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

## Overview

The C44P-R 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 screw terminals, a plastic insulator, and an overpressure safety device.

## Applications

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

## Benefits

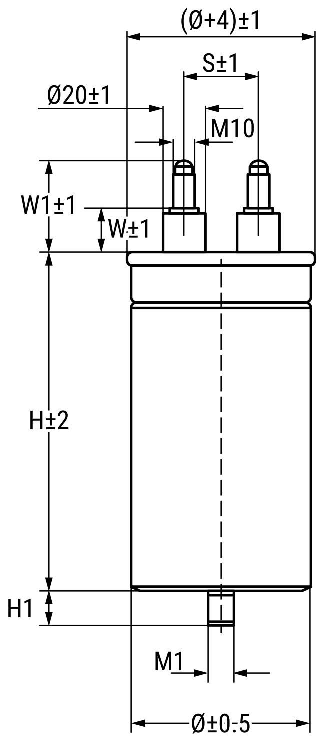
- Overpressure safety device
- High peak current capability
- High torque screw terminals with plastic insulator
- Long lifetime
- Self-healing

## 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<br>K = 440 VAC<br>M = 480 VAC<br>P = 550 VAC<br>R = 640 VAC<br>U = 780 VAC<br>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%<br>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] |

## 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 |
| Storage Temperature | -40 to 85°C |
| Relative Humidity | Annual average ≤ 80% at 24°C |
| | On 30 days/year permanently 100%.<br>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 |

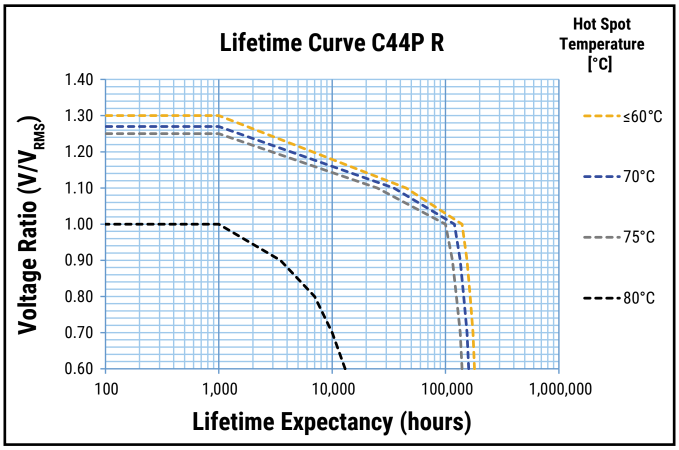
*NOTICE: Care should be taken to ensure that there still is electrical clearance of 15 mm between terminations and other live or earthed parts above the capacitor, in case of safety device activation.*

## Table 1 – Ratings & Part Number Reference

| Cap Value (µF) | $V_{rms}$ | Rated Voltage | Surge Voltage | Maximum Dimensions (mm) | | $I_{rms}$ 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) | | |
| 100 | 330 | 700 | 1,050 | 65 | 117 | 25 | 2.3 | 115 | 8.5 | 12.5 | C44PLGR6100RASJ |
| 200 | 330 | 700 | 1,050 | 75 | 117 | 43 | 1.7 | 140 | 6.1 | 12.5 | C44PLGR6200RASJ |
| 300 | 330 | 700 | 1,050 | 65 | 247 | 45 | 2.0 | 150 | 3.6 | 12.5 | C44PLGR6300RASJ |
| 320 | 330 | 700 | 1,050 | 65 | 247 | 55 | 2.0 | 160 | 3.6 | 12.5 | C44PLGR6320RASJ |
| 400 | 330 | 700 | 1,050 | 75 | 247 | 55 | 1.7 | 160 | 3.0 | 12.5 | C44PLGR6400RASJ |
| 500 | 330 | 700 | 1,050 | 75 | 247 | 58 | 1.7 | 170 | 3.0 | 12.5 | C44PLGR6500RASK |
| 500 | 330 | 700 | 1,050 | 85 | 197 | 63 | 1.2 | 160 | 3.4 | 12.5 | C44PLGR6500RBSK |
| 600 | 330 | 700 | 1,050 | 85 | 247 | 65 | 1.5 | 180 | 2.9 | 12.5 | C44PLGR6600RASJ |
| 600 | 330 | 700 | 1,050 | 85 | 280 | 75 | 1.1 | 210 | 2.4 | 12.5 | C44PLGR6600RBSK |
| 100 | 440 | 1,000 | 1,500 | 75 | 147 | 30 | 2.7 | 145 | 5.7 | 20 | C44PKGR6100RASJ |
| 100 | 440 | 1,000 | 1,500 | 65 | 197 | 50 | 1.8 | 135 | 4.4 | 20 | C44PKGR6100RBSJ |
| 120 | 440 | 1,000 | 1,500 | 65 | 197 | 50 | 1.8 | 165 | 4.2 | 20 | C44PKGR6120RASK |
| 133 | 440 | 1,000 | 1,500 | 65 | 247 | 40 | 2.5 | 155 | 3.7 | 20 | C44PKGR6133RASJ |
| 133 | 440 | 1,000 | 1,500 | 75 | 197 | 50 | 1.6 | 170 | 4.0 | 20 | C44PKGR6133RBSJ |
| 150 | 440 | 1,000 | 1,500 | 65 | 247 | 45 | 2.3 | 160 | 3.5 | 20 | C44PKGR6150RASJ |
| 200 | 440 | 1,000 | 1,500 | 75 | 247 | 55 | 2.0 | 175 | 3.2 | 20 | C44PKGR6200RASJ |
| 250 | 440 | 1,000 | 1,500 | 85 | 247 | 60 | 1.7 | 175 | 3.1 | 20 | C44PKGR6250RASJ |
| 300 | 440 | 1,000 | 1,500 | 85 | 247 | 60 | 1.6 | 180 | 2.8 | 20 | C44PKGR6300RASK |
| 60 | 480 | 1,100 | 1,650 | 75 | 117 | 35 | 2.4 | 140 | 6.9 | 20 | C44PMGR5600RASJ |
| 60 | 480 | 1,100 | 1,650 | 65 | 147 | 30 | 3.8 | 140 | 5.9 | 20 | C44PMGR5600RBSJ |
| 70 | 480 | 1,100 | 1,650 | 75 | 147 | 50 | 1.4 | 145 | 5.7 | 20 | C44PMGR5700RASJ |
| 80 | 480 | 1,100 | 1,650 | 75 | 147 | 50 | 1.4 | 150 | 5.3 | 20 | C44PMGR5800RASJ |
| 100 | 480 | 1,100 | 1,650 | 75 | 157 | 50 | 1.2 | 160 | 5.0 | 20 | C44PMGR6100RASJ |
| 150 | 480 | 1,100 | 1,650 | 75 | 197 | 50 | 1.4 | 170 | 5.8 | 20 | C44PMGR6150RASK |
| 166 | 480 | 1,100 | 1,650 | 85 | 197 | 55 | 1.4 | 173 | 5.0 | 20 | C44PMGR6166RASJ |
| 200 | 480 | 1,100 | 1,650 | 75 | 247 | 50 | 1.8 | 175 | 4.6 | 20 | C44PMGR6200RASK |
| 250 | 480 | 1,100 | 1,650 | 85 | 247 | 50 | 1.6 | 180 | 4.2 | 20 | C44PMGR6250RASJ |
| 22 | 550 | 1,280 | 1,900 | 65 | 117 | 34 | 2.1 | 125 | 11.5 | 30 | C44PPGR5220RASK |
| 33 | 550 | 1,280 | 1,900 | 75 | 117 | 40 | 1.6 | 130 | 10.4 | 30 | C44PPGR5330RASK |
| 47 | 550 | 1,280 | 1,900 | 65 | 197 | 50 | 1.4 | 135 | 7.8 | 30 | C44PPGR5470RASK |
| 68 | 550 | 1,280 | 1,900 | 65 | 247 | 50 | 1.7 | 145 | 6.1 | 30 | C44PPGR5680RASK |
| 100 | 550 | 1,280 | 1,900 | 75 | 247 | 57 | 1.4 | 160 | 5.2 | 30 | C44PPGR6100RASK |
| 120 | 550 | 1,280 | 1,900 | 85 | 247 | 60 | 1.3 | 165 | 4.6 | 30 | C44PPGR6120RASK |
| 150 | 550 | 1,280 | 1,900 | 95 | 247 | 60 | 1.2 | 180 | 4.4 | 30 | C44PPGR6150RASK |
| 15 | 640 | 1,400 | 2,100 | 65 | 117 | 30 | 2.5 | 120 | 12.2 | 30 | C44PRGR5150RASK |
| 22 | 640 | 1,400 | 2,100 | 65 | 147 | 30 | 3.0 | 125 | 10.1 | 30 | C44PRGR5220RASK |
| 33 | 640 | 1,400 | 2,100 | 75 | 147 | 36 | 2.2 | 135 | 9.1 | 30 | C44PRGR5330RASK |
| 47 | 640 | 1,400 | 2,100 | 65 | 247 | 49 | 1.9 | 145 | 5.9 | 30 | C44PRGR5470RASK |
| 68 | 640 | 1,400 | 2,100 | 75 | 247 | 55 | 1.6 | 160 | 5.2 | 30 | C44PRGR5680RASK |
| 100 | 640 | 1,400 | 2,100 | 95 | 247 | 60 | 1.3 | 170 | 4.4 | 30 | C44PRGR6100RASK |
| 120 | 640 | 1,400 | 2,100 | 95 | 247 | 60 | 1.3 | 180 | 4.1 | 30 | C44PRGR6120RASK |
| 150 | 640 | 1,400 | 2,100 | 116 | 247 | 60 | 1.2 | 180 | 3.8 | 30 | C44PRGR6150RASK |
| 10 | 780 | 1,700 | 2,500 | 65 | 117 | 25 | 3.0 | 130 | 14.2 | 70 | C44PUGR5100RASK |
| 15 | 780 | 1,700 | 2,500 | 75 | 147 | 28 | 3.6 | 135 | 9.7 | 70 | C44PUGR5150RASK |
| 22 | 780 | 1,700 | 2,500 | 75 | 147 | 35 | 2.7 | 140 | 8.1 | 70 | C44PUGR5220RASK |
| 33 | 780 | 1,700 | 2,500 | 85 | 147 | 42 | 2.0 | 150 | 7.1 | 70 | C44PUGR5330RASK |
| 47 | 780 | 1,700 | 2,500 | 75 | 247 | 52 | 1.8 | 160 | 5.2 | 70 | C44PUGR5470RASK |
| 68 | 780 | 1,700 | 2,500 | 85 | 247 | 55 | 1.5 | 170 | 4.8 | 70 | C44PUGR5680RASK |
| 100 | 780 | 1,700 | 2,500 | 95 | 247 | 60 | 1.3 | 180 | 4.0 | 70 | C44PUGR6100RASK |
| 15 | 1,000 | 2,300 | 3,300 | 75 | 147 | 32 | 2.5 | 150 | 9.4 | 85 | C44PXGR5150RASK |
| 20 | 1,000 | 2,300 | 3,300 | 75 | 140 | 36 | 2.1 | 150 | 8.3 | 85 | C44PXGR5200RCSK |
| 22 | 1,000 | 2,300 | 3,300 | 75 | 147 | 35 | 2.0 | 155 | 8.0 | 85 | C44PXGR5220RASK |
| 33 | 1,000 | 2,300 | 3,300 | 75 | 247 | 40 | 1.7 | 165 | 5.3 | 85 | C44PXGR5330RASK |
| 47 | 1,000 | 2,300 | 3,300 | 85 | 247 | 45 | 1.4 | 170 | 4.7 | 85 | C44PXGR5470RASK |
| 68 | 1,000 | 2,300 | 3,300 | 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 |

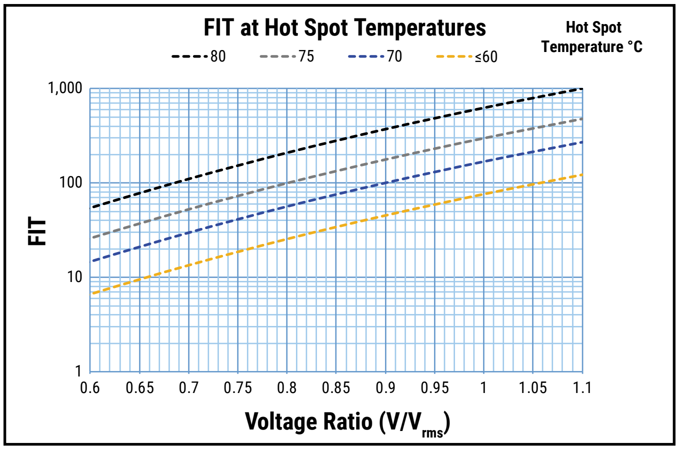
[1] *Maximum admissible RMS current $T_{HS} \leq 75°C$; $\Delta T_{max} \leq 35°C$.*

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

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).*

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

## Example of calculation

*Part Number: C44PKGR6100RASJ*

*Rated $V_{RMS}$ = 440 [$V_{RMS}$]*

*Rated $I_{RMS}$ = 30 [A]*

*$R_s$ = 2.7 [mΩ]*

*$R_{th}$ = 5.7 [°C/W]*

*Fundamental Frequency $F_1$ = 50 [Hz]*

*Ripple Frequency $F_2$ = 7,000 [Hz]*

*Fundamental Voltage $V_1$ = 440 [V~]*

*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]

$I_{RMS} = \sqrt{(13.8^2 + 27^2)} = 30 \leq 30 \rightarrow$ *Admitted*

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

$P_J(7{,}000) = 2.7 * 10^{-3} * 27^2 = 1.97$ [W]

$P_T = 1.22 + 0.03 + 0.52 + 1.97 = 3.74$ [W]

$\Delta T_{HS} = 5.7 * 3.74 = 21$ [°C]

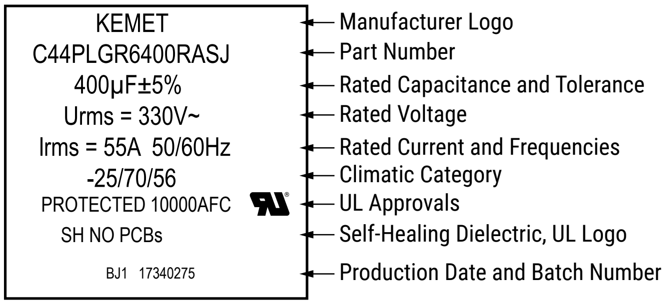
$T_{HS} = Ta + \Delta T_{HS}$

$T_{HS} = 39 + 21 = 60$ [°C] $\rightarrow$ *OK since hot spot temperature is less than maximum admitted*

*Expected Life at $T_{HS}$ = 75°C → 100,000 hours (see lifetime curve)*

*Expected Life at $T_{HS}$ = 60°C → 140,000 hours (see lifetime curve)*

## Marking

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All KEMET power film capacitors are RoHS compliant.

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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 $RI^2$ losses and eventual failure can result.

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