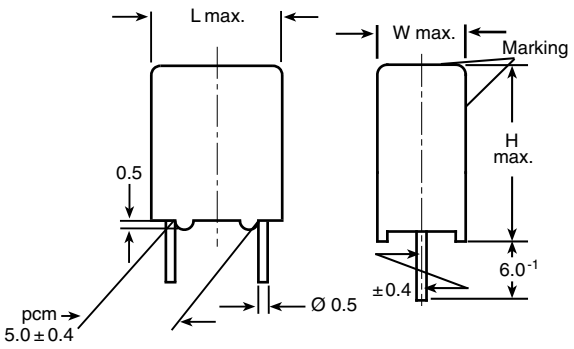
AC and Pulse Film Foil Capacitors
KP Radial Potted Type



Dimensions in millimeters

MAIN APPLICATIONS

Oscillator, timing and LC/RC filter circuits, high frequency coupling of fast digital and analog IC's.

REFERENCE STANDARDS

IEC 60384-13

MARKING

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

DIELECTRIC

Polypropylene film

ELECTRODES

Tin foil

CONSTRUCTION

Mono construction

RATED DC VOLTAGES

63 V, 250 V, 630 V

RATED AC VOLTAGES

40 V, 160 V, 250 V

FEATURES

5 mm lead pitch, supplied loose in box taped in ammopack or reel

- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

ENCAPSULATION

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

CLIMATIC TESTING CLASS ACCORDING TO IEC 60068-1

55/100/56

CAPACITANCE RANGE

100 pF to 0.022 µF

CAPACITANCE TOLERANCE

± 10 % , ± 5 %, ± 2.5 %, ± 2 %, ± 1 %

LEADS

Tinned wire

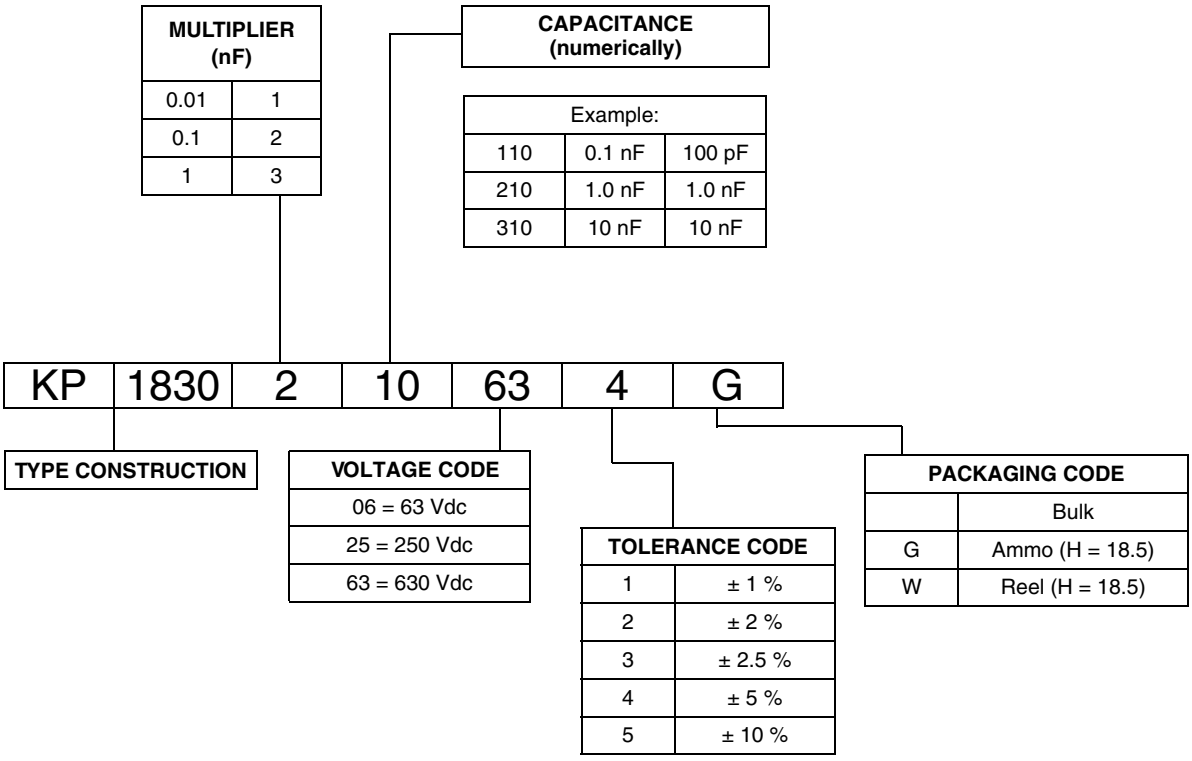
MAXIMUM APPLICATION TEMPERATURE

100 °C

DETAIL SPECIFICATION

For more detailed data and test requirements contact: dc-film@vishay.com

COMPOSITION OF CATALOG NUMBER



SPECIFIC REFERENCE DATA

DESCRIPTION	VALUE			
Tangent of loss angle:	at 1 kHz	at 10 kHz	at 100 kHz	at 1 MHz
C ≤ 1000 pF	-	5×10^{-4}	-	10×10^{-4}
1000 pF < C ≤ 5000 pF	-	5×10^{-4}	10×10^{-4}	-
5000 pF < C ≤ 20 000 pF	-	10×10^{-4}	15×10^{-4}	-
20 000 pF < C < 33 000 pF	-	15×10^{-4}	25×10^{-4}	-

Pitch (mm)	Maximum pulse rise time $(dU/dt)_R$ [V/µs]
5	> 10 000

R between leads, for C ≤ 0.33 µF at 100 V, 1 min	> 500 000 MΩ
R between leads and case, 100 V, 1 min	> 30 000 MΩ
Withstanding (DC) voltage (cut off current 10 mA), rise time 100 V/s	1.6 x U_{RDC}, 1 min
Withstanding (DC) voltage between leads and case	2 x U_{RDC}, 1 min
Maximum application temperature	100 °C

CAPACITANCE	CAPACITANCE CODE	VOLTAGE CODE 06 63 V_{DC} / 40 V_{AC}			VOLTAGE CODE 25 250 V_{DC} / 160 V_{AC}			VOLTAGE CODE 63 630 V_{DC} / 250 V_{AC}		
		W (mm)	H (mm)	L (mm)	W (mm)	H (mm)	L (mm)	W (mm)	H (mm)	L (mm)
100 pF	-110	-	-	-	-	-	-	4.5	6.0	7.2
110 pF	-111	-	-	-	-	-	-	4.5	6.0	7.2
120 pF	-112	-	-	-	-	-	-	4.5	6.0	7.2
130 pF	-113	-	-	-	-	-	-	4.5	6.0	7.2
150 pF	-115	-	-	-	-	-	-	4.5	6.0	7.2
160 pF	-116	-	-	-	-	-	-	4.5	6.0	7.2
180 pF	-118	-	-	-	-	-	-	4.5	6.0	7.2
200 pF	-120	-	-	-	-	-	-	4.5	6.0	7.2
220 pF	-122	-	-	-	-	-	-	4.5	6.0	7.2
240 pF	-124	-	-	-	-	-	-	4.5	6.0	7.2
270 pF	-127	-	-	-	-	-	-	4.5	6.0	7.2
300 pF	-130	-	-	-	-	-	-	4.5	6.0	7.2
330 pF	-133	-	-	-	-	-	-	4.5	6.0	7.2
360 pF	-136	-	-	-	-	-	-	4.5	6.0	7.2
390 pF	-139	-	-	-	-	-	-	4.5	6.0	7.2
430 pF	-143	-	-	-	-	-	-	4.5	6.0	7.2
470 pF	-147	-	-	-	-	-	-	4.5	6.0	7.2
510 pF	-151	-	-	-	-	-	-	4.5	6.0	7.2
560 pF	-156	-	-	-	-	-	-	4.5	6.0	7.2
620 pF	-162	-	-	-	-	-	-	4.5	6.0	7.2
680 pF	-168	-	-	-	-	-	-	4.5	6.0	7.2
750 pF	-175	-	-	-	-	-	-	4.5	6.0	7.2
820 pF	-182	-	-	-	-	-	-	4.5	6.0	7.2
910 pF	-191	-	-	-	-	-	-	4.5	6.0	7.2
1000 pF	-210	-	-	-	-	-	-	4.5	6.0	7.2
1100 pF	-211	-	-	-	-	-	-	4.5	6.0	7.2
1200 pF	-212	-	-	-	-	-	-	4.5	6.0	7.2
1300 pF	-213	-	-	-	-	-	-	4.5	6.0	7.2
1500 pF	-215	-	-	-	-	-	-	4.5	6.0	7.2
1600 pF	-216	-	-	-	-	-	-	4.5	6.0	7.2
1800 pF	-218	-	-	-	-	-	-	4.5	6.0	7.2
2000 pF	-220	-	-	-	4.5	6.0	7.2	5.5	7.0	7.2
2200 pF	-222	-	-	-	4.5	6.0	7.2	5.5	7.0	7.2
2400 pF	-224	4.5	6.0	7.2	4.5	6.0	7.2	5.5	7.0	7.2
2700 pF	-227	4.5	6.0	7.2	4.5	6.0	7.2	5.5	7.0	7.2
3000 pF	-230	4.5	6.0	7.2	5.5	7.0	7.2	5.5	7.0	7.2
3300 pF	-233	4.5	6.0	7.2	5.5	7.0	7.2	5.5	7.0	7.2
3600 pF	-236	4.5	6.0	7.2	5.5	7.0	7.2	7.5	7.0	7.2
3900 pF	-239	4.5	6.0	7.2	5.5	7.0	7.2	7.5	9.0	7.2
4300 pF	-243	4.5	6.0	7.2	5.5	7.0	7.2	7.5	9.0	7.2
4700 pF	-247	4.5	6.0	7.2	5.5	7.0	7.2	7.5	9.0	7.2
5100 pF	-251	4.5	6.0	7.2	7.5	9.0	7.2	7.5	9.0	7.2
5600 pF	-256	4.5	6.0	7.2	7.5	9.0	7.2	7.5	9.0	7.2
6200 pF	-262	4.5	6.0	7.2	7.5	9.0	7.2	7.5	9.0	7.2
6800 pF	-268	4.5	6.0	7.2	7.5	9.0	7.2	7.5	9.0	7.2
7500 pF	-275	5.5	7.0	7.2	7.5	9.0	7.2	9.0	10.0	7.2
8200 pF	-282	5.5	7.0	7.2	7.5	9.0	7.2	9.0	10.0	7.2
9100 pF	-291	5.5	7.0	7.2	7.5	9.0	7.2	9.0	10.0	7.2
0.010 µF	-310	5.5	7.0	7.2	7.5	9.0	7.2	9.0	10.0	7.2
0.011 µF	-311	5.5	7.0	7.2	9.0	10.0	7.2	-	-	-
0.012 µF	-312	5.5	7.0	7.2	9.0	10.0	7.2	-	-	-
0.013 µF	-313	5.5	7.0	7.2	9.0	10.0	7.2	-	-	-
0.015 µF	-315	5.5	7.0	7.2	9.0	10.0	7.2	-	-	-
0.016 µF	-316	9.0	10.0	7.2	-	-	-	-	-	-
0.018 µF	-318	9.0	10.0	7.2	-	-	-	-	-	-
0.020 µF	-320	9.0	10.0	7.2	-	-	-	-	-	-
0.022 µF	-322	7.5	9.0	7.2	-	-	-	-	-	-

Note

- Further C-values upon request

RECOMMENDED PACKAGING

LETTER CODE	TYPE OF PACKAGING	HEIGHT (H) (mm)	REEL DIAMETER (mm)	ORDERING CODE EXAMPLE	PITCH 5
G	Ammo	18.5	S [1]	KP1830-310-065-G	X
W	Reel	18.5	350	KP1830-310-065-W	X
-	Bulk	-	-	KP1830-310-065	X

Note

[1] S = box size 55 mm x 210 mm x 340 mm (W x H x L)

EXAMPLE OF ORDERING CODE

TYPE	CAPACITANCE CODE	VOLTAGE CODE	TOLERANCE CODE	PACKAGING CODE
KP1830	210	63	1	G
Tolerance codes: 1 = 1 % (F); 2 = 2 % (G); 3 = 2.5 % (H); 4 = 5 % (J); 5 = 10 % (K)				

Note

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

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 “Packaging information” www.vishay.com/doc?28139 or end of catalog

Specific Method of Mounting of Withstand Vibration and Shock

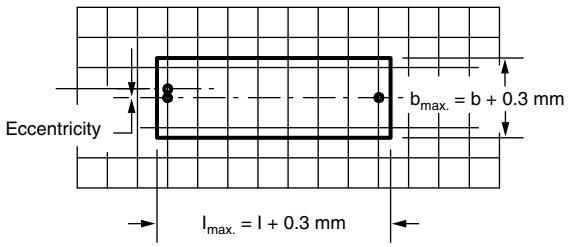
In order to withstand vibration and shock tests, it must be ensured that the stand-off pips are in good contact with the printed-circuit board.

- For pitches ≤ 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 the drawing:

- Eccentricity as in drawing. 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 60717” as reference: $h_{max.} \leq h + 0.4$ mm or $h_{max.} \leq h' + 0.4$ mm



Storage Temperature

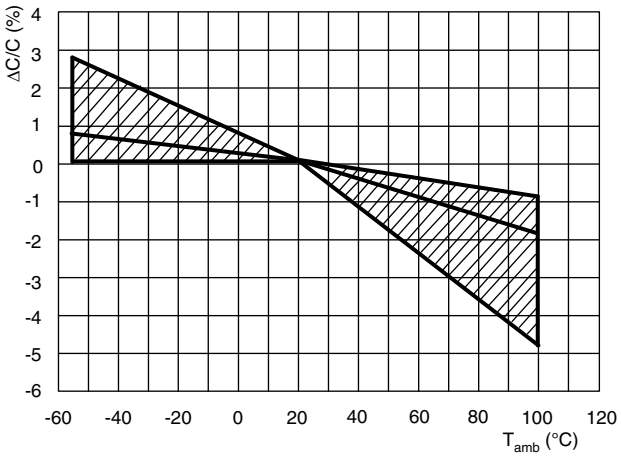
T_{stg} = -25 °C to +35 °C with RH maximum 75 % without condensation

Ratings and Characteristics Reference Conditions

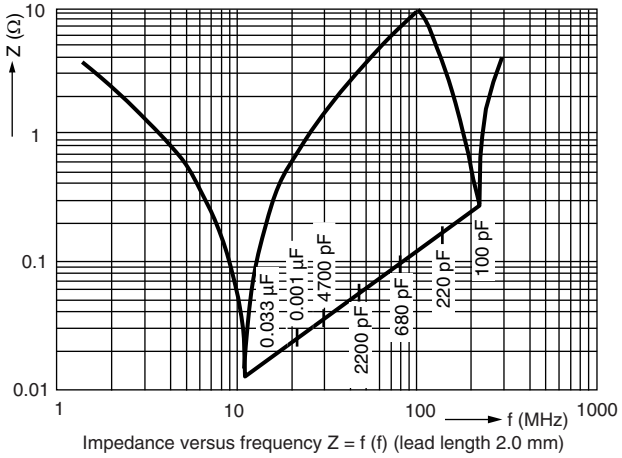
Unless otherwise specified, all electrical values apply to an ambient free temperature of 23 °C ± 1 °C, an atmospheric pressure of 86 kPa to 106 kPa and a relative humidity of 50 % ± 2 %.

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

CHARACTERISTICS

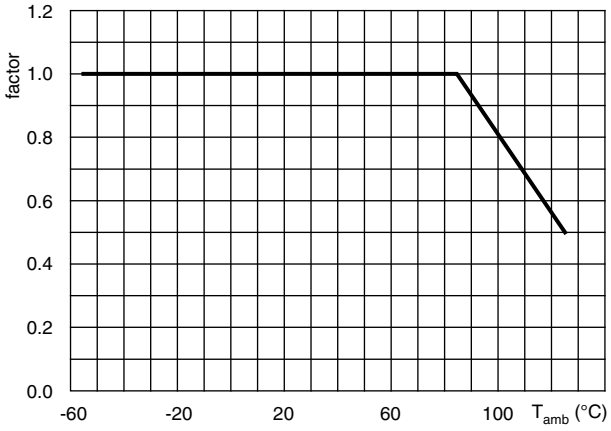


Capacitance as a function of ambient temperature (typical curve)

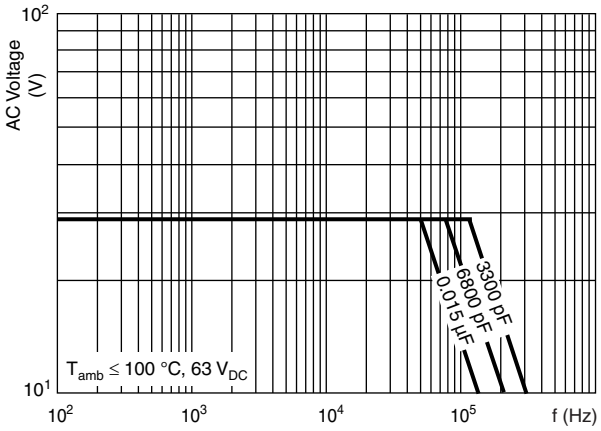


Impedance versus frequency Z = f (f) (lead length 2.0 mm)

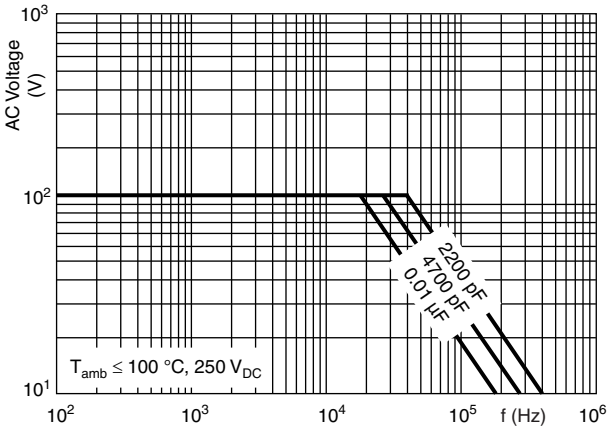
Impedance as a function of frequency (typical curve)



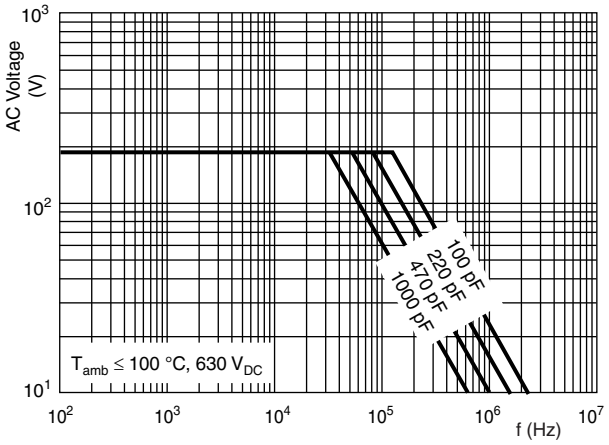
Maximum DC and AC voltage as a function of temperature



Maximum RMS voltage as a function of frequency



Maximum RMS voltage as a function of frequency



Maximum RMS voltage as a function of frequency

HEAT CONDUCTIVITY (G) AS A FUNCTION OF ORIGINAL PITCH AND CAPACITOR BODY THICKNESS IN mW/°C

$W_{max.}$ (mm)	HEAT CONDUCTIVITY (mW/°C)
	PITCH 5 mm
4.5	3
5.5	4
7.5	6
9.0	7

POWER DISSIPATION AND MAXIMUM COMPONENT TEMPERATURE RISE

The power dissipation must be limited in order not to exceed the maximum allowed component temperature rise as a function of the free air ambient temperature.

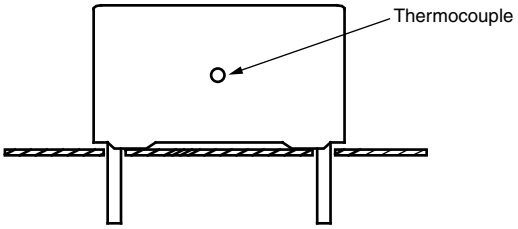
The power dissipation can be calculated according type detail specification “HQN-384-01/101: Technical Information Film Capacitors” with the typical t_{gd} of the curves.

The component temperature rise (ΔT) can be measured (see section “Measuring the component temperature” for more details) or calculated by $\Delta T = P/G$:

- ΔT = component temperature rise (°C)
- P = power dissipation of the component (mW)
- G = heat conductivity of the component (mW/°C)

MEASURING THE COMPONENT TEMPERATURE

A thermocouple must be attached to the capacitor body as in:



The temperature is measured in unloaded (T_{amb}) and maximum loaded condition (T_C).

The temperature rise is given by $\Delta T = T_C - T_{amb}$.

To avoid radiation or convection, the capacitor should be tested in a wind-free box.

APPLICATION NOTE AND LIMITING CONDITIONS

To select the capacitor for a certain application, the following conditions must be checked:

1. The peak voltage (U_p) shall not be greater than the rated DC voltage (U_{RDC}).
2. The peak-to-peak voltage ($U_{p\text{-}p}$) shall not be greater than the maximum ($U_{p\text{-}p}$) to avoid the ionization inception level.
3. The maximum component surface temperature rise must be lower than the limits.
4. The maximum application temperature must be lower than 105 °C.
5. There is no limit for the voltage pulse slope in the application.

INSPECTION REQUIREMENTS

General Notes

Sub-clause numbers of tests and performance requirements refer to the “Sectional Specification, Publication IEC 60384-13 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
4.3.1 Initial measurements	Capacitance at 1 kHz Tangent of loss angle at 100 kHz	
4.3 Robustness of terminations	Tensile: load 10 N; 10 s Bending: load 5 N; 4 x 90°	No visible damage
4.4 Resistance to soldering heat	No predrying Method: 1A Solder bath: 280 °C ± 5 °C Duration: 5 s	
4.14 Component solvent resistance	Isopropylalcohol at room temperature Method: 2 Immersion time: 5.0 min ± 0.5 min Recovery time: min. 1 h, max. 2 h	
4.4.2 Final measurements	Visual examination	No visible damage Legible marking
	Capacitance	$\|\Delta C/C\| \leq 2$ % of the value measured in 4.3.1
SUB-GROUP C1B PART OF SAMPLE OF SUB-GROUP C1		
4.6.1 Initial measurements	Capacitance at 1 kHz Tangent of loss angle at 100 kHz	
4.14 Solvent resistance of the marking	Isopropylalcohol at room temperature Method: 1 Rubbing material: cotton wool Immersion time: 5.0 min ± 0.5 min	No visible damage Legible marking
4.6 Rapid change of temperature	θA = -55 °C θB = +105 °C 5 cycles Duration t = 30 min	
4.7 Vibration	Visual examination Mounting: See section “Mounting” of this specification Procedure B4 Frequency range: 10 Hz to 55 Hz Amplitude: 0.75 mm or Acceleration 98 m/s^2 (whichever is less severe) Total duration 6 h	No visible damage
4.7.2 Final inspection	Visual examination	No visible damage
	Capacitance	$\|\Delta C/C\| \leq 2$ % of the value measured in 4.6.1
	Tangent of loss angle	As specified in section “Tangent of loss angle” of this specification

SUB-CLAUSE NUMBER AND TEST	CONDITIONS	PERFORMANCE REQUIREMENTS
4.9 Shock	Mounting: See section “Mounting” of this specification Pulse shape: half sine Acceleration: 490 m/s² Duration of pulse: 11 ms	
4.9.3 Final measurements	Visual examination	No visible damage
	Capacitance	$\|\Delta C/C\| \leq 2$ % of the value measured in 4.6.1.
SUB-GROUP C1 COMBINED SAMPLE OF SPECIMENS OF SUB-GROUPS C1A AND C1B		
4.10 Climatic sequence		
4.10.2 Dry heat	Temperature: +100 °C Duration: 16 h	
4.10.3 Damp heat cyclic Test Db, first cycle		
4.10.4 Cold	Temperature: -55 °C Duration: 2 h	
4.10.6 Damp heat cyclic Test Db, remaining cycles	Recovery 1 h to 2 h	
4.10.6.2 Final measurements	Voltage proof = U_{RDC} for 1 min within 15 min after removal from testchamber	No breakdown or flash-over
	Visual examination	No visible damage Legible marking
	Capacitance	$\|\Delta C/C\| \leq 2$ % of the value measured in 4.10.2
	Tangent of loss angle	As specified in section “Tangent of loss angle” of this specification or ≤ 1.4 times the value measured in 4.3.1 whichever is greater
	Insulation resistance	≥ 50 % of values specified in section “Insulation resistance” of this specification
SUB-GROUP C2		
4.11 Damp heat steady state		
4.11.1 Initial measurements	Capacitance at 1 kHz Tangent of loss angle at 1 kHz	
	Voltage proof = U_{RDC} for 1 min within 15 min after removal from testchamber	No breakdown or flash-over
4.11.3 Final measurements	Visual examination	No visible damage Legible marking
	Capacitance	$\|\Delta C/C\| \leq 1$ % of the value measured in 4.11.1.
	Tangent of loss angle	As specified in section “Tangent of loss angle” of this specification or ≤ 1.4 times the value measured in 4.11.1 whichever is greater
	Insulation resistance	≥ 50 % of values specified in section “Insulation resistance” of this specification

SUB-CLAUSE NUMBER AND TEST	CONDITIONS	PERFORMANCE REQUIREMENTS
SUB GROUP C3		
4.12 Endurance	Duration: 2000 h 1.5 x U_{RDC} at 85 °C 1.05 x U_{RDC} at 100 °C	
4.12.1 Initial measurements	Capacitance at 1 kHz Tangent of loss angle at 100 kHz	
4.12.5 Final measurements	Visual examination	No visible damage Legible marking
	Capacitance	$\|\Delta C/C\| \leq 2$ % of the value measured in 4.12.1
	Tangent of loss angle	As specified in section “Tangent of loss angle” of this specification or ≤ 1.4 times the value measured in 4.12.1 whichever is greater
	Insulation resistance	As specified in section “Insulation resistance” of this specification

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