Aluminum Can Power Film Capacitors

C44P-R Series, 330 – 1,000 VAC/700 – 2,300 VDC, for PFC & AC Filter

Overview

The C44P-R capacitor is a polypropylene metallized film capactior with a cylindrical, aluminium can-type design filled with a soft, vegetable oil-based, polyurethane resin. It uses screw terminals, a plastic insulator, and an overpressure safety device.

Applications

Typical applications include commutation, power factor correction, and AC harmonic filtering.

Benefits

- Overpressure safety device
- High peak current capability
- High torque screw terminals with plastic insulator
- Long lifetime
- Self-healing

Part Number System

C	44	P	L	G	R	6	4	0	0	R	AS	J
Series		Application	Rated Voltage	Case Type	Terminal Style	Capacitance Code (pF)				Filling	Internal Codes	Tolerance
MKP Capacitors for Power Applications	44 = 330 – 1,000 VAC	AC filter	L = 330 VAC K = 440 VAC M = 480 VAC P = 550 VAC R = 640 VAC U = 780 VAC X = 1,000 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.				Polyurethane resin filled		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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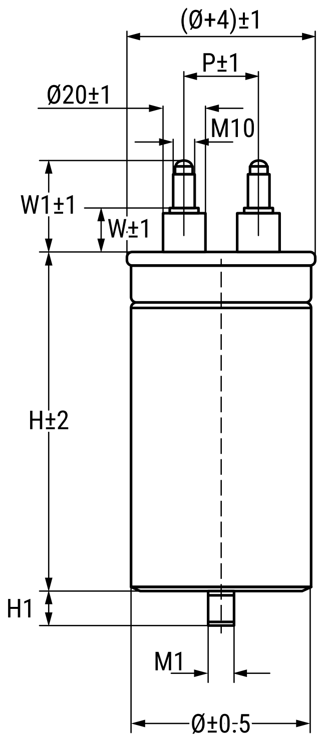
Dimensions – Millimeters



Diameter	P	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]

General Technical Data

Reference Standards	IEC 61071
	UL810 approved
Dielectric	Polypropylene film
	Non-inductive type winding
Climatic Category	25/70/56 – IEC 60068–1
Maximum hot spot temperature	+80°C
Endurance Test IEC 61071	+70°C at case temperature
Installation	Any position
Tinned brass deck with self-exstinguishing UL 94 V0 plastic insulators	

Electrical Characteristics

Rated Voltage	U_{rms} = (see table) VAC
Surge Voltage	U_s = (see table) VDC
Capacitance Tolerance	±5% or ±10%
Dissipation Factor PP typical (tgδ0)	≤ 0.0002 at 25°C
Relative Humidity	Annual average ≤ 80% at 24°C
	On 30 days/year permanently 100%. On other days occasionally 90%.
	Dewing not admitted
Capacitance deviation in temperature range (–40 +50°C)	±1.5% maximum on capacitance value at 20°C

Life Expectancy

Life Expectancy	100,000 hours at V_{RMS} with T_{HS} ≤ 75°C
Capacitance Drop at End of Life	–5% (typical)
Failure Rate IEC 61709	See FIT Graph

Test Methods

Test Voltage Term to Term (UTT)	1.5 x V_{RMS} for 10 seconds at 25°C
Test Voltage Term to Case (UTC)	3,600 V ~ 50 Hz for 10 seconds (V_{RMS} ≤ 480 VAC)
	6,000 V ~ 50 Hz for 10 seconds (V_{RMS} ≥ 550 VAC)
Damp Heat	IEC 60068–2–78
Change of Temperature	IEC 60068–2–14
Vibration Strength	IEC 60068–2–6

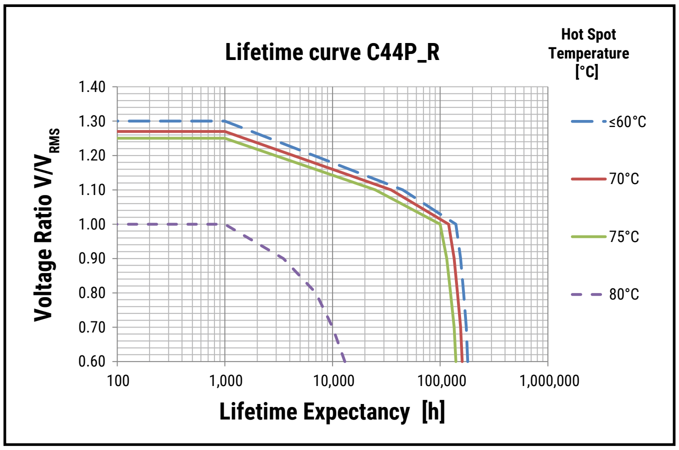
NOTICE: Care should be taken to ensure that there still is electrical clearance of 15 mm between terminations and other live or earthed parts above the capacitor, in case of safety device activation.

Table 1 – Ratings & Part Number Reference

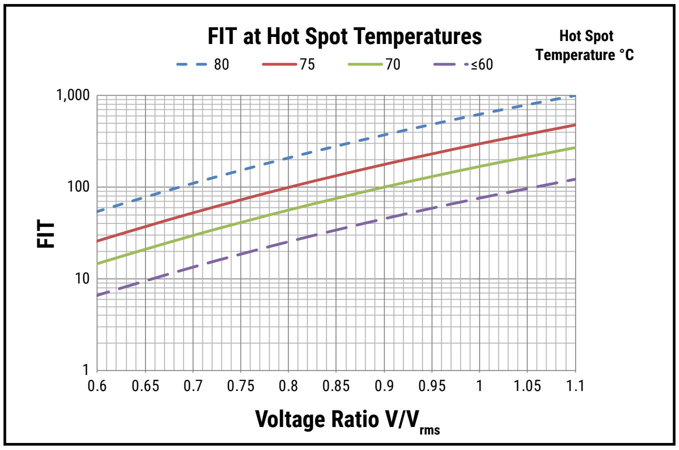
Cap Value (µF)	V_{rms}	Rated Voltage	Surge Voltage	Maximum Dimensions (mm)		I_{rms}	R_S	ESL	Thermal Resistance	dV/dt (V/µs)	Part Number
	VAC	VDC	VDC	D	H	(A)[1]	(mΩ)	(nH)	(°C/W)		
100	330	700	1050	65	117	25	2.3	115	8.5	12.5	C44PLGR6100RASJ
200	330	700	1050	75	117	43	1.7	140	6.1	12.5	C44PLGR6200RASJ
300	330	700	1050	65	247	45	2.0	150	3.6	12.5	C44PLGR6300RASJ
320	330	700	1050	65	247	55	2.0	160	3.6	12.5	C44PLGR6320RASJ
400	330	700	1050	75	247	55	1.7	160	3.0	12.5	C44PLGR6400RASJ
500	330	700	1050	75	247	58	1.7	170	3.0	12.5	C44PLGR6500RASK
500	330	700	1050	85	197	63	1.2	160	3.4	12.5	C44PLGR6500RBSK
600	330	700	1050	85	247	65	1.5	180	2.9	12.5	C44PLGR6600RASJ
600	330	700	1050	85	280	75	1.1	210	2.4	12.5	C44PLGR6600RBSK
100	440	1000	1500	75	147	30	2.7	145	5.7	20	C44PKGR6100RASJ
100	440	1000	1500	65	197	50	1.8	135	4.4	20	C44PKGR6100RBSJ
120	440	1000	1500	65	197	50	1.8	165	4.2	20	C44PKGR6120RASK
133	440	1000	1500	65	247	40	2.5	155	3.7	20	C44PKGR6133RASJ
133	440	1000	1500	75	197	50	1.6	170	4.0	20	C44PKGR6133RBSJ
150	440	1000	1500	65	247	45	2.3	160	3.5	20	C44PKGR6150RASJ
200	440	1000	1500	75	247	55	2.0	175	3.2	20	C44PKGR6200RASJ
250	440	1000	1500	85	247	60	1.7	175	3.1	20	C44PKGR6250RASJ
300	440	1000	1500	85	247	60	1.6	180	2.8	20	C44PKGR6300RASK
60	480	1100	1650	75	117	35	2.4	140	6.9	20	C44PMGR5600RASJ
60	480	1100	1650	65	147	30	3.8	140	5.9	20	C44PMGR5600RBSJ
70	480	1100	1650	75	147	50	1.4	145	5.7	20	C44PMGR5700RASJ
80	480	1100	1650	75	147	50	1.4	150	5.3	20	C44PMGR5800RASJ
100	480	1100	1650	75	157	50	1.2	160	5.0	20	C44PMGR6100RASJ
150	480	1100	1650	75	197	50	1.4	170	5.8	20	C44PMGR6150RASK
166	480	1100	1650	85	197	55	0.0	173	5.0	20	C44PMGR6166RASJ
200	480	1100	1650	75	247	50	1.8	175	4.6	20	C44PMGR6200RASK
250	480	1100	1650	85	247	50	1.6	180	4.2	20	C44PMGR6250RASJ
22	550	1280	1900	65	117	40	2.1	125	13.3	30	C44PPGR5220RASK
33	550	1280	1900	75	117	45	1.6	130	10.6	30	C44PPGR5330RASK
47	550	1280	1900	65	197	50	1.4	135	7.8	30	C44PPGR5470RASK
68	550	1280	1900	65	247	55	1.7	145	6.2	30	C44PPGR5680RASK
100	550	1280	1900	75	247	60	1.4	160	5.2	30	C44PPGR6100RASK
120	550	1280	1900	85	247	60	1.3	165	4.6	30	C44PPGR6120RASK
150	550	1280	1900	95	247	60	1.2	180	4.4	30	C44PPGR6150RASK
15	640	1400	2100	65	117	35	2.5	120	14.1	30	C44PRGR5150RASK
22	640	1400	2100	65	147	35	3.0	125	10.9	30	C44PRGR5220RASK
33	640	1400	2100	75	147	40	2.2	135	9.1	30	C44PRGR5330RASK
47	640	1400	2100	65	247	55	1.9	145	6.3	30	C44PRGR5470RASK
68	640	1400	2100	75	247	60	1.6	160	5.3	30	C44PRGR5680RASK
100	640	1400	2100	95	247	60	1.3	170	4.4	30	C44PRGR6100RASK
120	640	1400	2100	95	247	60	1.3	180	4.1	30	C44PRGR6120RASK
150	640	1400	2100	116	247	60	1.2	180	3.8	30	C44PRGR6150RASK
10	780	1700	2500	65	117	30	3.0	130	14.1	70	C44PUGR5100RASK
15	780	1700	2500	75	147	35	3.6	135	10.1	70	C44PUGR5150RASK
22	780	1700	2500	75	147	40	2.7	140	8.9	70	C44PUGR5220RASK
33	780	1700	2500	85	147	50	2.0	150	7.6	70	C44PUGR5330RASK
47	780	1700	2500	75	247	55	1.8	160	5.2	70	C44PUGR5470RASK
68	780	1700	2500	85	247	60	1.5	170	4.5	70	C44PUGR5680RASK
100	780	1700	2500	95	247	60	1.3	180	4.0	70	C44PUGR6100RASK
15	1000	2300	3300	75	147	33	2.5	150	9.2	85	C44PXGR5150RASK
20	1000	2300	3300	75	140	40	2.1	150	8.3	85	C44PXGR5200RCSK
22	1000	2300	3300	75	147	35	2.0	155	8.0	85	C44PXGR5220RASK
33	1000	2300	3300	75	247	40	1.7	165	5.3	85	C44PXGR5330RASK
47	1000	2300	3300	85	247	45	1.4	170	4.7	85	C44PXGR5470RASK
68	1000	2300	3300	95	247	55	1.2	180	4.1	85	C44PXGR5680RASK
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 $T_{HS} \leq 75°C$.*

Lifetime Expectancy/Failure Quota Graphs



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



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).*

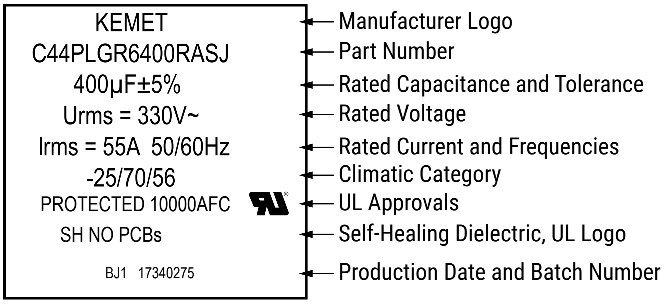
3. Maximum case temperature $(T_{CASE}) \le 70°C$

Example of calculation

Part Number: C44PKGR6100RASJ
Rated $V_{RMS} = 440\ [V_{RMS}]$
Rated $I_{RMS} = 30\ [A]$
$R_s = 2.7\ [m\Omega]$
$R_{th} = 5.7\ [°C/W]$
Fundamental Frequency $F_1 = 50\ [Hz]$
Ripple Frequency $F_2 = 7{,}000\ [Hz]$
Fundamental Voltage $V_1 = 440\ [V\sim]$
Ripple Current $I_2 = 27\ [A]$
$T_a = 39°C$
$I_1 = I(50) = 2 * \pi * 50 * 100 * 10^{-6} * 440 = 13.8\ [A]$
$V_2 = V(7{,}000) = [27/(2 * \pi * 7{,}000 * 100 * 10^{-6})] = 6.14\ [V]$

$I_{RMS} = \sqrt{(13.8^2 + 27^2)} = 30 \le 30 \rightarrow$ *Admitted*
$V_{RMS} = \sqrt{(440^2 + 6.1^2)} = 440 \le 440 \rightarrow$ *Admitted*
$P_D(50) = 2 * \pi * 50 * 100 * 10^{-6} * 440^2 * 2 * 10^{-4} = 1.22\ [W]$
$P_D(7{,}000) = [27^2/(2 * \pi * 7{,}000 * 100 * 10^{-6})] * 2 * 10^{-4} = 0.03\ [W]$
$P_J(50) = 2.7 * 10^{-3} * [(2 * \pi * 50 * 100 * 10^{-6} * 440)^2] = 0.52\ [W]$
$P_J(7{,}000) = 2.7 * 10^{-3} * 27^2 = 2.55\ [W]$
$P_T = 1.22 + 0.03 + 0.52 + 1.97 = 3.74\ [W]$
$\Delta T_{HS} = 5.7 * 3.74 = 21\ [°C]$
$T_{HS} = Ta + \Delta T_{HS}$
$T_{HS} = 39 + 21 = 60\ [°C] \rightarrow$ *OK since hot spot temperature is less than maximum admitted*
Expected Life at $T_{HS} = 75°C \rightarrow$ *100,000 hours (see lifetime curve)*
Expected Life at $T_{HS} = 60°C \rightarrow$ *140,000 hours (see lifetime curve)*

Marking



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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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Dissipation Factor

Dissipation factor is a complex function involved with capacitor inefficiency. The tgδ may vary up and down with increased temperature. For more information, refer to Performance Characteristics.

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.

Radiation
Radiation capabilities of capacitors must be taken into consideration. Electrical degradation in the form of dielectric embitterment can take place, causing shorts or opens.

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