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Capacitors for microwave ovens -- Part 1: General (IEC 61270-1:1996)

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EUROPEAN STANDARD

EN 61270-1

NORME EUROPÉENNE

EUROPÄISCHE NORM

November 1996

ICS 31.060.00; 97.040.20

Descriptors: Power capacitors, microwave ovens, definitions, use conditions, safety, construction characteristics, creepage distances, clearance distances, tests, voltage tests, mechanical tests, climatic tests, capacitance measurement, testing conditions, marking

English version

**Capacitors for microwave ovens**  
**Part 1: General**  
(IEC 1270-1:1996)

Condensateurs pour les fours  
à micro-ondes  
Partie 1: Généralités  
(CEI 1270-1:1996)

Kondensatoren für  
Mikrowellenkochgeräte  
Teil 1: Allgemeines  
(IEC 1270-1:1996)

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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**CENELEC**

European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

### Foreword

The text of document 33/228/FDIS, future edition 1 of IEC 1270-1, prepared by IEC TC 33, Power capacitors, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61270-1 on 1996-10-01.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1997-07-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1997-07-01

For products which have complied with the relevant national standard before 1997-07-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 2002-07-01.

Annexes designated "normative" are part of the body of the standard.  
Annexes designated "informative" are given for information only.  
In this standard, annex ZA is normative and annex A is informative.  
Annex ZA has been added by CENELEC.

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#### Endorsement notice

SIST EN 61270-1:1999

The text of the International Standard IEC 1270-1:1996 was approved by CENELEC as a European Standard without any modification.

In the official version, in clause A.4, the following notes have to be added after the reference to IEC 309-1:

NOTE 1: IEC 309-1:1988 + corrigendum March 1992 is harmonized as EN 60309-1:1992 (modified).

NOTE 2: IEC 695-2-1/0 to 1/3:1994 are being harmonized by CENELEC.

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## CAPACITORS FOR MICROWAVE OVENS –

### Part 1: General

#### 1 General

##### 1.1 *Scope and object*

This part of IEC 1270 applies to capacitors for microwave ovens operating at rated a.c. voltages of up to 3 000 V and a superimposed d.c. voltage of up to  $0,8 \cdot \sqrt{2}$  times the value of rated a.c. voltage.

This standard relates specifically to capacitors with a metal case and an upper rated maximum temperature of up to 100 °C, non-self-healing, with metal foil electrodes and dielectrics of paper and/or plastic, impregnated with a suitable oil.

The object of this standard is:

- a) to formulate uniform rules regarding performance, testing and rating;
- b) to formulate specific safety rules.

##### 1.2 *Normative references*

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 1270. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 1270 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 68-1: 1988, *Environmental testing – Part 1: General and guidance*

IEC 68-2, *Environmental testing – Part 2: Tests*

IEC 68-2-1: 1990, *Environmental testing – Part 2: Tests – Tests A: Cold*

IEC 68-2-3: 1969, *Environmental testing – Part 2: Tests – Test Ca: Damp heat, steady state*

IEC 68-2-14: 1984, *Environmental testing – Part 2: Tests – Test N: Change of temperature*

IEC 68-2-20: 1979, *Environmental testing – Part 2: Tests – Test T: Soldering*

IEC 68-2-21: 1983, *Environmental testing – Part 2: Tests – Test U: Robustness of terminations and integral mounting devices*

IEC 112: 1979, *Method for determining the comparative and the proof tracking indices of solid insulating materials under moist conditions*

IEC 335-2-25: 1993, *Safety of household and similar electric appliances – Part 2: Particular requirements for microwave ovens*

## 2 Definitions

For the purposes of this part of IEC 1270, the following definitions apply.

**2.1 capacitor for microwave ovens:** Power capacitor which is connected in the main power supply circuit of the magnetron of a microwave oven operated from a 50 Hz or 60 Hz power line, the capacitor being a component of the circuit for stabilizing the magnetron current.

**2.2 capacitor element:** Device which consists of two electrodes separated by a dielectric. The capacitor is constructed by assembling together one or more capacitor elements inside the same case and connecting the electrodes to external terminals.

**2.3 rated voltage ( $U_N$ ):** The r.m.s. value of the alternating voltage for which the capacitor has been designed. A superimposed d.c. voltage of up to  $0,8\sqrt{2}$  times the value of the rated a.c. voltage is permitted.

**2.4 highest rated voltage ( $U_m$ ):** Highest r.m.s. value of the alternating voltage(s) at which the capacitor has been designed to operate; it can be of interest particularly when two or more capacitors are structurally combined together inside the same case. Then  $U_m$  is the highest rated voltage of the combined capacitors.

$U_m$  is used as the reference for measuring the insulation between the terminals and the case.

Unless otherwise specified,  $U_m = U_N$ , but in any case  $U_m \geq U_N$ . Any difference between the highest rated voltage ( $U_m$ ) and the rated voltage ( $U_N$ ) should be indicated on the capacitor.

**2.5 minimum permissible capacitor operating temperature:** Minimum permissible temperature on the outside of the case at the moment of switching on the capacitor.

**2.6 maximum permissible operating temperature ( $t_c$ ):** Maximum permissible operating temperature of the hottest area of the outside of the capacitor case during operation.

**2.7 rated frequency ( $f_N$ ):** Highest mains frequency for which the capacitor has been designed to operate, i.e. 50 Hz or 60 Hz.

**2.8 rated capacitance of the capacitor ( $C_N$ ):** Capacitance value for which the capacitor has been designed.

**2.9 rated current ( $I_N$ ):** The r.m.s. value of the alternating current at the rated voltage and frequency.

**2.10 type of capacitor:** Capacitors are considered to be of the same type when of similar constructional form, the same constructional technology, the same rated voltage, the same climatic category and the same kind of operation. Capacitors of the same type can differ only in rated capacitance and size. Minor differences between terminations and mounting devices are permitted.

**2.11 model of capacitor:** Capacitors are considered to be of the same model when they are of the same construction and have the same functional and dimensional characteristics within the tolerance limits and are consequently interchangeable.

**2.12 application class of capacitor:** Two application classes of capacitors are considered:

- standard class: capacitors for standard applications (household microwave ovens);
- professional class: capacitors for commercial microwave ovens (microwave ovens for communities, refectories, canteens, hospitals, restaurants, etc.).

### 3 Service conditions

This standard gives the requirements for capacitors intended for use under the following conditions:

#### 3.1 Altitude

Not exceeding 2 000 m.

#### 3.2 Pollution

Capacitors included in the scope of this standard are designed for operation in lightly polluted atmospheres.

NOTE - The IEC has not yet established a definition for "lightly polluted". When this definition is established, it will be incorporated in this standard.

#### 3.3 Operating temperature

Between  $-10\text{ }^{\circ}\text{C}$  and  $+100\text{ }^{\circ}\text{C}$  (see 2.5 and 2.6). The preferred minimum and maximum permissible capacitor operating temperatures are as follows:

- minimum temperature:  $-10\text{ }^{\circ}\text{C}$ ;
- maximum temperatures:  $+60\text{ }^{\circ}\text{C}$ ;  $+70\text{ }^{\circ}\text{C}$ ;  $+85\text{ }^{\circ}\text{C}$ ;  $+100\text{ }^{\circ}\text{C}$ .

Capacitors shall be suitable for transport and storage at temperatures down to  $-25\text{ }^{\circ}\text{C}$ , without adverse effect on their quality.

#### 3.4 Damp heat severity

The preferred severity is 21 days, according to IEC 68-2-3.

No lower severity is allowed.



## 4 Safety and construction

### 4.1 Safety

4.1.1 Capacitors shall be constructed in such a way that no external damage is caused in normal conditions of transport.

4.1.2 Where the individual capacitor elements are protected by fuses, these fuses shall be so dimensioned and so arranged within the circuitry of the capacitor unit that they will not disconnect in the event of a short circuit occurring outside the capacitor unit when it is being operated at the rated voltages. The appropriate fuse shall, however, operate in the event of the breakdown of one of the capacitor elements.

4.1.3 Resistors or diodes inside the capacitor case shall not reduce substantially the operational reliability of the capacitor, for instance due to the breakdown of the resistor or as a result of the action of chemical substances. In any case these components shall meet the relevant IEC standards.

4.1.4 Discharge resistors structurally combined with capacitors shall be so dimensioned that the voltage at the capacitor's terminals, 1 min after the operating voltage is switched off, shall have fallen to below 50 V. They shall also withstand the voltage test in accordance with 5.9. The effect of the superimposed d.c. voltage shall also be taken into account in the dimensioning of discharge resistors.

4.1.5 Capacitors for microwave ovens generally do not contain internal fuses. In case of internal breakdown, normally a low-resistance short circuit will result. In case of short circuit of the capacitor, if the fuse of the appliance is able to disconnect the electric circuit within 3 s, case rupture or fire will be avoided.

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The incorporation of such a fuse shall be in accordance with IEC 335-2-25.

### 4.2 Terminations

4.2.1 The terminations (screw, soldering, tag terminations) shall be so positioned that the capacitor, when correctly connected, will not be subjected to damage, short circuit or interruptions.

4.2.2 The mechanical resistance of the terminations shall be sufficient to prevent any risk of damage during assembling or operation, especially in case of a short circuit.

4.2.3 Terminals shall be correctly designed with reference to the necessary cross-section of the connecting conductors.

#### 4.2.4 Safety

Capacitors shall be installed in such a way so as to protect the terminations against casual contacts.

When the capacitor has no suitable protection on the terminals, the case as well shall be protected against casual contacts.

#### 4.3 Creepage distances and clearances

The creepage distances over external surface of terminal insulation and the clearances between the exterior parts of terminal connections or between such live parts and the metal case of the capacitor shall be not less than the minimum values given in table 1.

These minimum distances shall apply to the terminals with or without the external wiring connected. They are not intended to apply to internal creepage distances and clearances.

The requirements for specific applications shall be satisfied.

The contribution of any groove less than 1 mm wide shall be limited to its width.

Any air-gap of less than 1 mm shall be ignored in calculating the total air path. Creepage distances are distances in air, measured along the external surface of insulating material. These shall be calculated using *a* and *b* values given in table 1, according to the resistance to surface currents of the material (Comparative tracking index, CTI), as indicated in table 2.

**Table 1 – Minimum creepage distances and clearances**

Upper limit of the rated voltage		Distances in		
		air	surface	
Alternative current (r.m.s.) V	Direct current V	a mm	a mm	b mm
500	600	3	4	5,5
660	800	4	5,5	7
750	900	4,5	6	8
1000	1200	6	8	11
1500	1800	9	12	17
2000	2400	12	16	23
2500	3000	15	20	30
3000	3600	18	25	36
6000	7200	36	50	70

**Table 2 – Surface distances as a function of insulating materials**

Comparative tracking index <sup>1)</sup> V	Surface distances	
	with ribs	without ribs
CTI > 100	<i>b</i>	$(a + b) / 2$
CTI = 380	$(a + b) / 2$	<i>a</i>
CTI > 600	<i>a</i>	<i>a</i>

<sup>1)</sup> The CTI of the material is determined according to IEC 112, using solution A.

#### 4.4 Temperature dependence of the capacitance

The actual value of the capacitance of the capacitor, when stored for at least 3 h in the absence of voltage at the upper and lower temperature limits, may deviate from the actual value at 20 °C by not more than the amounts indicated in table 3 for each group. This shall be indicated by the manufacturer.

**Table 3 – Maximum capacitance deviations at the temperature limits**

Upper and lower temperature limit °C	Capacitor temperature °C		Groups of maximum capacitance deviation		
			a %	b %	c %
+100	+20	up to +100	+6	-5	+1,5
+85	+20	+85	+5,5	-5,5	+1,5
+70	+20	+70	+4,5	-4	+1
+60	+20	+60	+3,5	-3,5	+0,5
0	0	+20	-2	+1	+0,5 / -3
-10	-10	+20	-3	+3,5	+0,5 / -3

NOTE – The groups of table 3 correspond to the physical characteristics of common dielectrics. A linear interpolation between adjacent values of a, b, c columns is allowed in case of limit temperatures which differ from those indicated.

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#### 4.5 Capacitance tolerance

The capacitance tolerance is determined by the application. The preferred tolerance is  $\pm 4\%$ .

Coloured dots or other methods to identify narrower tolerance ranges inside the rated tolerance limits are acceptable. These indications shall be agreed between user and manufacturer.

#### 4.6 Voltage

When specifying the rated voltage ( $U_N$ ) and the highest rated voltage ( $U_m$ ) of a capacitor, account shall be taken of the operating voltage at the terminals for a long period under the least favourable operating conditions.

NOTE – The conditions resulting from the application of the tests of the microwave oven according to IEC 335-2-25 should be considered. However, only the conditions which may last for at least one full operation period of the oven should be taken into consideration.

#### 4.7 Load capacity

The capacitor shall be capable of being loaded as follows at its standard continuous service rating, at case temperatures up to  $t_c$ :

- with an a.c. voltage of 1,1 times the rated voltage ( $U_N$ );
- with an a.c. current of 1,3 times the current which flows through the capacitor at the rated voltage and rated frequency. Due to the effect of harmonics, the capacitor shall be able to be loaded for a short period of time with higher values of current. Duration and current value shall be agreed between user and manufacturer;
- with a superimposed d.c. voltage of up to  $0,88 \cdot \sqrt{2}$  times the rated a.c. voltage.