

Overview

The KEMET ALA8A snap-in capacitors are designed for automotive applications. They can withstand vibration up to 10 g in accordance with the demanding requirements of the Automotive Electronics Council's AEC-Q200 qualification. The ALA8A capacitance values cover a range from 120 to 680 μF and a voltage range of 400 to 500 V.

Applications

Typical applications for the ALA8A capacitor is mainly in the field of e-mobility, such as on-board chargers, inverters, or wall boxes.

Benefits

- Designed for automotive usage
- Vibration proof 10 g
- AEC-Q200
- Operational lifetime of 5,000 hours at +105°C ($V_R I_R$ applied)
- High ripple current
- High voltage
- Excellent surge voltage capability
- PET sleeve and Lexan disc are recognized to UL: QMTR2, UL No. E358957
(Other options available upon request)
- Optimized designs available upon request



Part Number System

ALA8A	A	361	CE	450
Series	Termination	Capacitance Code (μF)	Size Code	Rated Voltage (VDC)
Snap-In Aluminum Electrolytic	See Termination Table	First two digits represent significant figures. Third digit specifies number of zeros.	See Dimension Table	400 = 400 450 = 450 500 = 500

Performance Characteristics

Item	Performance Characteristics		
Capacitance Range	120 – 680 μ F		
Rated Voltage	400 – 500 VDC		
Operating Temperature	-40 to +105°C		
Storage Temperature	-55 to +105°C		
Capacitance Tolerance	\pm 20% at 100 Hz/+20°C		
Operational Lifetime	D (mm)	Rated Voltage and Ripple Current at +105°C (hours)	
	25	5,000	
	30		
	35		
End of Life Requirement	$V_R > 100$ VDC $\Delta C/C < \pm 15\%$, ESR $< 3 \times$ ESR Limit, IL $<$ initial specified limit		
Shelf Life	2,000 hours at +85°C or 30,000 hours at +40°C 0 VDC		
Leakage Current	$I = 0.003 CV$ or 6,000 μ A (whichever is smaller)		
	$C =$ rated capacitance (μ F), $V =$ rated voltage (VDC). Voltage applied for 5 minutes at +20°C.		
Vibration Test Specifications		Procedure	Requirements
	$D \leq 35$ mm	1.5 mm displacement amplitude or 10 G maximum acceleration. Vibration applied for three directions of 4-hour sessions at 10 – 2,000 Hz. (Capacitor clamped by body.)	No leakage of electrolyte or other visible damage. Deviations in capacitance from initial measurements must not exceed $\Delta C/C < 5\%$
Standards	AEC-Q200: aluminum electrolytic capacitors IEC 60384-4 long life grade 40/85/56		

Surge Voltage

Test Condition	Voltage (VDC)		
	400	450	500
≤ 30 second surge followed by a no load period of 330 seconds, 1,000 cycles at +105°C	440	495	550

Test Method & Performance

Endurance Life Test		
Conditions	Performance	
Temperature	+105°C	
Test Duration	2,000 hours	
Ripple Current	Rated ripple current in specified table	
Voltage	The sum of DC voltage and the peak AC voltage must not exceed the rated voltage of the capacitor	
Performance	The following specifications will be satisfied when the capacitor is tested at +20°C:	
Capacitance Change	≥ 400 V	Within 10% of the initial value
Equivalent Series Resistance	Does not exceed 150% of the initial limit	
Leakage Current	Does not exceed leakage current limit	

Dimensions – Millimeters

Size Code	Dimensions in mm		Approximate Weight Grams
	D	L	
	-0/+1	±2	
BC	25	35	30
BD	25	40	35
BE	25	45	40
BF	25	50	45
CB	30	30	40
CC	30	35	45
CD	30	40	50
CE	30	45	55
CF	30	50	60
DC	35	35	60
DD	35	40	65
DE	35	45	75
DF	35	50	80

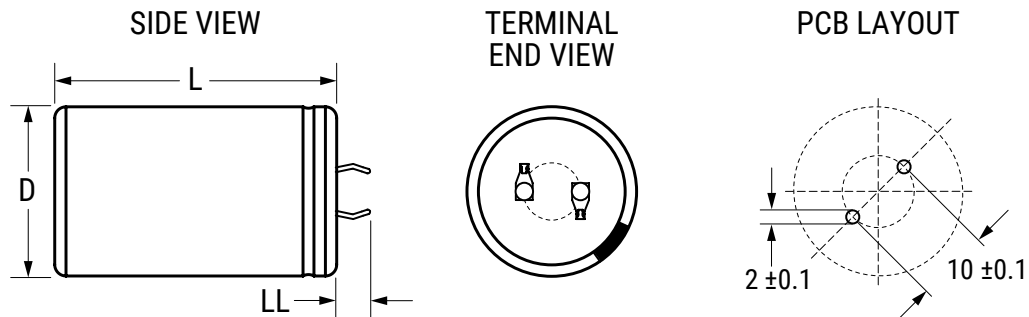
Note: Dimensions include sleeving

Termination Tables

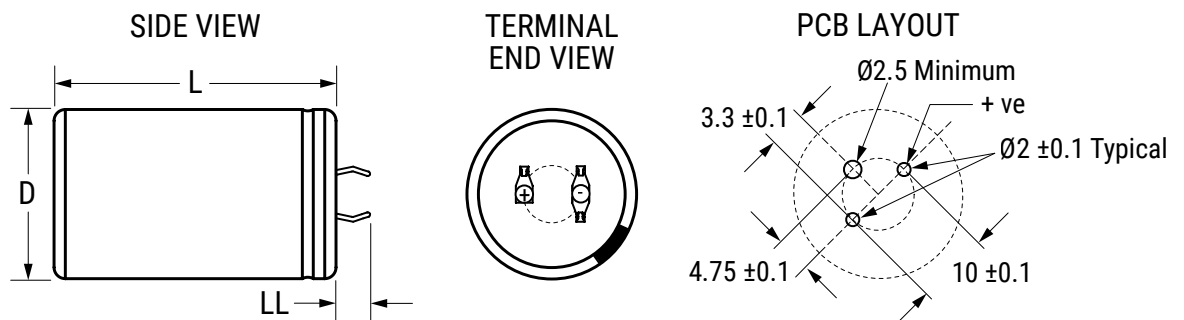
Termination Code	A	D	F
Diameter (mm)			
25	•	•	•
30	•	•	•
35	•	•	•

Termination Code	Termination Style	LL
		±1
Standard Termination Option		
A	2 Pin	6.3
Other Termination Options		
D	2 Pin	4.0
F	3 Pin	4.0
Dimensions in mm		

Style A/D



Style F



Black stripe denotes polarity stripe

Shelf Life

The capacitance, ESR, and impedance of a capacitor will not change significantly after extended storage periods; however, the leakage current will very slowly increase. KEMET products are particularly stable and allow a shelf life in excess of three years at 40°C. See sectional specification under each product series for specific data.

Re-age (Reforming) Procedure

Apply the rated voltage to the capacitor at room temperature for a period of one hour or until the leakage current has fallen to a steady value below the specified limit. During re-aging, a maximum charging current of twice the specified leakage current or 5 mA (whichever is greater) is suggested.

Reliability

The reliability of a component can be defined as the probability that it will perform satisfactorily under a given set of conditions for a given length of time.

In practice, it is impossible to predict with absolute certainty how any individual component will perform. Therefore, we must utilize probability theory. It is also necessary to clearly define the level of stress involved (e.g., operating voltage, ripple current, temperature, and time.) Finally, the meaning of satisfactory performance must be defined by specifying a set of conditions, which determine the end of life of the component.

KEMET provides an online life calculator that can be used to predict hours of life for a given part number in specific application conditions. This can be found at: <https://elc.kemet.com>.

End of Life Definition

Catastrophic failure: short circuit, open circuit or safety vent operation

Parametric Failure:

- Change in capacitance > $\pm 15\%$
- Leakage current > initial specified limit
- ESR > 3 x ESR Limit

Environmental Compliance



All Part Numbers in this datasheet are Reach and RoHS compliant and Halogen-Free.

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 such as China, legislation has been put in place to prevent the use of some hazardous materials, such as lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products and 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 worldwide and make any necessary changes in its products, whenever needed.

Some customer segments such as 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.

Due to customer requirements, there may appear additional markings such as lead-free (LF), or lead-free wires (LFW) on the label.

Table 1 – Ratings & Part Number Reference

Rated Voltage (VDC)	Rated Capacitance 100 Hz 20°C (µF)	Size Code	Case Size D x L (mm)	Ripple Current		ESR (Maximum)	Impedance (Maximum)	Part Number () Represents Part Number Options	SPQ
				100 Hz 105°C (A)	10 kHz 105°C (A)	100 Hz 20°C (mΩ)	10 kHz 20°C (mΩ)		
400	180	BC	25 x 35	1.2	3.1	846	500	ALA8A(1)181BC400	180
400	220	BD	25 x 40	1.2	3.3	694	410	ALA8A(1)221BD400	180
400	270	BE	25 x 45	1.6	4	568	336	ALA8A(1)271BE400	180
400	270	CC	30 x 35	1.7	4.7	558	326	ALA8A(1)271CC400	160
400	330	BF	25 x 50	1.8	4.3	466	278	ALA8A(1)331BF400	180
400	330	CD	30 x 40	1.9	5.3	456	268	ALA8A(1)331CD400	160
400	390	CE	30 x 45	2.2	5.9	386	228	ALA8A(1)391CE400	160
400	390	DC	35 x 35	2.2	5.4	394	234	ALA8A(1)391DC400	100
400	470	CF	30 x 50	2.4	6.5	322	190	ALA8A(1)471CF400	160
400	470	DD	35 x 40	2.5	6.2	326	194	ALA8A(1)471DD400	100
400	560	DE	35 x 45	2.8	6.8	274	162	ALA8A(1)561DE400	100
400	680	DF	35 x 50	3.2	7.5	228	136	ALA8A(1)681DF400	100
450	180	BC	25 x 35	1.2	3.3	778	454	ALA8A(1)181BC450	180
450	220	BD	25 x 40	1.4	3.5	638	372	ALA8A(1)221BD450	180
450	270	BE	25 x 45	1.6	4	522	306	ALA8A(1)271BE450	180
450	270	CC	30 x 35	1.7	4.8	510	296	ALA8A(1)271CC450	160
450	330	CD	30 x 40	2	5.4	418	242	ALA8A(1)331CD450	160
450	330	DC	35 x 35	2.1	5.4	424	246	ALA8A(1)331DC450	100
450	390	CE	30 x 45	2.2	6.1	354	206	ALA8A(1)391CE450	160
450	390	DD	35 x 40	2.3	6.1	358	208	ALA8A(1)391DD450	100
450	470	DE	35 x 45	2.7	6.8	298	174	ALA8A(1)471DE450	100
450	560	DF	35 x 50	3	7.5	250	146	ALA8A(1)561DF450	100
500	120	BC	25 x 35	1.1	2.5	1730	1272	ALA8A(1)121BC500	180
500	150	BD	25 x 40	1.2	2.8	1386	1020	ALA8A(1)151BD500	180
500	180	BE	25 x 45	1.4	3.2	1158	852	ALA8A(1)181BE500	180
500	180	CC	30 x 35	1.5	3.6	1148	842	ALA8A(1)181CC500	160
500	220	BF	25 x 50	1.6	3.6	950	700	ALA8A(1)221BF500	180
500	220	CD	30 x 40	1.7	4.1	940	690	ALA8A(1)221CD500	160
500	270	CE	30 x 45	1.9	4.6	766	562	ALA8A(1)271CE500	160
500	270	DC	35 x 35	1.9	4.4	774	578	ALA8A(1)271DC500	100
500	330	CF	30 x 50	2.2	5.1	628	462	ALA8A(1)331CF500	160
500	330	DD	35 x 40	2.2	5	634	456	ALA8A(1)331DD500	100
500	390	DE	35 x 45	2.5	5.6	536	386	ALA8A(1)391DE500	100
Rated Voltage	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR	Impedance	Part Number	SPQ

(1) Termination code: See Termination Tables for available options.

Mechanical Data

Polarity & Reversed Voltage

Aluminium electrolytic capacitors manufactured for use in DC applications contain an anode foil and a cathode foil. As such, they are polarized devices and must be connected with the +ve to the anode foil and the -ve to the cathode foil. If this were to be reversed, then the electrolytic process that took place in forming the oxide layer on the anode would be recreated in trying to form an oxide layer on the cathode. In forming the cathode foil in this way, heat would be generated and gas given off within the capacitor, usually leading to catastrophic failure.

The cathode foil already possesses a thin stabilized oxide layer. This thin oxide layer is equivalent to a forming voltage of approximately 2 V. As a result, the capacitor can withstand a voltage reversal of up to 2 V for short periods. Above this voltage, the formation process will commence. Aluminium electrolytic capacitors can also be manufactured for use in intermittent AC applications by using two anode foils in place of one anode and one cathode.

Mounting Position

The capacitor can be mounted upright or inclined to a horizontal position. Special attention should be taken for the safety vent, which ensures that internal gas generated can escape when the pressure reaches a certain value due to overstress or catastrophic failure. All mounting positions must allow the safety vent to work properly.

Insulating Resistance

≥ 100 MΩ at 100 VDC across insulating sleeve.

Voltage Proof

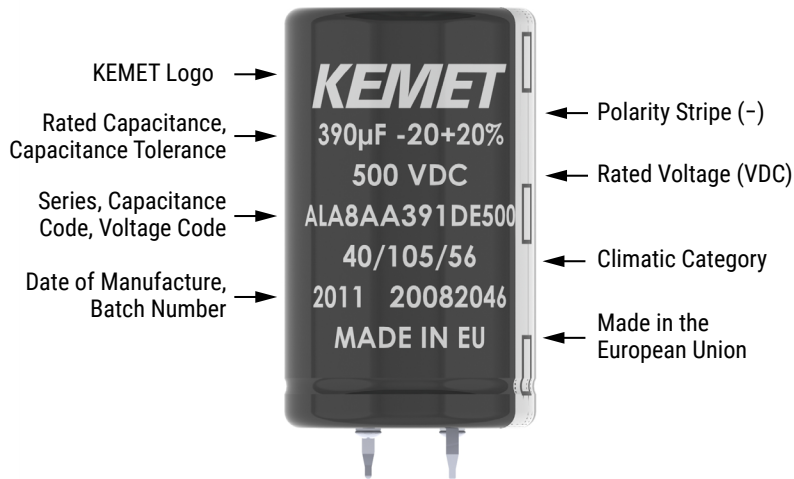
≥ 3,500 VDC across insulating sleeve.

≥ 2,500 VAC across insulating sleeve.

Safety Vent

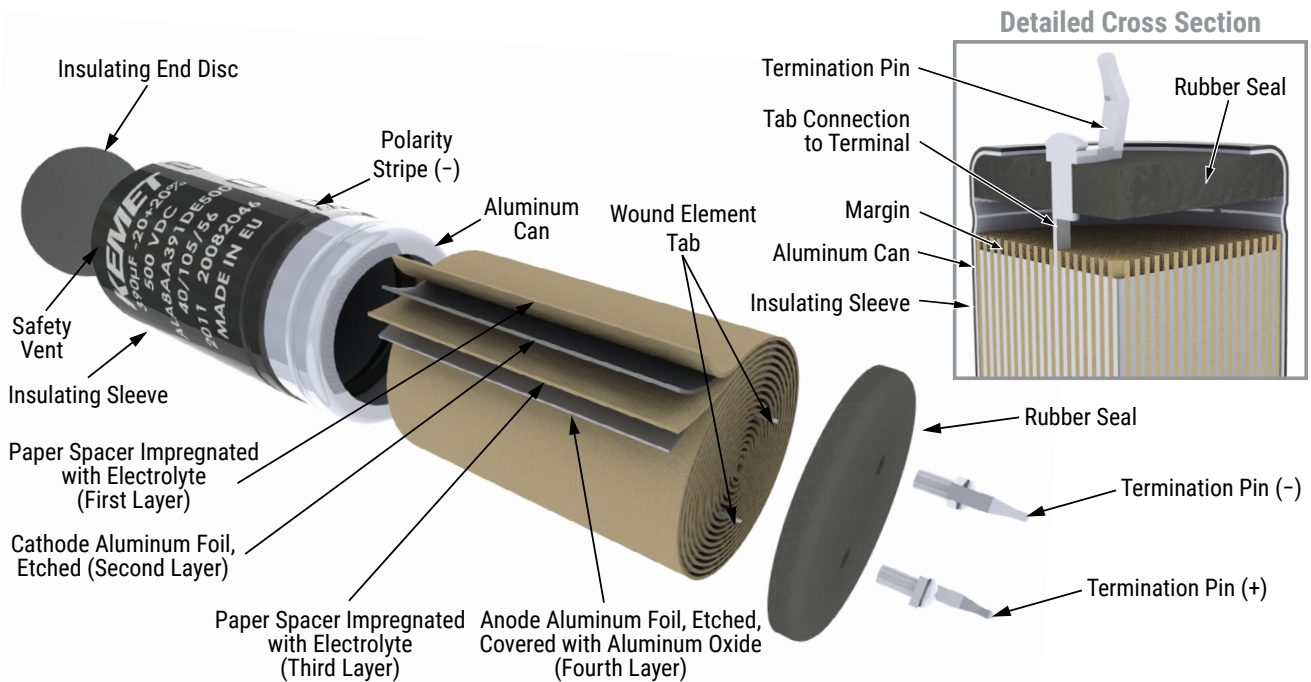
A safety vent for overpressure is featured on the base (opposing end to the terminals). This is a weakened area on the bottom of the can that is designed to relieve build-up of internal pressure due to overstress or catastrophic failure.

Marking



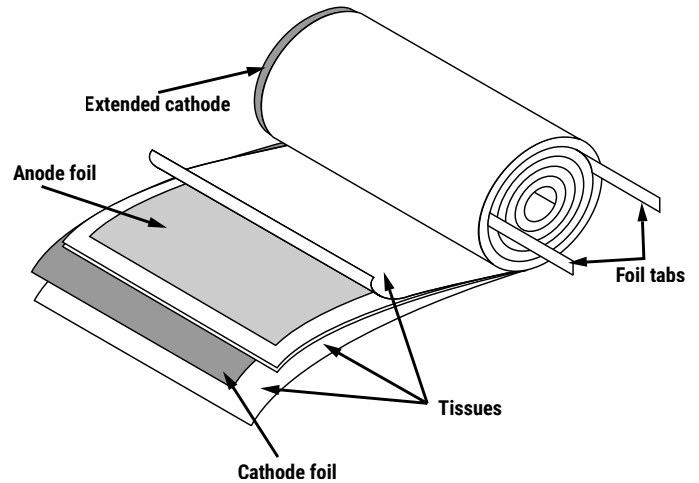
**Image for reference only. A slight change in the layout can occur, not affecting the marking content. This change will not impact the product's form, fit, or function, as the products remain equivalent in physical, mechanical, quality, and reliability characteristics.*

Construction



Construction Data

The manufacturing process begins with the anode foil being electrochemically etched to increase the surface area and then “formed” to produce the aluminum oxide layer. Both the anode and cathode foils are then interleaved with absorbent paper and wound into a cylinder. During the winding process, aluminum tabs are attached to each foil to provide the electrical contact.



The deck, complete with terminals, is attached to the tabs and then folded down to rest on top of the winding. The complete winding is impregnated with electrolyte before being housed in a suitable container, usually an aluminum can, and sealed. Throughout the process, all materials inside the housing must be maintained at the highest purity and be compatible with the electrolyte.

Each capacitor is aged and tested before being sleeved and packed. The purpose of aging is to repair any damage in the oxide layer and thus reduce the leakage current to a very low level. Aging is normally carried out at the rated temperature of the capacitor and is accomplished by applying voltage to the device while carefully controlling the supply current. The process may take several hours to complete.

Damage to the oxide layer can occur due to variety of reasons:

- Slitting of the anode foil after forming
- Attaching the tabs to the anode foil
- Minor mechanical damage caused during winding

A sample from each batch is taken by the quality department after completion of the production process. This sample size is controlled by the use of recognized sampling tables defined in BS 6001.

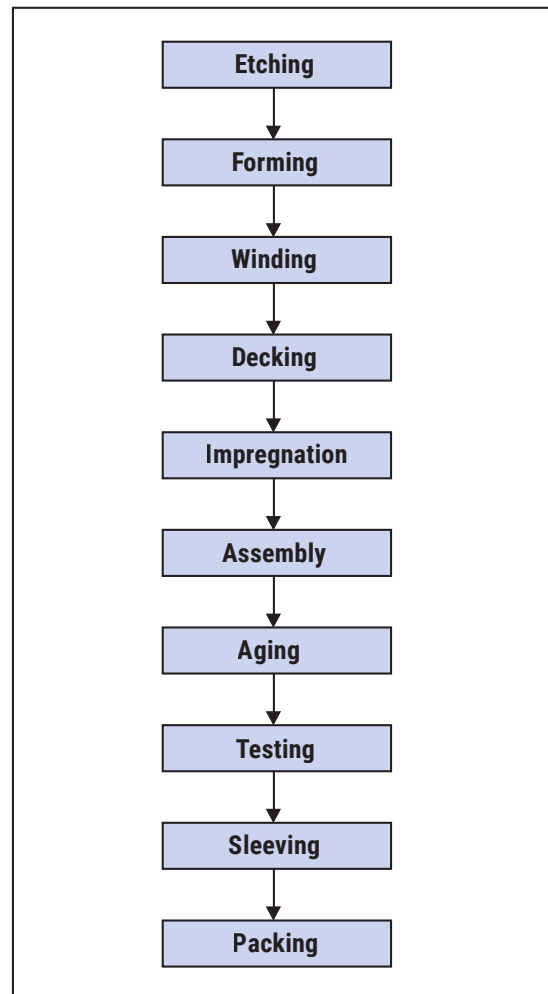
The following tests are applied and may be varied at the request of the customer. In this case the batch, or special procedure, will determine the course of action.

Electrical:

- Leakage current
- Capacitance
- ESR
- Impedance
- Tan Delta

Mechanical/Visual:

- Overall dimensions
- Torque test of mounting stud
- Print detail
- Box labels
- Packaging, including packed quantity



Product Safety

THESE NOTES SHOULD BE READ IN CONJUNCTION WITH THE PRODUCT DATA SHEET. FAILURE TO OBSERVE THE RATINGS AND THE INFORMATION ON THIS SHEET MAY RESULT IN A SAFETY HAZARD.

Warning

When potentially lethal voltages, e.g. 30 VAC (r.m.s) or 60 VDC are applied to the terminals of this product, the use of a hazard warning label is recommended. In the case of motor start capacitors they meet the requirements of British Standard Specifications BS.5267: 1976 and reference should be made to Appendix C -Guide for installation and operation.

1. Electrolyte

Aluminum electrolytic capacitors contain liquids (electrolytes) which can be hazardous. The electrolytes are conducting solutions of organic and/or boric acid, neutralized with amines or ammonia, in a variety of solvents. The major solvents are butyrolactone and ethylene glycol. Co-solvents e.g. N-methyl pyrrolidone may be present. Inorganic or organo-phosphates are present in low concentration. The physical, chemical and toxicological properties of the electrolytes are largely determined by the solvents, as summarized below:

Physical Properties

1. Low viscosity, typically 5 – 50 cp at 25°C
2. Combustible, flash points 95 – 120°C
3. Low vapor pressure, < 20 mm Hg at 25°C

Chemical properties

1. Non-corrosive
2. Can be aggressive to many plastics, lacquers and resins
3. Totally soluble in hot water

Toxicology

The electrolytes are moderately toxic, with LD50 values in the range 1.5 – 2 g/Kg. Skin exposure can cause drying and defatting. Severe irritation may be caused to the mucous membranes, particularly the eyes, where conjunctivitis may result.

Safety Precautions

In the event of electrolyte escape, wash the affected area with hot water. Use rubber gloves to avoid skin contact. Any contact with the eyes should be liberally irrigated with water and medical advice sought.

Note: The electrolyte systems do not contain materials currently listed as carcinogenic, mutagenic or teratogenic, e.g., polychlorinated biphenyls (PCBs), dimethylformamide (DMF) or dimethylacetamide (DMA).

Product Safety cont.

2. Intrinsic Properties

Operating

DC capacitors are polar devices and will operate safely only if correctly connected. Reversing the connections will result in high leakage currents which could subsequently cause short circuit failure, rupture of the safety vent, and possibly explosion and fire. Correctly polarized operation may result in the above failure modes if:

- The surge voltage is exceeded
- The ambient temperature is too high
- Excessive ripple currents are applied

AC types are non-polar. Catastrophic failure may be caused by:

- Abnormal duty cycles
- Voltage in excess of rated value
- Ambient temperature too high

Non-Operating

Aluminum electrolytic capacitors contain liquids which can leak out (see material content).

Damage to the encapsulation may cause leakage of the electrolyte. Excessive torque or soldering heat may affect the performance of the capacitor or damage the sealing. Electric shock may result if capacitors are not discharged.

3. Disposal

Aluminum electrolytic capacitors are consignable waste under the Special Waste Regulations 1996 (Statutory Instrument 1996 No 972), which complies with the EC Hazardous Waste Directive – Directive 91/689/EEC. The electrolyte should therefore be treated as a hazardous waste and advice should be sought from the local office of the Environmental Agency regarding its disposal.

Due to the construction of an aluminum electrolytic capacitor, high temperature incineration may cause the component to explode due to build-up of internal pressure. In addition, incineration may also cause the emission of noxious fumes. If it is decided that this is the best practicable option then it must be carried out under controlled conditions and at a minimum temperature of 1200°C. It should also be confirmed that the incinerator is authorized under parts A or B of the Environmental Protection Act.

The alternative is to dispose of them in an engineered lined landfill site that is licensed to take materials identified on the safety sheet. It should be stressed that these capacitors are not to be disposed of in a landfill site set aside for domestic waste.

KEMET strongly recommends that if there are any doubts regarding the disposal of aluminum electrolytic capacitors, that advice be sought from the local regulating authority.

In addition, KEMET would like to request that users of aluminum electrolytic capacitors respect the needs of the environment and, wherever possible, recover as much of the materials as possible, i.e. aluminum.

Product Safety cont.

4. Unsafe Use

Most failures are of a passive nature and do not represent a safety hazard. A hazard may, however, arise if this failure causes a dangerous malfunction of the equipment in which the capacitor is employed. Circuits should be designed to fail safe under the normal modes of failure.

The usual failure mode is an increase in leakage current or short circuit. Other possible modes are decrease of capacitance, increase in dissipation factor (and impedance) or an open circuit.

Capacitors should be used in a well-ventilated enclosure or cabinet.

5. Mounting

Care should be taken when mounting by clamp, that any safety vent in the can is not covered.

6. Fumigation

In many countries throughout the world it is now common practice to fumigate shipments of products in order to control insect infestation, particularly when wooden packaging is used. Currently, methyl bromide is widely used as a fumigant, which can penetrate cardboard packing and polymer bags and, therefore, come into direct contact with equipment or components contained within.

If aluminum electrolytic capacitors become exposed to methyl bromide then corrosion may occur, depending upon the concentration and exposure time to the chemical.

This failure mode can affect all types of KEMET aluminum electrolytic capacitors. Methyl bromide can penetrate the seals of aluminum electrolytic capacitors and cause internal corrosion of the anode connection, resulting in the component becoming open circuit. The rate of corrosion will depend upon the level of exposure to methyl bromide as well as the subsequent operating conditions, such as voltage and temperature. It may take months or, in some cases, several years before the component becomes open circuit.

7. Dielectric Absorption

A phenomenon known as dielectric absorption can cause aluminum electrolytic capacitors to recharge themselves. The phenomenon is well known but impossible to predict with any great accuracy, so potentially any electrolytic product could be affected. Thus, a capacitor that has been charged and then completely discharged will appear to recharge itself if left open circuit; this will manifest itself as a small voltage across the terminals of the capacitor. Generally, the voltages seen are less than 20 VDC. However, higher voltages have on occasion been reported.

In order to avoid any problems caused by this voltage, KEMET recommends that capacitors be discharged before connecting to the terminals.

8. Flammability

Most plastics and elastomers are combustible (e.g., will ignite if an ignition source is applied under suitable conditions of temperature and oxygen level). For most published data, the UL 94 Horizontal or Vertical Burning System has been applied. Although useful for comparative values, this test is not practicable, as the ignition characteristics are strongly influenced by the material dimensions and other materials with which they may be in intimate contact. KEMET has completed a series of flammability tests based on a Needle Flame Test, as specified in IEC 60695-2-2. Details of the tests undertaken on both the external components and internal wind elements can be found in a full technical article, TD005, Flammability Characteristics contained within KEMET Aluminum Electrolytic Capacitors – Application Notes.

KEMET Electronics Corporation Sales Offices

For a complete list of our global sales offices, please visit <https://www.yageogroup.com/SalesResources/SalesOffices>

Disclaimer

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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 indicated or that other measures may not be required.

KEMET requires its products to be packaged and shipped on pallets. This is because KEMET's products are specifically designed to be packed onto pallets during shipment. If for any reason, the products are removed from pallets by the shipping party and shipped to the end customer, then additional external protection is required. In this instance, an external box with two carton layers and an upwards orientation sticker must be used by the shipping party, with the empty space filled with filling material, and afterwards sealing the box. If this packing and packaging guideline is not followed by the shipping party, the shipping party, and not KEMET, will be held responsible for any packaging, packing and/or product damages upon delivery of the products to the end customer. KEMET hereby disclaims any liability for damages to the products or otherwise that have been, or threaten to be, inflicted, result from or are in any way related to the packaging, packing or damage by the shipping party in contravention of the packing and packaging guidelines herein.

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