

Overview

KEMET's ALC42 Series of capacitors is a high CV snap-in version of the ALC40 Series range. Both feature the same high ripple currents and long-life characteristics as the ALC10 Series but can operate at higher temperatures.

Applications

KEMET's ALC42 Series of capacitors is designed for applications where high reliability and compact sizes are important, such as switch mode power supplies (SMPS) and frequency converters.

Benefits

- Compact size
- 2,000 hours at +105°C (V_R , I_R applied)
- Excellent surge voltage capability
- Optimized designs available upon request



Part Number System

ALC42	A	561	CB	200
Series	Termination	Capacitance Code (μF)	Size Code	Voltage (VDC)
Snap-In type Aluminum Electrolytic	See Termination Table	First 2 digits equals first 2 significant figures, 3rd digit is the number of additional zeros.	See Dimension Table	200 = 200 250 = 250 350 = 350 400 = 400 450 = 450

Performance Characteristics

Item	Performance Characteristics		
Capacitance Range	120 – 6,800 μ F		
Rated Voltage	200 – 450 VDC		
Operational Temperature Range	-40 to +105°C		
Storage Temperature Range	-55 to +105°C		
Capacitance Tolerance	\pm 20% at 100 Hz / +20°C		
Operational Lifetime	Rated Voltage and Ripple Current at +105°C (hours)	Rated Voltage at +105°C (hours)	
	2,000	11,000	
End of Life Requirement	Δ C/C < \pm 10%, ESR < 2 x initial ESR value, 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 40 mm	0.75 mm displacement amplitude or 10 g maximum acceleration. Vibration applied for three 2-hour sessions at 10 – 500 Hz (Capacitor clamped by body).	No leakage of electrolyte or other visible damage. Deviations in capacitance and $\tan\delta$ from initial measurements must not exceed: Δ C/C < 5%
	D > 40 mm	0.35 mm displacement amplitude or 5g maximum acceleration. Vibration applied for three 0.5-hour sessions at 10 – 55 Hz (Capacitor clamped by body).	
Standards	IEC 60384–4 long life grade 40/105/56		

Surge Voltage

Condition	Voltage (VDC)				
	200	250	350	400	450
\leq 30s Surge followed by a no load period of 330s, 1,000 cycles at +85°C	230	288	385	440	495
\leq 500 ms surge, 100 cycles at 20°C, occurring randomly throughout the life of the capacitor	350	400	500	520	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	≤ 160 V	Within 15% of the initial value
	≥ 160 V	Within 10% of the initial value
Equivalent Series Resistance	Does not exceed 200% of the initial value	
Leakage Current	Does not exceed leakage current limit	

Dimensions – Millimeters

Size Code	Dimensions in mm	
	D	L
	-0/+1	±2
CB	30	30
CC	30	35
CD	30	40
CE	30	45
CF	30	50
DB	35	30
DC	35	35
DD	35	40
DE	35	45
DF	35	50
DG	35	55
DH	35	60
DL	35	80
EB	40	30
EC	40	35
ED	40	40
EE	40	45
EF	40	50
EG	40	55
EH	40	60

Note: Dimensions include sleeving

Size Code	Dimensions in mm	
	D	L
	-0/+1	±2
EL	40	80
EP	40	105
FB	45	30
FC	45	35
FD	45	40
FE	45	45
FF	45	50
FG	45	55
FH	45	60
FL	45	80
FP	45	105
KB	50	30
KC	50	35
KD	50	40
KE	50	45
KF	50	50
KG	50	55
KH	50	60
KL	50	80
KP	50	105

Note: Dimensions include sleeving

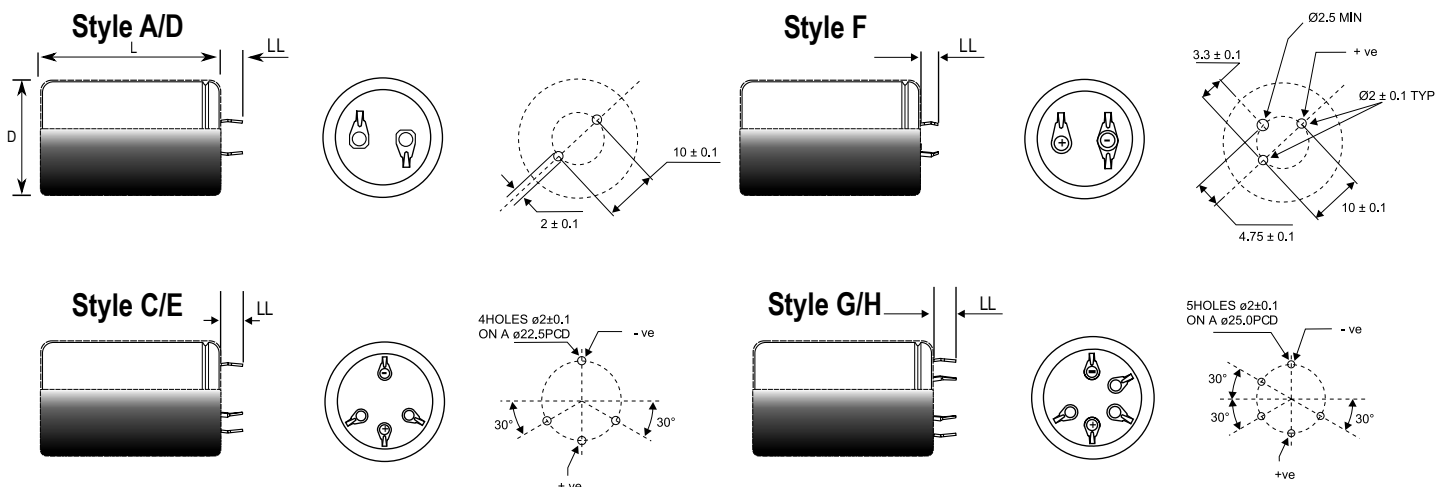
Termination Tables

Termination Code	A	D	F	C	E	G	H
Diameter (mm)							
30	•	•	•				
35	•	•	•	•	•		
40	•	•	•	•	•	•	•
45				•	•	•	•
50				•	•	•	•

Mounting: These capacitors are designed to be mounted by their terminations alone and may be used in any position. Dummy pins must be isolated on 4 and 5 pin styles.

Termination Code	Termination Style	LL
		±1
Standard Termination Option		
A	2 Pin	6.3
G (D ≥ 45)	5 Pin	6.3
Other Termination Options		
D	2 Pin	4
F	3 Pin	4
C	4 Pin	6.3
E	4 Pin	4
H	5 Pin	4

Dimensions in mm



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; thus, 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.

Reliability as a function of time, $R(t)$, is normally expressed as: $R(t)=e^{-\lambda t}$
where $R(t)$ is the probability that the component will perform satisfactorily for time t , and λ is the failure rate.

Failure Rate

The failure rate is the number of components failing per unit time. The failure rate of most electronic components follows the characteristic pattern:

- Early failures are removed during the manufacturing process.
- The operational life is characterized by a constant failure rate.
- The wear out period is characterized by a rapidly increasing failure rate.

The failures in time (FIT) are given with a 60% confidence level for the various type codes. By convention, FIT is expressed as 1×10^{-9} failures per hour. Failure rate is also expressed as a percentage of failures per 1,000 hours.

e.g., 100 FIT = 1×10^{-7} failures per hour = 0.01%/1,000 hours

End of Life Definition

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

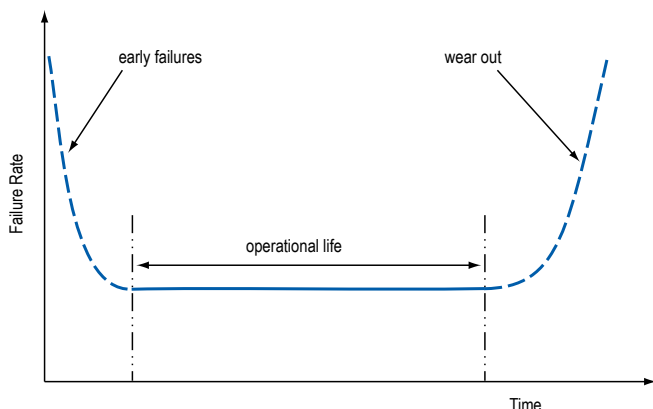
Parametric Failure:

- Change in capacitance $> \pm 10\%$
- Leakage current $>$ specified limit
- ESR $> 2 \times$ initial ESR value

MTBF

The mean time between failures (MTBF) is simply the inverse of the failure rate.

$$MTBF = 1/\lambda$$



The failure rate is derived from our periodic test results. The failure rate (λ_r) is, therefore, only given at test temperature for life tests. An estimation is also given at 40°C. The expected failure rate for this capacitor range is based on our periodic test results for capacitors with structural similarity. Failure rate is frequently quoted in FIT (Failures In Time) where 1 FIT = 1×10^{-9} failures per hour. Failure rate per hour includes both catastrophic and parametric failures.

T_a	Failure Rate per Hour
85°C	230 FIT
40°C	11 FIT

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, 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 world wide and makes 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.

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



RoHS Compliant

Table 1 – Ratings & Part Number Reference

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR Maximum	Impedance Maximum	Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 105°C (A)	10 kHz 105°C (A)	100 Hz 20°C (mΩ)	10 kHz 20°C (mΩ)	
200	560	CB	30 x 30	1.78	2.88	328	213	ALC42(1)561CB200
200	680	CC	30 x 35	2.09	3.46	266	171	ALC42(1)681CC200
200	820	CD	30 x 40	2.44	4.04	220	142	ALC42(1)821CD200
200	1000	DC	35 x 35	2.58	3.61	213	148	ALC42(1)102DC200
200	1000	EB	40 x 30	2.26	2.87	252	186	ALC42(1)102EB200
200	1200	CF	30 x 50	3.14	4.98	156	102	ALC42(1)122CF200
200	1200	DD	35 x 40	2.97	4.17	176	122	ALC42(1)122DD200
200	1200	EC	40 x 35	2.73	3.55	199	145	ALC42(1)122EC200
200	1500	DF	35 x 50	3.64	5.24	137	93	ALC42(1)152DF200
200	1500	ED	40 x 40	3.15	4.07	163	119	ALC42(1)152ED200
200	1800	EE	40 x 45	3.54	4.53	138	101	ALC42(1)182EE200
200	2200	DH	35 x 60	4.21	5.60	105	75	ALC42(1)222DH200
200	2200	EF	40 x 50	3.92	4.91	119	89	ALC42(1)222EF200
200	2200	EG	40 x 55	4.24	5.52	109	79	ALC42(1)222EG200
200	2700	DL	35 x 80	5.06	7.01	89	65	ALC42(1)272DL200
200	2700	EH	40 x 60	4.49	5.57	99	74	ALC42(1)272EH200
200	3300	EL	40 x 80	5.52	7.16	81	61	ALC42(1)332EL200
200	4700	EP	40 x 105	8.22	12.69	46	32	ALC42(1)472EP200
200	5600	FP	45 x 105	8.68	12.61	41	29	ALC42(1)562FP200
200	6800	KP	50 x 105	9.09	12.39	36	26	ALC42(1)682KP200
250	390	CB	30 x 30	1.59	2.81	442	285	ALC42(1)391CB250
250	470	CC	30 x 35	1.86	3.36	362	232	ALC42(1)471CC250
250	560	CD	30 x 40	2.16	3.92	303	194	ALC42(1)561CD250
250	680	DC	35 x 35	2.36	3.64	278	187	ALC42(1)681DC250
250	680	EB	40 x 30	2.12	2.95	313	221	ALC42(1)681EB250
250	820	CF	30 x 50	2.80	4.87	212	137	ALC42(1)821CF250
250	820	DD	35 x 40	2.72	4.19	230	155	ALC42(1)821DD250
250	820	EC	40 x 35	2.55	3.62	251	175	ALC42(1)821EC250
250	1000	ED	40 x 40	2.95	4.18	206	144	ALC42(1)102ED250
250	1200	DF	35 x 50	3.40	5.04	160	110	ALC42(1)122DF250
250	1200	EE	40 x 45	3.31	4.65	174	122	ALC42(1)122EE250
250	1500	DH	35 x 60	3.90	5.66	134	92	ALC42(1)152DH250
250	1500	EF	40 x 50	3.70	5.02	146	104	ALC42(1)152EF250
250	1800	DL	35 x 80	4.64	7.19	105	70	ALC42(1)182DL250
250	1800	EG	40 x 55	4.01	5.31	127	92	ALC42(1)182EG250
250	2700	EL	40 x 80	5.28	7.02	84	60	ALC42(1)272EL250
250	3300	EP	40 x 105	7.47	12.71	53	34	ALC42(1)332EP250
250	4700	FP	45 x 105	8.32	12.45	41	28	ALC42(1)472FP250
250	5600	KP	50 x 105	8.70	12.21	37	26	ALC42(1)562KP250
350	220	CB	30 x 30	1.34	2.74	704	461	ALC42(1)221CB350
350	270	CC	30 x 35	1.57	3.26	571	373	ALC42(1)271CC350
350	330	CD	30 x 40	1.84	3.80	468	306	ALC42(1)331CD350
350	390	DC	35 x 35	2.06	3.65	420	282	ALC42(1)391DC350
350	390	EB	40 x 30	1.91	3.01	451	311	ALC42(1)391EB350
350	470	CF	30 x 50	2.37	4.75	332	218	ALC42(1)471CF350
350	470	DD	35 x 40	2.37	4.20	349	234	ALC42(1)471DD350
350	560	EC	40 x 35	2.34	3.51	328	230	ALC42(1)561EC350
350	680	DF	35 x 50	2.98	5.09	246	166	ALC42(1)681DF350
350	680	ED	40 x 40	2.71	4.06	270	189	ALC42(1)681ED350
350	820	DH	35 x 60	3.40	5.75	204	140	ALC42(1)821DH350
350	820	EF	40 x 50	3.31	5.19	216	149	ALC42(1)821EF350
350	1000	EG	40 x 55	3.63	5.48	182	127	ALC42(1)102EG350
350	1200	DL	35 x 80	4.21	7.01	140	96	ALC42(1)122DL350
350	1200	EH	40 x 60	3.83	5.62	160	114	ALC42(1)122EH350
350	1500	EL	40 x 80	4.76	7.20	120	84	ALC42(1)152EL350
350	2200	EP	40 x 105	6.71	12.34	72	48	ALC42(1)222EP350
350	2700	FP	45 x 105	7.26	12.35	62	41	ALC42(1)272FP350
350	3300	KP	50 x 105	7.77	12.21	53	36	ALC42(1)332KP350
400	180	CB	30 x 30	1.28	2.73	733	467	ALC42(1)181CB400
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR	Impedance	Part Number

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

Table 1 – Ratings & Part Number Reference cont'd

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR Maximum	Impedance Maximum	Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 105°C (A)	10 kHz 105°C (A)	100 Hz 20°C (mΩ)	10 kHz 20°C (mΩ)	
400	220	CC	30 x 35	1.49	3.25	587	375	ALC42(1)221CC400
400	270	CD	30 x 40	1.75	3.79	488	310	ALC42(1)271CD400
400	330	DC	35 x 35	1.99	3.61	426	280	ALC42(1)331DC400
400	330	EB	40 x 30	1.84	2.96	458	308	ALC42(1)331EB400
400	390	CF	30 x 50	2.28	4.74	342	218	ALC42(1)391CF400
400	390	DD	35 x 40	2.21	4.17	360	235	ALC42(1)391DD400
400	390	EC	40 x 35	2.18	3.65	377	251	ALC42(1)391EC400
400	470	ED	40 x 40	2.52	4.22	313	208	ALC42(1)471ED400
400	560	DF	35 x 50	2.88	5.06	250	164	ALC42(1)561DF400
400	560	EE	40 x 45	2.84	4.71	264	176	ALC42(1)561EE400
400	680	DH	35 x 60	3.27	5.72	211	139	ALC42(1)681DH400
400	680	EF	40 x 50	3.19	5.14	222	149	ALC42(1)681EF400
400	820	EG	40 x 55	3.50	5.45	189	128	ALC42(1)821EG400
400	1000	DL	35 x 80	4.06	6.96	145	96	ALC42(1)102DL400
400	1200	EL	40 x 80	4.56	7.20	128	86	ALC42(1)122EL400
400	1800	EP	40 x 105	6.41	12.32	76	49	ALC42(1)182EP400
400	2200	FP	45 x 105	6.96	12.32	65	42	ALC42(1)222FP400
400	2700	KP	50 x 105	7.48	12.17	55	37	ALC42(1)272KP400
450	120	CB	30 x 30	1.13	2.69	918	580	ALC42(1)121CB450
450	180	CC	30 x 35	1.40	3.20	622	396	ALC42(1)181CC450
450	220	CD	30 x 40	1.69	3.73	510	324	ALC42(1)221CD450
450	220	DC	35 x 35	1.80	3.66	525	335	ALC42(1)221DC450
450	270	CF	30 x 50	2.06	4.67	412	262	ALC42(1)271CF450
450	270	DD	35 x 40	2.08	4.19	428	275	ALC42(1)271DD450
450	270	EB	40 x 30	1.78	2.90	476	320	ALC42(1)271EB450
450	330	EC	40 x 35	2.13	3.54	385	257	ALC42(1)331EC450
450	390	ED	40 x 40	2.44	4.12	323	215	ALC42(1)391ED450
450	470	DF	35 x 50	2.78	4.94	260	171	ALC42(1)471DF450
450	470	EE	40 x 45	2.70	4.59	270	180	ALC42(1)471EE450
450	560	EF	40 x 50	3.02	5.03	230	154	ALC42(1)561EF450
450	680	DL	35 x 80	3.69	6.88	187	125	ALC42(1)681DL450
450	680	EH	40 x 60	3.55	5.73	191	128	ALC42(1)681EH450
450	820	EL	40 x 80	4.20	7.21	161	109	ALC42(1)821EL450
450	1200	EP	40 x 105	5.70	11.82	102	66	ALC42(1)122EP450
450	1500	FP	45 x 105	6.29	12.03	84	55	ALC42(1)152FP450
450	1800	KP	50 x 105	6.79	12.07	72	48	ALC42(1)182KP450
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR	Impedance	Part Number

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

Mechanical Data

Polarity and 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.

Insulating Resistance

≥ 100 MΩ at 100 VDC across insulating sleeve. UL recognized sleeving is available for custom parts in this range, upon request. (UL No. E358957)

Voltage Proof

≥ 2,500 VDC across insulating sleeve.

Safety Vent

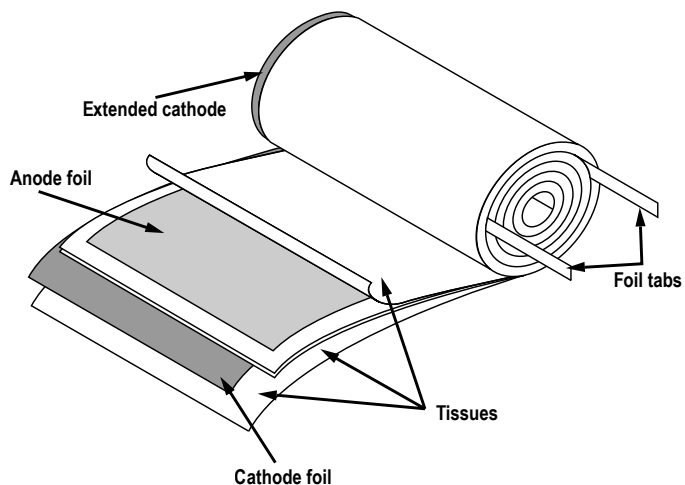
A safety vent for overpressure is featured on either the base (opposing end to the terminals) or the side of the can. This appears in the form of a grooved section on the surface of the can, which is a weakened area and designed to relieve build-up of internal pressure due to overstress or catastrophic failure.

Print Detail

- KEMET Logo
- Rated capacitance
- Capacitance tolerance
- Rated voltage
- Climatic Category
- Date of manufacture & Batch No.
- Article code

Construction

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.

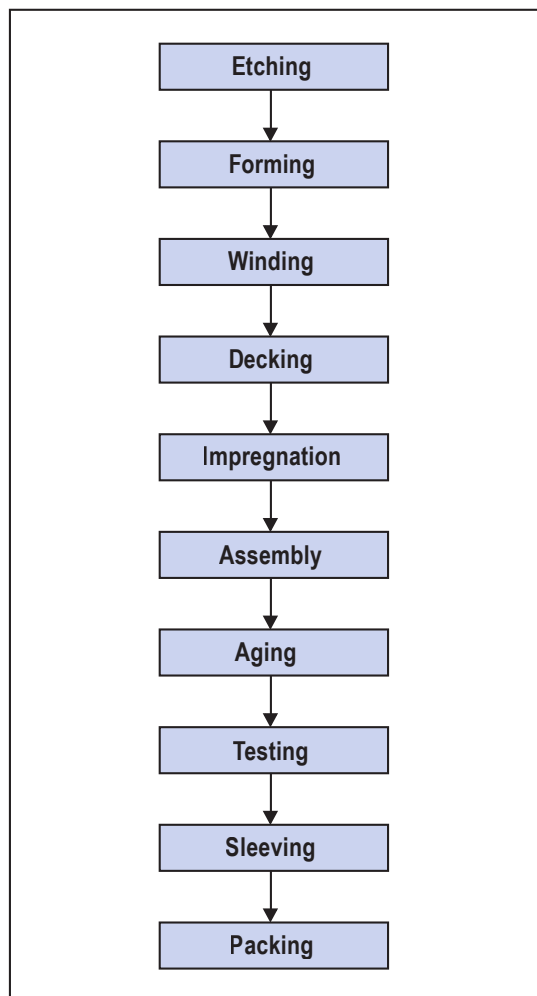
The following tests are applied and may be varied at the request of the customer. In this case the batch, or special procedure, will determine the course of action.

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



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Disclaimer

All product specifications, statements, information and data (collectively, the "Information") in this datasheet are subject to change. The customer is responsible for checking and verifying the extent to which the Information contained in this publication is applicable to an order at the time the order is placed.

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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.