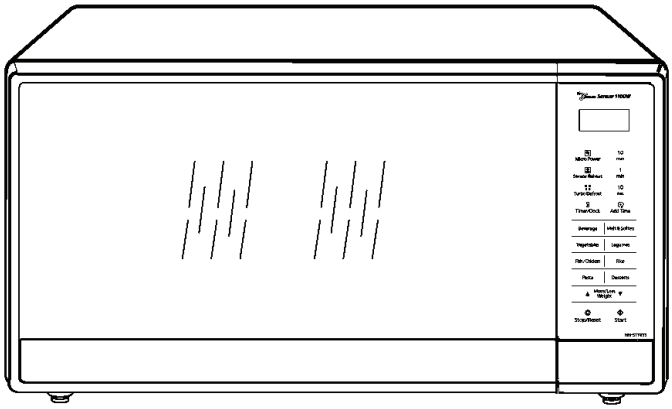
ORDER NO.PAPMOSH1507026CE

# Service Manual

## Microwave Oven

## NN-ST785S



PTE(Iran)

KPQ(Kuwait, Doha, Qatar, Oman, Bahrain, Pakistan)

## Specifications:

| Specifications: / Models: | NN-ST785S |
|---|---|
| Power Source: | 230V-240V AC Single Phase, 50Hz ---------- for KPQ model<br>220V AC Single Phase, 50Hz ---------- for PTE model |
| Power Consumption: | 1000W |
| Output: | 1100W |
| Microwave Frequency: | 2450MHz |
| Timer: | 30 min. / Stage (P10 Power) ~ 3 Stage Maximum<br>99 min. 99 sec / Stage (Other Power Levels) ~ 3 Stage Maximum |
| Outside Dimensions: | 555mm(W) X 304mm(H) X 493mm(D) |
| Oven Cavity Dimensions: | 398mm(W) X 210mm(H) X 470mm(D) |
| Weight: | 14.3 kg |
| 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.

PTE ..... For Iran

KPQ ..... For Kuwait, Doha, Qatar, Oman, Bahrain, Pakistan

## 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)**

## INVERTER WARNING

**This Inverter board looks like a regular PCB. However, this PCB drives the magnetron tube with extremely high voltage and high current. 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:**

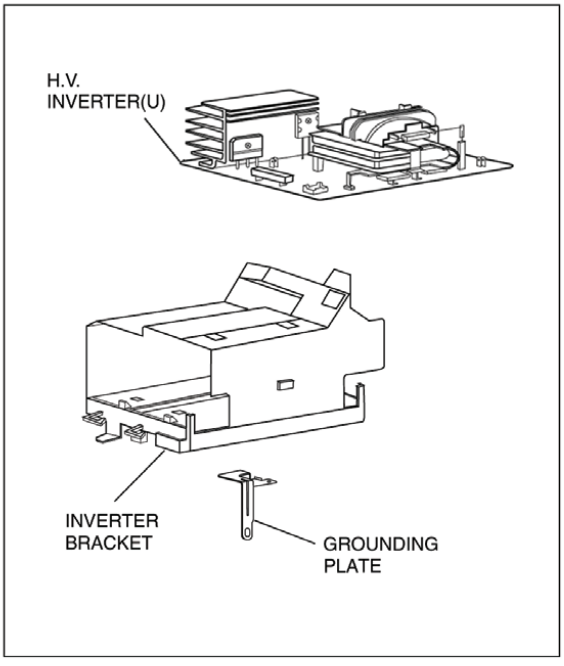
* 1. **Do not touch circuitry because it has very hot (high voltage) circuitry. Even when replacing board, extreme care should be taken to avoid possible electric shock hazards. High voltage charge may remain in circuits.**

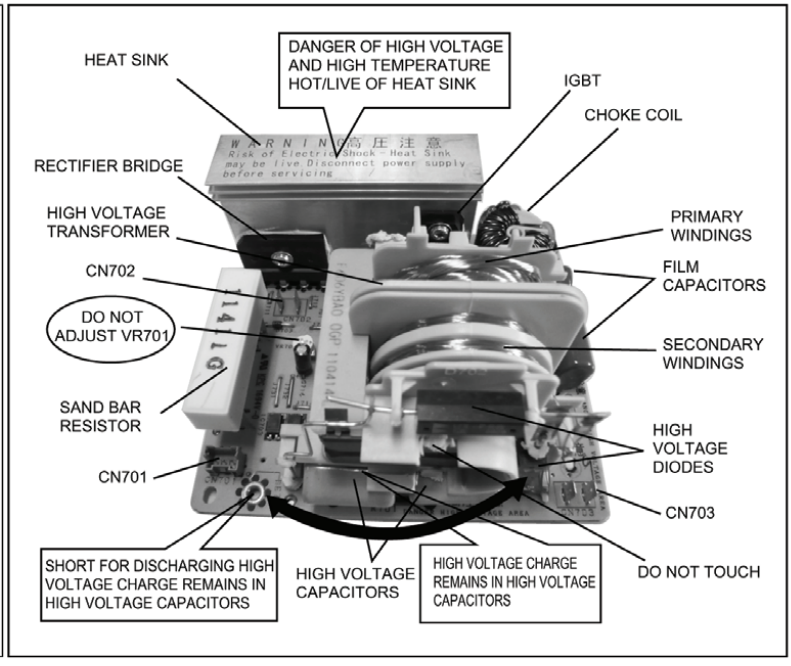
* 2. **Do not touch aluminum heat sink because it is energized with very high voltage and is also very hot in high heat energy.**

* 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.**

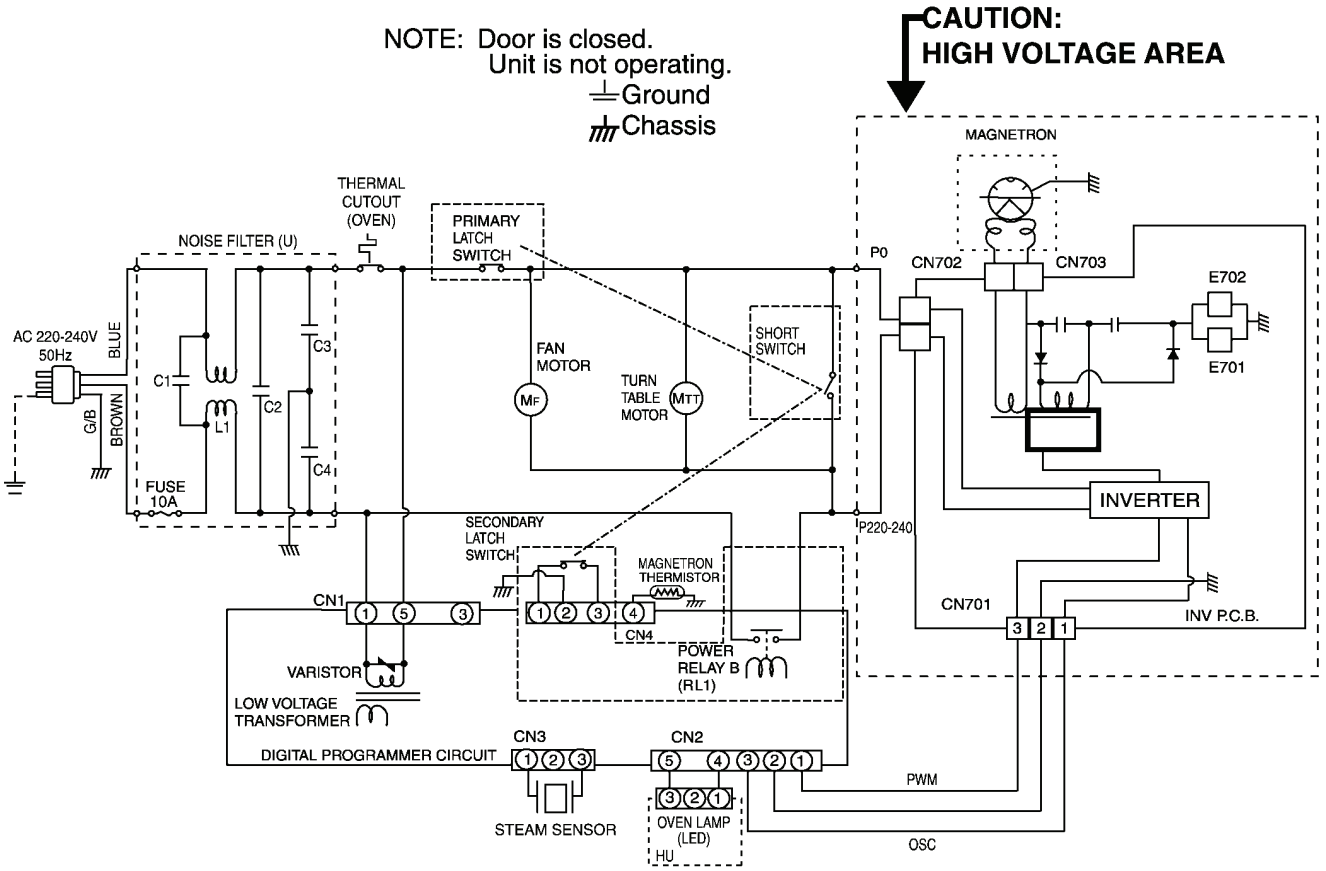
## INVERTER POWER SUPPLY



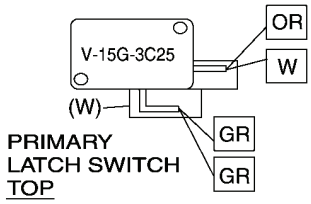



# CONTENTS

# 1 SCHEMATIC DIAGRAM



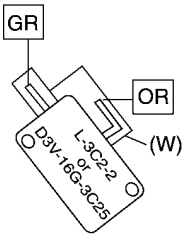

**WIRING DIAGRAM**



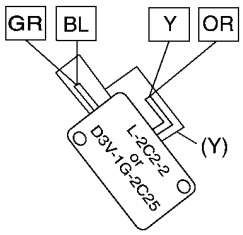

PRIMARY LATCH SWITCH TOP

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

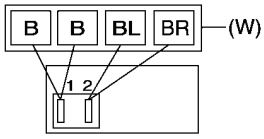
WARNING: H.V.



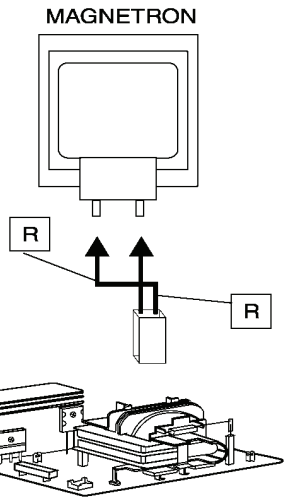

SECONDARY LATCH SWITCH BOTTOM (OUTSIDE)




SHORT SWITCH BOTTOM (INSIDE)




POWER RELAY B (RL1)




HIGH VOLTAGE INVERTER(U)

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

(S-BQ0)

# 2 DESCRIPTION OF OPERATING SEQUENCE

## 2.1. Variable power cooking control

High Voltage Inverter Power Supply (U) controls output power by the signal from Digital Programmer Circuit (DPC). Power relay always stay 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 | P10 | 100% | 22 | 0 |
| | P9 | 90% | 22 | 0 |
| | P8 | 80% | 22 | 0 |
| MEDIUM-HIGH | P7 | 70% | 22 | 0 |
| MEDIUM | P6 | 60% | 22 | 0 |
| | P5 | 50% | 22 | 0 |
| | P4 | 40% | 20 | 2 |
| MEDIUM-LOW | P3 | 30% | 15 | 7 |
| | P2 | 20% | 10 | 12 |
| | P1 | 10% | 6 | 16 |
| DEFROST | P3 | 30% | 15 | 7 |

## 2.2. 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.

## 2.3. Inverter defrost

When the Auto Control feature is selected and the Start pad 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. Table shows the corresponding cooking times for respective serving by categories.

**Inverter Turbo Defrost**

| SELECTED WEIGHT | COOKING TIME |
|---|---|
| 1.0 Kg | 20 min.50 sec. |

2. When cooking time in the display window has elapsed, the oven turns off automatically by a control signal from the digital programmer circuit.

## 2.4. Sensor cooking

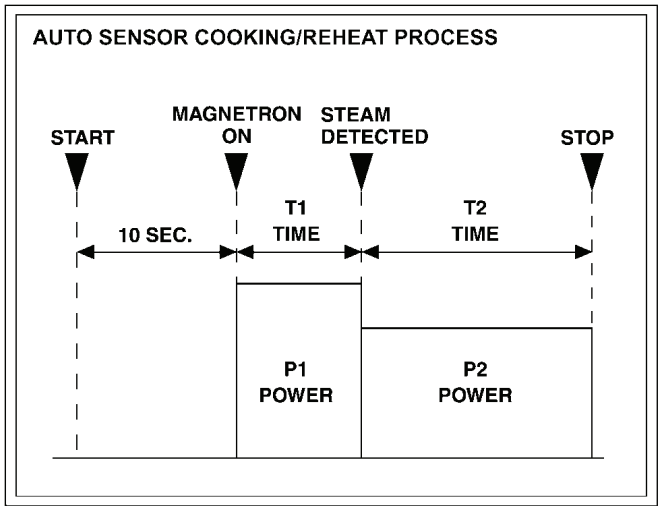
Auto sensor cooking without setting a power level or selecting a time. All that is necessary is to select an Auto Sensor Program before starting to cook.

**Understanding Auto Sensor Cooking**

As the food cooks, a certain amount of steam is produced. If the food is covered, this steam builds up and eventually escapes from the container. In Auto Sensor Cooking, a carefully designed instrument, called the steam sensor element, senses this escape of steam. Then, based upon the Auto Sensor Program selected, the unit will automatically determine the correct power level and the proper length of time it will take to cook the food.

**NOTE:**

**Auto Sensor Cooking is successful with the foods and recipes found in the Auto Sensor Cooking Guide. Because of the vast differences in food composition, items not mentioned in the Cooking Guide should be prepared in the microwave oven using power select and time features. Please consult Variable Power Microwave Cookbook for procedures.**



**Explanation of the Auto Sensor Cooking process**

1. During the first 10 second period there is no microwave activity. When calculating the T2 time by using the formula below make sure this 10 seconds is subtracted from the T1 time. In other words, T1 time starts at the end of the 10 second period.
2. **T1 time** The total amount of time it takes the microwave oven to switch to T2 time after the 10 second period.
3. **T2 time** When the steam escapes from the cooking container placed in the oven, the steam sensor detects it and the microprocessor calculates the balance of cooking time. This T2 time is then shown in the display and begins counting down.

   **Balance of cooking time (T2 time)**

   The balance of cooking time which is called T2 time, can be calculated by the following formula.
   T2 time (in sec.) = T1 time X K factor

**NOTE:**

Remember, the T1 time starts after the 10 second period. The coefficient K is programmed into the microprocessor memory and they are listed in the following tables along with the P1 and P2 powers.

**NOTE:**

When "More" or "Less" pad is selected, the K factor varies resulting in T2 time to be increased or decreased.

**Example of calculating the T2 time**

Example 1: If the T1 time is measured to be 2 minutes and 40 seconds after the 10 second period, and the Auto program selected is Oatmeal:

T2 = T1 × K

= 2 min. and 40 sec. × 0.1

= 160sec. × 0.1

= 16 sec.

| Category | P1 Power | P2 Power | K Factor Standard |
|---|---|---|---|
| Vegetables | Power Level P7 | Power Level P7 | 0.1 |

## 2.5. Sensor reheat

Auto Sensor Reheat is a quick and easy way to reheat refrigerated and room temperature foods.

Simply press the reheat pad. There is no need to select power level and cooking time.

**NOTE:**

The Auto Sensor Reheat process is same as Auto Sensor Cooking process.

| Category | P1 Power | P2 Power | K Factor Standard |
|---|---|---|---|
| Sensor Reheat | Power Level P7 | Power Level P6 | 0.4 |

## 2.6. Steam sensor and digital programmer circuit

In order to determine if the steam sensor function of the digital programmer circuit is working, do the following test.

1. Place a water load (100 cc) in the oven.
2. Tap Sensor Reheat pad.
3. Tap Start pad.
4. Steam Sensor detects steam about 1.5 to 2 minutes after the Start pad is tapped.
5. T1 time cooking automatically switches to remaining time for cooking (T2).
6. The remaining cooking time (T2) appears in display window. If the following cooking time appears, Steam Sensor function is normal.

| T1 TIME | T2 TIME (Remaining cooking time) |
|---|---|
| 50 Sec. ~ 2 Min. | 0 Sec. ~ 24 Sec. |

# 3 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.

## 3.1. 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.

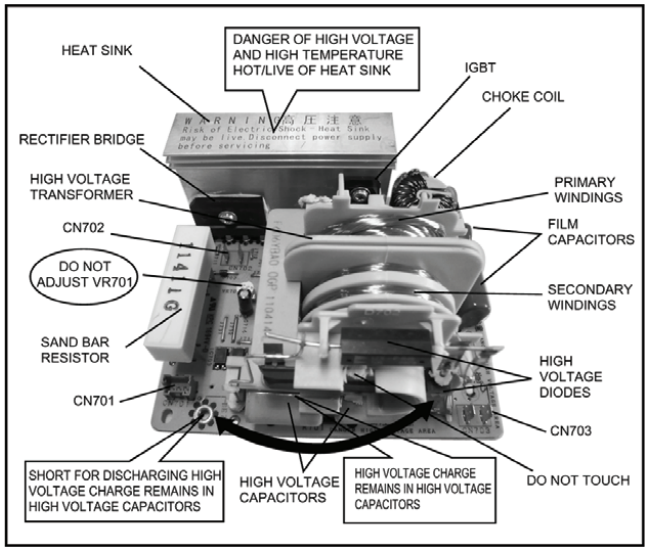
## 3.2. Inverter warnings

**⚠ WARNING HIGH VOLTAGE AND HIGH TEMPERATURE (HOT/LIVE) OF THE INVERTER POWER 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.

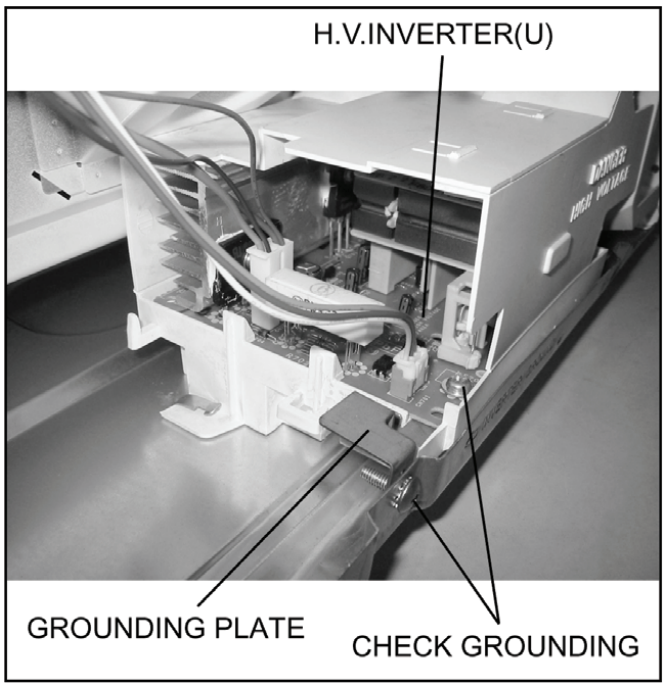
The aluminum heat sink may be HOT due to heat energy, therefore, extreme care should be taken during servicing.




**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.

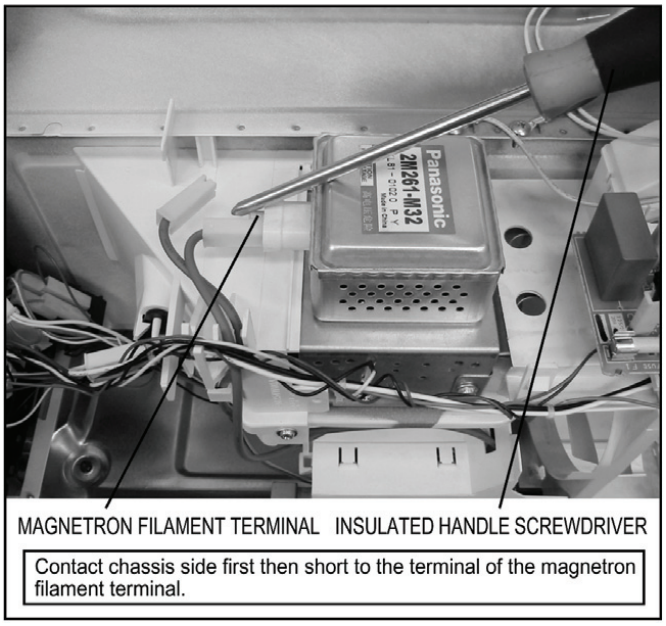



Grounding of the inverter circuit board

**⚠ 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 sink of 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.

## 3.3. Part replacement.

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

## 3.4. 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 RL1).

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.

## 3.5. 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.

## 3.6. 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.

## 3.7. Sharp edges

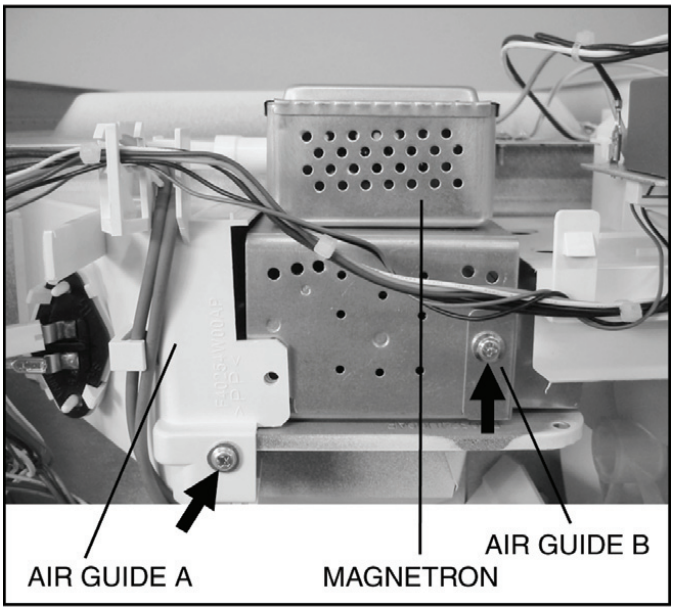
⚠ **CAUTION**

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.

# 4 DISASSEMBLY AND PARTS REPLACEMENT PROCEDURE

## 4.1. Magnetron

1. Discharge high voltage charge.
2. Remove 1 screw holding air guide A on the oven cavity.
3. Remove 1 screw holding air guide A on the magnetron.
4. Remove 1 screw holding air guide B.




5. Disconnect 2 high voltage lead wires from magnetron filament terminals.
6. 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.**

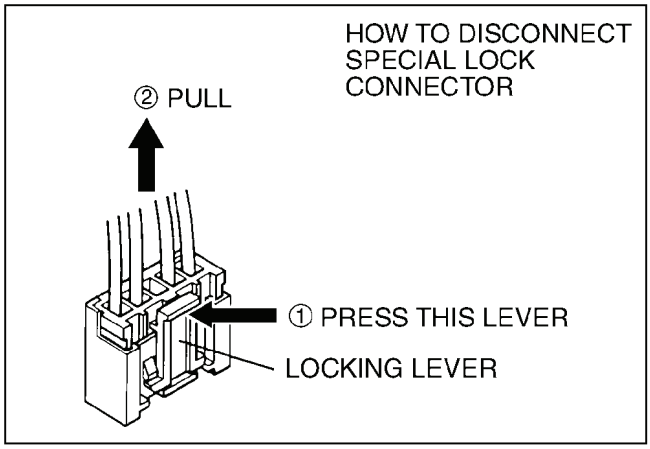
| CAUTION |
| --- |
| When replacing the magnetron, be sure the antenna gasket is in place. |

## 4.2. Digital programmer circuit (D.P.C)

⚠ **CAUTION:**

**Be sure to ground any static electric charge built up in your body before handling the DPC.**

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




2. Disconnect connector CN701 from H.V. Inverter.
3. Remove 2 screws holding escutcheon base on cavity front plate and slide the escutcheon base upward slightly.
4. Remove 1 screw holding D.P.C. board on escutcheon base.

## 4.3. Low voltage transformer and/or power relays (RL1)

⚠ **CAUTION:**

**Be sure to ground any static electric charge built up in your body before handling the DPC.**

1. 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.

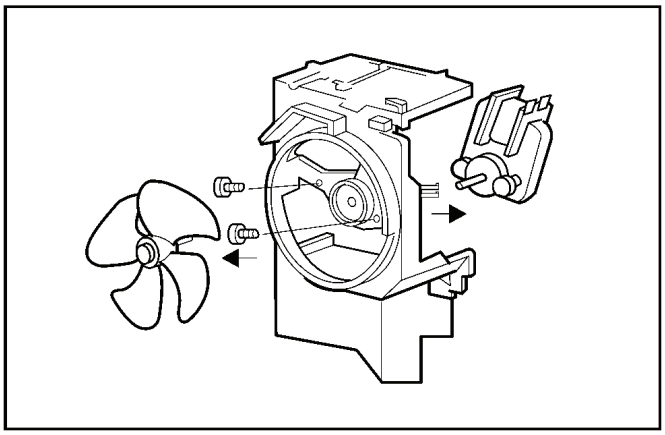
   ⚠ **CAUTION:**

   **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.

## 4.4. Fan motor

1. Disconnect 2 lead wires from fan motor terminals.
2. Remove 2 screws at location on oven attaching orifice assembly.
3. Remove orifice assembly from oven assembly.
4. Remove fan blade from the fan motor shaft by pulling it straight out.
5. Remove 2 screws holding fan motor to orifice.



## 4.5. 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.
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 screen B from door A.
6. Remove door key and door key spring.
7. Replace other components.

**To re-install components:**

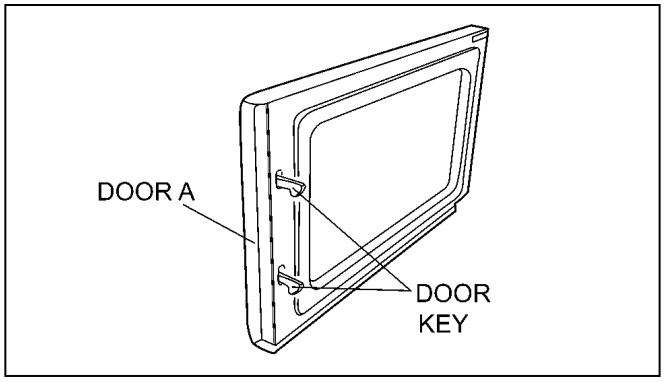
1. Place the door's lower hinge pin into the bottom hinge hole.
2. Use your left index finger to support the door's lower hinge pin while guiding the door's upper hinge pin into the top hinge hole.
3. Lower your finger to seat the door onto the hinges.

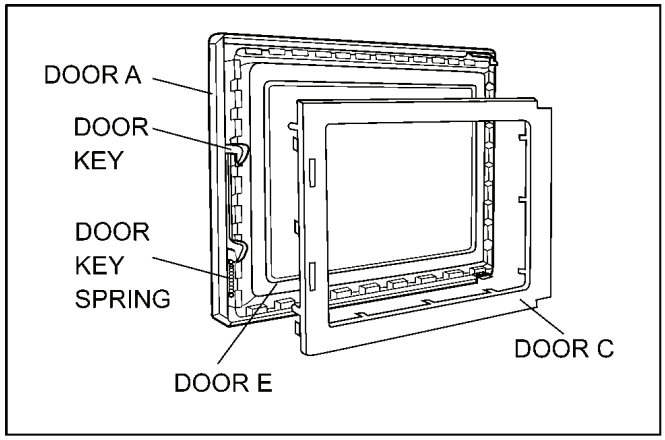
**NOTE:**

**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:**

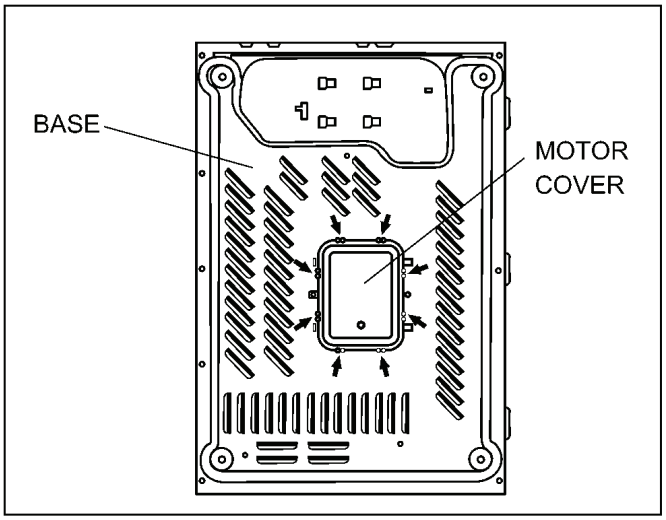
**Always perform the microwave leakage measurement test after installation and adjustment of door assembly.**



## 4.6. Turntable motor

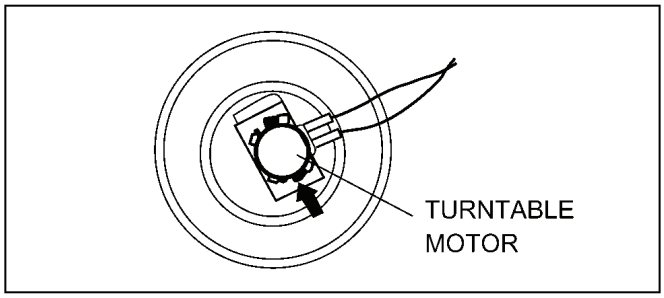
1. Remove the motor cover by breaking off at the 8 spots indicated by arrows with a cutter or the like.




⚠ **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 turntable motor.
3. Remove the turntable motor by removing screw.

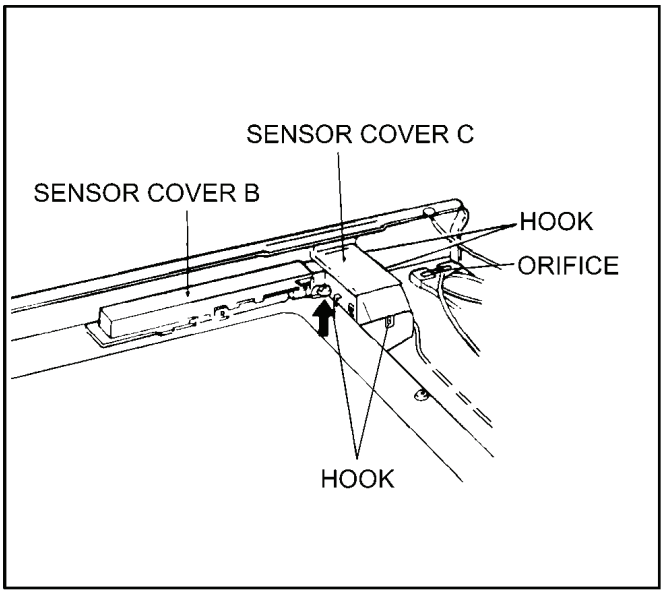



⚠ **NOTE:**

**After reinstalling the new turntable 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.**

## 4.7. Steam sensor

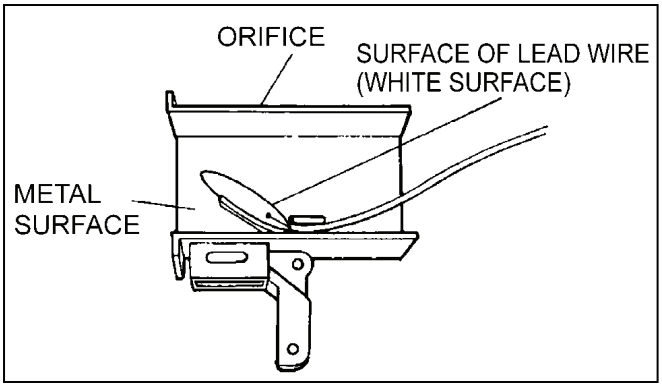
1. Disconnect connector CN2 from digital programmer circuit board.
2. Disengage catch hooks on sensor cover C from orifice.




3. Remove steam sensor from orifice.

⚠ **NOTE:**

**When installing the steam sensor, make sure that the direction of steam sensor is as shown in figure.**

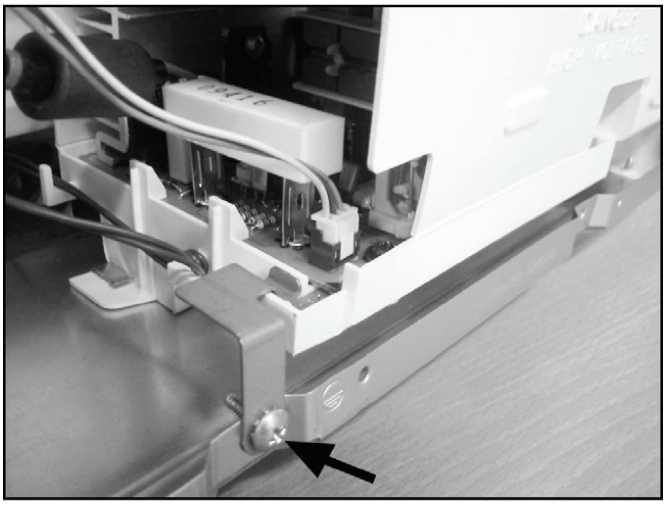


## 4.8. Inverter power supply

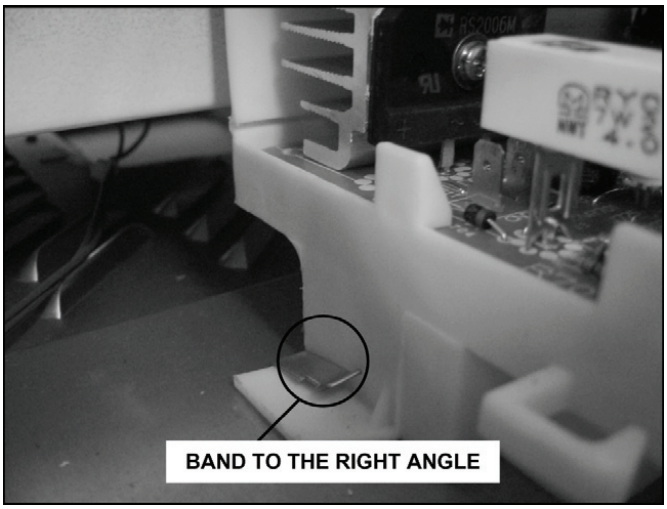
**CAUTIONS**

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.

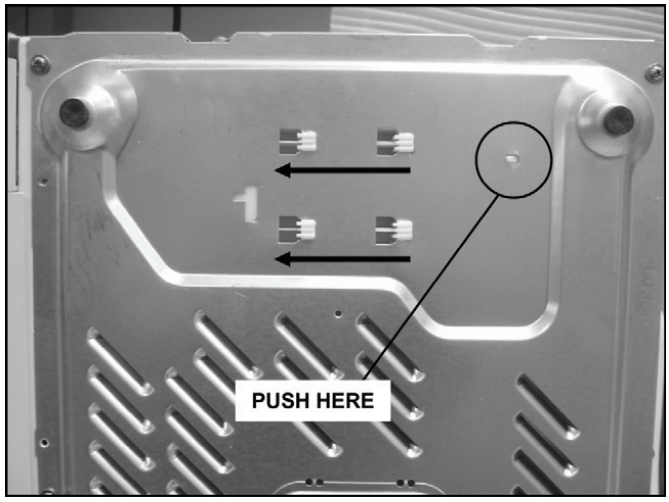
1. Discharge high voltage charge.
2. Remove the H.V.lead wire from magnetron terminals.
3. Disconnect 2 connectors from CN701 & CN702 on H.V.Inverter(U).
4. Remove 1 screw holding grounding plate to the base.



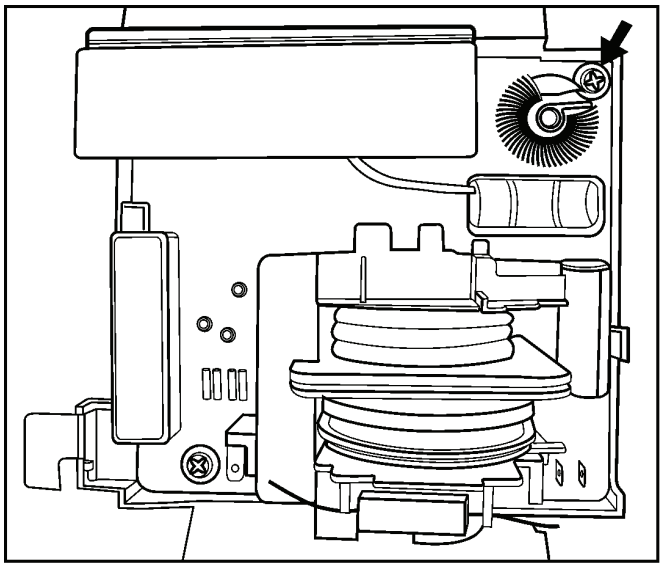
5. Bend back 1 locking metal tab on the base.



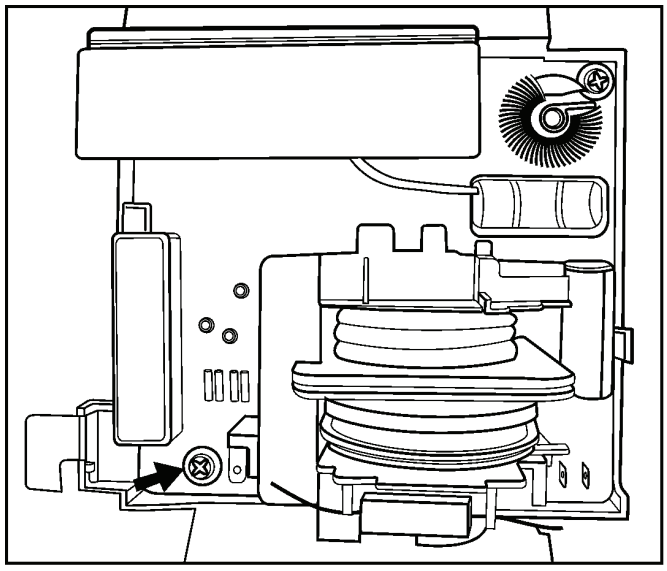

6. Press 1 encircled locking tab and then slide 4 locking tabs of Inverter bracket at the bottom of the base in direction of arrows.




7. Remove 1 screw holding H.V.Inverter to Inverter bracket.



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



9. Seperate H.V. Inverter from Inverter bracket by freeing 3 catch hooks on the Inverter bracket.

# 5 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 8).

## 5.1. Primary, Secondary Latch Switch interlocks & Power Relay RL1

1. Unplug lead connectors to Power Relay RL1 and verify open circuit of the Power Relay RL1 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 RL1 | ∞Ω (Open) | ∞Ω(Open) |

## 5.2. 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.

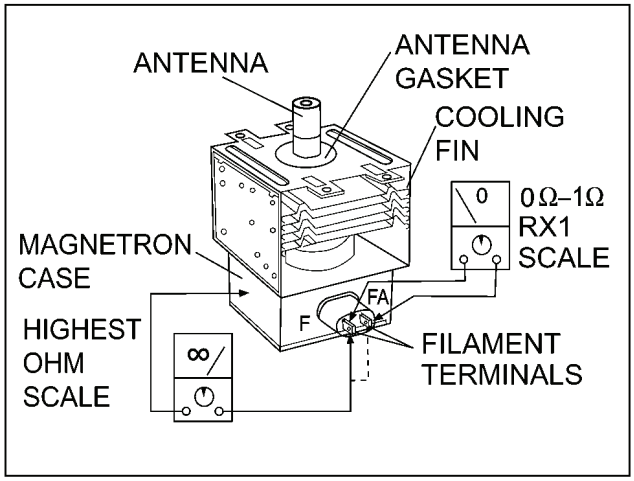
   Normal continuity readings should be as follows.

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

## 5.3. Magnetron

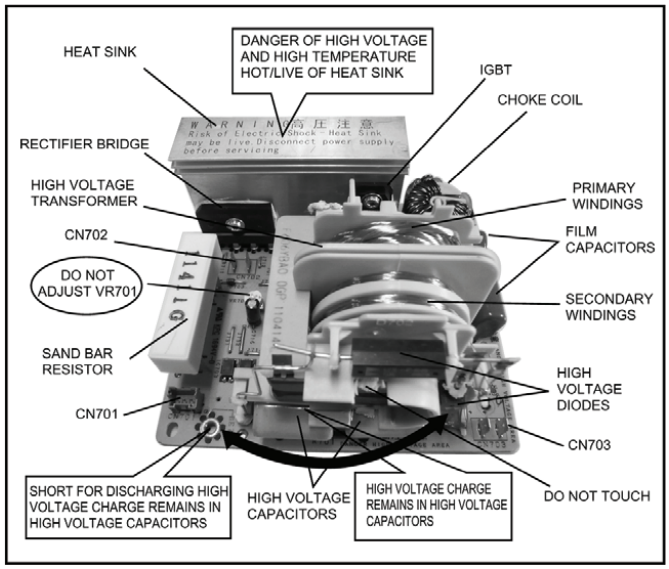
Continuity checks can only indicate an open filament or a shorted magnetron. To diagnose for an open filament or shorted magnetron.

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.



## 5.4. 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 [Timer/Clock] button twice.
   b. Press [Start] button once.
   c. 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 [Timer/Clock] button twice.
   b. Press [Start] button once.
   c. 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.

## 5.5. Temperature thermistor

The thermistor that is attached to the magnetron detects the temperature of the magnetron and will stop magnetron operation when overheating is detected. A normal thermistor´s resistance is 35KΩ to 110KΩ for an ambient temperature range of 10-30 degree C.

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 [Timer/Clock] button twice → press [Start] button once → press [Power Level] button once).
2. Program oven at Standing Time for 1 minute and press [Start] button.
3. Press [Micro Power] twice, the thermistor level reading will shown on the display.

   The normal reading should be in the range of 15-240.

# 6 MEASUREMENTS AND ADJUSTMENTS

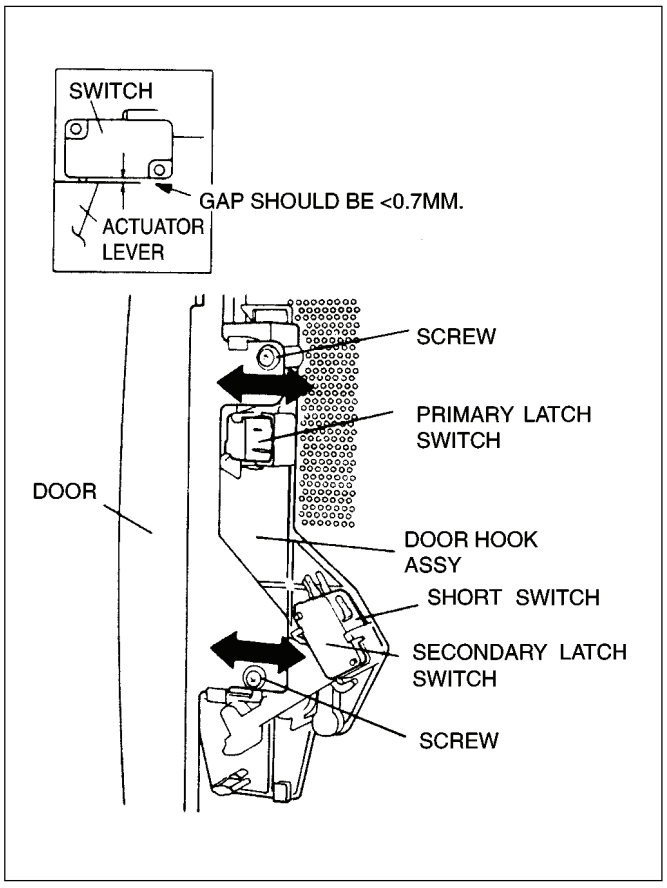
## 6.1. Adjustment of primary latch switch, secondary latch switch and short switch.

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.




## 6.2. 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 |
|---|---|
| 1100W | Min. 9.4°C |

# 7 TROUBLESHOOTING GUIDE

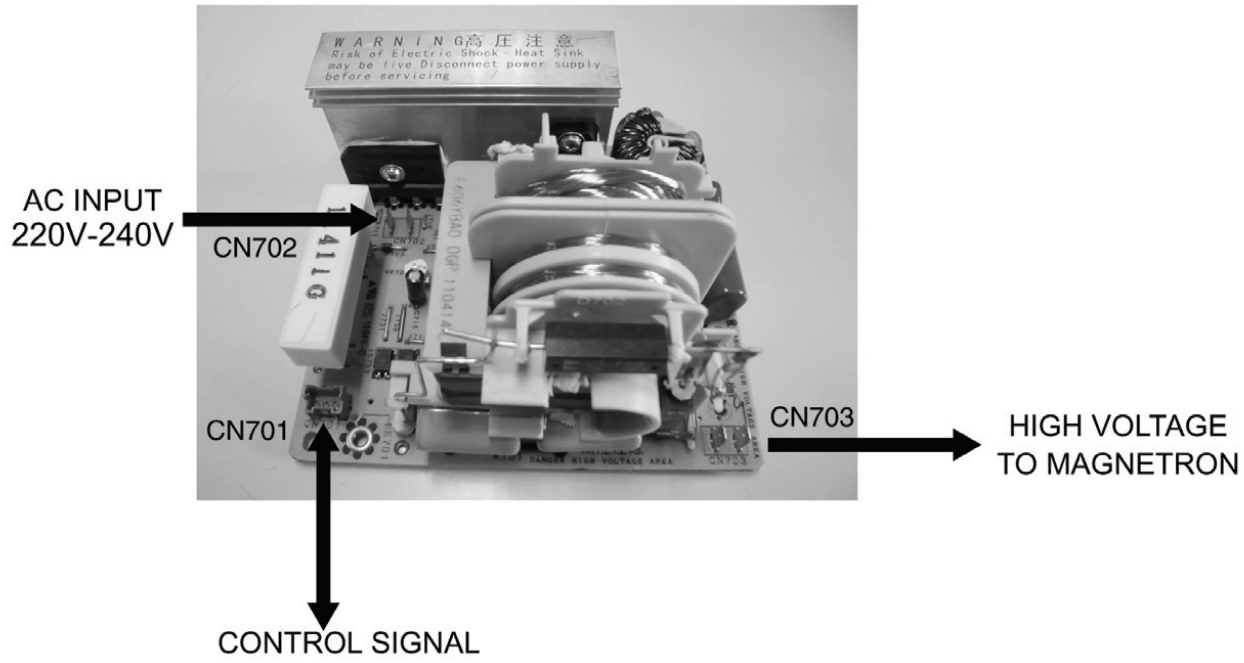
**DANGER: HIGH VOLTAGES ⚠**

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. 220/240V 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.

## 7.1. (Troubleshooting) Oven stops operation during cooking

| | SYMPTOM | CAUSE | CORRECTIONS |
|---|---|---|---|
| 1. | **Oven stops in 3 seconds** after pressing [Start] pad. | No input AC is supplied to H.V.Inverter (U) CN702 terminals | 1. Latch Switch<br>2. Power relay RL1<br>3. Loose lead wire connector CN701, CN702<br>4. H.V. Inverter (U) |
| | **Oven stops in 23 seconds** after pressing [Start] pad. | H.V.Inverter (U) operates by the control signals from DPC but magnetron is not oscillating | 1. Magnetron<br>2. Loose lead wire connector CN703<br>3. H.V. Inverter (U) |
| | **Oven stops in 10 seconds** after pressing [Start] pad.<br>(Auto sensor cooking) | Steam sensor circuit does not function | 1. Steam sensor<br>2. DPC<br>3. Loose wiring connector CN2 |
| 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<br>2. Loose wiring connectors |

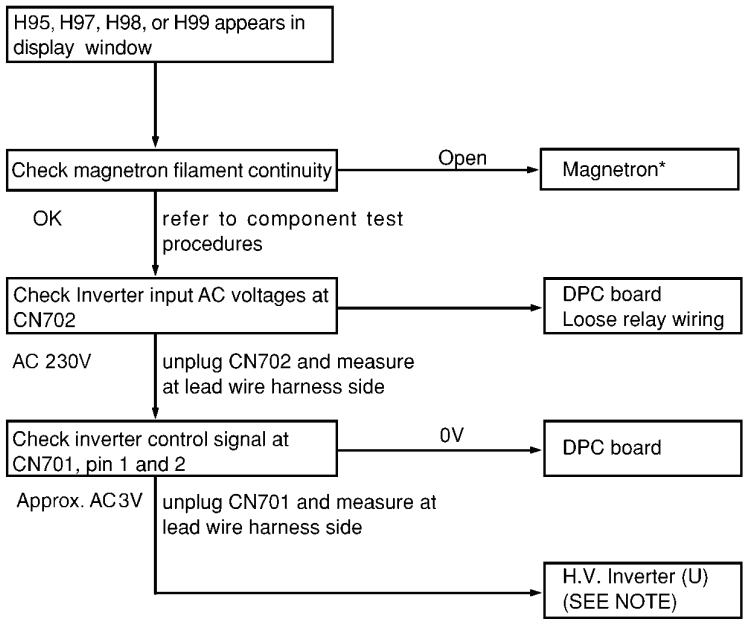


# 7.2. (Troubleshooting) Other problems

| | SYMPTOM | CAUSE | CORRECTIONS |
|---|---|---|---|
| 1. | Oven is dead.<br>Fuse is OK.<br>No display and no operation at all. | 1. Open or loose lead wire harness<br>2. Open thermal cutout / thermistor<br>3. Open low voltage transformer<br>4. Defective DPC | Check thermal cutout is defective. |
| 2. | No display and no operation at all.<br>Fuse is blown. | 1. Shorted lead wire harness<br>2. Defective primary latch switch<br>3. Defective short switch (NOTE 1)<br>4. Defective Inverter Power Supply (U) | Check adjustment of primary, secondary latch switch and interlock monitor switch including door. |
| | | NOTE 1:<br>Replace components (primary latch switch, short switch and power relay RL1).<br>Also replace the secondary latch switch when the continuity check reads shorted contacts. | |
| 3. | Oven does not accept key input (Program) | 1. Key input is not in proper sequence<br>2. Defective DPC or defective membrane switch | Refer to operation procedure.<br>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<br>2. Defective secondary latch switch<br>3. Door switch CN4 | Adjust door and latch switches. |
| 5. | Timer starts count down but no microwave oscillation.<br>(No heat while oven lamp and fan motor turn on) | 1. Off-alignment of primary latch switch<br>2. Open or loose connection of high voltage circuit especially magnetron filament circuit<br>NOTE:<br>Large contact resistance will cause lower magnetron filament voltage and cause magnetron to have lower output and/or be intermittent.<br>3. Defective high voltage component<br>H.V. Inverter Power Supply (U)<br>Magnetron<br>4. Open or loose wiring of power relay RL1<br>5. Defective primary latch switch<br>6. Defective DPC or power relay RL1 | Adjust door and latch switches.<br><br>Check high voltage component according to component test procedure and replace if it is defective.<br><br>Refer to DPC troubleshooting |
| 6. | Oven can program but timer does not start countdown. | 1. Open or loose wiring of secondary latch switch<br>2. Off-alignment of secondary latch switch<br>3. Defective secondary interlock switch | |
| 7. | Microwave output is low. Oven takes longer time to cook food. | 1. Decrease in power source voltage<br>2. Open or loose wiring of magnetron filament circuit.(Intermittent oscillation)<br>3. Aging change of magnetron | Consult electrician |
| 8. | Fan motor turns on and turntable 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] pad 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. | Turntable motor does not rotate. | 1. Open or loose wiring of turntable motor<br>2. Defective turntable motor | |
| 12. | Oven stops operation during cooking. | 1. Open or loose wiring of primary and secondary latch switch<br>2. Operation of thermal cutout | Adjust door and latch switches. |

# 7.3. 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 [Timer/Clock] button twice → 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] pad is pressed and there is no microwave oscillation.



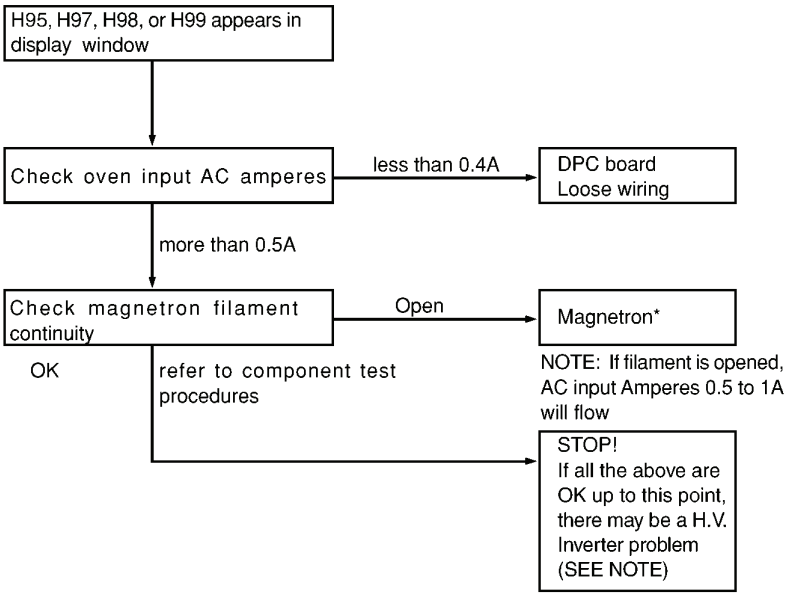

⚠ WARNING: DO NOT try to repair this Inverter Power Supply (U) and also DO NOT RE-ADJUST PRESET CONTROL on the board. It is very dangerous to repair or adjust without proper test equipment because this circuit generates very high voltage and very large current. Off alignment of inverter board operation 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] pad is pressed and no microwave oscillation with AC Ampere meter used for troubleshooting.




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

# 7.4. 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 | Low voltage transforment (L.V.T.) secondary voltage | Abnormal 0V | L.V.T. |
| | | | Normal | →Step3 |
| | 3 | IC1 pin13 voltage | Abnormal | IC10, IC11 |
| | | | Normal=5V | IC1, CX320, Display |
| No key input | 1 | Touch switch continuity | Abnormal | Touch switch |
| | | | Normal | IC1 |
| No beep sound | 1 | IC1 pin 49 voltage | Abnormal | IC1 |
| | | | Normal=5V | BZ210, Q210 |
| No microwave oscillation at any power | 1 | IC1 pin 51 voltages while operation at high power | Abnormal | IC1 |
| | | | Normal=5V | →Step2 |
| | 2 | Collector of Q227 | Abnormal | Q225 and/or Q226, Q227 |
| | | | Normal≂0.7V | →Step3 |
| | 3 | Short circuit between collector of Q227 and emitter of Q225 | Still not turn on | RL1 |
| | | | RL1 turns on | Q225 and/or 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<br>2. D.P.C. /Power Relay |
| | | | Normal=220~240V | →Step2 |
| | 2 | Unplug CN701 (3 pin) connector and measure pin3 voltage | Abnormal=0V | D.P.C. |
| | | | Approx. AC 3V | Magnetron |

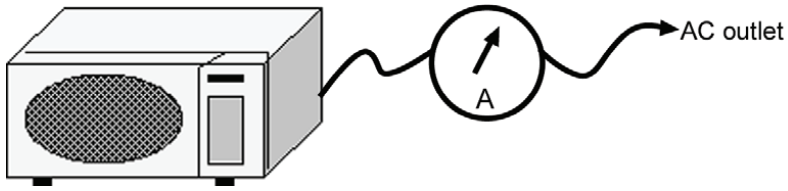
# 7.5. SIMPLE WAY OF H.V. INVERTER/MAGNETRON TROUBLESHOOTING

**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.**

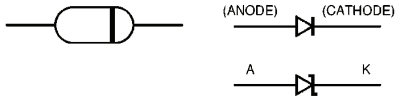
| Power will: | Ammeter reading is: | To do: | Remedy: |
|---|---|---|---|
| Shut off in 23 seconds after "Start". | 1. Between 0.5A and 1.0A. | Check and repair open magnetron circuit CN703. | Open magnetron wiring between Inverter and magnetron terminal. |
| | 2. Between 1.0A and 2.0A. | Check continuity of D702 in Inverter PCB. | |
| | | ⇩ | |
| | | 1. D702 shorted | Replace **H.V.Inverter**(F606YBA00QP) |
| | | 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, CN701 and CN702. | Replace defective component(s), or correct switch, cables and connectors. |

# 7.6. H.V. Inverter main parts list (F606YBA00QP)

| Ref. No. | | Part No. | Part Name & Description | Pcs/Set | Remarks |
|---|---|---|---|---|---|
| Q701 | | B1JAEV000003 | IGBT | 1 | |
| C701 | | ECWHC3B104JA | FILM CAPACITOR | 1 | 0.1µF,1000VDC |
| C702 | | ECWF4305N851 | FILM CAPACITOR | 1 | 3µF,250VDC |
| DB701 | | B0FBBQ000006 | RECTIFIER BRIDGE | 1 | |
| L701 | | F5020W100AP | CHOKE COIL | 1 | |
| R702 | | D0CM562JA002 | SAND BAR RESISTOR | 1 | |
| T701 | | F609ABA00GP | TRANSFORMER | 1 | (INCLUDING D701,D702,C706,C707) |
| D701,D702 | | B0FBAZ000003 | DIODE | 2 | |
| C706 | | F0C3F562A002 | FILM CAPACITOR | 1 | 5600PF/3KV |
| C707 | | F0C3F822A002 | FILM CAPACITOR | 1 | 8200PF/3KV |

# 7.7. How to check the semiconductors using an OHM meter

**Diode**



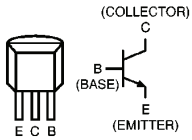

| | FORWARD | REVERSE |
|---|---|---|
| A-K | SMALL | ∞ |

**Transistor**

**NPN Transistor**

**2SC·····**

**2SD·····**

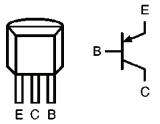



| | FORWARD | REVERSE |
|---|---|---|
| B-E | SMALL | ∞ |
| B-C | SMALL | ∞ |
| C-E | ∞ | ∞ |

**PNP Transistor**

**2SA·····**

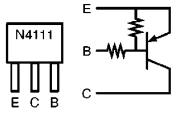
**2SB·····**




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

**Digital Transistor**

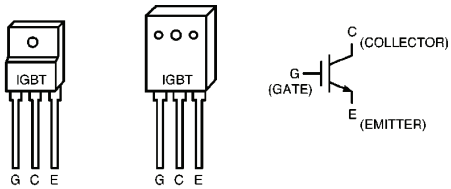
**PNP Transistor**




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

**IGBT**

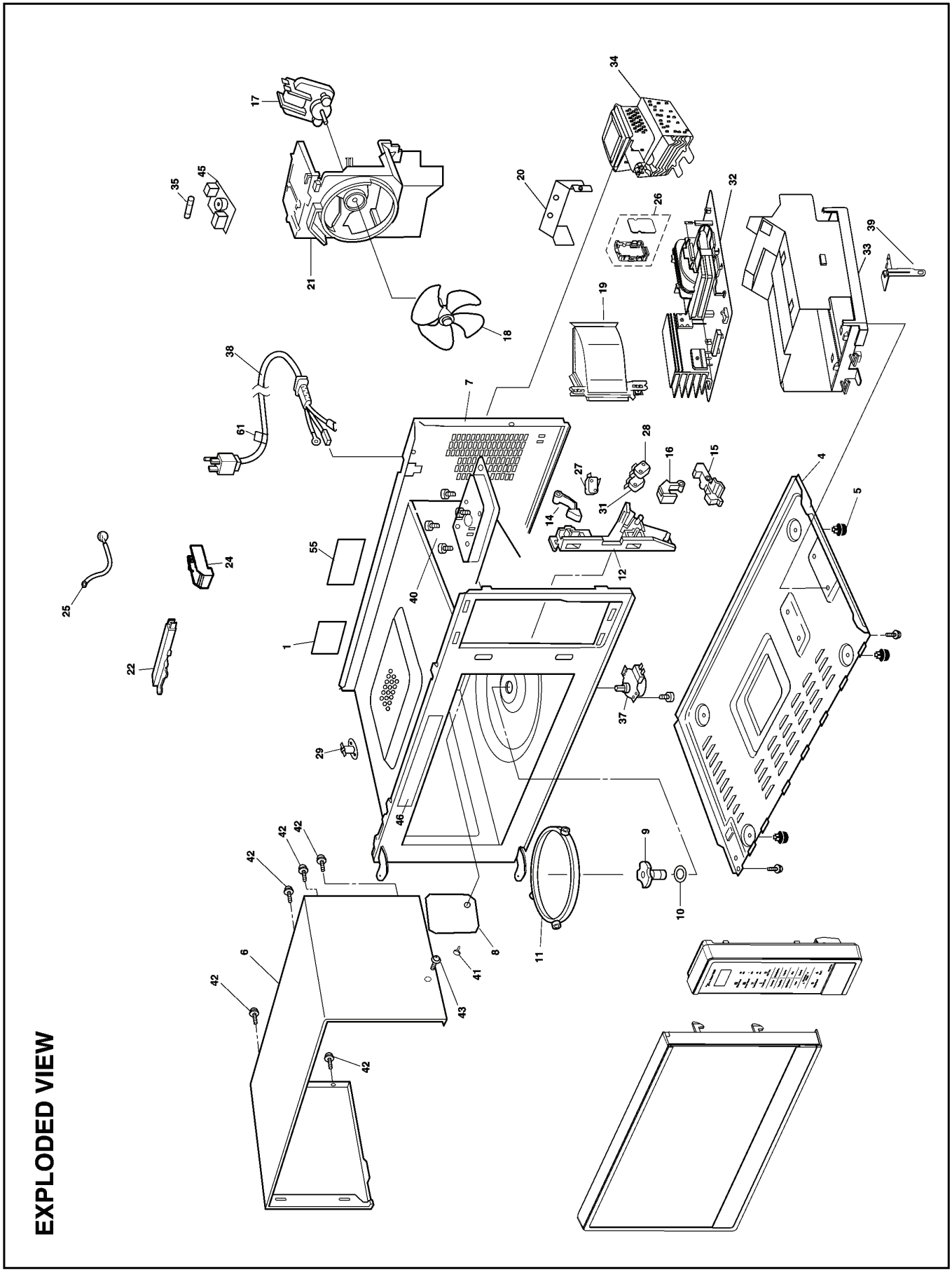
**(INSULATED GATE BIPOLAR TRANSISTOR)**




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

# 8 EXPLODED VIEW AND PARTS LIST

## 8.1. EXPLODED VIEW



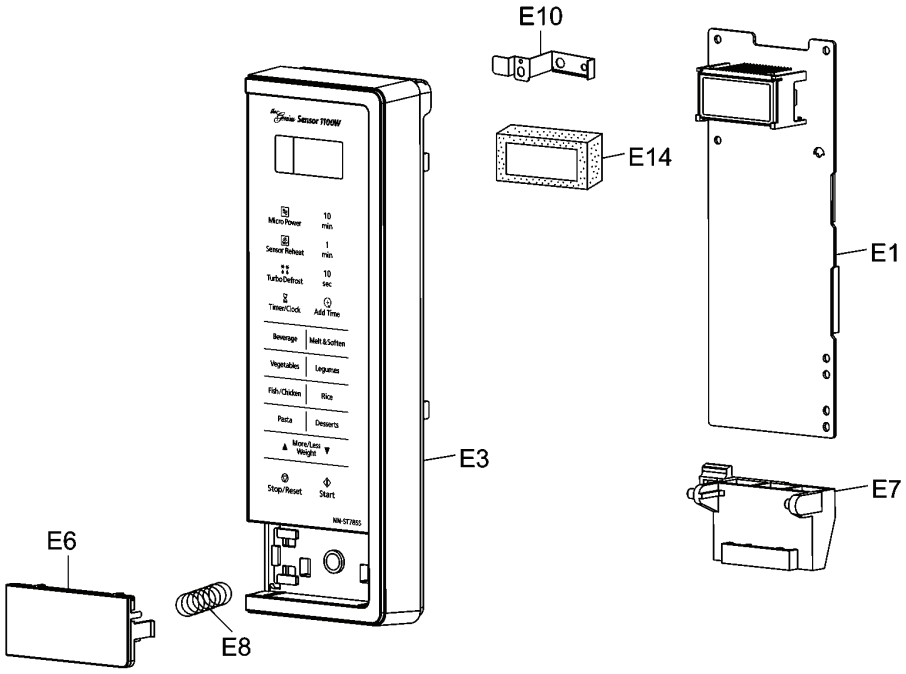
# 8.2. PARTS LIST

**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.

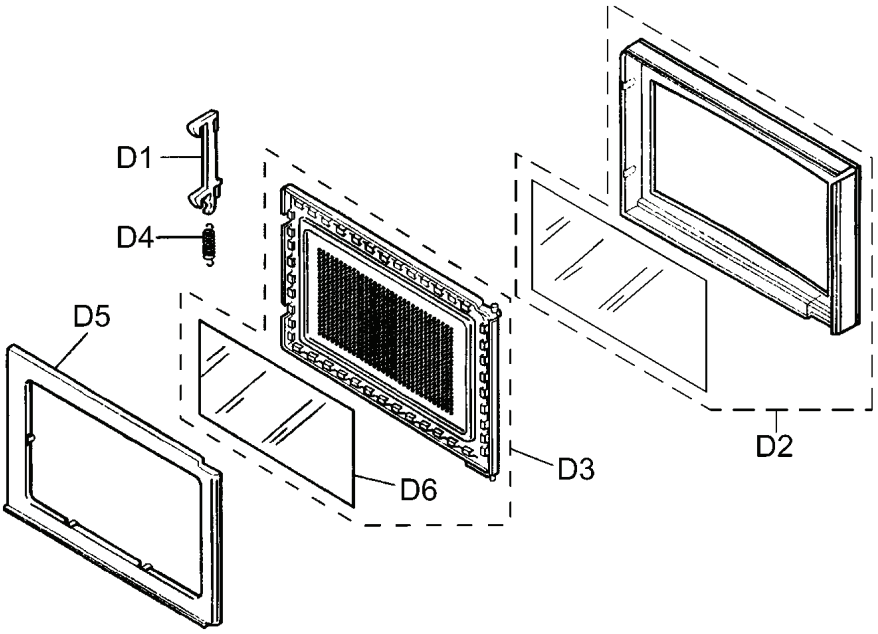
| Ref. No. | | Part No. | Part Name & Description | Pcs/Set | Remarks |
|---|---|---|---|---|---|
| 1 | | F00066V00HP | CAUTION LABEL | 1 | |
| 4 | | F10016H60APG | BASE | 1 | |
| 5 | | F10084T00APS | RUBBER FOOT | 4 | |
| | | | | | |
| 6 | | F10095X20SCP | CABINET BODY | 1 | |
| 7 | ⚠ | F200ABP40HAP | OVEN (U) | 1 | |
| 8 | | F20555K00AP | COVER | 1 | |
| 9 | | F21315Y00AP | PULLY SHAFT | 1 | |
| 10 | | F2177-F80 | WASHER | 1 | |
| | | | | | |
| 11 | | F290D9330AP | ROLLER RING (U) | 1 | |
| 12 | ⚠ | F30206G30AP | DOOR HOOK | 1 | |
| 14 | | F31366G30AP | HOOK LEVER A | 1 | |
| 15 | | F31376G30AP | HOOK LEVER B | 1 | |
| | | | | | |
| 16 | | F31386G30AP | HOOK LEVER C | 1 | |
| 17 | | F400A6V00QP | FAN MOTOR | 1 | AC240V,SINGLE PHASE,50Hz |
| 18 | | F40084T00AP | FAN BLADE | 1 | |
| 19 | | F4025BP20AP | AIR GUIDE A | 1 | |
| 20 | | F40264T60APG | AIR GUIDE B | 1 | |
| | | | | | |
| 21 | | F41445W00AP | ORIFICE | 1 | |
| 22 | | F64508660AP | SENSOR COVER B | 1 | |
| 24 | | F65434W00AP | SENSOR COVER C | 1 | |
| 25 | | J607S4M00AP | STEAM SENSOR | 1 | |
| | | | | | |
| 26 | | F612EBQ00QP | LAMP (U) | 1 | LED LAMP INSIDE |
| 27 | ⚠ | F61425U30XN | MICRO SWITCH | 1 | (PRIMARY LATCH SWITCH) |
| 28 | ⚠ | F61415U30XN | MICRO SWITCH | 1 | (SECONDARY LATCH SWITCH) |
| 29 | ⚠ | F61455L00CP | THERMAL CUTOUT | 1 | 105°C |
| | | | | | |
| 31 | ⚠ | F61785U30XN | MICRO SWITCH | 1 | (SHORT SWITCH) |
| 32 | ⚠ | F606YBA00QP | H.V.INVERTER (U) | 1 | |
| 33 | | F65856K50AP | INVERTER BRACKET | 1 | |
| 34 | ⚠ | 2M261-M32JP | MAGNETRON | 1 | |
| 35 | ⚠ | F62306V60BP | FUSE | 1 | 10A/240V,50Hz |
| | | | | | |
| 37 | | F63269P00HP | TURNTABLE MOTOR | 1 | |
| 38 | ⚠ | F900C8F60PT | AC CORD W/PLUG | 1 | PTE |
| 38 | ⚠ | F900C8F70YK | AC CORD W/PLUG | 1 | KPQ |
| 39 | | F66626H60AP | GROUNDING PLATE | 1 | |
| 40 | | XTWFL4+12T | SCREW | 4 | FOR MAGNETRON |
| | | | | | |
| 41 | | F90804W00AP | CANOE CLIP | 1 | FOR COVER |
| 42 | | XTWFA4+12D | SCREW | 5 | FOR CABINET BODY |
| 43 | | XTTFL4+6BN | SCREW | 1 | FOR CABINET BODY SIDE |
| 45 | | F607XBQ00QP | NOISE FILTER | 1 | |
| | | | | | |
| 46 | | F0334BQ00KP | MENU LABEL | 1 | |
| 55 | | F0007BQ00SPT | NAME PLATE | 1 | PTE |
| 55 | | F0007BQ00SKP | NAME PLATE | 1 | KPQ |
| | | | | | |
| 61 | | F02395E20KN | AC CORD CAUTION LABEL | 1 | |

# 8.3. ESCUTCHEON BASE ASSEMBLY



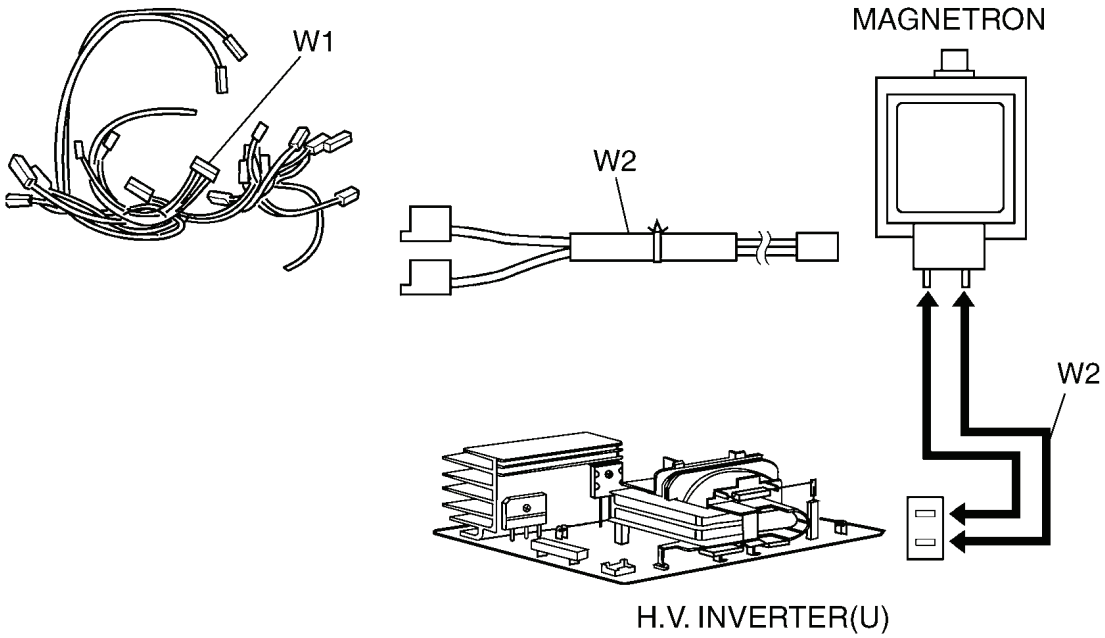

| Ref. No. | | Part No. | Part Name & Description | Pcs/Set | Remarks |
|---|---|---|---|---|---|
| E1 | | F603LBQ00PT | D.P.CIRCUIT (AU) | 1 | PTE |
| E1 | | F603LBQ00KP | D.P.CIRCUIT (AU) | 1 | KPQ |
| E3 | | F800LBQ00SQP | ESCUTCHEON BASE (U) | 1 | |
| | | | | | |
| E6 | | F891PBP90SAP | DOOR OPENING BUTTON (U) | 1 | |
| E7 | | F82565X00AP | DOOR OPENING LEVER | 1 | |
| E8 | | F80375K00AP | COOK BUTTON SPRING | 1 | |
| E10 | | F90098N00AP | GROUNDING PANEL | 1 | |
| | | | | | |
| E14 | | F8284BQ00AP | CUSHION RUBBER | 1 | |

# 8.4. DOOR ASSEMBLY



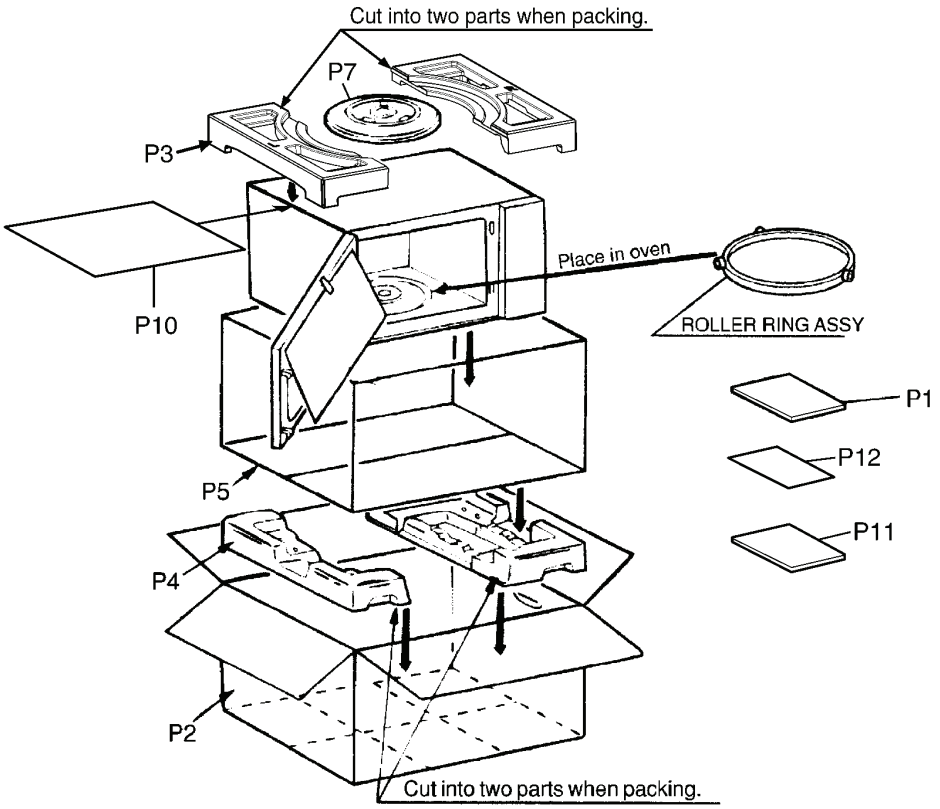

| Ref. No. | | Part No. | Part Name & Description | Pcs/Set | Remarks |
|---|---|---|---|---|---|
| D1 | | F30186P40AG | DOOR KEY A | 1 | |
| D2 | ⚠ | F302ABQ20SAP | DOOR A (U) | 1 | |
| D3 | ⚠ | F302KBF20AP | DOOR E (U) | 1 | |
| D4 | | F30216P40AG | DOOR KEY SPRING | 1 | |
| D5 | ⚠ | F3085BF20AP | DOOR C | 1 | |
| | | | | | |
| D6 | ⚠ | F31454W00AP | DOOR SCREEN A | 1 | |

## 8.5. WIRING MATERIALS



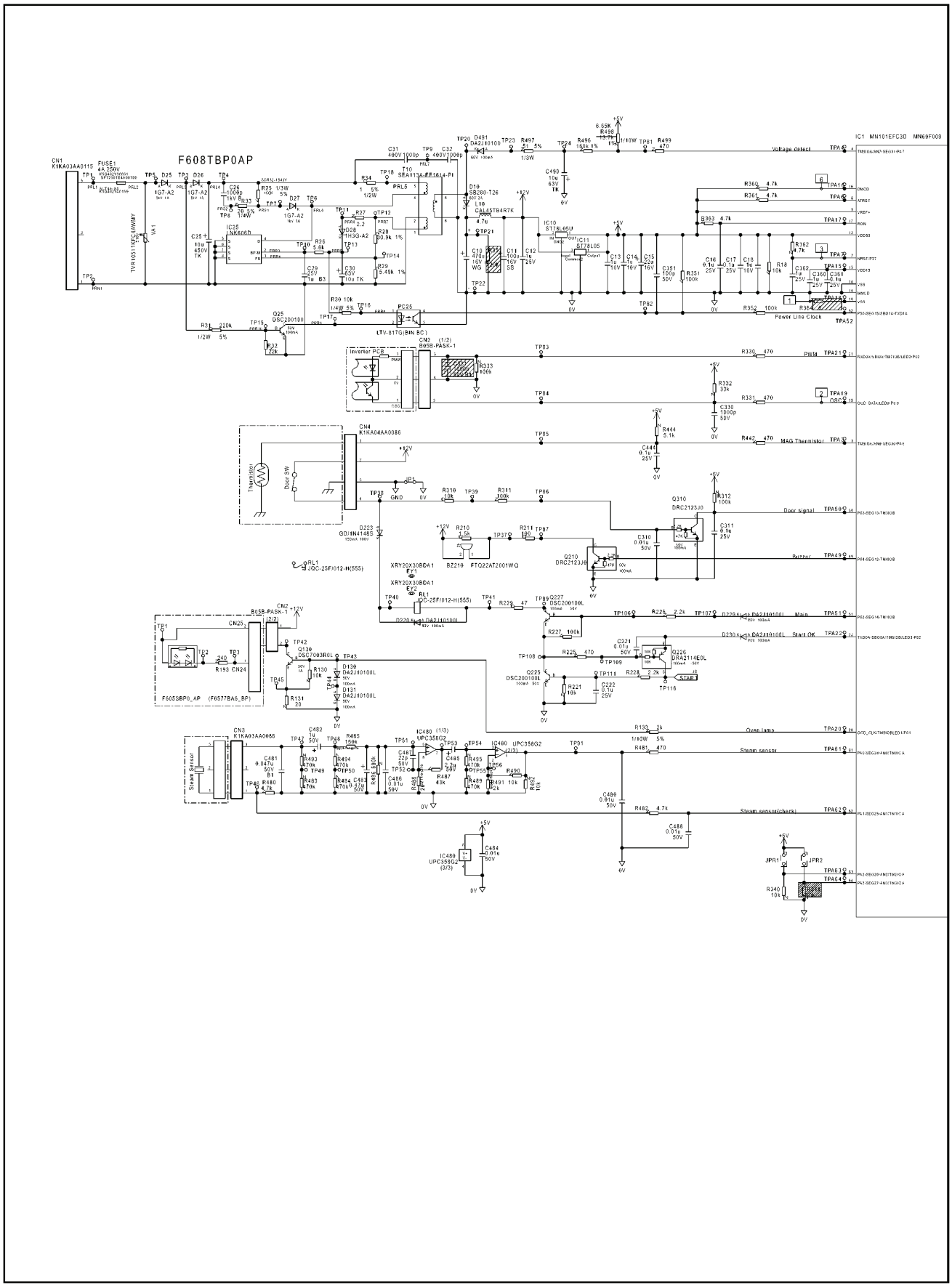

| Ref. No. | | Part No. | Part Name & Description | Pcs/Set | Remarks |
|---|---|---|---|---|---|
| W1 | | F030ABQ00QP | LEAD WIRE HARNESS | 1 | |
| W2 | | F030E6G30AP | H.V.LEAD WIRE | 1 | |

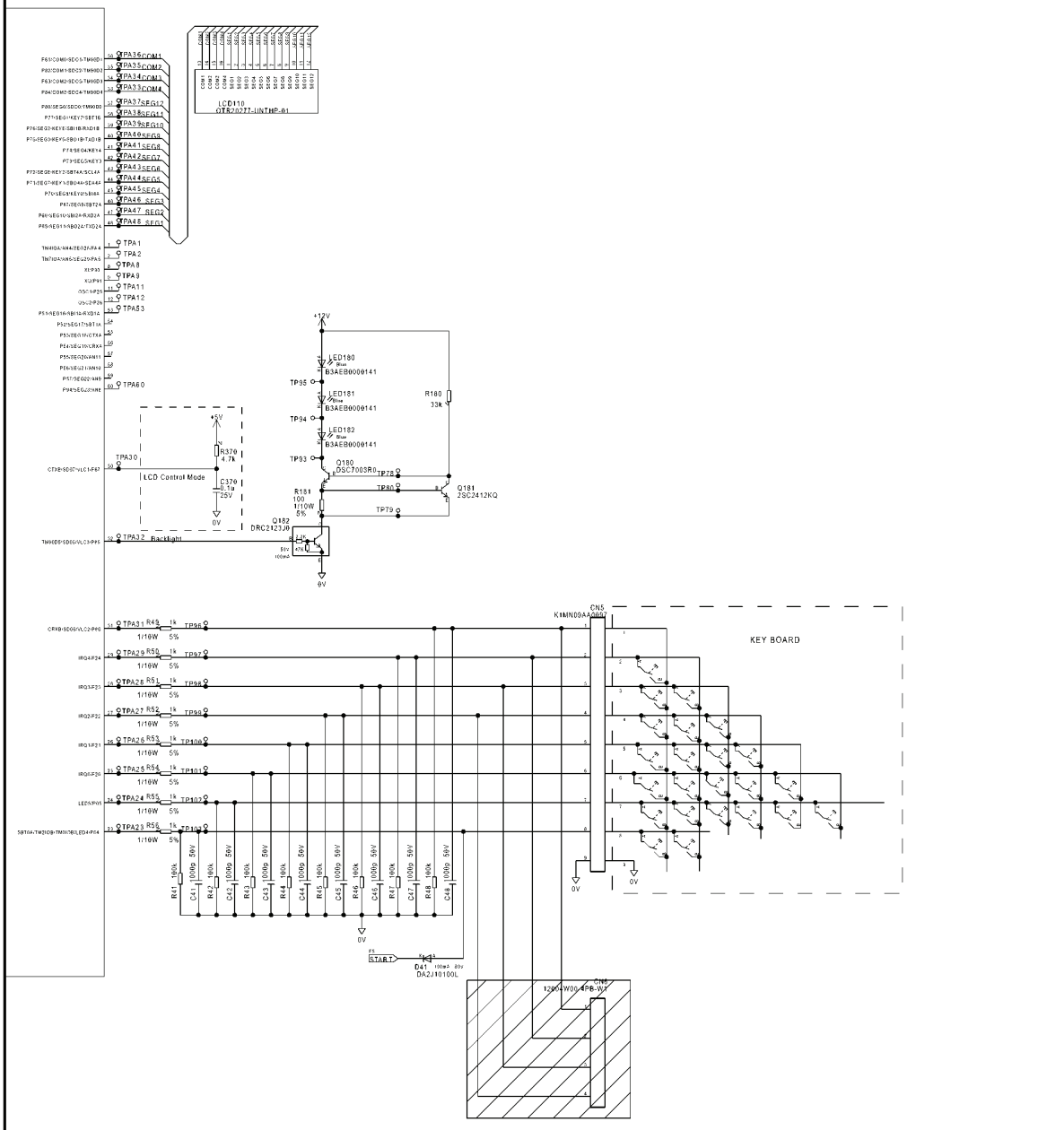
# 8.6. PACKING AND ACCESSORIES




| Ref. No. | | Part No. | Part Name & Description | Pcs/Set | Remarks |
|---|---|---|---|---|---|
| P1 | | F0003BQ00KP | INSTRUCTION MANUAL | 1 | |
| P2 | | F0102BQ00SKP | PACKING CASE,PAPER | 1 | |
| P3 | | F0104BP80AP | UPPER FILLER | 1 | |
| P4 | | F0105BP80AP | LOWER FILLER | 1 | |
| P5 | | F01067C50AP | P.E.BAG | 1 | |
| | | | | | |
| P7 | | A06014A00AP | COOKING TRAY | 1 | |
| P10 | | F01924U00AP | SHEET | 1 | |
| | | | | | |
| P11 | | F000B7J70KP | COOK BOOK | 1 | |
| P12 | | F0445BQ00SKP | OVERLAY | 1 | |

# 9 DIGITAL PROGRAMMER CIRCUIT






| Dev. No. | Model No. | P.C.B A U | JPR1 |
|---|---|---|---|
| S-BQ0QPQ | NN-ST785SQPQ | F603LBQ00QP | Open |
| S-BQ0PTE | NN-ST785SPTE | F603LBQ00PT | 10K |
| S-BQ0KPQ | NN-ST785SKPQ | F603LBQ00KP | Short |

# 9.1. PARTS LIST

| Ref. No. | | Part No. | Part Name & Description | Pcs/Set | Remarks |
|---|---|---|---|---|---|
| BZ210 | | L0DDEA000014 | BUZZER | 1 | 2.0KHz |
| DISP110 | | L5AYAYY00302 | LCD | 1 | |
| DISP HOLDER | | F6617BP80AP | LCD HOLDER | 1 | |
| | | F6752BP80AP | DIFFUSION SHEET | 1 | |
| VA1 | | D4EAY511A148 | VARISTOR | 1 | 510V |
| IC1 | | MN69F009LT1 | L.S.I. | 1 | |
| IC10 | | C0DBGYY05981 | IC | 1 | VOLTAGE-STABILIZED |
| IC25 | | C0DBBYY00073 | IC | 1 | |
| IC480 | | C0ABBA000230 | IC | 1 | |
| PC25 | | B3PAA0000302 | IC | 1 | |
| RL1 | | K6B1AYY00129 | POWER RELAY | 1 | |
| T10 | | G4DYA0000681 | SWITCH POWER SUPPLY | 1 | 240V |
| FUSE1 | | K5G402YA0159 | FUSE | 1 | 4A,250V |



07/15
S-BQ0
Printed in China