

# C44P/C20A Series, 250 – 1,000 VAC, 400 – 1,400 VDC, for PFC and AC Filter

## Overview

The C44P/C20A Series are a polypropylene metallized film with cylindrical aluminium can type filled with oil, screw terminals, plastic insulator and 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

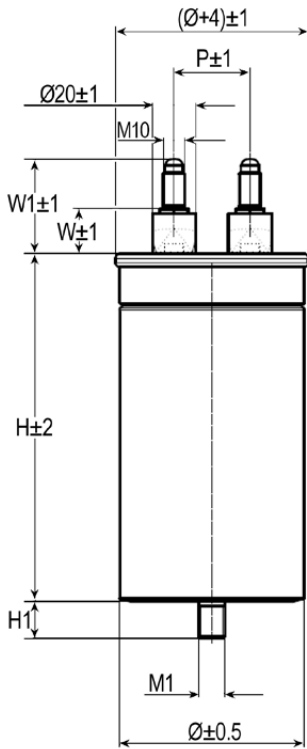


## Part Number System

C	44	P	F	G	R	6	1	0	0	A	A	S	J	
Series		Application	Rated Voltage (VAC)		Case Type	Terminal Style		Capacitance Code (pF)			Internal Code		Internal Codes	Tolerance
MKP Capacitors for Power Applications	44 = 250/440 V <sub>ac</sub> 20 = 550/1,000 V <sub>ac</sub>	AC Filter  P = C44 A = C20	<b>For C44P:</b> F = 250 L = 330 K = 440	<b>For C20A:</b> K = 550 L = 640 Q = 780 Z = 1000	G = M12 bolt	R = Male M10		Digits 9, 10, & 11 indicate the first 3 digits of capacitance value. Digit 8 indicates the number of zeros that must be added to obtain rated capacitance in pF.			A = Standard Z = Special			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	P	W	W1	M1	H1
$\text{Ø} = 65$	28	18	40	12	16
$\text{Ø} \geq 75$	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 @ Case Temperature
Installation	Whatever position
Tinned brass deck with self extinguish UL94 V0 plastic insulators	

## Electrical Characteristics

Rated Voltage	Urms = (see table) VAC
Surge Voltage	Us = (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 @ $V_{RMS}$ with $T_{HS} \leq 75^\circ\text{C}$
Capacitance drop at end of life	- 5% (typical)
Failure Rate IEC 61709	See FIT Graph

## Test Methods

Test voltage term to term (Utt)	$1.5 \times V_{RMS}$ for 10 seconds at 25°C
Test voltage term to case (Utc)	3,600 V ~ 50 Hz for 10 seconds (C44P) 6,000 V ~ 50 Hz for 10 seconds (C20A)
Damp Heat	IEC 60068-2-78
Change of Temperature	IEC 60068-2-14
Vibration Strength	IEC 60068-2-6

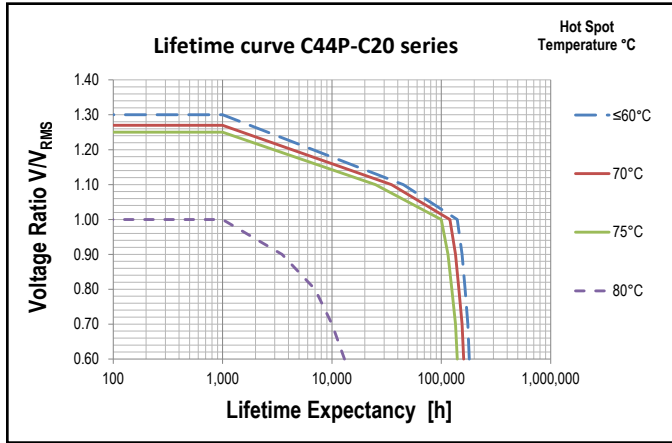
*NOTICE: Care should be taken to ensure that there still is electrical clearance of 15 mm between terminations and other live or earthed parts above the capacitor, in case of safety device activation.*

Table 1 – Ratings &amp; Part Number Reference

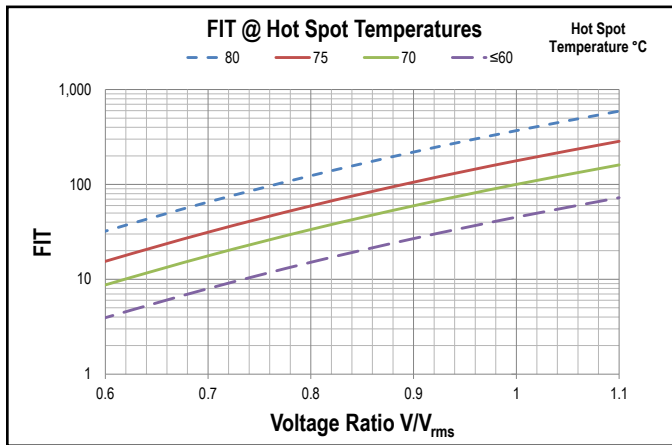
Cap Value (μF)	V <sub>rms</sub>	Rated Voltage	Surge Voltage	Maximum Dimensions (mm)		Ripple Current	ESR	ESL	Thermal Res	dV/dt (V/μs)	Part Number
	VAC	VDC	VDC	D	H	10 kHz 40°C (A) <sup>1</sup>	10 kHz (mΩ)	(nH)	(°C/W)		
100	330	700	1050	65	117	25	3.0	115	8.5	12.5	C44PLGR6100AASJ
200	330	700	1050	65	147	43	2.8	140	5.4	12.5	C44PLGR6200ZASJ
300	330	700	1050	65	247	50	2.3	150	3.6	12.5	C44PLGR6300ZASJ
300	330	700	1050	75	197	55	1.4	160	4.2	12.5	C44PLGR6300AASJ
400	330	700	1050	65	247	55	2.0	160	3.1	12.5	C44PLGR6400ZASJ
500	330	700	1050	75	247	58	1.8	170	2.9	12.5	C44PLGR6500ZASJ
500	330	700	1050	85	197	63	1.2	160	3.4	12.5	C44PLGR6500ZBSJ
600	330	700	1050	85	247	65	1.6	180	2.9	12.5	C44PLGR6600AASJ
600	330	700	1050	85	280	75	1.1	210	2.4	12.5	C44PLGR6600ZASJ
100	440	1000	1500	75	147	30	3.5	145	5.6	20	C44PKGR6100AASJ
100	440	1000	1500	65	197	50	2.3	135	4.4	20	C44PKGR6100ZASJ
120	440	1000	1500	65	197	50	1.8	165	4.2	20	C44PKGR6120AASJ
133	440	1000	1500	65	247	40	3.0	155	3.7	20	C44PKGR6133AASJ
133	440	1000	1500	75	197	50	1.6	170	4.0	20	C44PKGR6133ZASJ
150	440	1000	1500	65	247	45	2.8	160	3.5	20	C44PKGR6150AASJ
200	440	1000	1500	75	247	55	2.4	175	3.2	20	C44PKGR6200AASJ
250	440	1000	1500	85	247	60	2.0	175	3.4	20	C44PKGR6250AASJ
300	440	1000	1500	85	247	60	1.9	180	2.7	20	C44PKGR6300AASJ
400	440	1000	1500	95	247	65	1.7	200	2.5	20	C44PKGR6400AASK
22	550	1280	1900	65	117	40	2.1	125	13.3	30	C20AKGR5220AASK
33	550	1280	1900	75	117	45	1.6	130	10.6	30	C20AKGR5330AASK
47	550	1280	1900	65	197	50	1.4	135	7.8	30	C20AKGR5470AASK
68	550	1280	1900	65	247	55	1.7	145	6.2	30	C20AKGR5680AASK
100	550	1280	1900	75	247	60	1.4	160	5.2	30	C20AKGR6100AASK
120	550	1280	1900	85	247	60	1.3	165	4.6	30	C20AKGR6120AASK
150	550	1280	1900	95	247	60	1.2	180	4.4	30	C20AKGR6150AASK
15	640	1400	2100	65	117	35	2.5	120	14.1	30	C20ALGR5150AASK
22	640	1400	2100	65	147	35	3.0	125	10.9	30	C20ALGR5220AASK
33	640	1400	2100	75	147	40	2.2	135	9.1	30	C20ALGR5330AASK
47	640	1400	2100	65	247	55	1.9	145	6.3	30	C20ALGR5470AASK
68	640	1400	2100	75	247	60	1.6	160	5.3	30	C20ALGR5680AASK
100	640	1400	2100	95	247	60	1.3	170	4.4	30	C20ALGR6100AASK
120	640	1400	2100	95	247	60	1.3	175	4.1	30	C20ALGR6120AASK
150	640	1400	2100	116	247	60	1.2	180	3.8	30	C20ALGR6150AASK
10	780	1700	2500	65	117	30	3.0	130	14.1	70	C20AQR5100AASK
15	780	1700	2500	75	147	35	3.6	135	10.1	70	C20AQR5150AASK
22	780	1700	2500	75	147	40	2.7	140	8.9	70	C20AQR5220AASK
33	780	1700	2500	85	147	50	2.0	150	7.6	70	C20AQR5330AASK
47	780	1700	2500	75	247	55	1.8	160	5.2	70	C20AQR5470AASK
68	780	1700	2500	85	247	60	1.5	170	4.5	70	C20AQR5680AASK
100	780	1700	2500	95	247	60	1.3	180	4.0	70	C20AQR6100AASK
15	1000	2300	3300	75	147	33	2.5	150	9.2	85	C20AZGR5150AASK
20	1000	2300	3300	75	140	40	2.1	150	8.3	85	C20AZGR5200ZBSK
22	1000	2300	3300	75	147	35	2.0	155	8.0	85	C20AZGR5220AASK
33	1000	2300	3300	75	247	40	1.7	165	5.3	85	C20AZGR5330AASK
47	1000	2300	3300	85	247	45	1.4	170	4.7	85	C20AZGR5470AASK
68	1000	2300	3300	95	247	55	1.2	180	4.1	85	C20AZGR5680AASK
Cap Value	VAC	Rated	Surge	D	H	Ripple Current	ESR	ESL	Thermal Res	dV/dt (V/μs)	Part Number

<sup>1</sup> Maximum admissible RMS current  $T_{HS} \leq 75^{\circ}\text{C}$ .

## 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

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

which can be alternatively calculated as

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

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

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).

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

### Example of calculation

Part Number: C44PKGR6100AASJ

Rated  $V_{RMS} = 440$  [V<sub>RMS</sub>]

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

$R_s = 3.5$  [mΩ]

$R_{th} = 5.6$  [°C/W]

Fundamental Frequency  $F_1 = 50$  [Hz]

Ripple Frequency  $F_2 = 7000$  [Hz]

Fundamental Voltage  $V_1 = 440$  [V~]

Ripple Current  $I_2 = 27$  [A]

$T_a = 35^\circ\text{C}$

$I_1 = I(50) = 2 * \pi * 50 * 100 * 10^{-6} * 440 = 13.8$  [A]

$V_2 = V(7000) = [27 / (2 * \pi * 7000 * 100 * 10^{-6})] = 6.14$  [V]

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

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

$$P_D(50) = 2 * \pi * 50 * 100 * 10^{-6} * 440^2 * 2 * 10^{-4} = 1.22$$
 [W]

$$P_D(7000) = [27^2 / (2 * \pi * 7000 * 100 * 10^{-6})] * 2 * 10^{-4} = 0.03$$
 [W]

$$P_J(50) = 3.5 * 10^{-3} * [(2 * \pi * 50 * 100 * 10^{-6} * 440)^2] = 0.67$$
 [W]

$$P_J(7000) = 3.5 * 10^{-3} * 27^2 = 2.55$$
 [W]

$$P_T = 1.22 + 0.03 + 0.67 + 2.55 = 4.47$$
 [W]

$$\Delta T_{HS} = 5.6 * 4.47 = 25$$
 [°C]



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

$T_{HS} = 35 + 25 = 60$  [°C] → OK since hot spot temperature is less than maximum admitted

Expected Life @  $T_{HS} = 75^\circ\text{C}$  → 100,000 hours (see lifetime curve)

Expected Life @  $T_{HS} = 60^\circ\text{C}$  → 140,000 hours (see lifetime curve)

## Marking

KEMET	→ Manufacturer Logo
C20AZGR5200ZBSK	→ Part Number
20 $\mu$ F $\pm$ 10%	→ Rated Capacitance and Tolerance
Urms=1000V~	→ Rated Voltage
Irms=50A 50/60Hz	→ Rated Current and Frequencies
-25/70/56	→ Climatic Category
PROTECTED 1000AFC	→ UL Approvals
SH NO PCBs 	→ Self-Healing Dielectric. UL Logo.
 B4 11374275	→ CE Logo. Production Date and Batch Number

## Dissipation Factor

Dissipation factor is a complex function involved with the inefficiency of the capacitor. The  $\tan\delta$  may change up and down with increased temperature. For more information, please refer to Performance Characteristics.

## Sealing

### Hermetically Sealed Capacitors

When the temperature increases, the pressure inside the capacitor increases. If the internal pressure is high enough, it can cause a breach in the capacitor which can result in leakage, impregnation, filling fluid or moisture susceptibility.

### Resin Encased/Wrap & Fill Capacitors

The resin seals on resin encased and wrap and fill capacitors will withstand short-term exposure to high humidity environments without degradation. Resins and plastic tapes will form a pseudo-impervious barrier to humidity and chemicals. These case materials are somewhat porous and through osmosis can cause contaminants to enter the capacitor. The second area of contaminated absorption is the lead-wire/resin interface. Since resins cannot bond 100% to tinned wires, there can be a path formed up to the lead wire into the capacitor section. Aqueous cleaning of circuit boards can aggravate this condition.

### Barometric Pressure

The altitude at which hermetically sealed capacitors are operated controls the voltage rating of the capacitor. 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. This can be in the form of capacitance changes or dielectric arc-over as well as low insulation resistance. Heat transfer can also be affected by altitude operation. Heat generated in operation cannot be dissipated properly and can result in high RI2 losses and eventual failure.

### 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.

## Environmental Compliance

As an environmentally conscious company, KEMET is working continuously with improvements concerning the environmental effects of both our capacitors and their production.

In Europe (RoHS Directive) and in some other geographical areas like China, legislation has been put in place to prevent the use of some hazardous materials, like Lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products to fulfill these legislative requirements. The only material of concern in our products has been Lead (Pb), which has been removed from all designs to fulfill the requirement of containing less than 0.1% of Lead in any homogeneous material.

KEMET will closely follow any changes in legislation world wide and makes any necessary changes in its products, whenever needed. Some customer segments like Medical, Military and Automotive Electronics may still require the use of Lead in electrode coatings. To clarify the situation and distinguish products from each other, a special symbol is used on the packaging labels for RoHS compatible capacitors.

Because of customer requirements there may appear additional markings like LF = Lead Free or LFW = Lead Free Wires on the label.

All KEMET power film products are RoHS Compliant.



RoHS Compliant

---

## Materials & Environment

The selection of materials used by KEMET for the production of capacitors is the result of extensive experience and constant attention to environmental protection. KEMET selects its suppliers according to ISO 9001 standards and carries out statistical analysis on the materials purchased before acceptance. All materials are, to the company's present knowledge, non-toxic and free from Cadmium, Mercury, Chrome and compounds, PCB (Polychlorine Triphenyl), Bromide and Chlorine Dioxins Bromurate Chlorurate, CFC and HCFC and Asbestos.

## Green Products

All KEMET power film products are ROHS Compliant.

## Insulation Resistance

When the capacitor temperature increases, the insulation resistance decreases. This is due to increased electron activity. Low insulation resistance can also be the result of moisture trapped in the windings, caused by a prolonged exposure to excessive humidity.

## KEMET Corporation World Headquarters

2835 KEMET Way  
Simpsonville, SC 29681

Mailing Address:  
P.O. Box 5928  
Greenville, SC 29606

www.kemet.com  
Tel: 864-963-6300  
Fax: 864-963-6521

**Corporate Offices**  
Fort Lauderdale, FL  
Tel: 954-766-2800

## North America

**Southeast**  
Lake Mary, FL  
Tel: 407-855-8886

**Northeast**  
Wilmington, MA  
Tel: 978-658-1663

**Central**  
Novi, MI  
Tel: 248-306-9353

**West**  
Milpitas, CA  
Tel: 408-433-9950

**Mexico**  
Guadalajara, Jalisco  
Tel: 52-33-3123-2141

## Europe

**Southern Europe**  
Paris, France  
Tel: 33-1-4646-1006

Sasso Marconi, Italy  
Tel: 39-051-939111

**Central Europe**  
Landsberg, Germany  
Tel: 49-8191-3350800

Kamen, Germany  
Tel: 49-2307-438110

**Northern Europe**  
Bishop's Stortford, United Kingdom  
Tel: 44-1279-460122

Espoo, Finland  
Tel: 358-9-5406-5000

## Asia

**Northeast Asia**  
Hong Kong  
Tel: 852-2305-1168

Shenzhen, China  
Tel: 86-755-2518-1306

Beijing, China  
Tel: 86-10-5829-1711

Shanghai, China  
Tel: 86-21-6447-0707

Taipei, Taiwan  
Tel: 886-2-27528585

**Southeast Asia**  
Singapore  
Tel: 65-6586-1900

Penang, Malaysia  
Tel: 60-4-6430200

Bangalore, India  
Tel: 91-806-53-76817

*Note: KEMET reserves the right to modify minor details of internal and external construction at any time in the interest of product improvement. KEMET does not assume any responsibility for infringement that might result from the use of KEMET Capacitors in potential circuit designs. KEMET is a registered trademark of KEMET Electronics Corporation.*



## Prototype Sample Disclaimer

*The Customer acknowledges the following limitations of the prototype samples:*

- (1) Prototype samples are manufactured from preliminary designs and manufacturing processes; may not represent final designs; have not been released for commercial use and are not subject to the same quality control procedures applicable to released products.*
- (2) Prototype samples are not qualified parts and are provided “as-is” by KEMET Electronics Corporation, which specifically disclaims any and all warranties and guarantees, explicit or implied, including, without limitation, the warranties of merchantability and fitness for a particular purpose or use.*
- (3) Prototype samples are not intended for commercial use; are provided for engineering evaluation only and are not recommended for use in the Customer’s production line.*
- (4) The Customer assumes the risk of any and all uses that the Customer makes of the prototype samples.*

## General Disclaimer

*“All product specifications, statements, information and data given herein are believed to be accurate and reliable, but are presented without guarantee, warranty, or responsibility of any kind, expressed or implied. Statements of suitability for certain applications are based on our knowledge of typical operating conditions for such applications, but are not intended to constitute – and we specifically disclaim – any warranty concerning suitability for a specific customer application or use. This information is intended for use only by customers who have the requisite experience and capability to determine the correct products for their application.*

*KEMET’s product warranty is set forth at [www.kemet.com](http://www.kemet.com) under Terms and Conditions of Sale.”*