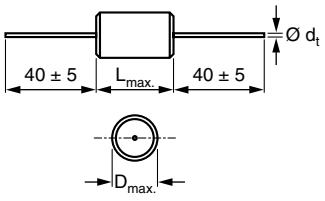
AC Capacitors, Suppression Capacitors
Class X2 AC 253 V (MKT) - Axial Type



Dimensions in mm

LEAD DIAMETER d_t (mm)	D (mm)
0.7 ± 0.07	≤ 7
0.8 ± 0.08	> 7 to < 16.5
1.0 ± 0.1	≥ 16.5

APPLICATIONS

High stabililty grade for continuous across the line X2 applications.

See also application note:
www.vishay.com/docs/28153/anaccaps.pdf

REFERENCE STANDARDS

IEC 60384-14 ed-3 and EN 60384-14

UL 1283

CSA

MARKING

C-value; tolerance; rated voltage; sub-class; manufacturer's type; code for dielectric material; manufacturer location; manufacturer's logo; year and week; safety approvals

DIELECTRIC

Polyester film

ELECTRODES

Metallized

CONSTRUCTION

Series construction

FEATURES

Supplied loose in box, taped on reel or ammopack

RoHS compliant

Pb-free

e3

RoHS COMPLIANT

RATED VOLTAGE

AC 253 V; 50 Hz to 60 Hz

PERMISSIBLE DC VOLTAGE

DC 630 V

ENCAPSULATION

Plastic, epoxy resin sealed, flame retardant UL-class 94 V-0

CLIMATIC TESTING CLASS ACC. TO IEC 60068-1

C ≤ 1.0 µF = 40/100/21/C
C > 1.0 µF = 40/085/21/C

CAPACITANCE RANGE (E12 SERIES)

E12 series 0.01 µF X2 to 2.2 µF X2

Preferred values acc. to E6

CAPACITANCE TOLERANCE

0.01 µF to ≤ 0.1 µF: ± 20 %

0.12 µF to ≤ 2.2 µF: ± 10 %

LEADS

Tinned wire

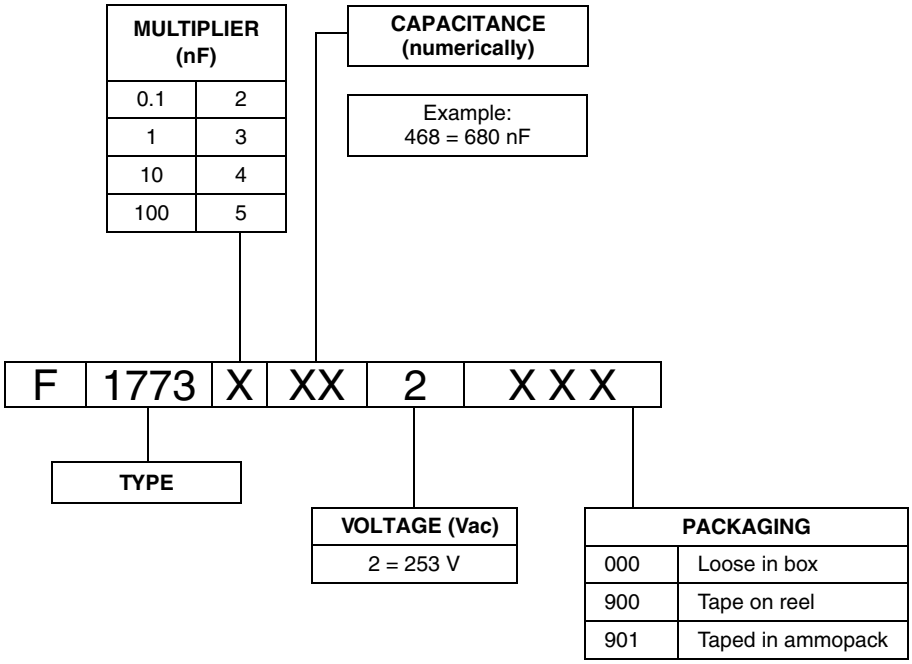
MAXIMUM APPLICATION TEMPERATURE

100 °C

DETAIL SPECIFICATION

For more detailed data and test requirements contact:
RFI@vishay.com

COMPOSITION OF CATALOG NUMBER



Note
• For detailed tape specifications refer to “Packaging information” www.vishay.com/doc?28139 or end of catalog

SPECIFIC REFERENCE DATA

DESCRIPTION	VALUE
Rated AC voltage (U_{Rac})	253 V
Permissible DC voltage (U_{Rdc})	630 V
Tangent of loss angle	≤ 100 x 10^{-4} at 1 kHz
Rated voltage pulse slope $(dU/d_t)_R$ at 350 Vdc L 19 mm L 26.5 mm L 31.5 mm L 41.5 mm	 200 V/µS 150 V/µS 100 V/µS 100 V/µS
R between leads, for C ≤ 0.33 µF at 100 V; 1 min	> 15 000 MΩ
RC between leads, for C > 0.33 µF at 100 V; 1 min	> 5000 s
R between leads and case; 100 V; 1 min	> 30 000 MΩ
Withstanding (AC) voltage between leads and cover	2000 V; - 1 min
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	1200 V; 1 min
Maximum application temperature	100 °C

CAPACITANCE (µF)	TOLERANCE (%)	PITCH (mm)	DIMENSIONS D x L (mm)	MASS (g)	SPQ (1) (pieces)	ORDERING CODE (2)
d_t = 0.70 ± 0.07 mm						
0.01	± 20	22.5	6.0 x 19.0	0.9	1500	F1773-310-2...
0.012	± 20	22.5	6.0 x 19.0	0.9	1500	F1773-312-2...
0.015	± 20	22.5	6.0 x 19.0	0.9	1500	F1773-315-2...
0.018	± 20	22.5	6.0 x 19.0	0.9	1500	F1773-318-2...
0.022	± 20	22.5	6.0 x 19.0	0.9	1500	F1773-322-2...
0.027	± 20	22.5	6.0 x 19.0	0.9	1500	F1773-327-2...
0.033	± 20	22.5	6.0 x 19.0	0.9	1500	F1773-333-2...
0.039	± 20	22.5	6.5 x 19.0	1.0	1500	F1773-339-2...
0.047	± 20	22.5	7.0 x 19.0	1.1	1500	F1773-347-2...
d_t = 0.80 ± 0.08 mm						
0.056	± 20	22.5	8.0 x 19.0	1.6	1500	F1773-356-2...
0.068	± 20	22.5	8.0 x 19.0	1.6	1500	F1773-368-2...
0.082	± 20	22.5	9.0 x 19.0	1.8	1500	F1773-382-2...
0.1	± 20	22.5	9.5 x 19.0	2.0	1000	F1773-410-2...
0.12	± 10	22.5	10.5 x 19.0	2.2	1000	F1773-412-2...
0.15	± 10	30.0	8.5 x 26.5	2.2	1000	F1773-415-2...
0.18	± 10	30.0	9.5 x 26.5	2.6	1000	F1773-418-2...
0.22	± 10	30.0	10.0 x 26.5	2.8	1000	F1773-422-2...
0.27	± 10	30.0	11.0 x 26.5	3.3	750	F1773-427-2...
0.33	± 10	30.0	12.0 x 26.5	3.8	750	F1773-433-2...
0.39	± 10	30.0	13.0 x 26.5	4.7	750	F1773-439-2...
0.47	± 10	30.0	14.0 x 26.5	5.5	1250	F1773-447-2...
0.56	± 10	35.0	14.0 x 31.5	6.2	1000	F1773-456-2...
0.68	± 10	35.0	15.0 x 31.5	6.7	1000	F1773-468-2...
d_t = 1.0 ± 0.1 mm						
0.82	± 10	35.0	16.5 x 31.5	8.3	750	F1773-482-2...
1.0	± 10	35.0	18.0 x 31.5	9.5	750	F1773-510-2...
1.2	± 10	35.0	19.5 x 31.5	11.0	500	F1773-512-2...
1.5	± 10	45.0	18.0 x 41.5	13.5	500	F1773-515-2...
1.8	± 10	45.0	19.5 x 41.5	15.7	450	F1773-518-2...
2.2	± 10	45.0	21.5 x 41.5	17.8	400	F1773-522-2...

Notes

(1) SPQ = Standard Packaging Quantity

(2) These capacitors can be delivered on continuous tape and reel; the ordering code is F1773-...-2900 taped on reel, F1773-...-2901 taped ammopack

- For detailed tape specifications refer to packaging information: www.vishay.com/doc?28139 or end of catalog

APPROVALS

SAFETY APPROVALS X2	VOLTAGE	VALUE	FILE NUMBERS
EN 60384-14 (ENEC) (= IEC 60384-14 ed-3)	253 Vac	0.01 µF to 2.2 µF X2	40005089
UL1283	250 Vac	0.01 µF to 2.2 µF X	E 76297
CSA	253 Vac	0.01 µF to 1.0 µF X2	1913342
CB Test-Certificate	253 Vac	0.01 µF to 2.2 µF X2	DE 1-7470
The ENEC-approval together with the CB-Certificate replace all national 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.			

MOUNTING

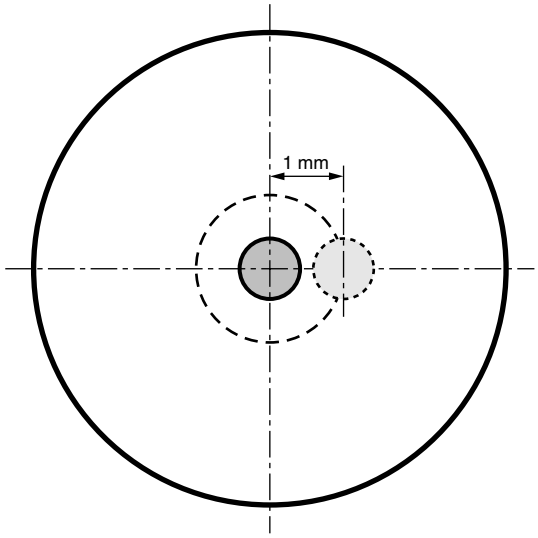
Normal Use

The capacitors are designed for mounting on printed-circuit boards. The capacitors packed in bandoliers are designed for mounting in pinted-circuit boards by means of automatic insertion machines.
For detailed tape specifications refer to packaging information: www.vishay.com/doc?28139 or end of catalog

Specific Method of Mounting to Withstand Vibration and Shock

In order to withstand vibration and shock tests,it must be ensured that capacitor body is in good contact with the printed-circuit board:

- For L ≤ 19 mm capacitors shall be mechanically fixed by the leads
- For larger pitches the capacitors shall be mounted in the same way and the body clamped
- The maximum diameter and length of the capacitors are specified in the dimensions table
- Eccentricity as shown in the drawing below:



Storage Temperature

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

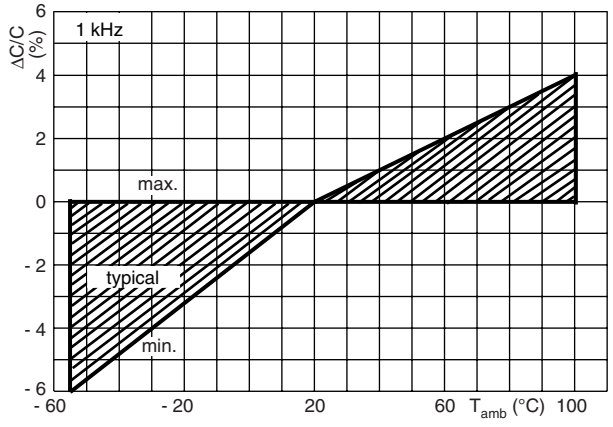
Ratings and Characteristics Reference Conditions

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

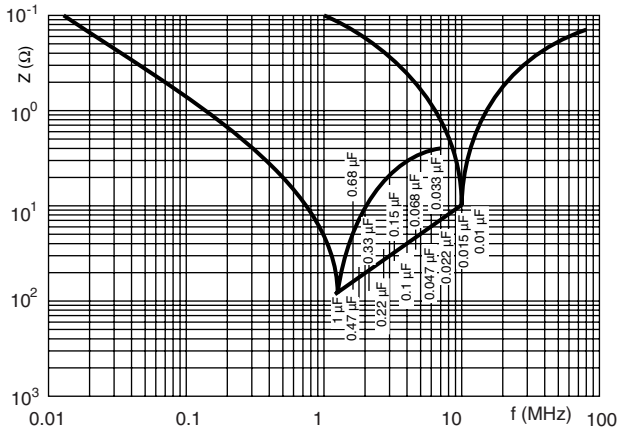
For reference testing, a conditioning period shall be applied over 96 ± 4 h by heating the products in a circulating air oven at the rated temperature and a relative humidity not exceeding 20 %.

CHARACTERISTICS

Capacitance as a function of ambient temperature (typical curve)

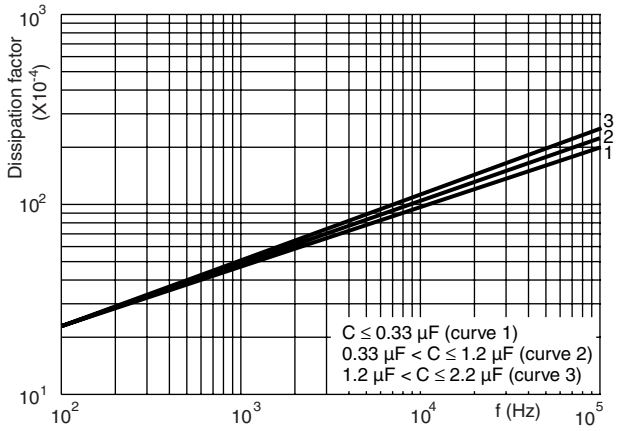


Impedance as a function of frequency (typical curve)

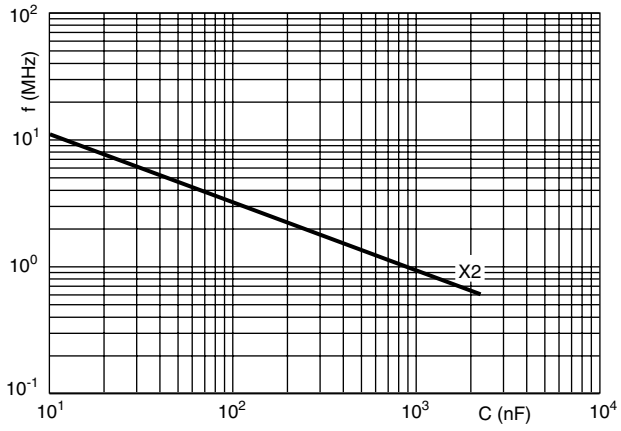


Impedance (Z) as a function of frequency (f)
at T_a = 20 °C (average)
Measurement with length 6 mm

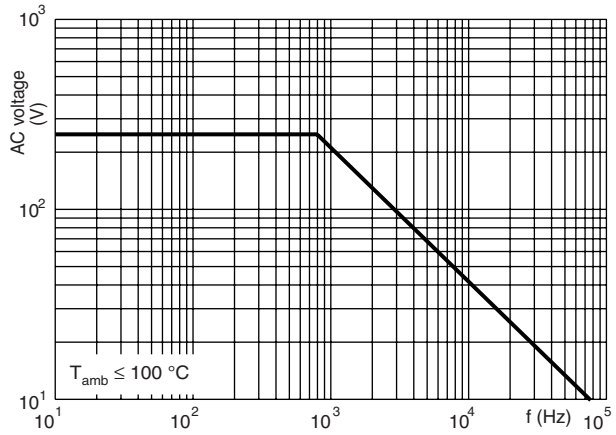
Tanget of loss angle as a function of frequency (typical curve)



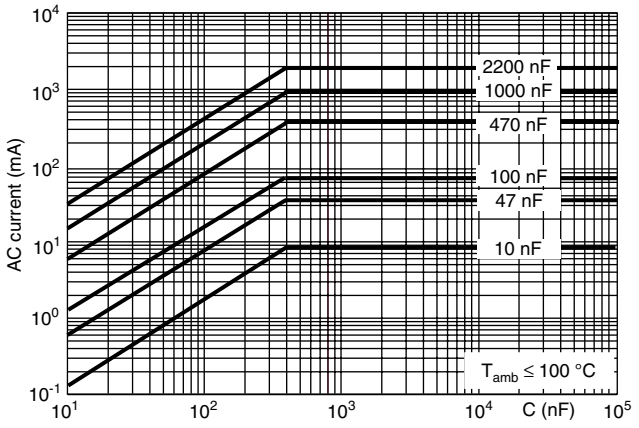
Resonant frequency as a function of capacitance (typical curve)



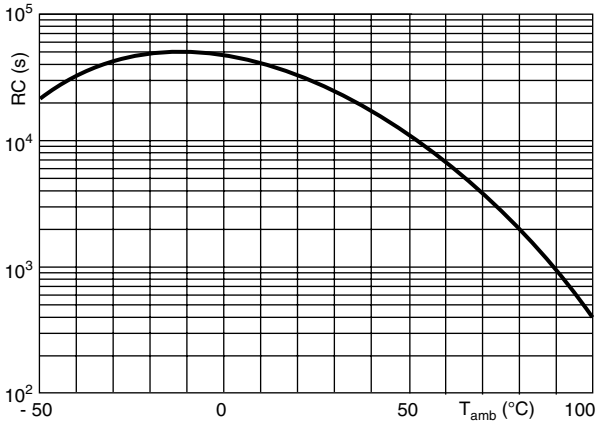
Max. RMS voltage as a function of frequency



Max. RMS current as a function of frequency



Insulation resistance as a function of ambient temperature
(typical curve)



APPLICATION NOTES AND LIMITING CONDITIONS

- For X2 electromagnetic interference suppression where a higher stabililty grade is needed for **continuous across the line applications** (50/60 Hz) with a maximum mains voltage of 253 Vac.
- These capacitors are not intended for continuous pulse application. For these situations capacitors of the AC and pulse programs must be used.
- For series impedance applications we refer to application note: www.vishay.com/doc?28153
- 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 350 Vdc and divided by the applied voltage.

INSPECTION REQUIREMENTS

General Notes

Sub-clause numbers of tests and performance requirements refer to the “Sectional Specification, Publication IEC 60384-14 ed-3 and Specific Reference Data”.

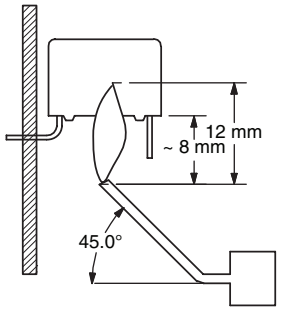
Group C inspection requirements

SUB-CLAUSE NUMBER AND TEST		CONDITIONS	PERFORMANCE REQUIREMENTS
SUB-GROUP C1A PART OF SAMPLE OF SUB-GROUP C1			
4.1	Dimensions (detail)		As specified in chapters “General data” of this specification
	Initial measurements	Capacitance Tangent of loss angle: For C ≤ 1 µF at 10 kHz or for C > 1 µF at 1 kHz	
4.3	Robustness of terminations	Tensile: Load 10 N; 10 s Bending: Load 5 N; 4 x 90°	No visible damage

SUB-CLAUSE NUMBER AND TEST		CONDITIONS	PERFORMANCE REQUIREMENTS
4.4	Resistance to soldering heat	No pre-drying Method: 1A Solder bath: 280 °C ± 5 °C Duration: 10 s	
4.19	Component solvent resistance	Isopropylalcohol at room temperature Method: 2 Immersion time: 5 ± 0.5 min Recovery time: Min. 1 h, max. 2 h	
4.4.2	Final measurements	Visual examination	No visible damage Legible marking
		Capacitance	$\|\Delta C/C\| \leq 5$ % of the value measured initially
		Tangent of loss angle	Increase of tan δ: ≤ 0.008 for: $C \leq 1$ µF or ≤ 0.005 for: $C > 1$ µF Compared to values measured initially
		Insulation resistance	As specified in section "Insulation resistance" of this specification
SUB-GROUP C1B PART OF SAMPLE OF SUB-GROUP C1			
	Initial measurements	Capacitance Tangent of loss angle: For $C \leq 1$ µF at 10 kHz or for $C > 1$ µF at 1 kHz	
4.20	Solvent resistance of the marking	Isopropylalcohol at room temperature Method: 1 Rubbing material: Cotton wool Immersion time: 5 ± 0.5 min	No visible damage Legible marking
4.6	Rapid change of temperature	θA = - 40 °C θB = + 100 °C 5 cycles Duration t = 30 min	
4.6.1	Inspection	Visual examination	No visible damage
4.7	Vibration	Mounting: See section "Mounting" of this specification Procedure B4 Frequency range: 10 Hz to 55 Hz Amplitude: 0.75 mm or Acceleration 98 m/s² (whichever is less severe) Total duration 6 h	
4.7.2	Final inspection	Visual examination	No visible damage
4.9	Shock	Mounting: See section "Mounting" for more information Pulse shape: Half sine Acceleration: 490 m/s² Duration of pulse: 11 ms	

SUB-CLAUSE NUMBER AND TEST	CONDITIONS	PERFORMANCE REQUIREMENTS
4.9.2 Final measurements	Visual examination Capacitance Tangent of loss angle Insulation resistance	No visible damage $\|\Delta C/C\| \leq 5$ % of the value measured initially Increase of tan δ: ≤ 0.008 for: $C \leq 1$ µF or ≤ 0.005 for: $C > 1$ µF Compared to values measured initially As specified in section “Insulation resistance” of this specification
SUB-GROUP C1 COMBINED SAMPLE OF SPECIMENS OF SUB-GROUPS C1A AND C1B		
4.11 Climatic sequence		
4.11.1 Initial measurements	Capacitance Measured in 4.4.2 and 4.9.2 Tangent of loss angle: Measured initially in C1A and C1B	
4.11.2 Dry heat	Temperature: 100 °C Duration: 16 h	
4.11.3 Damp heat cyclic Test Db First cycle		
4.11.4 Cold	Temperature: - 40 °C Duration: 2 h	
4.11.5 Damp heat cyclic Test Db remaining cycles		
4.11.6 Final measurements	Visual examination Capacitance Tangent of loss angle Voltage proof 1200 Vdc; 1 min between terminations Insulation resistance	No visible damage Legible marking $\|\Delta C/C\| \leq 5$ % of the value measured in 4.11.1. Increase of tan δ: ≤ 0.008 for: $C \leq 1$ µF or ≤ 0.005 for: $C > 1$ µF Compared to values measured in 4.11.1. No permanent breakdown or flash-over ≥ 50 % of values specified in section “Insulation resistance” of this specification
SUB-GROUP C2		
4.12 Damp heat steady state	21 days; 40 °C; 90 % to 95 % RH no load	
4.12.1 Initial measurements	Capacitance Tangent of loss angle: For $C \leq 1$ µF at 10 kHz or for $C > 1$ µF at 1 kHz	

SUB-CLAUSE NUMBER AND TEST	CONDITIONS	PERFORMANCE REQUIREMENTS
4.12.3 Final measurements	Visual examination	No visible damage Legible marking
	Capacitance	$\|\Delta C/C\| \leq 5$ % of the value measured in 4.12.1.
	Tangent of loss angle	Increase of tan δ: ≤ 0.008 for: $C \leq 1$ µF or ≤ 0.005 for: $C > 1$ µF Compared to values measured in 4.12.1.
	Voltage proof 1200 Vdc; 1 min between terminations	No permanent breakdown or flash-over
	Insulation resistance	≥ 50 % of values specified in section "Insulation resistance" of this specification
SUB-GROUP C3		
4.13.1 Initial measurements	Capacitance Tangent of loss angle: For $C \leq 1$ µF at 10 kHz or for $C > 1$ µF at 1 kHz	
4.13 Impulse voltage	3 successive impulses, full wave, peak voltage: X2: 2.5 kV for $C \leq 1$ µF X2: 2.5 kV/√C for $C > 1$ µF Max. 24 pulses	No self healing breakdowns or flashover
4.14 Endurance	Duration: 1000 h 1.25 x U_{Rac} at 100 °C for $C \leq 1$ µF 1.25 x U_{Rac} at 85 °C for $C > 1$ µF Once in every hour the voltage is increased to 1000 V_{RMS} for 0.1 s via resistor of 47 Ω ± 5 %	
4.14.7 Final measurements	Visual examination	No visible damage Legible marking
	Capacitance	$\|\Delta C/C\| \leq 10$ % compared to values measured in 4.13.1.
	Tangent of loss angle	Increase of tan δ: ≤ 0.008 for: $C \leq 1$ µF or ≤ 0.005 for: $C > 1$ µF Compared to values measured in 4.13.1.
	Voltage proof 1200 Vdc; 1 min between terminations 2000 Vac; 1 min between terminations and case	No permanent breakdown or flash-over
	Insulation resistance	≥ 50 % of values specified in section "Insulation resistance" of this specification
SUB-GROUP C4		
4.15 Charge and discharge	10 000 cycles Charged to 350 Vdc Discharge resistance: $R = \frac{350\ Vdc}{2 \times C\ (dU/dt)}$	
4.15.1 Initial measurements	Capacitance Tangent of loss angle: For $C \leq 1$ µF at 10 kHz or for $C > 1$ µF at 1 kHz	

SUB-CLAUSE NUMBER AND TEST	CONDITIONS	PERFORMANCE REQUIREMENTS
4.15.3 Final measurements	Capacitance	$\|\Delta C/C\| \leq 10$ % compared to values measured in 4.15.1.
	Tangent of loss angle	Increase of tan δ: ≤ 0.008 for: $C \leq 1$ µF or ≤ 0.005 for: $C > 1$ µF Compared to values measured in 4.15.1.
	Insulation resistance	≥ 50 % of values specified in section "Insulation resistance" of this specification
SUB-GROUP C5		
4.16 Radio frequency characteristic	Resonance frequency	≥ 0.9 times the value as specified in section "Resonant frequency" of this specification
SUB-GROUP C6		
4.17 Passive flammability Class C	Bore of gas jet: Ø 0.5 mm Fuel: Butane Test duration for actual volume V in mm³: $V \leq 250$: 5 s $250 < V \leq 500$: 10 s $500 < V \leq 1750$: 20 s $V > 1750$: 30 s One flame application  	After removing test flame from capacitor, the capacitor must not continue to burn for more than 30 s. No burning particle must drop from the sample.
SUB-GROUP C7		
4.18 Active flammability	20 cycles of 2.5 kV discharges on the test capacitor connected to U_{Rac}	The cheese cloth around the capacitors shall not burn with a flame. No electrical measurements are required.

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