Interference suppression film capacitors MKP 335 1

MKP RADIAL POTTED CAPACITORS **PITCH 15/22.5/27.5 mm**

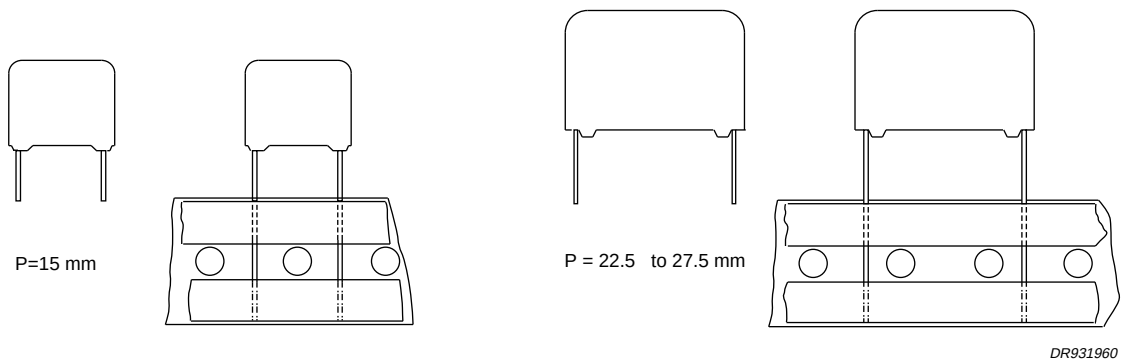

Fig.1 Simplified outlines.

FEATURES

- 15 to 27.5 mm lead pitch
- Supplied loose in box and taped on reel
- Consists of a low-inductive wound cell of metallized polypropylene film, potted in a flame-retardant case.

APPLICATIONS

- For X2-electromagnetic interference suppression
- Specially designed to meet the NEW REQUIREMENTS of the new *"IEC 384-14 2nd edition, EN 132400",* requiring a 2.5 kV peak pulse voltage test.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
Capacitance range (E6 series)	10 nF to 1 μF
Capacitance tolerance	±10%, ±20%
Rated voltage (AC), 50 to 60 Hz	250 V
Climatic category	40/085/21/C
Rated temperature	85 °C
Maximum application temperature	85 °C
Reference specifications	IEC 384-14 2nd edition, EN 132400; note 1
Safety approvals	UL1283, CSA-C22.2 No 8, SEV, VDE, FI, N, D, S, IMQ, ÖVE
Materials	qualified in accordance with UL94V-O
Safety class	X2

Note

1. IEC 384-14 2nd edition = EN 132400.

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MKP 335 1 GENERAL DATA **PITCH 15/22.5/27.5 mm**

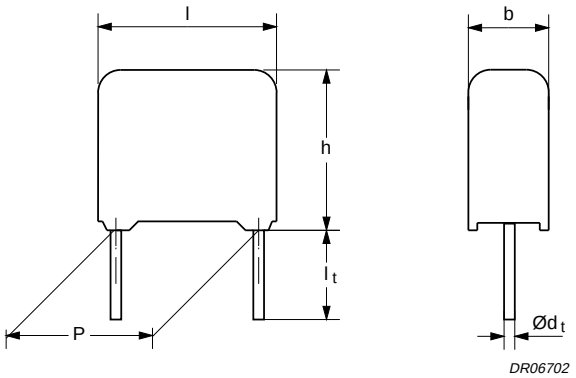


Fig.2 Outline.

Specific reference data for the 250 V AC capacitors

DESCRIPTION	VALUE	
	at 10 kHz	at 100 kHz
Tangent of loss angle:		
C ≤ 100 nF	$\leq 10 \times 10^{-4}$	$\leq 30 \times 10^{-4}$
100 nF < C ≤ 470 nF	$\leq 20 \times 10^{-4}$	$\leq 70 \times 10^{-4}$
C > 470 nF	$\leq 70 \times 10^{-4}$	–
Rated voltage pulse slope $(dU/dt)_R$	100 V/μs	
R between leads, for C ≤ 0.33 μF	>30000 MΩ	
RC between leads, for C > 0.33 μF	>10000 s	
Test voltage (DC)	1075 V; 1 s	

Available 250 V AC versions

PACKAGING	DIMENSIONS	C-tol	FIRST 9 DIGITS OF CATALOGUE NUMBER	ORDERING
Loose in box	l_t = 3.5 ±0.3 mm	±20%	2222 335 10...	preferred
		±10%	2222 335 11...	on request
	l_t = 5.0 ±1.0 mm	±20%	2222 335 16...	on request
		±10%	2222 335 17...	on request
	l_t = 25.0 ±2.0 mm	±20%	2222 335 14...	on request
		±10%	2222 335 15...	on request
Taped on reel	H = 18.5 mm; note 1	±20%	2222 335 12...	on request
		±20%	2222 335 13...	on request

Note

1. H = in-tape height; for detailed specifications refer to this handbook, Chapter *"Packaging"*.

Available 250 V AC versions on request

DIMENSIONS	C-tol	VALUES	ORDERING
l_t = 3.2 to 35 mm	–	E12 series	on request

Safety approvals

SAFETY APPROVALS	FILE NUMBERS	SAFETY APPROVALS	FILE NUMBERS
UL1283	E 109565	NEMKO (EN132400)	P941017.59
CSA-C22.2 No.8-M1986	LR 94054-7	DEMKO (EN132400))	108282EC121
SEV (EN132400)	96,770673	SEMKO (EN132400)	9439122
VDE (EN132400)	94632	IMQ (EN132400)	V 3205
FI (EN132400)	CCA/FI 880	ÖVE	PA21441/R

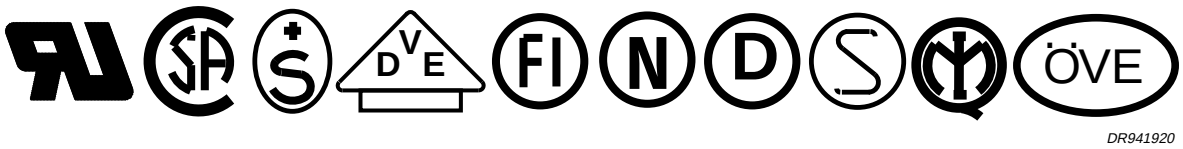


Fig.3 Safety approvals.

U_{Rac} = 250 V (AC) X2 **loose and taped**

C (µF)	DIMENSIONS b × h × l (mm)	MASS (g)	CATALOGUE NUMBER 2222 335 ..... AND PACKAGING			
			LOOSE IN BOX			REEL
			short leads		long leads	H = 18.5 mm
			l_t = 3.5 ±0.3 mm	SPQ	l_t = 25.0 ±2.0 mm	SPQ
			last 5 digits of catalogue number(1)		SPQ	
			C-tol = ±20%			
Pitch = 15.0 ±0.4 mm; d_t = 0.80 ±0.08 mm						
0.01 0.015 0.022 0.033	5.0 × 11.0 × 17.5	1.2	10103 10153 10223 10333	1000	1000	1100
0.033 0.047	6.0 × 12.0 × 17.5	1.4	note 2 10473	1000	1000	900
0.068	7.0 × 13.5 × 17.5	1.9	10683	1000	500	800
0.1	8.5 × 15.0 × 17.5	2.6	10104	1000	500	650
Pitch = 22.5 ±0.4 mm; d_t = 0.80 ±0.08 mm						
0.15	7.0 × 16.5 × 26.0	3.2	10154	200	500	550
0.22	8.5 × 18.0 × 26.0	4.4	10224	200	500	450
0.33	10.0 × 19.5 × 26.0	5.5	10334	200	500	350
Pitch = 27.5 ±0.40 mm; d_t = 0.80 ±0.08 mm						
0.47	11.0 × 21.0 × 31.0	7.8	10474	100	125	300
0.68	15.0 × 25.0 × 31.0	12.8	10684	100	125	200
1	18.0 × 28.0 × 31.0	17.2	10105	100	125	150

Notes

1. The shading indicates preferred types.
2. Other dimensions for 10% versions.

CONSTRUCTION

Description

- Low-inductive wound cell of metallized polypropylene (PP) film, potted with epoxy resin in a flame-retardant polypropylene case
- Radial leads, solder-coated
  - Copper clad steel wire (pitch = 6e)
  - Copper wire (pitch = 9e and 11e)
- Small stand-off pips allow removal of solder flux etc. during cleaning of the printed-circuit board.

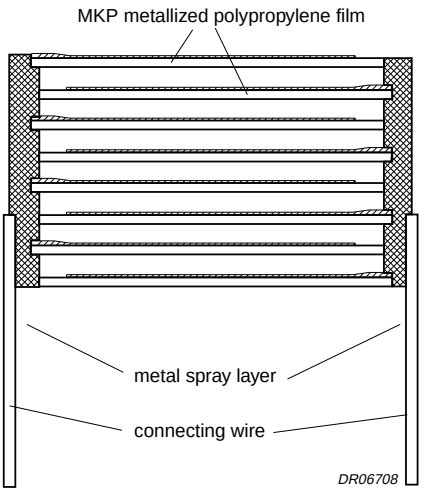


Fig.4 Construction.

Mounting

NORMAL USE

The capacitors are designed for mounting on printed-circuit boards. The capacitors packed in bandoliers are designed for mounting on printed-circuit boards by means of automatic insertion machines.
For detailed tape specifications refer to this handbook, Chapter *"Packaging"*.

SPECIFIC METHOD OF MOUNTING TO WITHSTAND VIBRATION AND SHOCK

In order to withstand vibration and shock tests, it must be ensured that the stand-off pips are in good contact with the printed-circuit board:

- For pitches of 15 mm the capacitors shall be mechanically fixed by the leads.
- For larger pitches the capacitors shall be mounted in the same way and the body clamped.

SPACE REQUIREMENTS ON PRINTED-CIRCUIT BOARD

The maximum length and width of film capacitors is shown in Fig.5:

- Eccentricity as in Fig.5. The maximum eccentricity is smaller than or equal to the lead diameter of the product concerned.
- Product height with seating plane as given by *"IEC 717"* as reference: $h_{max} \leq h + 0.3$ mm.

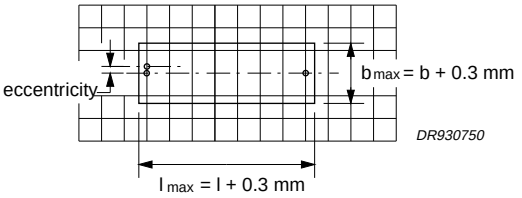


Fig.5 Lay-out.

RATINGS AND CHARACTERISTICS

Unless otherwise specified, all electrical values apply at an ambient free air temperature of 23 ±1 °C, an atmospheric pressure of 86 to 106 kPa and a relative humidity of 50 ±2%.

For reference testing, a conditioning period shall be applied over 96 ±4 hours by heating the products in a circulating air oven at the rated temperature and a relative humidity not exceeding 20%.

Capacitance

All capacitance values are specified at 1 kHz.

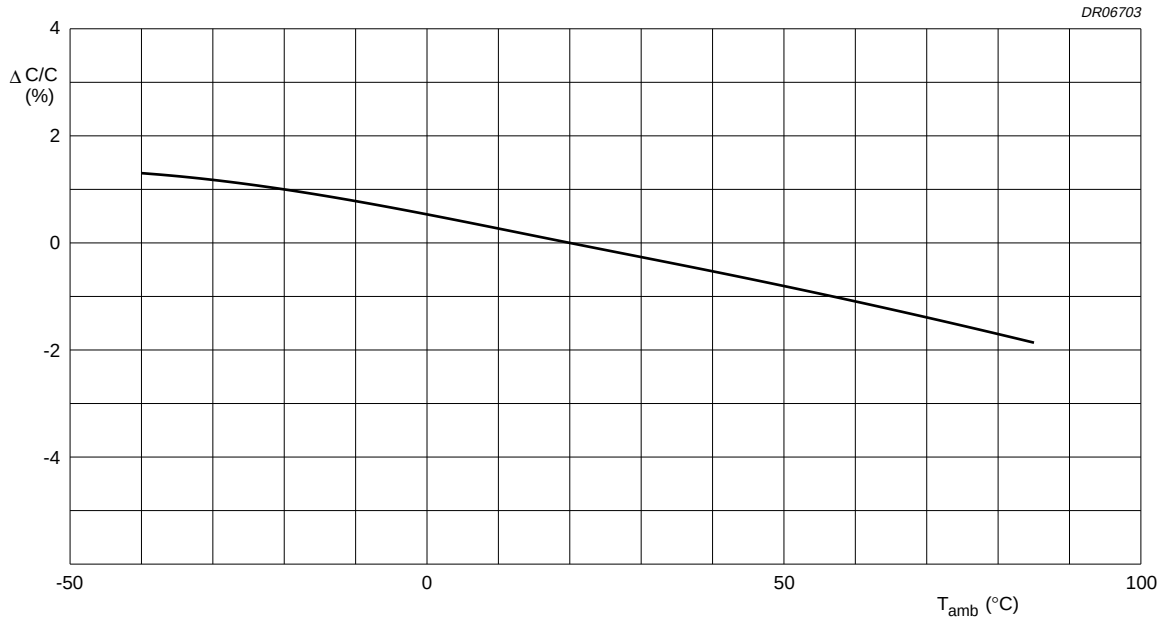


Fig.6 Capacitance change as a function of ambient temperature; typical curve.

Impedance

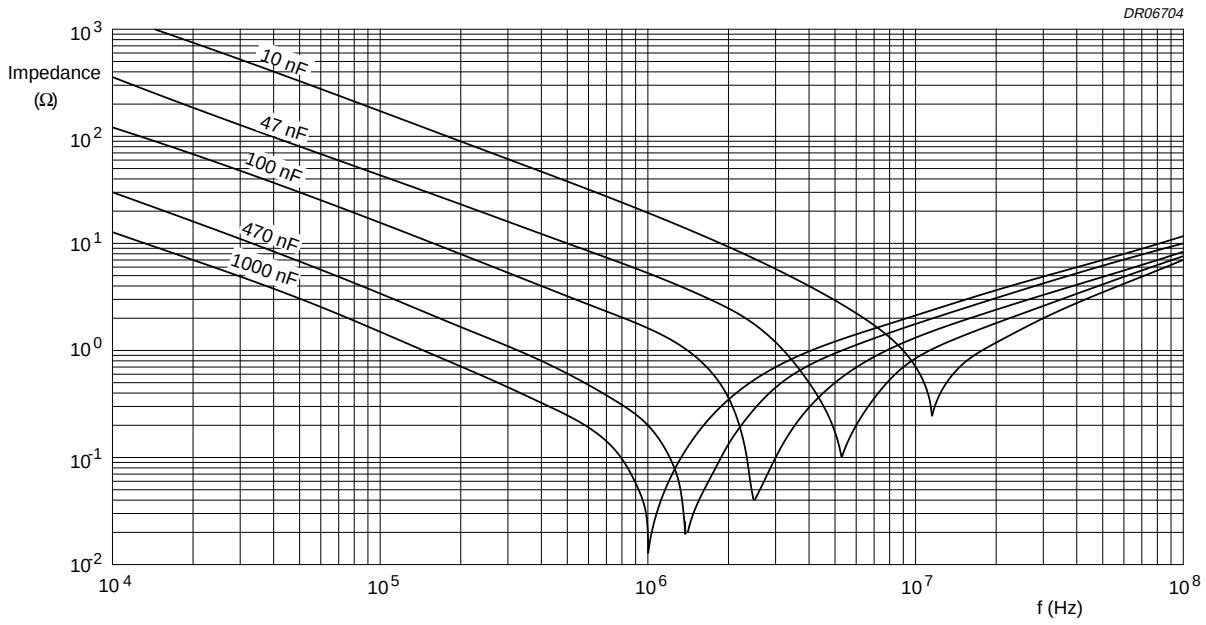


Fig.7 Impedance as a function of frequency; typical curves.

Resonant frequency

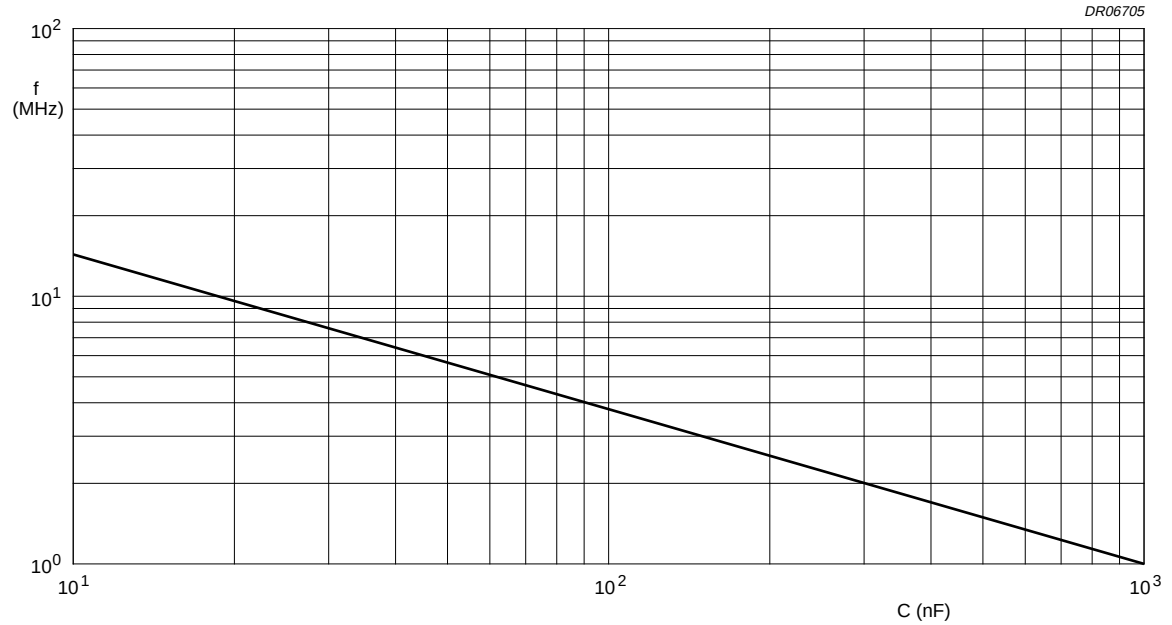


Fig.8 Resonant frequency as a function of capacitance; typical curve.

Maximum RMS voltage (sinewave) as a function of frequency for $T_{amb} \leq 85$ °C

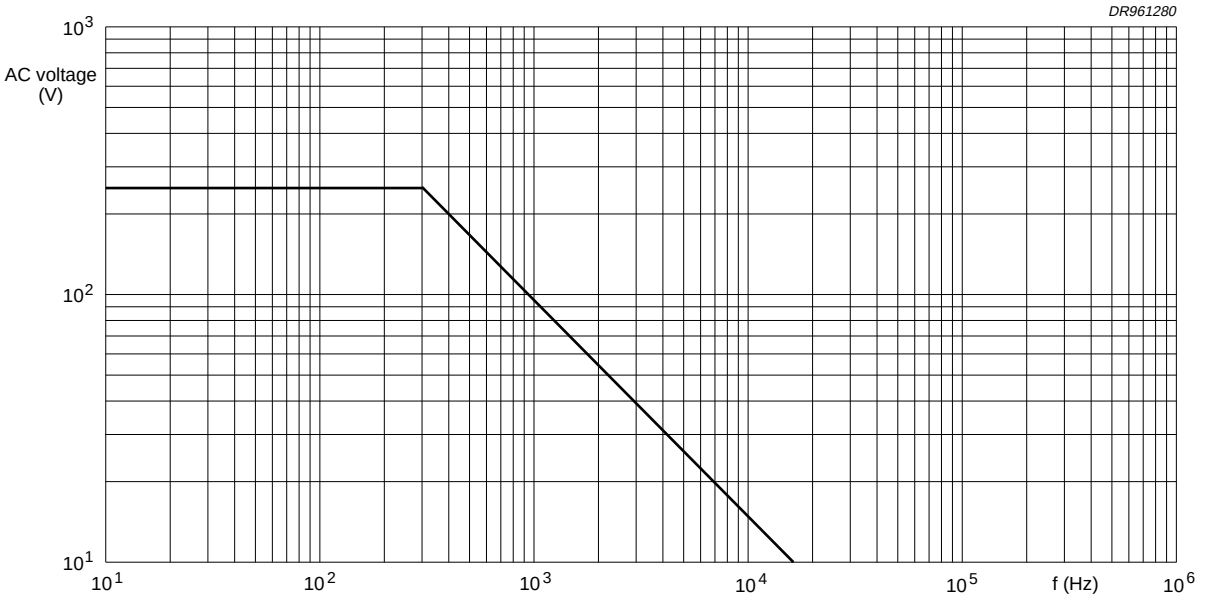


Fig.9 AC voltage (RMS value) as a function of frequency at $T_{amb} \leq 85$ °C.

Tangent of loss angle

CAPACITANCE	TANGENT OF LOSS ANGLE	
	at 10 kHz	at 100 kHz
C ≤ 100 nF	$\leq 10 \times 10^{-4}$	$\leq 30 \times 10^{-4}$
100 nF < C ≤ 470 nF	$\leq 20 \times 10^{-4}$	$\leq 70 \times 10^{-4}$
C >470 nF	$\leq 70 \times 10^{-4}$	–

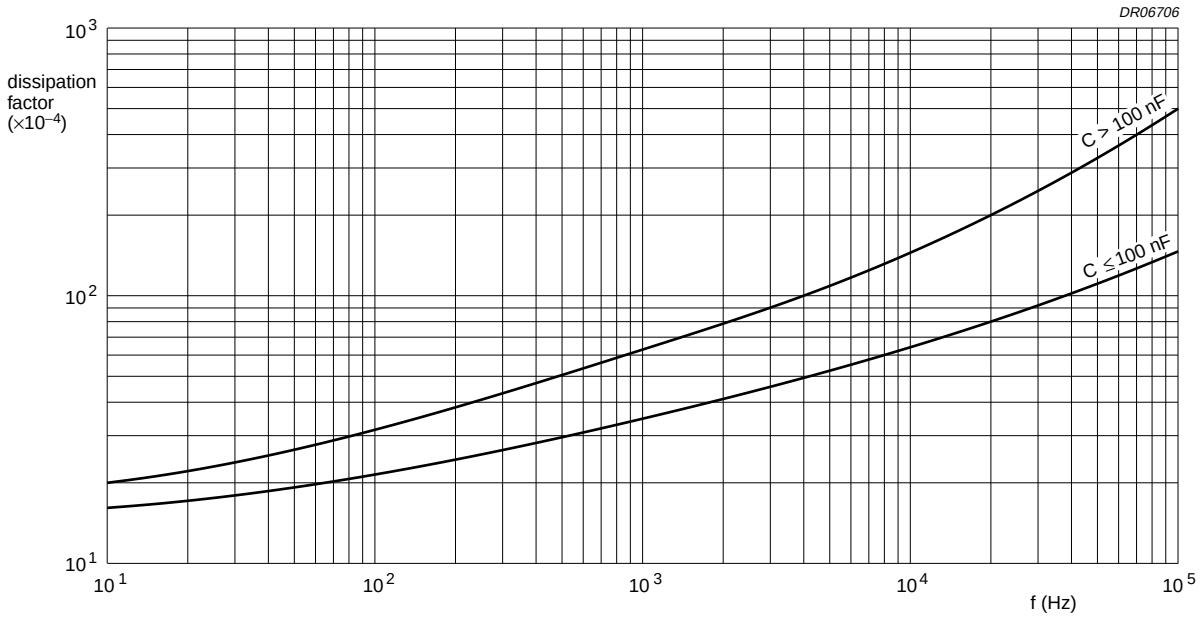


Fig.10 Tangent of loss angle as a function of frequency: typical curves

Temperature

- Storage temperature: T_{stg} = –25 to +40 °C with RH maximum 80% without condensation.

Voltage

- Test voltage between leads, 100% on line for 1 second: 1075 V (DC)
- Test voltage between interconnected leads and case (foil method): 2000 V (AC).

Rated voltage pulse slope $(dU/dt)_R$

Maximum pulse load: 100 V/µs.
If the pulse voltage is lower than the rated voltage, the values of the specific reference data can be multiplied by $\sqrt{2} \times U_{Rac}$ and divided by the applied voltage.

Insulation resistance

The insulation resistance is measured after a voltage of 100 ±15 V has been applied for 1 minute ±5 seconds, at T_{amb} = 20 °:

- R between leads for C ≤ 0.33 μF: >30000 MΩ
- RC between leads for C > 0.33 μF: >10000 s
- R between interconnected leads and case (foil method): >30000 MΩ.

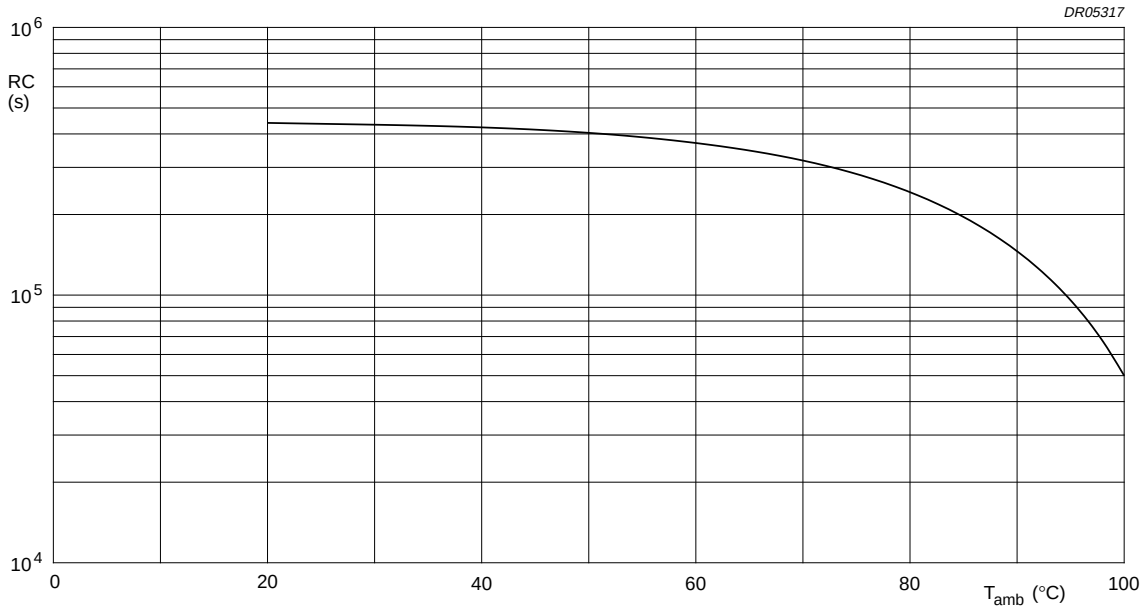


Fig.11 RC product as a function of ambient free air temperature; typical curve.

MARKING

Product marking

CAPACITORS WITH PITCH 15 TO 27.5 mm

The capacitors are marked by laser print; on the top (pitch ≥22.5 mm) or on the top and one side (pitch =15 mm), with the following information:

1. Rated capacitance code in accordance with *"IEC 62"*
2. Tolerance on rated capacitance; M = ±20%; K = ±10%
3. Rated voltage (AC) (250 V~)
4. Sub-class (X2)
5. Manufacturer's type designation (335 1)
6. Code for dielectric material (MKP)
7. Manufacturer (PHILIPS)
8. Year and week of manufacture (e.g. 9411)
9. Safety approvals.
   The products will not be marked with (N, D, and ÖVE) symbols.

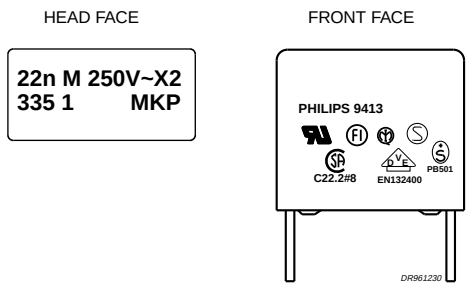


Fig.12 Example of marking for a capacitor with pitch 15 mm.

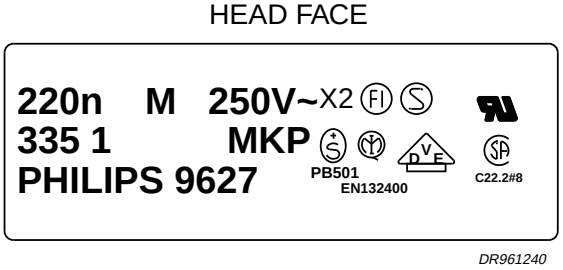
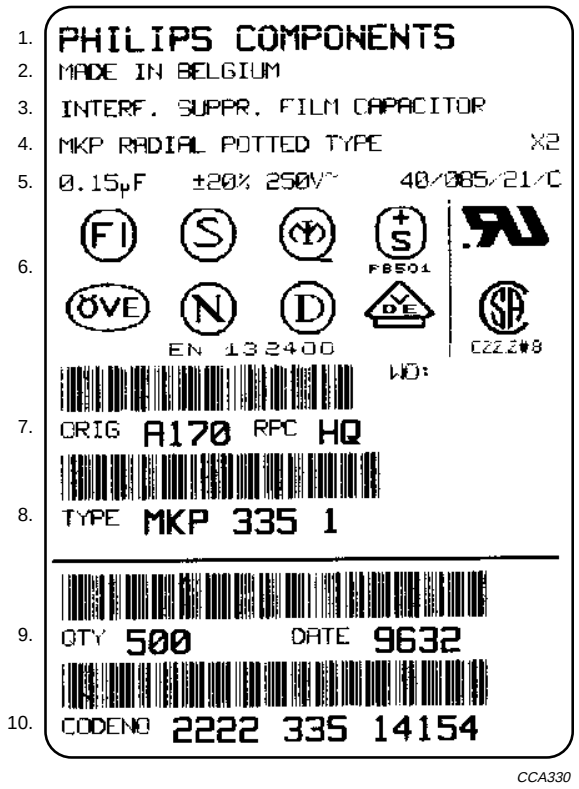


Fig.13 Example of marking for a capacitor with pitch 22.5 or 27.5 mm.

Package marking

The package containing the capacitors is marked as shown in Fig.14.



Barcode label marking

LINE	MARKING EXPLANATION
1	Manufacturer's name
2	Country of origin
3	Sub-family
4	Type description and safety class X2
5	Capacitance value, tolerance, voltage and climatic category *("IEC 68-1")*
6	Safety approvals
7	Preference origin code: A Country of origin in code: 170 (Belgium) Responsible production centre: HQ Work order: WO
8	Product type description
9	Quantity and production period, year and week code
10	Product code (12NC)

Fig.14 Barcode label.

QUICK REFERENCE TEST REQUIREMENTS (see note 1)

TEST	PROCEDURE (quick reference)	REQUIREMENTS
Robustness of leads		
Tensile and bending: *"IEC 68-2-21"*		no visible damage legible marking
Resistance to soldering heat: *"IEC 68-2-20"*	solder bath: 260 °C; 10 s	$\lvert\Delta C/C\rvert \leq 5\%$
Component solvent resistance	isopropyl alcohol; 23 °C; 5 minutes	$\Delta\tan\delta \leq 100 \times 10^{-4}$ ($C \leq 100$ nF); note 2 $\Delta\tan\delta \leq 200 \times 10^{-4}$ (100 nF < C ≤ 470 nF); note 2 $\Delta\tan\delta \leq 70 \times 10^{-4}$ ($C > 470$ nF); note 2
Robustness of component		
Rapid change of temperature: *"IEC 68-2-14"*	5 cycles 1 cycle = 30 minutes at –40 °C and 30 minutes at 85 °C	$\lvert\Delta C/C\rvert \leq 5\%$ $\Delta\tan\delta \leq 100 \times 10^{-4}$ ($C \leq 100$ nF); note 2 $\Delta\tan\delta \leq 200 \times 10^{-4}$ (100 nF < C ≤ 470 nF); note 2 $\Delta\tan\delta \leq 70 \times 10^{-4}$ ($C > 470$ nF); note 2
Vibration: *"IEC 68-2-6"*	10 to 55 Hz; amplitude 0.75 mm; 6 hours	
Shock: *"IEC 68-2-27"*	half sinewave; 490 m/s^2; 11 ms	
Climatic sequence		
Dry heat: *"IEC 68-2-2"*	16 hours; 85 °C	$\lvert\Delta C/C\rvert \leq 5\%$ $\Delta\tan\delta \leq 100 \times 10^{-4}$ ($C \leq 100$ nF); note 2 $\Delta\tan\delta \leq 200 \times 10^{-4}$ (100 nF < C ≤ 470 nF); note 2 $\Delta\tan\delta \leq 70 \times 10^{-4}$ ($C > 470$ nF); note 2 $R_{ins} \geq 50\%$ of specified value
Damp heat, cyclic, test Db, first cycle: *"IEC 68-2-30"*		
Cold: *"IEC 68-2-1"*	2 hours; –40 °C	
Damp heat, cyclic, test Db, remaining cycles: *"IEC 68-2-30"*		
Voltage proof: *"IEC 384-14"*	V_p = 1075 V (DC); 1 minute	

TEST	PROCEDURE (quick reference)	REQUIREMENTS
Other applicable tests		
Damp heat, steady state: *"IEC 68-2-3"*	21 days; 40 °C; 95 to 98% RH no load V_p = 1075 V (DC); 1 minute	$\lvert\Delta C/C\rvert \leq 5\%$ $\Delta\tan\delta \leq 100 \times 10^{-4}$ ($C \leq 100$ nF); note 2 $\Delta\tan\delta \leq 200 \times 10^{-4}$ (100 nF < C ≤ 470 nF); note 2 $\Delta\tan\delta \leq 70 \times 10^{-4}$ ($C > 470$ nF); note 2 $R_{ins} \geq 50\%$ of specified value
Endurance (AC): *"IEC 384-14"*	3×2.5 kV pulse voltage; 1000 hours; $1.25 \times U_{Rac}$ at 85 °C; once per hour; 0.1 s; 1000 V (RMS) via resistor of 47 Ω, V_p = 1075 V (DC); 1 minute	$\lvert\Delta C/C\rvert \leq 10\%$ $\Delta\tan\delta \leq 100 \times 10^{-4}$ ($C \leq 100$ nF); note 2 $\Delta\tan\delta \leq 200 \times 10^{-4}$ (100 nF < C ≤ 470 nF); note 2 $\Delta\tan\delta \leq 70 \times 10^{-4}$ ($C > 470$ nF); note 2 $R_{ins} \geq 50\%$ of specified value
Charge and discharge: *"IEC 384-14"*	10000 cycles; 5 ms; $1.5 \times$ dV/dt	$\lvert\Delta C/C\rvert \leq 10\%$ $\Delta\tan\delta \leq 100 \times 10^{-4}$ ($C \leq 100$ nF); note 2 $\Delta\tan\delta \leq 200 \times 10^{-4}$ (100 nF < C ≤ 470 nF); note 2 $\Delta\tan\delta \leq 70 \times 10^{-4}$ ($C > 470$ nF); note 2 $R_{ins} \geq 50\%$ of specified value
Passive flammability: *"IEC 695-2-2"*	class C	no burning
Active flammability: *"IEC 384-14"*	20×2.5 kV discharge	no burning
Heat storage: *"IEC 384-14"*	1000 hours; 85 °C	$\lvert\Delta C/C\rvert \leq 5\%$ $\Delta\tan\delta \leq 100 \times 10^{-4}$ ($C \leq 100$ nF); note 2 $\Delta\tan\delta \leq 200 \times 10^{-4}$ (100 nF < C ≤ 470 nF); note 2 $\Delta\tan\delta \leq 70 \times 10^{-4}$ ($C > 470$ nF); note 2
Resistance to soldering heat with preheating: *"IEC 384-14"*	preheating: 85 °C; solder bath: 260 °C; 10 s	$\lvert\Delta C/C\rvert \leq 5\%$ $\Delta\tan\delta \leq 100 \times 10^{-4}$ ($C \leq 100$ nF); note 2 $\Delta\tan\delta \leq 200 \times 10^{-4}$ (100 nF < C ≤ 470 nF); note 2 $\Delta\tan\delta \leq 70 \times 10^{-4}$ ($C > 470$ nF); note 2

Notes

1. For detailed information, see *"Type specification"*.
2. Measuring frequency 100 kHz for C ≤ 470 nF and 10 kHz for C > 470 nF.