

## Overview

KEMET's PEG220 is an electrolytic capacitor with outstanding electrical performance. The device has a polarized all-welded design, tinned copper wire leads, and a negative pole connected to the case. The PEG220 winding is housed in a cylindrical aluminum can with a high purity aluminum lid and high quality rubber gasket. Low ESR is the result of a low resistive electrolyte/paper system and an all-welded design. Thanks to its mechanical robustness, the PEG220 is suitable for use in mobile and aircraft installations with operation up to +150°C.

## Applications

KEMET's PEG220 is a new generation of high performance axial electrolytic capacitors. It is designed for automotive applications with extremely high demands.

## Benefits

- 4,000 hours at +150°C
- Very high ripple current
- Up to 21A ripple, RMS, continuous load
- High vibration resistance



## Part Number System

PEG220	H	F	415	0	Q
Series	Voltage (VDC)	Size Code	Capacitance Code (µF)	Version	Capacitance Tolerance
Axial Aluminum Electrolytic	H = 25 K = 40 M = 63	See Dimension Table	The second two digits indicate the two most significant digits of the capacitance value. The first digit indicates the total number digits.	0 = Standard	Q = -10 +30% M = ±20%

## Performance Characteristics

Item	Performance Characteristics	
Capacitance Range	250 – 4,700 $\mu$ F	
Rated Voltage	25 – 63 VDC	
Temperature Range	-40 to +150°C	
Capacitance Tolerance	-10/+30%, ( $\pm$ 20% select values) sat 100 Hz/+20°C	
Shelf Life	5,000 hours at +105°C or 10 years at +40°C 0 VDC	
Leakage Current	$I = 0.003 CV + 4,000$ ( $\mu$ A)	
	C = rated capacitance ( $\mu$ F), V = rated voltage (VDC). Voltage applied for 5 minutes at +20°C.	
Vibration Test Specifications	Procedure	Requirements
	1.5 mm displacement amplitude or 20 g maximum acceleration. Vibration applied for three 2-hour sessions at 10 – 2,000 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: $\Delta C/C < 5\%$
Standards	IEC 60384–4 long life grade 40/125/56, AEC–Q200	

## Compensation Factor of Ripple Current (RC) vs. Frequency

Frequency	100 Hz	300 Hz	1 kHz	5 kHz	100 kHz
Coefficient	0.35	0.57	0.80	1.00	1.04

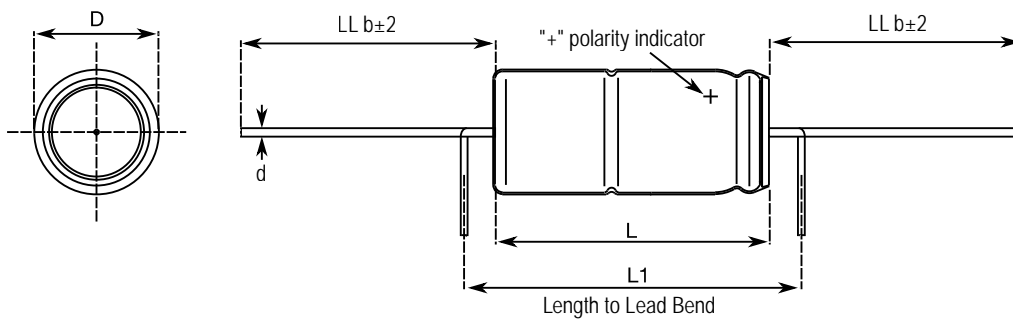
## Test Method & Performance

Endurance Life Test	
Conditions	Performance
Temperature	+150°C
Test Duration	1,500 hours (D = 16 mm)
	2,000 hours (D = 20 mm)
Ripple Current	Maximum ripple current specified in table
Voltage	The sum of DC voltage and the peak AC voltage must not exceed the rated voltage of the capacitor
<b>Performance</b>	<b>The following specifications will be satisfied when the capacitor is tested at +20°C:</b>
Capacitance Change	Within 15% of the initial value
Equivalent Series Resistance	Does not exceed 200% of the initial value
Leakage Current	Does not exceed leakage current limit

## Ordering Options Table

Packaging Kind	Lead Length (mm)	Lead and Packaging Code
Standard Packaging Option		
Bulk (bag)	40 ±2	(Blank)

## Dimensions – Millimeters



Size Code	Dimensions in mm				
	D ±0.5	L ±1	L1 Minimum	d ±0.03	LL b±2 Box
F	16	26.5	33	1.0	40
G	16	34.5	41	1.0	40
H	20	26.5	33	1.0	40
J	20	34.5	41	1.0	40
L	20	42.5	49	1.0	40

## 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  $\lambda$  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  $1 \times 10^{-9}$  failures per hour. Failure rate is also expressed as a percentage of failures per 1,000 hours.

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

## End of Life Definition

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

Parametric Failure:

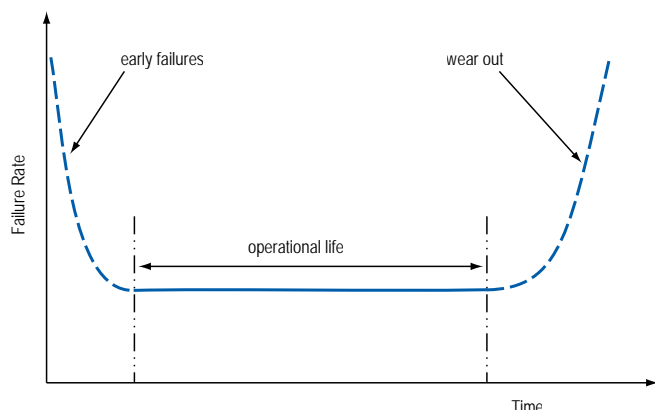
- Change in capacitance  $> \pm 10\%$
- Leakage current  $>$  specified limit
- ESR  $> 2 \times$  initial ESR value

## Failure Rate cont'd

### MTBF

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

$$MTBF = 1/\lambda$$



Estimated field failure rate:  $\leq 0.15$  ppm (failures per year/produced number of capacitors per year)

The expected failure rate for this capacitor range is based on field experience for capacitors with structural similarity.

## 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 &amp; Part Number Reference

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current					ESR Maximum			Part Number
				Maximum			Rated	Maximum	100 Hz 20°C (mΩ)	100 kHz 20°C (mΩ)	5 – 100 kHz 125 – 150°C (mΩ)	
				≥ 5 kHz 125°C (A) <sup>1</sup>	≥ 5 kHz 140°C (A) <sup>1</sup>	≥ 5 kHz 150°C (A) <sup>1</sup>	≥ 5 kHz 125°C (A) <sup>2</sup>	≥ 5 kHz 125°C (A) <sup>3</sup>				
25	1500	F	16 x 27	13.9	8.8	3.9	4.8	6.1	78	42	18.4	PEG220HF4150M
25	2200	G	16 x 35	15.8	10.0	4.5	5.8	7.4	56	31	14.3	PEG220HG4220M
25	2200	H	20 x 27	16.6	10.5	4.7	5.2	6.6	61	36	19	PEG220HH4220Q
25	3300	J	20 x 35	19.1	12.1	5.4	6.4	8.1	43	26	14.3	PEG220HJ4330Q
25	4700	L	20 x 43	21.0	13.3	5.9	7.4	9.3	32	20	11.8	PEG220HL4470Q
40	800	F	16 x 27	13.6	8.6	3.9	4.7	5.9	108	43	19.2	PEG220KF3800Q
40	1200	G	16 x 35	15.5	9.8	4.4	5.7	7.2	74	31	14.8	PEG220KG4120Q
40	1500	H	20 x 27	17.1	10.8	4.8	5.4	6.8	68	33	17.8	PEG220KH4150Q
40	2200	J	20 x 35	19.4	12.2	5.5	6.5	8.2	49	25	13.9	PEG220KJ4220Q
40	2700	L	20 x 43	20.7	13.1	5.9	7.3	9.2	39	20	12.1	PEG220KL4270Q
63	250	F	16 x 27	10.5	6.6	3.0	3.6	4.5	233	59	32.4	PEG220MF3250Q
63	370	G	16 x 35	12.2	7.7	3.5	4.5	5.7	160	42	23.9	PEG220MG3370Q
63	470	H	20 x 27	14.2	9.0	4.0	4.5	5.7	134	41	25.9	PEG220MH3470Q
63	680	J	20 x 35	16.3	10.3	4.6	5.6	7.0	94	30	19.7	PEG220MJ3680Q
63	900	L	20 x 43	17.7	11.2	5.0	6.3	7.9	74	25	16.6	PEG220ML3900Q
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current					ESR			Part Number

<sup>1</sup> Capacitor mounted with low thermal resistance path (heat-sink)

<sup>2</sup> Continuous operation at natural convection (D=20, 4000h; D=16, 3000h)

<sup>3</sup> Reduced life (D=20, 2000h; D=16, 1500h)

## Packaging Quantities

Size Code	Packaging Quantities
	Bulk
F	125
G	100
H	150
J	125
L	100

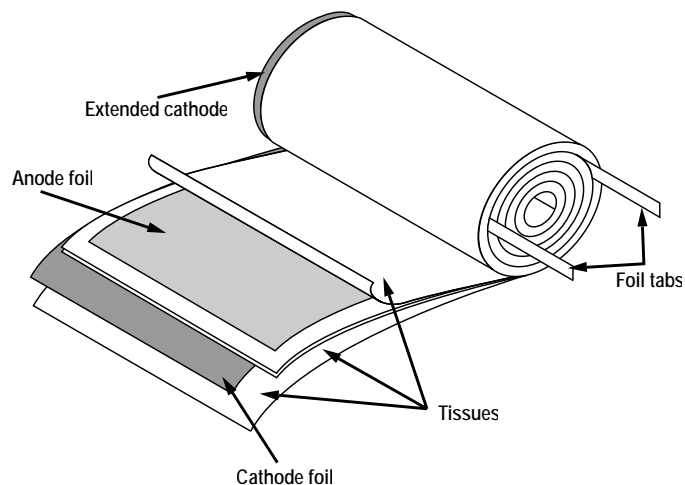
## Print Detail

### Standard Marking for PEG and PEH types

- KEMET Logo
- Rated capacitance
- Capacitance tolerance
- Rated voltage
- Date code
- Polarity indication
- 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.

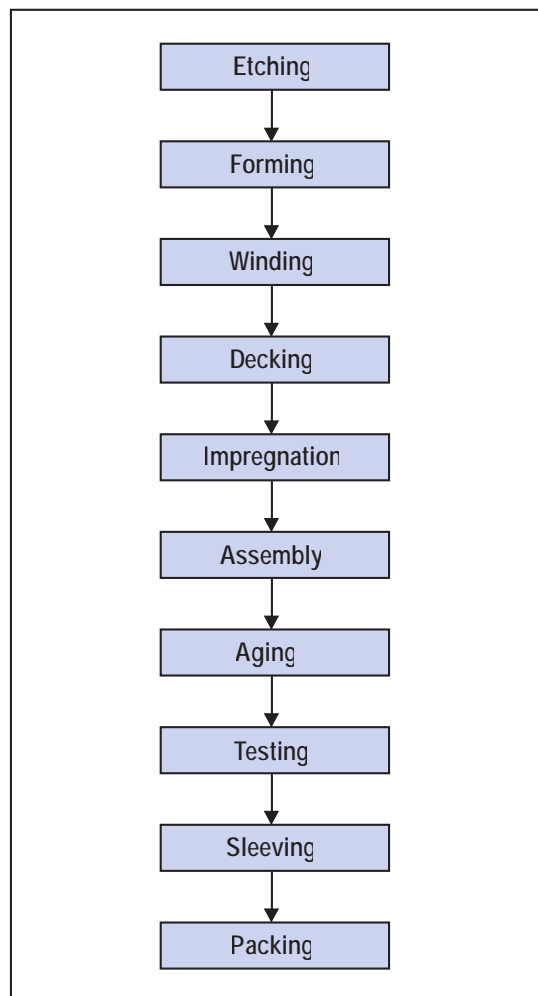
The following tests are applied and may be varied at the request of the customer. In this case the batch, or special procedure, will determine the course of action.

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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## Other KEMET Resources

Tools	
Resource	Location
Configure A Part: CapEdge	<a href="http://capacitoredge.kemet.com">http://capacitoredge.kemet.com</a>
SPICE & FIT Software	<a href="http://www.kemet.com/spice">http://www.kemet.com/spice</a>
Search Our FAQs: KnowledgeEdge	<a href="http://www.kemet.com/keask">http://www.kemet.com/keask</a>
Electrolytic LifeCalculator	<a href="http://www.kemet.com:8080/elc">http://www.kemet.com:8080/elc</a>

Product Information	
Resource	Location
Products	<a href="http://www.kemet.com/products">http://www.kemet.com/products</a>
Technical Resources (Including Soldering Techniques)	<a href="http://www.kemet.com/technicalpapers">http://www.kemet.com/technicalpapers</a>
RoHS Statement	<a href="http://www.kemet.com/rohs">http://www.kemet.com/rohs</a>
Quality Documents	<a href="http://www.kemet.com/qualitydocuments">http://www.kemet.com/qualitydocuments</a>

Product Request	
Resource	Location
Sample Request	<a href="http://www.kemet.com/sample">http://www.kemet.com/sample</a>
Engineering Kit Request	<a href="http://www.kemet.com/kits">http://www.kemet.com/kits</a>

Contact	
Resource	Location
Website	<a href="http://www.kemet.com">www.kemet.com</a>
Contact Us	<a href="http://www.kemet.com/contact">http://www.kemet.com/contact</a>
Investor Relations	<a href="http://www.kemet.com/ir">http://www.kemet.com/ir</a>
Call Us	1-877-MyKEMET
Twitter	<a href="http://twitter.com/kemetcapacitors">http://twitter.com/kemetcapacitors</a>

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