DATA SHEET

MKP 435 X2
Interference suppression film capacitors, insulated leads

Product Specification
NEW
File under BCcomponents, BC05

2001 Jun 22

BC COMPONENTS

Interference suppression film capacitors, insulated leads — MKP 435 X2

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

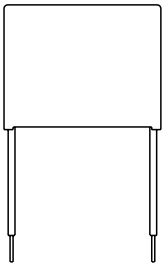

Fig.1 Simplified outlines.

FEATURES

- 15 to 27.5 mm lead pitch
- Insulated leads
- Supplied loose in box
- 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 requirements of the "IEC 60384-14 2nd edition and EN 132400", requiring for X2 a 2.5 kV peak pulse voltage test and both UL1414 and CSA-C22.2 No 1 specifications.

DETAIL SPECIFICATION

For more detailed data and test requirements see "*Type detail specification HQN-384-14/117*".

QUICK REFERENCE DATA

DESCRIPTION	VALUE
Capacitance range (E12 series)	0.01 to 1.0 µF
Capacitance tolerance	±20%, ±10%
Rated (AC) voltage , 50 to 60 Hz	275 V
Rated (DC) voltage	630 V
Climatic category	40/100/56/C (15 nF to 1.0 µF) 40/085/56/C (10 nF)
Rated temperature	100 °C
Maximum application temperature	100 °C
Reference specifications	IEC 60384-14 2nd edition and EN 132400
Safety approvals: 250 V 275 V	 UL1414 and CSA-C22.2.1; note 1 VDE
Safety class	X2; across the line

Note

1. Pending.

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SAFETY APPROVALS AND SAFETY TEST REPORT

Approvals

SAFETY APPROVALS (X2)		VOLTAGE	VALUE	FILE NUMBERS
c UL us	UL1414 and CSA-C22.2.1	250 V (AC)	10 nF to 1.0 µF	pending
ENEC 02	EN132400	275 V (AC)	15 nF to 1.0 µF: 40/100/56/C	ENEC/B07/2001

Safety test report

SAFETY TEST REPORT	VOLTAGE	VALUE	FILE NUMBERS
CB TEST CERTIFICATE	275 V (AC)	10 nF to 1.0 µF: 40/085/21/C	DE-1-5671

The Enec-approval together with the CB-Certificate replace all national approval marks of the following countries (they have already signed the ENEC-Agreement): Austria; Belgium; Czech. Republic; Denmark; Finland; France; Germany; Greece; Hungary; Ireland; Italy; Luxembourg; Netherlands; Norway, Portugal; Slovenian; Spain; Sweden; Switzerland and United Kingdom.

Safety approvals to be replaced by ENEC during 2001

SAFETY APPROVALS (X2)		VOLTAGE	VALUE	FILE NUMBERS
VDE	VDE (EN132400)	275 V (AC)	15 nF to 1.0 µF: 40/100/56/C	128645

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COMPOSITION OF CATALOGUE NUMBER

TYPE AND PITCHES	
435 X2	15.0 mm
	22.5 mm
	27.5 mm

CAPACITANCE (numerically)

MULTIPLIER (nF)	
1	3
10	4
100	5

Example:
104 = 10 x 10 = 100 nF

2222	435	XX	XX	X

TYPE	PACKAGING	STANDARD DIMENSIONS	LEAD CONFIGURATION	C-TOL	PREFERRED TYPES
435 X2	loose in box	lead length 35.0 mm	Solid Cu wire 0.8 mm	±20%	20
		lead length 35.0 mm	Stranded Cu wire 0.5 mm^2	±20%	23
					ON REQUEST
435 X2	loose in box	lead length 35.0 mm	Solid Cu wire 0.8 mm	±10%	30
		lead length 40.0 mm		±20%	21
				±10%	31
		lead length 45.0 mm		±20%	22
				±10%	32
		lead length 35.0 mm	Stranded Cu wire 0.5 mm^2	±10%	33
		lead length 40.0 mm		±20%	24
				±10%	34
		lead length 45.0 mm		±20%	25
				±10%	35

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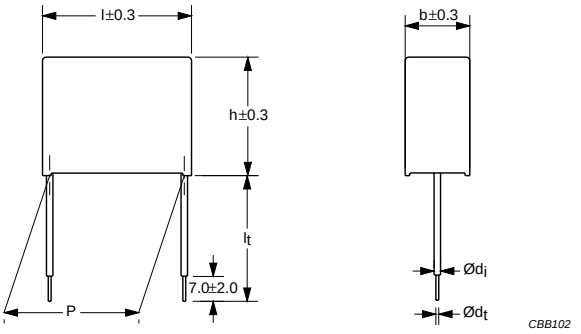
MKP 435 GENERAL DATA **PITCH 15/22.5/27.5 mm**



Dimensions in mm.

Fig.3 Outline.

Specific reference data for the 275 V AC (X2) capacitors

DESCRIPTION	VALUE		
Tangent of loss angle:	at 1 kHz	at 10 kHz	at 100 kHz
100 nF < C ≤ 470 nF	$\leq 10 \times 10^{-4}$	$\leq 20 \times 10^{-4}$	$\leq 100 \times 10^{-4}$
470 nF < C ≤ 1 µF	$\leq 20 \times 10^{-4}$	$\leq 70 \times 10^{-4}$	–
Rated voltage pulse slope $(dU/dt)_R$ at 385 V (DC)	100 V/µs		
R between leads, for C ≤ 0.33 µF at 100 V; 1 minute	>30000 MΩ		
RC between leads, for C > 0.33 µF at 100 V; 1 minute	>10000 s		
R between leads and case; 100 V; 1 minute	>30000 MΩ		
Withstanding (DC)voltage (cut off current 10 mA); rise time 100 V/s	1200 V; 1 minute		
Withstanding (AC) voltage between leads and case	2050 V; 1 minute		

Available 275 V AC (X2) versions

PACKAGING	STANDARD DIMENSIONS(1)(2)	LEAD CONFIGURATION	C-tol	FIRST 9 DIGITS OF CATALOGUE NUMBER	ORDERING
loose in box	lead length 35.0 mm	Solid Cu wire 0.8 mm	±20%	2222 435 20...	preferred
			±10%	2222 435 30...	on request
	lead length 40.0 mm		±20%	2222 435 21...	on request
			±10%	2222 435 31...	on request
	lead length 45.0 mm		±20%	2222 435 22...	on request
			±10%	2222 435 32...	on request
	lead length 35.0 mm	Stranded Cu wire 0.5 mm^2	±20%	2222 435 23...	preferred
			±10%	2222 435 33...	on request
	lead length 40.0 mm		±20%	2222 435 24...	on request
			±10%	2222 435 34...	on request
	lead length 45.0 mm		±20%	2222 435 25...	on request
			±10%	2222 435 35...	on request

Notes

1. Lead length: $l_t = \pm 5$ mm.
2. The parts without insulation are tinned.

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U_{Rac} = 275 V (X2); U_{Rdc} = 630 V

C (μF)	DIMENSIONS b × h × l (mm)	MASS (g)	CATALOGUE NUMBER	
			LOOSE IN BOX	
			l_t = 35 ±5 mm	
			lead configuration = solid Cu wire = 0.8 mm(1)	lead configuration = stranded Cu wire = 0.5 mm²(2)
			C-tol = ±20%	C-tol = ±20%
			catalogue number	last 5 digits
Reference pitch: P = 15 mm				
0.01	5.5 × 10.5 × 18.0	1.5	2222 435 20**103**	.. 23**103**
0.015			2222 435 20**153**	.. 23**153**
0.022			2222 435 20**223**	.. 23**223**
0.033			2222 435 20**333**	.. 23**333**
0.047	6.5 × 12.5 × 18.0	2.0	2222 435 20**473**	.. 23**473**
0.068	7.5 × 13.5 × 18.0	2.5	2222 435 20**683**	.. 23**683**
0.10	8.5 × 14.5 × 18.0	3.0	2222 435 20**104**	.. 23**104**
Reference pitch: P = 22.5 mm				
0.15	7.5 × 15.5 × 26.5	4.0	2222 435 20**154**	.. 23**154**
0.22	8.5 × 16.5 × 26.5	5.0	2222 435 20**224**	.. 23**224**
0.33	10.5 × 18.5 × 26.5	6.5	2222 435 20**334**	.. 23**334**
Reference pitch: P = 27.5 mm				
0.47	11.5 × 20.5 × 31.5	10.0	2222 435 20**474**	.. 23**474**
0.68	13.5 × 23.5 × 31.5	13.0	2222 435 20**684**	.. 23**684**
1	15.0 × 24.5 × 31.5	15.0	2222 435 20**105**	.. 23**105**

Notes

1. ∅ di isolation = 2.4 mm for P = 15 mm and 2.8 mm for P > 15 mm.
2. ∅ di isolation = 2.4 mm.

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CONSTRUCTION

Description

- Low-inductive wound cell of metallized polypropylene (PP) film, potted with epoxy resin in a flame-retardant case
- Radial insulated leads:
  - Solid wire 0.8 mm with PVC insulation
  - Stranded tinned wire 0.5 mm2 with PVC insulation.

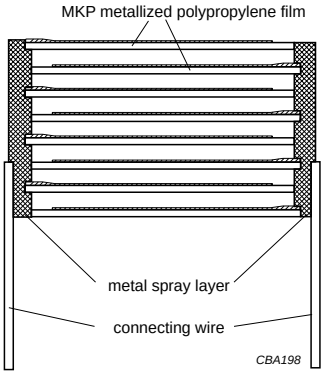

Fig.4 Construction.

Mounting

NORMAL USE

The capacitors are designed for snap-in mounting and soldering.

Storage temperature

- Storage temperature: Tstg = −25 to +40 °C with RH maximum 80% without condensation.

RATINGS AND CHARACTERISTICS REFERENCE CONDITIONS

Unless otherwise specified, all electrical values apply to an ambient 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%.

CHARACTERISTICS

Capacitance

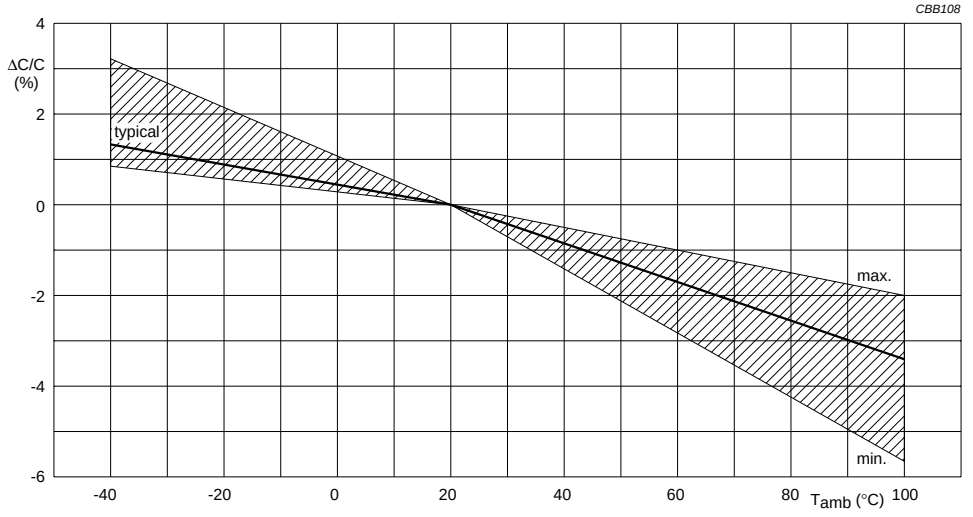

Fig.5 Capacitance change at 1 kHz as a function of temperature.

Tangent of loss angle

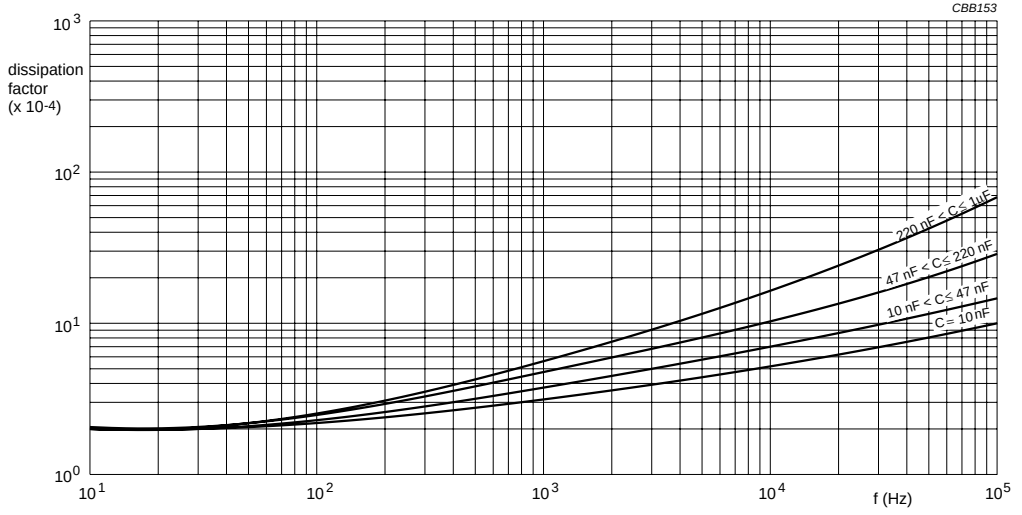

Fig.6 Tangent of loss angle as a function of frequency: typical curves.

Impedance

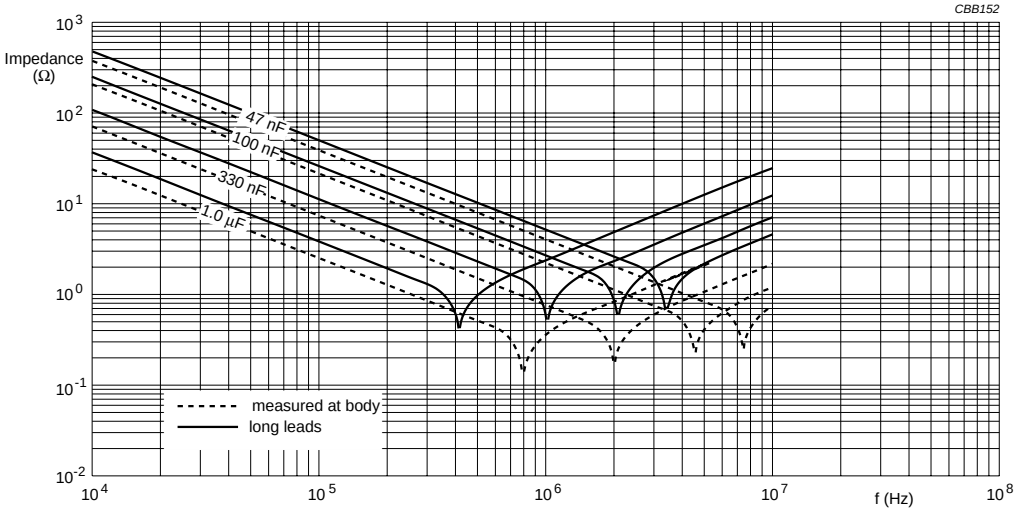

Fig.7 Impedance as a function of frequency: typical curves for 20% values measured with 35 mm lead length.

Resonant frequency

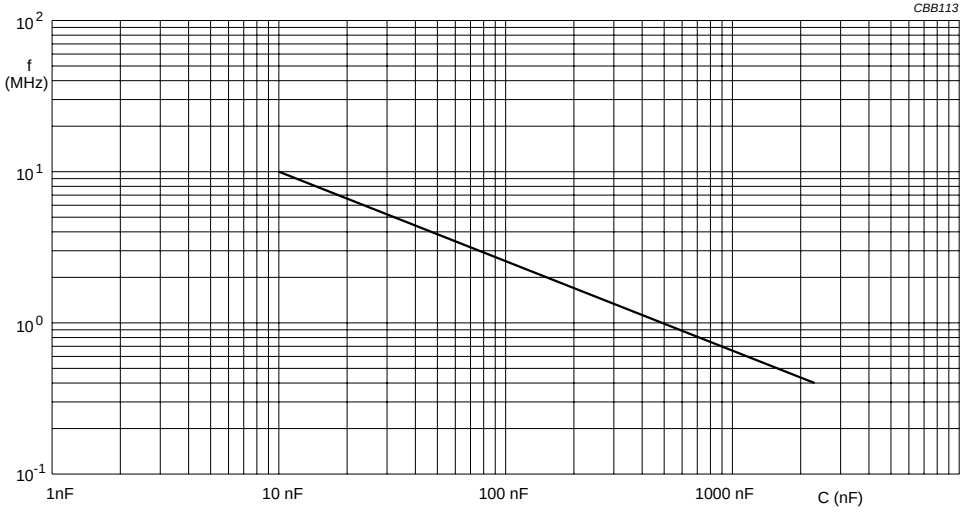

Fig.8 Resonant frequency as a function of capacitance: typical curves for 20% values.

Maximum RMS voltage and AC current (sinewave) as a function of frequency for $T_{amb} \leq 100$ °C

Fig.9 AC voltage (RMS value) as a function of frequency at $T_{amb} \leq 100$ °C.

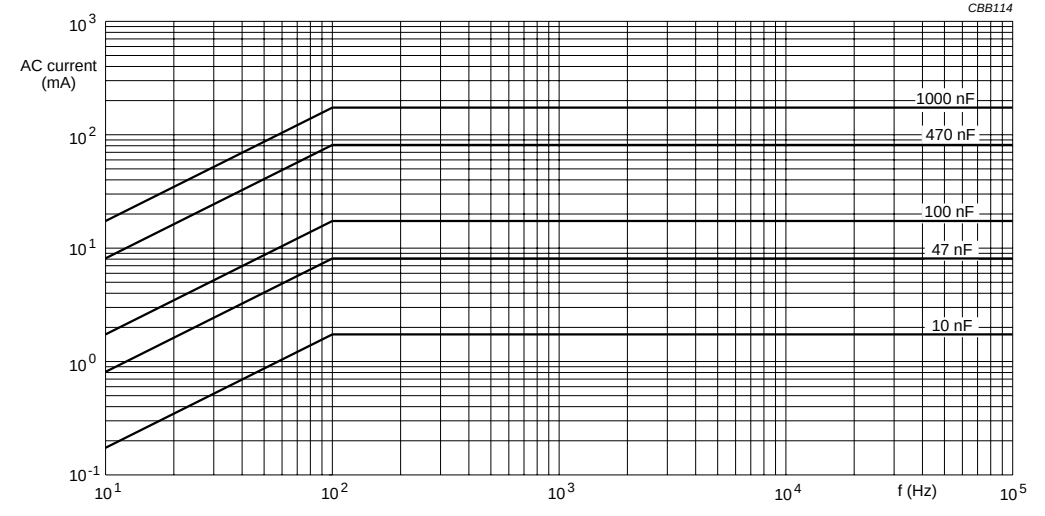

Fig.10 AC current (RMS value) as a function of frequency at $T_{amb} \leq 100$ °C.

Insulation resistance

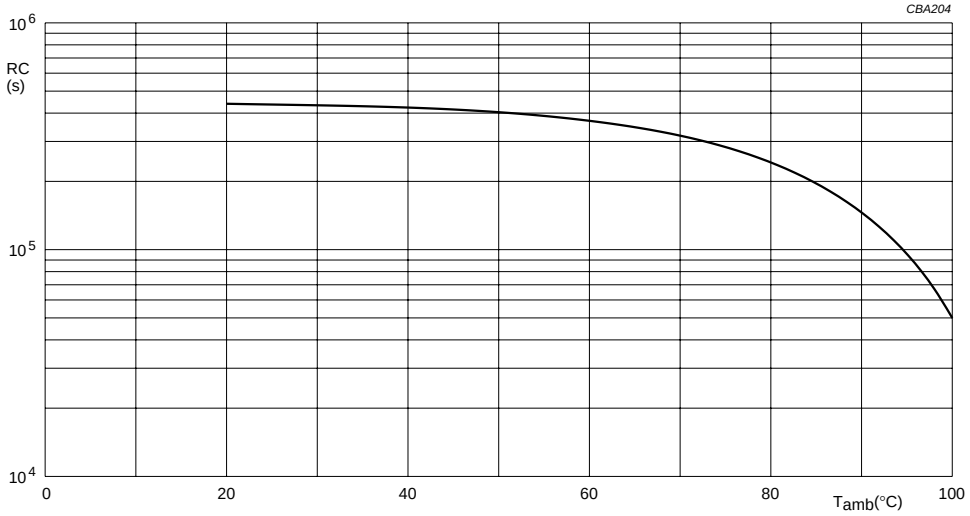

Fig.11 RC product as a function of ambient free air temperature: typical curve.

APPLICATION NOTES

- For X2 electromagnetic interference suppression in across the line applications (50/60 Hz) with a maximum mains voltage of 275 V (AC) ±10% instability.
- These capacitors are not intended for continuous pulse applications. For these situations, capacitors of the AC and pulse program must be used, such as: 2222 375 .....; 2222 383 ..... or 2222 479 .....
- The maximum ambient temperature must not exceed 100 °C.
- Rated voltage pulse slope:
  - If the pulse voltage is lower than the rated voltage, the values of the specific reference data can be multiplied by 385 V (DC) and divided by the applied voltage.

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MARKING

Product marking

The capacitors are marked (see Fig.12) with the following information:

1. Rated capacitance code in accordance with "IEC 60062"
2. Tolerance on rated capacitance; M = ±20%; K = ±10%
3. Rated (AC) voltage (e.g. 275 V)
4. Sub-class (e.g. X2)
5. Manufacturer's type designation (e.g. 435)
6. Code for dielectric material (MKP) for capacitors with original pitch = 15, 22.5 and 27.5 mm
7. Manufacturer (BC) and manufacturer place
8. Year and week of manufacture (e.g. 0133) for capacitors with original pitch = 15, 22.5 and 27.5 mm.

NEW MARKING (INTRODUCED DURING 2001)

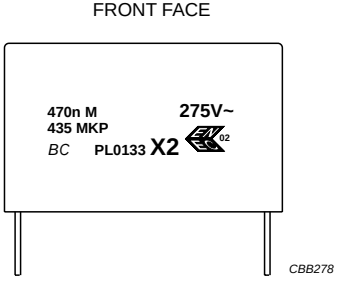

Fig.12 Example of marking.

PRESENT MARKING

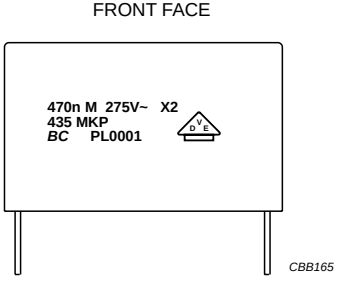

Fig.13 Example of marking.

Package marking

The package containing the capacitors is marked as shown (see Fig.14).

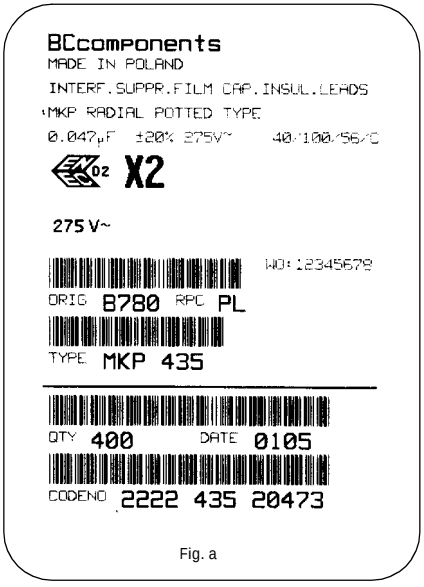

Fig. a

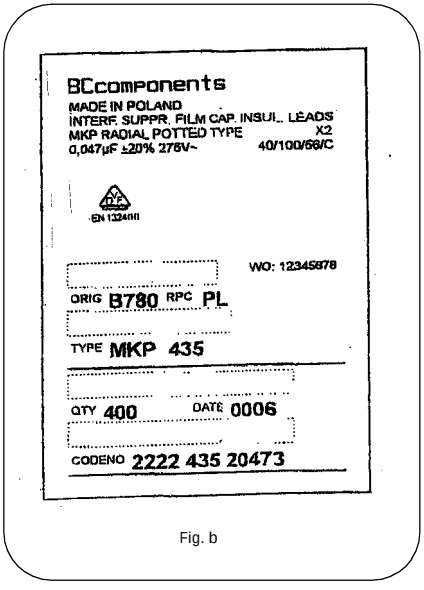

Fig. b

Barcode label marking

LINE	MARKING EXPLANATION
1	Manufacturer's name
2	Country of origin
3	Sub-family
4	Type description and sub class
5	Capacitance value, tolerance, voltage and climatic category (*"IEC 60068-1"*)
6	Safety approvals, see note 1 and 2
7	Preference origin code: B Country of origin in code: 780 (Poland) Responsible production centre: PL Work order: WO
8	Product type description
9	Quantity and production period, year and week code
10	Product code (12NC)

Notes

1. New label (introduced during 2001): see "Fig. a".
2. Present label: see "Fig. b".

Fig.14 Barcode label.

QUICK REFERENCE TEST REQUIREMENTS

TEST	PROCEDURE (quick reference)	REQUIREMENTS
Robustness of leads		
Tensile strength: "IEC 60068-2-21"	load 10 N; 10 s	no visible damage legible marking $\|\Delta C/C\| \leq 5\%$ $\Delta\tan\delta \leq 80 \times 10^{-4}$ ($C \leq 1\ \mu F$); note 1
Bending: "IEC 60068-2-21"	load 5 N; 4 × 90 °	
Component solvent resistance	isopropyl alcohol; 23 °C; 5 minutes	
Robustness of component		
Rapid change of temperature: "IEC 60068-2-14"	5 cycles 1 cycle = 30 minutes at –40 °C and 30 minutes at 100 °C	$\|\Delta C/C\| \leq 5\%$ $\Delta\tan\delta \leq 80 \times 10^{-4}$ ($C \leq 1\ \mu F$); note 1
Vibration: "IEC 60068-2-6"	10 to 55 Hz; amplitude 0.75 mm; 6 hours	
Shock: "IEC 60068-2-27"	half sinewave; 490 m/s^2; 11 ms	
Climatic sequence		
Dry heat: "IEC 60068-2-2"	16 hours; 100 °C	$\|\Delta C/C\| \leq 5\%$ $\Delta\tan\delta \leq 80 \times 10^{-4}$ ($C \leq 1\ \mu F$); note 1 $R_{ins} \geq 50\%$ of specified value
Damp heat, cyclic, test Db, first cycle: "IEC 60068-2-30"		
Cold: "IEC 60068-2-1"	2 hours; –40 °C	
Damp heat, cyclic, test Db, remaining cycles: "IEC 60068-2-30"		
Voltage proof: "IEC 60384-14"	V_p = 1200 V (DC); 1 minute	
Other applicable tests		
Damp heat, steady state: "IEC 60068-2-3"	56 days; 40 °C; 90 to 95% RH no load V_p = 1200 V (DC); 1 minute	$\|\Delta C/C\| \leq 5\%$ $\Delta\tan\delta \leq 80 \times 10^{-4}$ ($C \leq 1\ \mu F$); note 1 $R_{ins} \geq 50\%$ of specified value
Endurance (AC): "IEC 60384-14"	3 × 2.5 kV pulse voltage for X2; 1000 hours; 1.25 × U_{Rac} at 100 °C; once per hour; 0.1 s; 1000 V (RMS) via resistor of 47 Ω; V_p = 1200 V (DC); 1 minute	$\|\Delta C/C\| \leq 10\%$ $\Delta\tan\delta \leq 80 \times 10^{-4}$ ($C \leq 1\ \mu F$); note 1 $R_{ins} \geq 50\%$ of specified value
Charge and discharge: "IEC 60384-14"	10000 cycles; 5 ms; 1.5 × dV/dt	$\|\Delta C/C\| \leq 10\%$ $\Delta\tan\delta \leq 80 \times 10^{-4}$ ($C \leq 1\ \mu F$); note 1 $R_{ins} \geq 50\%$ of specified value
Passive flammability: "IEC 60384-14"	class C	no burning

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TEST	PROCEDURE (quick reference)	REQUIREMENTS
Active flammability: "IEC 60384-14"	20 × 2.5 kV discharge	no burning
Heat storage: "IEC 60384-14"	1000 hours; 100 °C	$\|\Delta C/C\| \leq 5\%$ $\Delta \tan\delta \leq 80 \times 10^{-4}$ ($C \leq 1\ \mu F$); note 1
Active flammability test	voltage proof up to 2 × peak impulse voltage of 4.13 or until breakdown (100 V/sec, current limited 2mA) failed capacitors connected to a 250 V (AC) power supply during 5 minutes	no burning

Note

1. Measuring frequency 10 kHz for $C \leq 1\ \mu F$.