TOYOSTOVE®

TOYOTOMI

VENTED HEATER SERVICE MANUAL

Laser 300 (TypeA)

Laser 530 (TypeA)

Laser 560 (TypeA)

Laser 730 (TypeA)

Table of Contents

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 require minimal service.

The following section outlines the Laser Heater and its various components

1-2 Physical Specifications

	W × D × H (inches)	Weight	Flue Pipe Hole
Laser 300	17-3/8" × 21-3/4" × 15-1/8" (440 × 555 × 385 mm)	31 lbs. (14kg)	2-3/4 to 3" diameter (7.0 - 7.5 cm)
Laser 530	19-5/8" × 23-5/8" × 16-1/2" (496 × 600 × 418 mm)	38 lbs. (17kg)	
Laser 560	24-3/8" × 26-3/4" × 16" (620 × 680 × 405 mm)	60 lbs. (27kg)	
Laser 730/ Laser 730AT	30" × 27-1/2" × 16-3/4" (760 × 700 × 427 mm)	75 lbs. (34kg)	

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. When the room temp. increaces sufficiently, the heater shuts down and goes through a post-purge mode for approx. 3 minutes.

The Laser Heaters is equipped with a programmable 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.

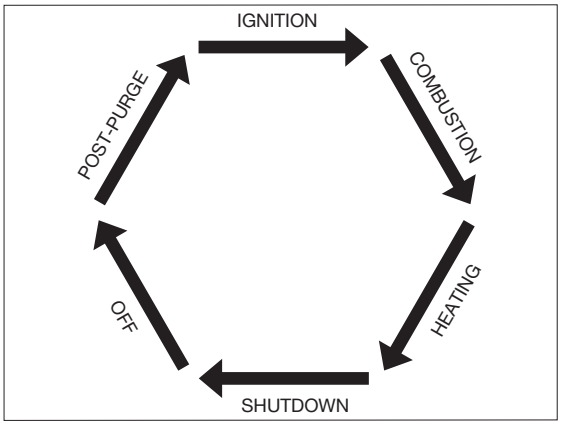

Figure 1-1 SIMPLIFIED OPERATIVE CYCLE

1-4 Description

The Laser Heaters 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 Chamber

The combustion chamber consists of two main parts; one is the heat chamber and the other is the heat exchanger. The combustion chamber is secured to the top of the burner. The heat chamber has a window, allowing the serviceman to visually examine the combustion process (i.e. glowing igniter or proper flame).

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.

1-6 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 is the igniter (located within the burner), a fuel line and a flame sensor. Within the burner is the burner ring. An airway on the rear panel channels

Section 1 Description

air from the intake fan of the combustion blower to the burner. The flame rod sensor is mounted through the wall of the burner.
Laser 300: 20470242 Laser 530: 20479842
Laser 560: 20470442 Laser 730: 20470642

1-7 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.
Laser 300: 20479543 Laser 530: 20478343
Laser 560: 20478343 Laser 730: 20478643

1-8 Burner Mat / Coating

The textured burner mat (coating) insures the even vaporization of fuel for proper combustion.
Burner mat — Laser 300/laser 730
Burner Coating — Laser 530/Laser560
Laser 300: 20479513 Laser 730: 20478613

1-9 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.
Laser 300: 20470211 Laser 530: 20479811
Laser 560: 20470411 Laser 730: 20470611

1-10 Igniter

The ceramic-type igniter is designed to pre-heat the burner pot, to vaporize, and ignite the air/fuel mixture to start the combustion process.
Laser 300/Laser 530/Laser 560/Laser 730: 20470218

1-11 Flue Pipe

The wall thickness which the flue pipe can be installed is from 4 in. (100 mm) to 9 in. (230 mm) The extension flue pipe (option) is available for installation in wall thickness from 9 in. (230 mm) to 13 in. (330 mm) This provides the flexibility to meet the installation requirements of dwellings of various wall thicknesses up to 24 inches.

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

1-12 Blower Motor Assembly

The turbo fan is used for the combustion blower on the intake air side only. The exhaust gas is expelled through the flue pipe.

The blower motor assembly on Laser560/730 is a dual function fan with the intake air and exhaust air fans mounted on a common shaft. Inside of the blower case 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, runs on a common shaft with the intake fan, expels all combustion by-products through the flue pipe.

The Laser Heaters blower motor has 3-speed. 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.
Laser 300: 20470237 Laser 530: 20470337
Laser 560: 20470438 Laser 730: 20470638

1-13 Air Circulation Fan

The air circulation fan forces room air through the heat exchanger, then out of the louvered front panel to be distributed throughout the room. The Laser Heaters circulation fan motor has three speeds. The circulation fan will keep running for 180 seconds after the heater shuts down. This cools the heater.
Laser 300: 20479671 Laser 530: 20474171
Laser 560: 20475071 Laser 730: 20475171

1-14 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.
Only the Laser 560 gives the user the option of using either the removable fuel tank.
Laser 560: 20475922

Section 1 Description

1-15 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.

Laser 300: 20470219 Laser 530: 20470319

Laser 560: 20470419 Laser 730: 20470619

1-16 Main Circuit Board

The control circuit board provides safety timings, controls relays and provides clock and thermostat functions for the Laser Heater

Laser 300/Laser 530: 20470212

Laser 560: 20470412 Laser 730: 20470612

1-17 Room Temperature Sensor

The room temperature sensor, which is capable of sensing room temperatures within a 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 to a favorable location. You can also use speaker wire to extend the mounting location up to 20 feet (6m).

Laser 300/Laser 530/Laser 560/Laser 730: 20478373

1-18 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.

Laser 300/Laser 530/Laser 560/Laser 730: 20470234

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.

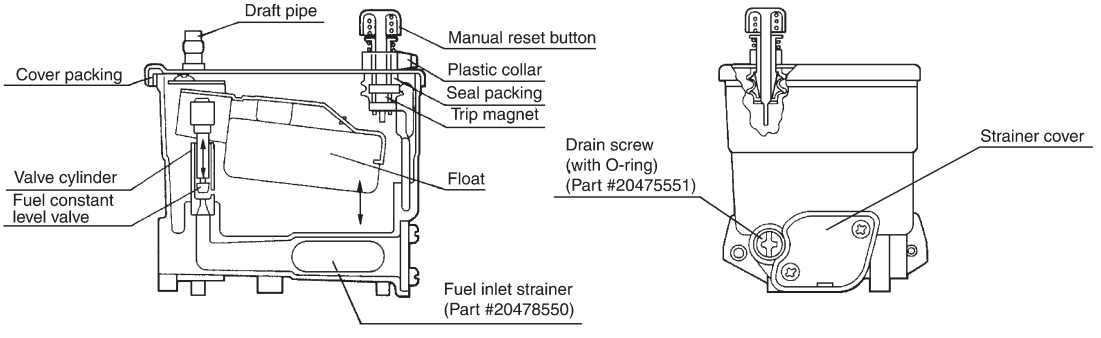

Figure 1-2 FUEL SUMP (FUEL CONSTANT LEVEL VALVE) (Part #20470234)

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1-19 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 a the user from accidental contact burn with these hot metal surfaces.
Laser 300/Laser 530/Laser 560/Laser 730: 20474955

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

1-20 Air Circulation Fan Filter (Cover)

The fan filter (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.
Laser 300: 20479540 Laser 530: 20479840

1-21 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 250 V AC, 10-amps and 250 V AC, 5-amps.

The electrical outlet into which the heater is connected should be protected by at least a 15-amp. fuse or circuit breaker.
Laser 300/Laser 530/Laser 560/Laser 730:
20470678 / 20470679

1-22 Overheat Protector Switch

Overheat Protector Switch is rated at 194°F (90°C). Should a heater overheat (internal temperature rises beyond 194°F (90°C)), the overheat protector switch (also called a high limit switch) will open to shut off the heater. Error code “E-12” 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 158°F (70°C), the system can be restarted manually as follows:

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

The heater will start with normal operation.
Laser 300/Laser 530/Laser 560/Laser 730: 20470206

1-23 Pressure Relief Plate

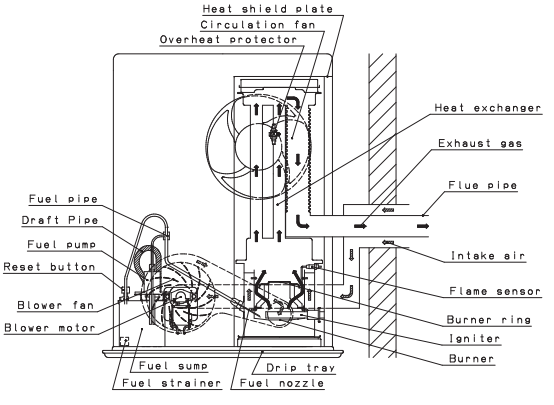
The pressure relief plate is located at the top part of the heat exchanger, which effectively prevents damage caused by misfire.
(Laser 300/530 only)
Laser 300 Laser 530: 20479530

1-24 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.

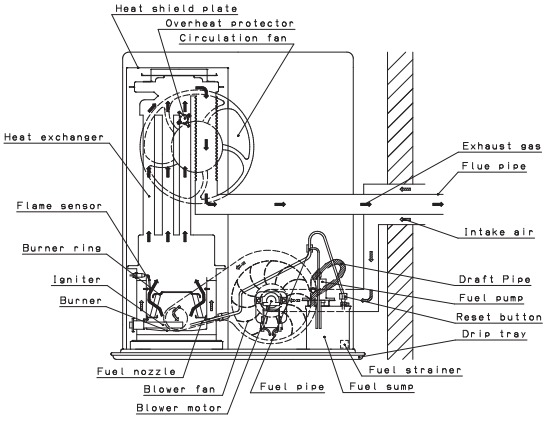
The Laser combustion systems are safeguarded by an overheat protector switch that will shut down the heater (to protect it from damage) in the event of excessive heat build-up. The error code “E-12” will be displayed on the digital indicator at this time. The overheat protector switch will be reset after the cooling down period. Turn the ON/OFF button to “ON” again to restart.

Model Laser 300

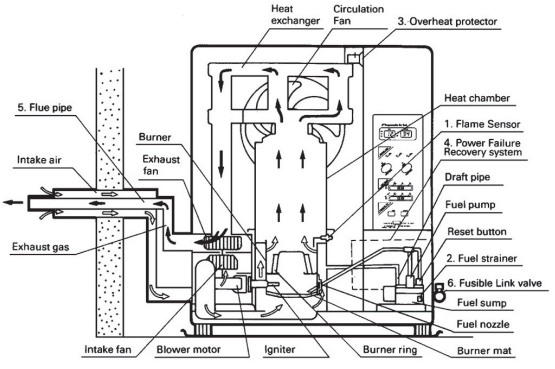


Section 1 Description

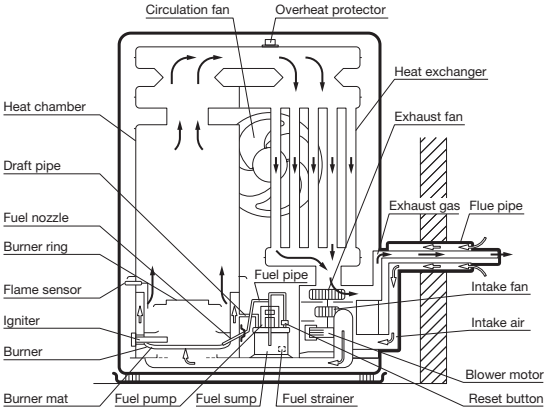
Model Laser 530



Model Laser 560



Model Laser 730



1-25 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 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.

1-26 Fuel Delivery System

Fuel moves by gravity from the external fuel storage or the removable fuel tank (Laser 560).
Fuel must be maintained at the level corresponding to the burn mode so that combustion can be conducted efficiently.
The fuel pump controls the flow of fuel from the fuel sump to the burner through a copper fuel pipe and a fuel nozzle.

1-27 Electrical System

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

1-28 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, shutting down the heater and displaying an error code on the digital indicator if a malfunction occurs.

1-29 Power Failure Recovery System

If at any time a power failure occurs during operation, heater will turn off. When the power returns, the unit will automatically restart with the following conditions. Please reset each setting when the settings are erased as indicated below.

TIME LENGTH OF POWER FAILURE	LESS THAN 3 SECONDS	MORE THAN 3 SECONDS	
		IN BACKUP MEMORY	OUT OF BACKUP MEMORY
OPERATION	Restart the combustion with the same condition before the power failure.	Start the combustion from the beginning.	Start the combustion from the beginning. Set temperature will change to 13˚C (56˚F) for safety. Set temperature and room temperature will blank that at least more than 30 min. power failure has occurred. To stop the blinking the set temperature and room temperature, press any button once.
POWER SAVER OPERATION	Keep the same condition before the power failure.	Keep the same condition before the power failure.	Keep the same condition before the power failure.
AUTO OPERATION	Keep the same condition before the power failure.	Keep the same condition before the power failure.	The setting will be erased.
CHILD LOCK OPERATION	Keep the same condition before the power failure.	The setting will be erased.	The setting will be erased.

If at any time a power failure occurs when heater is not in operation, the unit will basically start the operation while keeping the same condition before the power failure. However, when the power failure continued more than 3 seconds, the following settings will be erased. Please reset each setting.

WHEN HEATER IS NOT IN OPERATION

IN BACKUP MEMORY	Child lock operation
OUT OF BACKUP MEMORY	Clock and Day setting
	Auto operation
	Child lock operation

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1-30 Operation Recovery

If the power is turned off during combustion/ operation, then it is possible continue operation by turning the power button back on within 3 seconds. After 3 seconds the heater needs to go through it's preheat cycle, before turning back on. The circulation fan motor will remain on during this time.

1-31 Reigniting Operation

Start to reignite (T1) from turning the operation button ON if the reigniting time becomes over 3 seconds after turning the operation button OFF during combustion. (Include the unit OFF from the Save Mode and Timer Operation Mode.) Also, the fan motor keeps operate in this condition.

1-32 Error Codes History

To show the error codes history, first turn the unit off (if not already in off), then push the "DOWN" and "UP" button at the same time for 3 seconds, and a buzzer will sound. To get out of the error codes history, press the "DOWN" and "UP" button again at the same time for 3 seconds. This will indicate the past 9 error codes. The error codes are indicated as "XE YY". (X stands for 1~9 with 1 being the most recent. Error codes more then 9 codes ago will be deleted. YY stands for the error code or Altitude Setting – see High Altitude Setting Mode.)

If you press the "DOWN" button, the display shows "AL YY"→"9E YY"→····→"1E YY"→"AL YY"→····

If you press the "UP" button, the display shows "AL YY"→"1E YY"→····→"9E YY"→"AL YY"→"1E YY"→····

When the unit is turned ON during Error Codes History, the unit exits the Error Code History and starts normal operation.

1-33 Igniting Failure Error Lock

If the igniting fault error "E-2" occurrs 3 times in a row, then the display will show "E-22", and it is not able to reset by the power button but it can be reset by unpluging the power cord for at least 30 minutes.

1-34 Burner Thermistor Normal Detecting Temperatures

L300 / L530 : above 120°C or 248 F normal
L560 / L730 : above 100°C or 212 F normal

1-35 Backup Life

Back up time is more than 30 minutes(reference value)
The life guarantee is more than 10 years.

1-36 Deleting The Error Code History

To clear the error code history press the "AUTO" button for 3 seconds while in the Error Codes History. The display will show "Er CL", which will flash 3 times, and then switch to time display.

1-37 Detection of Abnormal Electrical Frequency Condition

When the electrical frequency of the power supplied to the unit is abnormal and the power button is ON the unit will display an error code of "E-0" and the unit will not start. To reset turn the power button OFF and then back ON.

The judging range for the frequence is 55Hz≦ or <65Hz. Normal frequence is 60Hz.

1-38 Power Button Malfunction

If there is a problem with the power button the unit will make a long buzzer beep sound (by 100msec. interval.), which will indicate that a short circuit has occurred.

If the power button short circuit condition occurs for more than 30 seconds, then the following happens:

- Flash all on display
- Flash the power LED
- Make a beep sound
- All buttons are invalid. No beep sound by pressing buttons.

To cancel beeping noise turn the power button OFF.

1-39 Low Voltage Detection

The unit will turn OFF with "E-0" when the low voltage condition keeps for more than 10 seconds +/- 2 seconds.

1-40 Forced Flame Detection

If the flame is detected when the power button is turned ON or the unit comes back on from a power failure, the operation lamp will flash (0.5 Hz) and both the blower motor and circulation fan motor will turn to high revolution. The heater will turn ON if the flame goes out within 30 seconds from turning ON or returning back

Section 1 Description

from power failure. The heater will be turned OFF for safety with the error code of “E-23” if the flame is detected for more than 30 seconds. However, both the blower motor and circulation fan will continue to run on high, until the flame is no longer detected.

1-41 Manual Ignitor Cleaning System

When the power button is OFF, press the “SET” and “CLEAR” buttons at the same time for 3 seconds, the unit will make a beep sound, indicating it is in Cleaning Mode. LCD display will show “CL: 10” ~ ”CL: 01” (colon flashing) and make a countdown at every minute. The countdown is shown on the right side of the indicator in double figures as “10, 09 ... 02, 01”. The blower motor turns at Low revolution while the igniter is on for ten minutes. When the “SET and CLEAR” buttons are pressed at the same time for 3 seconds during the Manual Igniting Cleaning modes, the unit will make a beep sound and cancel Cleaning Mode. When the heater is in operation and the “SET and CLEAR” buttons are pressed at the same time for 3 seconds, the heater will make a beep sound, but the Manual Ignitor Cleaning mode will not accepted. If the unit is in the Manual Ignitor Cleaning mode and the power button is turned ON then the cleaning mode will be cancelled and the heater will turn on.

1-42 Automatic Ignitor Cleaning System

The heater will turn OFF automatically when the time becomes 2 AM during operation. After the post purge finishes, the ignitor will be turned on and the blower motor turns at Low revolution for cleaning operation mode. LCD display will change to show as “CL:10” ~ “CL:01” (colon flashing) and make a countdown at every minute. The countdown is shown on the right side of the display as “10, 09 ... 02, 01”. After the countdown finishes the unit will shift back to normal operation.

1-43 Manual Combustion Operation Mode

To put the unit in Manual Fuel Pump Operation Mode, first have the power button “ON”, and then push and hold the “DOWN” and “UP” button at the same time for 3 seconds. A buzzer sound will happen. To return to normal operation push these buttons again at the same time for 3 seconds, the unit will then shift back to the Normal Operation Mode and will make a buzzer sound. Manual Fuel Pump Operation Mode cannot be cancelled by turning off the power button. The unit will turn off, however, when unit is turned back on it will be in Manual Fuel Pump Operation Mode again.

Combustion Indicator.

P3: High Combustion P2: Middle Combustion P1: Low Combustion

<table>
<tr><td></td><td colspan="2">SET</td><td>ROOM</td></tr>
<tr><td>Normal Operation Mode</td><td colspan="2">Set Temperature</td><td>Room Temperature</td></tr>
<tr><td rowspan="3">Manual Fuel Pump Operation Mode</td><td>①</td><td rowspan="3">Combustion Indicator</td><td>Room Temperature Value</td></tr>
<tr><td>②</td><td>Burner Theremistor Temp. AD Value</td></tr>
<tr><td></td><td>Flame Electric Current AD Value</td></tr>
</table>

The first display in the SET field is the Combustion Indicator which starts as “P3”. To change down to P2 use the HOUR button, and to change up use the MIN button. There are 2 kinds of sub modes in Manual Fuel Pump Operation Modes. To shift into these modes push the “TIMER” button for 5 seconds. Room display can be switched between the Burner Thermistor Temperature AD Value and Flame Electric Current AD Value by pressing the “DAY SELECT” button. The first display is the Burner Thermistor Temperature AD Value (BTTADV) mode and is indicated by a flashing °C in the bottom right corner. The Flame Electric Current AD Value (FECADV) is indicated by a flashing °F top right side. Both BTTAD Value and the FECAD Valve are always updating and are shown on the display. The colon “:” symbol will flash indicating preheat mode. Once unit reaches it set pump mode “:” will disappear.

1-44 High Altitude Setting Mode

All units are shipped from factory with the altitude setting at Low. To change the Altitude Setting, turn the unit off (if not already off), press the “DOWN” and “UP” button at the same time for 3 seconds (this is the same for getting into the Error Codes History), then press the “DOWN” button once. The display will show “AL Lo”. Press the “AUTO” and “TIMER” button at the same time for 3 seconds. The display will show “AL Hi”, flash for 3 times, and then shift to off mode. If the power button is turned on when flashing “AL Hi” the display will switch from “AL Hi” flashing to temperature and start normal operation. To

Section 1 Description

switch back to Lo altitude setting repeat the steps above. When switching to Hi altitude setting mode, the fuel pump flow rates levels will all be switched to Level 1 (see Flow Volume Setting Mode for the Fuel Pump below), which is a 10% decrease in fuel flow. In the high altitude setting mode "AL Hi" the fuel flow rate is L1=1, L2=1, L3=1. The Lo altitude setting mode is 5 (meaning fuel flow rates are L1= 5, L2= 5, L3= 5).
If the fuel pump flow rate setting mode is changed to L1=1, L2=1, L3=1, it is shifted to "Hi" altitude setting mode automatically.

1-45 Combustion Cleaning Mode

When the unit is in the high combustion for more than 2 hours continuously, it will automatically shift to low combustion for 5 minutes. During Combustion Cleaning mode the unit will change to medium combustion for 30 seconds, then to low combustion for 4 minutes, and back to medium combustion for 30 seconds, and then to high combustion. The display will show "CL:05" (colon flashes at 1.0Hz, and counts down every minute. The countdown is shown on the right side of the display in double figures as "04, 03, 02, 01".

1-46 Flow Volume Setting Mode for The Fuel Pump

To adjust the Fuel Pump Flow Rate, first get in the Flame Electric Current AD Value (FECADV) (see Manual Fuel Pump Operation above) then press both "CLEAR" and "DAY SELECT" buttons at the same time for 3 seconds.
There are 3 fuel pump modes high, medium, and low, and each mode can be set to 9 levels.
Low combustion mode L1 → L
Medium combustion mode L2 → M, M1, M2
High combustion mode L3 → H, H1

Fuel Pump Level	1	2	3	4	5	6	7	8	9
Changing rate %	-10	-7.5	-5.0	-2.5	±0	+2.5	+5.0	+7.5	+10

To shift the Fuel Pump Levels down "L□ 5"→"L□ 4"→"L□ 3"→"L□ 2"→"L□ 1" press "DOWN" button.
When Fuel Pump Level is at "L□ 1" condition, a beep sound will occur and stay at "L□ 1"
To shift the Fuel Pump Levels up "L□ 5"→"L□ 6"→"L□ 7"→"L□ 8"→"L□ 9" press "UP" button.
When Fuel Pump Level is at "L□ 9" condition, a beep sound will occur and stay at "L□ 9".

By pressing the "TIMER" button, the set mode will shift from "L1 □" → "L2 □" → "L3 □" → "P□" with every press.

"P□" is the Manual Fuel Pump Operation mode.
Shift to P1 to P3 by pressing "DOWN" and "UP" buttons.

If the Altitude Setting Mode is change to Hi or back to Lo then all Fuel Pump Flow Rates are changed, "Lo" is a change to level 1 on all combustion modes.

Section 2 Routine Maintenance

2-1 Introductlon

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.

2-2 Routine Maintenance

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

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.

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

Table 2-1 SUGGESTED ROUTINE MAINTENANCE

ACTIVITY	MATERIAL	REMARKS
Check all fuel lines for leaks and/or loose connections.	3/8" (9.52 mm) OD copper tubing	Fuel lines must be secure and free of leaks. Replace tubing if necessary.
Inspect exhaust lines for leaks and/or loose connections.		All exhaust pipes must be covered by the insulating cloth cover.
Check fuel for water and/or other contamination. If the removable fuel tank is used for Laser 560, tank filter should be checked, cleaned or replaced. Also, make sure that the fuel supply hose is tightly connected to both the removable fuel tank and the fuel sump.		Fuel filter or water block filter on the fuel line is recommended. Fuel color should be crystal clear. If fuel is contaminated, see corrective maintenance procedure, paragraph 4-7.
Inspect the fuel pipe for obstruction.		The piping should be free of sharp bends or obstrustions. Air locks could block the fuel supply.
Inspect the electrical wiring for cracks, signs of deterioration, bare wires and/or loose connectors.		
Clean the front panel louvers. (once a week)	Use a clean, lint-free cloth and a non-abrasive household cleaning agent. USE ONLY NON-PETROLEUM DISTILLATE CLEANERS.	Wipe off louvers. Vacuum inside of heater if necessary.
Clean the room air circulation fan. (once a week)		Vacuum filter cover. 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.

Section 2 Routine 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. Replace the burner mat, if necessary.
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 intake pipe, exhaust pipe, 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 drill bit or piece of straight wire. CAUTION: If any obstruction is felt, remove fuel nozzle before proceeding.

Section 3 Servicing

3-1 Introduction

Servicing is required when the heaters is running at proper efficiency. This section covers the possible causes and the corrective procedures for efficiency loses.

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 and/or exchanger.
- Lowered heat output.
- Failed ignition.
- Failure to maintain combustion.
- Noise from the blower motor.

3-2 Cleaning The Heat Exchanger 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 exchanger gasket onto a piece of cardboard. Or replace the gaskets, if necessary, carefully remove the gaskets because they are easy to break.

1. Remove front panel assembly.
2. Remove top plate.
3. Remove top heat shield.
4. Remove heat exchanger.
5. Remove heat shield.
6. Remove flame rod sensor.
7. Turn burner ring counter-clockwise to remove. Burner ring is secured by three burner side pins. If burner ring does not turn, pull it up slightly to loosen the spring clips.
8. Use a wire brush to clean inside the heat exchanger and burner air holes. Clean all carbon on the burner bottom by using a flat-bladed screw driver or wire brush. Vacuum all burner deposits and wipe clean.

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

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

How to replace/attach the burner matts;

For Laser 300
Place the edge of rectangular burner mat (Part # 20479513) under the fuel nozzle and have the other end be in the center. Please refer to Fig. A.

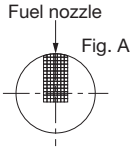


Fig. A

For Laser 530/560
Both models do not have a burner mat. A burner coating is on the original units. When cleaning up bottom of the burner pot, remove the old burner coating.
The burner coating can be purchase locally from an auto parts store. The burner coating is an exhaust manifold paint rated for at least 1200 degrees F.

For Laser 730
Place burner mat (Part # 20478613) in center of burner bottom and position semicircle cut out by ignitor ares. Please refer to Fig. C.

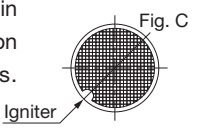


Fig. C

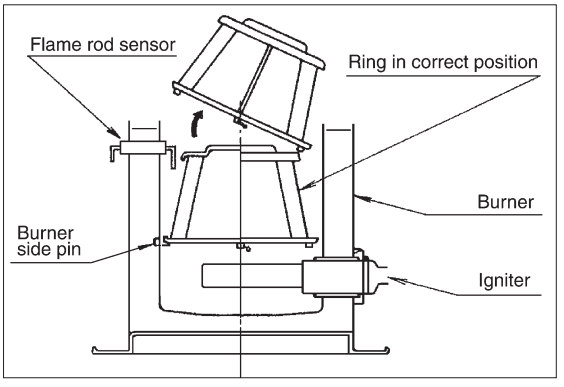
*Please use Burner adhesive Part # 20478526 to attach burner matts

NOTE: A bent burner ring may cause abnormal combustion with uneven and/or yellow flames extending into the heat chamber. It may cause the heat exchanger to become red hot.

When replacing the burner ring, carefully ensure that all three side pins of the burner pot are correctly engaged to the three clips on the buttom of the burner ring.

11. Reinstall the heat exchanger and the flame rod sensor into the correct position.

Section 3 Servicing



3-3 Removal of Water Deposits and Contaminants From Fuel Sump and Fuel Lines

Unplug the heaters from the power supply before proceeding.

1. If using an external tank on the heater, 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 button to “ON”. Proceed with a test run.

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

3-4 Cleaning The 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.

3-5 Error Message

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.

Should problems arise during operation or ignition, use this chart to determine the cause and the proper steps to take. Be sure to unplug heater and allow to cool completely before taking corrective measures.
In the event that heater should extinguish itself, without any action or your part, you should look to the digital indicator for any of the following error codes.

ERROR CODE	CAUSE	SOLUTION
E– 0	Power failure (low voltage, unstable frequency)	Check power source. (See page 36)
E– 23	Primary flame (Flame sensor) is malfunction and/or dirty	Consult your dealer for cleaning and inspection. (See page 36)
E– 6	Fuel line malfunction	Consult your dealer. (See page 34)
E– 2	Out of fuel / no flame	Check fuel gauge on fuel tank; refuel. (See page 33)
E– 2 / E– 6	Flue pipe blockage or leak	Consult your dealer. / Check flue pipe. (See page 33/34)
E– 8	Blower motor malfunction	Consult your dealer. (See page 32)
E– 12	High limit switch activated	Clean circulation fan filter and remove any obstructions, allow your heater to cool completely and re-ignite. (See page 35)
E– 13	Burner thermistor failure Flue pipe blockage or leak	Consult your dealer. Check flue pipe. / Consult your dealer. (See page 35)
E– 22	Ignition failure three times	Consult your dealer. (See page 35)

Section 3 Servicing

3-6 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.

3-7 Verify Igniter Operation

Visually inspect igniter operation.

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

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 (or 220V 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.

3-8 Clean Fuel Inlet Strainer

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

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 removable fuel tank or the external fuel tank to avoid draining all the fuel from the tanks

NOTE: Power should be “OFF” during the performance of this procedure.

STEP 1: Disassembly

A. Remove the two (2) screws from the strainer cover and remove.

NOTE: To catch the fuel which will drain, set the oil catch under the fuel sump, with a small container under it.

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

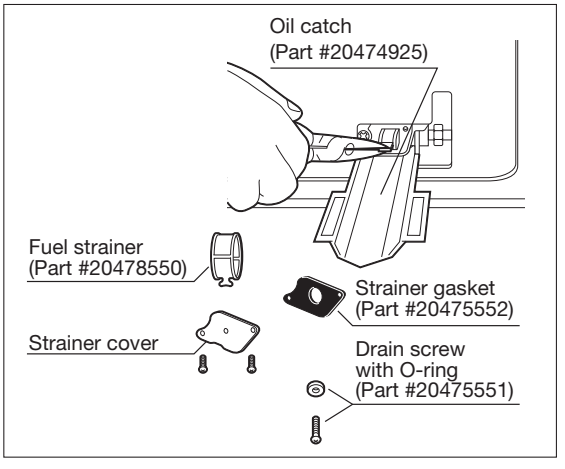


Figure 4-1 CLEAN FUEL INLET STRAINER

Section 3 Servicing

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 loosen the drain screw, there is no need to remove (phillips head screw) which is located to the left of strainer cover. (See Fig. 4-1.)

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: Carefully 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.

3-9 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 front panel assembly.

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 are 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 set-back timer must be reprogrammed after the power is restored.

3-10 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 Laser kerosene lifter 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, or disconnect the fuel supply hose and clean the contamination from the removable fuel tank (Laser 560). Refill with fresh, clean fuel.

STEP 2: Clean the Heater

A. Clean the fuel inlet strainer inside of the fuel sump.

B. Remove 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 heat chamber.
Replace the burner mat, if necessary.

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, the removable fuel tank, and the fusible valve, replace all covers and supply power to the heater.

If the problem still exists and contaminated fuel is suspected, it can be checked.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 3 Servicing

3-11 Cleaning Blower Motor (Only Laser 560/730)

Usage of poor-quality kerosene (High sulfer, 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

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

NOTE: 2.0 mm (5/64 in.) hex key and 7 mm (9/32 in.) socket are required.

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

STEP 2: Replacing the Blower Motor or Intake Fan

A. Remove the spacer from the shaft.
B. Remove five (5) screws from the blower motor bracket.
C. Remove the motor wire bushing and then the blower motor from the housing.
D. Loosen the set screw and remove intake fan.
E. Remove the two (2) screws fixed on the blower motor bracket of blower motor.

Section 3

Servicing

Burner thermistor temperature indication

Display	°C
0	—
1	334.0
2	288.7
3	265.1
4	249.5
5	238.0
6	228.9
7	221.4
8	215.1
9	209.6
0A	204.8
0B	200.5
0C	196.6
0D	193.1
0E	189.9
0F	186.9
10	184.2
11	181.6
12	179.2
13	176.9
14	174.8
15	172.8
16	170.9
17	169.1
18	167.3
19	165.7
1A	164.1
1B	162.5
1C	161.1
1D	159.7
1E	158.3
1F	157.0
20	155.7
21	154.5
22	153.3
23	152.1
24	151.0
25	149.9
26	148.8
27	147.8
28	146.8
29	145.8
2A	144.9
2B	143.9
2C	143.0
2D	142.1
2E	141.2
2F	140.4
30	139.5
31	138.7

Display	°C
32	137.9
33	137.1
34	136.3
35	135.6
36	134.8
37	134.1
38	133.4
39	132.6
3A	131.9
3B	131.3
3C	130.6
3D	129.9
3E	129.2
3F	128.6
40	127.9
41	127.3
42	126.7
43	126.1
44	125.5
45	124.9
46	124.3
47	123.7
48	123.1
49	122.5
4A	121.9
4B	121.4
4C	120.8
4D	120.3
4E	119.7
4F	119.2
50	118.7
51	118.1
52	117.6
53	117.1
54	116.6
55	116.1
56	115.6
57	115.1
58	114.6
59	114.1
5A	113.6
5B	113.1
5C	112.6
5D	112.1
5E	111.6
5F	111.2
60	110.7
61	110.2
62	109.8
63	109.3

Display	°C
64	108.9
65	108.4
66	108.0
67	107.5
68	107.1
69	106.6
6A	106.2
6B	105.7
6C	105.3
6D	104.9
6E	104.4
6F	104.0
70	103.6
71	103.1
72	102.7
73	102.3
74	101.9
75	101.4
76	101.0
77	100.6
78	100.2
79	99.8
7A	99.3
7B	98.9
7C	98.5
7D	98.1
7E	97.7
7F	97.3
80	96.9
81	96.5
82	96.1
83	95.7
84	95.3
85	94.9
86	94.5
87	94.1
88	93.6
89	93.2
8A	92.8
8B	92.4
8C	92.0
8D	91.6
8E	91.2
8F	90.8
90	90.4
91	90.0
92	89.6
93	89.2
94	88.8
95	88.4

Display	°C
96	88.0
97	87.6
98	87.2
99	86.8
9A	86.4
9B	86.0
9C	85.6
9D	85.2
9E	84.8
9F	84.4
A0	84.0
A1	83.6
A2	83.2
A3	82.8
A4	82.4
A5	82.0
A6	81.6
A7	81.2
A8	80.8
A9	80.3
AA	79.9
AB	79.5
AC	79.1
AD	78.7
AE	78.3
AF	77.8
B0	77.4
B1	77.0
B2	76.5
B3	76.1
B4	75.7
B5	75.3
B6	74.8
B7	74.4
B8	73.9
B9	73.5
BA	73.0
BB	72.6
BC	72.1
BD	71.7
BE	71.2
BF	70.8
C0	70.3
C1	69.8
C2	69.3
C3	68.9
C4	68.4
C5	67.9
C6	67.4
C7	66.9

Display	°C
C8	66.4
C9	65.9
CA	65.4
CB	64.9
CC	64.4
CD	63.8
CE	63.3
CF	62.8
D0	62.2
D1	61.7
D2	61.1
D3	60.5
D4	60.0
D5	59.4
D6	58.8
D7	58.2
D8	57.6
D9	57.0
DA	56.3
DB	55.7
DC	55.0
DD	54.3
DE	53.7
DF	53.0
E0	52.3
E1	51.5
E2	50.8
E3	50.0
E4	49.2
E5	48.4
E6	47.6
E7	46.8
E8	45.9
E9	45.0
EA	44.0
EB	43.1
EC	42.1
ED	41.0
EE	39.9
EF	38.8
F0	37.6
F1	36.3
F2	35.0
F3	33.6
F4	32.1
F5	30.5
F6	28.7
F7	26.9
F8	24.8
F9	22.5

Display	°C
FA	19.9
FB	16.8
FC	13.3
FD	8.8
FE	2.7
FF	-7.0

Section 3

Servicing

Flame electric current value indication

HEX	µA
0	more than 1
1	
2	
3	
4	
5	
6	
7	
8	
9	
0A	
0B	
0C	
0D	
0E	
0F	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
1A	
1B	
1C	
1D	
1E	
1F	
20	
21	
22	
23	
24	
25	
26	
27	
28	0.9
29	0.9
2A	0.9
2B	0.9
2C	0.9
2D	0.9
2E	0.9
2F	0.9
30	0.9
31	0.9

HEX	µA
32	0.9
33	0.9
34	0.9
35	0.9
36	0.9
37	0.9
38	0.9
39	0.9
3A	0.9
3B	0.9
3C	0.9
3D	0.9
3E	0.9
3F	0.8
40	0.8
41	0.8
42	0.8
43	0.8
44	0.8
45	0.8
46	0.8
47	0.8
48	0.8
49	0.8
4A	0.8
4B	0.8
4C	0.8
4D	0.8
4E	0.8
4F	0.8
50	0.8
51	0.8
52	0.8
53	0.8
54	0.8
55	0.7
56	0.7
57	0.7
58	0.7
59	0.7
5A	0.7
5B	0.7
5C	0.7
5D	0.7
5E	0.7
5F	0.7
60	0.7
61	0.7
62	0.7
63	0.7

HEX	µA
64	0.7
65	0.7
66	0.7
67	0.7
68	0.7
69	0.7
6A	0.7
6B	0.6
6C	0.6
6D	0.6
6E	0.6
6F	0.6
70	0.6
71	0.6
72	0.6
73	0.6
74	0.6
75	0.6
76	0.6
77	0.6
78	0.6
79	0.6
7A	0.6
7B	0.6
7C	0.6
7D	0.6
7E	0.6
7F	0.6
80	0.6
81	0.5
82	0.5
83	0.5
84	0.5
85	0.5
86	0.5
87	0.5
88	0.5
89	0.5
8A	0.5
8B	0.5
8C	0.5
8D	0.5
8E	0.5
8F	0.5
90	0.5
91	0.5
92	0.5
93	0.5
94	0.5
95	0.5

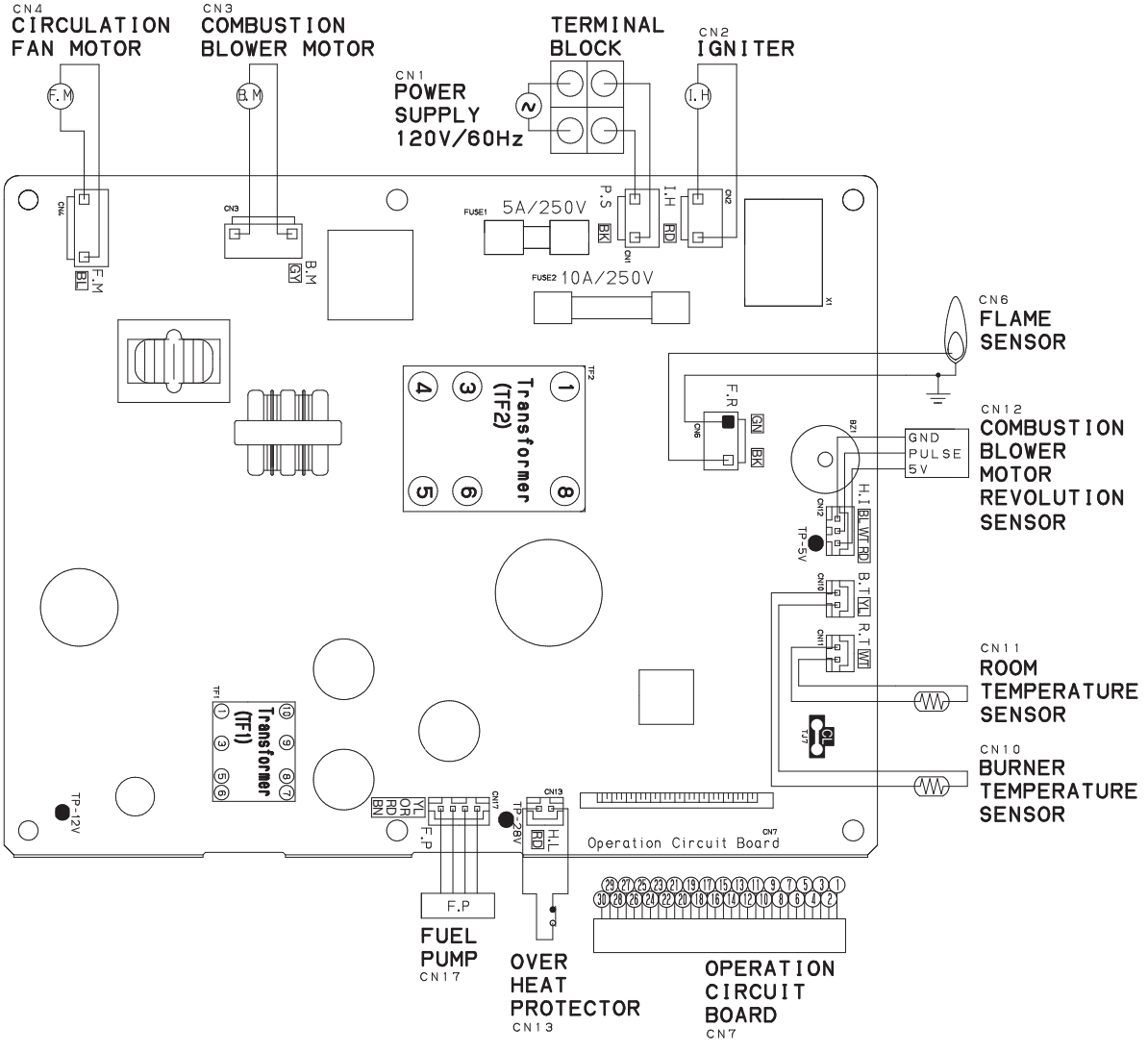
HEX	µA
96	0.5
97	0.5
98	0.4
99	0.4
9A	0.4
9B	0.4
9C	0.4
9D	0.4
9E	0.4
9F	0.4
A0	0.4
A1	0.4
A2	0.4
A3	0.4
A4	0.4
A5	0.4
A6	0.4
A7	0.4
A8	0.4
A9	0.4
AA	0.4
AB	0.4
AC	0.4
AD	0.4
AE	0.3
AF	0.3
B0	0.3
B1	0.3
B2	0.3
B3	0.3
B4	0.3
B5	0.3
B6	0.3
B7	0.3
B8	0.3
B9	0.3
BA	0.3
BB	0.3
BC	0.3
BD	0.3
BE	0.3
BF	0.3
C0	0.3
C1	0.3
C2	0.3
C3	0.3
C4	0.2
C5	0.2
C6	0.2
C7	0.2

HEX	µA
C8	0.2
C9	0.2
CA	0.2
CB	0.2
CC	0.2
CD	0.2
CE	0.2
CF	0.2
D0	0.2
D1	0.2
D2	0.2
D3	0.2
D4	0.2
D5	0.2
D6	0.2
D7	0.2
D8	0.2
D9	0.2
DA	0.1
DB	0.1
DC	0.1
DD	0.1
DE	0.1
DF	0.1
E0	0.1
E1	0.1
E2	0.1
E3	0.1
E4	0.1
E5	0.1
E6	0.1
E7	0.1
E8	0.1
E9	0.1
EA	0.1
EB	0.1
EC	0.1
ED	0.1
EE	0.1
EF	0.1
F0	0
F1	0
F2	0
F3	0
F4	0
F5	0
F6	0
F7	0
F8	0
F9	0

HEX	µA
FA	0
FB	0
FC	0
FD	0
FE	0
FF	0

Section 4 Trouble Shooting

4-1 Resistor/Capacitor Value



Section 4 Trouble Shooting

4-1 Resistor/Capacitor Value

Resistor Value

COMPONENT		Laser300	Laser530	Laser560	Laser 730/730AT
Igniter at cold condition (73°F(23°))		17Ω±10%			
Transformer (TF1)	Primary Side ① to ③	3.7Ω±30%			
	Secondary Side ⑤ to ⑥	0.6Ω±30%			
	Secondary Side ⑦ to ⑧	0.7Ω±30%			
	Secondary Side ⑨ to ⑩	0.2Ω±30%			
Transformer (TF2)	Primary Side ① to ④	800Ω±20%			
	Secondary Side ⑤ to ⑧	1.2kΩ±20%			
Circulation Fan Motor		300Ω±10%	84Ω±10%	450Ω±10%	230Ω±10%
Combustion Blower Motor		27Ω±20%	22Ω±20%	22Ω±20%	11Ω±20%
Thermistor (at 77°F(25°))		10kΩ±5%			
Fuel Pump (coil)		95Ω±25Ω			

Component Voltage Readings

COMPONENT		READING TAKEN AT		Laser300	Laser530	Laser560	Laser 730/730AT
Fuel Pump		F.P (CN17) OR to YL (•••)		DC 24V±15%			
Igniter		I.H (CN2)		AC 120V±15%			
Transformer (TF1)		"TP-5V" to "F.R (GN) (CN6)"		DC 5V±15%			
		"TP-12V" to "F.R (GN) (CN6)"		DC 12V±15%			
		"TP-28V" to "F.R (GN) (CN6)"		DC 28V±15%			
Transformer (TF2)	Primary Side	① to ④		AC 120V±15%			
	Secondary Side	⑤ to ⑧		AC 140V±15%			
Circulation Fan Motor		F.M (CN4) Motor connected	High	AC 118V±15%	AC 118V±15%	AC 118V±15%	AC 118V±15%
			Medium	AC 101V±15%	AC 101V±15%	AC 93V±15%	AC 93V±15%
			Low	AC 83V±15%	AC 83V±15%	AC 34V±15%	AC 34V±15%
Combustion Blower Motor		B.M (CN3) Motor connected	High	AC 80V±15%	AC 102V±15%	AC 97V±15%	AC 98V±15%
			Medium	AC 71V±15%	AC 93V±15%	AC 77V±15%	AC 75V±15%
			Low	AC 60V±15%	AC 80V±15%	AC 69V±15%	AC 67V±15%
Revolution Sensor (CN12)		RD (+) to BL (-)		DC 5V±15%			
		WT (S) to BL (-) (in operation)		DC 2.5V±15%			

Section 4 Trouble Shooting

4-2 Control Circuit Board Time Chart

MA-252 series

LASER 300 / LASER 530 / LASER 560 / LASER 730

A : LASER 300 / LASER 530 B : LASER 560 / LASER 730

No	Item	Specification	Conditions	Remarks
1	Timing			
–1	Blower motor starting timing (T1)	5 ± 2 sec.		
–2	Preheat timing (T2)	A : 90±8 sec. B : 180±8 sec.	Room temperature above 15 deg. C	
		A : 120±10 sec. B : 360±10 sec.	0 deg. C < room temperature < 15 deg. C	
		A : 240±12 sec. B : 540±12 sec.	Room temperature below 0 deg. C. Note that when automatic preheating is conducted after post purging is completed, it should last 90 seconds regardless of the room temperature.	
–3	Fuel pump starting timing (T3)	5 ± 2 sec.	Shift to M2 after flame detection	
–4	Blower motor (BM) delay timing (T4)	15±3 sec.	At start	
–5	Fan motor (FM) starting timing (T5)	120±10 sec.		
–6	Fan motor H speed timing (T6)	5 ± 3 sec.	At start	
–7	Pre-combustion timing (T7)	300±15 sec.		
–8	BM delay timing (T8)	5±2 sec.		
–9	Fuel pump delay timing (T9)	1±0.5 sec.		
–10	FM delay timing (T10)	30±5 sec.		
–11	Post-purge timing (T11)	180±10 sec.	No flame after detection	
–12	Miss ignition timing (T12)	140 ± 9 sec.		
–13	Miss flame timing (T13)	3±2 sec.		
–14	Motor lock (initial) timing (T14)	5±2 sec.	When slow rotation has continued for more than 5 seconds during normal operation	
–15	Identical combustion timing (T19)	30 ± 3 sec.	When combustion shifts from High to Low and Low to High	
–16	Initial H1 combustion timing (T21)	300 ± 30 sec.	For correcting flow temperature characteristics only when High combustion starts after reserve combustion	

Section 4 Trouble Shooting

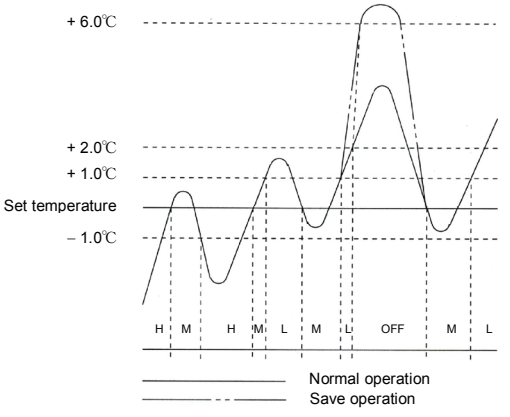
4-2 Control Circuit Board Time Chart

No	Item	Specification	Conditions	Remarks
1				
–17	Set OK timing (T22)	10 ± 2 sec.	Set room temperature	
–18	Fuel recovery timing (T23)	Within 3 sec.		
–19	Burner thermistor low temperature timing (T25)	3±2 sec.		
–20	Burner thermistor timing (T26)	300 ± 30 sec.		
–21	False flame detection timing (T44)	30 ± 2 sec.		
–22	Low voltage timing (T46)	10 ± 2 sec.		
2	Flame detector		Measurement meter: Yokogawa 2011-SB2 (class 1, range of 3μ A)	
–1	Detection current	More than 0.6 μA (recommended value is 0.3 μA)	When no flame is detected during miss ignition timing (T12), display E- 2. When miss ignition is detected 3 times in succession, display E- 22. When no flame is detected during combustion, shift to extinguishing process and stop operation.	
–2	Allowable leakage resistance	More than 1.5 MΩ	Only when the detection current exceeds 0.6 ΩA  S5566N 4.7MΩ	
3	Room thermistor		Thermistor used is B constant 4100; resistance at 25 deg. C is 10 KΩ.	
–1	Maximum set temperature	32.7 ± 2.3℃ ($7.08^{+0.74}_{-0.68}$ KΩ)	Shall display 90 deg. F	
–2	Minimum set temperature	10.4 ± 2.0℃ ($20.34^{+2.18}_{-1.92}$ KΩ)	Shall display 50 deg. F	
–3	Differential 1	1.0 ± 0.5deg	Normal combustion	
	Maximum temperature setting	($0.24^{+0.11}_{-0.12}$ KΩ)	Set temperature: 90 deg. F	
	Minimum temperature setting	($1.01^{+0.32}_{-0.33}$ KΩ)	Set temperature: 50 deg. F	
–4	Differential 2	2.0 ± 0.7deg	Flame extinguishing	
	Maximum temperature setting	($0.58^{+0.22}_{-0.33}$ KΩ)	Set temperature: 90 deg. F	
	Minimum temperature setting	($3.28^{+1.19}_{-1.25}$ KΩ)	Set temperature: 50 deg. F	

Section 4 Trouble Shooting

4-2 Control Circuit Board Time Chart

No	Item	Specification	Conditions	Remarks
3 –5	Differential 3	6.0 ± 1.0deg	Save flame extinguishing	
	Maximum temperature setting	(1.54 $^{+0.31}_{-0.30}$ KΩ)	Set temperature: 90 deg. F	
	Minimum temperature setting	(5.46 $^{+0.74}_{-0.71}$ KΩ)	Set temperature: 50 deg. F	
–6	Preheat reduction resistor 1	15.6 ± 1.9deg (15.68 $^{+1.58}_{-1.42}$ KΩ)	A: Preheat for 90 sec. B: Preheat for 180 sec.	
	Preheat reduction resistor 2	0.7 ± 2.5deg (33.85 $^{+4.51}_{-3.77}$ KΩ)	A: Preheat for 120 sec. B: Preheat for 360 sec.	
–7	Room thermistor combustion control (See the following diagram)			
–8	Initial room thermistor combustion control (after T7 ends)	High combustion Medium combustion Low combustion	For the set temperature: Less than –1.0 deg. -1.0 to 0 deg. Over 0 deg.	
		2 ± 0.7deg	Flame extinguishing begins when the set temperature is exceeded by more than 2 degrees C. Operation begins again when the temperature inside the room falls below the set temperature during the flame extinguishing process.	
–9	Power saver operation	6 ± 1.0deg	Flame extinguishing begins when the set temperature is exceeded by more than 6 degrees C. Operation begins again when the temperature inside the room falls below the set temperature during the flame extinguishing process.	



Section 4 Trouble Shooting

4-2 Control Circuit Board Time Chart

No	Item	Specification	Conditions	Remarks
4	Burner thermistor trouble detection	A : 200 ± 40kΩ B : 450 ± 90kΩ	When abnormal combustion is detected after pre-combustion timing (T7), shift to extinguishing process and stop operation. Display E- 13 Thermistor used is B constant 5250; resistance at 25 deg. C is 8.02 KΩ.	
5	Fuel pump frequency control			
	H combustion	A : 15.970 ± 0.5Hz		
		B : 20.540 ± 0.5Hz		
	H1 combustion	A : 14.373 ± 0.5Hz		
		B : 18.486 ± 0.5Hz		
	M combustion	A : 11.380 ± 0.5Hz		
		B : 14.263 ± 0.5Hz		
	M1 combustion	A : 11.380± 0.5Hz		
		B : 14.263 ± 0.5Hz		
	M2 combustion	A : 7.985± 0.5Hz		
		B : 10.269 ± 0.5Hz		
	L combustion	A : 6.330± 0.5Hz		
		B : 7.990 ± 0.5Hz		
6	Blower motor control			
–1	Speed (1 minute average)			
	High (H)	A : 2900 ± 1.4%rpm		
		B : 3200 ±1.4%rpm		
	Medium (M)	A : 2550 ±1.4%rpm		
		B : 2550 ±1.4%rpm		
	(M1)	A : 2550 ±1.4%rpm		
		B : 2700 ±1.4%rpm		
	(M2)	A : 2350 ±1.4%rpm		
		B : 2500 ±1.4%rpm		
	Low (L)	A : 1700 ±1.4%rpm		
		B : 1800 ±1.4%rpm		
	(L1)	A : 1500 ±1.4%rpm		
		B : 1500 ±1.4%rpm		

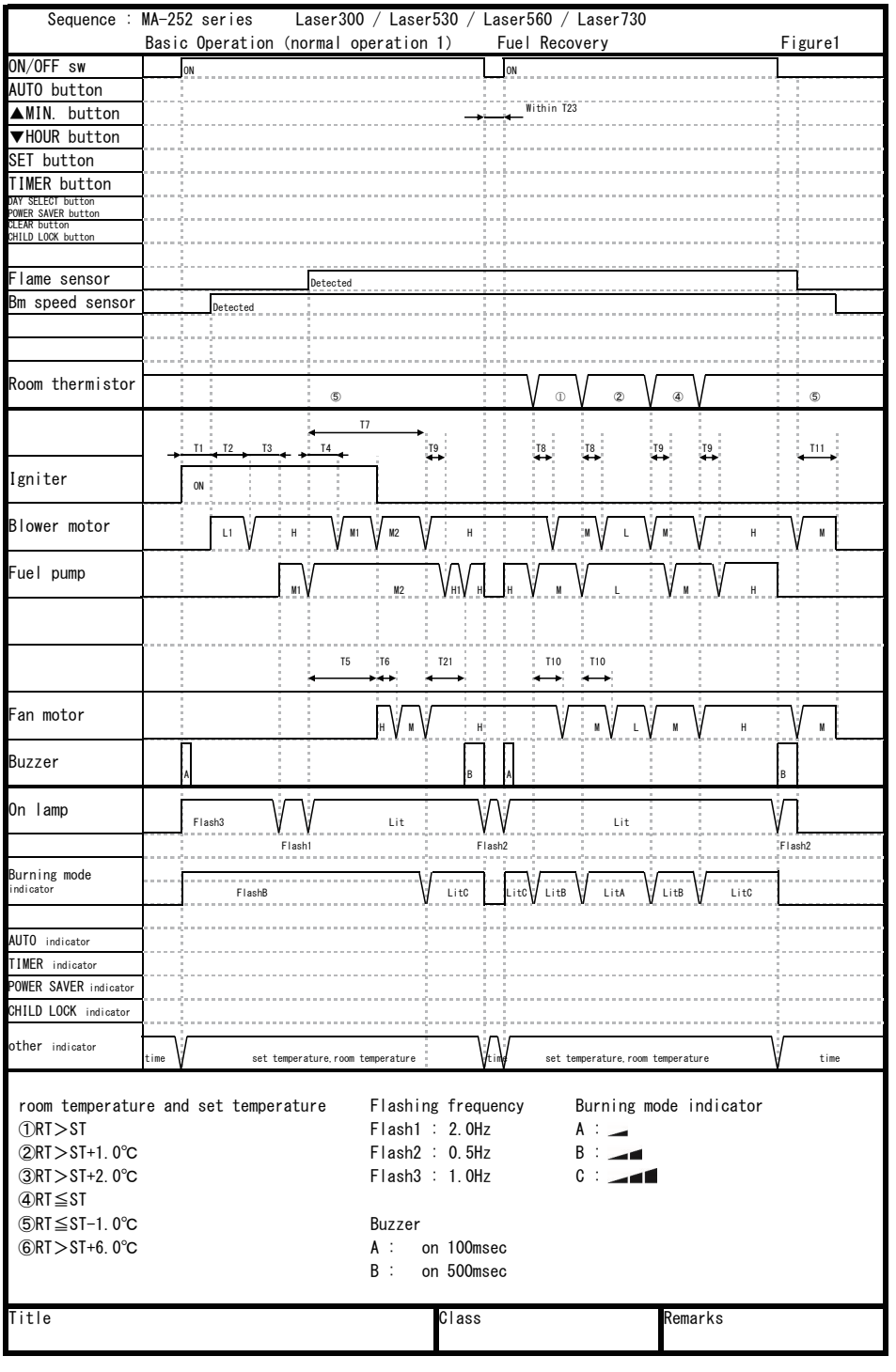
Section 4 Trouble Shooting

4-2 Control Circuit Board Time Chart

No	Item	Specification	Conditions	Remarks
–2	Motor lock speed High (H) Medium (M) (M1) (M2) Low (L) (L1)	 A : 1144 ±1.4%rpm B : 1259 ±1.4%rpm A : 1030 ±1.4%rpm B : 1030 ±1.4%rpm A : 1030 ±1.4%rpm B : 1030 ±1.4%rpm A : 1030 ±1.4%rpm B : 1030 ±1.4%rpm A : 687 ±1.4%rpm B : 687 ±1.4%rpm A : not detected B : not detected	When motor lock is detected during combustion, shift to extinguishing process and stop operation. Display E- 8.	
7	Fan motor control High (H) Medium (M) Low (L)	 A : Full wave B : Full wave A : 5 : 1 (ON : OFF) B : 3 : 1 (ON : OFF) A : 2 : 1 (ON : OFF) B : 1 : 3 (ON : OFF)		
8	Overheat protector Abnormal overheat detection	When normal ON When abnormal overheat is detected	When abnormal overheat is detected during electromagnetic pump operation, shift to extinguishing process and stop operation. Display E- 12.	
9	Power failure recovery system	More than 30 minutes	Keep in memory of current time, set timer time, set room temperature, timer operation and power saver operation during power failure.	
10	Segment safety display	E- 0 Power failure E- 2 Miss ignition E- 6 Miss flame E- 8 Motor lock E-12 Recovery after overheat protector operated E-13 Burner thermistor trouble detection E-22 When an ignition error has occurred 3 times in succession E-23 Primary flame (Flame sensor) is malfunction		

Section 4 Trouble Shooting

4-2 Control Circuit Board Time Chart

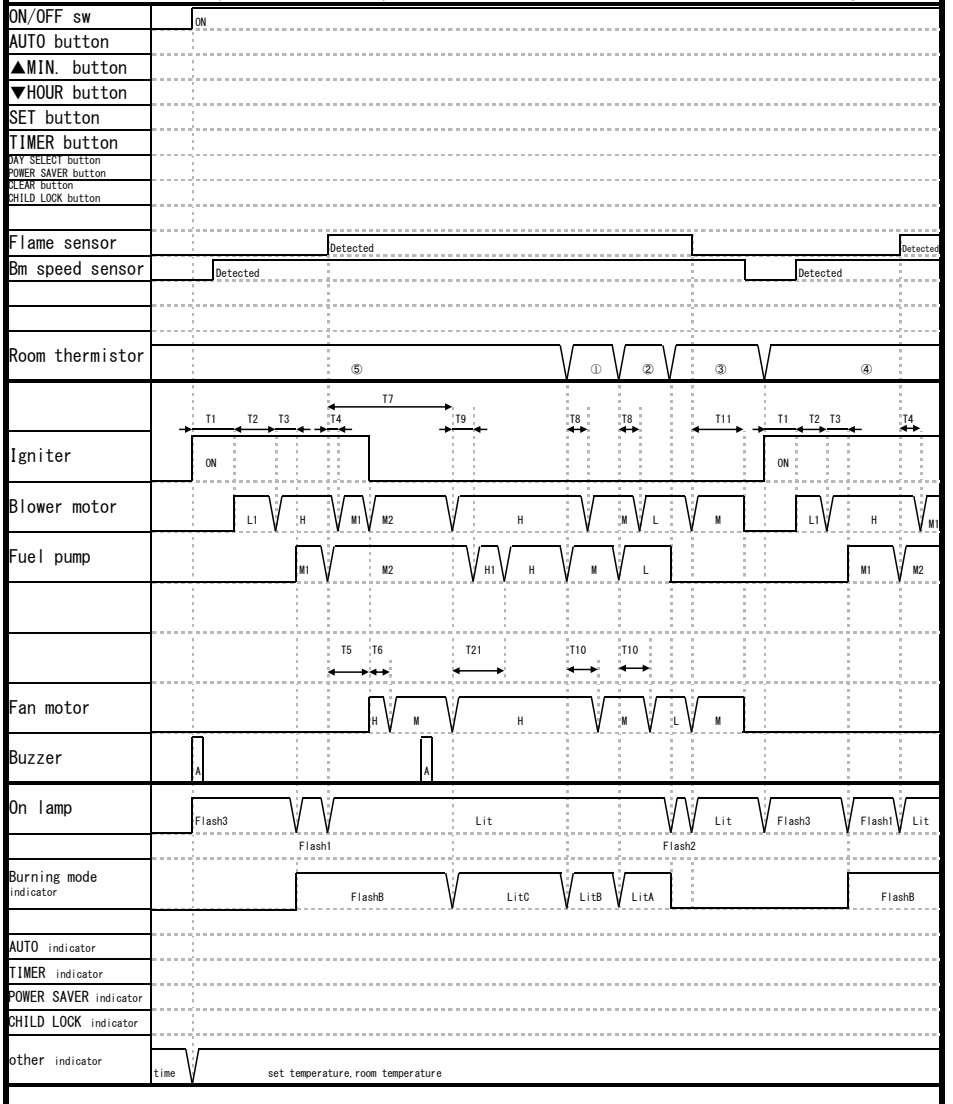


Section 4 Trouble Shooting

4-2 Control Circuit Board Time Chart

Sequence : MA-252 series Laser300 / Laser530 / Laser560 / Laser730

Basic Operation (normal operation 2) Figure2

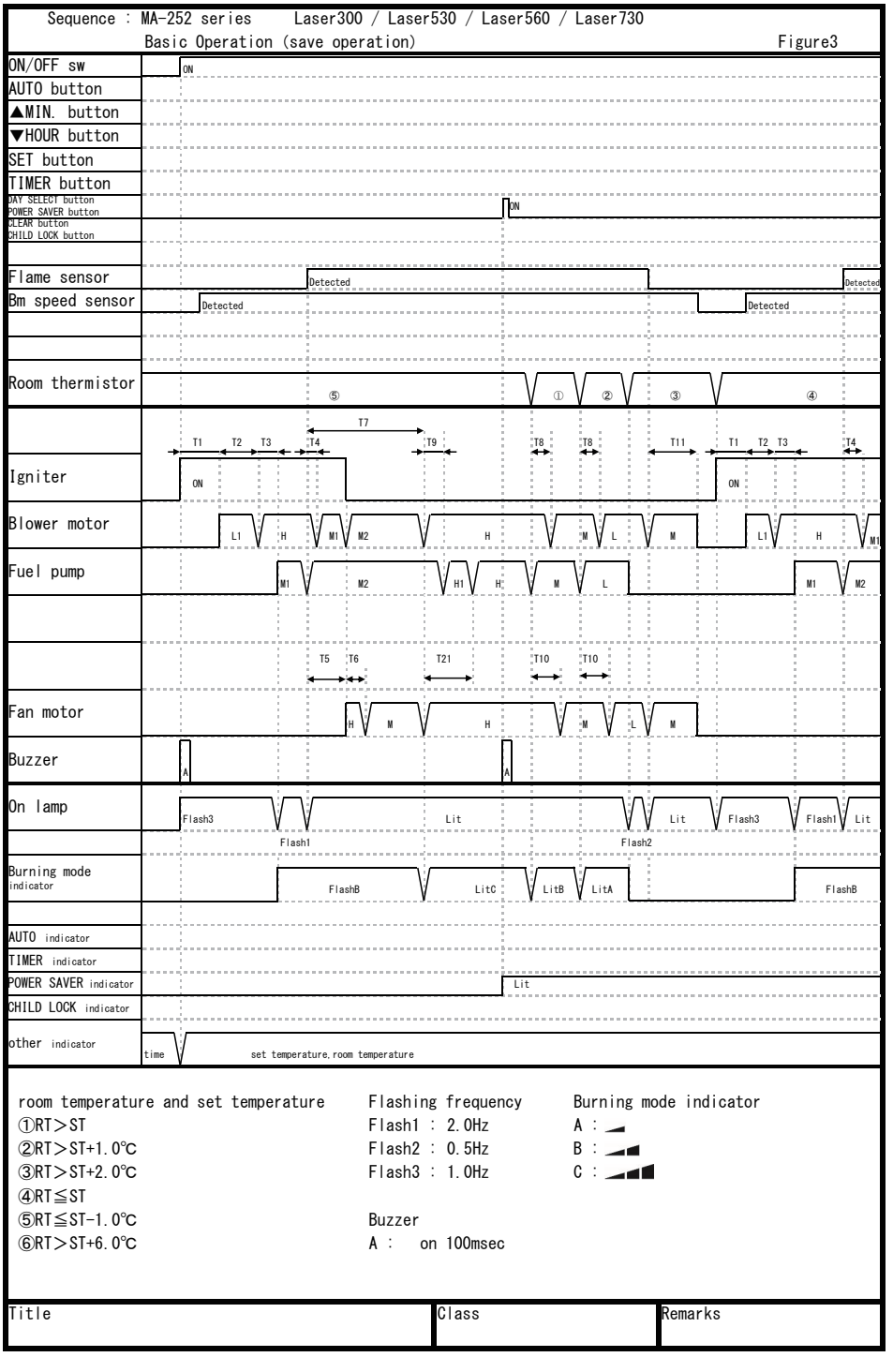


room temperature and set temperature	Flashing frequency	Burning mode indicator
①RT＞ST	Flash1 : 2.0Hz	A :
②RT＞ST+1.0℃	Flash2 : 0.5Hz	B :
③RT＞ST+2.0℃	Flash3 : 1.0Hz	C :
④RT≦ST		
⑤RT≦ST-1.0℃	Buzzer	
⑥RT＞ST+6.0℃	A : on 100msec	

Title	Class	Remarks

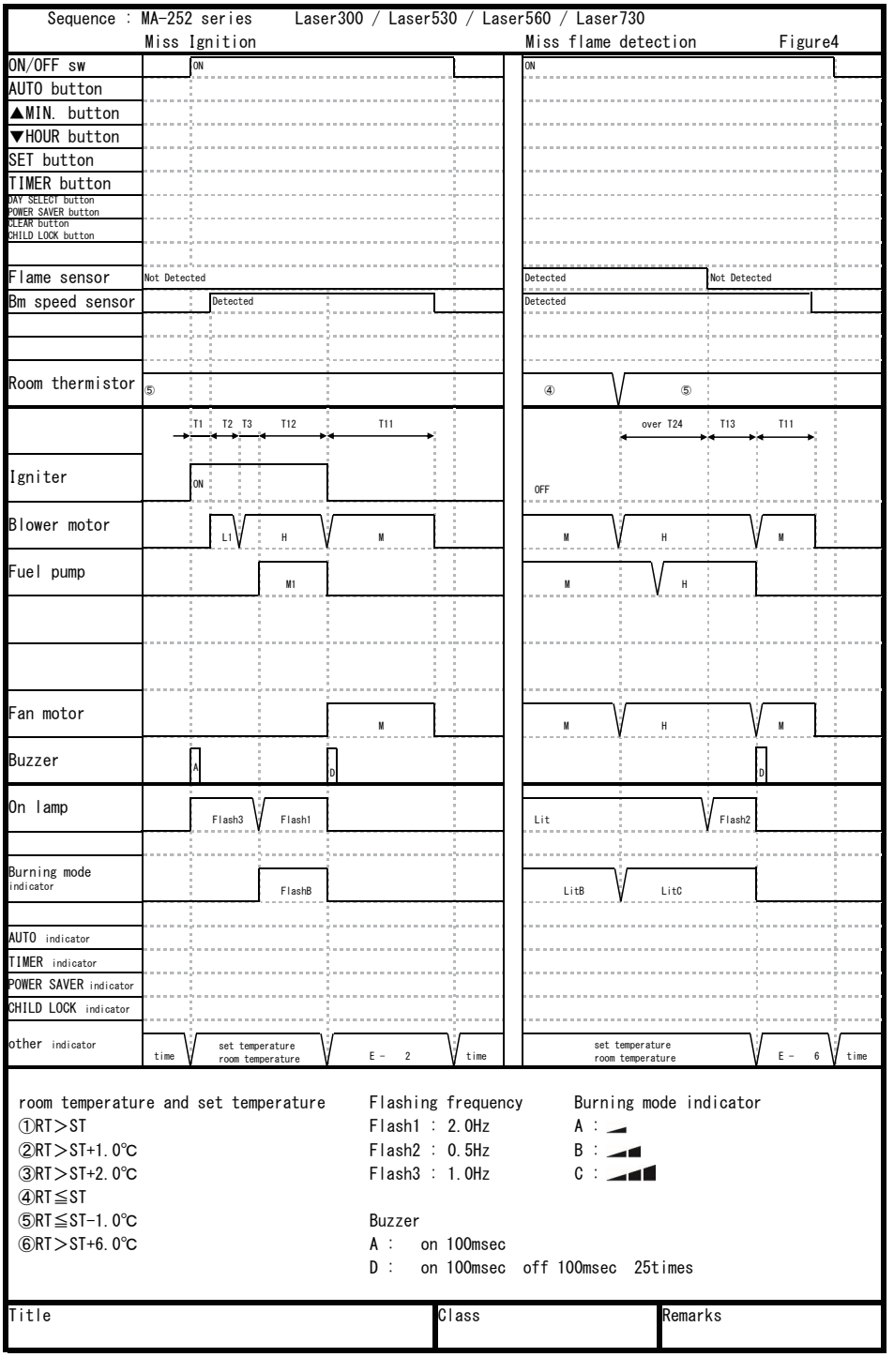
Section 4 Trouble Shooting

4-2 Control Circuit Board Time Chart



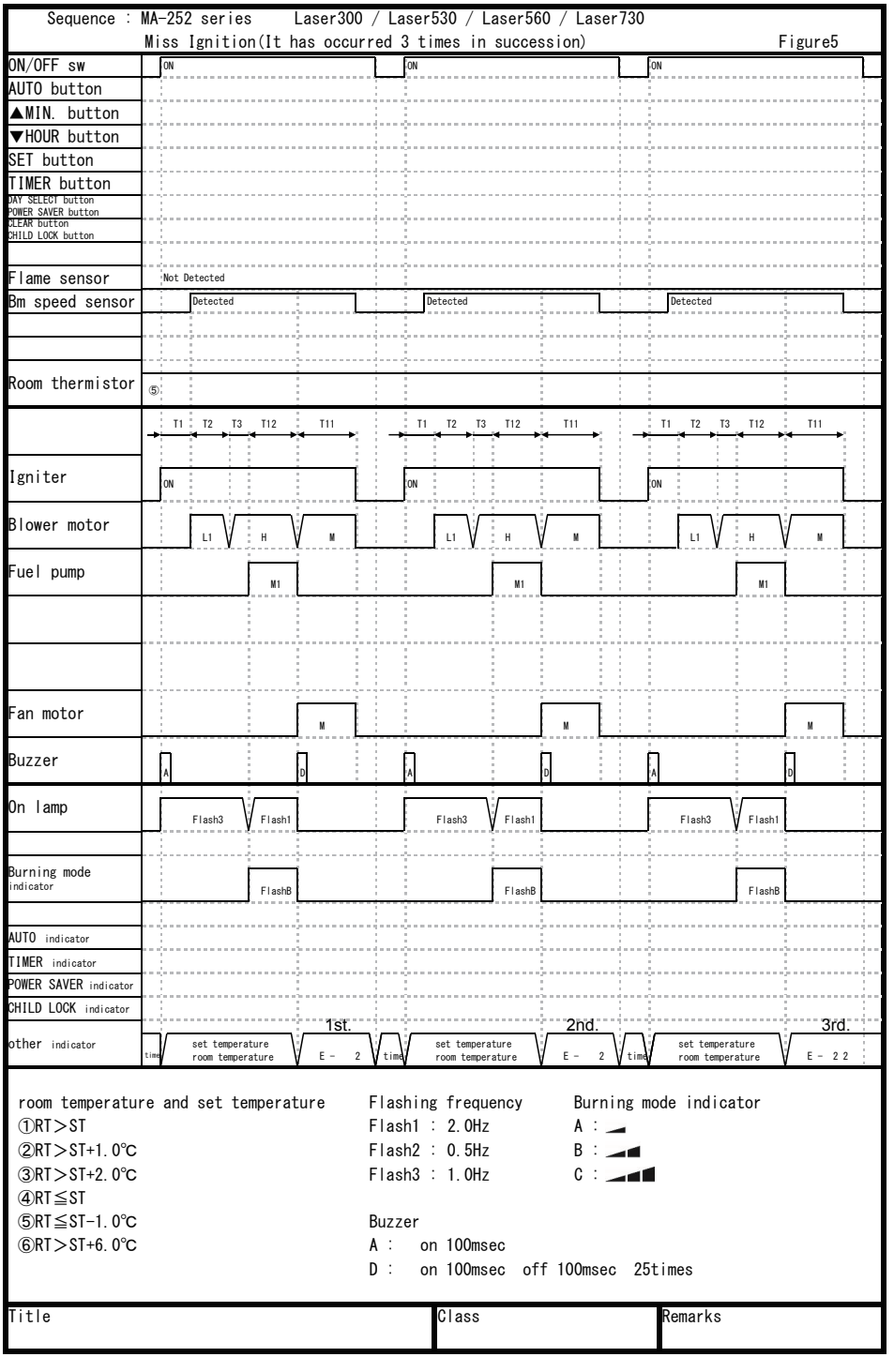
Section 4 Trouble Shooting

4-2 Control Circuit Board Time Chart



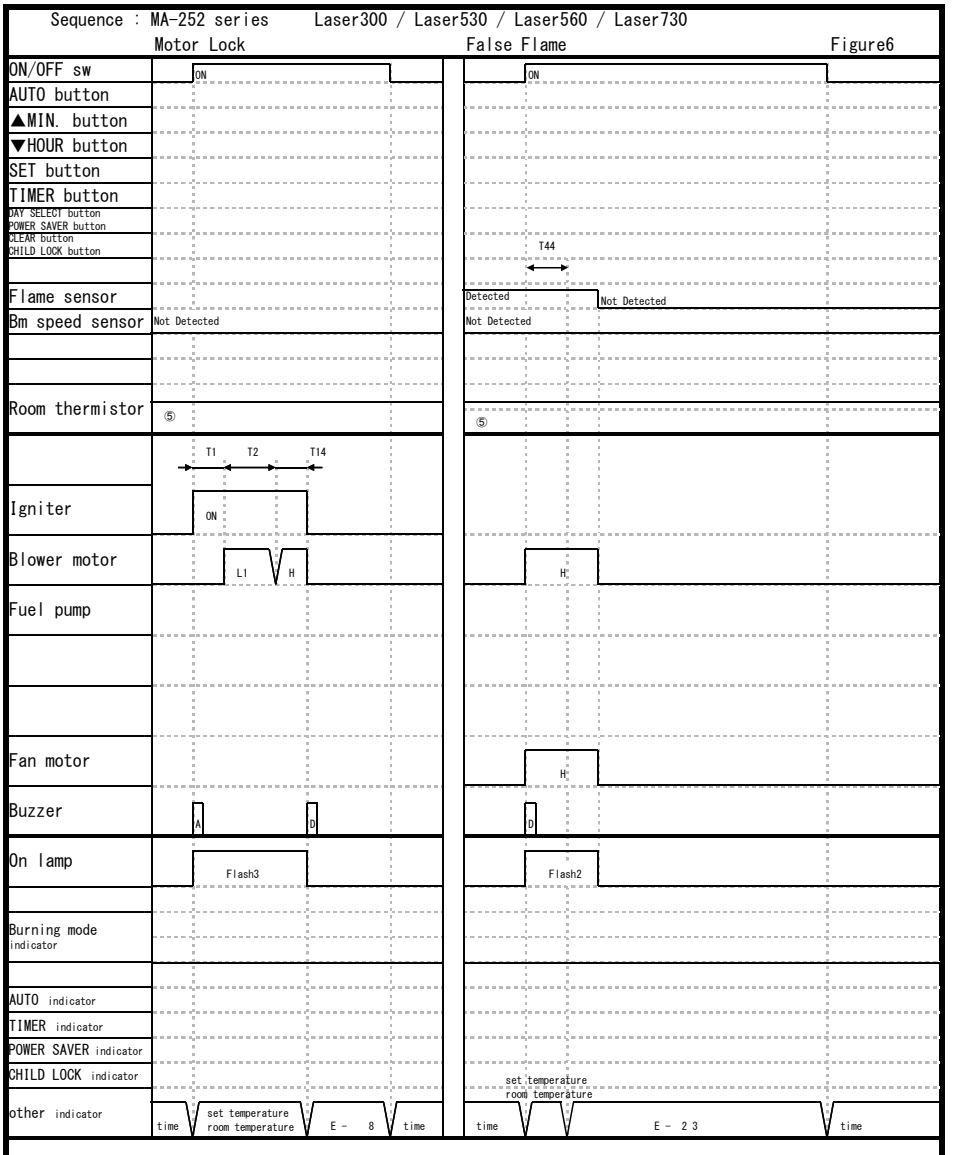
Section 4 Trouble Shooting

4-2 Control Circuit Board Time Chart



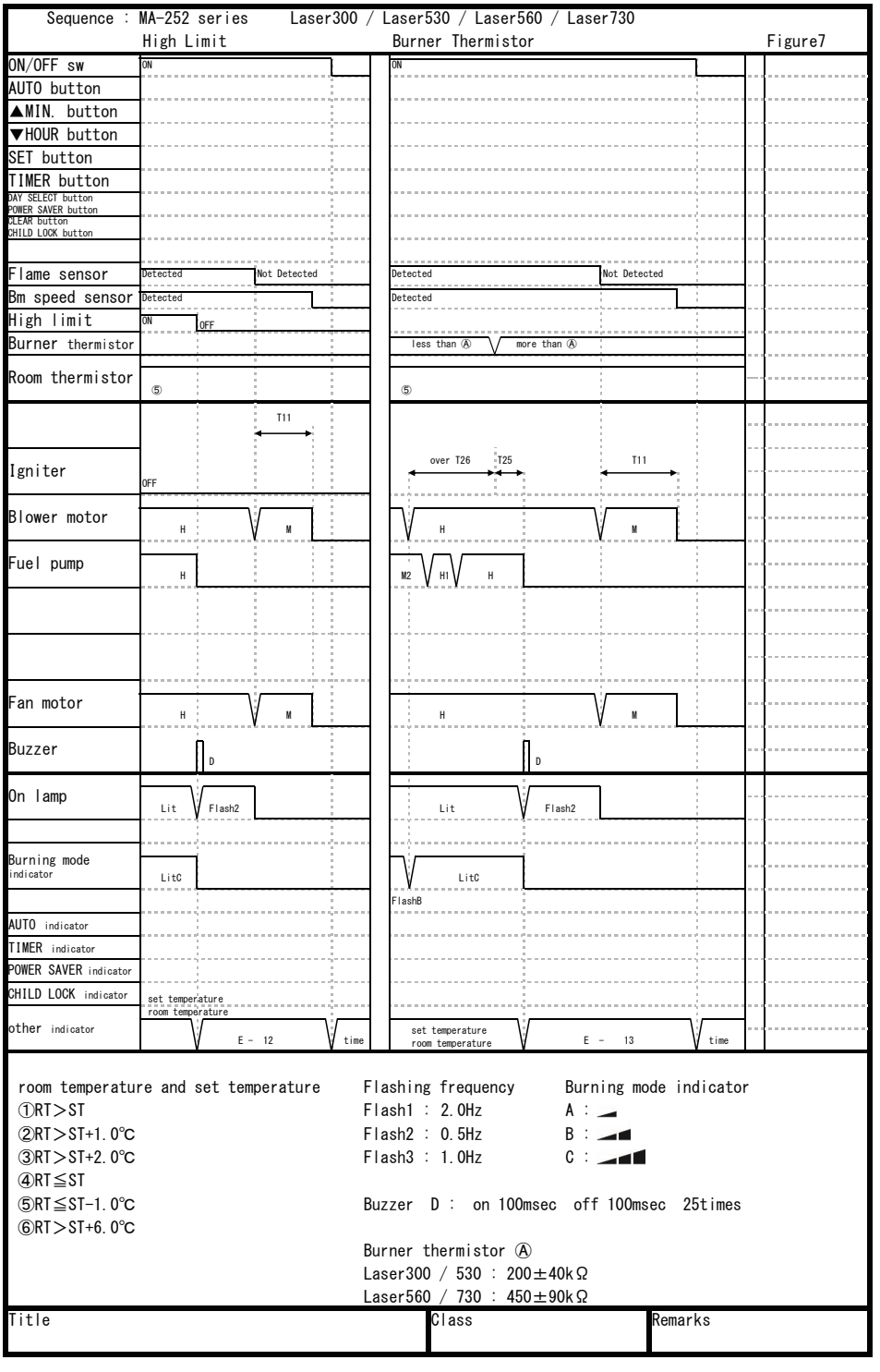
Section 4 Trouble Shooting

4-2 Control Circuit Board Time Chart



Section 4 Trouble Shooting

4-2 Control Circuit Board Time Chart



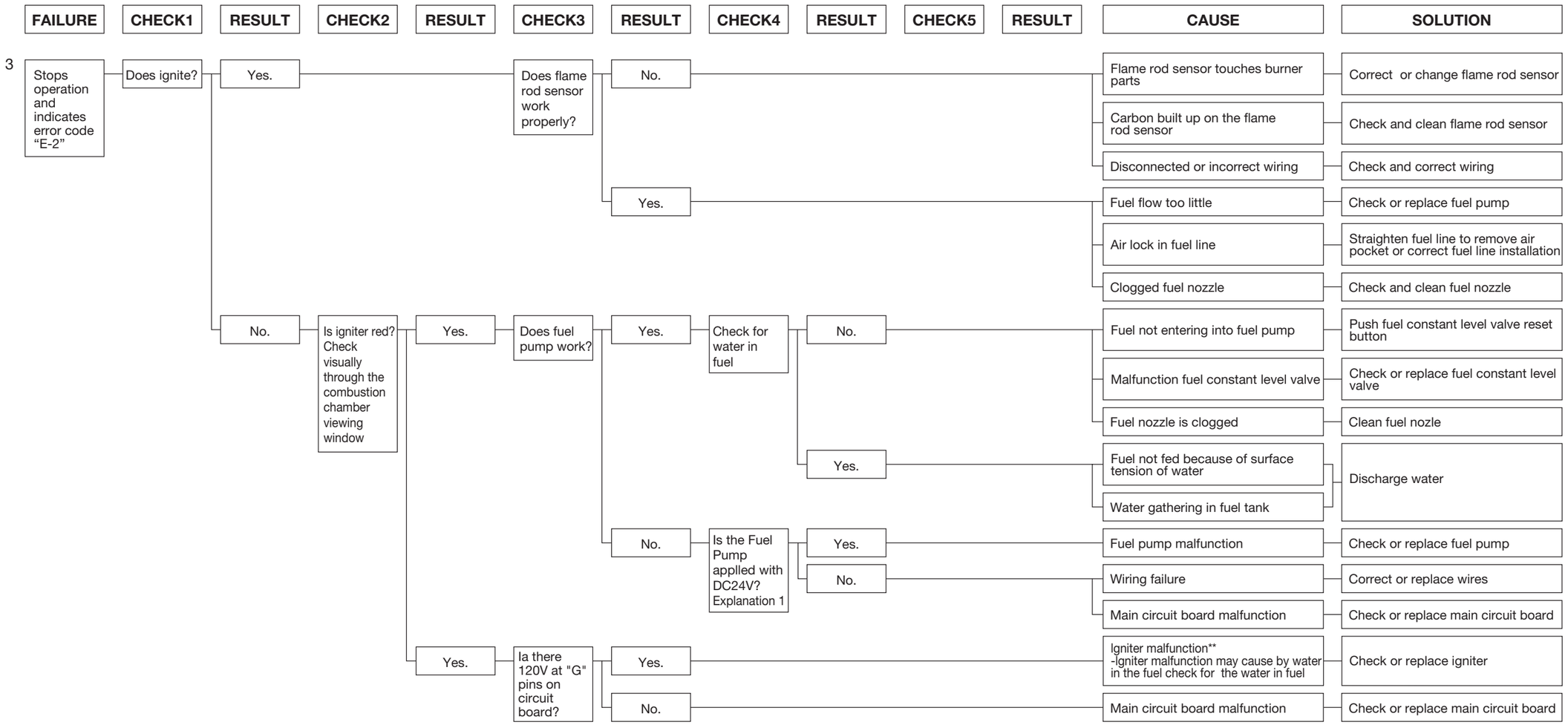
Section 4 Trouble Shooting

GENERAL CHECKS

- ☑ Is power available in wall outlet?
- ☑ Is power plug inserted in wall outlet?
- ☑ Has there been a power interruption?
- ☑ Has circulation fan stopped?
- ☑ Is fuel in tank? Tank valve open?
- ☑ Is ON/OFF button on?
- ☑ Is operation mode on “MANUAL”?
- ☑ Is set temperature in “HIGH” position?
- ☑ Is fusible link valve “OPEN”?
- ☑ Is heater/fuel line/fuel tank installed properly?

	FAILURE	CHECK1	RESULT	CHECK2	RESULT	CHECK3	RESULT	CHECK4	RESULT	CHECK5	RESULT	CAUSE	SOLUTION
1	Does not operate	Digital indicator lamp lit?	No.	Check fuse	Nomal	Check if the direction insertion and contact terminal of ribbon cable is correct.	Yes.					Main circuit board or indicator lamp circuit malfunction	Check or replace main circuit board or indicator lamp circuit.
							No.					Ribbon cable malfunction	Check or replace ribbon cable
					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 95F	Yes.			Room temp is too high	Heater does not work at room temp. over 95F (35C)
									No.			Incorrect wiring for room thermistor	Correct wiring
												Failure of room thermistor	Check or replace room thermistor
							Yes.					Heater is on “OFF” cycle*.	*This is not malfunction
					No.							Main circuit board malfunction	Check or replace main circuit board
				· Flash all on display · Flash the power LED · Make a beep sound · All button are invalid. No beep sound by pressing buttons.	Yes.							Power Button Malfunction	Replace the Operation Panel
2	Stops operation and indicates error code “E-8”	Does blower motor work when ON/OFF button is “ON”	No.	Check blower motor if blower fan rotates smoothly	No.							Blower motor malfunction or blower fan touches to obstruction	Check or replace blower motor or blower motor case
					Yes.							Disconnected or incorrect wiring	Correct wiring
												Blower motor malfunction	Check or replace blower motor
			Yes.									Rotating sensor malfunction	Check or replace blower motor

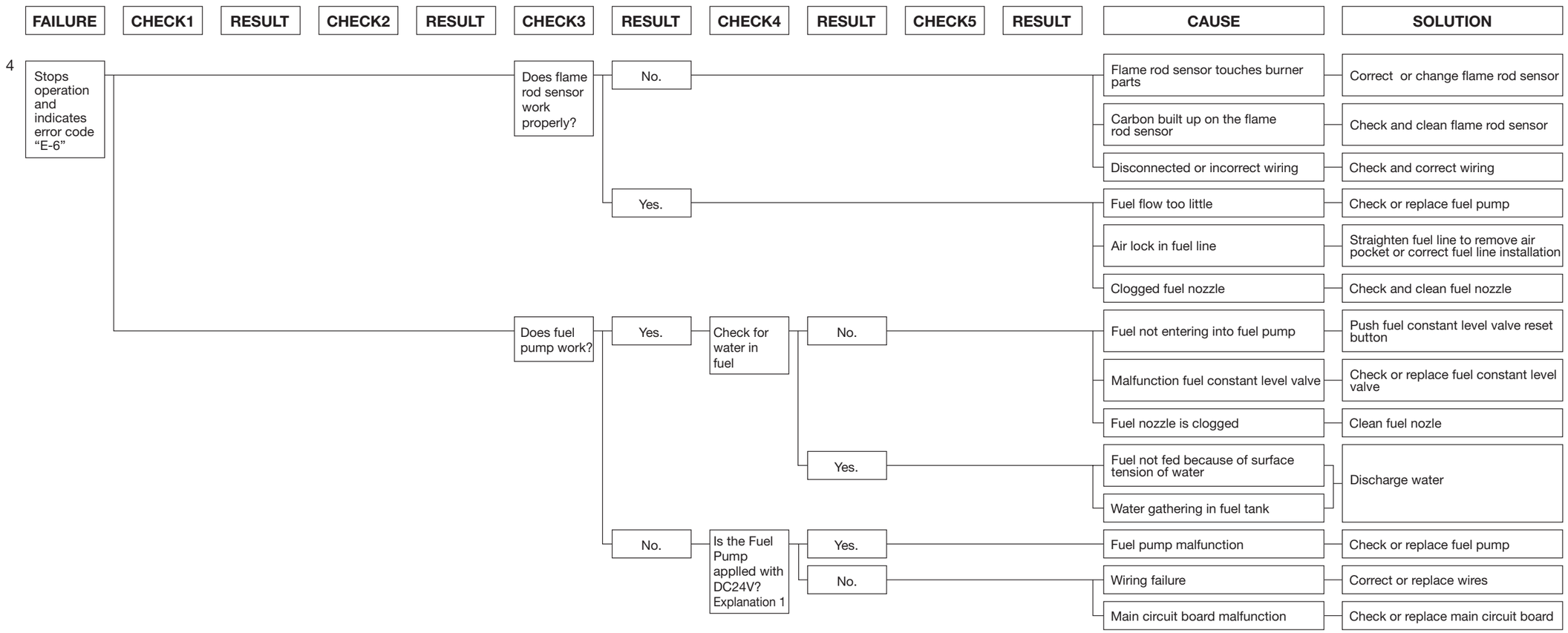
Section 4 Trouble Shooting



Explanation 1

Measure the output of the output terminal for Fuel Pump. DC24V is outputted between the yellow and the orange lead wires after preheating has been completed.

Section 4 Trouble Shooting



Explanation 1

Measure the output of the output terminal for Fuel Pump. DC24V is outputted between the yellow and the orange lead wires after preheating has been completed.

Section 4 Trouble Shooting

	FAILURE	CHECK1	RESULT	CHECK2	RESULT	CHECK3	RESULT	CHECK4	RESULT	CHECK5	RESULT	CAUSE	SOLUTION
5	The overheat protector is activated Stops operation and indicates error code "E-12"	Is window curtain too close to the rear of unit? Is circulation fan cover dusty?	Yes.									Curtain or other obstruction covers circulation air inlet.	Clean fan cover Leep curtain from unit
			No.	Indicates error code "E-12" when the operation switch is turned on.	Yes.							The overheat protector is malfunction	Check or replace overheat protector
												Incorrect wiring	Check or correct wiring
					No.	Indicates error code "E-12" when the fuel pump starts.	Yes.					The fuel pump is malfunction	Check or replace fuel pump
							No.	Does circulation fan operate property?	Yes.			Obstacle covers circulating air outlet	Remove obstacle
									No.			Main circuit board malfunction	Check or replace main circuit board
												Circulation fan motor malfunction	Check or replace fan motor
6	Stops operation and indicates error code “E-13”	Resistor is below 200kΩ after preheating	Yes.									Main circuit board malfunction	Check or replace main circuit board
			No.									Wiring failure	Correct or replace wires
												Bumer thermistor malfunction	Check or replace burner thermistor
												Fuel drain in bumer	Check and clean fuel pipe
													Check blower motor
													Check fuel pump
7	Stops operation and indicates error code “E-22”											Ignition failure occured three times consecutively with E-2 error code Fuel may accumulate in the bumer	Remove fuel in the burner Heater won't re-start by the power button. Unplug the heater

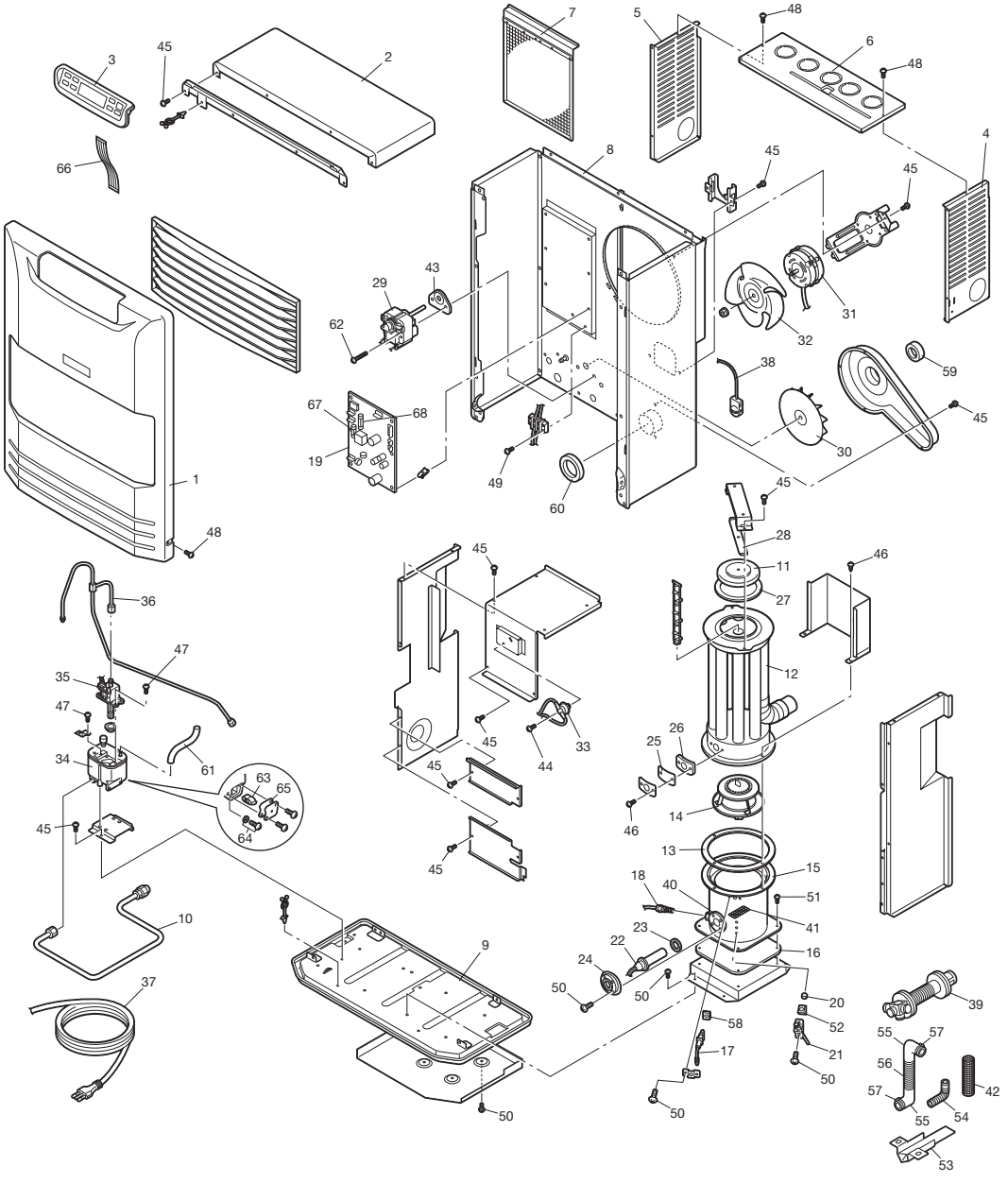
Section 4 Trouble Shooting

	FAILURE	CHECK1	RESULT	CHECK2	RESULT	CHECK3	RESULT	CHECK4	RESULT	CHECK5	RESULT	CAUSE	SOLUTION
8	Yellow high flame whistling noise or smoke produced when set "HIGH"	Is a unit placed horizontally?	Normal	Does blower motor work properly?	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
									No.				Check and correct or replace the burner ring
				Check for obstructions (such as wasps nests in exhaust or air supply piping)			Abnormal					Intake or exhaust line clogged	Clean out air and exhaust ducts
					Abnormal							Blower motor failed	Replace blower motor
												Clogged air supply or exhaust piping	Remove obstructions
			Abnormal									Not as specified	Correct as specified
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.
10	Stops operation and indicates error code "E-23"											There is flame before ignition.	Heater operates normally after flame disappears.
												Flame sensor malfunction	Check or replace flame sensor
												Main circuit board malfunction	Check or replace main circuit board
	Stops operation and indicates error code "E-0"	Check if the power source is 120V-60Hz.	Yes.									Main circuit board malfunction	Check or replace main circuit board
			No.									Power source failure	Check the power souce

Section 4 Trouble Shooting

Laser 300

4-3 Parts Description



Section 4 Trouble Shooting

Laser 300

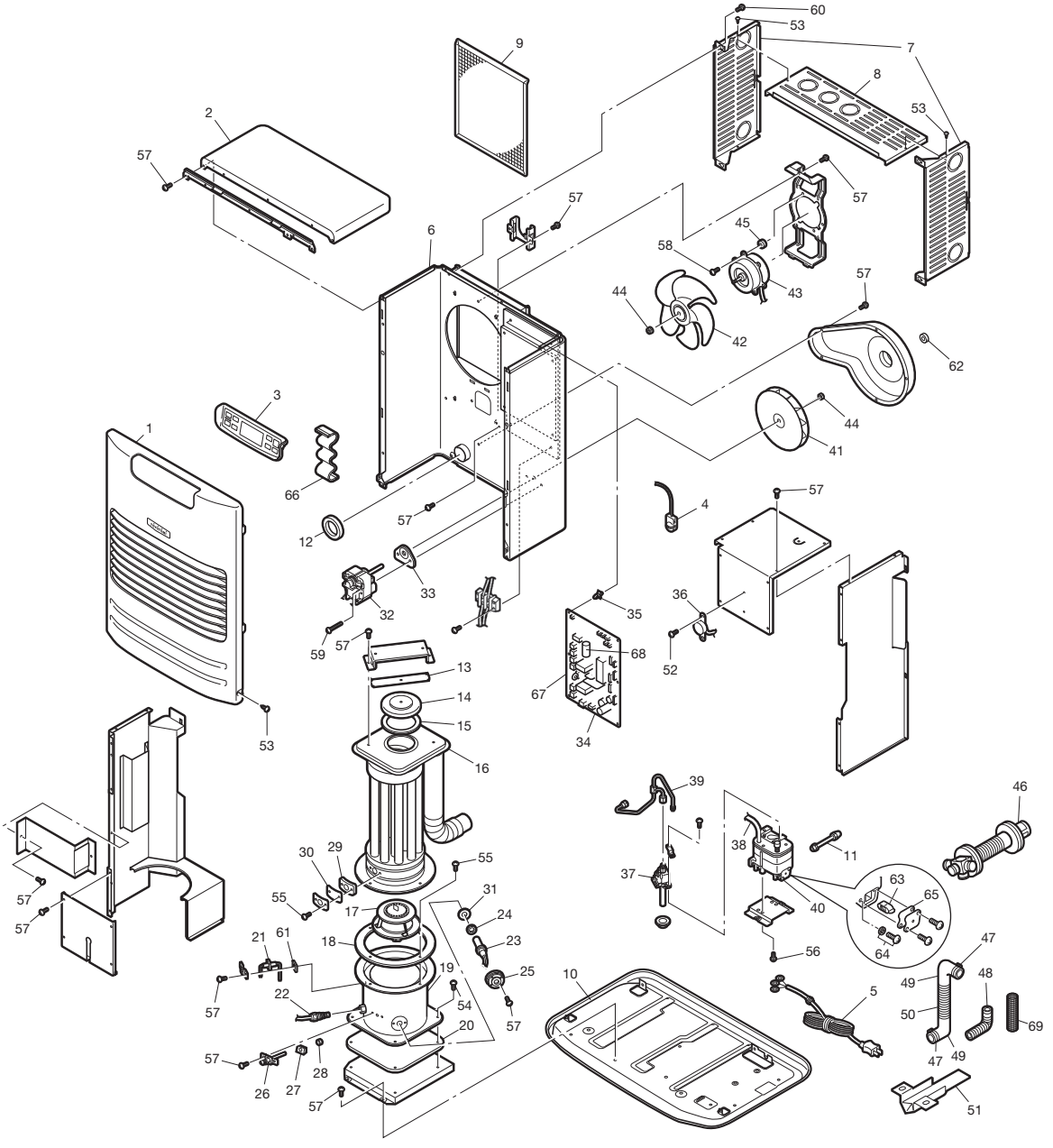
4-3 Parts Description

REF #	PART #	PART NAME	REF #	PART #	PART NAME
1	20470227	Front panel assembly	33	20470206	High limit switch
1	20470827	Front panel assembly (BK)	34	20470234	Fuel sump
2	20470260	Top plate	35	20470219	Fuel pump
2	20470860	Top plate (BK)	36	20470241	Fuel pipe assembly
3	20470276	Operation panel	37	20475535	Power supply cord
3	20470876	Operation panel (BK)	38	20478373	Thermistor
4	20470251	Rear guard right	39	20479891	Flue pipe
4	20479551	Rear guard right (BK)	40	20479521	Igniter guide gasket
5	20470253	Rear guard left	41	20479513	Burner mat
5	20479553	Rear guard left (BK)	42	20470255	Insulating cloth cover
6	20470250	Rear guard top	43	20479574	Blower motor gasket
6	20479550	Rear guard top (BK)	44	20470220	Screw 4I
7	20479540	Circulation air filter	45	20470254	Screw 4J
8	20470246	Cabinet assembly	46	20476452	Screw B2
8	20470846	Cabinet assembly (BK)	47	20474053	Screw F
9	20470229	Drip tray	48	20455862	Screw S2
9	20470829	Drip tray (BK)	48	20470756	Screw 4D (BK)
10	20470252	Leveler fuel pipe	49	20477084	Screw F5
11	20479530	Pressure relief plate	50	20474050	Screw C
12	20470244	Heat exchanger	51	20474048	Screw B
13	20479593	Heat exchanger gasket	52	20479585	Outside nozzle gasket
14	20479543	Burner ring	53	20474925	Oil catch
15	20470242	Burner assembly	54	20479584	Bent joint
16	20479594	Burner gasket	55	20474975	L-shaped hose
17	20470211	Primary flame rod	56	20470261	Inlet hose
18	20470273	Burner thermistor	57	20474977	Hose band
19	20470212	Main circuit board	58	17185352	Flame rod gasket
20	20474083	Fuel nozzle gasket	59	20479866	Air damper
21	20475834	Fuel nozzle	60	20479568	Air joint gasket
22	20470218	Igniter	61	20470286	Draft tube
23	17187582	Igniter gasket	62	20479556	Screw 1M
24	20474920	Igniter cover	63	20478550	Fuel inlet strainer
25	17185314	Peep window	64	20475551	Drain screw with O-ring
26	17185327	Peep window gasket	65	20475552	Strainer gasket
27	20479591	Relief gasket	66	20470275	Ribbon cable
28	20479531	Relief spring	67	20470678	Fuse 1 (5A)
29	20470237	Blower motor assembly	68	20470679	Fuse 2 (10A)
30	20479683	Air intake fan	69	20470295	Instruction manual
31	20470269	Circulation fan motor	70	20470299	Carton
32	20479671	Circulation fan	70	20470899	Carton (BK)

Section 4 Trouble Shooting

Laser 530

4-3 Parts Description



Section 4 Trouble Shooting

Laser 530

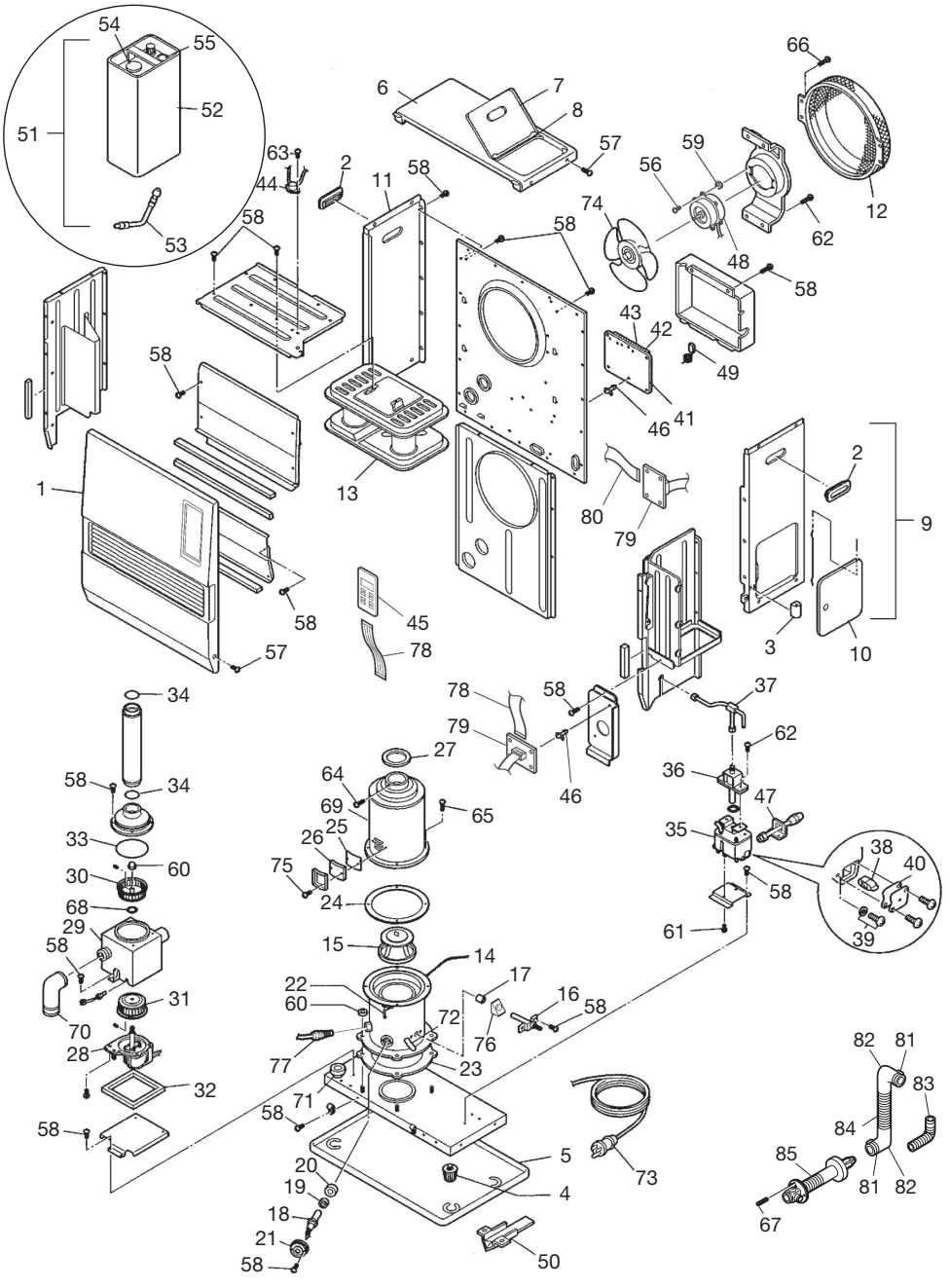
4-3 Parts Description

REF #	PART #	PART NAME	REF #	PART #	PART NAME
1	20470327	Front panel assembly	37	20470319	Fuel pump
2	20470360	Top plate	38	20479886	Draft tube
3	20470377	Operation panel	39	20470341	Fuel pipe assembly
4	20478373	Thermistor	40	20470234	Fuel sump
5	20475535	Power supply cord	41	20479803	Air intake fan
6	20470346	Cabinet assembly	42	20474171	Circulation fan
7	20470351	Rear guard (L & R)	43	20479869	Circulation fan motor
8	20470350	Rear guard top	44	20470366	Nut L
9	20479840	Circulation air filter	45	20474039	Insulator A
10	20470329	Drip tray	46	20479891	Flue pipe
11	20470352	Leveler fuel pipe	47	20474977	Hose band
12	20479568	Air joint gasket	48	20479884	Bent joint
13	20479531	Relief spring	49	20474975	L-shaped hose
14	20479530	Pressure relief plate	50	20470261	Inlet hose
15	20479591	Relief gasket	51	20474925	Oil catch
16	20479844	Heat exchanger	52	20470220	Screw 4I
17	20478343	Burner ring	53	20455862	Screw S2
18	20479893	Heat exchanger gasket	54	20474048	Screw B
19	20479842	Burner assembly	55	20476452	Screw B2
20	20479894	Burner gasket	56	20470353	Screw 4P
21	20479811	Primary flame rod	57	20470254	Screw 4J
22	20470273	Burner thermistor	58	20470355	Screw 4Q
23	20470218	Igniter	59	20478355	Screw 1Z
24	17187582	Igniter gasket	60	20470666	Screw 4C
25	20474920	Igniter cover	61	17185352	Flame rod gasket
26	20478026	Fuel nozzle	62	20479866	Air damper
27	20479885	Outside nozzle gasket	63	20478550	Fuel inlet strainer
28	20479883	Fuel nozzle gasket	64	20475551	Drain screw with O-ring
29	17185327	Window gasket	65	20475552	Strainer gasket
30	17185314	Peep window	66	20470375	Ribbon cable
31	20479521	Igniter guide gasket	67	20470678	Fuse 1 (5A)
32	20470337	Blower motor assembly	68	20470679	Fuse 2 (10A)
33	20479574	Blower motor gasket	69	20470255	Insulating cloth cover
34	20470212	Main circuit board	70	20470395	Instruction manual
35	20477414	PCB support	71	20470399	Carton
36	20470206	High limit switch			

Section 4 Trouble Shooting

Laser 560

4-3 Parts Description



Section 4 Trouble Shooting

Laser 560

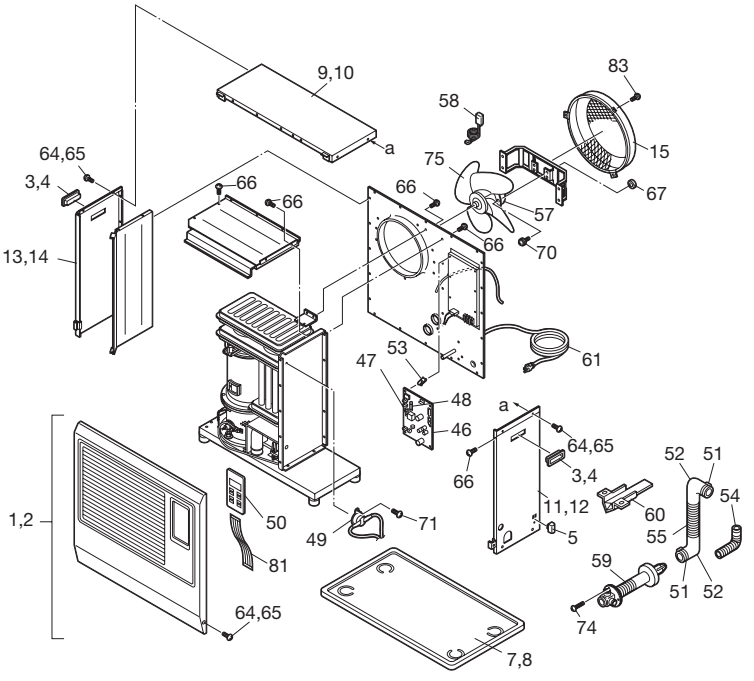
4-3 Parts Description

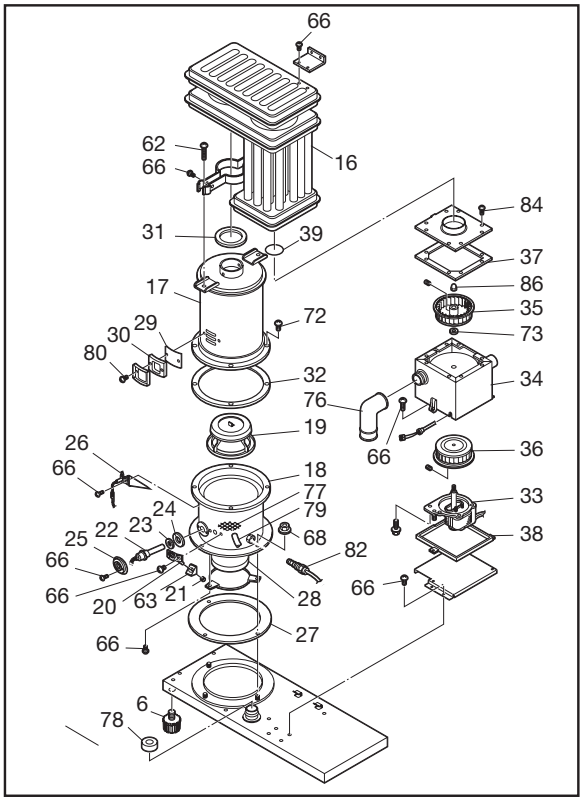
REF #	PART #	PART NAME	REF #	PART #	PART NAME
1	20470446	Front panel assembly	43	20470679	Fuse 2 (10A)
2	20475804	Carrying handle	44	20470206	High limit switch
3	20450007	Plumb bob	45	20470476	Operation panel
4	20474970	Adjustable leg	46	20477414	PCB support
5	20475929	Drip tray	47	20470452	Leveler fuel pipe
6	20470460	Top plate with tank lid	48	20470469	Circulation fan motor
7	20470465	Tank lid with pin	49	20478373	Thermistor
8	20475566	Tank lid pin	50	20474925	Oil catch
9	20470463	Right side panel with access door	51	20475922	Removable fuel tank with hose
10	20470470	Level valve access door with pin	52	20475722	Removable fuel tank without hose
11	20470464	Left side panel	53	20475925	Fuel supply hose
12	20475072	Fan cover	54	20475924	Fuel tank cap
13	20478044	Heat exchanger	55	20475923	Fuel gauge
14	20470442	Burner assembly	56	20474055	Screw O
15	20478343	Burner ring	57	20455862	Screw S2
16	20478026	Fuel nozzle	58	20474050	Screw C
17	20478383	Fuel nozzle gasket	59	20474039	Insulator A
18	20470218	Igniter	60	20474057	Flange nut
19	17187582	Igniter gasket	61	20470353	Screw 4P
20	20479521	Igniter guide gasket	62	20474053	Screw F
21	20474920	Igniter cover	63	20450220	Screw 4I
22	20470411	Primary flame rod	64	20478091	Screw 1U
23	20475094	Burner gasket	65	20478090	Screw 1T
24	20475093	Heat exchanger gasket	66	20470666	Screw 4C
25	20475831	Peep window	67	20474272	Screw M
26	20475881	Peep window gasket	68	20475874	Washer for blower motor
27	20474992	Joint packing	69	20478509	Heat chamber assembly
28	20470438	Blower motor assembly	70	20474983	Outlet adapter
29	20470448	Blower motor assembly with case	71	20478366	Air damper (ø25)
30	20475971	Blower motor exhaust fan	72	20479987	Draft tube
31	20475983	Blower motor intake fan	73	20475535	Power supply cord
32	20475978	Rubber mat	74	20475071	Circulation fan
33	20478082	O-ring (ø110)	75	20474163	Screw I
34	20475977	O-ring (ø49)	76	20479885	Outside nozzle gasket
35	20470234	Fuel sump	77	20470273	Burner thermistor
36	20470419	Fuel pump (Type A)	78	20470475	Ribbon cable A
36	20470519	Fuel pump (Type B)	79	20470477	Ribbon cable circuit board
37	20470441	Fuel pipe assembly (Type A)	80	20470478	Ribbon cable B
37	20478041	Fuel pipe assembly (Type B)	81	20474977	Hose band
38	20478550	Fuel inlet strainer	82	20474975	L-shaped hose
39	20475551	Drain screw with O-ring	83	20470484	Bent joint
40	20475552	Strainer gasket	84	20470651	Inlet hose
41	20470412	Main circuit board (Type A)	85	20479891	Flue pipe
41	20470512	Main circuit board (Type B)	86	20470495	Instruction manual
42	20470678	Fuse 1 (5A)	87	20470499	Carton

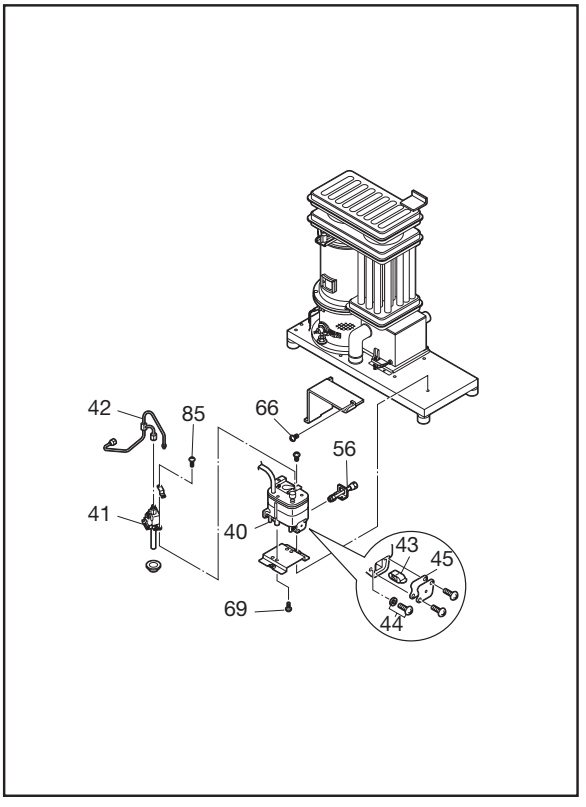
Section 4 Trouble Shooting

Laser 730 / Laser 730 AT

4-3 Parts Description







Section 4 Trouble Shooting

Laser 730 / Laser 730 AT

4-3 Parts Description

REF #	PART #	PART NAME	REF #	PART #	PART NAME
1	20470646	Front panel assembly	46	20470612	Main circuit board
2	20470746	Front panel assembly (Laser 730AT)	47	20470678	Fuse 1 (5A)
3	20475804	Carrying handle	48	20470679	Fuse 2 (10A)
4	20479104	Carrying handle (Laser 730AT)	49	20470206	High limit switch
5	20450007	Plumb bob	50	20470676	Operation panel
6	20474970	Adjustable leg	50	20470776	Operation panel (Laser 730AT)
7	20478129	Drip tray	51	20474977	Hose band
8	20479129	Drip tray (Laser 730AT)	52	20474975	L-shaped hose
9	20470660	Top plate	53	20477414	PCB support
10	20479160	Top plate (Laser 730AT)	54	20474984	Bent joint (L)
11	20470663	Right side panel	55	20470651	Inlet hose
12	20470763	Right side panel (Laser 730AT)	56	20470652	Leveler fuel pipe
13	20470664	Left side panel	57	20470669	Circulation fan motor
14	20479164	Left side panel (Laser 730AT)	58	20478373	Thermistor
15	20475172	Fan cover	59	20479891	Flue pipe
16	20478644	Heat exchanger	60	20474925	Oil catch
17	20475808	Heat chamber assembly	61	20475535	Power supply cord
18	20470642	Burner assembly	62	20478188	Screw 1X
19	20478643	Burner ring	63	20479885	Outside nozzle gasket
20	20478026	Fuel nozzle	64	20455862	Screw S2
21	20478383	Fuel nozzle gasket	65	20470756	Screw 4D (Laser 730AT)
22	20470218	Igniter	66	20470254	Screw 4J
23	17187582	Igniter gasket	67	20474039	Insulator A
24	20479521	Igniter guide gasket	68	20474057	Flange nut
25	20474920	Igniter cover	69	20470353	Screw 4P
26	20470611	Primary flame rod	70	20470355	Screw 4Q
27	20475194	Burner gasket	71	20450220	Screw 4I
28	20475850	Burner insulating pad	72	20478090	Screw 1T
29	20475831	Peep window	73	20476150	Washer E
30	20475881	Peep window gasket	74	20474985	Screw 4G
31	20474992	Joint packing	75	20475171	Circulation fan
32	20475893	Heat exchanger gasket	76	20474983	Outlet adapter
33	20470638	Blower motor assembly	77	20478613	Burner mat
34	20470648	Blower motor assembly with case	78	20478366	Air damper (ø25)
35	20478871	Blower motor exhaust fan	79	20478683	Draft tube
36	20475883	Blower motor intake fan	80	20474163	Screw I
37	20475875	Blower motor case gasket	81	20470675	Ribbon cable
38	20475878	Rubber mat	82	20470273	Burner thermistor
39	20475877	O-ring (ø75)	83	20470666	Screw 4C
40	20470234	Fuel sump	84	20475554	Screw 1Q
41	20470619	Fuel pump	85	20474053	Screw F
42	20470641	Fuel pipe assembly	86	20479957	Nut J
43	20478550	Fuel inlet strainer	87	20470695	Instruction manual
44	20475551	Drain screw with O-ring	88	20470699	Carton
45	20475552	Strainer gasket	89	20470799	Carton (Laser 730AT)

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