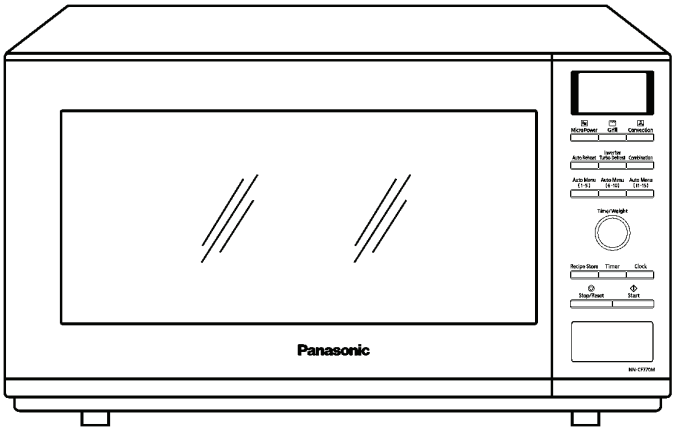
ORDER NO.PAPMOSH1302020CE

Service Manual

Microwave Oven



NN-CF770M

VPQ (South Africa)

Specification

Models		NN-CF770M
Power Source:		230V-240V AC Single Phase, 50Hz
Power Consumption:	Microwave	860W
	Ceramic Heater	1020W
	Convection Heater	1450W
Output:	Microwave	1000W
	Ceramic Heater	1000W
	Convection Heater	1400W
Microwave Frequency:		2450MHz
Timer:		90 Min. 00 Sec.
Outside Dimensions:		529mm(W) x 494mm(D) x 326mm(H)
Oven Cavity Dimensions:		354mm(W) x 343mm(D) x 205mm(H)
Weight:		17.5kg
PbF		This product with PbF
Specifications subject to change without notice.		

Panasonic®

⚠ WARNING

This service information is designed for experienced repair technicians only and is not designed for use by the general public. It does not contain warnings or cautions to advise non-technical individuals of potential dangers in attempting to service a product.
Products powered by electricity should be serviced or repaired only by experienced professional technicians. Any attempt to service or repair the product or products dealt with in this service information by anyone else could result in serious injury or death.

WARNING

1. This product should be serviced only by trained, qualified personnel.
2. Check for radiation leakage before and after every servicing according to the "procedure for measuring radiation leakage."
3. If the unit cannot be repaired on site, advise the customer not to use until unit is repaired.
4. There are special components used in the microwave oven which are important for safety. These parts are marked with a ⚠ on the replacement parts list. It is essential that these critical parts be replaced only with the manufacture's specified parts to prevent microwave leakage, shock, fire, or other hazards. Do not modify the orginal design.

This service manual covers products for following markets.
When troubleshooting or replacing parts, please refer to the country identifications shown below for your applicable product specification.

VPQ ..... For South Africa

CAUTION

About lead free solder (PbF)

Distinction of PbF PCB: PCBs (manufactured) using lead free solder will have a PbF stamp on the PCB.

Caution:
- Pb free solder has a higher melting point than standard solder; Typically the melting point is 30 - 40˚C higher. Please use a high temperature soldering iron. In case of the soldering iron with temperature control, please set it to 370 ± 10˚C.
- Pb free solder will tend to splash when heated too high (about 600˚C).

DANGER OF HIGH VOLTAGE AND HIGH TEMPERATURE (HOT/LIVE) OF THE INVERTER POWER SUPPLY (U)

⚠ WARNING

This Inverter board looks like a regular PCB. However, this PCB drives the magnetron tube with extremely high voltage and high current. Take cautionary measures when disassembling and troubleshooting the Inverter circuit. Improper handling can result in an electrical shock or burns, which might lead to injury or death.

IT HAS:

1. **Very high voltage and high current circuits.**
   It functions the same as the high voltage transformer and high voltage capacitor in ordinary microwave ovens.
2. **Aluminum heat sink that is energized with very high voltage and high heat energy.**
3. **Very high voltage which may remain in circuitry even when oven is off. High voltage charge may remain in the capacitors on the board.**

DO NOT:

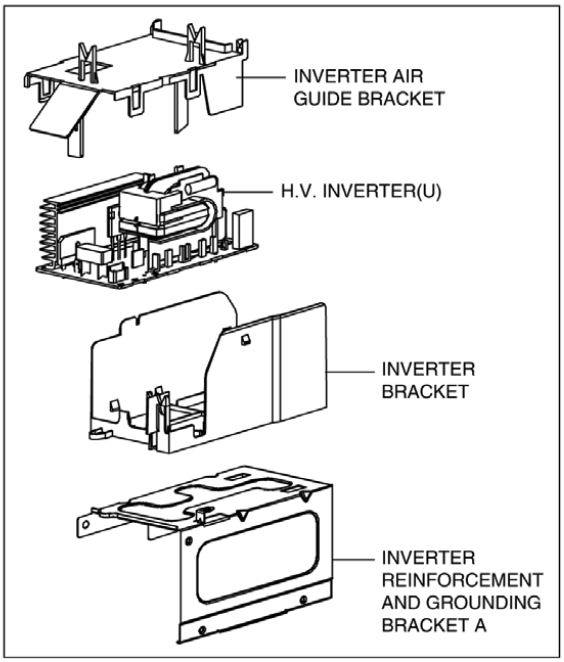
* 1. **Do not touch circuitry because it has very hot (high voltage) circuitry. Even when replacing board, extreme care should be taken to avoid possible electric shock hazards. High voltage charge may remain in circuits.**

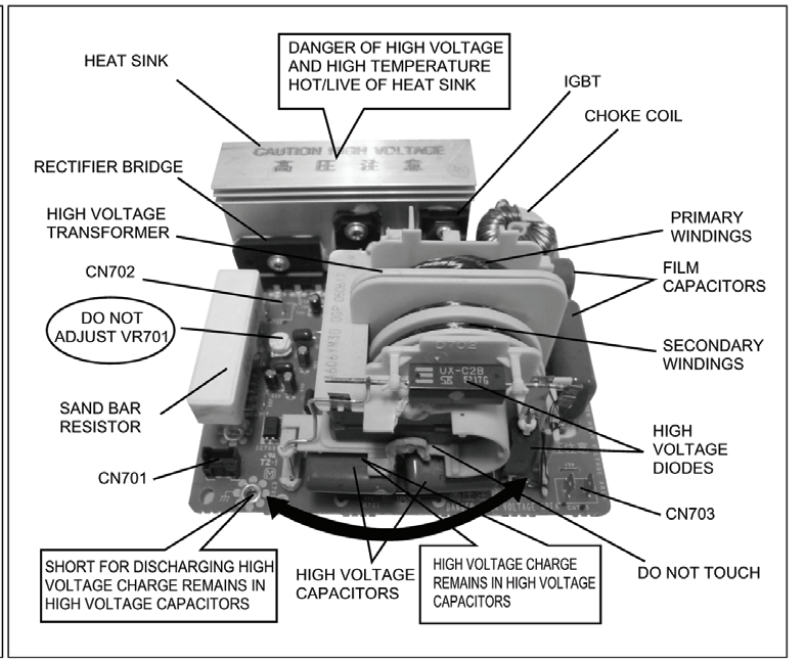
* 2. **Do not touch aluminum heat sink because it is energized with very high voltage and is also very hot in high heat energy.**

* 3. **Do not try to adjust or tamper with preset control on the Inverter board because it is very dangerous to adjust without proper test equipment.**

* 4. **Do not test oven while Inverter grounding plate or screws are loose. It is very dangerous to operate H.V. Inverter Circuit (U) with loose mounting screws or if improperly grounded.**

INVERTER POWER SUPPLY



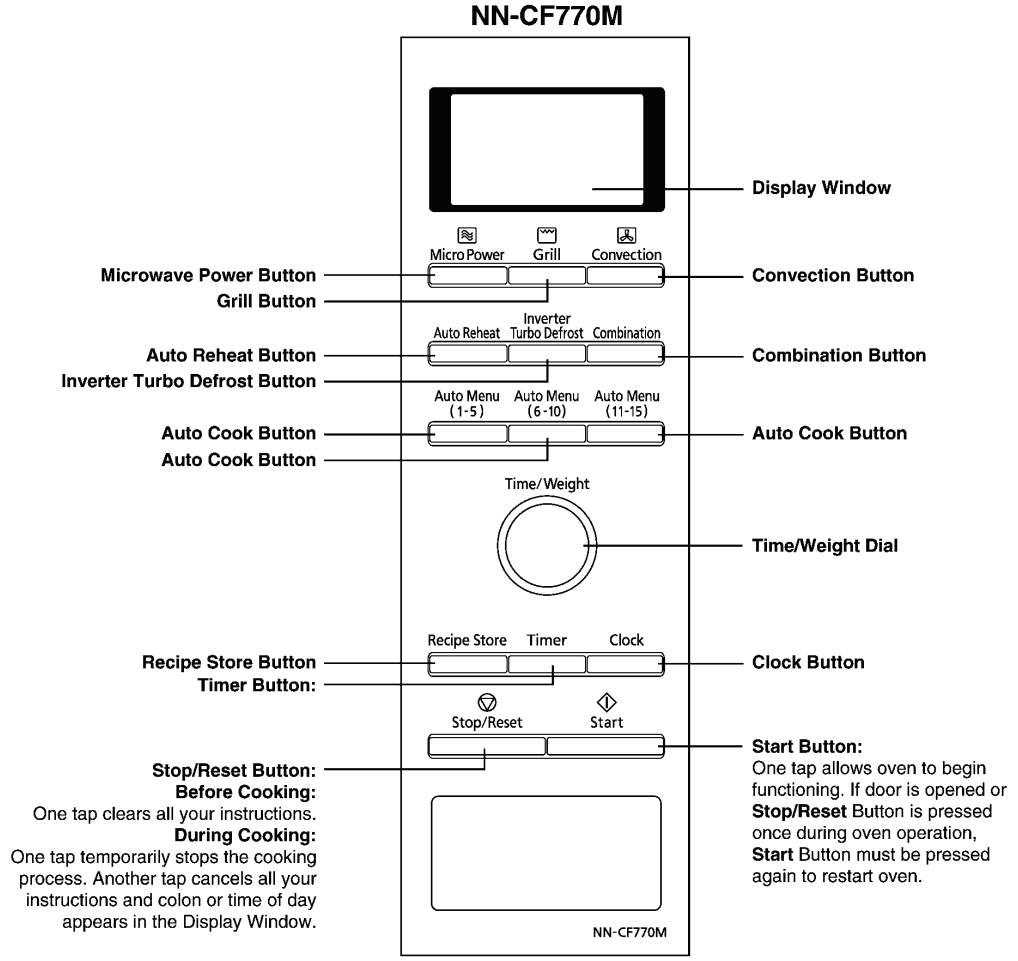


CONTENTS

1 FEATURE CHART

FEATURE \ MODEL	NN-CF770M
3 Stage Cooking	○
Microwave	○
Grill	○
Combination	○
Convection	○
Turbo Defrost	○
Auto Menu	○
Auto Reheat	○
Recipe Store (Memory)	○
Timer	○
Clock	○
Child Safety Lock	○

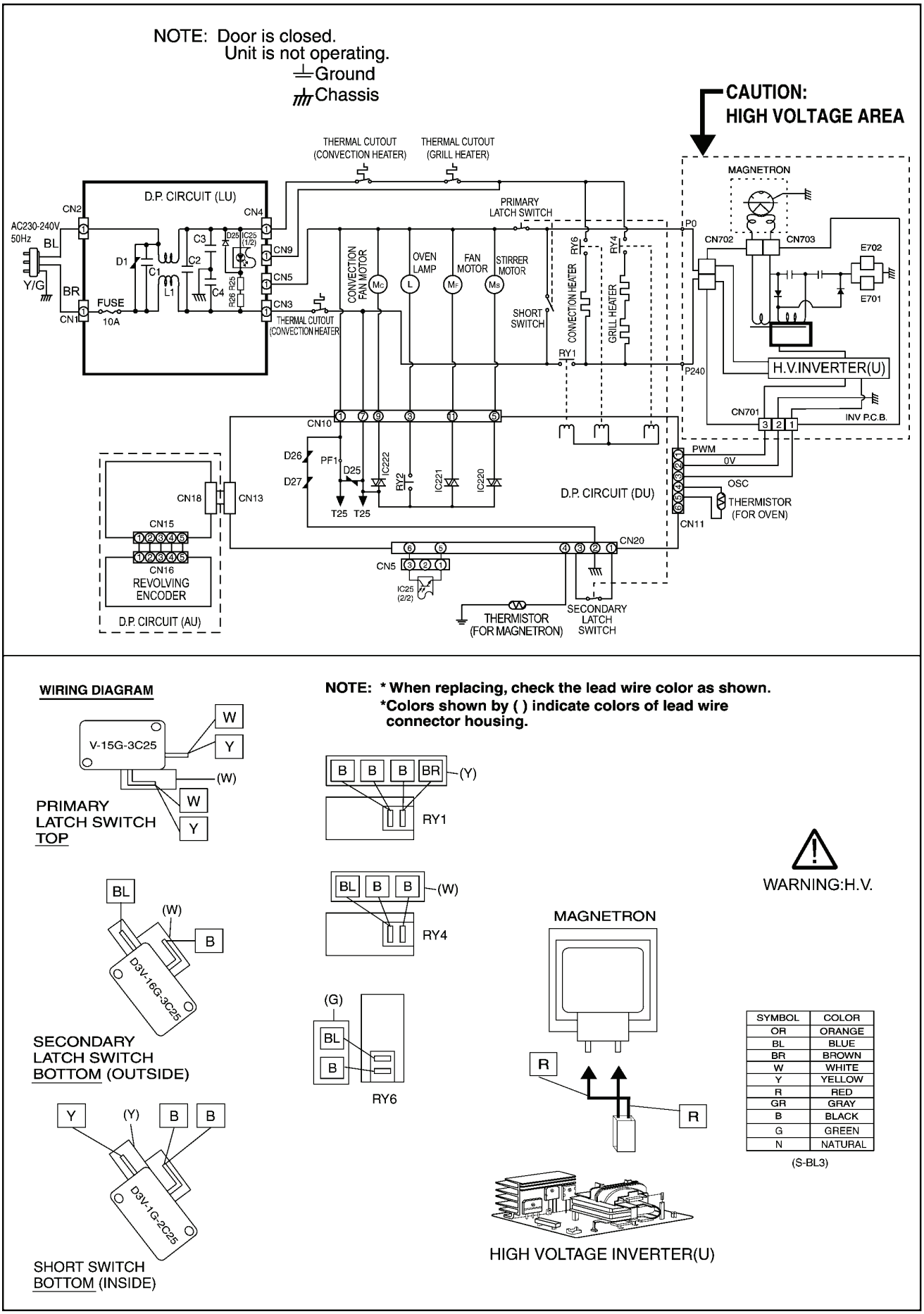
2 CONTROL PANEL



Beep Sound:
When a button is pressed correctly, a beep sound will be heard. If a button is pressed and no beep is heard, the unit did not or could not accept the instruction. The oven will beep twice between programmed stages. At the end of any completed program, the oven will beep 5 times.

Note:
If an operation is set and Start Button is not pressed, after 6 minutes, the oven will automatically cancel the operation. The display will revert back to clock or colon mode.

3 SCHEMATIC DIAGRAM



WIRING DIAGRAM

PRIMARY LATCH SWITCH TOP

SECONDARY LATCH SWITCH BOTTOM (OUTSIDE)

SHORT SWITCH BOTTOM (INSIDE)

NOTE: * When replacing, check the lead wire color as shown.
***Colors shown by ( ) indicate colors of lead wire connector housing.**

HIGH VOLTAGE INVERTER(U)

WARNING:H.V.

SYMBOL	COLOR
OR	ORANGE
BL	BLUE
BR	BROWN
W	WHITE
Y	YELLOW
R	RED
GR	GRAY
B	BLACK
G	GREEN
N	NATURAL

(S-BL3)

4 DESCRIPTION OF OPERATING SEQUENCE

4.1. Variable power cooking control

High Voltage Inverter Power Supply (U) controls output power by the signal from Digital Programmer Circuit (D.P.C.). Power relay always stays ON, but PWM (Pulse Width Modulation) signal controls microwave output power.

NOTE:

The ON/OFF time ratio does not correspond with the percentage of microwave power since approximately 2 seconds are required for heating of magnetron filament.

Variable Power Cooking

POWER SETTING	OUTPUT POWER(%) APPROX.	MANUAL MICROWAVE DUTY	
		ON(SEC)	OFF(SEC)
HIGH	100%	22	0
MEDIUM-HIGH	70%	22	0
MEDIUM	60%	22	0
MEDIUM-LOW	45%	22	0
DEFROST	35%	17	5
LOW	25%	13	9

4.2. Inverter power supply circuit

The Inverter Power Supply circuit powered from the line voltage, 230V 50Hz AC input supplies 4,000V DC to the magnetron tube, and functions in place of the H.V. transformer, the H.V. capacitor and H.V. diode.

1. The AC input voltage 230V 50Hz is rectified to DC voltage immediately.
2. DC voltage will be supplied to the switching devices called IGBT. These devices are switched ON-OFF by the 20 to 40 KHz PWM (pulse width modulation) signal from the microcomputer in the DPC.
3. This drives the High voltage transformer to increase voltage up to 2,000V AC.
4. Then the half-wave doubler voltage rectifier circuit, consisting of the H.V. diodes and capacitors, generates the necessary 4,000V DC needed for the magnetron.
5. Output power of the magnetron tube is always monitored by the signal output from the current transformer built into the inverter circuit.
6. This signal is fed back to the microcomputer in the DPC to determine operating conditions and output necessary to control PWM signal to the Inverter Power Supply for control of the output power.

4.3. Auto Menu cooking

When the Auto Menu feature is selected and the [Start] button is tapped:

1. The digital programer circuit determines the power level and cooking time to complete cooking and indicates the operating state in the display window.
2. When cooking time in the display window has elapsed, the oven turns off automatically by a control signal from the digital programmer circuit.

4.4. Grill cooking control

Grill cooking is accomplished by upper heaters only. One grill cooking cycle is 33 seconds.

1. During grill cooking, the digital programmer circuit controls power relay RY4´s ON-OFF time. In all three grill cooking categories, power relay RY1 always stay ON, but RY4´s ON-OFF time are shown in Figure.

GRILL CATEGORY	GRILL (RY4)		MICROWAVE (DUTY)	
	ON (sec.)	OFF (sec.)	ON (sec.)	OFF (sec.)
1	33	0	0	33
2	24	9		
3	18	15		

4.5. Combination Cooking

Combination cooking is accomplished by microwave and grill cooking (upper heaters) being done synchronously during one combination cooking cycle. One combination cooking cycle is 33 seconds.

1. During combination cooking, the digital programmer circuit controls power relay RY4 & RY1´s duty ON-OFF time. In all three combination cooking categories, power relay RY4 & RY1's duty ON-OFF time are as shown in Figure.

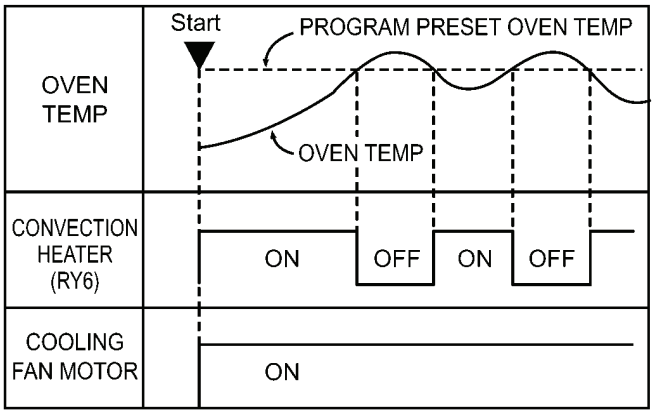
COMBINATION CATEGORY	GRILL(RY4)		MICROWAVE(DUTY)	
	ON(sec.)	OFF(sec.)	ON(sec.)	OFF(sec.)
1	27	6	6	27
2	21	12	12	21
3	14	19	19	14

4.6. Convection cooking control

The digital programmer circuit controls the ON-OFF time of the heater in order to control oven cavity temperature.

1. After selecting desired oven cavity temperature of Convection/Grill Convection (the range of selected oven temp is 100°C-250°C) and pressing [Start] button, a high level signal comes out of the micro computer and applies to power relay (RY6).
2. When RY6 are switched to ON, power source voltage is applied to the convection heater, and the heaters turn on.
3. The digital programmer circuit senses the oven cavity temperature through oven temp sensor (thermistor). When the oven temperature reaches the set temperature, DPC stops supplying high level signal to the power relay, and the heater turn off.
4. After the convection heater turn off, the oven temperature will continue increasing for a while and then decrease.

   When the oven temperature drops below the set temperature, the digital programmer circuit senses the signal and starts supplying a high level signal to RY6 again.



NOTE:

a. If only convection heater works, convection motor would rotate for over 1 minute after cooking to cool oven and electric components.

b. After convection cooking, fan motor rotates for 1~6 minutes to cool oven and electric components.

5 CAUTIONS TO BE OBSERVED WHEN TROUBLESHOOTING

Unlike many other appliances, the microwave oven is a high voltage, high current device. It is free from danger in ordinary use, though extreme care should be taken during repair.

⚠ CAUTION

Servicemen should remove their watches & rings whenever working close to or replacing the magnetron.

5.1. Check the grounding

Do not operate on a two wire extension cord. The microwave oven is designed to be grounded when used. It is imperative, therefore, to ensure the appliance is properly grounded before beginning repair work.

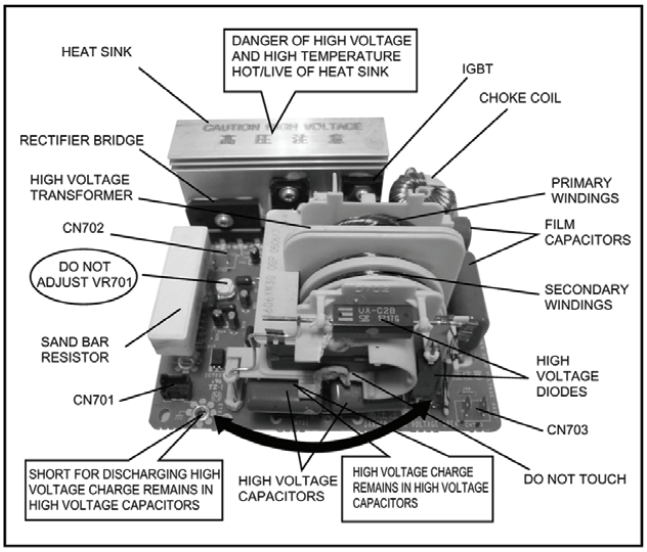
5.2. Inverter warnings

⚠ WARNING HIGH VOLTAGE AND HIGHTEMPERATURE (HOT/LIVE) OF THE INVERTERPOWER SUPPLY (U)

The High Voltage Inverter Power Supply generates very high voltage and current for the magnetron tube. Though it is free from danger in ordinary use, extreme care should be taken during repair.

The aluminum heat sink is also energized with high voltage (HOT), do not touch when the AC input terminals are energized. The power device Collector is directly connected to the aluminum heat sink.

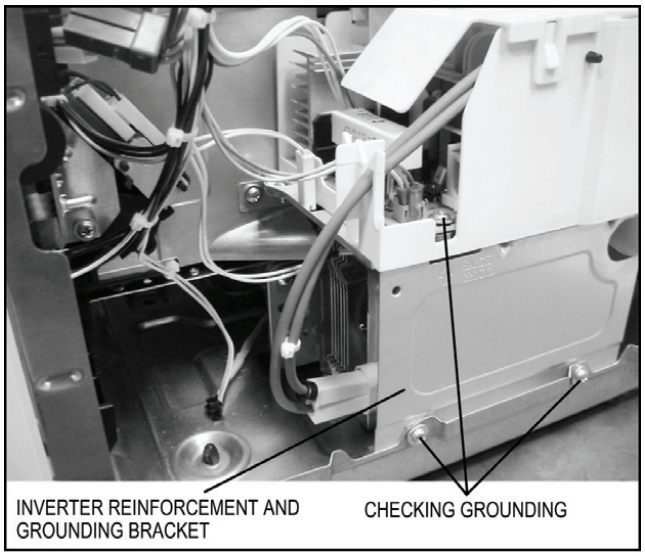
The aluminum heat sink may be HOT due to heat energy, therefore, extreme care should be taken during servicing.



H.V. Inverter warning

⚠ WARNING FOR INVERTER POWER SUPPLY (U) GROUNDING

Check the High Voltage Inverter Power Supply circuit grounding. The high voltage inverter power supply circuit board must have a proper chassis ground. The inverter grounding plate must be connected to the chassis. If the inverter board is not grounded it will expose the user to very high voltages and cause extreme DANGER! Be sure that the inverter circuit is properly grounded via the inverter grounding plate.

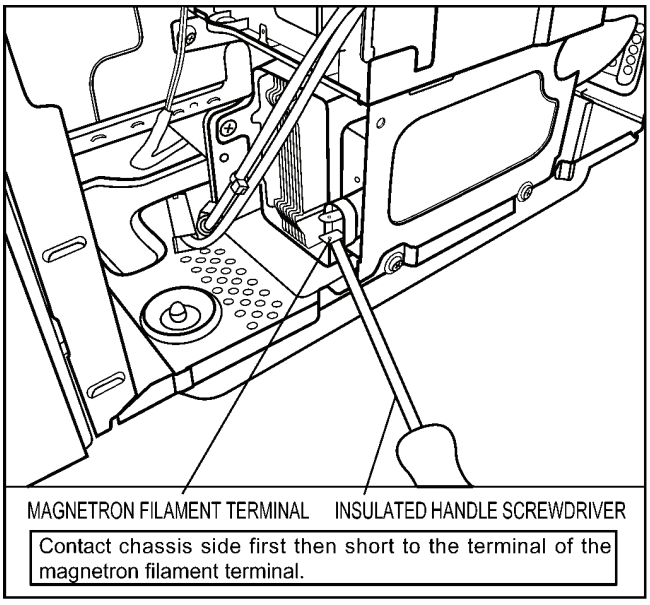


Grounding of the inverter circuit board

⚠ WARNING DISCHARGE THE HIGH VOLATGE CAPACITORS

For about 30 seconds after the oven is turned off, an electric charge remains in the high voltage capacitors of the Inverter Power Supply circuit board.

When replacing or checking parts, remove the power plug from the outlet and short the inverter output terminal of the magnetron filament terminals to the chassis ground with an insulated handle screwdriver to discharge. Please be sure to contact the chassis ground side first and then short to the output terminal.



Discharging the high voltage capacitors

⚠ **WARNING**

There is high voltage present with high current capabilities in the circuits of the primary and secondary windings, choke coil and heat sinkof the inverter. It is extremely dangerous to work on or near these circuits with the oven energized. DO NOT measure the voltage in the high voltage circuit including the filament voltage of the magnetron.

⚠ **WARNING**

Never touch any circuit wiring with your hand or with an insulated tool during operation.

5.3. Part replacement.

When troubleshooting any part or component is to be replaced, always ensure that the power cord is unplugged from the wall outlet.

5.4. When the 10A fuse is blown due to the malfunction of the short switch:

WARNING

When the 10A 250V fuse is blown due to the malfunction of the short switch, replace all of the components (primary latch switch, short switch and power relay RY1).

1. This is mandatory. Refer to “measurements and adjustments” for the location of these switches.
2. When replacing the fuse, confirm that it has the appropriate rating for these models.
3. When replacing faulty switches, be sure the mounting tabs are not bent, broken or deficient in their ability to hold the switches.

5.5. Avoid inserting nails, wire etc. through any holes in the unit during operation.

Never insert a wire, nail or any other metal object through the lamp holes on the cavity or any holes or gaps, because such objects may work as an antenna and cause microwave leakage.

5.6. Verification after repair

1. After repair or replacement of parts, make sure that the screws of the oven, etc. are neither loosen or missing. Microwave energy might leak if screws are not properly tightened.
2. Make sure that all electrical connections are tight before inserting the plug into the wall outlet.
3. Check for microwave energy leakage.

CAUTION OF MICROWAVE RADIATION LEAKAGE

USE CAUTION NOT TO BECOME EXPOSED TO RADIATION FROM THE MICROWAVE MAGNETRON OR OTHER PARTS CONDUCTING MICROWAVE ENERGY.

IMPORTANT NOTICE

1. The following components have potentials above 2000V while the appliance is operated.
   - Magnetron
   - High voltage transformer (Located on inverter (U))
   - High voltage diodes (Located on inverter (U))
   - High voltage capacitors (Located on inverter (U))

   Pay special attention to these areas.
2. When the appliance is operated with the door hinges or magnetron installed incorrectly, the microwave leakage can exceed more than 5mW/cm^2. After repair or exchange, it is very important to check if the magnetron and the door hinges are correctly installed.

5.7. Sharp edges

⚠ **CAUTION**

Please use caution when disassembling or reassembling internal parts. Some exposed edges may be sharp to the touch and can cause injury if not handled with care.

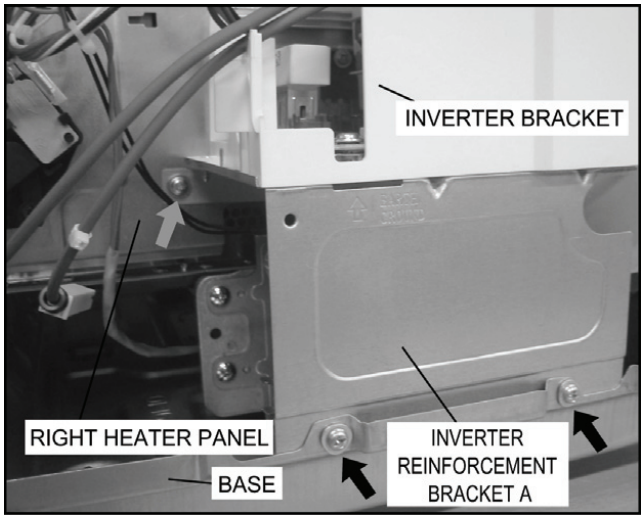
6 DISASSEMBLY AND PARTS REPLACEMENT PROCEDURE

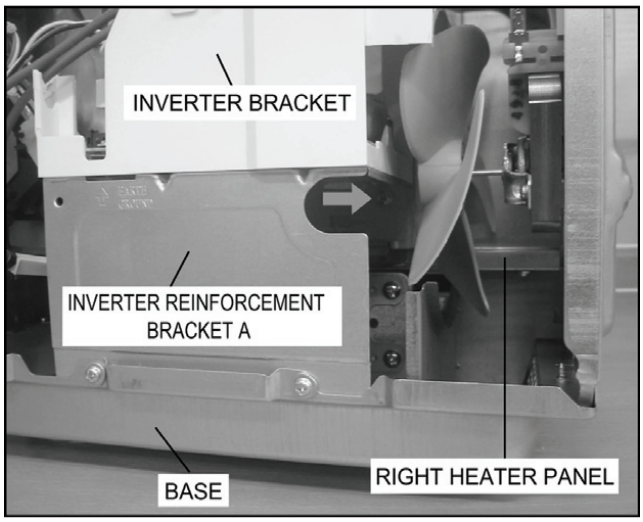
6.1. Inverter power supply

CAUTIONS

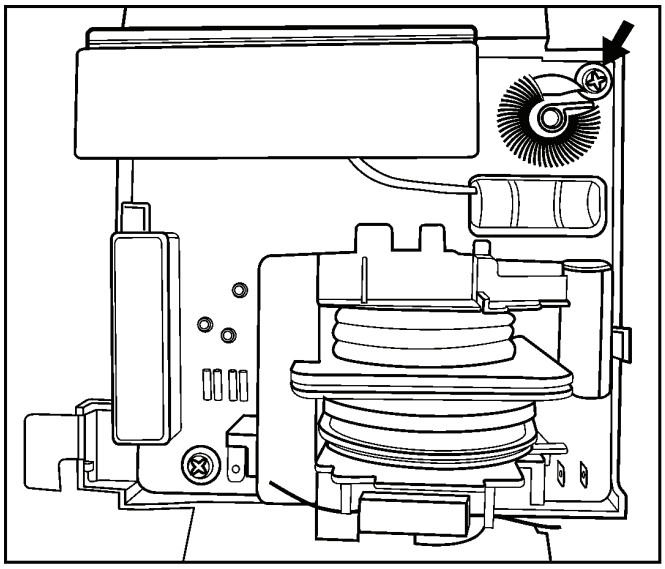
1. Always leave the grounding plate in place.
2. Always securely tighten the ground screw through the bottom of the chassis (base).
3. Securely connect 3 lead wire connectors.
4. Make sure the heat sink has enough space (gap) from the oven. Take special care not to dress any lead wire over the aluminum heat sink because it is hot.

1. Discharge high voltage remaining in high voltage capacitor.
2. Disconnect 2 high voltage lead wires from magnetron filament terminals.
3. Disconnect connector CN701 & CN702 from H.V. Inverter board.
4. Remove 4 screws holding inverter reinforcement bracket A on right heater panel & base plate respectively.

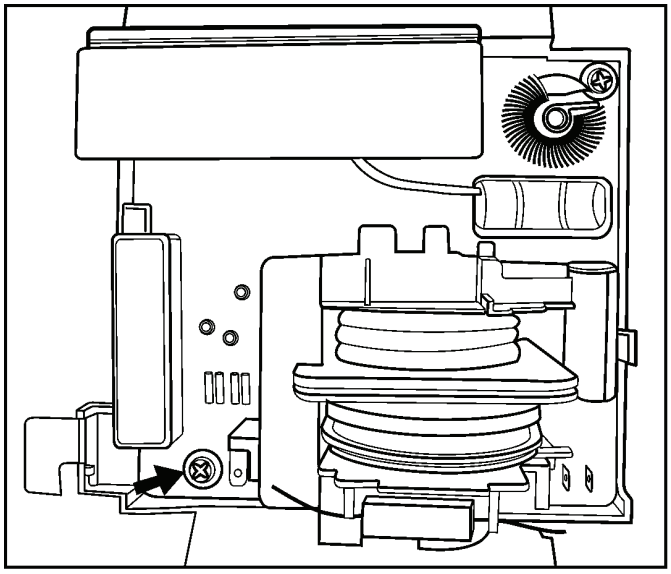




5. Release locking tabs connecting inverter air guide with inverter bracket.
6. Remove 1 screw holding H.V.Inverter to Inverter bracket.

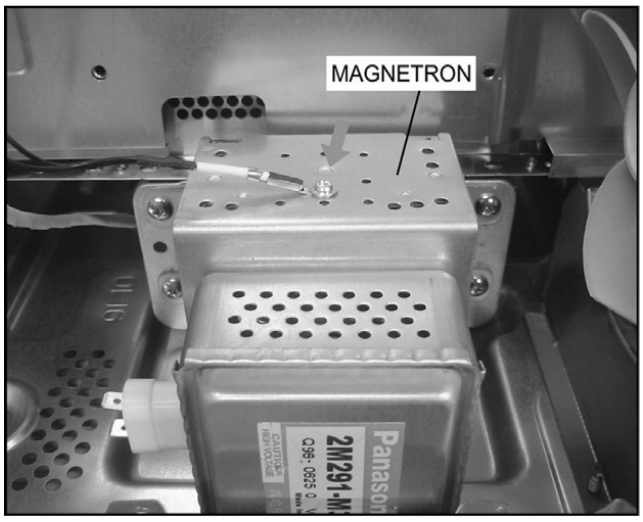


7. Remove 1 screw holding grounding plate to H.V. Inverter.

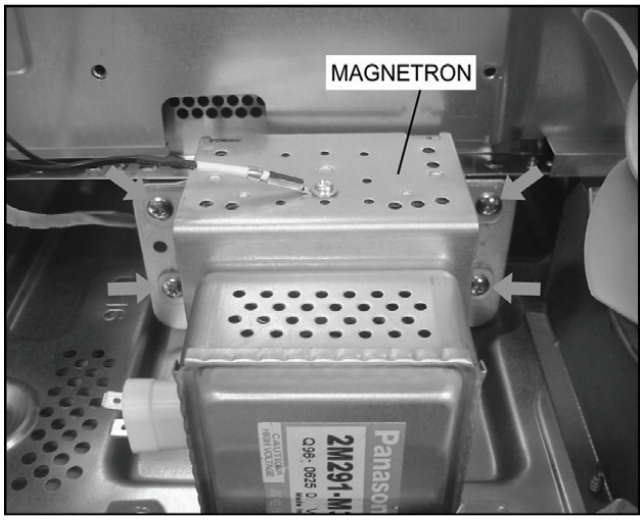


6.2. Magnetron

1. Steps same as disassembly of H.V. Inverter step 1 to step 4.
2. Remove 1 screw holding thermistor on magnetron.



3. Remove 4 screws holding the magnetron.



NOTE:

After replacement of the magnetron, tighten mounting screws properly in an x pattern, making sure there is no gap between the waveguide and the magnetron to prevent microwave leakage.

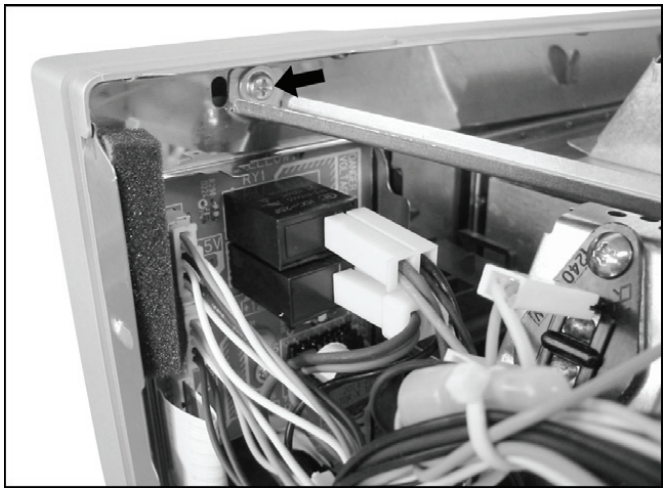
CAUTION
When replacing the magnetron, be sure the antenna gasket is in place.

6.3. Digital programmer circuit (D.P.C) & Membrane Sheet

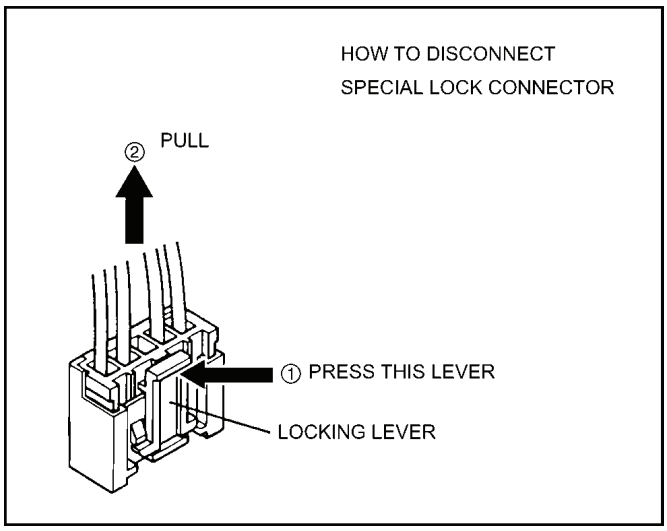
NOTE:

Be sure to ground any static electric charge built up on your body before handling the D.P.C.

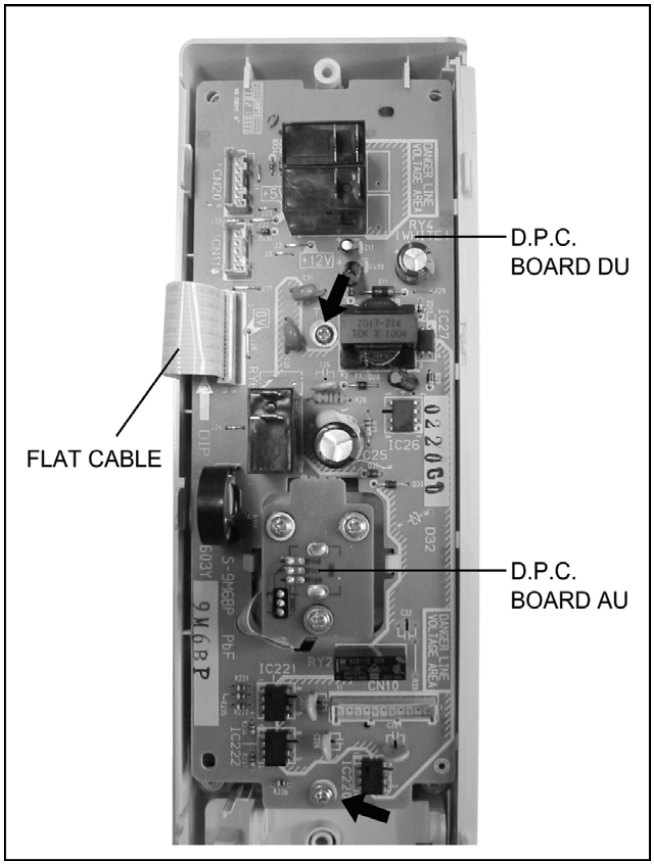
1. Remove 1 screw holding reinforcement bracket and escutcheon base on front plate.



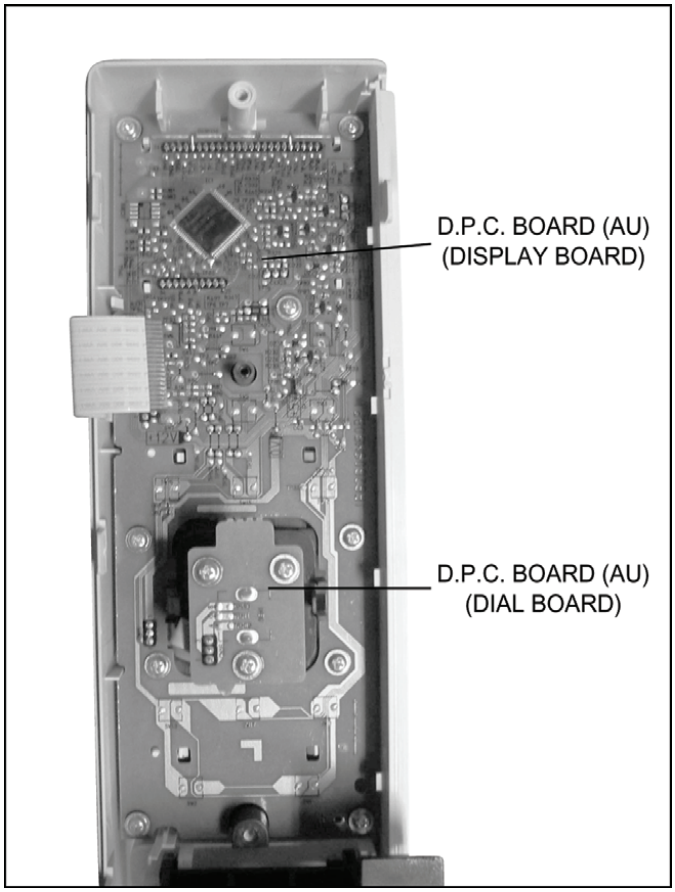
2. Disconnect all connectors from D.P.C. board.



3. Remove 2 screws holding D.P.C. board DU (Relay board).



4. Remove flat cable from CN13 on D.P.C board DU by pulling it out slightly.
5. Remove all screws holding D.P.C board AU (Display & Dial board)



6. Separate D.P.C board from tabs on the escutcheon base and remove D.P.C board.

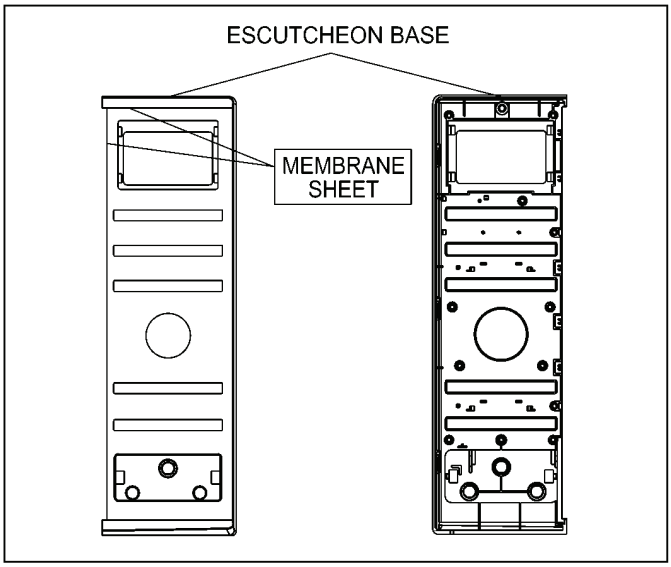
   To replace membrane key board

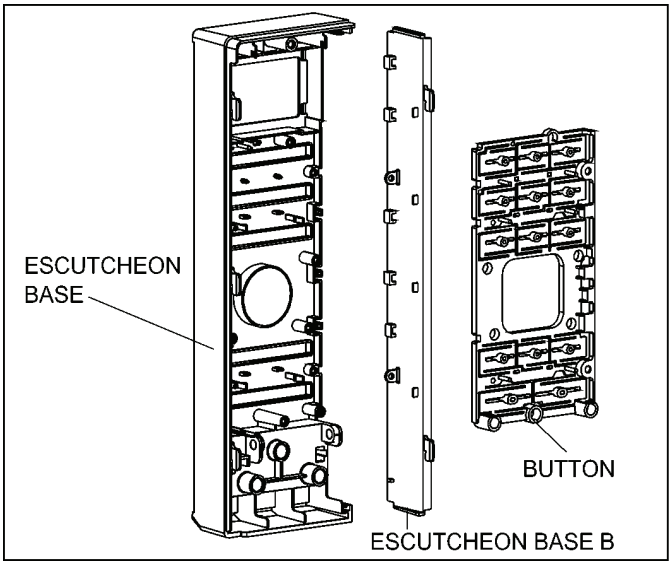
7. Use tools such as kinfe etc. to lift the edge of membrane sheet and peel off escutcheon sheet & key board membrane completely from escutcheon base.

   NOTE:

   a. The membrane key board is attached to the escutcheon base with double faced adhesive tape. Therefore, applying hot air such as using a hair dryer is recommended for smoother removal.

   b. When installing the new key board membrane, make sure that the surface of escutcheon base is clean to prevent a malfunction or shorted contacts.





6.4. Low voltage transformer and/or power relays (RY1, RY2, RY4, RY6)

NOTE:

Be sure to ground any static electric charge built up on your body before handling the D.P.C.

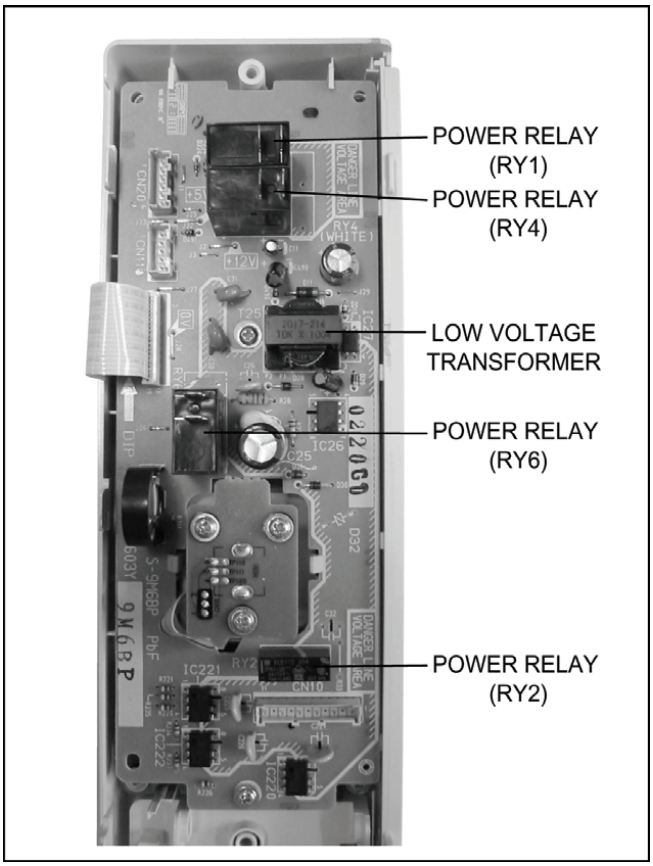
1. Disconnect all connectors from D.P.C. board.
2. Remove 6 screws holding D.P.C. board on escutcheon base.
3. Replace D.P.C. board.

(A) Using solder wick or a desoldering tool and 30W soldering iron carefully remove all solder from the terminal pins of the low voltage transformer and/or power relays.

NOTE:

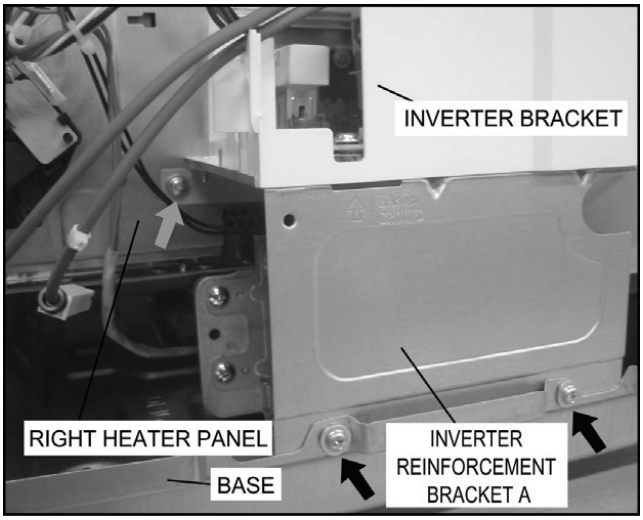
Do not use a soldering iron or desoldering tool of more than 30 watts on D.P.C. contacts.

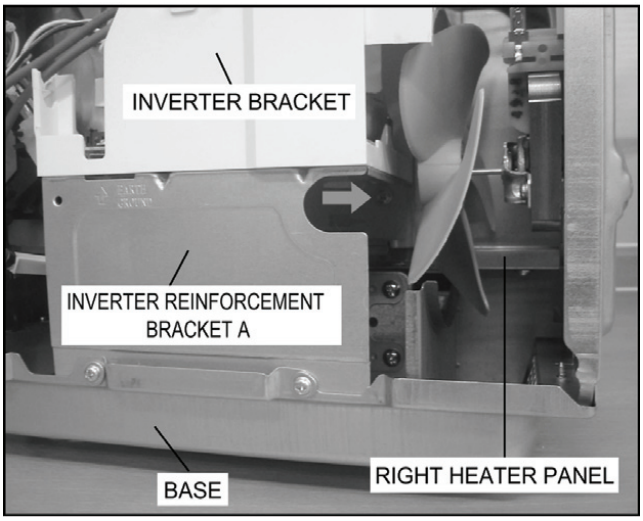
(B) With all the terminal pins cleaned and separated from D.P.C. contacts, remove the defective transformer/power relays, Replace components making sure all terminal pins are inserted completely resolder all terminal contacts carefully.



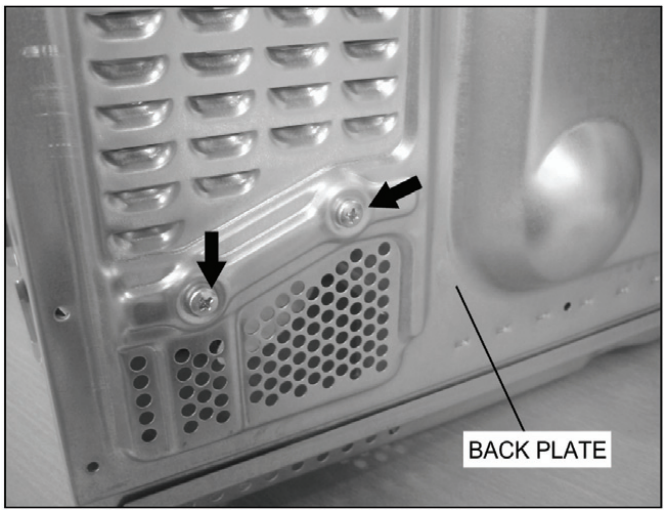
6.5. Fan motor

1. Disconnect 2 lead wires from fan motor terminals.
2. Remove 4 screws holding inverter reinforcement bracket A on right heater panel & base plate respectively.





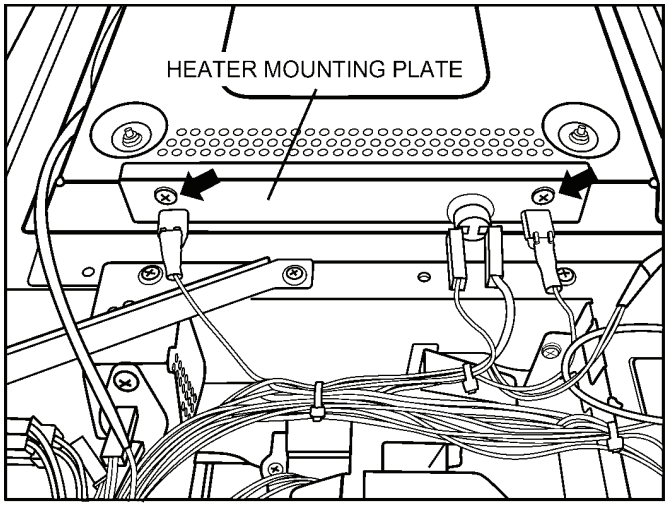
3. Remove 2 screws holding fan moter on oven assembly.



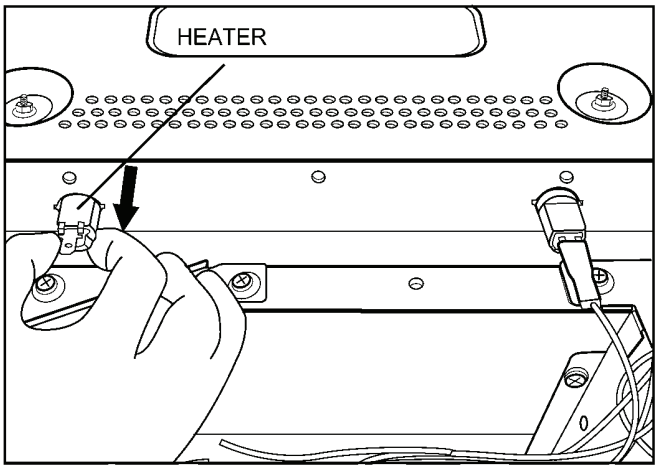
4. Remove fan blade from the fan motor shaft by pulling it straight out.

6.6. Quartz heater

1. Disconnect lead wires from heater terminals.
2. Remove 2 screws holding heater mounting plate from the right side .



3. Remove the heater by pulling it out.



6.7. Door assembly

1. Remove door C from door E by carefully pulling outward, starting from upper right hand corner using a flat blade screwdriver.
2. Separate door E from tabs on door A and remove door A (U).
3. Open Door E at the opening angle of approximately **10°(Note: The door cannot be removed if the opening angle is greater than 10°).**
4. Remove the door E from its hinges by pushing the door E upward and out.
5. Remove door key and door key spring.

To re-install components:

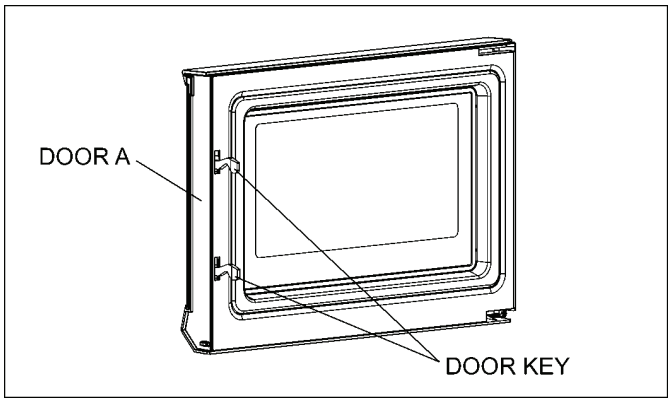
1. Place the door's lower hinge pin into the bottom hinge hole.
2. Use your left index finger to support the door's lower hinge pin while guiding the door's upper hinge pin into the top hinge hole.
3. Lower your finger to seat the door onto the hinges.
4. Replace other components.

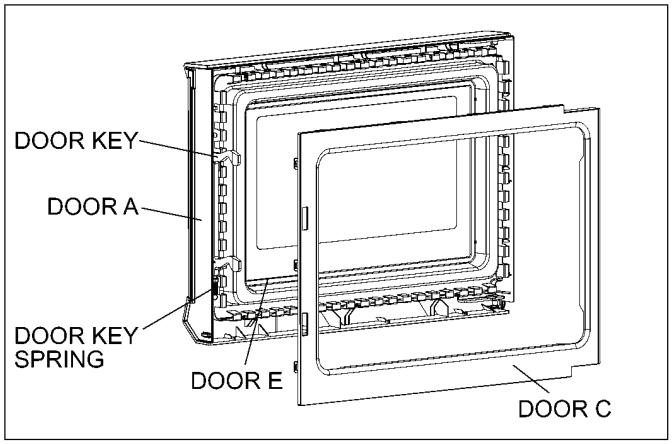
NOTE:

Adjust so that the upper portion of the door will touch firmly to the oven cavity front plate, without pushing the door. If the door assembly is not mounted properly, microwave power may leak from the clearance between the door and oven.

NOTE:

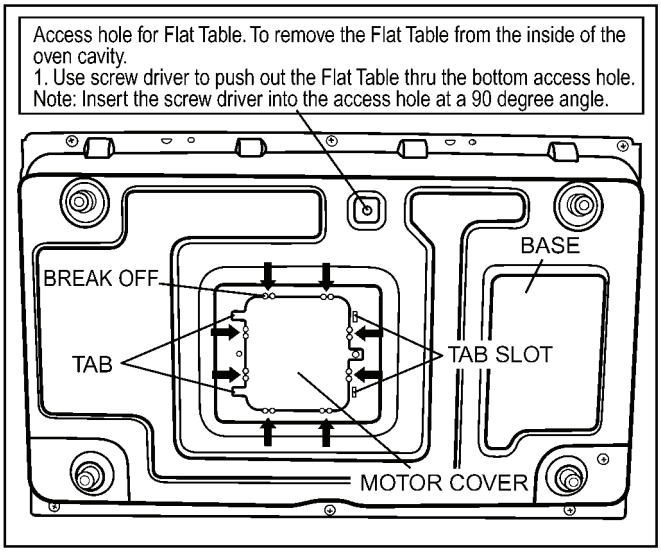
Always perform the microwave leakage measurement test after installation and adjustment of door assembly.





6.8. Stirrer motor

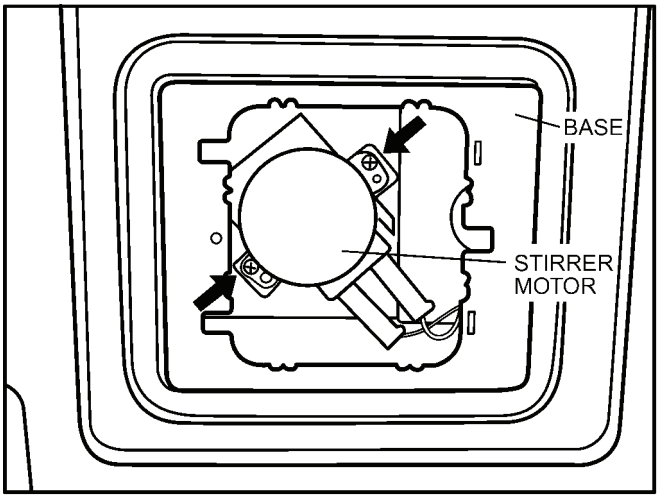
1. Remove the motor cover by breaking off at the 8 spots indicated by arrows with a cutter or the like.



⚠ **NOTE:**

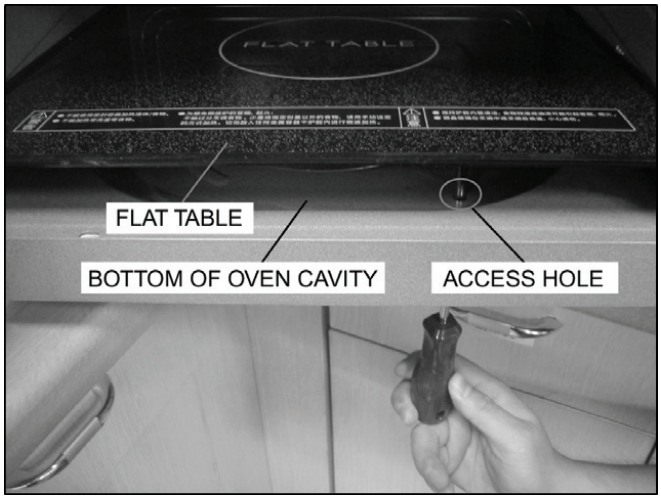
After removing the motor cover, be sure that cut portions are properly trimmed or bent to the inside so that no sharp edges will be exposed to outside.

2. Disconnect 2 lead wires connected to the stirrer motor.
3. Remove the stirrer motor by removing screw.



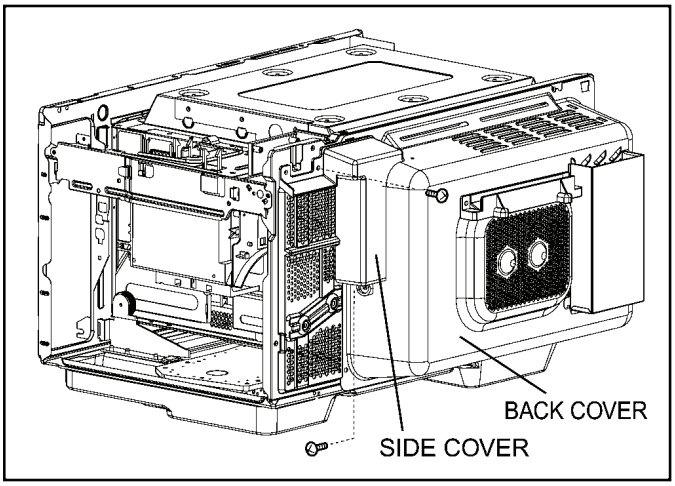
⚠ **NOTE:**

After reinstalling the new stirrer motor and reconnecting the 2 lead wires, reinstall the motor cover by rotating it around 180, tucking the 2 tabs under the base in the 2 provided slots, then screw the single tab to the base using a 4mm × 6mm screw.



6.9. Convection fan motor and convection heater

1. Remove 1 screw holding side cover on cavity back plate.

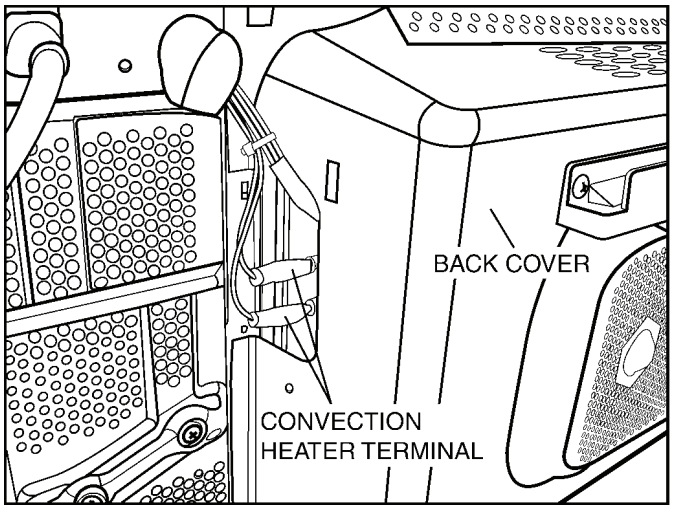


2. Remove 1 screw holding side cover on the side of back cover, then remove side cover & circuit breaker.

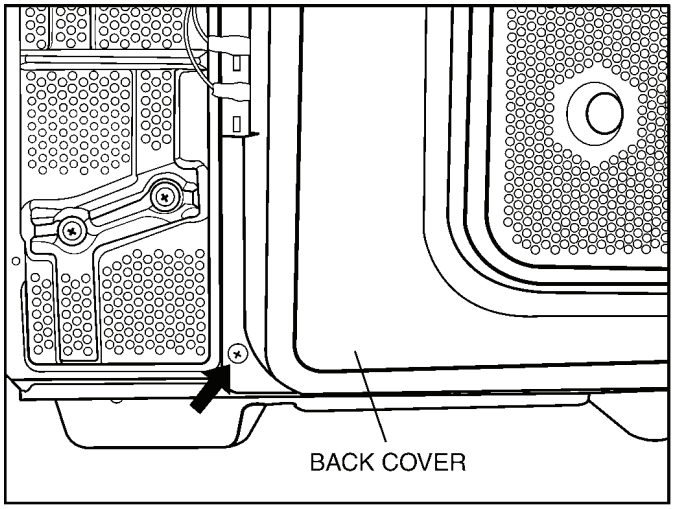
⚠ **NOTE:**

When reassembling the side cover, the edges may damage the lead wire if not handled with care.

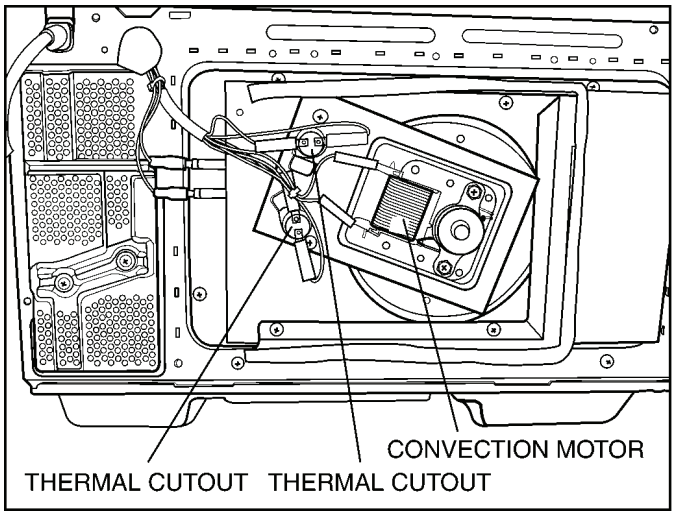
3. Disconnect 2 lead wires from convection heater terminals.



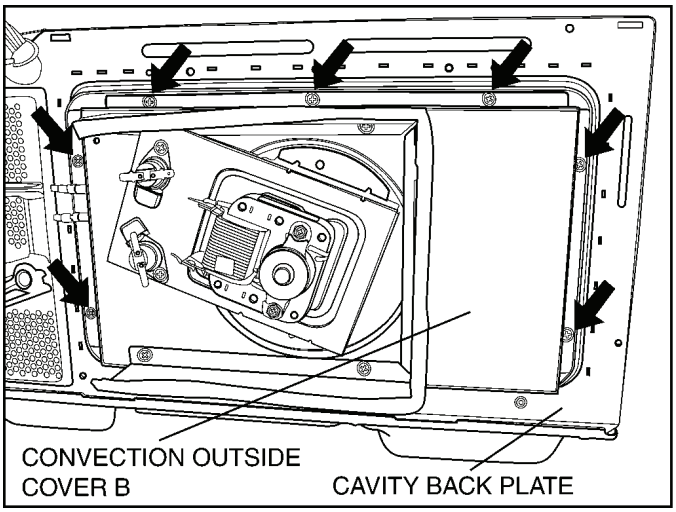
4. Remove 1 screw holding back cover on the lower of back plate, then remove back cover.

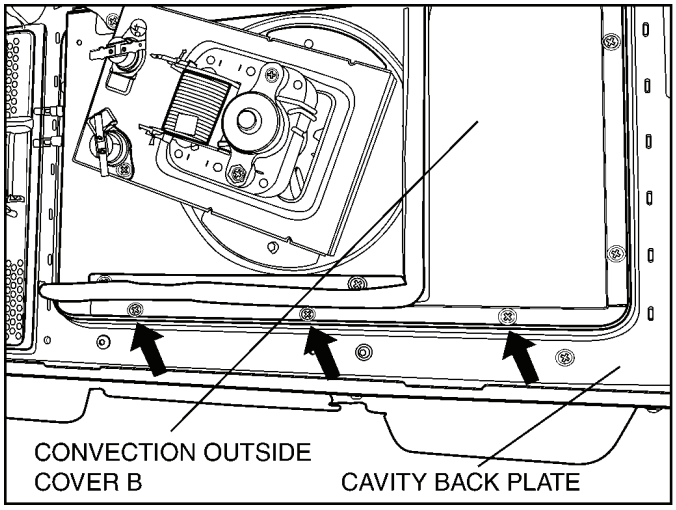


5. Disconnect 4 lead wires from 2 thermal cutouts and convection motor terminals respectively.



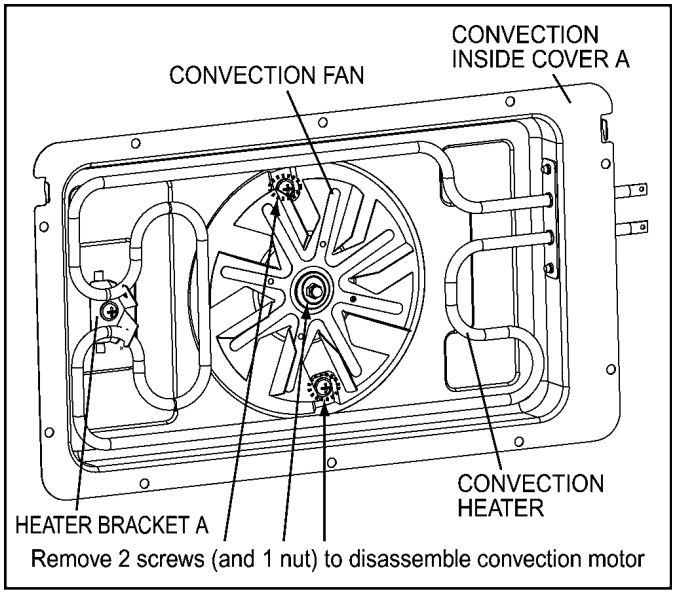
6. Remove 10 screws holding convection outside cover B on cavity back plate, then remove the module, which consists of convection inside cover A, convection motor and convection heater.



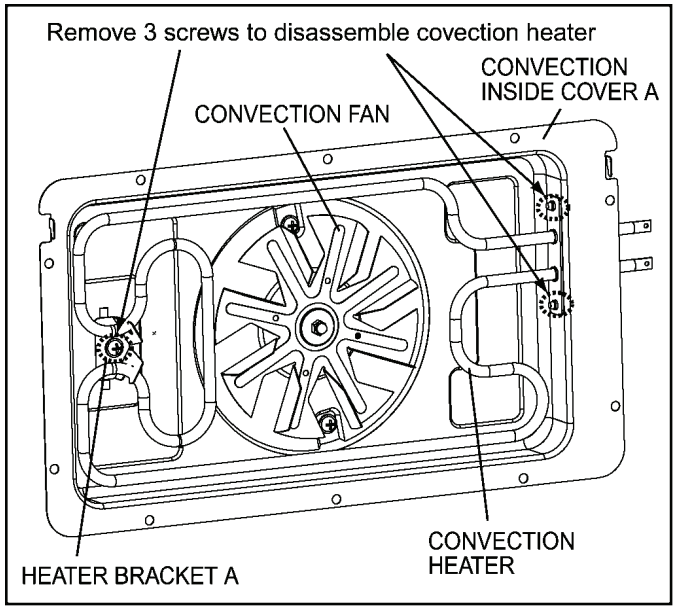


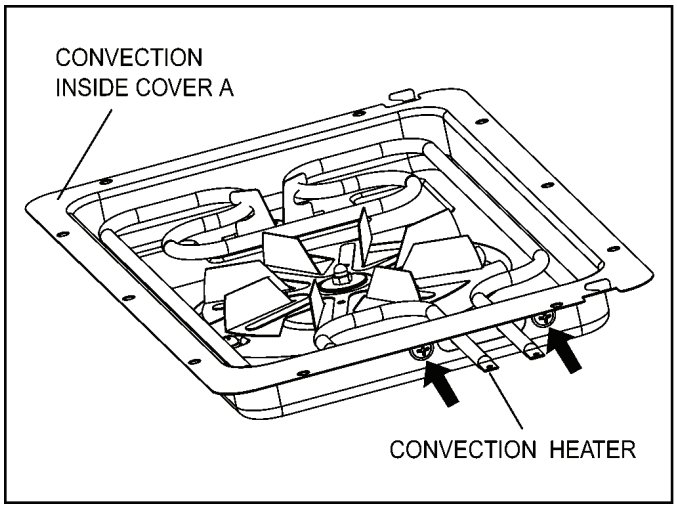
To replace convection heater

7. Remove 1 nut holding convection fan, then remove convection fan.
8. Remove 2 screws holding convection fan bracket on convection inside cover A.



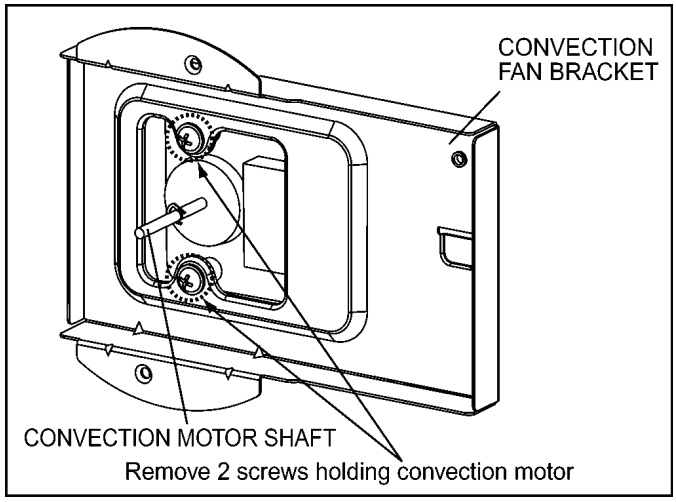
9. Remove 1 screw holding heater bracket A on convection inside cover A.
10. Remove 2 screws holding convection heater on convection inside cover A.





To replace convection motor

11. Remove 2 screws holding convection motor on convection fan bracket.



7 COMPONENT TEST PROCEDURE

⚠ WARNING

1. High voltage is present at the output terminals of the High Voltage Inverter (U) including aluminum heat sink during any cook cycle.
2. It is neither necessary nor advisable to attempt measurement of the high voltage.
3. Before touching any oven components, or wiring, always unplug the power cord and discharge the high voltage capacitors (see page 9).

7.1. Primary, Secondary Latch Switch interlocks & Power Relay RY1

1. Unplug lead connectors to Power Relay RY1 and verify open circuit of the Power Relay RY1 1-2 terminals.
2. Unplug lead connectors to Primary Latch Switch and Secondary Latch Switch.
3. Test the continuity of switches at door opened and closed positions with ohm meter (low scale).

   Normal continuity readings should be as follows.

	Door Closed	Door Opened
Primary Latch Switch	0Ω (Close)	∞Ω(Open)
Secondary Latch Switch	0Ω (Close)	∞Ω(Open)
Power Relay RY1	∞Ω (Open)	∞Ω(Open)

7.2. Short Switch

1. Unplug lead wires from Inverter Power Supply (U) primary terminals.
2. Connect test probes of ohm meter to the disconnected leads that were connected to Inverter Power Supply (U).
3. Test the continuity of short switch with door opened and closed positions using lowest scale of the ohm meter.

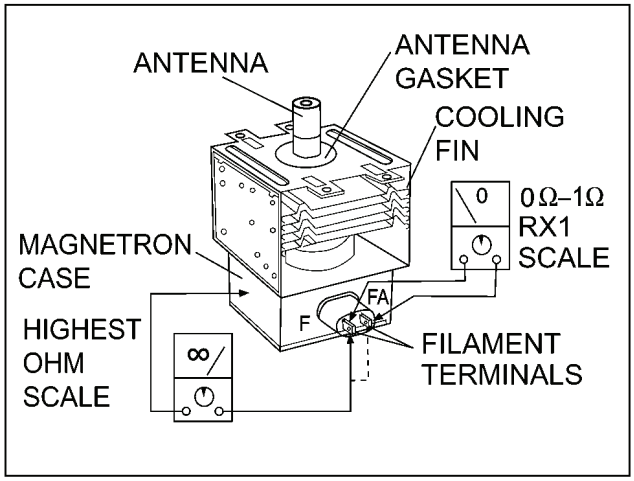
   Normal continuity readings should be as follows.

Door Opened	Door Closed
0Ω (Close)	∞Ω (Open)

7.3. Magnetron

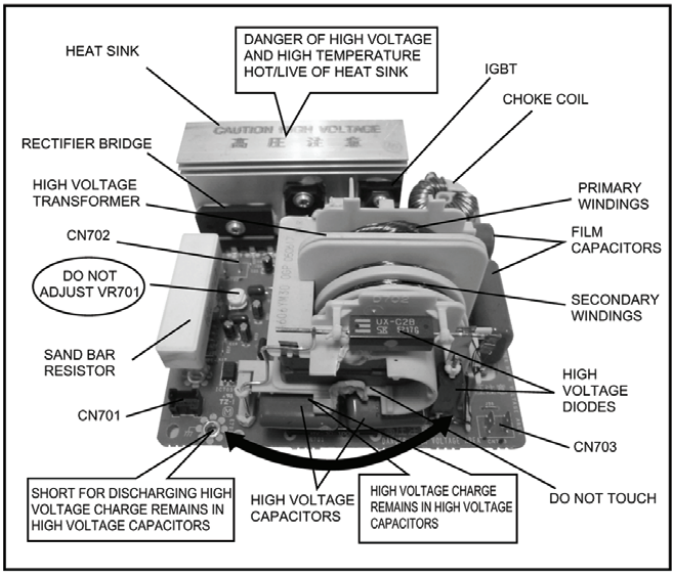
Continuity checks can only indicate an open filament or a shorted magnetron. To diagnose for an open filament or shorted magnetron.

1. Isolate magnetron from the circuit by disconnecting the leads.
2. A continuity check across magnetron filament terminals should indicate one ohm or less.
3. A continuity check between each filament terminal and magnetron case should read open.



7.4. Inverter power supply (U)

DO NOT try to REPAIR H.V. Inverter power supply (U).Replace complete H.V. Inverter(U) Unit.



WARNING: HIGH VOLTAGE

Test if failure codes H95, H97 or H98 appear when performing the following procedure. It is recommended to use an AC line input current ammeter for testing.

Test 1

1. With the oven unit's AC power supply cord is unplugged from the wall outlet, unplug the 2 pin H.V. connector CN703 from the magnetron tube.
2. Place 1 liter of water load into oven cavity.
3. Plug in the oven's AC power supply cord into outlet.
4. Program DPC.
   a. Press [Clock] button once.
   b. Press [Timer] button once.
   c. Press [Start] button once.
   d. Press [Micro Power] button once.
5. Program oven at High power for 1 minute and press [Start] button.
   a. After approximately 23 seconds, oven stops operating.
   b. During oven operation, the input current is approximately 0.5 to 1A. If both a and b are OK, proceed to test 2.

	INPUT CURRENT	FAILURE CODE
Unplug CN703	0.5 to 1A	Oven stops in 23 seconds after started.

Test 2

Continued from Test 1

1. Unplug the oven's AC power supply cord from outlet.
2. Unplug 3 pin connector CN701. CN703 remains unplugged.
3. Plug in the oven's AC power supply cord into outlet.
4. Program DPC.
   a. Press [Clock] button once.
   b. Press [Timer] button once.
   c. Press [Start] button once.
   d. Press [Micro Power] button once.
5. Program oven at High power for 1 minute and press [Start] button.
   a. After approximately 3 seconds, oven stops operating.
   b. During oven operation, the input current is approximately 0.4A.

	INPUT CURRENT	FAILURE CODE
Unplug CN701	≈ 0.4A	Oven stops in 3 seconds after started.

If both a and b check OK, the Inverter Power Supply (U) can be determined to be OK.

7.5. Temperature thermistor

These sensor monitors the heat produced by the heater circuit and maintains the magnetron temperature which user had selected. Normal room temperature 10°C to 30°C, the reading across the temperature thermistor should be from 35KΩ to 110 KΩ.

If the resistance reading is out of the range stated here, the thermistor is detective and must be replaced.

It is also possible to display thermistor level by taking the following steps.

1. Program the DPC into TEST MODE (Plug-in oven → press [Clock] button once → press [Timer] button once → press [Start] button once → press [Micro Power] button once).
2. Program oven at Standing Time for 1 minute and press [Start] button.
3. Press [Micro Power] once, the thermistor level reading will shown on the display.

   The normal reading should be in the range of 16-230.

8 MEASUREMENTS AND ADJUSTMENTS

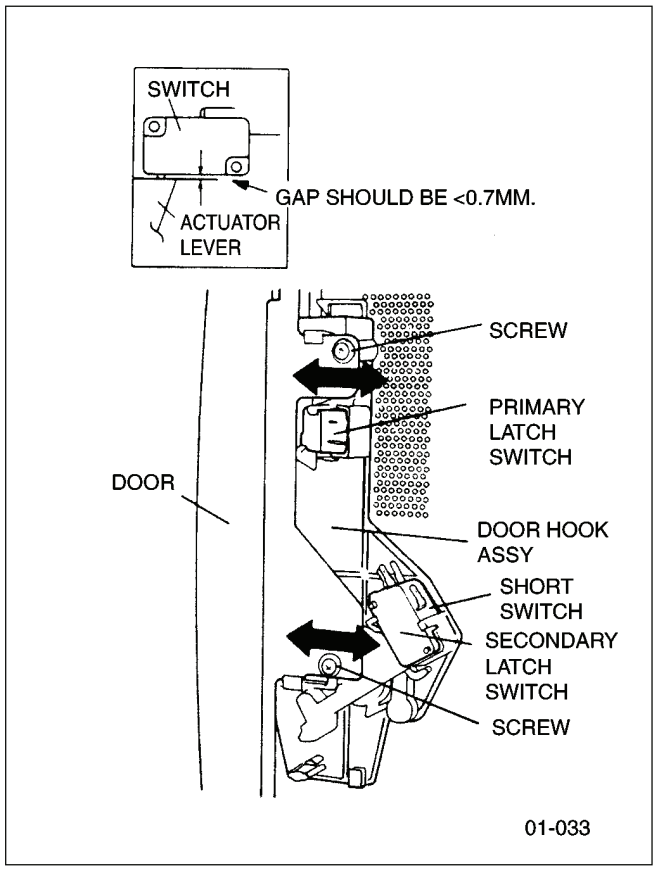
8.1. Adjustment of primary latch switch, secondary latch switch and short switch.

1. Mount the Primary latch switch, the Secondary latch switch and the Short switch to the door hook assembly as shown in illustration.

   NOTE:

   No specific individual adjustments during installation of the Primary latch switch, Secondary latch switch or Short switch to the door hook are required.

2. When mounting the door hook assembly to the oven assembly, adjust the door hook assembly by moving it in the direction of the arrows in the illustration so that the oven door will not have any play in it. Check for play in the door by pulling the door assembly. Make sure that the latch keys move smoothly after adjustment is completed. Completely tighten the screws holding the door hook assembly to the oven assembly.
3. Reconnect the short switch and check the continuity of the monitor circuit and all latch switches again by following the component test procedures.



8.2. Measurement of microwave output

The output power of the magnetron can be determined by performing IEC standard test procedures. However,due to the complexity of IEC test procedures, it is recommended to test the magnetron using the simple method outlined below.

Necessary Equipment:

- 1 liter beaker
- Glass thermometer
- Wrist watch or stopwatch

NOTE:

Check the line voltage under load. Low voltage will lower the magnetron output. Take the temperature readings and heating time as accurately as possible.

1. Fill the beaker with exactly one liter of tap water.Stir the water using the thermometer and record the water's temperature. (recorded as T1).
2. Place the beaker on the center of glass tray.
   Set the oven for High power and heat it for exactly one minute.
3. Stir the water again and read the temperature of the water. (recorded as T2).
4. The normal temperature rise at High power level for each model is as shown in table.

TABLE (1L-1min. test)

RATED OUTPUT	TEMPERATURE RISE
1000W	Min. 8.5°C

9 TROUBLESHOOTING GUIDE

DANGER: HIGH VOLTAGES ⚠

1. **DO NOT RE-ADJUST PRESET CONTROL on the H.V.Inverter (U).** It is very dangerous to repair or adjust without proper test equipment because this circuit generates very large current and high voltage. Operating a misaligned inverter circuit is dangerous.
2. Ensure proper grounding before troubleshooting.
3. Be careful of the high voltage circuitry, taking necessary precautions when troubleshooting.
4. Discharge high voltage remaining in the H.V.Inverter (U).
5. When checking the continuity of the switches or the H.V.Inverter, disconnect one lead wire from these parts and then check continuity with the AC plug removed. Doing otherwise may result in a false reading or damage to your meter. When disconnecting a plastic connector from a terminal, you must hold the plastic connector instead of the lead wire and then disconnect it, otherwise lead wire may be damaged or the connector cannot be removed.
6. Do not touch any parts of the circuitry on the digital programmer circuit, since static electric discharge may damage this control panel. Always touch ground while working on this panel to discharge any static charge in your body.
7. 230V AC is present on the digital programmer circuit (Terminals of power relay's and primary circuit of Digital Programmer Circuit). When troubleshooting, be cautious of possible electrical shock hazard.

Before troubleshooting, operate the microwave oven following the correct operating procedures in the instruction manual in order to find the exact cause of any trouble, since operator error may be mistaken for the oven's malfunction.

Self diagnostic display

Oven has self diagnostic function but it will not be activated in normal operation mode.

To show self diagnostic result, please take the following steps.

1. Firstly, you must program the DPC into TEST MODE (Plug-in oven → press [Clock] button once → press [Timer] button once → press [Start] button once → press [Micro Power] button once.)
2. Keep pressing [Clock] button for more than 2 seconds until buzzer beeps.
3. Press [Start] button once, oven will show the magnetron cooking time (hours).
4. Press [Stop/Reset] button to exit.

   NOTE:

   Keep pressing [Start] button for more than 2 seconds, the memory will be clean up.
5. Error code list

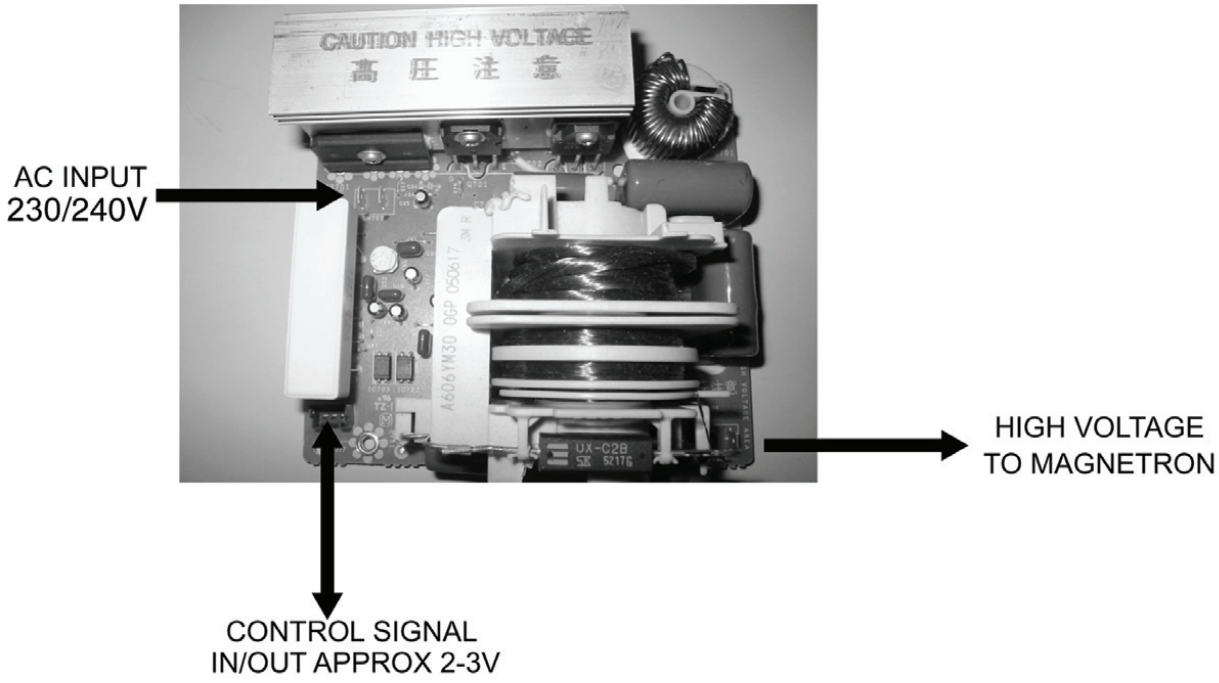
   H** Hardware problem, oven itself has problem.

   U** Usage problem such as run out of water and oven itself works well.

Error code	Cause for error
H99	Inverter on/off control error
H98	Magnetron no oscillation error
H97	Inverter input error
H96	Inverter custom IC error
H95	Inverter input failure
H90	Power down controlled by Inverter thermistor
H00	EPROM failure
	Usage problem
U65	Power down controlled by Inverter thermistor
HOT	Oven is hot (It is able to show up both in test mode and cooking mode)

9.1. (Troubleshooting) Oven stops operation during cooking

	SYMPTOM	CAUSE	CORRECTIONS
1.	**Oven stops in 3 seconds** after pressing [Start] button.	No input AC is supplied to H.V.Inverter (U) CN702 terminals	1. Latch Switch 2. Power relay RY1 3. Loose lead wire connector CN701, CN702 4. H.V. Inverter (U)
	Oven stops in 23 seconds after pressing [Start] button.	H.V.Inverter (U) operates by the control signals from DPC but magnetron is not oscillating	1. Magnetron 2. Loose lead wire connector CN703 3. H.V. Inverter (U)
	Oven stops in 1 minute after pressing [Start] button. (Convection function)	Oven thermistor circuit is not functioning.	1. Oven thermistor 2. Loose wiring
2.	No display and no operation at all. Fuse is blown.	Most probably loose connection of connectors, or door latch mechanism is not adjusted properly	1. Align door, Door Latch Switches 2. Loose wiring connectors

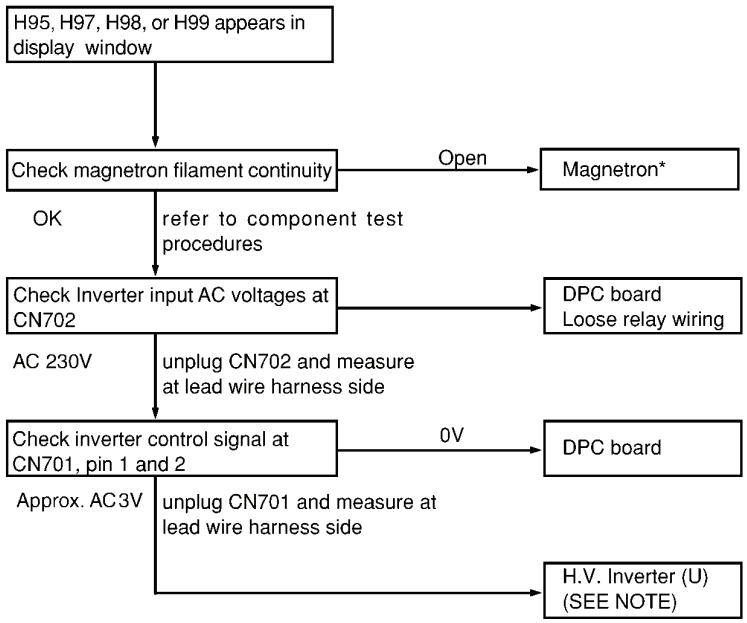


9.2. (Troubleshooting) Other problems

	SYMPTOM	CAUSE	CORRECTIONS
1.	Oven is dead. Fuse is OK. No display and no operation at all.	1. Open or loose lead wire harness 2. Open thermal cutout / thermistor 3. Open low voltage transformer 4. Defective DPC	Check thermal cutout is defective.
2.	No display and no operation at all. Fuse is blown.	1. Shorted lead wire harness 2. Defective primary latch switch (NOTE 1) 3. Defective short switch (NOTE 1) 4. Defective Inverter Power Supply (U)	Check adjustment of primary, secondary latch switch and short switch including door.
		NOTE 1: All of these switches must be replaced at the same time. Check continuity of power relay RY1 contacts (between 1 and 2) and if it has continuity, replace power relay RY1 also.	
3.	Oven does not accept key input (Program)	1. Key input is not in proper sequence 2. Open or loose connection of membrane key button to DPC (Flat cable) 3. Shorted or open membrane key board 4. Defective DPC	Refer to operation procedure. Refer to DPC troubleshooting.
4.	Fan motor turns on when oven is plugged in with door closed.	1. Misadjustment or loose wiring of secondary latch switch 2. Defective secondary latch switch 3. Door switch CN20	Adjust door and latch switches.
5.	Timer starts count down but no microwave oscillation. (No heat while oven lamp and fan motor turn on)	1. Off-alignment of primary latch switch 2. Open or loose connection of high voltage circuit especially magnetron filament circuit NOTE: Large contact resistance will cause lower magnetron filament voltage and cause magnetron to have lower output and/or be intermittent. 3. Defective high voltage component H.V. Inverter Power Supply (U) Magnetron 4. Open or loose wiring of power relay RY1 5. Defective primary latch switch 6. Defective DPC or power relay RY1	Adjust door and latch switches. Check high voltage component according to component test procedure and replace if it is defective. Refer to DPC troubleshooting
6.	Oven can program but timer does not start countdown.	1. Open or loose wiring of secondary latch switch 2. Off-alignment of secondary latch switch 3. Defective secondary latch switch	
7.	Microwave output is low. Oven takes longer time to cook food.	1. Decrease in power source voltage 2. Open or loose wiring of magnetron filament circuit.(Intermittent oscillation) 3. Aging change of magnetron	Consult electrician
8.	Fan motor turns on and stirrer motor rotates when door is opened.	1. Low voltage transformer on DPC.	
9.	Oven does not operate and return to plugged in mode as soon as [Start] button is pressed.	1. Defective DPC	Check grounding connector on escutcheon base.
10.	Loud buzzing noise can be heard.	1. Loose fan and fan motor	
11.	Heater does not turn on.	1. Open or loose wiring of heater 2. Defective heater 3. Defective power relay 4. Defective DPC	
12.	Oven stops operation during cooking.	1. Open or loose wiring of primary and secondary latch switch 2. Operation of thermal cutout	Adjust door and latch switches.

9.3. Troubleshooting of inverter circuit (U) and magnetron

This oven is programmed with a self diagnostics failure code system which will help for troubleshooting. H95, H97, H98 and H99 are the provided failure codes to indicate magnetron and inverter circuit problem areas. This section explains failure codes of H95, H97, H98 and H99. First, you must program the DPC into TEST MODE, press [Clock] button once → press [Timer] button once → Press [Start] button once → press [Micro Power] button once. Program unit for operation. H95, H97, H98, H99 appears in display window a short time after [Start] button is pressed and there is no microwave oscillation.



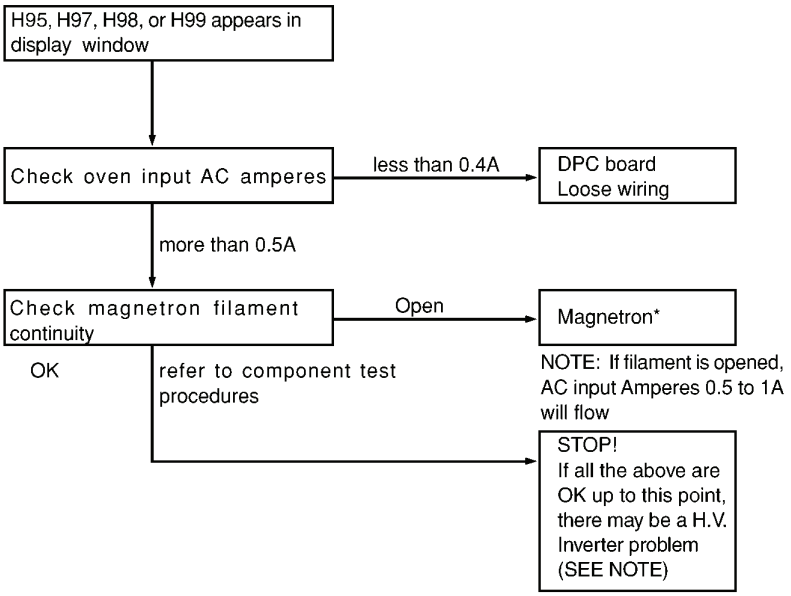
⚠ WARNING: DO NOT try to repair this Inverter Power Supply (U) and also DO NOT RE-ADJUST PRESET CONTROL on the board. It is very dangerous to repair or adjust without proper test equipment because this circuit generates very high voltage and very large current. Off alignment of inverter board operation is dangerous. Operating a misaligned Inverter circuit is dangerous due to the very high voltage and current that is produced by this board. Defective boards must be replaced with a new one.

* Check magnetron filament for open or short to case before proceeding to determine a good magnetron.

NOTE: After check, unplug unit to reset to normal operation mode.

Alternate way to troubleshoot oven with AC Ampere meter used

H95, H97, H98, H99 appears in display window a short time after [Start] button is pressed and no microwave oscillation with AC Ampere meter used for troubleshooting.



NOTE: After check, unplug unit to reset to normal operation mode.

9.4. Trouble related to Digital Programmer Circuit

SYMPTOM	STEP	CHECK	RESULT	CAUSE/CORRECTIONS
No display when oven is first plugged in	1	Fuse pattern of D.P.C.	Normal	→Step2
			Open	Replace D.P.C. or Fuse Pattern
	2	IC10 pin4 voltage	Abnormal 0V	IC26
			Normal=12V	→Step3
	3	IC1 pin9 voltage	Abnormal	IC10
			Normal=5V	IC1, CX320, Display
No key input	1	Touch switch	Abnormal	Touch switch
			Normal	IC1
No beep sound	1	IC1 pin 5 voltage	Abnormal	IC1
			Normal=5V	BZ310, IC200
Power relay RY2 does not turn on even though the program had been set and the [start] pad is tapped	1	IC1 pin 78 voltage while operation	Abnormal	IC1
			Normal=5V	→Step2
	2	Short circuit between pin 14 of IC200 and ground	Still not turn on	RY2
			RY2 turns on	IC200
No microwave oscillation at any power	1	IC1 pin 27 voltages while operation at high power	Abnormal	IC1
			Normal=5V	→Step2
	2	Collector of Q222 voltage	Abnormal	Q222 and /or Q225,Q226,Q227
			Normal≒0.7V	→Step3
	3	Short circuit between collector of Q222 and emitter of Q225	Still not turn on	RY1
			RY1 turns on	Q222 and/or Q225,Q226,Q227
Dark or unclear display	1	Replace display and check operation	Normal	Display
			Abnormal	IC1
Missing or lighting of unnecessary segment	1	Replace IC1 and check operation	Normal	IC1
			Abnormal	Display
H95/H97/H98 appears in window and oven stops operation.Program High power for 1 minute and conduct following test quickly, unless H95/H97/H98 appears and oven stops	1	Unplug CN702 (2 pin) connector and measure voltage between terminals	Abnormal=0V	1. Latch Switch 2. D.P.C. /Power Relay
			Normal=230-240V	→Step2
	2	Unplug CN701 (3 pin) connector and measure pin1 voltage of CN3	Abnormal=0V	D.P.C.
			Approx. AC 3V	Magnetron

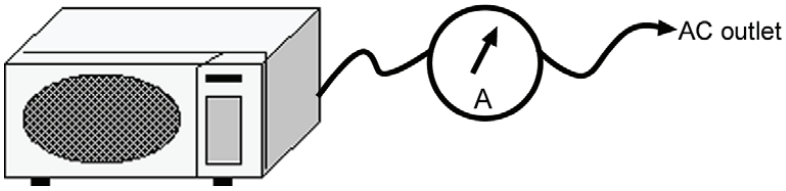
9.5. Simple way of H.V. Inverter/magnetron troubleshooting

Purpose:

Simple way **(3/23 seconds rule)** of identifying whether it's Magnetron, Inverter, or others.

Set-up:

The unit under question is connected through the Ammeter as shown below.



Procedure:

Follow the matrix table below to identify the problem source.

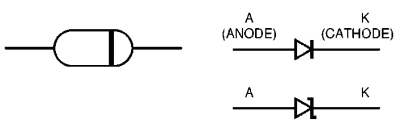
Note:

Do not replace both Inverter board and Magnetron simultaneously and automatically without going through this procedure.

Power will:	Ammeter reading is:	To do:	Remedy:
Shut off in 23 seconds after "Start".	1. Between 0.5A and 1.0A.	Check and repair open magnetron circuit	Open magnetron wiring between Inverter and magnetron terminal.
	2. Between 1.0A and 2.0A.	Check continuity of D702 in Inverter PCB.	
		⇩	
		1. D702 shorted	Replace **H.V.Inverter** (F606Y6Y40BP)
		2. D702 is OK	Replace **magnetron**
Shut off in 3 seconds after "Start"	1. Less than 0.5A	Check open circuit: Latch Switch, DPC, Power Relay and CN701	Replace defective component(s), or correct switch, cables and connectors.

9.6. How to check the semiconductors using an OHM meter

Diode



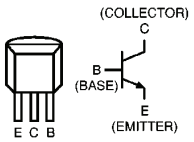
	FORWARD	REVERSE
A-K	SMALL	∞

Transistor

NPN Transistor

2SC·····

2SD·····

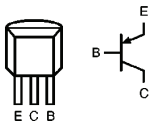


	FORWARD	REVERSE
B-E	SMALL	∞
B-C	SMALL	∞
C-E	∞	∞

PNP Transistor

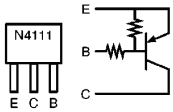
2SA·····

2SB·····



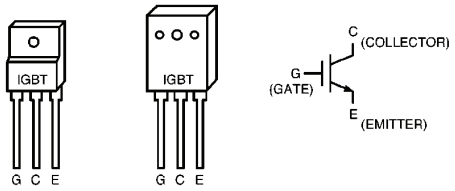
	FORWARD	REVERSE
B-E	SMALL	∞
C-B	SMALL	∞
C-E	∞	∞

Digital Transistor
PNP Transistor



	FORWARD	REVERSE
E-B	10kΩ ~ 30kΩ	10kΩ ~ 30kΩ
C-B	50kΩ ~ 90kΩ	∞
C-E	40kΩ ~ 80kΩ	∞

IGBT
(INSULATED GATE BIPOLAR TRANSISTOR)



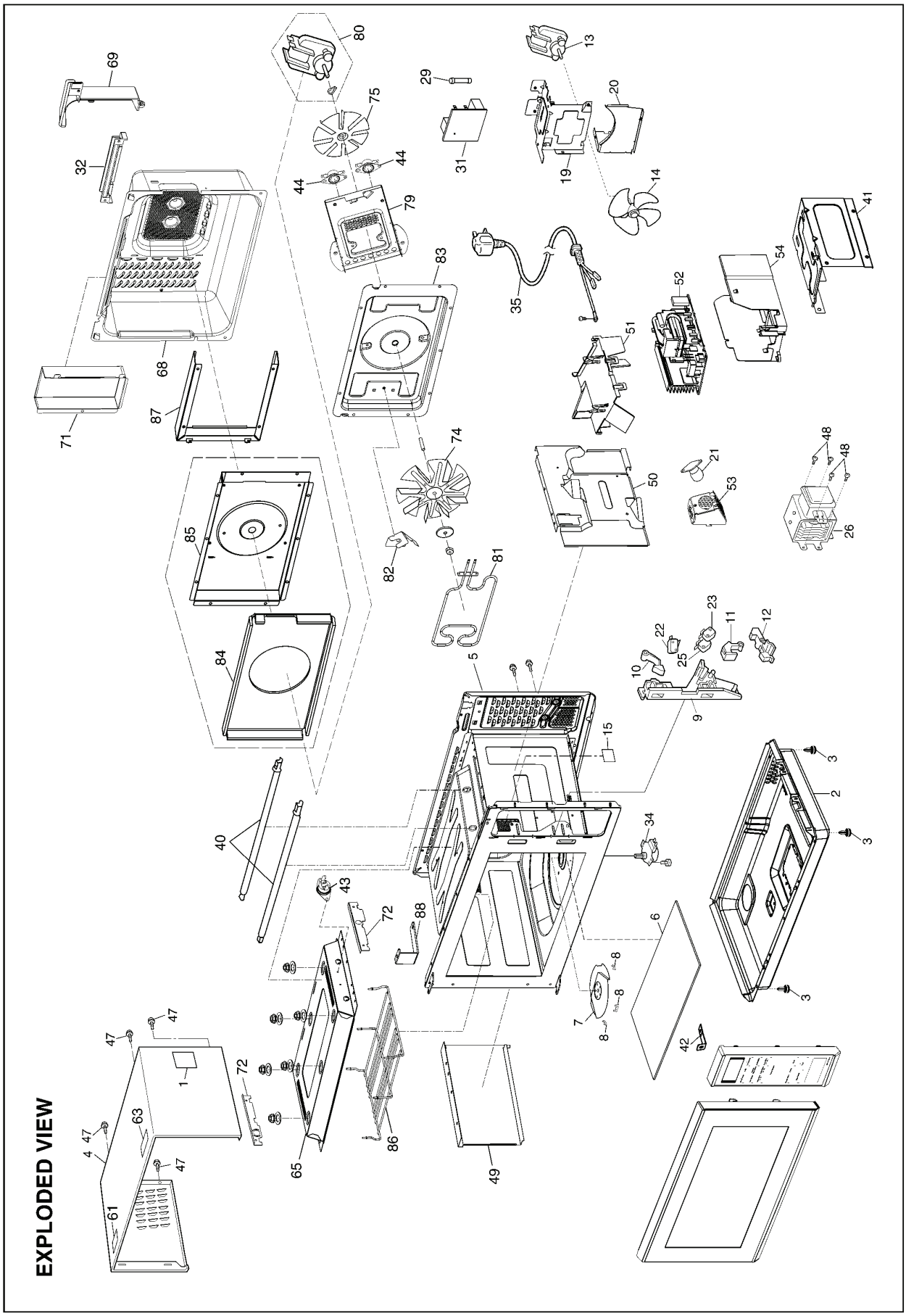
	FORWARD	REVERSE
E-C	SMALL	∞
E-G	∞	∞
C-G	∞	∞

9.7. H.V. Inverter main parts list (F606Y6Y40BP)

Ref. No.		Part No.	Part Name & Description	Pcs/Set	Remarks
Q701	⚠	A691EM300BP	IGBT	1	
Q702	⚠		IGBT	1	
C701		F0C2H184A013	FILM CAPACITOR	1	
C702		F0C2E505A262	FILM CAPACITOR	1	
C703		F0C2E395A246	FILM CAPACITOR	1	
DB701	⚠	B0FBBS000001	RECTIFIER BRIDGE	1	
L701	⚠	F5020M300XN	CHOKE COIL	1	
R702		D0CM352JA002	SAND BAR RESISTOR	1	
T701	⚠	A609A6Y40BPP	TRANSFORMER	1	(INCLUDING D701, D702, C706, C707)
D701, D702	⚠	B0FBAZ000004	DIODE	2	
C706		F0C3F562A002	FILM CAPACITOR	1	
C707		F0C3F432A002	FILM CAPACITOR	1	

10 EXPLODED VIEW AND PARTS LIST

10.1. EXPLODED VIEW



10.2. PARTS LIST

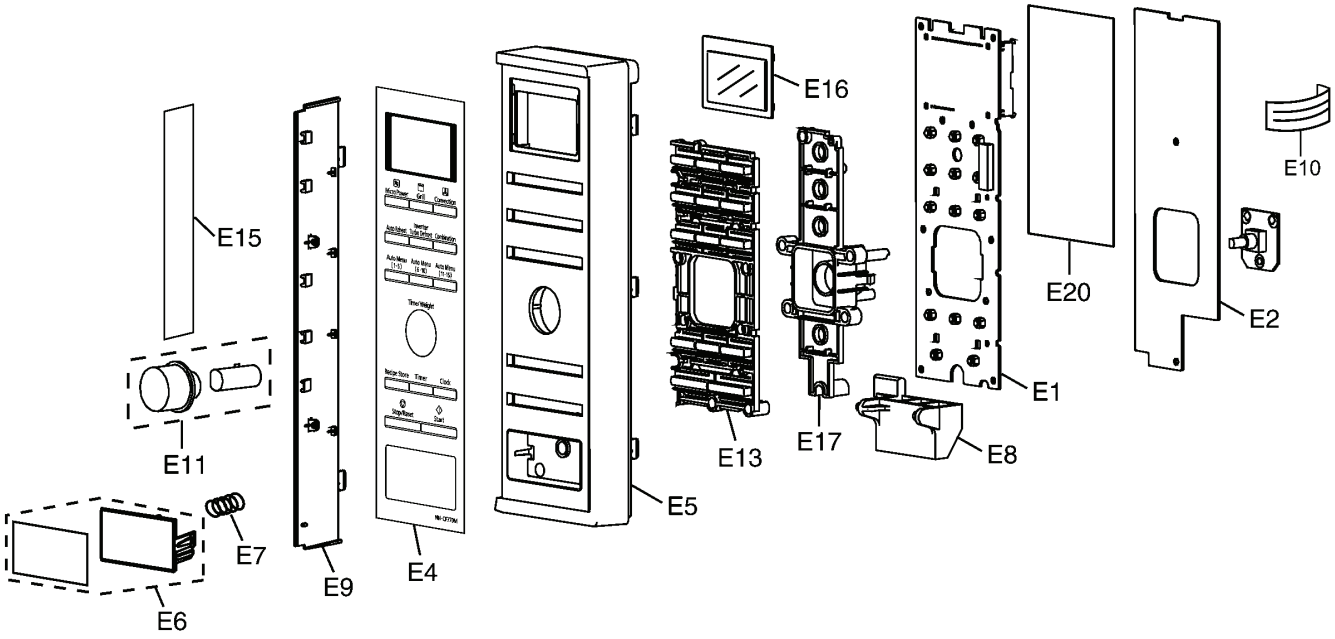
NOTE:

1. When ordering replacement part(s), please use part number(s) shown in this part list.
   Do not use description of the part.
2. Important safety notice:
   Components identified by ⚠ mark have special characteristics important for safety.
   When replacing any of these components, use only manufacture's specified parts.

Ref. No.		Part No.	Part Name & Description	Pcs/Set	Remarks
1		F00066V00HP	CAUTION LABEL	1	
2		F10019L10XPG	BASE	1	
3		F1008-1L40BS	RUBBER FOOT	4	
4		F10099M60SBP	CABINET BODY	1	
5	⚠	F200A9M50QP	OVEN	1	
6		A010T7R00SP	FLAT TABLE (U)	1	
7		F202K7R00BP	ANTENNA STIRRER (U)	1	
8		F20197J70XP	ANTENNA BRACKET	3	
9	⚠	F30206G30AP	DOOR HOOK	1	
10		F31366G30AP	HOOK LEVER A	1	
11		F31376G30AP	HOOK LEVER B	1	
12		F31386G30AP	HOOK LEVER C	1	
13		F400A9L00XP	FAN MOTOR	1	
14		F4008-1L70	FAN BLADE	1	
15		F64377J70XP	GLASS	1	
19		F41449M60BP	UPPER ORIFICE	1	
20		F4146-1P00	LOWER ORIFICE	1	
21		F612E9L60XP	INCANDESCENT LAMP (U)	1	
22	⚠	F61425U30XN	MICRO SWITCH	1	(PRIMARY LATCH SWITCH)
23	⚠	F61415U30XN	MICRO SWITCH	1	(SECONDARY LATCH SWITCH)
25	⚠	F61785U30XN	MICRO SWITCH	1	(SHORT SWITCH)
26	⚠	2M261-M32J5P	MAGNETRON	1	
29	⚠	A62304210BP	FUSE	1	10A/250V
31		F607X9M50QP	NOISE FILTER (U)	1	
32		F81247Q70BP	BREAKWATER	1	
34		F61449M60BP	STIRRER MOTOR	1	
35	⚠	F900CBL30VP	AC CORD W/PLUG	1	
40		F630G9M50QP	HEATER	2	
41		F1161-1P00	REINFORCEMENT BRACKET A	1	
42		F11659M60BP	REINFORCEMENT BRACKET B	1	
43		F61456V50HP	THERMAL CUTOUT	1	
44		F61457J70XP	THERMAL CUTOUT	2	
47		XTWBFE4+8D	SCREW	4	FOR CABINET BODY
48		XTT4+8RDN	SCREW	4	FOR MAGNETRON
49		F22379M60BP	LEFT HEATER PANEL	1	
50		F22369M60BP	RIGHT HEATER PANEL	1	
51		F40279M60BP	INVERTER AIR GUIDE	1	
52		F606Y6Y40BP	H.V.INVERTER (U)	1	
53		F6074-1P00	INCANDESCENT LAMP BRACKET	1	
54		F65859L00XP	INVERTER BRACKET	1	
61		F01505R00BP	NO TOUCHING LABEL	1	
63		F01508G60HP	NO TOUCHING LABEL	1	
65		F22189M50QP	UPPER HEATER PANEL	1	
68		F10599M60BP	BACK COVER	1	
69		F10589M60BP	SIDE COVER	1	
71		F40307Q70BP	AIR GUIDE D	1	
72		F64609M50QP	HEATER MOUNTING PLATE	2	
74		F22397Q70BP	CONVECTION FAN BLADE	1	
75		F41594V00BP	COOLING FAN BLADE	1	
79		F41809M60BP	CONVECTION FAN BRACKET	1	

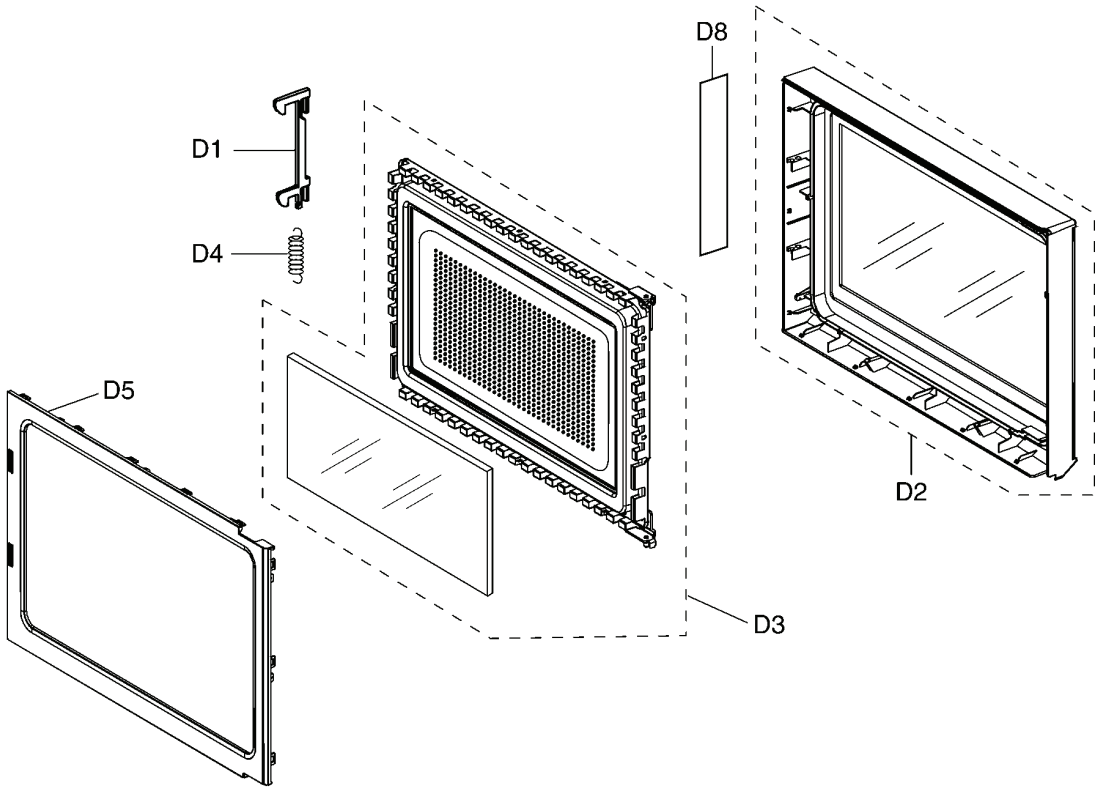
Ref. No.		Part No.	Part Name & Description	Pcs/Set	Remarks
80		F490S6Y40XP	CONVECTION FAN MOTOR	1	
81		F631D7Q70BP	CONVECTION HEATER	1	
82		F64174V00BP	HEATER BRACKET A	1	
83		F66797Q70BP	CONVECTION INSIDE COVER	1	
84		F22429M60BP	ADIABATIC MATERIAL	1	
85		F66807Q70BP	CONVECTION OUTSIDE COVER	1	
86		A67359M50QP	HEATER PROTECTOR	1	
87		F40667Q70BP	EXHAUST GUIDE D	1	
88		F20999L70XP	REINFORCEMENT BRACKET D	1	

10.3. ESCUTCHEON BASE ASSEMBLY



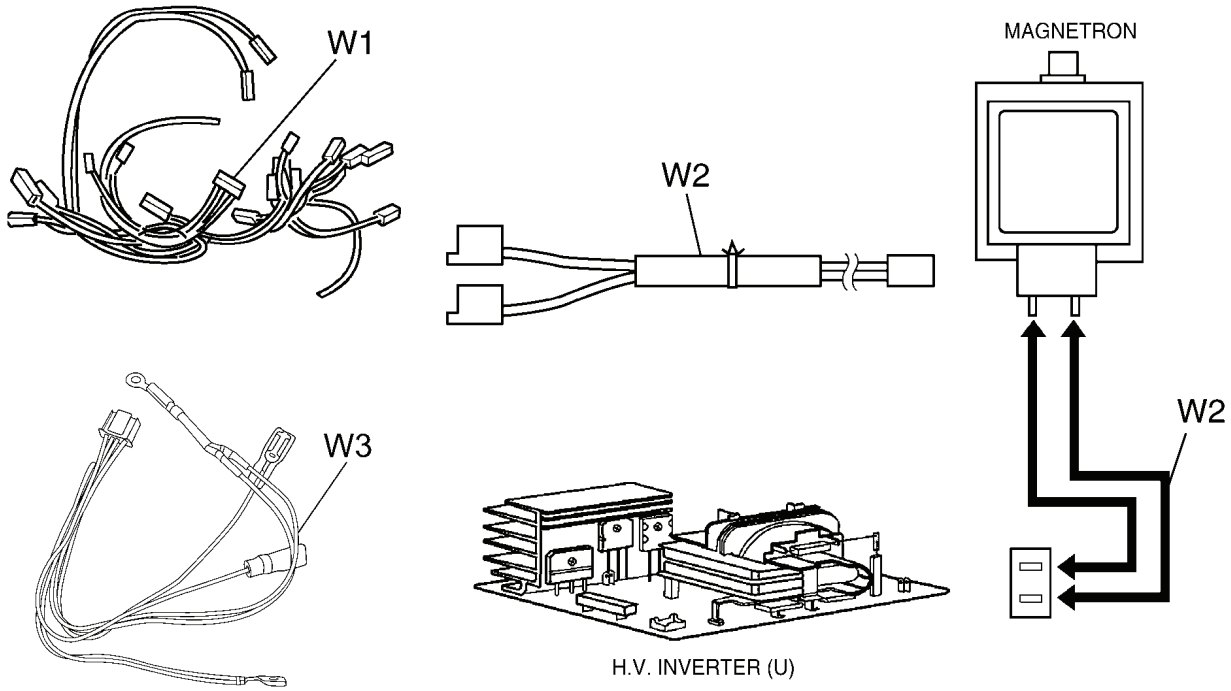
Ref. No.		Part No.	Part Name & Description	Pcs/Set	Remarks
E1		F603L9M50QP	D.P.CIRCUIT (AU)	1	
E2		F603Y9M60BP	D.P.CIRCUIT (DU)	1	
E4		F83379N00SQP	MEMBRANE SHEET	1	
E5		F80349M60SEP	ESCUTCHEON BASE	1	
E6		F891P9L60KXP	DOOR OPENING BUTTON (U)	1	
E7		F80375K00AP	COOK BUTTON SPRING	1	
E8		F82569M60BP	DOOR OPENING LEVER	1	
E9		F80579M60BBP	ESCUTCHEON BASE B	1	
E10		F66168J00XP	FLAT CABLE	1	
E11		F803G9M60SBP	POP-OUT DIAL (U)	1	
E13		F82989N00SMP	BUTTON	1	
E15		F0157BL30SVP	NAME PLATE	1	
E16		F81269M60BP	LCD DISPLAY WINDOW	1	
E17		F80189M60EP	DIAL SUPPORT	1	
E20		F60709M50QP	INSULATION SHEET	1	

10.4. DOOR ASSEMBLY



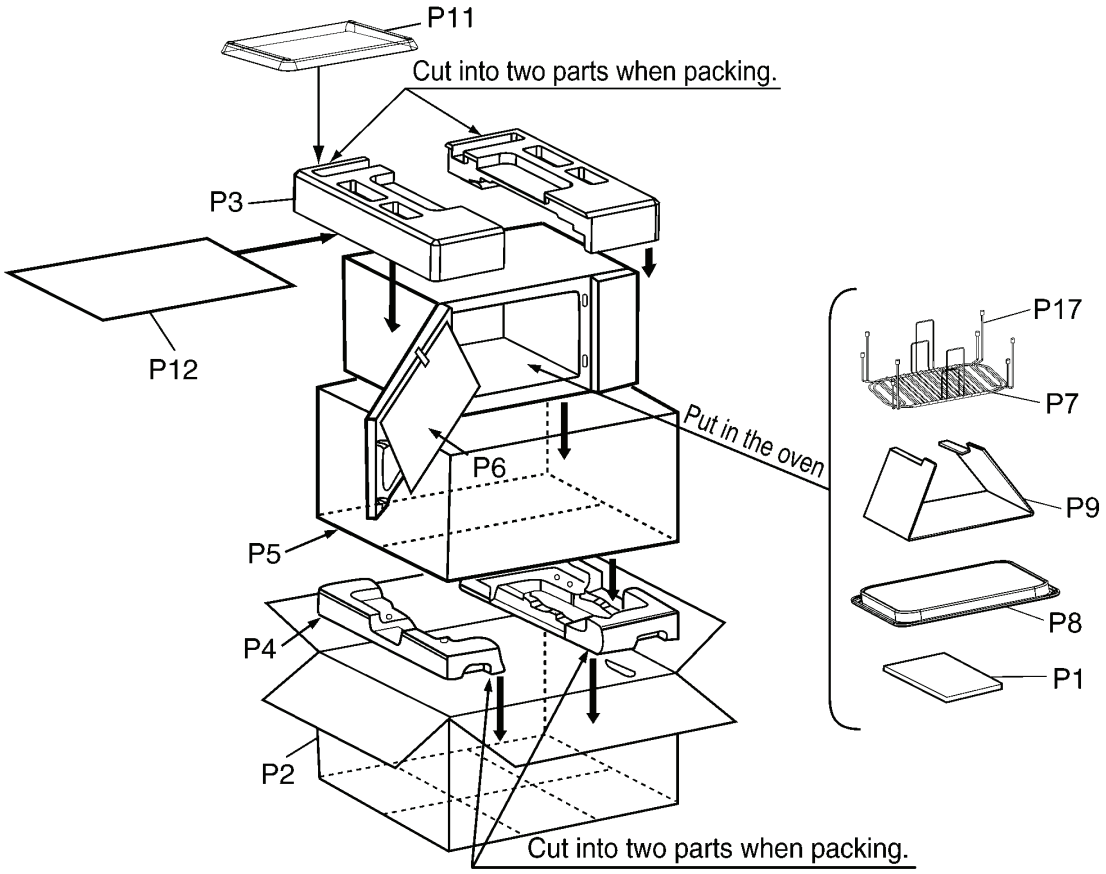
Ref. No.		Part No.	Part Name & Description	Pcs/Set	Remarks
D1		F30186P40AG	DOOR KEY A	1	
D2	⚠	F302A9M50SQP	DOOR A (U)	1	
D3	⚠	F301P9M60BP	DOOR E (U)	1	
D4		F30215G10XN	DOOR KEY SPRING	1	
D5	⚠	F30859Q30AP	DOOR C	1	
D8		F01726V00JP	CAUTION LABEL B	1	

10.5. WIRING MATERIALS



Ref. No.		Part No.	Part Name & Description	Pcs/Set	Remarks
W1		F030A9M50QP	LEAD WIRE HARNESS	1	(INCLUDING OVEN TEMP SENSOR & MAGNETRON THERMISTOR)
W2		F030E-1P00	H.V.LEAD WIRE	1	
W3		F03877R00SP	LEAD WIRE HARNESS U	1	

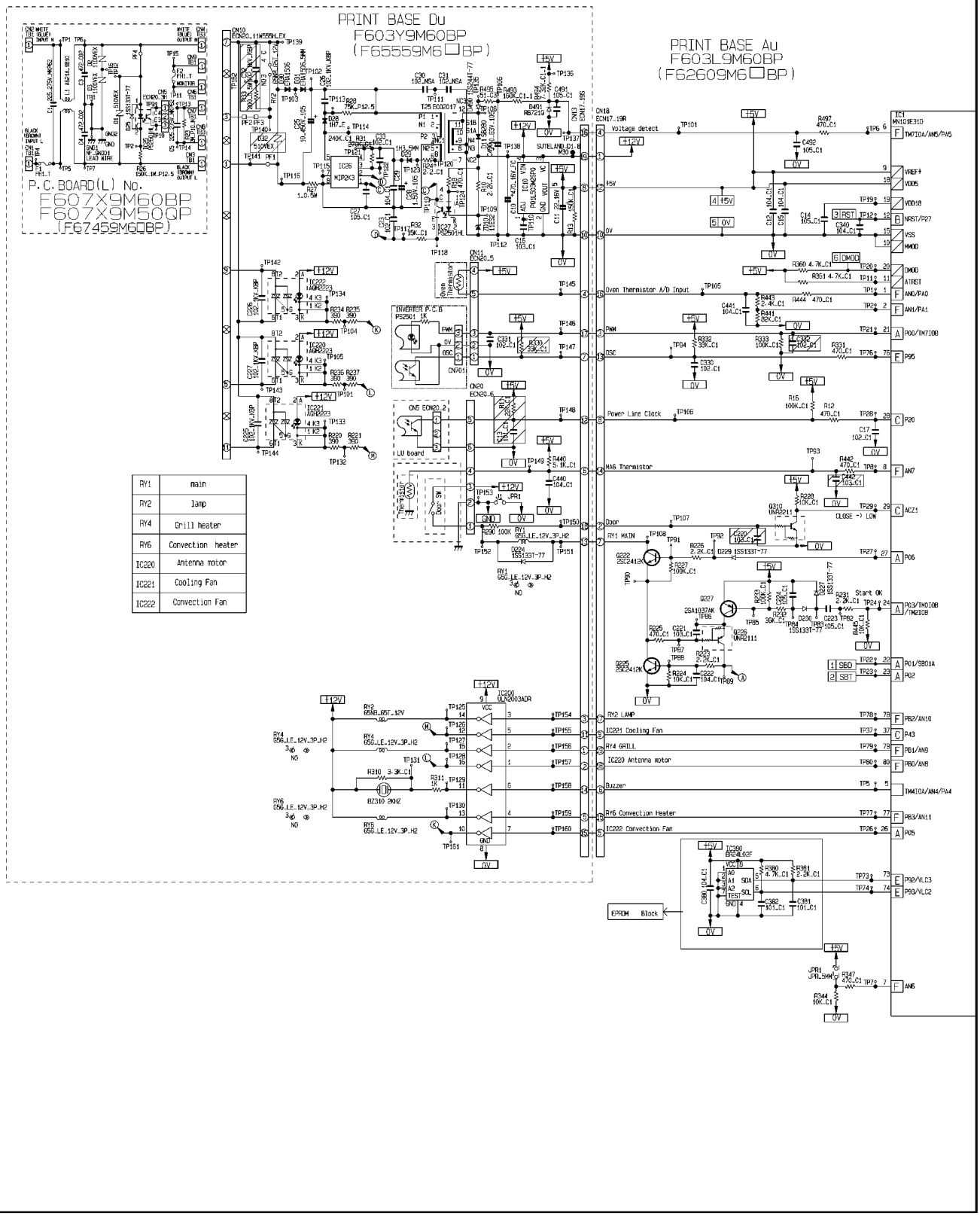
10.6. PACKING AND ACCESSORIES



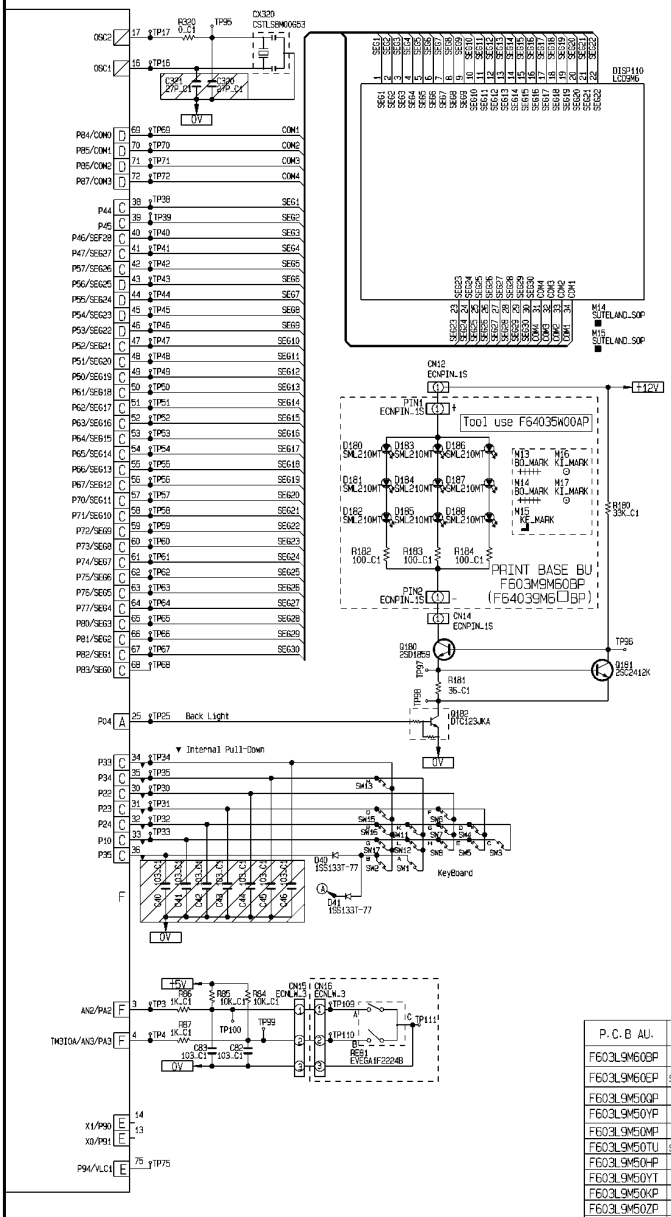
Ref. No.		Part No.	Part Name & Description	Pcs/Set	Remarks
P1		F00039M50QP	INSTRUCTION MANUAL	1	
P2		F01029M50SQP	PACKING CASE,PAPER	1	
P3		F01049M60BP	UPPER FILLER	1	
P4		F01059M60BP	LOWER FILLER	1	
P5		F01066Y40XP	P.E.BAG	1	
P6		F01078100XN	DOOR SHEET	1	
P7		F060V9M60QP	WIRE RACK	1	LOW
P8		F06037J70XP	ENAMEL SHELF	1	
P9		F01089M50QP	TRAY PACKING	1	
P11		E07496Y40BP	GLASS TRAY	1	
P12		F01926Y40XP	SHEET	1	
P17		F060V9M50QP	WIRE RACK	1	HIGH

11 DIGITAL PROGRAMMER CIRCUIT

11.1. SCHEMATIC DIAGRAM



RY1	main
RY2	lamp
RY4	Grill heater
RY6	Convection heater
IC220	Antenna motor
IC221	Cooling Fan
IC222	Convection Fan



P.C.B AU.	JPR1	P.C.B DU.	P.C.B LU.	EPROM block
F603L9M60BP	open	F603Y9M60BP	F607X9M60BP (F1 use 15A)	No USE
F603L9M60EP	short			
F603L9M50QP	open		F607X9M50QP (F1 use 10A)	USE
F603L9M50YP	open			No USE
F603L9M50MP	68K			
F603L9M50TU	short			
F603L9M50HP	10K			
F603L9M50YT	30K			
F603L9M50KP	3.3K			
F603L9M50ZP	1.5K			
F603L9M50GT	6.2K			
F603L9M50RP	15K			

11.2. PARTS LIST

Ref. No.		Part No.	Part Name & Description	Pcs/Set	Remarks
BZ310		L0DDEA000014	BUZZER	1	2.0KHz
CX320		H2A8004A0038	CERAMIC RESONATOR	1	8.0MHz
DISP110		L5AYAYY00058	LCD	1	
DISP HOLDER		F66179M60BP	LCD HOLDER	1	
		F67529L60XP	DIFFUSION SHEET	1	
IC1		MN9M5F31AAE	L.S.I.	1	
IC10		C0DBAHD00013	IC	1	
IC26		MIP2K30MSSCF	IC	1	
IC27		B3PAA0000387	IC	1	
IC200		B1HBGFF00007	IC	1	
IC220,IC221,IC222		B3PAC0000060	IC	3	
IC380		MIP2K30MSSCF	IC	1	
RY1		K6B1AYY00129	POWER RELAY	1	
RY2		K6B1AGA00119	POWER RELAY	1	
RY4,RY6		K6B1AGA00258	POWER RELAY	2	
T25		G4D2A0000320	SWITCH TRANSFORMER	1	
RE81		EVEJ1HF2224M	REVOLVING ENCODER	1	
SW1-SW8,SW11-SW13,SW15-SW17		EVQ11L05R	SWITCH	14	

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