

**MICROWAVE OVENS  
IN GENERAL**

*Fundamentals  
Measuring technique  
Fault-finding*



© AEG Hausgeräte GmbH  
Muggenhofer Straße 135  
D-90429 Nürnberg  
Germany

Fax +49 (0)911 323 1420

TSE - N  
Ausgabe: 03.2001

Publ.-Nr.:  
**599 510 968**  
Trainingsunterlagen  
EN

**Microwave  
Ovens**

**in general**

Page	Content
<b>3</b>	<b>Microwave technology – advantages</b> <b>Frequencies</b> <b>Radiation spectrum</b>
<b>4</b>	<b>How do microwaves behave...</b>
<b>5</b>	<b>What for are the various cooking utensils suitable for</b>
<b>6</b>	<b>Electromagnetic conversion of energy</b> <b>Interpenetration/Penetration</b>
<b>7</b>	<b>Guiding of waves</b>
<b>8</b>	<b>Microwave capacity</b>
<b>9</b>	<b>Input – control panels</b>
<b>10</b>	<b>Metal in the oven – sometimes even useful</b>
<b>11</b>	<b>Wiring diagram of a timer-controlled microwave oven</b>
<b>12</b>	<b>Mechanical safety system</b> <b>Electromechanical safety system</b>
<b>13</b>	<b>Interlock safety system</b>
<b>14</b>	<b>Primary circuit</b>
<b>15</b>	<b>High-voltage transformer</b>
<b>16</b>	<b>Voltage doubling</b>
<b>17</b>	<b>Fuse diode</b>
<b>18</b>	<b>Magnetron</b>
<b>19</b>	<b>Measurements in practice</b>
<b>20</b>	<b>Voltage measurement "Easy Way"</b> <b>Measurement of capacity levels</b>
<b>21</b>	<b>Rules for leaky rays</b> <b>Measurement of leaky rays</b>
<b>22</b>	<b>Checking of the interlock door safety system</b> <b>Measuring the fuse diode</b> <b>Checking the high-voltage diode</b>
<b>23</b>	<b>Measuring the magnetron</b> <b>Measuring the high-voltage capacitor</b> <b>Checking the high-voltage transformer</b>
<b>24</b>	<b>Fault finding trees</b>
<b>25</b>	<b>Fault finding tree</b>
<b>26</b>	<b>Fault finding tree</b>
<b>27</b>	<b>Fault finding tree</b>
<b>28</b>	<b>Well-aimed advises for the end</b>
<b>29</b>	<b>Note for setting of voltage</b>

**Service information for microwave ovens with additional equipment (Duo, Combi) and different chassis designs are included in TDS system under the corresponding ovens.**  
**Here you can also find the appropriate wiring diagrams.**

# Microwave Technology - Advantages

- time-saving cooking speed
- the taste (natural flavor)
- healthy cooking, no fat used, no loss of vitamins
- energy saving, no pre-heating, time-saving speed
- quick and problem free defrosting
- less washing up, food cooked in the serving dish
- easy to clean
- easy to use

## Frequency

The frequencies are determined by the number of current oscillations resp. of the electromagnetic waves per second.

### Classification of Frequency Bands:

3 - 30 KHz	- VLF	- Very low frequency - Telephone
30 - 300 KHz	- LF	- Low frequency - Ultrasonics
300 - 3000 KHz	- MF	- Frequency modulation - Radio
3 - 30 MHz	- HF	- High frequency - Radio, Broadcast
30 - 300 MHz	- VHF	- Very high frequency - TV, Broadcast
300 - 3000 MHz	- UHF	- Ultra high frequency - Radar, Microwaves
3 - 30 GHz	- SHF	- Super high frequency - Satellite Transmissions

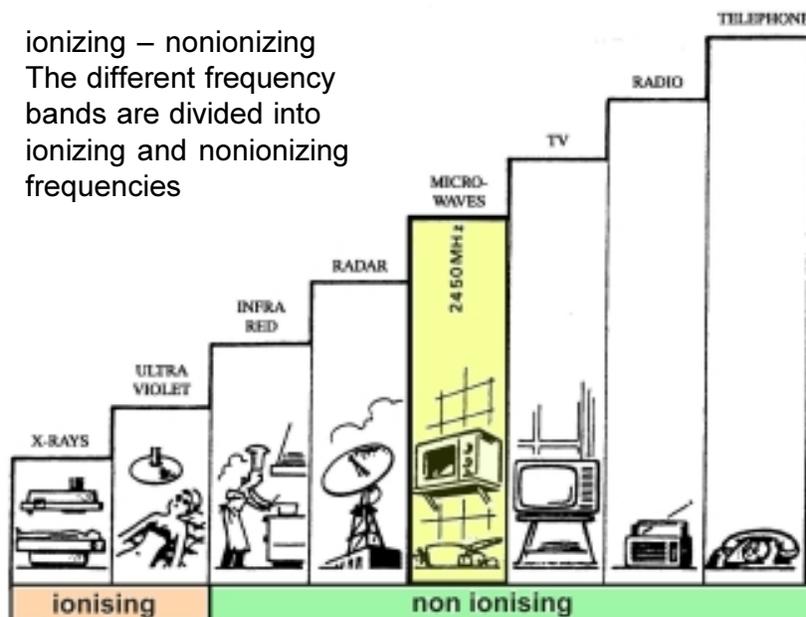
Transmitting frequencies and microwave frequencies in the UHF range are fixed by international agreements.

To avoid any influences and interferences, the microwave frequency is fixed to:

**2450 MHz**

## Radiation Spectrum

ionizing – nonionizing  
The different frequency bands are divided into ionizing and nonionizing frequencies



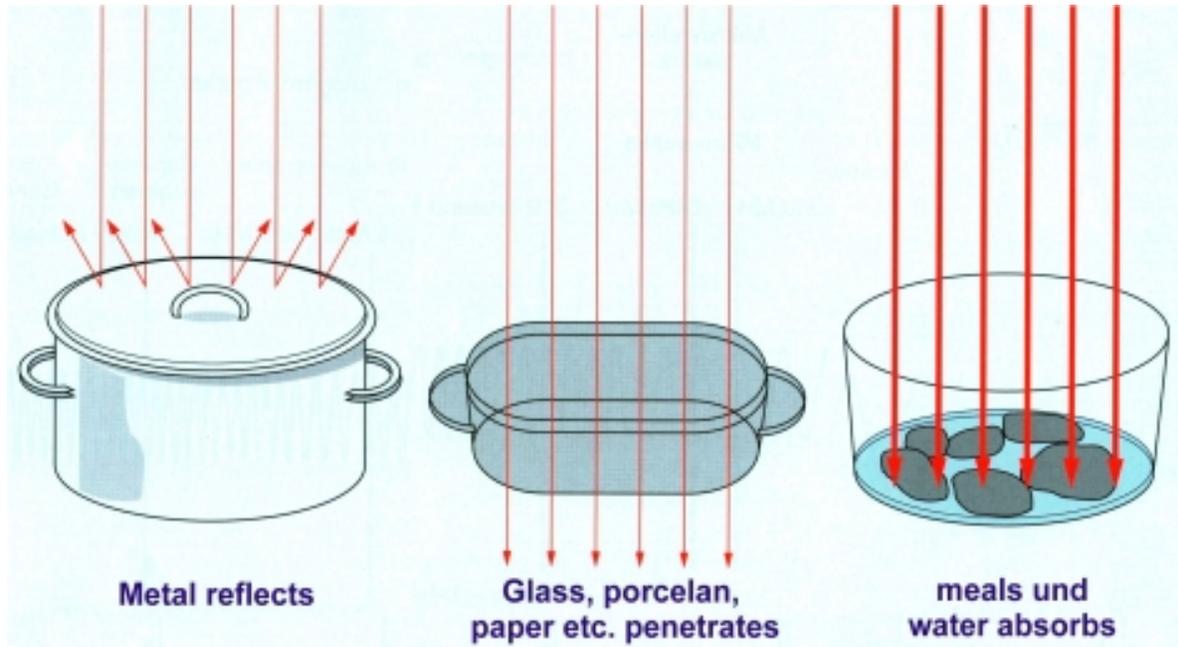
Microwaves are in the nonionizing range. They therefore also do not have anything to do with radioactivity. Radioactivity can only occur with essentially higher frequencies. The microwave effect only influences a heating of water molecules which, whatever capacity is affecting, does not exceed 100°C.

## Fundamentals...

How do microwaves behave

The microwaves for the heating of meals behave like the electromagnetic waves which one knows by e.g. broadcast and television. The frequency of 2,450 MHz means that the radiated energy is oscillating 2,450,000,000 times a second.

The graphic below shows how microwaves behave in connection with substances, in this case different dishes.



### Reflection

Microwaves are reflected by metal. This is also used in the oven cavity to spread the waves. However, the meals would be shielded from the microwaves when using metal pots. It may lead to sparks or, when the waves have a retrospective effect on the magnetron, to a damaging of its anode.

**Therefore, never use an empty microwave oven!!!**

### Interpenetration

Many materials let microwaves pass through without that they react themselves (glass, porcelain, pottery, plastic (suitable for microwaves!) and paper/board (dry)).

This is used during the microwave operation. The waves can penetrate into the food without loss.

### Absorbtion

Liquids and nearly all organic food absorb microwaves and convert their energy into heat (cooking): Depending on the liquid contents of the food, this heating behaviour is different, too.



**CLOSED CONTAINERS SUCH AS BOTTLES, SCREW CAP GLASSES AND EVEN EGGS (SHELL!) DO NOT BELONG IN THE MICROWAVE OVEN.**

# Suitable Ovenware

Ovenware material	Mode of Operation		
	Defrosting	Heating	Cooking
Ovenproof glass and ceramic dishes (without any metal parts, e.g. Pyrex, Oven-to-tableware)	●	●	●
Non ovenproof glass and porcelain (e.g. table crockery) <sup>1)</sup>	●	-	-
Glass ceramic and vitro-ceramic made of fire/frost proof material (e.g. Arcoflam)	●	●	●
Ovenproof earthenware <sup>2)</sup>	●	●	●
Plastic, heat-resistant up to 200°C <sup>3)</sup>	●	●	●
Paper, cardboard	●	-	-
Clingfilm	●	-	-
Microwave ding film <sup>3)</sup>	●	●	●
Black-lacquered or silicone-coated baking tins	-	-	-

○ suitable      - non suitable

1) excluding silver, gold, platinum or metal decoration

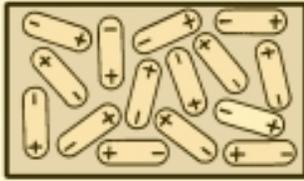
2) does not include glaze containing metal

3) please note the maximum temperature stated by the manufacturer

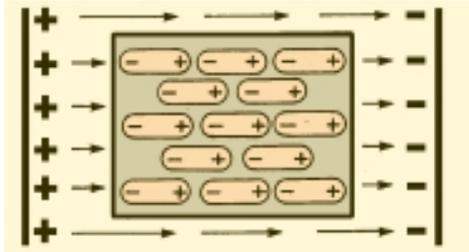


**CLOSED CONTAINERS LIKE BOTTLES, FOOD GLASSES AND EGGS ALSO ARE NOT TO BE USED IN THE MICROWAVE OVEN !!!**

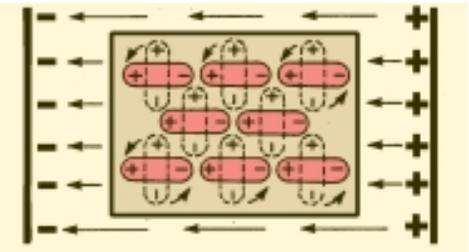
## Electromagnetic conversion of energy



In any food, positively/negatively charged liquid molecules are accidentally arranged in disorder.



If we now put this food into an electromagnetic field, these molecules will adjust to the +/- field direction. If we now change this field +/-, also the adjustment of molecules will change.

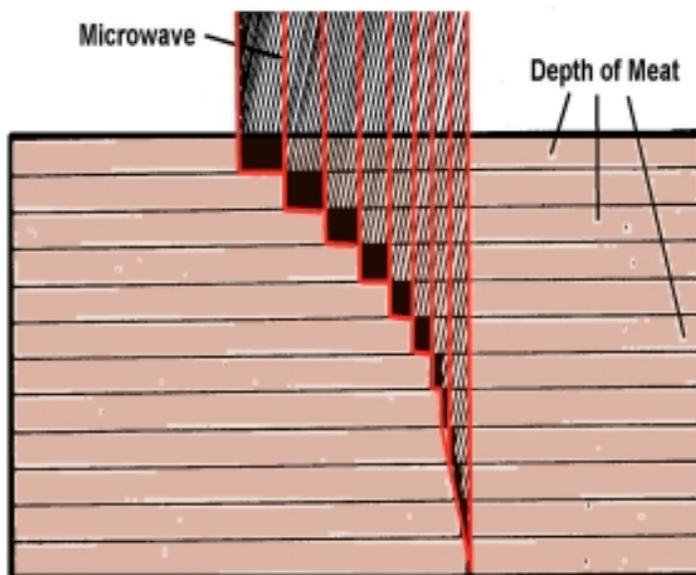


If this changes rather fast, the molecules as well will move correspondingly fast. The molecules are rubbing with each other and produce heat. In case of a microwave frequency of 2,450 MHz, this results in 4,900,000,000 changes per second. Thereby the required cooking temperature is produced.

## Penetration

The heat reaction as a result of the correlation of microwaves and water molecules is letting up after penetration into the food. This is measured in  $W/cm^2$ .

Depending on the dielectric behaviour of the food, the energy is falling progressively with increasing depth of penetration.



On the left, the loss of capacity of the microwaves in the food is shown graphically. The thermal output has a declining effect from the outside to the inside.

Therefore it is advisable to reduce the capacity e.g. with large meat pieces, and to extend the time, that the heat can better spread in the food.

Liquids such as soups should be stirred for a change for the same reason. This helps to distribute the heat and prevents too high temperatures on the surface. In the extreme case, this could attack the upper edge of the material when using plastic containers.

# Guiding of Waves

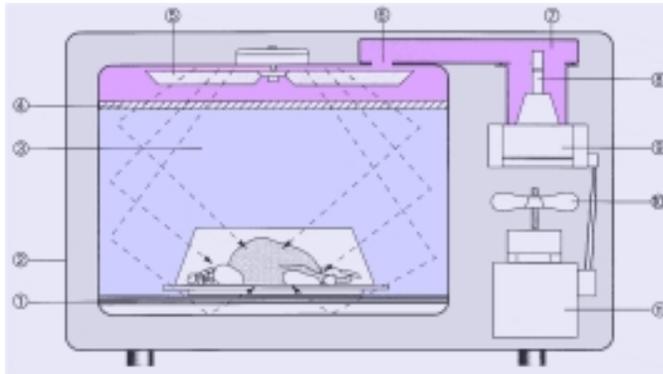
## Wave Duct

The microwaves produced by the magnetron are guided to the oven cavity through a metallic wave channel.

## Wave Agitator (Stirrer)

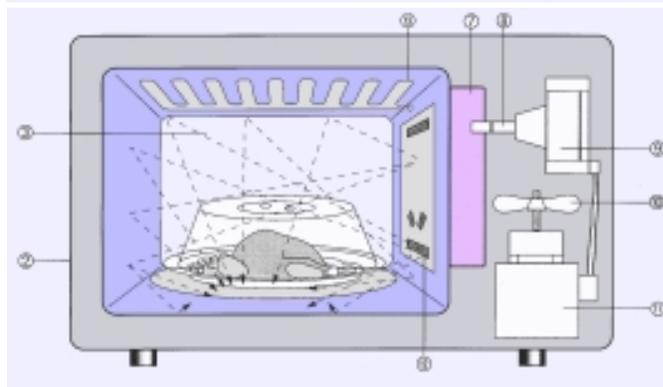
The wave agitator consists of reflecting metal and is turning. As it is continuously in another position, the reflection and distribution of waves is changing, too. The wave agitator may have various forms, in most cases it is a kind of propeller.

It is run by a motor. With older ovens, also the air flow of the fan is partly used in order to operate the wave agitator by it.



### Oven with stirrer:

- 1 - Bottom Plate
- 2 - Housing
- 3 - Cooking Area
- 4 - Sheet
- 5 - Stirrer
- 6 - Microwave Input
- 7 - Duct
- 8 - Anode
- 9 - Magnetron
- 10 - Ventilator
- 11 - High Voltage Transformer



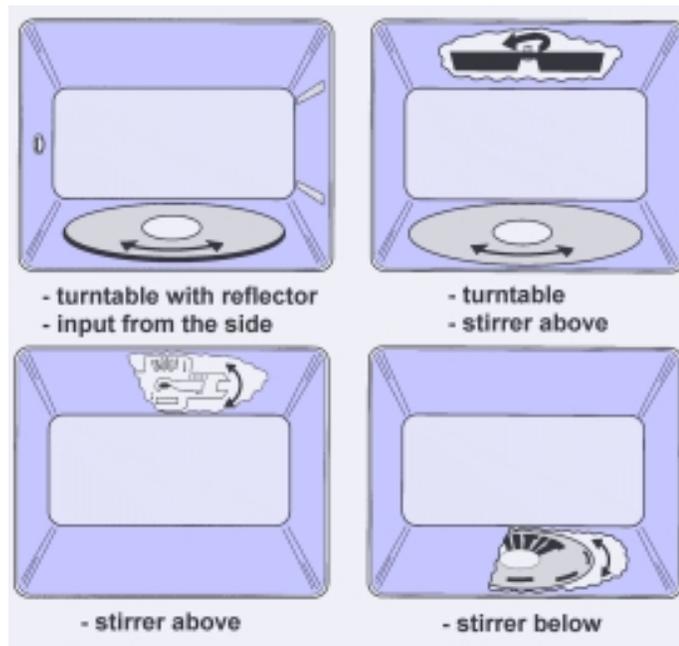
### Oven without stirrer.

**Special MW-input and turntable ensures MW-distribution:**

- 2 - Housing
- 3 - Cooking Area
- 7 - Duct
- 8 - Anode
- 9 - Magnetron
- 10 - Ventilator
- 11 - High Voltage Transformer
- 12 - Microwave Input + Fat Shield
- 12 - Grill

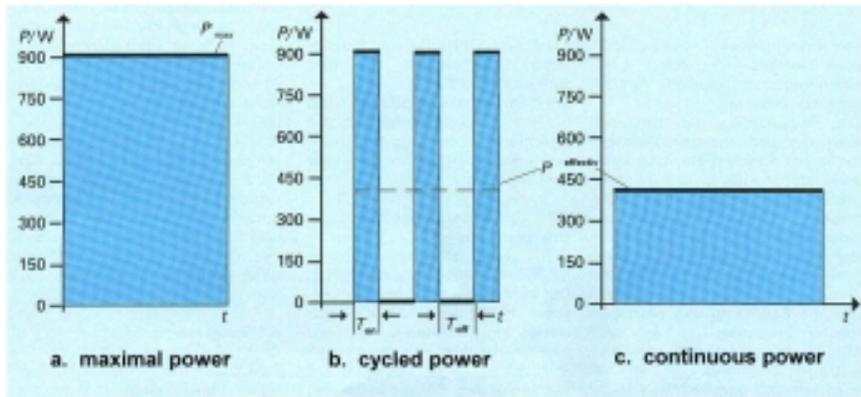
Various ways of feeding and distribution of microwaves.

Using turntables guarantees a good distribution of waves for the food.



# Microwave-Capacity

A magnetron cannot be controlled continuously. When it is functioning, it always runs at 100%. In order to get a capacity control, one pulses the switch-on duration, i.e. the desired capacity is achieved by switching on/off the magnetron over a certain period of time. The same principle as e.g. in ovens or with hot plates.



POWER LEVEL	OUTPUT POWER AGAINST FULL POWER	RELAY "1" TURN ON, OFF TIME
0	0/29 (0%)	ON: 29s, OFF: 0s
1	3/29 (10%)	ON: 3s, OFF: 26s
2	5/29 (17%)	ON: 5s, OFF: 24s
3	8/29 (28%)	ON: 8s, OFF: 21s
4	11/29 (38%)	ON: 11s, OFF: 18s
5	14/29 (48%)	ON: 14s, OFF: 15s
6	17/29 (59%)	ON: 17s, OFF: 12s
7	20/29 (69%)	ON: 20s, OFF: 9s
8	23/29 (79%)	ON: 23s, OFF: 6s
9	26/29 (90%)	ON: 26s, OFF: 3s
Hi	29/29 (100%)	ON: 29s, OFF: 0s

A timing cycle is normally 29/30 seconds. <(example 29 sec).

If 48(50)% capacity is required, that means 14(15) seconds ON and 15 seconds OFF.

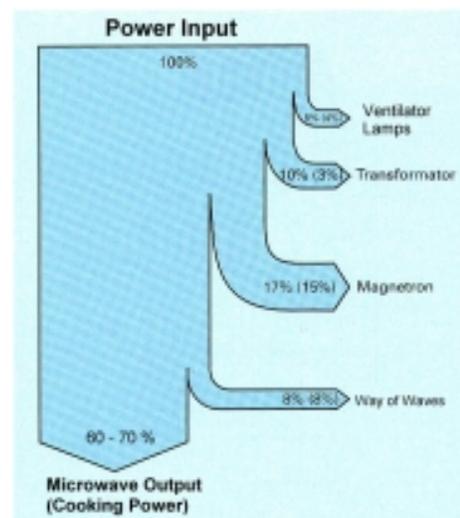
The timing cycles can differ a little bit due to the different types (electronic/timer), the principle is always the same!

Thus, 10 of these cycles will pass within 5 min.

## Following important note:

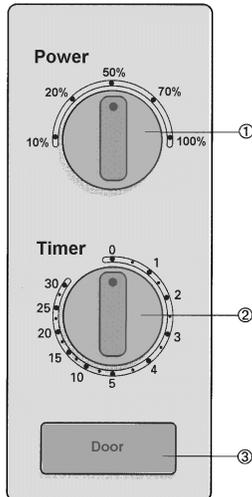
**Never switch on a microwave oven without energy-absorbing food in the oven. If despite that microwave energy is fed to an empty oven, these waves work off their energy where it is not welcome.**

**It results in sparks and scorch spots. In the worst case, there will be a reaction on the anode resp. antenna of the magnetron, which may even be destroyed!**



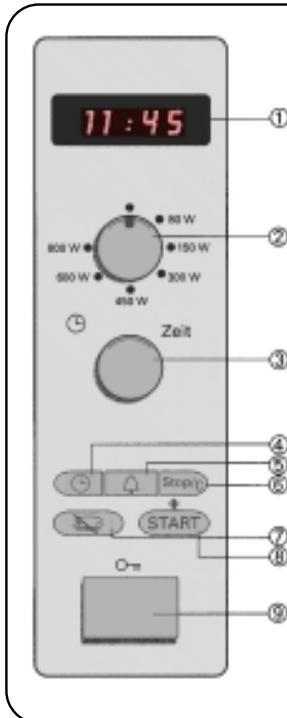
## Mechanical timer

1. capacity
2. timer
3. door opener



## "Easy-to-use" electronic

- 1 display
- 2 capacity
- 3 timer
- 4 –8. start button and functions
- 9 door opener



Here, the mechanical timer is replaced by an electronic with a display.

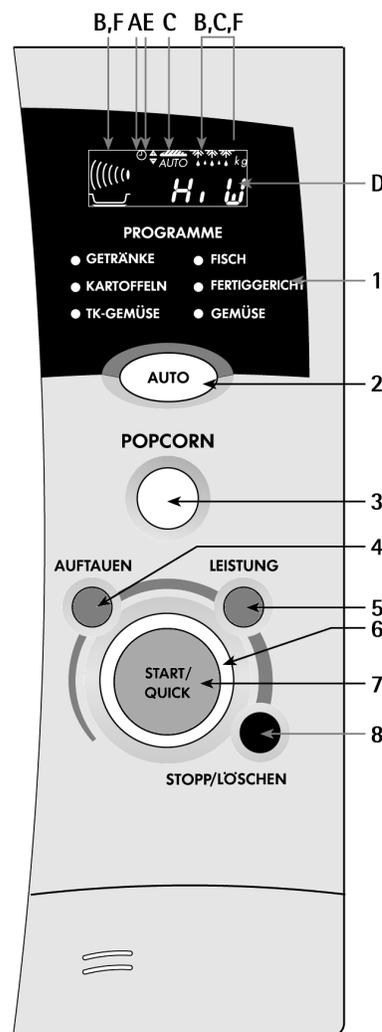
Instead of a controller it is also possible to use input fields.

1. Anzeigefeld – für Tageszeit, Betriebsart und Garzeit
2. PROGRAMME – Automatikprogramme und Leuchtanzeige für:  
GETRÄNKE FISCHE  
KARTOFFELN FERTIGGERICHT  
TK-GEMÜSE GEMÜSE

3. POPCORN
4. AUFTAUEN – nach Gewicht
5. LEISTUNG – für gewünschte Mikrowellenleistung
6. Drehwähler – zur Auswahl der Zeit und des Gewichts oder der Menge
7. START/QUICK – zum Starten eines gewünschten Programms oder zur Aktivierung eines START/QUICK-Programms
8. STOPP/LÖSCHEN – zum Unterbrechen oder Abbrechen eines Programms und zur Einstellung der Kindersicherung

### Anzeigefeld

- A Blinkende Anzeige, die Sie dazu auffordert, die Tageszeit einzugeben.
- B Blinkende Anzeigen für autom. Garen, Mikrowelle und Auftauen, die Sie dazu auffordern, die Lebensmittelmenge, das Gewicht (kg) oder die Garzeit einzugeben.
- C Blaue Anzeigen für Auftau- und Brotprogramme.

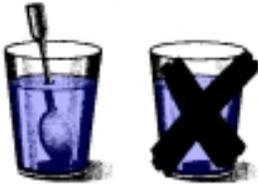


Here is a typical portrayal of the control panel from an instruction manual.

Just with appliances controlled by electronics, you can find the most different equipment features and programmes.

The basic function of the microwave oven is, on the whole, always the same

## Metal in the oven – sometimes even very useful:



When cooking liquids, especially when cooking repeatedly or in slim, high containers, a so-called boiling delay may occur. In this case the liquid is in fact boiling hot, the typical air bubbles however do not arise. Shaking, e.g. when taking out the container, may lead to an abruptly over-boiling due to a chemical reaction, so that the user may scald himself.

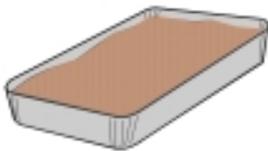
In order to avoid this it is recommended to put e.g. a coffee spoon into the container during boiling. The boiling delay is thus excluded – the liquid is boiling "normally".



Meals with skin, such as sausages or tomatoes, tend to burst during the heating due to an internal formation of steam.

In order to avoid this unpleasant effect, the food should be pricked a little before with a fork. Thus the steam can go out and there will be no tensions and the skin keeps normally to be undamaged.

When using too high capacity levels, that means a too fast heating, the bursting often can also not be avoided by pricking.



Instant meals in aluminium plates can also be heated in the microwave oven.

In this connection one has to observe that the microwave energy only affects the food from above and that the required cooking duration will thereby be extended.

Furthermore, a distance of 2 cm to the oven wall must be kept to in order to avoid a sparkover.

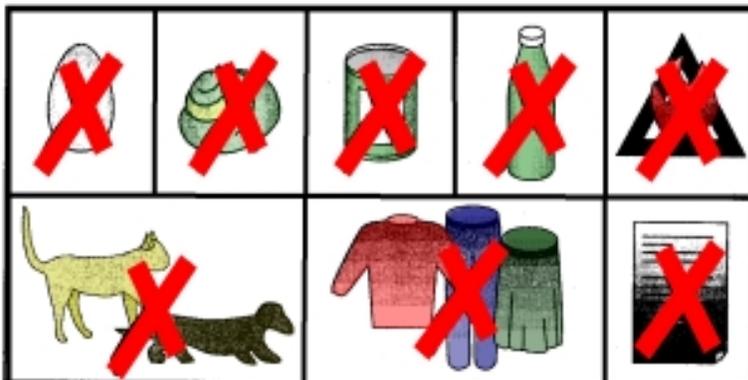


Aluminium foil wrapped around thinner parts, such as ends of poultry legs, shields the microwave energy and thus prevents a too strong drying up.



Browning dishes, such as crunch plates, are coated with a specially absorbing metal. Due to this absorption the dishes heat up and it works in addition like a frying pan. In connection with the grilling function, one gets, e.g. with pizza or a vegetable cake, a browning from above and below.

As a rule, the browning dishes are heated 2 to 3 minutes at full capacity before the food is put in.



**CLOSED CONTAINERS SUCH AS BOTTLES OR SCREWTAP GLASSES AS WELL AS EGGS (SHELL!) DO NOT BELONG IN THE OVEN!!!**

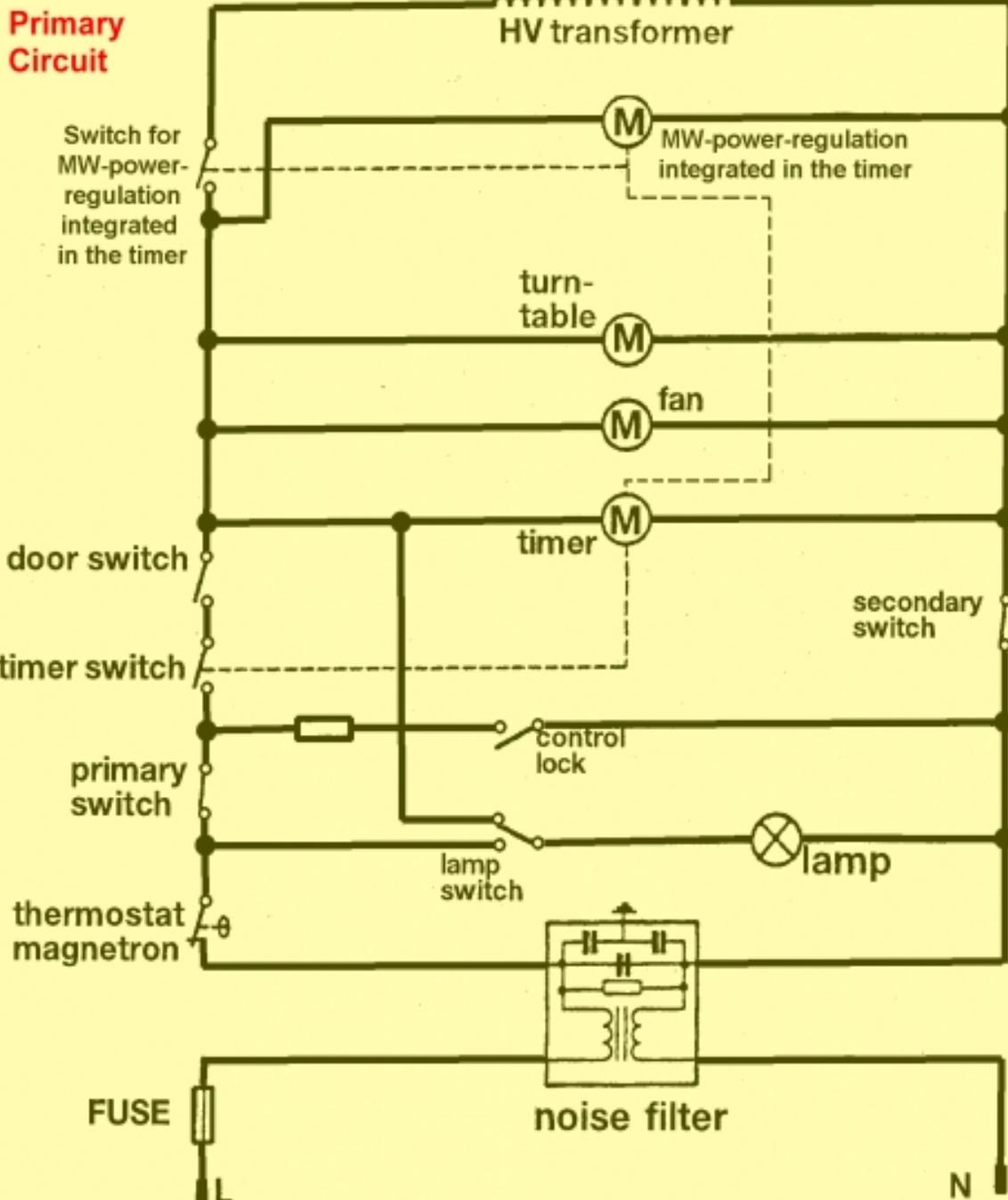
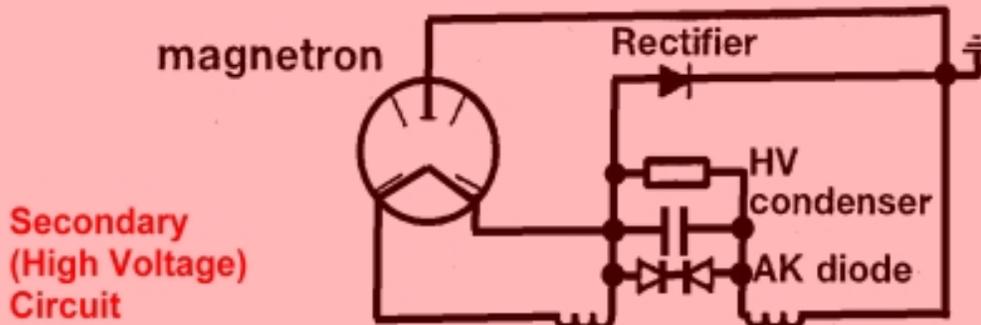
**PUT ON POSSIBLE COVERS TO AVOID THE EVAPORATION ONLY LOOSE!**

**During heating please pay attention that the inner part of the food will achieve at least a temperature of 70°C.**

**However, never use liquid thermometers in the oven!!!**

# Wiring diagram of a timer-controlled microwave oven

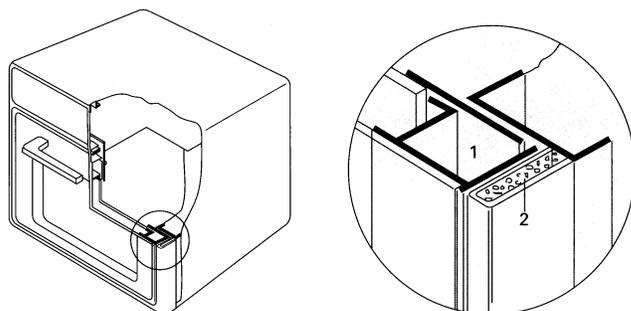
The various sections are explained on the following pages.



## Mechanical safety system

The task of this system is to suppress leaky microwave rays between oven and closed door.

- The wave trap, whose size and structure is depending on the microwave length
- The door sealing of magnetic material in order to thus absorb possible remaining radiation



1 Quarter-Wave-Trap  
2 Ferrit Seal



The magnetic sealing integrated in the door

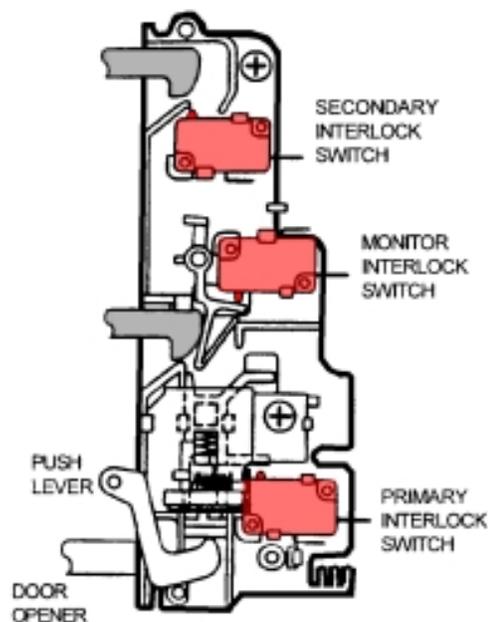
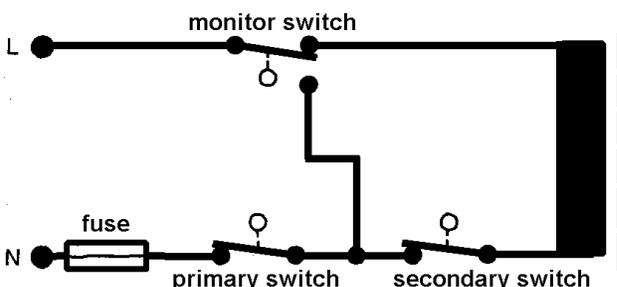
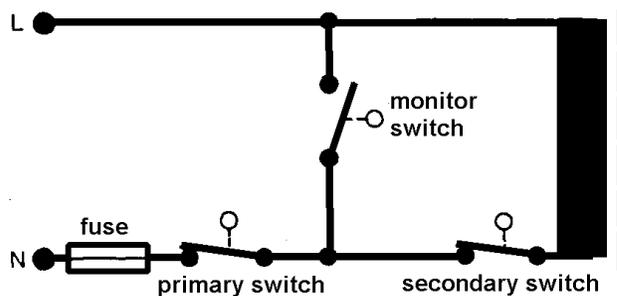
## Electromagnetic safety system

**"Interlock"-microswitch system**

- primary
- secondary
- monitor

When opening the door, all 3 microswitches are actuated via at least two mechanical systems. In doing so, primary and secondary switches interrupt the power supply.

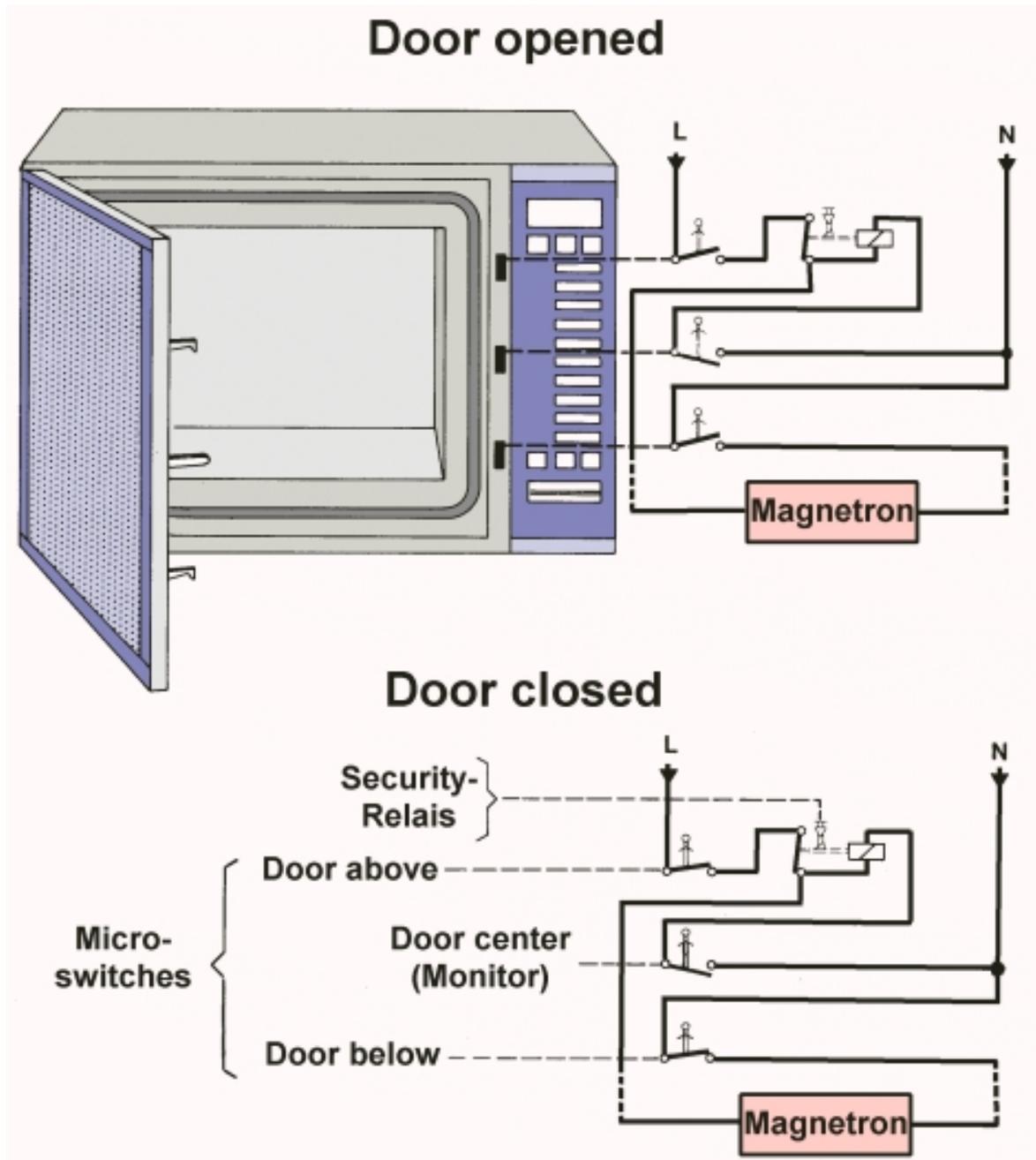
If, for whatever reason, one of these switches does not open, the monitoring switch short-circuits the entry circuit resp. high-voltage transformer. The triggering off of the fuse is hereby accepted. **Safety first!!!**



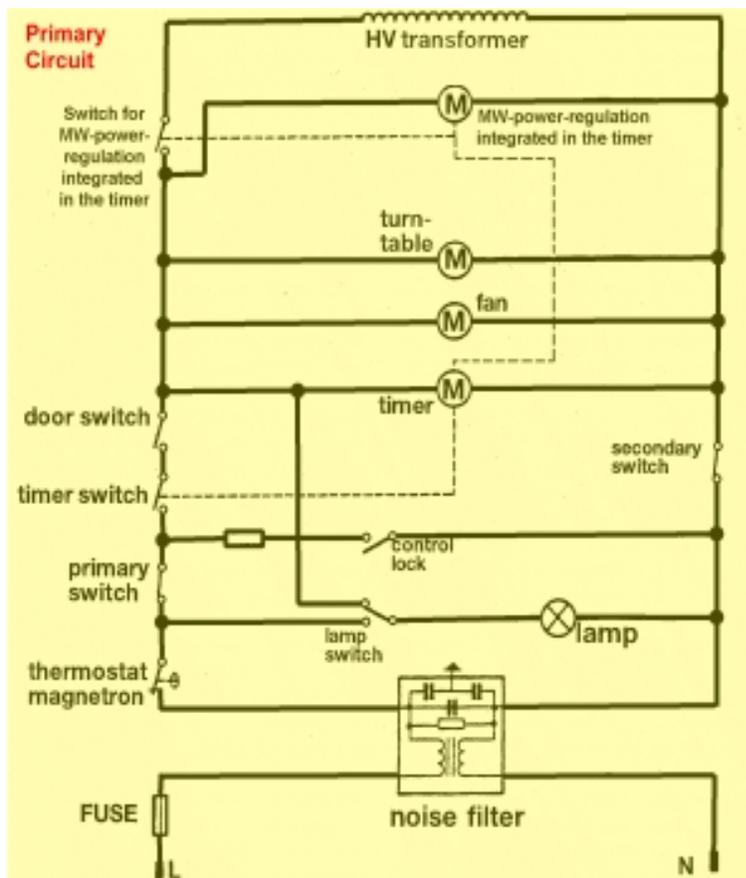
# Interlock-Safety System

At first sight the interlock safety system can have a different view from one model to the other when looking first at the wiring diagram.

**The basic functions are always the same!**

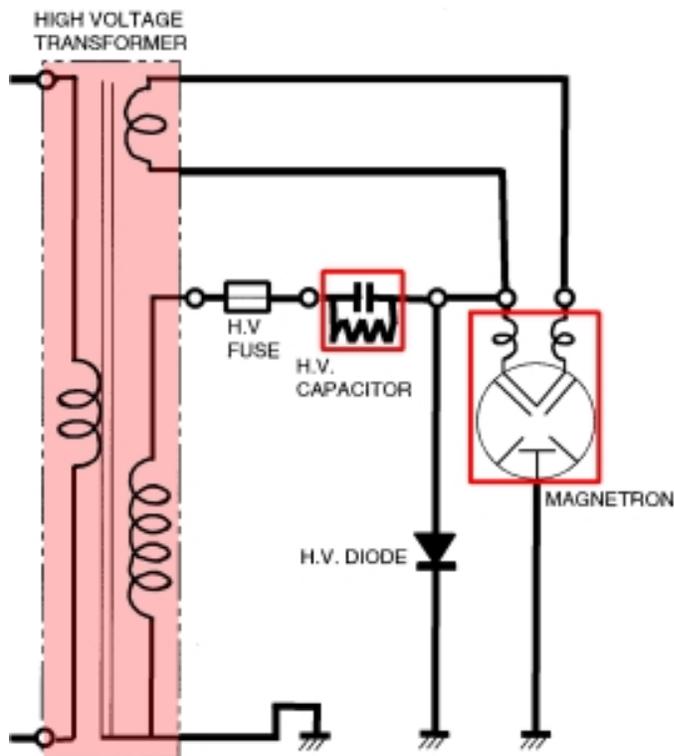


## Primary Circuit

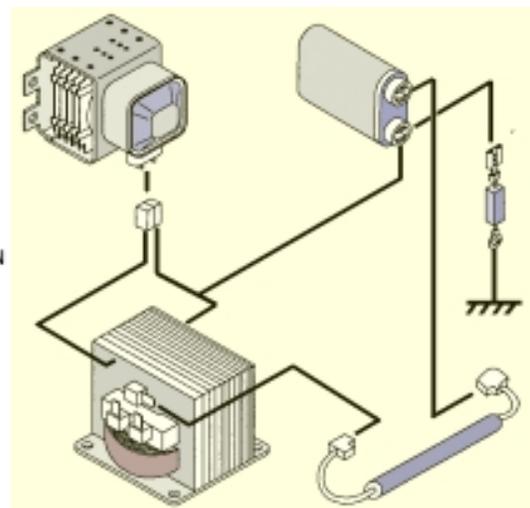


- The clocked power control is normally integrated in the timer or is controlled by an electronic component.
- Timer, fan and turntable motor are only running after switching on.
- How primary, secondary and monitoring switches are cooperating with each other, see under >Electr. safety system<.
- More elements such as the overheat thermostat for the magnetron can be installed depending on the model (thermostat of oven, grilling or air duct).
- The suppressor filter is blocking high frequencies and demanded by law.

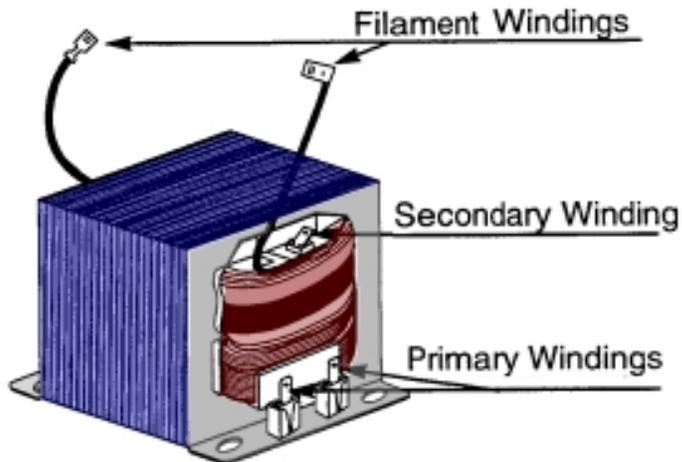
## Secondary Circuit



The function of the secondary and/or high-voltage circuit is explained on the following pages.



# High Voltage Transformer

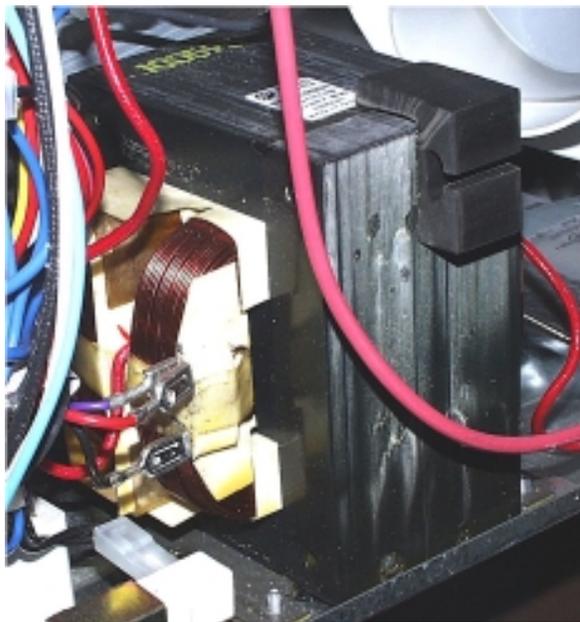
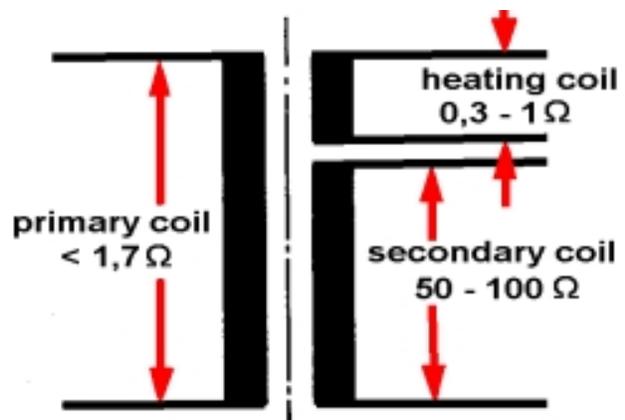


The high-voltage capacitor consists of three windings:

- a primary winding
- a secondary high-voltage winding
- a secondary low voltage winding

If the primary winding is supplied with a mains voltage of 230 V, following voltages are induced into secondary windings:

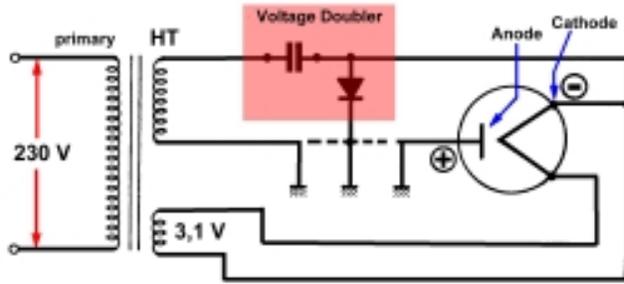
- 3.1 V as low voltage, directly connected with the heating winding of the magnetron for heating the cathodes
- 2,750 V as high voltage, connected with the voltage doubling



Thus the high-voltage transformer is placed in the appliance.

The stuck-on rubber parts are indispensable for the prevention of vibrations to the casing.

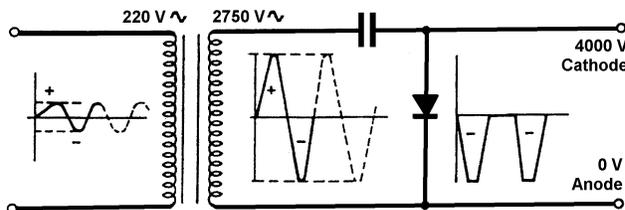
# Voltage doubling



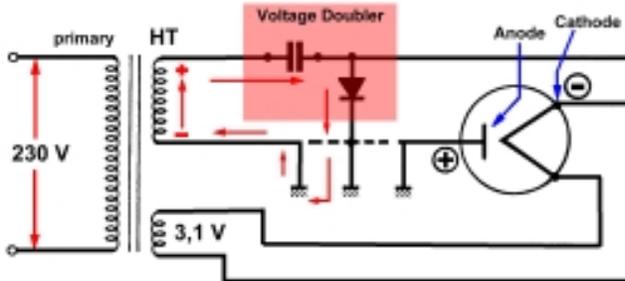
The voltage doubler consists of a diode and a capacitor.

The following indications of voltage serve the explanation and should never be measured again.

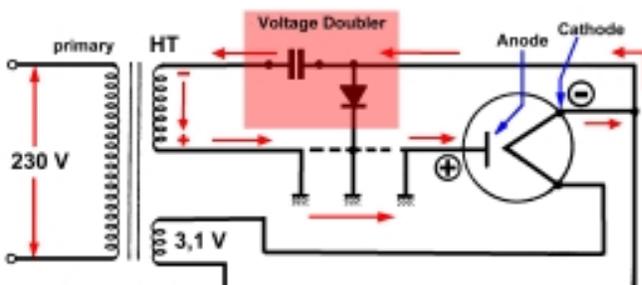
**Measurements, especially in the high-voltage part, must only be carried out as resistance measurements in an oven which is disconnected from the mains!!!**



The over 2,000 Volt AC voltage of the secondary winding of the high-voltage transformer are converted into over 4,000 Volt DC voltage. That operates the magnetron.



After the oven has been switched on, the first positive wave charges the capacitor with more than 2,000 Volt.

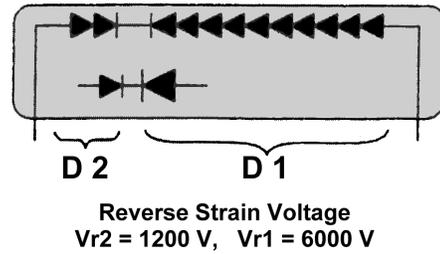
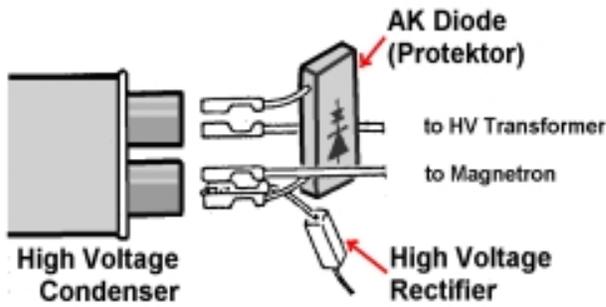


After the polarity has been changed, the diode avoids that the capacitor is discharging.

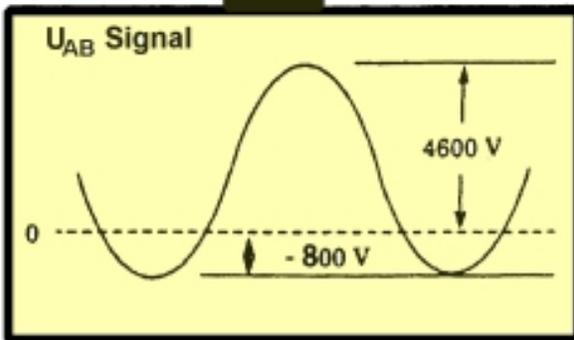
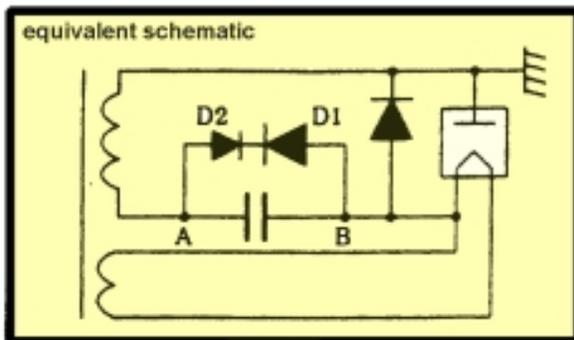
The voltage of the positive half wave is added to the charge of the capacitor.

The desired DC voltage of approx. 4,000 Volt arises.

# AK Diode



## Normal Operation



### Negatives Waves

$U_{AB \text{ max}} = -800 \text{ Volts}$

- D1 : Passing direction
- D2 : Reverse voltage lower than  $V_{r2}$

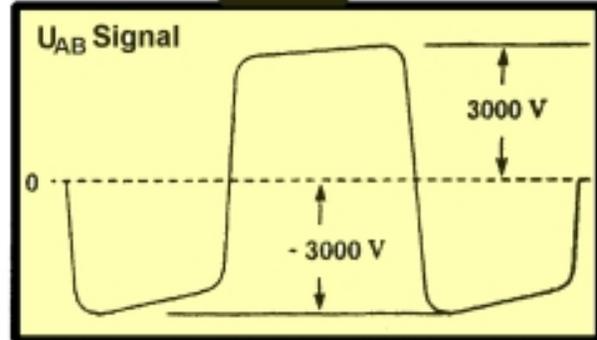
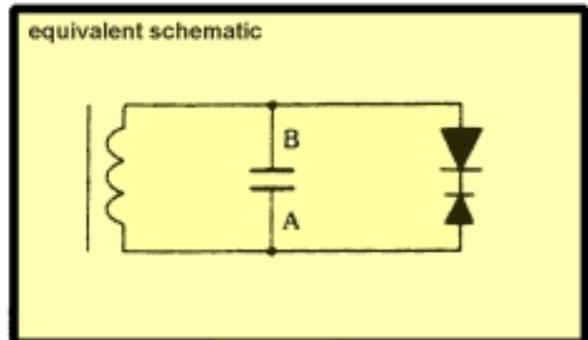
### Positives Waves

$U_{AB \text{ max}} = +4600 \text{ Volts}$

- D2 : Passing direction
- D1 : Reverse voltage lower than  $V_{r1}$

**Operation not disturbed**

## Short-Circuited Diode



### Negatives Waves

$U_{AB \text{ max}} = -3000 \text{ Volts}$

- D1 : Passing direction
- D2 : Reverse voltage over  $V_{r2}$  (1200 V)

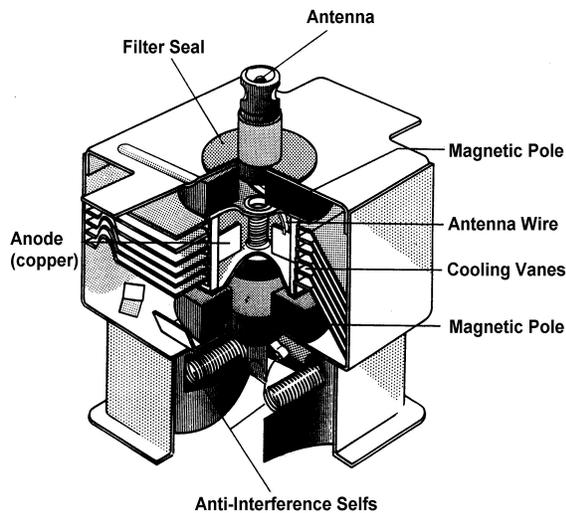
D2 strain causing it to short-circuit  
 Current in D1 too high, causing it to short-circuit

Secondary coil short-circuited

Current too strong in the primary coil and fusion of the primary fuse

**Transformer protected**

# Magnetron



The magnetron is the heart of the microwave oven.

With the help of transformer, rectifier and magnetic field, it converts the 230 Volt-50 Hz into microwave energy with the frequency of 2,450 MHz.

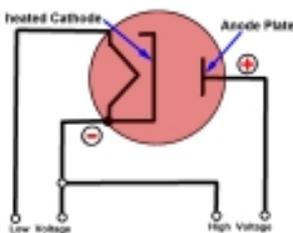
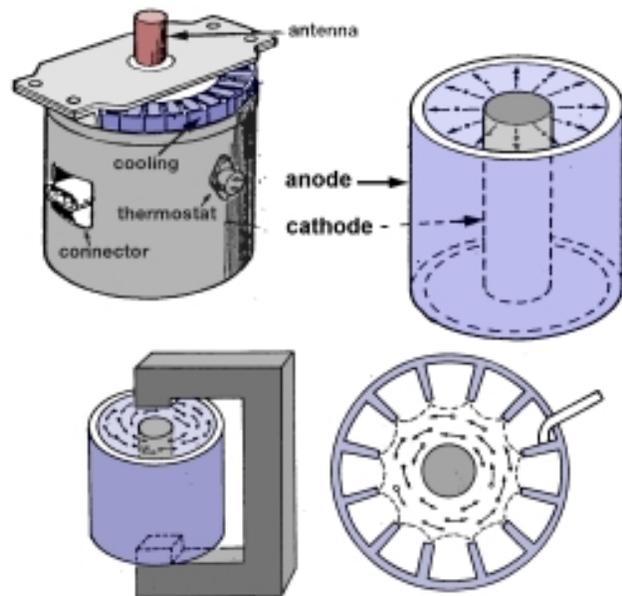
The magnetron consists of following parts:

Main body with anode (positive) and cathode (negative), cooling ribs, permanent magnet, connections for heating and high voltage as well as antenna, in order to radiate the microwave energy.

The inner cylinder is heating element and cathode at the same time.

The outer cylinder is the anode block with the resonant chambers.

Due to the big difference in potential between anode and cathode, the electrodes are moving from the inner to the outer cylinder.

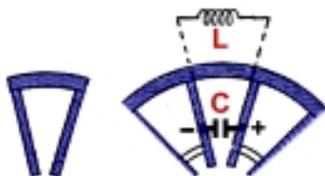
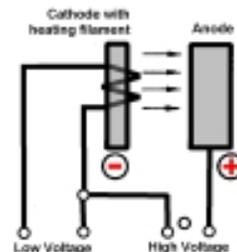


The magnetron requires a high DC voltage (4,000 Volt), a low AC voltage for the heating of cathodes and a magnetic field to be able to work.

The cathode is heated in order to cause the electrons emitting, so that they will flow to the anode.

In order to achieve the oscillation, one needs a permanent magnet. Because of its magnetic field, the electrons are moving in an orbit round the cathode, instead of flowing in a straight line from the cathode to the anode.

In this connection, the electrons are passing the resonant chambers and produce oscillations.



These resonant chambers are specially formed. Within the high-voltage frequency range they have a capacitive and even inductive effect. They also determine the produced microwave frequency.

These oscillations are then guided via the antenna into the oven.

### **Measurements and repairs – Important notes!!!**

Precautionary measures have to be made before and during a repair to prevent that the after-sales technician is possibly exposed to microwave energy.

\*Never put the oven into operation with an open door!

\*Before putting an oven to be repaired into operation, carry out the previous safety tests.

Locking behaviour of the door – sealings and surfaces – hinges and lock bolts – mechanical (foreign) interventions from the outside.

### **In case of measurements or repairs: PULL THE MAINS PLUG!!!**

By all means discharge the high-voltage capacitor before. This must be made by suitable lines with isolated peaks.

With every microwave oven it is necessary to carry out a high frequency leakage check (measurement of leaky rays) and the checking according to VDE 0701 after a repair (the mere opening of the oven is also a repair).

Microwave ovens must only be repaired by technicians who are correspondingly trained and informed and who have the required tools, measuring instruments and technical documents.

# Measurement of capacity – simple version

1 liter water (17 -24°)  
62 seconds full capacity



**Important**

- Use a container with thin material. Thick container walls extract parts from the water of the rising heat and falsify the measuring result.
- If possible, initial temperature 20°C
- Exact time measurement
- An exact thermometer, if possible a digital one
- Stir the water before the measurement

temperature difference (C°)	MW-output power (W)
7	490
8	560
9	630
10	700
11	770
12	840
13	910
14	980
15	1050
16	1120
17	1190

# Measurement of capacity levels



The most reasonable method is the time control of power absorption by a metra tester (left) or a current probe (right).  
If the current increases abruptly, the high-voltage part begins operating and microwave energy is emitted.



The proportion of on/off switching times are to be taken from the technical documents:

Simplest rule:

50% on – 50% off  
50% capacity

30% on – 70% off  
30% capacity

Useful clock cycle:  
30 seconds

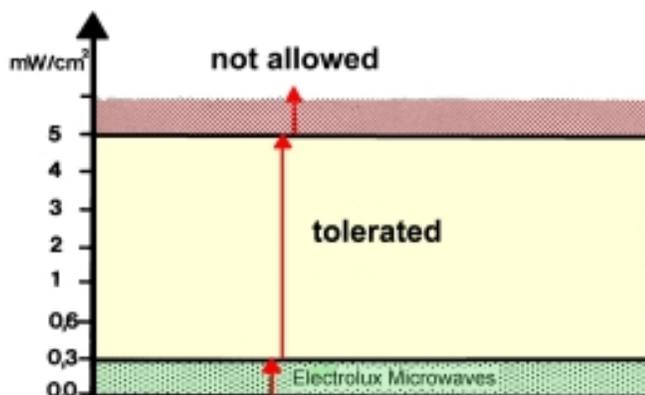


POWER LEVEL	OUTPUT POWER AGAINST FULL POWER	RELAY "1" TURN ON, OFF TIME	
		ON	OFF
0	0/29 (0%)	000	000
1	3/29 (10%)	000	000
2	5/29 (17%)	000	000
3	8/29 (28%)	000	000
4	11/29 (38%)	000	000
5	14/29 (48%)	000	000
6	17/29 (59%)	000	000
7	20/29 (69%)	000	000
8	23/29 (79%)	000	000
9	26/29 (90%)	000	000
11	29/29 (100%)	000	000

## Rules for leaky rays

In most countries the limit for leaky rays, which is determined by law, is fixed to:

**max. 5 mW/cm<sup>2</sup> in a distance of 5 cm**



The door of a modern microwave oven is normally designed for a HF leakiness of much less than 1 mW/cm<sup>2</sup>.

This result should also be achieved during re-adjusting.

**Even when the human body "stands" 100 mW/cm<sup>2</sup> within 24 hours, is this no reason to check carelessly!!!**

## Measurement of leaky rays

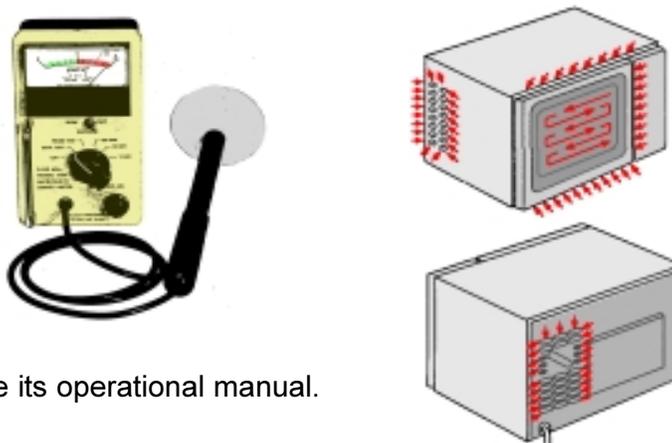
Pour **275 ml tap water** into a measuring cup and place it in the middle of the oven.

**Close door**

**Timer to 3 minutes**

**Capacity to 100%**

**Start oven**

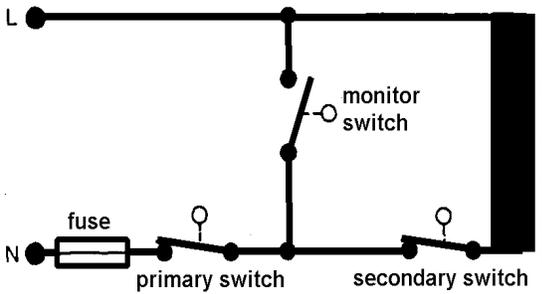


For use of the measuring device, see its operational manual.

Check the leaky rays by moving the test probe from right above clockwise, starting at the door, not faster than 25 mm/sec, back to the initial position.

The measurement must be made in a distance of 5 cm. Styrofoam distance pieces or other distance pieces are in most cases already integrated in the instrumental probe. Check also the whole door front as well as all openings and edges of the casing.

# Electric checking of the interlock door safety system



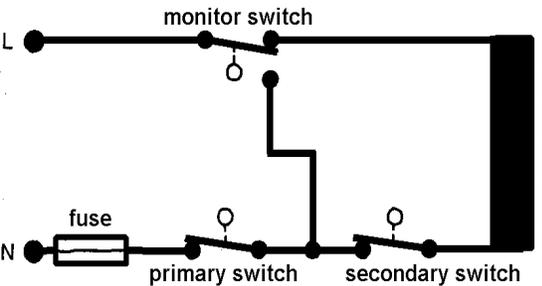
## PRIMARY/SECONDARY SWITCH

The measuring of these switches is made with disconnected connecting leads and when the door is opened/closed.

## MONITORING SWITCH:

It is recommended to measure the passage after the primary switch. Its connecting lead must be disconnected.

In any case, the monitoring switch has to short-circuit the input circuit with an open door.

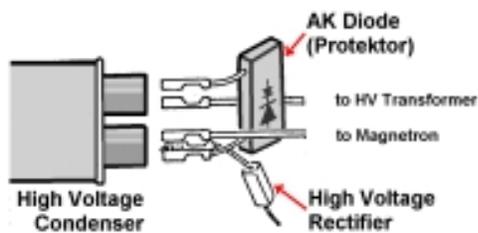


Switch	Door Open	Door Closed
Primary interlock switch	$\infty$	0
Secondary interlock switch	$\infty$	0
Interlock monitor circuit	0	$\infty$

## Required values

In this list you can find the values to be measured in a table form, in this case >passage< or >infinite<.

# Measuring the fuse diode (AK-Diode)



left: The high-voltage connection diagram of capacitor and diodes

## Attention:

Wrong connections affect an immediate damaging resp. destruction of components!

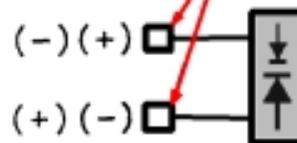
**Disconnect the mains plug before any measurement!!!**

**Check Continuity between the Terminals**

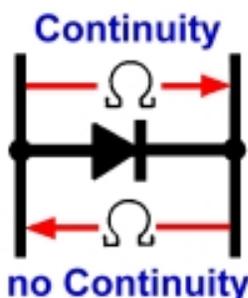
\*Short-circuit the capacitor with suitable isolated means and thus discharge it.

\*Check the fuse diode in both directions for passage.

\*An intact fuse diode must LOCK in both directions!



# Checking the high-voltage diode



- **Unplug the oven from the mains!**

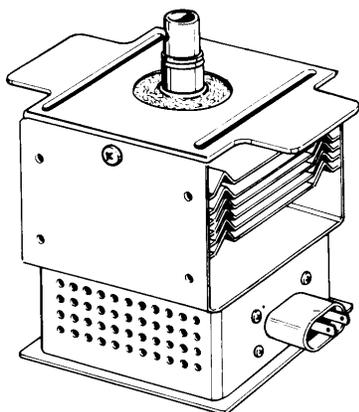
- Ensure that the capacitor is discharged!

- Disconnect the diode for measurement.

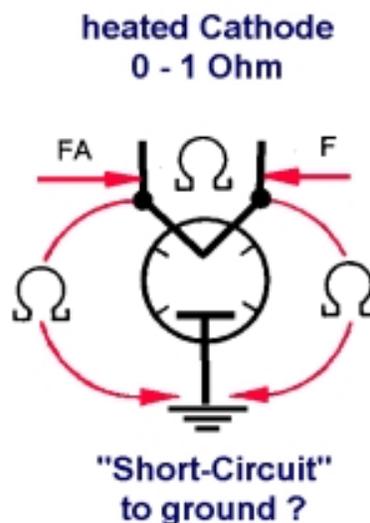
- Measure in both directions using an ohmmeter with the highest adjustment.

In one direction the diode must lock in full, in another direction you have to measure a three-digit kOhm value. The measuring instrument must have a supply voltage of over 9 V, as a certain threshold voltage must be overcome with this diode.

## Measuring the magnetron

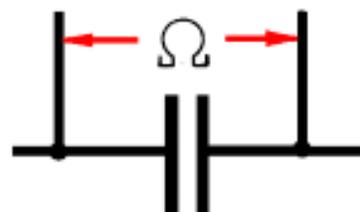


- **disconnect the mains plug**
- ensure that the capacitor has been discharged!
- separate the magnetron
- measure the resistance between the connections
- The resistance of the cathode (heating) should be approx. 0.5 Ohm.
- The resistance of the connections to the mass of the casing must be infinite.



## Measuring the high-voltage capacitor

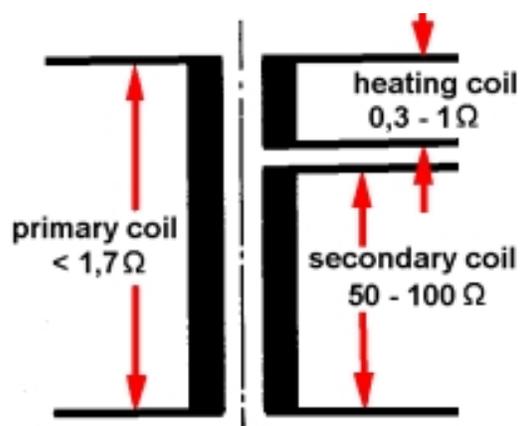
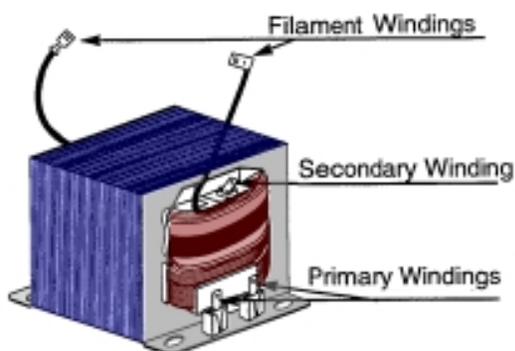
- Small resistance increasing fast... ... ok  
 Small resistance remaining... ... short-circuit  
 Very high resistance remaining... ... interruption



In the case of a capacitor exchange, please use by all means the original capacitor.

The correct function and the values depend to a great extent on the exact capacity.

## Checking the high-voltage transformer



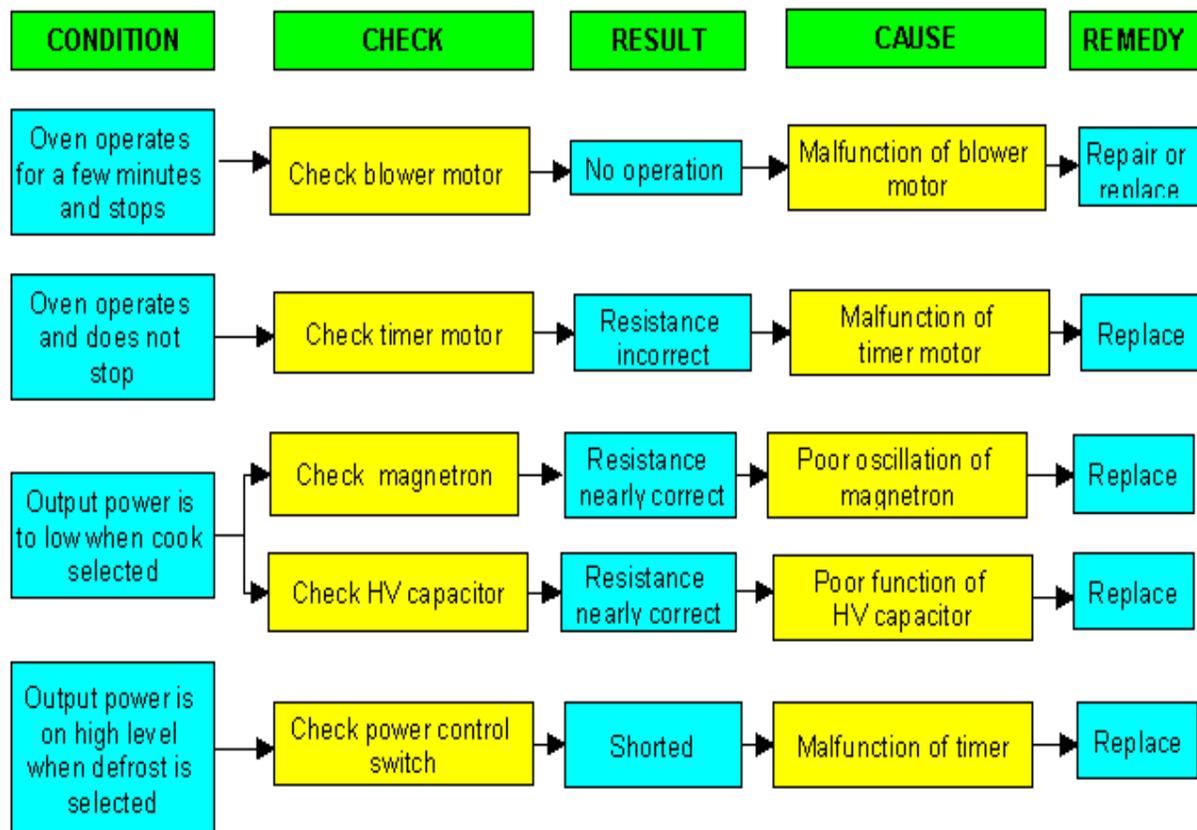
## Fault finding tree of timer-controlled microwave ovens Mains voltage existing – timer in function – door closed

CONDITION	CHECK	RESULT	CAUSE	REMEDY
Cavity lamp does not light and oven also does not operate	Check continuity of interlock switch	No continuity	Malfunction of interlock switch	Replace
	Check continuity of timer switch	No continuity	Malfunction of timer switch	Replace
	Check fuse	No continuity	Blown fuse	Replace
	Check continuity of cavity thermostat	No continuity	Malfunction of cavity thermostat	Replace
	Check continuity of magnetron thermostat	No continuity	Malfunction of magnetron thermostat	Replace

## Fault finding tree of timer-controlled microwave ovens Mains voltage existing – timer in function – door closed

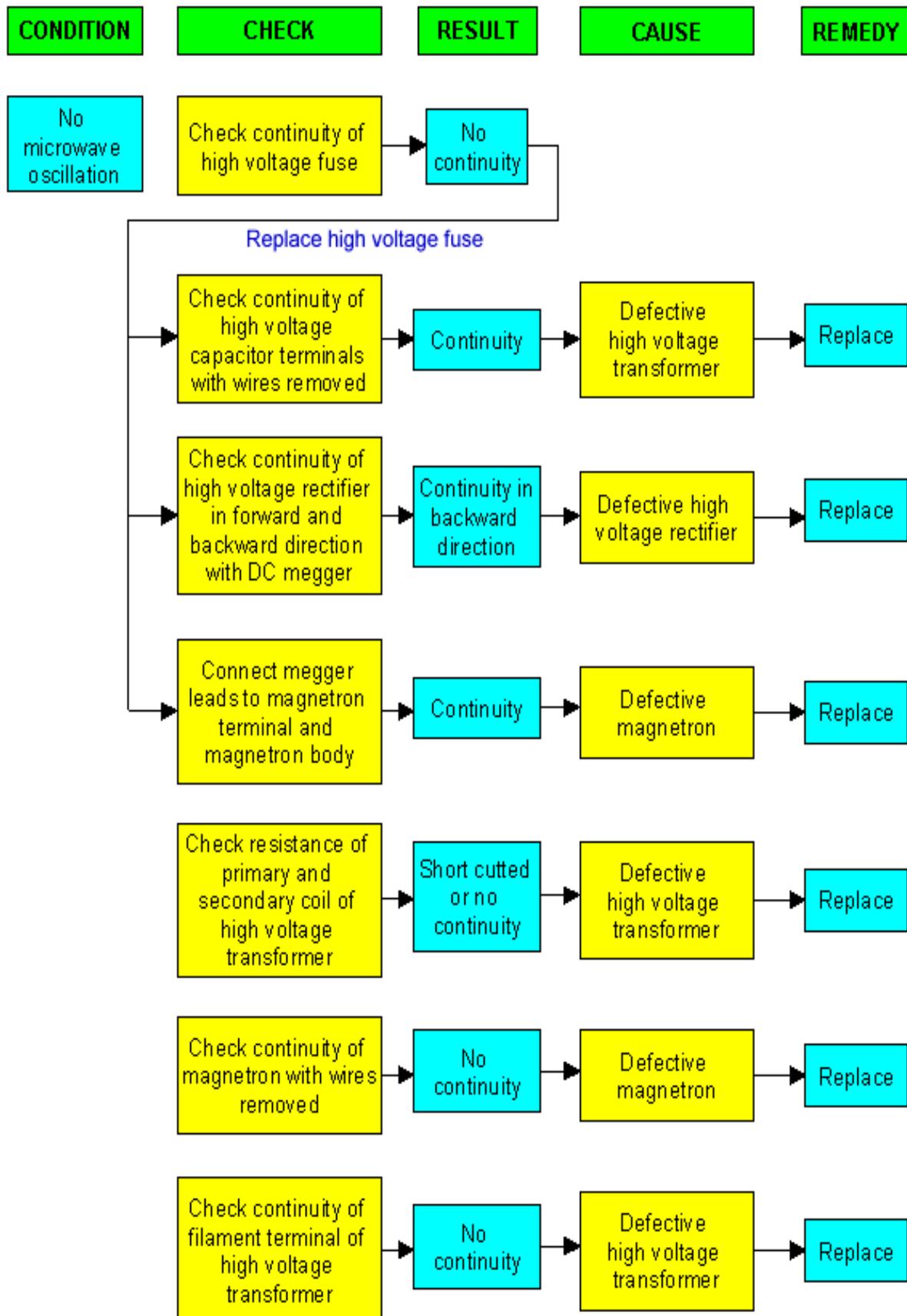
CONDITION	CHECK	RESULT	CAUSE	REMEDY
Oven does not operate but cavity lamp lights	Check continuity of power control switch	No continuity	Malfunction of interlock switch	Replace
	Check continuity of HV transf. windings	Resistance incorrect	Malfunction of HV transformer	Replace
	Check HV diode and HV fuse	Resistance incorrect	Malfunction of HV diode or/and fuse	Replace
	Check HV capacitor	Resistance incorrect	Malfunction of HV capacitor	Replace
	Check magnetron	Resistance incorrect	Malfunction of magnetron thermostat	Replace

## Fault finding tree of timer-controlled microwave ovens Mains voltage existing – timer in function – door closed



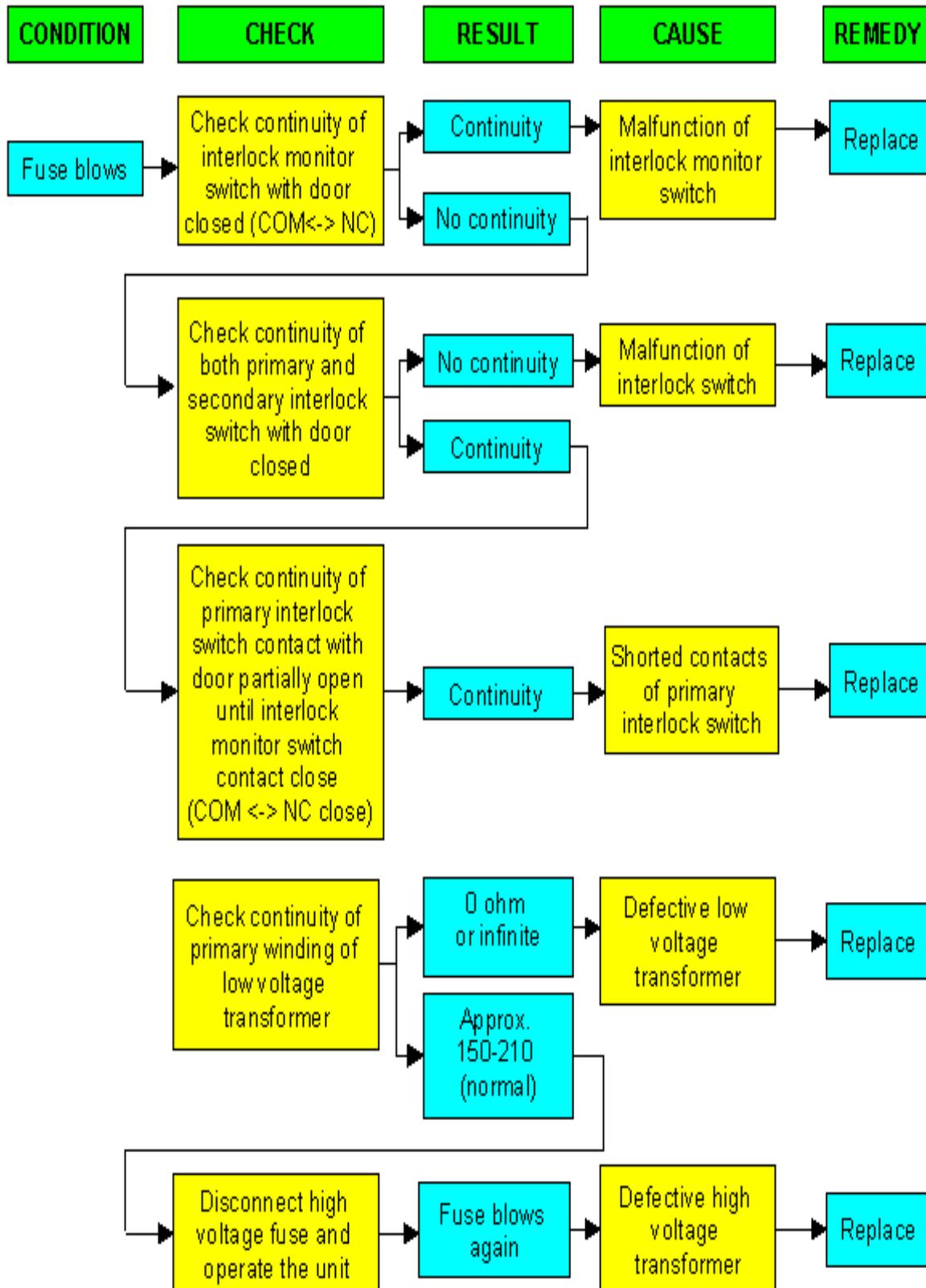
# Fault finding tree for microwave ovens

## No microwave capacity – fan is running



# Fault finding tree for microwave ovens

## No function – no reaction to any entry



## For the end, some well-aimed advises for the consumer



- Give enough time to the meals to get hot. There are some parts which need more time.
- The meals should not be served directly from the microwave oven. When you leave them covered for some minutes, the heat can better balance itself.
- Thick slices of meat, for example, are mostly hotter outside than inside.
- Round cylindrical parts of food with a diameter of 20 to 50 mm, however,

tend to become hotter inside than outside.

- Basically, packing material and especially metal foils should be removed before the cooking.
- However, if the shielding effect is intended, you have to stick to a distance of 2 cm to the oven wall, that no sparks will jump over.
- As these meals get cooked very fast, a lot of steam will arise. When the meals are covered (only loose!), nothing will fall down in the oven.
- The heat within covered meals is spreading better.



- Covered meals do not dry up so fast.
- When an over-baking is intended, the food should not be covered.
- When using the grilling function, of course nothing should be covered as well!
- Liquid meals should be stirred from time to time.
- Add some water to harder vegetables (e.g. carrots).
- It is not necessary to add liquid to softer vegetables (e.g. tomatoes).

-If possible, defrost frozen and unpacked meat in a glass or porcelain container. At best on a drain plate, so that a liquid that arises during the defrosting can flow off.

-It is advantageous to turn defrosting food, if possible, after the half defrosting time.

-If possible, do not defrost the food completely with microwave energy. Thus you can avoid irregularities (dry rims).



- Basically, do not defrost in the packing material. It makes no difference whether board, paper or plastics – not in metal anyway.
- Fruits and vegetables should also not be defrosted completely in the microwave oven, if it is not further used immediately. Some room temperature at the end of defrosting is good for the taste.
- If required, fruits and vegetables can however be cooked ready directly from the frozen condition. Naturally, capacity and time have to be adjusted.

-Instant meals in aluminium plates or plastic containers with metal-coated cover foils (of course, prick it!) can be heated in the microwave oven as far as the producer explicitly indicates it on the packing.

-The picture on the left demands "give it into a dish". Therefore unpack it!

-Information of food producers, however, are not always an "excuse".



## Notes for setting the capacity

***Following survey shows the capacity settings with the processes, for which they are provided.***

- 900 W** - heating of liquids
- and over** - parboiling and initial frying at the beginning of a cooking process
  
- 750 W** - cooking of vegetables (rather less)  
- cooking of food (rather less)
  
- 600 W** - defrosting and heating of frozen foods  
- heating of one-pot courses
  
- 500 W** - finish cooking of hot pots  
- cooking of egg dishes
  
- 450 W** - continued cooking of meals
- 350 W** - cooking of sensitive food  
- heating of baby food
  
- 250 W** - swelling up of rice  
- melting of gelatine
  
- 150 W** - defrosting of meat, fish, bread
  
- 80 W** - defrosting of cheese, cream, butter  
- raise the yeast dough  
- preheating of cold meals or beverages