C44P/C20A Series, 330 – 1,000 VAC, 700 – 2,300 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

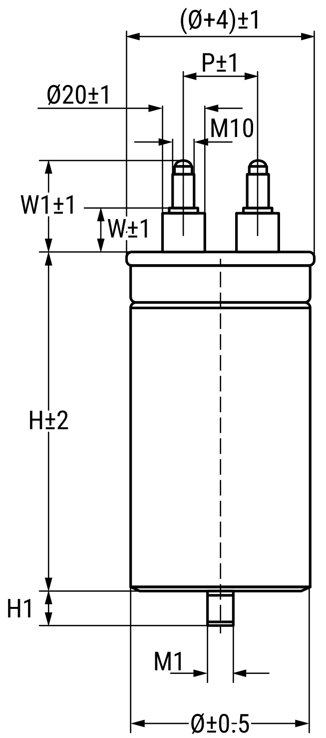
- Overpressure safety device
- High peak current capability
- High torque screw terminals with plastic insulator
- Long lifetime
- Self-healing

Part Number System

C	44	P	L		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 = 330 – 440 VAC 20 = 550 – 1,000 VAC	AC Filter P = C44 A = C20	For C44P: L = 330 K = 440	For C20A: K = 550 L = 640 Q = 780 Z = 1000	G = M12 bolt	R = Male M10	Digits 9 – 11 indicate the first three 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
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	Whatever position
Tinned brass deck with self estinguish 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 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 (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

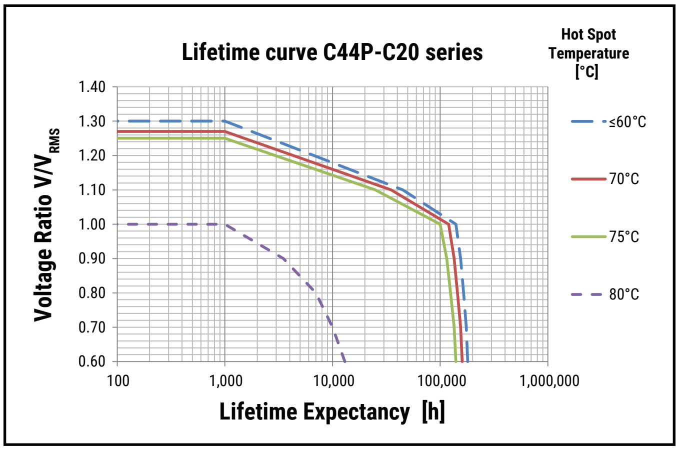
NOTICE: Care should be taken to ensure that there still is electrical clearance of 15 mm between terminations and other live or earthed parts above the capacitor, in case of safety device activation.

Table 1 – Ratings & Part Number Reference

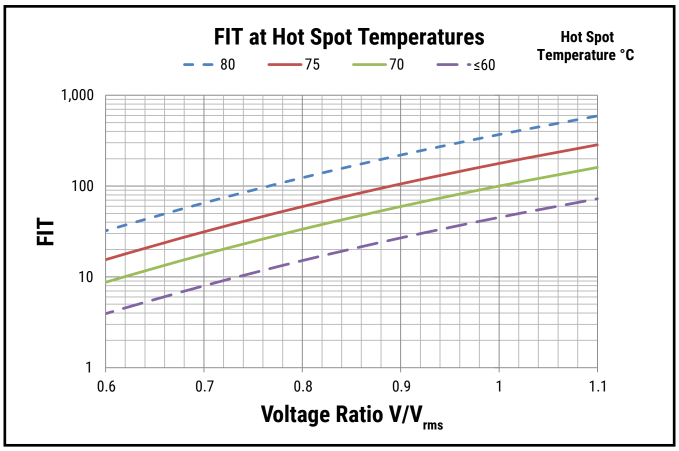
Cap Value (µF)	V_{rms}	Rated Voltage	Surge Voltage	Maximum Dimensions (mm)		Ripple Current	ESR	ESL	Thermal Res	dV/dt (V/µs)	Part Number
	VAC	VDC	VDC	D	H	10 kHz 40°C (A)[1]	10 kHz (mΩ)	(nH)	(°C/W)		
100	330	700	1,050	65	117	25	3.0	115	8.5	12.5	C44PLGR 6100 AA
200	330	700	1,050	65	147	43	2.8	140	5.4	12.5	C44PLGR 6200 ZA
300	330	700	1,050	65	247	50	2.3	150	3.6	12.5	C44PLGR 6300 ZA
300	330	700	1,050	75	197	55	1.4	160	4.2	12.5	C44PLGR 6300 AA
400	330	700	1,050	65	247	55	2.0	160	3.1	12.5	C44PLGR 6400 ZA
500	330	700	1,050	75	247	58	1.8	170	2.9	12.5	C44PLGR 6500 ZA
500	330	700	1,050	85	197	63	1.2	160	3.4	12.5	C44PLGR 6500 ZB
600	330	700	1,050	85	247	65	1.6	180	2.9	12.5	C44PLGR 6600 AA
600	330	700	1,050	85	280	75	1.1	210	2.4	12.5	C44PLGR 6600 ZA
100	440	1,000	1,500	75	147	30	3.5	145	5.6	20	C44PKGR 6100 AA
100	440	1,000	1,500	65	197	50	2.3	135	4.4	20	C44PKGR 6100 ZA
120	440	1,000	1,500	65	197	50	1.8	165	4.2	20	C44PKGR 6120 AA
133	440	1,000	1,500	65	247	40	3.0	155	3.7	20	C44PKGR 6133 AA
133	440	1,000	1,500	75	197	50	1.6	170	4.0	20	C44PKGR 6133 ZA
150	440	1,000	1,500	65	247	45	2.8	160	3.5	20	C44PKGR 6150 AA
200	440	1,000	1,500	75	247	55	2.4	175	3.2	20	C44PKGR 6200 AA
250	440	1,000	1,500	85	247	60	2.0	175	3.4	20	C44PKGR 6250 AA
300	440	1,000	1,500	85	247	60	1.9	180	2.7	20	C44PKGR 6300 AA
400	440	1,000	1,500	95	247	65	1.7	200	2.5	20	C44PKGR 6400 AA
22	550	1,280	1,900	65	117	40	2.1	125	13.3	30	C20AKGR 5220 AA
33	550	1,280	1,900	75	117	45	1.6	130	10.6	30	C20AKGR 5330 AA
47	550	1,280	1,900	65	197	50	1.4	135	7.8	30	C20AKGR 5470 AA
68	550	1,280	1,900	65	247	55	1.7	145	6.2	30	C20AKGR 5680 AA
100	550	1,280	1,900	75	247	60	1.4	160	5.2	30	C20AKGR 6100 AA
120	550	1,280	1,900	85	247	60	1.3	165	4.6	30	C20AKGR 6120 AA
150	550	1,280	1,900	95	247	60	1.2	180	4.4	30	C20AKGR 6150 AA
15	640	1,400	2,100	65	117	35	2.5	120	14.1	30	C20ALGR 5150 AA
22	640	1,400	2,100	65	147	35	3.0	125	10.9	30	C20ALGR 5220 AA
33	640	1,400	2,100	75	147	40	2.2	135	9.1	30	C20ALGR 5330 AA
47	640	1,400	2,100	65	247	55	1.9	145	6.3	30	C20ALGR 5470 AA
68	640	1,400	2,100	75	247	60	1.6	160	5.3	30	C20ALGR 5680 AA
100	640	1,400	2,100	95	247	60	1.3	170	4.4	30	C20ALGR 6100 AA
120	640	1,400	2,100	95	247	60	1.3	175	4.1	30	C20ALGR 6120 AA
150	640	1,400	2,100	116	247	60	1.2	180	3.8	30	C20ALGR 6150 AA
10	780	1,700	2,500	65	117	30	3.0	130	14.1	70	C20AQGR 5100 AA
15	780	1,700	2,500	75	147	35	3.6	135	10.1	70	C20AQGR 5150 AA
22	780	1,700	2,500	75	147	40	2.7	140	8.9	70	C20AQGR 5220 AA
33	780	1,700	2,500	85	147	50	2.0	150	7.6	70	C20AQGR 5330 AA
47	780	1,700	2,500	75	247	55	1.8	160	5.2	70	C20AQGR 5470 AA
68	780	1,700	2,500	85	247	60	1.5	170	4.5	70	C20AQGR 5680 AA
100	780	1,700	2,500	95	247	60	1.3	180	4.0	70	C20AQGR 6100 AA
15	1,000	2,300	3,300	75	147	33	2.5	150	9.2	85	C20AZGR 5150 AA
20	1,000	2,300	3,300	75	140	40	2.1	150	8.3	85	C20AZGR 5200 ZB
22	1,000	2,300	3,300	75	147	35	2.0	155	8.0	85	C20AZGR 5220 AA
33	1,000	2,300	3,300	75	247	40	1.7	165	5.3	85	C20AZGR 5330 AA
47	1,000	2,300	3,300	85	247	45	1.4	170	4.7	85	C20AZGR 5470 AA
68	1,000	2,300	3,300	95	247	55	1.2	180	4.1	85	C20AZGR 5680 AA
Cap Value	VAC	Rated Voltage	Surge Voltage	D	H	Ripple Current	ESR	ESL	Thermal Res	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:

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

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).

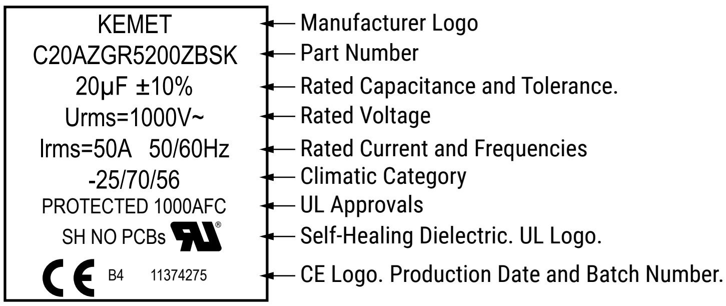
3. Maximum case temperature (T_{CASE}) ≤ 70°C

Example of calculation

Part Number: C44PKGR6100AASJ
Rated V_{RMS} = 440 [V_{RMS}]
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°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]

$I_{RMS} = \sqrt{(13.8^2 + 27^2)} = 30 \leq 30 \rightarrow$ 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]
$P_D(7000) = [27^2/(2 * \pi * 7000 * 100 * 10^{-6})] * 2 * 10^{-4} = 0.03$ [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]
$T_{HS} = Ta + \Delta T_{HS}$
$T_{HS} = 35 + 25 = 60$ [°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



Dissipation Factor

Dissipation factor is a complex function involved with the inefficiency of the capacitor. The tgδ 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 the production of them.

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 and Pb-Free capacitors.

Because of customer requirements, additional markings such as "LF" for lead-free or "LFW" for lead-free wires may appear on the packaging label.

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, polychlorine triphenyl (PCB), bromide and chlorine dioxins bromurate clorurate, 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.

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Although KEMET designs and manufactures its products to the most stringent quality and safety standards, given the current state of the art, isolated component failures may still occur. Accordingly, customer applications which require a high degree of reliability or safety should employ suitable designs or other safeguards (such as installation of protective circuitry or redundancies) in order to ensure that the failure of an electrical component does not result in a risk of personal injury or property damage.

Although all product–related warnings, cautions and notes must be observed, the customer should not assume that all safety measures are indicted or that other measures may not be required.