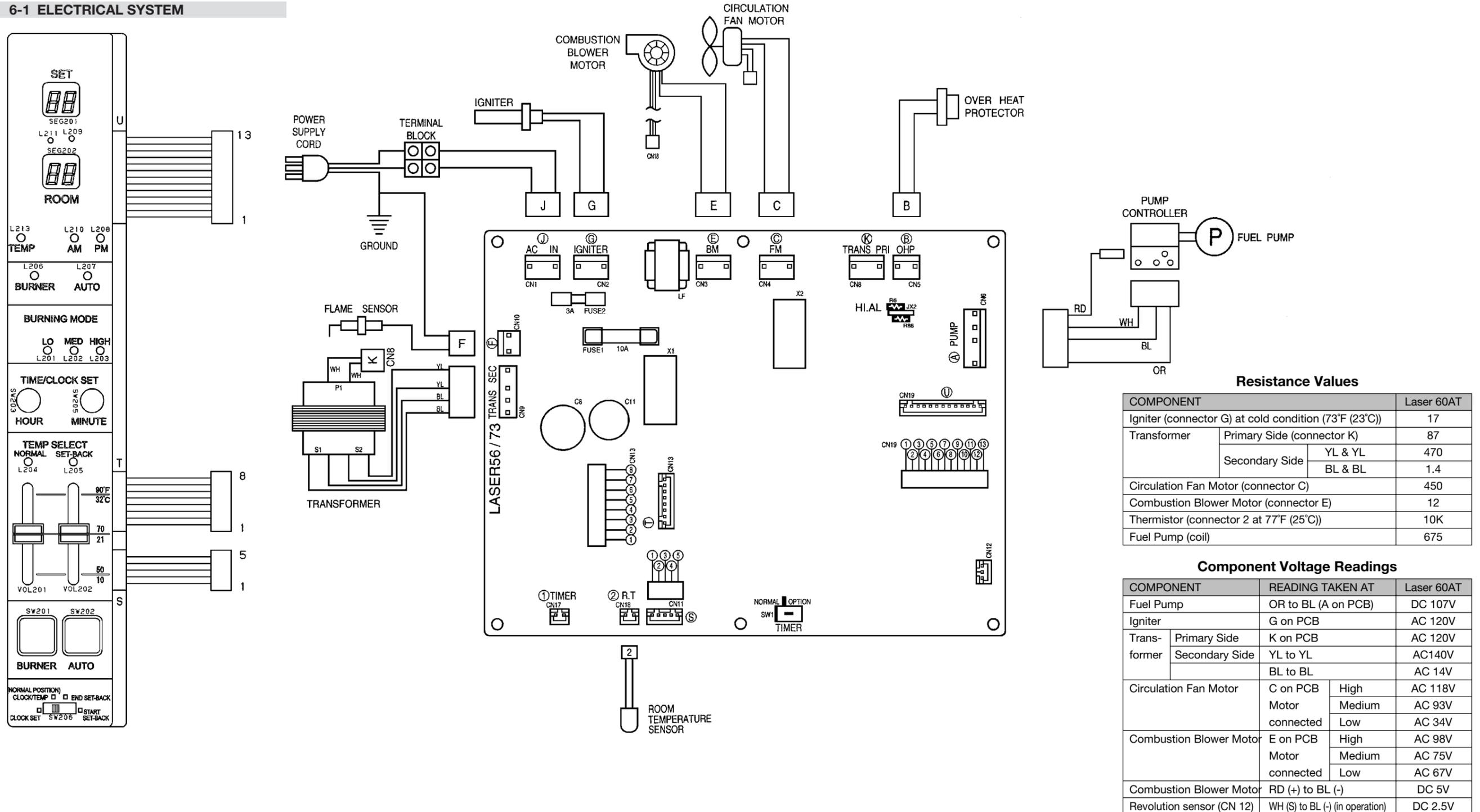
**WARNING:** Do not re-use the unit until the cause of the “EE10” code has been determined.

# LASER HEATING SYSTEMS

## Section 6

### Trouble Shooting

#### 6-1 ELECTRICAL SYSTEM



#### Resistance Values

COMPONENT	Lasers 60AT		
Igniter (connector G) at cold condition (73°F (23°C))	17		
Transformer	Primary Side (connector K)	87	
	Secondary Side	YL & YL	470
		BL & BL	1.4
Circulation Fan Motor (connector C)	450		
Combustion Blower Motor (connector E)	12		
Thermistor (connector 2 at 77°F (25°C))	10K		
Fuel Pump (coil)	675		

#### Component Voltage Readings

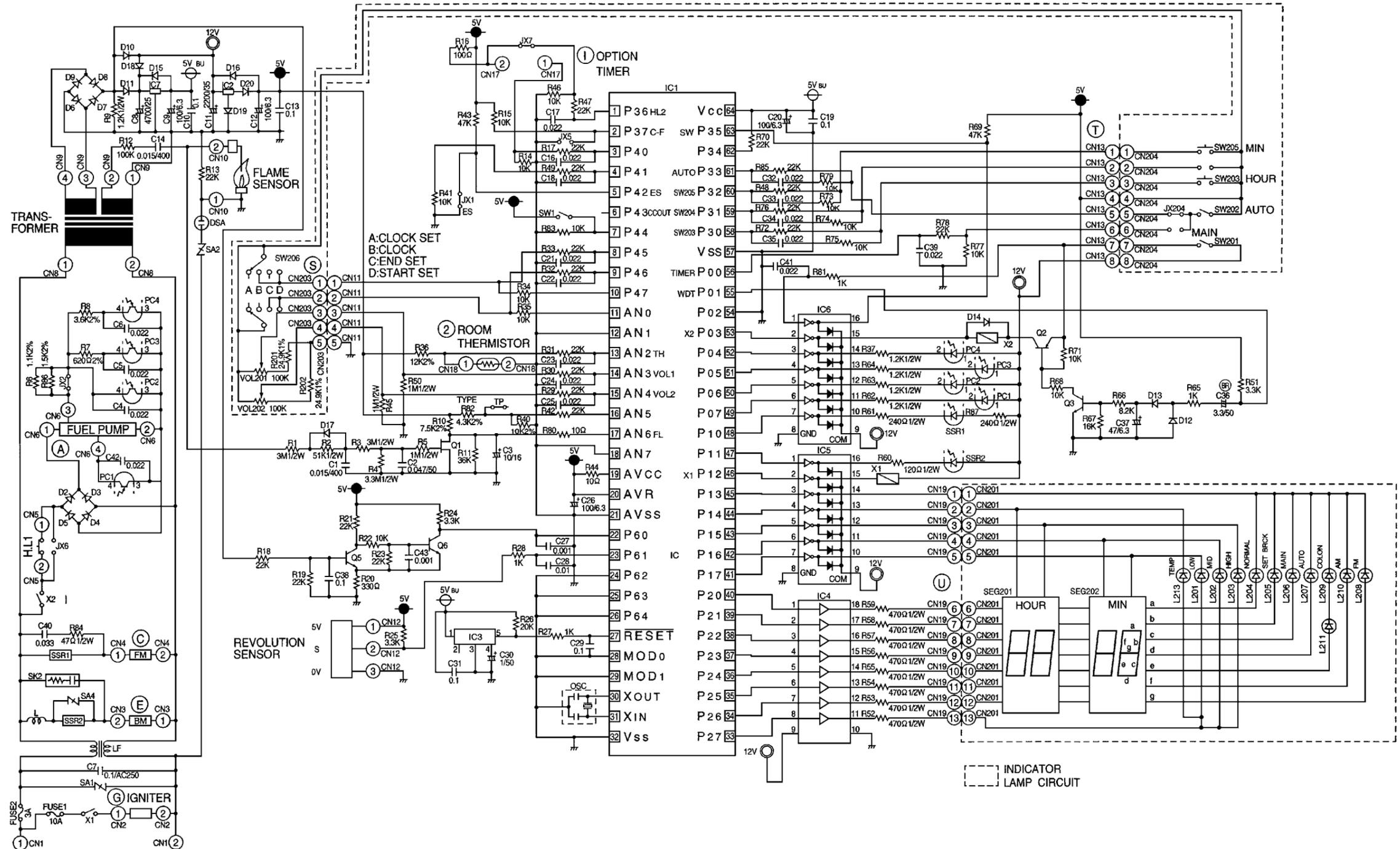
COMPONENT	READING TAKEN AT	Lasers 60AT	
Fuel Pump	OR to BL (A on PCB)	DC 107V	
Igniter	G on PCB	AC 120V	
Transformer	Primary Side	K on PCB	AC 120V
	Secondary Side	YL to YL	AC 140V
		BL to BL	AC 14V
Circulation Fan Motor	C on PCB Motor connected	High	AC 118V
		Medium	AC 93V
		Low	AC 34V
Combustion Blower Motor	E on PCB Motor connected	High	AC 98V
		Medium	AC 75V
		Low	AC 67V
Combustion Blower Motor	RD (+) to BL (-)	DC 5V	
Revolution sensor (CN 12)	WH (S) to BL (-) (in operation)	DC 2.5V	

# LASER HEATING SYSTEMS

## Section 6

### Trouble Shooting

6-2 SCHEMATIC WIRING DIAGRAM



# L A S E R   H E A T I N G   S Y S T E M S

## Section 6

## Trouble Shooting

### 6-3 RESISTOR/CAPACITOR VALUE

#### Resistor Values ( $\Omega$ )

R 1	3M	R 23	22K	R 45	1M	R 67	16K
R 2	51K	R 24	3.3K	R 46	10K	R 68	10K
R 3	3M	R 25	3.3K	R 47	22K	R 69	47K
R 4	33M	R 26	20K	R 48	22K	R 70	22K
R 5	1M	R 27	1K	R 49	22K	R 71	10K
R 6		R 28	1K	R 50	1M	R 72	22K
R 7	620K (2%)	R 29	22K	R 51	3.3K	R 73	10K
R 8	6K (2%)	R 30	22K	R 52	470 (1/2W)	R 74	10K
R 9	1.2K (1/2W)	R 31	22K	R 53	470 (1/2W)	R 75	10K
R 10	7.5K (1/2W)	R 32	22K	R 54	470 (1/2W)	R 76	
R 11	36K	R 33	22K	R 55	470 (1/2W)	R 77	10K
R 12	100K	R 34	10K	R 56	470 (1/2W)	R 78	22K
R 13	22K	R 35	10K	R 57	470 (1/2W)	R 79	10K
R 14	10K	R 36	12K	R 58	470 (1/2W)	R 80	
R 15	10K	R 37	1.2K	R 59	470 (1/2W)	R 81	1K
R 16	100	R 38		R 60	120 (1/2W)	R 82	10K (2%)
R 17	22K	R 39		R 61	470 (1W)	R 83	10K
R 18	22K	R 40	10K (2%)	R 62	1.2K	R 84	
R 19	22K	R 41	10K	R 63	1.2K	R 85	22K
R 20	330	R 42	22K	R 64	1.2K	R	
R 21	22K	R 43	47K	R 65	1K	R	
R 22	10K	R 44	10	R 66	8.2K	R	

Unspecified Rating. 1/4 W, 5%

#### CAPACITOR Values ( $\mu\text{F}$ )

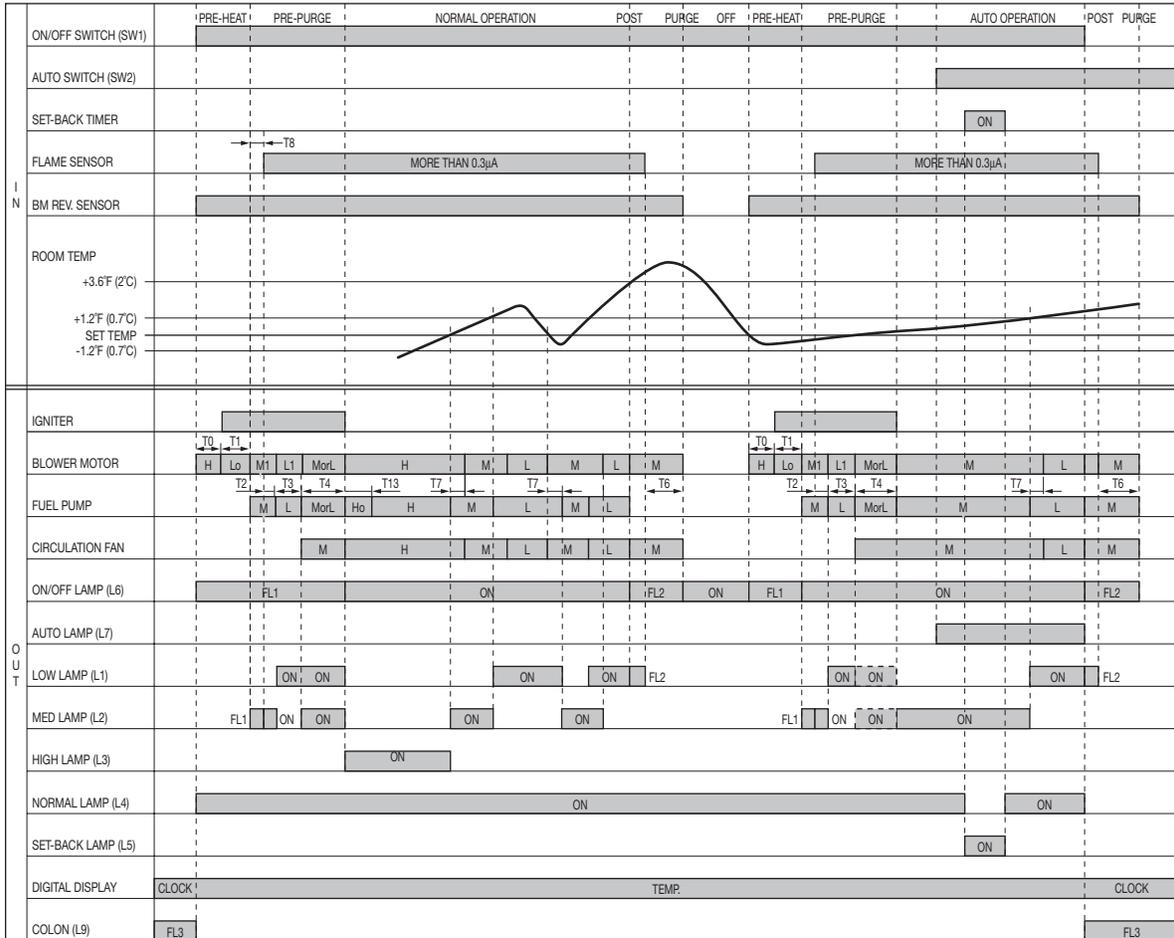
C 1	.015 (400V)	C 12	100 (6.3V)	C 23	.022 (50V)	C 34	.022 (50V)
C 2	.047 (50V)	C 13	.1 (50V)	C 24	.022 (50V)	C 35	.022 (50V)
C 3	10 (16V)	C 14	.015 (400V)	C 25	.022 (50V)	C 36	3.3 (50V)
C 4	.022 (50V)	C 15		C 26	100 (50V)	C 37	47 (6.3V)
C 5	.022 (50V)	C 16	.022 (50V)	C 27	.001 (50V)	C 38	.022 (50V)
C 6	.022 (50V)	C 17	.022 (50V)	C 28	.01 (50V)	C 39	.022 (50V)
C 7	.1 (AC250V)	C 18	.022 (50V)	C 29	.1 (50V)	C 40	
C 8	4700 (25V)	C 19	.1 (50V)	C 30	1 (50V)	C 41	.022 (50V)
C 9	100 (6.3V)	C 20	100 (6.3V)	C 31	.1 (50V)	C 42	.022 (50V)
C 10	.1 (50V)	C 21	.022 (50V)	C 32	.022 (50V)	C 43	.001 (50V)
C 11	2200 (35V)	C 22	.022 (50V)	C 33	.022 (50V)	C	

# L A S E R H E A T I N G S Y S T E M S

## Section 6

## Trouble Shooting

### 6-4 CONTROL CIRCUIT BOARD TIME CHART



#### BLOWER MOTOR

L0	1500 rpm
L	1800 rpm
L1	2300 rpm
M	2550 rpm
M1	3200 rpm
H	3200 rpm

#### CIRCULATION FAN

L	3/4 WAVE CUT (AC 34V)
M	1/4 WAVE CUT (AC 93V)
H	FULL WAVE (AC 118V)

#### LED LAMP

FL1	2Hz FLICK
FL2	0.5Hz FLICK
FL3	1Hz FLICK

#### TIMING

		SEC.
T0	BLOWER MOTOR WARMING UP	5-300
T1	PRE-HEAT	RT<0°C: 540
		0°C<RT<15°C: 360
		RT>15°C: 180
T2	IGNITION	10
T3	PRE-COMBUSTION 1	180
T4	PRE-COMBUSTION 2	180
T6	POST PURGE 1	180
T7	POST PURGE 2	5
T8	SAFETY TIMING 1 (IGNITION FAILURE)	UP TO 140
T13	INITIAL HIGH MODE	1200

#### FUEL PUMP

	PC1	PC2	PC3	PC4	RELAY X2
H	OFF	ON	OFF	OFF	ON
Ho	OFF	OFF	ON	OFF	ON
M	OFF	OFF	OFF	ON	ON
L	OFF	OFF	OFF	OFF	ON
OFF	ON	OFF	OFF	ON	OFF

# L A S E R H E A T I N G S Y S T E M S

## Section 6

### Trouble Shooting

GENERAL CHECKS	
<input checked="" type="checkbox"/> Is power available in wall outlet?	<input checked="" type="checkbox"/> Is ON/OFF switch on?
<input checked="" type="checkbox"/> Is power plug inserted in wall outlet?	<input checked="" type="checkbox"/> Is operation mode on "MANUAL"?
<input checked="" type="checkbox"/> Has there been a power interruption?	<input checked="" type="checkbox"/> Is set temperature in "HIGH" position?
<input checked="" type="checkbox"/> Has circulation fan stopped?	<input checked="" type="checkbox"/> Is fusible link valve "OPEN"?
<input checked="" type="checkbox"/> Is fuel in tank? Tank valve open?	<input checked="" type="checkbox"/> Is heater/fuel line/fuel tank installed properly?

#### 6-5 TROUBLE SHOOTING GUIDE

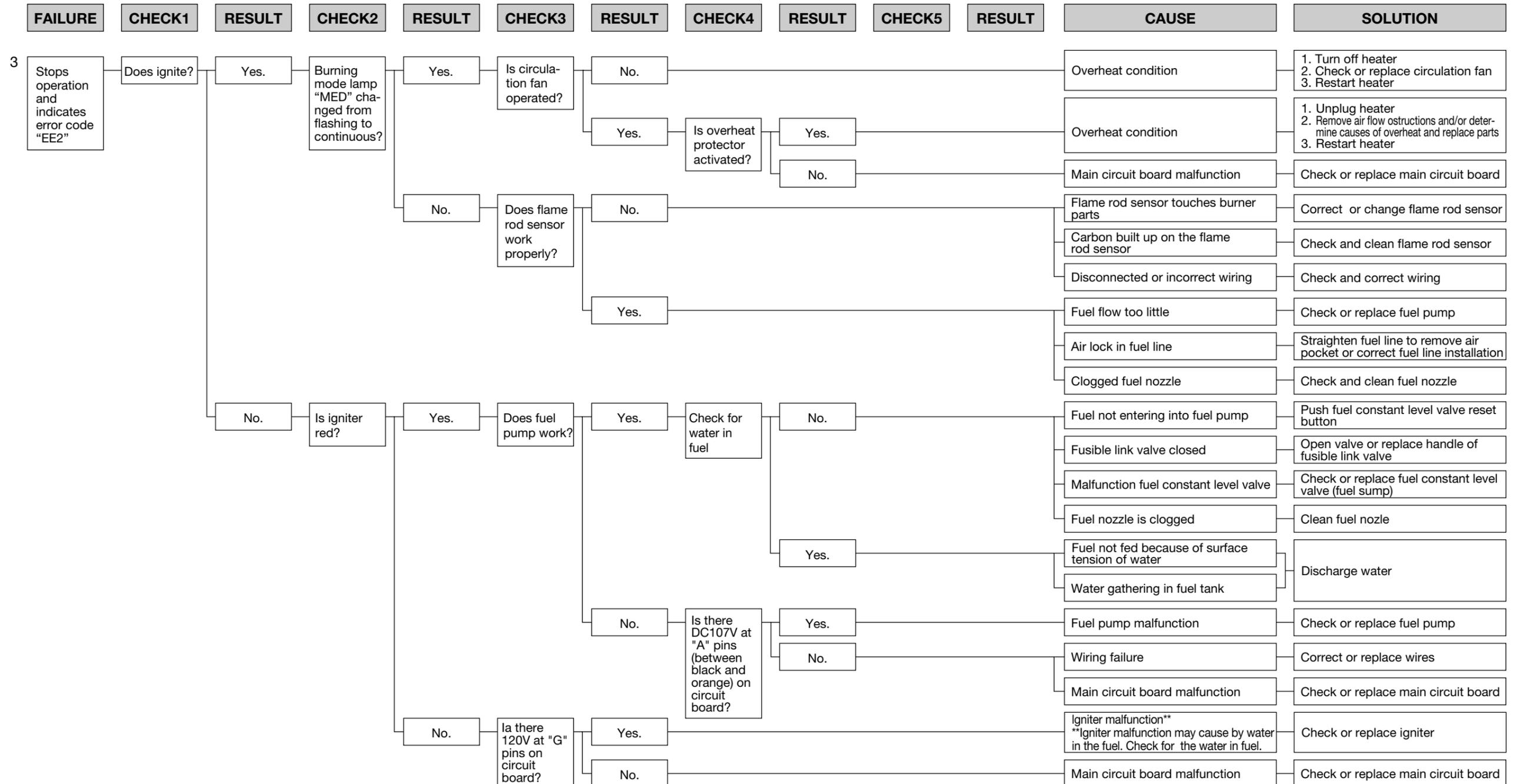
FAILURE	CHECK1	RESULT	CHECK2	RESULT	CHECK3	RESULT	CHECK4	RESULT	CHECK5	RESULT	CAUSE	SOLUTION		
1 Does not operate	Digital indicator lamp lit?	No.	Check fuse	Normal	Check transformer	Yes.	Disconnect or incorrect wiring for transformer	Yes.			Main circuit board or indicator lamp circuit malfunction	Check or replace main circuit board or indicator lamp circuit.		
						No.		Disconnected or incorrect wiring			Check and correct wiring			
				No.	Transformer malfunction	Check or replace transformer								
				Melted	Change fuse and plug in power cord	Yes.	Fuse open	Change fuse						
					No.	Short circuit of lead wire	Correct or change							
		Yes.	Room temp. exceeds set temp?	Yes.	Room temp. indicates "HI"	Yes.	Room temp. is over 95°F	Yes.	Room temp. is too high	Heater does not work at room temp. over 95°F (35°C)				
		No.		Yes.		No.		Incorrect wiring for room thermistor	Correct wiring					
						Yes.		Failure of room thermistor	Check or replace room thermistor					
						Yes.		Heater is on "OFF" cycle*. *This is not malfunction.	Move temperature slide switch all the way to right to check					
				No.				Main circuit board malfunction	Check or replace main circuit board					
2 Stops operation and indicates error code "EE8"	Does blower motor work when ON/OFF switch is "ON"	Does not work	Check blower motor if blower fan rotates smoothly	No.	Heater gets too cold	No.	Restart heater after operating manual cleaning system (10 minutes)	Extinguished and indicates error code "EE8"			Blower motor malfunction or blower fan touches to obstruction	Check or replace blower motor or blower motor case		
						Yes.		Operates normally			Heater got too cold	In case that heater gets too cold blower motor may not work. Warm heater up by operating manual cleaning system before ignition.		
						Yes.					Disconnected or incorrect wiring	Correct wiring		
		Stops in 300 seconds											Blower motor malfunction	Check or replace blower motor
													Rotating sensor malfunction	Check or replace blower motor

# L A S E R H E A T I N G S Y S T E M S

## Section 6

### Trouble Shooting

#### 6-5 TROUBLE SHOOTING GUIDE

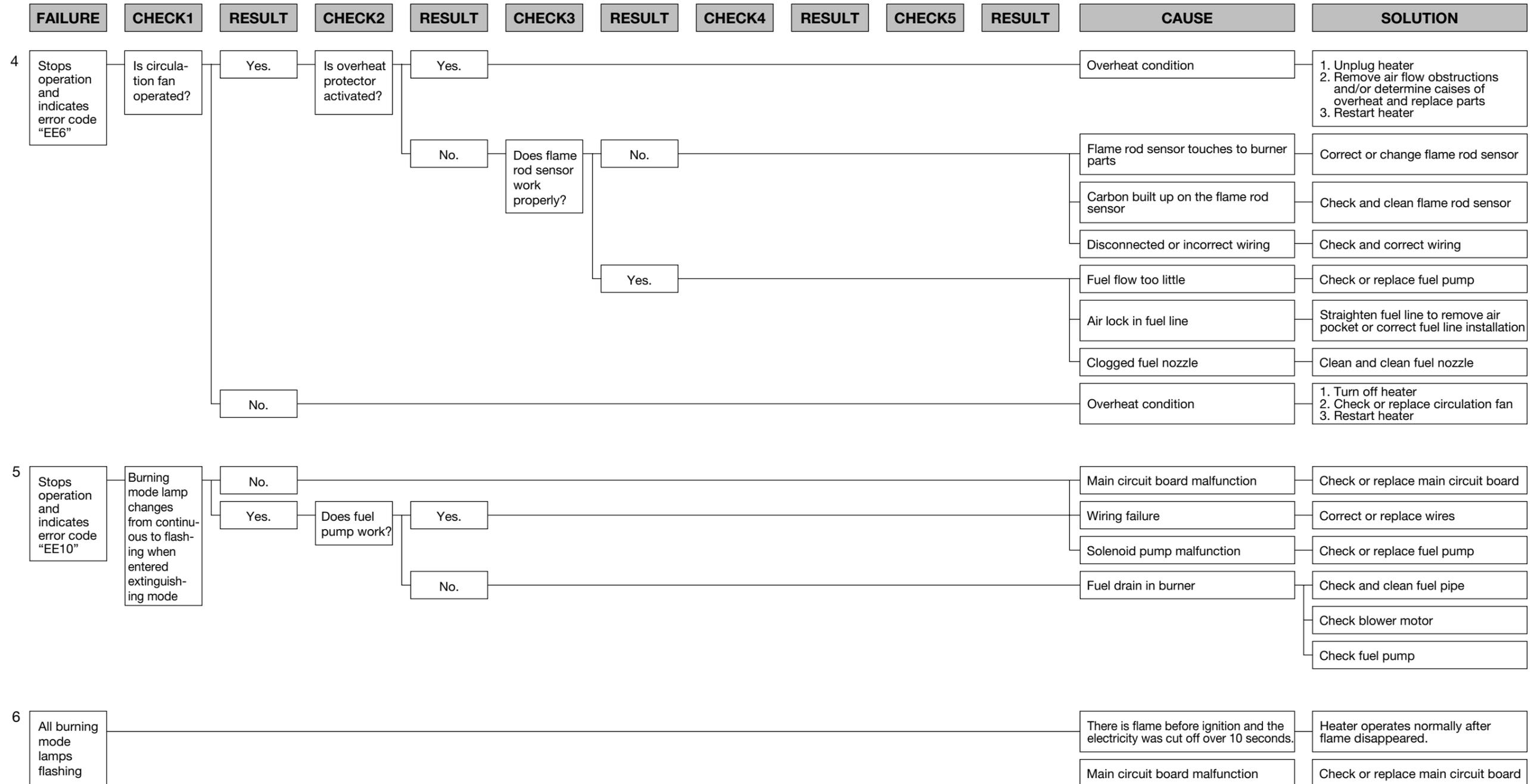


# L A S E R H E A T I N G S Y S T E M S

## Section 6

### Trouble Shooting

#### 6-5 TROUBLE SHOOTING GUIDE



# L A S E R H E A T I N G S Y S T E M S

## Section 6

### Trouble Shooting

#### 6-5 TROUBLE SHOOTING GUIDE

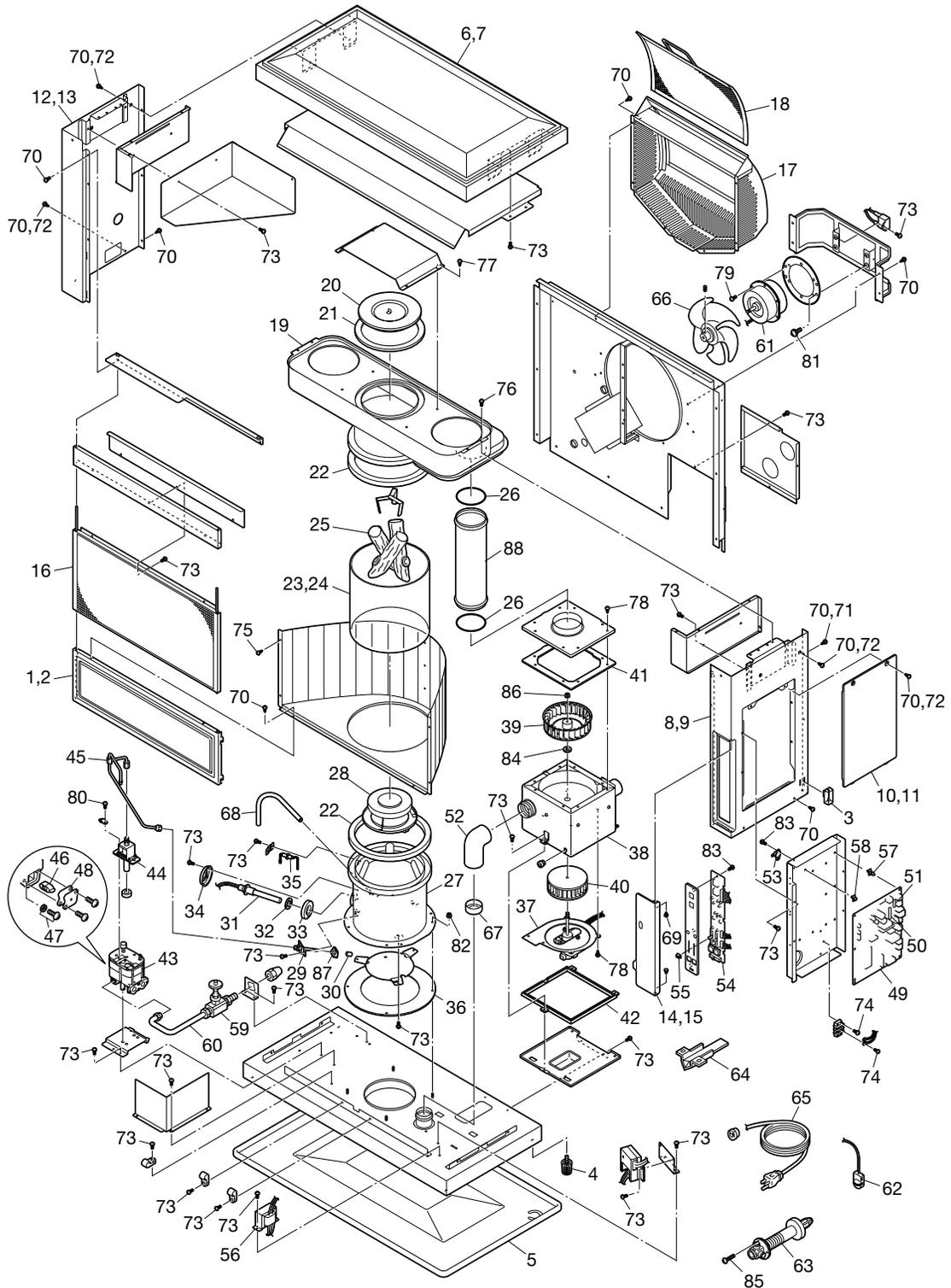
FAILURE	CHECK1	RESULT	CHECK2	RESULT	CHECK3	RESULT	CHECK4	RESULT	CHECK5	RESULT	CAUSE	SOLUTION	
7 Yellow high flame whistling noise or smoke produced when set "HIGH"	Is a unit placed horizontally? Is flue pipe too long or have too many bends?	Normal	Does blower motor work properly? Check for obstructions (such as wasps nests in exhaust or air supply piping)	Normal	Check out side end of flue pipe for flow of air and exhaust	Normal	Burner ring sit properly in the burner	Yes.			Fuel pump malfunction	Replace fuel pump	
		Abnormal		Abnormal		No.				Intake or exhaust line clogged	Clean out air and exhaust ducts		
											Blower motor failed	Replace blower motor assembly	
											Clogged air supply or exhaust piping	Remove obstructions	
											Not as specified	Correct as specified	
8 The overheat protector is activated	Is a window curtain too close to the rear of unit? Is circulation fan cover dusty?	Yes.	Does circulation fan operate properly?	Yes.							Curtain or other obstruction covers circulation air inlet	Clean fan cover Keep curtain away from unit	
		No.		No.							Obstacle covers circulating air outlet	Remove obstacle	
											Main circuit board malfunction	Check or replace main circuit board	
											Circulation fan motor malfunction	Check and replace fan motor	
											Incorrect wiring	Check and correct wiring	
9 Room temp. indicates "LO"	Room temp. is below 14°F (-10°C)	Yes.										Room temp. is too low	
		No.										Wiring failure	Correct wiring
												Main circuit board malfunction	Check or replace main circuit board
												Room temperature sensor malfunction	Check or replace room temperature sensor

# L A S E R   H E A T I N G   S Y S T E M S

## Section 6

## Trouble Shooting

### 6-6 PARTS DESCRIPTION



# L A S E R H E A T I N G S Y S T E M S

## Section 6

## Trouble Shooting

### 6-6 PARTS DESCRIPTION

REF #	PART #	PART NAME	REF #	PART #	PART NAME
1	20479946	Front panel assembly	49	20478512	Main circuit board
2	20470046	Front panel assembly (L-60AT (W))	50	20478378	Fuse A (10A)
3	20450007	Plumb bob	51	20478379	Fuse B (5A)
4	20479570	Adjustable leg	52	20479983	Outlet adapter
5	20479929	Drip tray	53	20478306	High limit switch (=20474506)
6	20479960	Top plate	54	20479976	Indicator lamp circuit
7	20470060	Top plate (L-60AT (W))	55	20479901	Knob for temp selector
8	20479963	Right side panel	56	20479917	Transformer
9	20470063	Right side panel (L-60AT (W))	57	20479914	PCB support
10	20479970	Access panel	58	20479915	PCB support (S)
11	20470070	Access panel (L-60AT (W))	59	10005597	Fusible link valve
12	20479964	Left side panel	60	20479952	Leveler fuel pipe
13	20470064	Left side panel (L-60AT (W))	61	20479969	Circulation fan motor
14	20479931	Control panel door	62	20478373	Thermistor
15	20470031	Control panel door (L-60AT (W))	63	20479891	Flue pipe
16	20479903	Grille	64	20474925	Oil catch
17	20479972	Fan cover	65	20479935	Power supply cord
18	20479940	Circulation air filter	66	20475071	Circulation fan
19	20479944	Heat exchanger	67	20478366	Air damper (P25)
20	20479945	Canopy	68	20479987	Draft tube
21	20479955	Canopy gasket	69	20474059	Holder A
22	20479981	Glass cylinder gasket	70	20479956	Screw AT1
23	20479909	Glass cylinder (Type A, B)	71	20478156	Screw 1S (L-60AT (W))
24	20479949	Coated glass cylinder (Type C)	72	20455862	Screw S2 (L-60AT (W))
25	20479908	Ceramic log	73	20474050	Screw C
26	20475877	O-ring (P75)	74	20476482	Screw B10
27	20479942	Burner assembly	75	20479958	Screw AT2
28	20479943	Burner ring	76	20474051	Screw D
29	20478026	Fuel nozzle	77	20476452	Screw B2
30	20478383	Fuel nozzle gasket	78	20475554	Screw 1Q
31	20479518	Igniter	79	20476454	Screw B4
32	17187582	Igniter gasket (=17185580)	80	20474053	Screw F
33	20474921	Igniter guide gasket	81	20474055	Screw O
34	20474920	Igniter cover	82	20474057	Flange Nut
35	20479911	Primary flame rod	83	20450120	Screw for igniter unit
36	20475194	Burner gasket	84	20475874	Washer for blower motor
37	20479937	Blower motor assembly	85	20474272	Screw M
38	20479947	Blower motor assembly with case	86	20479957	Nut J
39	20478871	Blower motor exhaust fan	87	20479885	Outside nozzle gasket
40	20475883	Blower motor intake fan	88	20479982	Joint pipe
41	20475875	Blower motor case gasket	89	20479995	Instruction manual (Type A)
42	20475878	Rubber mat	90	20479996	Instruction manual (Type B)
43	20478534	Fuel sump	91	20479994	Instruction manual (Type C)
44	20479919	Fuel pump	92	20479999	Carton (Type A)
45	20479941	Fuel pipe assembly	93	20479998	Carton (Type B)
46	20478550	Fuel inlet strainer	94	20479997	Carton (Type C)
47	20475551	Drain screw with O-ring	95	20470099	Carton (L-60AT (W))
48	20475552	Strainer gasket			

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New 06/12  
Part #B0400021

Printed in Japan