

## 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, industrial drives.

## Benefits

- Long lifetime up to 220,000h
- High temperature up to 90°C Hot Spot
- Harsh-environmental 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

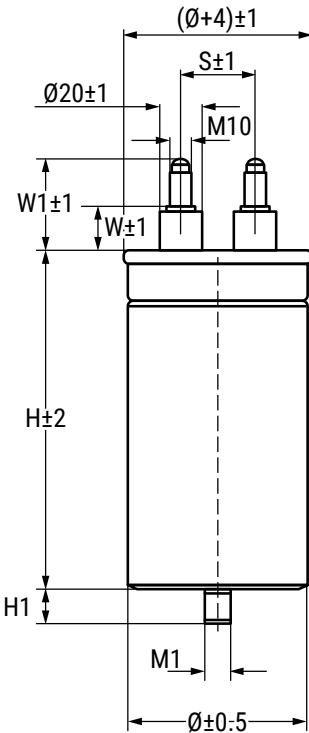


## Part Number System

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	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.*

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

(\*) Preferred 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

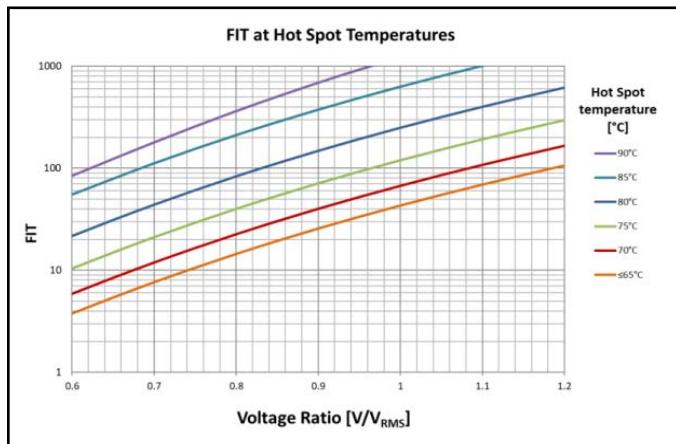
*NOTICE: Care should be taken to ensure that there still is electrical clearance of 20 mm between terminations and other live or earthed parts above the capacitor, in case of safety device activation. Flexible cables should be used in order to allow proper safety device activation.*

**Table 1 – Ratings & Part Number Reference**

Cap Value (μF)	V <sub>rms</sub>	Rated Voltage	Surge Voltage	Maximum Dimensions (mm)		I <sub>rms</sub> at 10 kHz, 40°C	R <sub>s</sub>	ESL	Thermal Resistance	dV/dt (V/μs)	Part Number
	VAC	VDC	VDC	D	H	(A) <sup>1</sup>	(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 <sub>rms</sub>	R <sub>s</sub>	ESL	Thermal Resistance	dV/dt (V/μs)	Part Number

<sup>1</sup> Maximum admissible RMS current

## Lifetime Expectancy/Failure Quota Graphs



$V$  = Operating Voltage [VAC]

$V_{rms}$  = Rated Voltage [VAC]

3. Maximum case temperature ( $T_{CASE}$ )  $\leq 70^{\circ}\text{C}$

### Example of calculation

Part Number: C44PRGR6100T99K

Rated  $V_{rms}$  = 640 [Vrms]

Rated  $I_{rms}$  = 60 [A]

$R_s$  = 1.3 [ $\text{m}\Omega$ ]

$R_{th}$  = 4.4 [ $^{\circ}\text{C}/\text{W}$ ]

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

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

which can be alternatively calculated as

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

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

#### 2. Joule Power Losses:

$$P_J(f_i) = R_s * I(f_i)^2$$

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:

$$\Delta T_{HS} = P_T * R_{th-hs}$$

The Hot Spot Temperature is:

$$T_{HS} = T_a + \Delta T_{HS}$$

### Limits for the formulas

The limits listed below should not be exceeded:

$$1. \sqrt{\sum_i V(f_i)^2} \leq V_{RMS}$$

$$2. \sqrt{\sum_i I(f_i)^2} \leq I_{RMS}$$

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

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).

$$I_{RMS} = \sqrt{(18.535^2 + 32^2)} = 36.98 \leq 60 \rightarrow \text{Admitted}$$

$$V_{RMS} = \sqrt{(440^2 + 6.1^2)} = 440 \leq 440 \rightarrow \text{Admitted}$$

$$P_D(50) = 2 * \pi * 50 * 100 * 10^{-6} * 590^2 * 2 * 10^{-4} = 2.186 \text{ (W)}$$

$$P_D(10,000) = [32^2 / (2 * \pi * 10000 * 100 * 10^{-6})] * 2 * 10^{-4} = 0.0259 \text{ (W)}$$

$$P_J(50) = 1.3 * 10^{-3} * [(2 * \pi * 50 * 100 * 10^{-6} * 590)^2] = 0.446 \text{ (W)}$$

$$P_J(10,000) = 1.3 * 10^{-3} * 322 = 1.331 \text{ (W)}$$

$$P_T = 2.186 + 0.0259 + 0.446 + 1.331 = 3.9889 \text{ (W)}$$

$$\Delta T_{HS} = 4.4 * 3.9889 = 17.55 \text{ (}^{\circ}\text{C)}$$

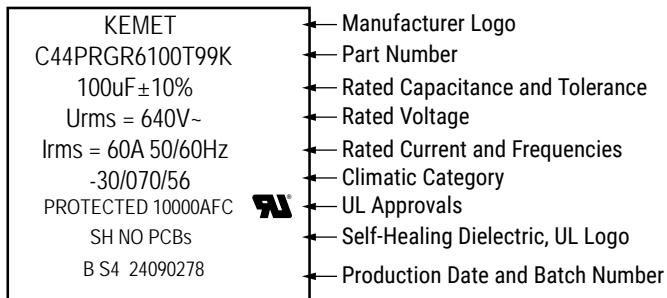
$$T_{HS} = T_a + \Delta T_{HS}$$

$T_{HS} = 55 + 17.55 = 72.55$  ( $^{\circ}\text{C}$ )  $\rightarrow$  OK since hot spot temperature is less than maximum admitted

$$\text{Voltage Ratio (V/V}_{RMS}) = 590/640 = 0.92$$

Expected Life @  $T_{HS} = 72.55^{\circ}\text{C}$  and  $0.92 \times V_{RMS}$   $\rightarrow$  250,000 hours (see lifetime curve)

## Marking



## Environmental Compliance

As a leading global supplier of electronic components and an environmentally conscious company, KEMET continually aspires to improve the environmental effects of our manufacturing processes and our finished electronic components.

In Europe (RoHS Directive) and in some other geographical areas such as China (China RoHS), legislation has been enacted to prevent or otherwise limit the use of certain hazardous materials, including lead (Pb), in electronic equipment. KEMET monitors legislation globally to ensure compliance and endeavors to adjust our manufacturing processes and/or electronic components as may be required by applicable law.

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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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