Aluminum Can Power Film Capacitors

C44P-T, 550 – 850 VAC / 1280 – 2,000 VDC, Long Lifetime, High Temperature and THB

Overview

The C44P-T capacitor is a polypropylene metallized film capacitor with a cylindrical, aluminium can-type design filled with a soft, vegetable oil-based, polyurethane resin. It uses high current screw terminals, metal deck with a plastic insulators, and an overpressure safety device.

Applications

Typical applications include commutation, power factor correction, and AC harmonic filtering. Suitable for renewable energy, traction, industrical drives.

Benefits

- Long lifetime up to 220,000h
- High temperature up to 90˚C Hot Spot
- Harsh-environemntal conditions - 85˚C/85% R.H. and Vr for 1000h
- Overpressure safety device obtained with safety groove
- High peak current capability
- High torque screw terminals with plastic insulator
- Self-healing



Part Number System

C4	4	P	R	G	R	6	1	0	0	T	9	9	K
Series		Application	Rated Voltage	Case Type	Terminal Style	Capacitance Code (pF)				Variants	Case Diameter	Case Height	Tolerance
C4 = MKP Capacitors for Power Applications	4 = Cylindrical types	AC filter	P = 550 VAC R = 640 VAC U = 780 VAC W=850 VAC	G = M12 bolt	R = Male M10	Digits nine, ten, and eleven indicate the first three digits of capacitance value. Digit 8 indicates the number of zeros to be added.				T = Standard Other symbol = Special	6 = 65mm 7 = 75mm 8 = 85mm 9 = 95mm A = 116mm	1 … Z	J = ±5% K = ±10%

It is not possible to manufacture every part number which could be created from coding description. Please refer to table of standard part numbers and ask KEMET for other possibilities.

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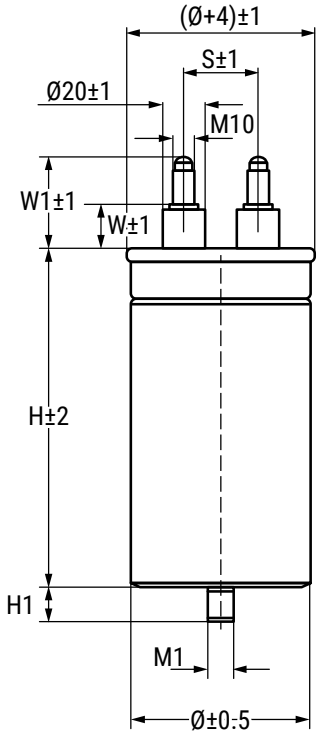
Dimensions – Millimeters



Diameter	S	W	W1	M1	H1
Ø = 65	28	18	40	12	16
Ø ≥ 75	35	21	45	12	16
All dimensions are in mm					

Maximum Driving Torque	
Terminals M10	10 [N*m]
Bolt M12	12 [N*m]

Qualifications

Reference Standards	IEC 61071 - EN 61071
	UL810 approved - E107629
Climatic Category	30/070/56
Damp Heat	IEC 60068-2-78
Change of Temperature	IEC 60068-2-14
Vibration Strength	IEC 60068-2-6

General Technical Data

Dielectric	Polypropylene film
	Non-inductive type winding
Climatic category	30/070/56 - IEC 60068-1
Maximum hot spot temperature	+90°C
Harsh-environmental withstanding	1000h @ Vr, 85°C, 85% Relative Humidity
Protection	Aluminium case
	Metal deck with self-extinguishing UL 94-V0 plastic insulators
Leads	High current M10 male terminals
Packaging	Packed in cardboard boxes with protection for the terminals
Installation	Any position (*)

(*) Prefered with terminals on top

Electrical Characteristics

Rated Voltage	Urms = (see table) VAC
Surge Voltage	Us = (see table) VDC for maximum 10 times in lifetime at +25°C ±5°C
Peak Non-Repetitive Current	1.5 x Ipkr maximum 1,000 times in lifetime
Over-Voltage (IEC 61071)	1.15 x VNDC for maximum 30 minutes, once per day
	1.3 x VNDC for maximum 1 minute, once per day
Capacitance Tolerance	±5% or ±10%
Dissipation Factor PP Typical (tgδ0)	≤ 0.0002 at 25°C
Storage Temperature Limits	-40 to 85°C

Life Expectancy

Life Expectancy	100,000 hours at VRMS with THS ≤ 70°C
Capacitance drop at end of life	-3% (typical)
Failure Rate IEC 61709	See FIT Graph

Test Methods

Test Voltage Term to Term (UTT)	1.5 x VRMS for 10 seconds at 25°C
Test Voltage Term to Case (UTC)	6,000 V ~ 50 Hz for 10 seconds

NOTICE: Care should be taken to ensure that there still is electrical clearance of 20 mm between terminations and other live or earthed parts above the capacitor, in case of safety device activation. Flexible cables should be used in order to allow proper saftey device activation.

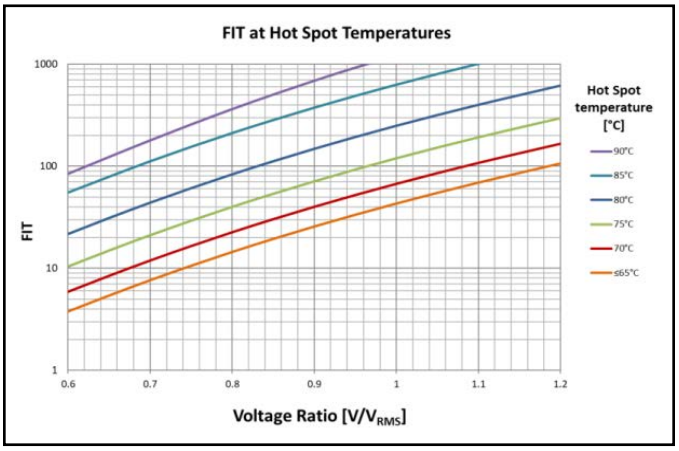
Table 1 – Ratings & Part Number Reference

Cap Value (µF)	V_{rms}	Rated Voltage	Surge Voltage	Maximum Dimensions (mm)		I_{rms} at 10 kHz, 40°C	R_S	ESL	Thermal Resistance	dV/dt (V/µs)	Part Number
	VAC	VDC	VDC	D	H	(A)[1]	(mΩ)	(nH)	(°C/W)		
22	550	1,280	1,900	65	117	34	2.1	125	11.5	30	C44PPGR5220T61K
33	550	1,280	1,900	75	117	40	1.6	130	10.4	30	C44PPGR5330T71K
47	550	1,280	1,900	65	197	50	1.4	135	7.8	30	C44PPGR5470T68K
68	550	1,280	1,900	65	247	50	1.7	145	6.1	30	C44PPGR5680T69K
100	550	1,280	1,900	75	247	57	1.4	160	5.2	30	C44PPGR6100T79K
120	550	1,280	1,900	85	247	60	1.3	165	4.6	30	C44PPGR6120T89K
150	550	1,280	1,900	95	247	60	1.2	180	4.4	30	C44PPGR6150T99K
15	640	1,400	2,100	65	117	30	2.5	120	12.2	30	C44PRGR5150T61K
22	640	1,400	2,100	65	147	30	3.0	125	10.1	30	C44PRGR5220T64K
33	640	1,400	2,100	75	147	36	2.2	135	9.1	30	C44PRGR5330T74K
47	640	1,400	2,100	65	247	49	1.9	145	5.9	30	C44PRGR5470T69K
68	640	1,400	2,100	75	247	55	1.6	160	5.2	30	C44PRGR5680T79K
100	640	1,400	2,100	95	247	60	1.3	170	4.4	30	C44PRGR6100T99K
120	640	1,400	2,100	95	247	60	1.3	180	4.1	30	C44PRGR6120T99K
150	640	1,400	2,100	116	247	60	1.2	180	3.8	30	C44PRGR6150TA9K
10	780	1,700	2,500	65	117	25	3.0	130	14.2	70	C44PUGR5100T61K
15	780	1,700	2,500	75	147	28	3.6	135	9.7	70	C44PUGR5150T74K
22	780	1,700	2,500	75	147	35	2.7	140	8.1	70	C44PUGR5220T74K
33	780	1,700	2,500	85	147	42	2.0	150	7.1	70	C44PUGR5330T84K
47	780	1,700	2,500	75	247	52	1.8	160	5.2	70	C44PUGR5470T79K
68	780	1,700	2,500	85	247	55	1.5	170	4.8	70	C44PUGR5680T89K
100	780	1,700	2,500	95	247	60	1.3	180	4.0	70	C44PUGR6100T99K
23	850	2,000	2,900	75	147	36	2.5	140	8.0	80	C44PWGR5230T74K
30	850	2,000	2,900	85	147	40	2.1	150	7.1	80	C44PWGR5300T84K
42	850	2,000	2,900	75	247	50	1.8	160	5.2	80	C44PWGR5420T79K
56	850	2,000	2,900	85	247	55	1.4	170	4.4	80	C44PWGR5560T89K
75	850	2,000	2,900	95	247	60	1.4	180	4.0	80	C44PWGR5750T99K
Cap Value	**VAC**	**Rated Voltage**	**Surge Voltage**	**D**	**H**	**I_{rms}**	**R_S**	**ESL**	**Thermal Resistance**	**dV/dt (V/µs)**	**Part Number**

[1] *Maximum admissible RMS current*

Lifetime Expectancy/Failure Quota Graphs





V = Operating Voltage [VAC]
V_{rms} = Rated Voltage [VAC]

3. Maximum case temperature (T_{CASE}) ≤ 70°C

Example of calculation

Part Number: C44PRGR6100T99K
Rated V_{RMS} = 640 [Vrms]
Rated I_{RMS} = 60 [A]
R_s = 1.3 [mΩ]
R_{th} = 4.4 [°C/W]
Fundamental Frequency F_1 = 50 [Hz]
Ripple Frequency F_2 = 10,000 (Hz)
Fundamental Voltage V_1 = 590 (V~)
Ripple Current I_2 = 32 [A]
T_a = 55°C
$I_1 = I(50) = 2 * \pi * 50 * 100 * 10^{-6} * 590 = 18.535$ (A)
$V_2 = V(10000) = [32/(2 * \pi * 10000 * 100 * 10^{-6})] = 5.11$ (V)

Power Losses and Hot Spot Temperature Calculation

At each frequency, the Power Losses are the sum of:
1. Dielectric Power Losses
$P_D(f_i) = 2 * \pi * f_i * C * V(f_i)^2 * tg\delta_0$

which can be alternatively calculated as

$$P_D(f_i) = \frac{I(f_i)^2}{2 * \pi * f_i * C} * tg\delta_0$$

where: $tg\delta_0 = 2 * 10^{-4}$

2. Joule Power Losses:
$P_J(f_i) = Rs * I(f_i)^2$

The Total Power Losses are the sum of the components at each frequency:

$$P_T = \sum_i [P_D(f_i) + P_J(f_i)]$$

The Thermal Jump in the Hot Spot is:
$\Delta T_{HS} = P_T * R_{th\text{-}hs}$

The Hot Spot Temperature is:
$T_{HS} = T_a + \Delta T_{HS}$

Limits for the formulas

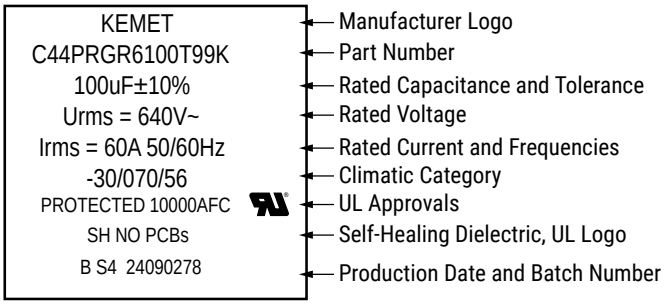
The limits listed below should not be exceeded:
1. $\sqrt{\sum_i V(f_i)^2} \le V_{RMS}$
2. $\sqrt{\sum_i I(f_i)^2} \le I_{RMS}$

$T_{HS} = T_a + \Delta T_{HS} \le (T_{HS})_{MAX}$

Where T_a is the ambient temperature (steady state temperature of the cooling air flowing around the capacitor, measured at 100 mm of distance from the capacitor and at a height of 2/3 height of the capacitor).

$I_{RMS} = \sqrt{(18.535^2 + 32^2)} = 36.98 \le 60 \rightarrow$ Admitted
$V_{RMS} = \sqrt{(440^2 + 6.1^2)} = 440 \le 440 \rightarrow$ Admitted
$P_D(50) = 2 * \pi * 50 * 100 * 10^{-6} * 590^2 * 2 * 10^{-4} = 2.186$ (W)
$P_D(10{,}000) = [32^2/(2 * \pi * 10000 * 100 * 10^{-6})] * 2 * 10^{-4} = 0.0259$ (W)]
$P_J(50) = 1.3 * 10^{-3} * [(2 * \pi * 50 * 100 * 10^{-6} * 590)^2] = 0.446$ (W)
$P_J(10{,}000) = 1.3 * 10^{-3} * 322 = 1.331$ (W)
$P_T = 2.186 + 0.0259 + 0.446 + 1.331 = 3.9889$ (W)
$\Delta T_{HS} = 4.4 * 3.9889 = 17.55$ (°C)
$T_{HS} = Ta + \Delta T_{HS}$
$T_{HS} = 55 + 17.55 = 72.55$ (°C) →OK since hot spot temperature is less than maximum admitted
Voltage Ration (V/V_{RMS}) = 590/640 = 0.92
Expected Life @ T_{HS} = 72.55°C and 0.92xVrrms à →250,000 hours (see lifetime curve)

Marking



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Sealing

Hermetically Sealed Capacitors
As the temperature increases, the pressure inside the capacitor increases. If the internal pressure is high enough, it can cause a breach in the capacitor. Such a breach can result in leakage, impregnation, filling fluid, or moisture susceptibility.

Barometric Pressure
The altitude at which hermetically sealed capacitors are operated controls the capacitor's voltage rating. As the barometric pressure decreases, the susceptibility to terminal arc-over increases. Non-hermetic capacitors can be affected by internal stresses due to pressure changes. These effects can be in the form of capacitance changes, dielectric arc-over, and/or low insulation resistance. Altitude can also affect heat transfer. Heat that is generated in an operation cannot be dissipated properly, and high RI2 losses and eventual failure can result.

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