Radial Crown Aluminum Electrolytic Capacitors

PEH126, +150°C, PEH220, +150°C, PEH225, +125ºC and +150ºC, and PEH226, +150ºC

Electronic Components
KEMET
CHARGED.

Overview

These electrolytic capacitors contain a radial crown which allows them to be mounted in a standing position. They feature outstanding electrical performance, a polarized, all-welded design, tinned copper wire leads, a negative pole connected to the case, and plastic insulation. The winding is housed in a cylindrical aluminium can with a high purity aluminium lid and a high quality rubber gasket. Low ESR is a result of a low resistive electrolyte/paper system and an all-welded design. Thanks to its mechanical robustness these capacitors are suitable for use in mobile and aircraft installations with operation up to +150°C.

Applications

KEMET's PEH126, PEH220, PEH225, and PEH226 are a high performance electrolytic capacitor. It is designed for automotive applications with high demands on resistance to vibrations and high ambient temperature.

Benefits

- High performance
- 2,000 hours at +150°C
- High ripple current
- Low ESR

Part Number System

PEH126	H	F	368	E	Q
Series	Voltage (VDC)	Size Code	Capacitance Code (pF)	Version	Capacitance Tolerance
Radial Crown Aluminum Electrolytic with Soldering Star Termination	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.	E = Standard	Q = -10 +30%

Part Number System cont'd

PEH220	H	F	415	0	M
Series	Voltage (VDC)	Size Code	Capacitance Code (pF)	Version	Capacitance Tolerance
Radial Crown Aluminum Electrolytic with Soldering Star Termination	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%

PEH225	H	F	422	0	M
Series	Voltage (VDC)	Size Code	Capacitance Code (pF)	Version	Capacitance Tolerance
Radial Crown Aluminum Electrolytic with Soldering Star Termination	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%

PEH226	H	F	415	0	M
Series	Voltage (VDC)	Size Code	Capacitance Code (pF)	Version	Capacitance Tolerance
Radial Crown Aluminum Electrolytic with Soldering Star Termination	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 PEH126

Item	Performance Characteristics	
Series	PEH126	
Capacitance Range	250 – 4,000 µF	
Rated Voltage	25 – 63 VDC	
Temperature Range	-40 to +150°C	
Capacitance Tolerance	-10/+30%, (±20% select values) at 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 + 4.0 (µA)	
	C = rated capacitance (µF), 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 δ from initial measurements must not exceed: Δ C/C < 5%
Standards	IEC 60384–4 long life grade 40/125/56, AEC–Q200	

Performance Characteristics PEH220

Item	Performance Characteristics	
Series	PEH220	
Capacitance Range	250 – 4,700 µF	
Rated Voltage	25 – 63 VDC	
Temperature Range	-40 to +150°C	
Capacitance Tolerance	-10/+30%, (±20% select values) at 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 + 4.0 (µA)	
	C = rated capacitance (µF), 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 22-hour sessions at 10 – 2,000 Hz (capacitor clamped by body).	No leakage of electrolyte or other visible damage. Deviations in capacitance and tan δ from initial measurements must not exceed: Δ C/C < 5%
Standards	IEC 60384–4 long life grade 40/125/56, AEC–Q200	

Performance Characteristics PEH225

Item	Performance Characteristics	
Series	PEH225	
Capacitance Range	470 – 6,300 µF	
Rated Voltage	25 – 63 VDC	
Temperature Range	-40 to +125°C (-40 to +150°C at derated voltage)	
Capacitance Tolerance	-10/+30%, (±20% select values) at 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 + 4.0 (µA)	
	C = rated capacitance (µF), 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 22-hour sessions at 10 – 2,000 Hz (capacitor clamped by body).	No leakage of electrolyte or other visible damage. Deviations in capacitance and tan δ from initial measurements must not exceed: Δ C/C < 5%
Standards	IEC 60384–4 long life grade 40/125/56, AEC–Q200	

Performance Characteristics PEH226

Item	Performance Characteristics	
Series	PEH226	
Capacitance Range	250 – 4,700 µF	
Rated Voltage	25 – 63 VDC	
Temperature Range	-40 to +150°C	
Capacitance Tolerance	-10/+30%, (±20% select values) at 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 + 4.0 (µA)	
	C = rated capacitance (µF), 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 22-hour sessions at 10 – 2,000 Hz (capacitor clamped by body).	No leakage of electrolyte or other visible damage. Deviations in capacitance and tan δ from initial measurements must not exceed: Δ 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

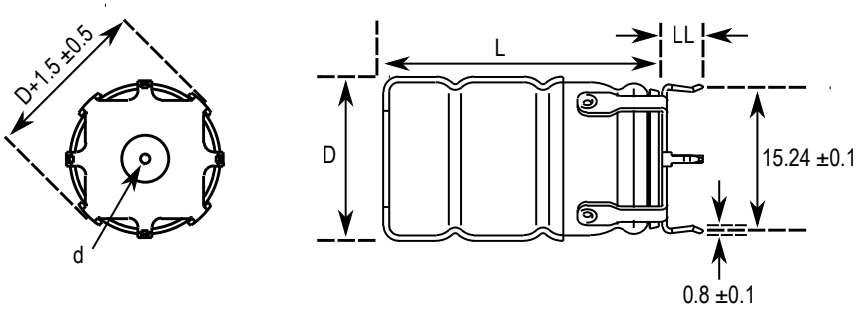
Test Method & Performance

Endurance Life Test	
Conditions	Performance
Temperature	+150°C
Test Duration	1,500 hours (16 mm diameter), 2,000 hours (20 mm diameter)
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
Performance	**The following specifications will be satisfied when the capacitor is tested at +20°C:**
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

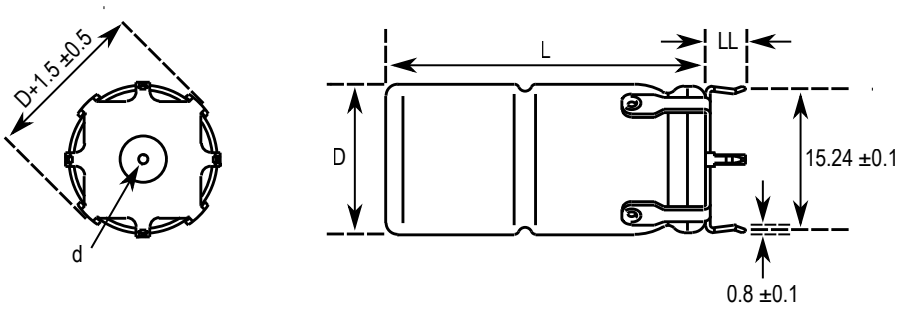
Packaging Kind	Lead Length (mm)	Lead and Packaging Code
Standard Packaging Option		
Box	3.3 ±0.5	E1

Dimensions – Millimeters PEH126



Size Code	Dimensions in mm			
	D	L	d	LL
	±0.5	±1	±0.03	±0.5
F	16.0	27.5	1.0	3.3
G	16.0	35.5	1.0	3.3
H	20.0	31.0	1.0	3.3
J	20.0	39.0	1.0	3.3
L	20.0	48.0	1.0	3.3

Dimensions – Millimeters PEH220 – 226



Size Code	Dimensions in mm			
	D	L	d	LL
	±0.5	±1	±0.03	±0.5
F	16.0	27.5	1.0	3.3
G	16.0	35.5	1.0	3.3
H	20.0	27.5	1.0	3.3
J	20.0	35.5	1.0	3.3
L	20.0	43.5	1.0	3.3

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 ten years at 40°C. See sectional specification under each product series for specific data.

Failure Rate

Estimated field failure rate: ≤ 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.
As per PEG Equivalents.

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 1A – PEH126, Ratings & Part Number Reference

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current Maximum				ESR Maximum		L_{ESL}	Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 125°C (A)	≥ 5 kHz 105°C (A)	≥ 5 kHz 125°C (A)	≥ 5 kHz 150°C (A)	100 Hz 20°C (mΩ)	100 kHz 20°C (mΩ)	Approximate (nH)	
25	1000	G	16 x 37	1.7	8.8	5.2	2	80	28	12	PEH126HG410EQ
25	1500	G	16 x 37	2.1	9.2	5.4	2.1	63	26	12	PEH126HG415EQ
25	2200	H	20 x 29	2.5	9.4	5.5	2.1	51	25	12	PEH126HH422EQ
25	3300	J	20 x 37	3.2	11.7	6.9	2.6	34	17	15	PEH126HJ433EQ
25	4000	L	20 x 46	3.7	13.1	7.7	2.9	29	14	17	PEH126HL440EM
40	470	F	16 x 29	1.1	5.9	3.5	1.3	150	45	10	PEH126KF347EQ
40	600	G	16 x 37	1.4	8.3	4.9	1.9	120	30	12	PEH126KG360EQ
40	1000	H	20 x 29	1.9	9.4	5.5	2.1	75	23	12	PEH126KH410EQ
40	1200	H	20 x 29	2	9	5.3	2	71	26	12	PEH126KH412EQ
40	1500	H	20 x 29	2.2	9.7	5.7	2.2	58	22	12	PEH126KH415EQ
40	2200	J	20 x 37	2.8	11.4	6.7	2.6	43	18	15	PEH126KJ422EQ
40	2700	L	20 x 46	3.1	12.1	7.1	2.7	37	17	17	PEH126KL427EQ
63	250	F	16 x 29	0.9	5.3	3.1	1.2	240	53	10	PEH126MF325EQ
63	370	G	16 x 37	1.2	6.7	3.9	1.5	160	37	12	PEH126MG337EQ
63	470	H	20 x 29	1.4	7.3	4.3	1.6	130	32	12	PEH126MH347EQ
63	680	J	20 x 37	1.7	9	5.3	2	90	23	15	PEH126MJ368EQ
63	900	L	20 x 46	2.1	10.5	6.1	2.3	69	18	17	PEH126ML390EQ
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current				ESR		L_{ESL}	Part Number

Table 1B – PEH220, Ratings & Part Number Reference

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current					ESR Maximum			Part Number
				Maximum			Rated	Maximum				
	100 Hz 20°C (µF)		D x L (mm)	≥ 5 kHz 125°C (A)[1]	≥ 5 kHz 140°C (A)[1]	≥ 5 kHz 150°C (A)[1]	≥ 5 kHz 125°C (A)	≥ 5 kHz 125°C (A)	100 Hz 20°C (mΩ)	100 kHz 20°C (mΩ)	5 – 100 kHz 1 25 – 150°C (mΩ)	
25	1500	F	16 x 27	13.9	8.8	3.9	4.8	6.1	78	42	18.4	PEH220HF4150M
25	2200	G	16 x 35	15.8	10	4.5	5.8	7.4	56	31	14.3	PEH220HG4220M
25	2200	H	20 x 27	16.6	10.5	4.7	5.2	6.6	61	36	19	PEH220HH4220Q
25	3300	J	20 x 35	19.1	12.1	5.4	6.4	8.1	43	26	14.3	PEH220HJ4330Q
25	4700	L	20 x 43	21	13.3	5.9	7.4	9.3	32	20	11.8	PEH220HL4470Q
40	800	F	16 x 27	13.6	8.6	3.9	4.7	5.9	108	43	19.2	PEH220KF3800Q
40	1200	G	16 x 35	15.5	9.8	4.4	5.7	7.2	74	31	14.8	PEH220KG4120Q
40	1500	H	20 x 27	17.1	10.8	4.8	5.4	6.8	68	33	17.8	PEH220KH4150Q
40	2200	J	20 x 35	19.4	12.2	5.5	6.5	8.2	49	25	13.9	PEH220KJ4220Q
40	2700	L	20 x 43	20.7	13.1	5.9	7.3	9.2	39	20	12.1	PEH220KL4270Q
63	250	F	16 x 27	10.5	6.6	3	3.6	4.5	233	59	32.4	PEH220MF3250Q
63	370	G	16 x 35	12.2	7.7	3.5	4.5	5.7	160	42	23.9	PEH220MG3370Q
63	470	H	20 x 27	14.2	9	4	4.5	5.7	134	41	25.9	PEH220MH3470Q
63	680	J	20 x 35	16.3	10.3	4.6	5.6	7	94	30	19.7	PEH220MJ3680Q
63	900	L	20 x 43	17.7	11.2	5	6.3	7.9	74	25	16.6	PEH220ML3900Q
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current					ESR			Part Number

[1] *Capacitor mounted with low thermal resistance path (heat-sink)*

Table 1C – PEH225, Ratings & Part Number Reference

VDC	VDC	Rated Capacitance	Size Code	Case Size	Ripple Current					ESR Maximum			Part Number
					Maximum			Rated	Maximum (Reduced Voltage)				
	(150°C)	100 Hz 20°C (µF)		D x L (mm)	≥ 5 kHz 125°C (A)[1]	≥ 5 kHz 140°C (A)[2]	≥ 5 kHz 150°C (A)[2]	≥ 5 kHz 125°C (A)	≥ 5 kHz 125°C (A)	100 Hz 20°C (mΩ)	100 kHz 20°C (mΩ)	5 – 100 kHz 125 – 150°C (mΩ)	
25	18	2200	F	16 x 27	17.3	11	4.9	6.1	7.7	60	34	11.9	PEH225HF4220M
25	18	3000	G	16 x 35	19.7	12.5	5.6	7.4	9.4	44	25	9.2	PEH225HG4300M
25	18	3600	H	20 x 27	23.5	14.9	6.7	7.6	9.6	38	22	9.4	PEH225HH4360Q
25	18	4800	J	20 x 35	26.7	16.9	7.6	9.2	11.7	28	16	7.3	PEH225HJ4480Q
25	18	6300	L	20 x 43	28.3	17.9	8	10.2	12.9	24	14	6.5	PEH225HL4630Q
40	32	1200	F	16 x 27	16.6	10.5	4.7	5.8	7.4	80	36	13	PEH225KF4120M
40	32	1800	G	16 x 35	19.3	12.2	5.5	7.2	9.2	55	25	9.6	PEH225KG4180M
40	32	2000	H	20 x 27	22.8	14.4	6.5	7.3	9.3	50	23	10	PEH225KH4200Q
40	32	3000	J	20 x 35	25.8	16.3	7.3	8.9	11.3	35	17	7.8	PEH225KJ4300Q
40	32	3900	L	20 x 43	27.7	17.5	7.8	10	12.7	28	14	6.8	PEH225KL4390Q
63	54	470	F	16 x 27	12.1	7.7	3.4	4.2	5.3	156	52	24.3	PEH225MF3470Q
63	54	680	G	16 x 35	13.8	8.7	3.9	5.3	6.7	109	37	18.7	PEH225MG3680Q
63	54	900	H	20 x 27	18	11.4	5.1	5.8	7.3	86	31	16.1	PEH225MH3900Q
63	54	1400	J	20 x 35	20.9	13.2	5.9	7.3	9.2	57	22	11.9	PEH225MJ4140Q
63	54	1800	L	20 x 43	22.8	14.4	6.5	8.3	10.5	45	18	10	PEH225ML4180Q
VDC	VDC (150°C)	Rated Capacitance	Size Code	Case Size	Ripple Current					ESR			Part Number

[1] *Capacitor-mounted with low thermal resistance path (heat-sink).*

[2] *Valid for capacitor supplied with reduced DC voltage, capacitor-mounted with low thermal resistance path.*

Table 1D – PEH226, Ratings & Part Number Reference

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current					ESR Maximum			Part Number
				Maximum			Rated	Maximum				
	100 Hz 20°C (µF)		D x L (mm)	≥ 5 kHz 125°C (A)[1]	≥ 5 kHz 140°C (A)[1]	≥ 5 kHz 150°C (A)[1]	≥ 5 kHz 125°C (A)[2]	≥ 5 kHz 125°C (A)	100 Hz 20°C (mΩ)	100 kHz 20°C (mΩ)	5 – 100 kHz 1 25 – 150°C (mΩ)	
25	1500	F	16 x 27	16.8	10.6	4.7	5.9	7.4	72	36	12.7	PEH226HF4150M
25	2200	G	16 x 35	19.2	12.1	5.4	7.2	9.1	51	26	9.7	PEH226HG4220M
25	2200	H	20 x 27	22.2	14	6.3	7.1	9.1	50	25	10.6	PEH226HH4220Q
25	3300	J	20 x 35	25.8	16.3	7.3	8.9	11.3	34	17	7.8	PEH226HJ4330Q
25	4700	L	20 x 43	28.5	18	8.1	10.3	13.1	25	13	6.4	PEH226HL4470Q
40	800	F	16 x 27	16.2	10.2	4.6	5.6	7.2	100	36	13.6	PEH226KF3800Q
40	1200	G	16 x 35	18.6	11.8	5.3	7	8.8	69	26	10.3	PEH226KG4120Q
40	1500	H	20 x 27	22.8	14.4	6.5	7.3	9.3	57	22	10	PEH226KH4150Q
40	2200	J	20 x 35	25.7	16.2	7.3	8.9	11.2	41	17	7.9	PEH226KJ4220Q
40	2700	L	20 x 43	27.9	17.6	7.9	10.1	12.8	32	13	6.7	PEH226KL4270Q
63	250	F	16 x 27	11.5	7.3	3.3	4	5.1	227	53	26.9	PEH226MF3250Q
63	370	G	16 x 35	13.6	8.6	3.9	5.1	6.4	155	37	19.2	PEH226MG3370Q
63	470	H	20 x 27	17.3	10.9	4.9	5.5	7	125	32	17.5	PEH226MH3470Q
63	680	J	20 x 35	20	12.7	5.7	6.9	8.7	87	23	13	PEH226MJ3680Q
63	900	L	20 x 43	22.2	14	6.3	8.1	10.2	67	18	10.6	PEH226ML3900Q
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current					ESR			Part Number

[1] *Capacitor mounted with low thermal resistance path (heat-sink)*

[2] *Continuous operation at natural convection*

Packaging Quantities

Size Code	Packaging Quantities
	Bulk
F	100
G	100
H	*
J	*
L	*

** No standard packing solution available. Packing specification will be individually defined.*

Print Detail

Standard Marking for PEG and PEH types

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

Construction – PEH 126, +150°C

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 winding is assembled to the capacitor Al-can and to the Al-lid. The can is filled with electrolyte and the winding is impregnated during a vacuum treatment. The capacitor is sealed. Throughout the process, all materials inside the housing must be maintained at the highest purity and be compatible with the electrolyte.

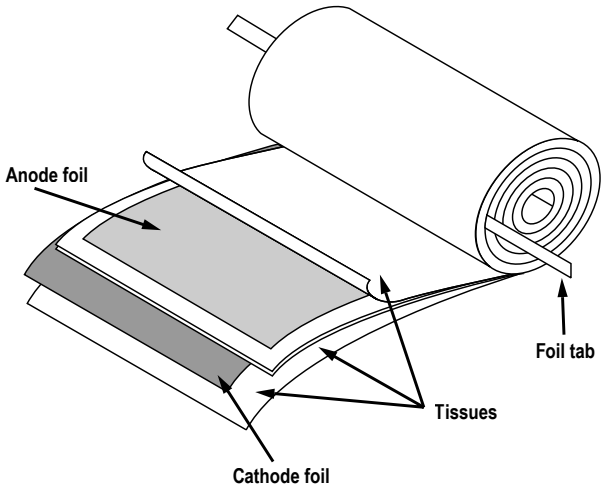
Each capacitor is aged and tested before being packed. The purpose of aging is to repair any damage in the oxide layer and thus reduce the leakage current to a very low level. Aging is carried out at elevated temperature and is accomplished by applying voltage to the device while carefully controlling the supply current. The process takes between 2 and 20 hours, depending on voltage rating.

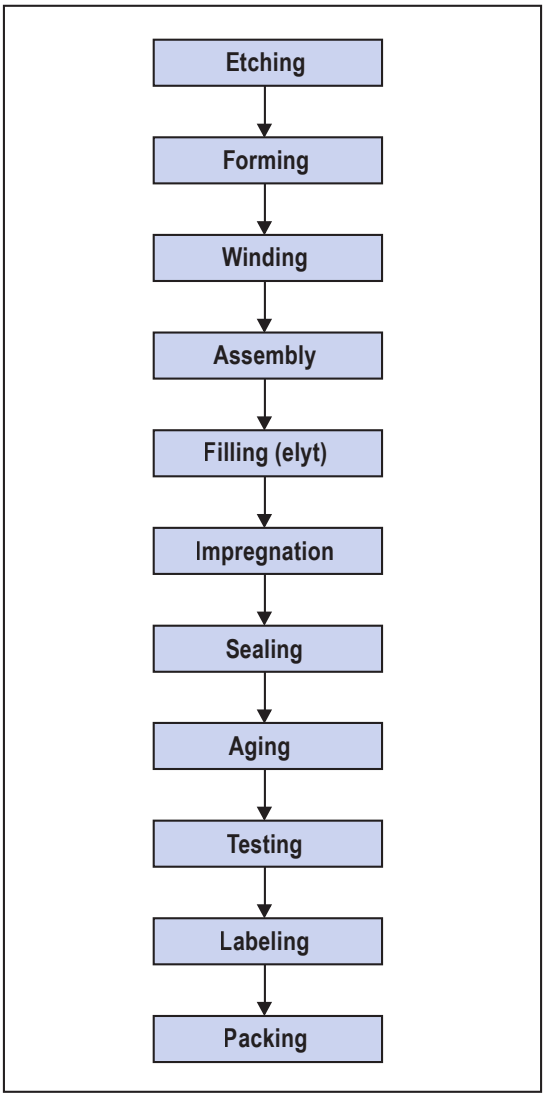
Damage to the oxide layer can occur due to a variety of reasons:
- Slitting of the anode foil after forming
- Attaching the tabs to the anode foil
- Minor mechanical damage caused during winding

The following tests are applied for each individual capacitor.

Electrical:
- Leakage current
- Capacitance
- ESR
- Tan Delta

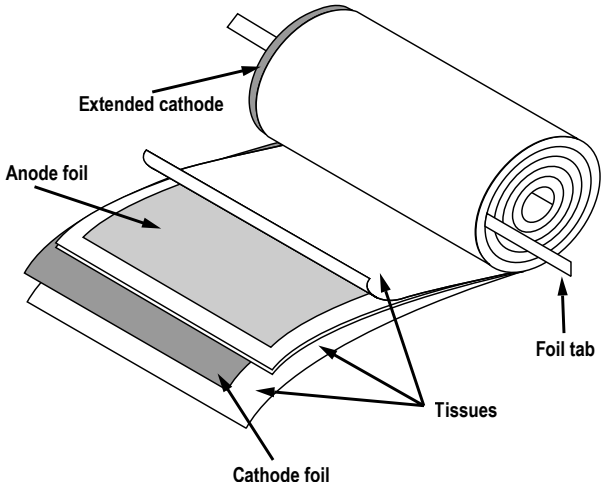
Mechanical/Visual:
- Pull strength test of wire terminals
- Print detail
- Box labels
- Packaging, including packed quantity





Construction – PEH 220, +150°C, PEH 225, +125°C and +150°C, and PEH226, +150°C

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.



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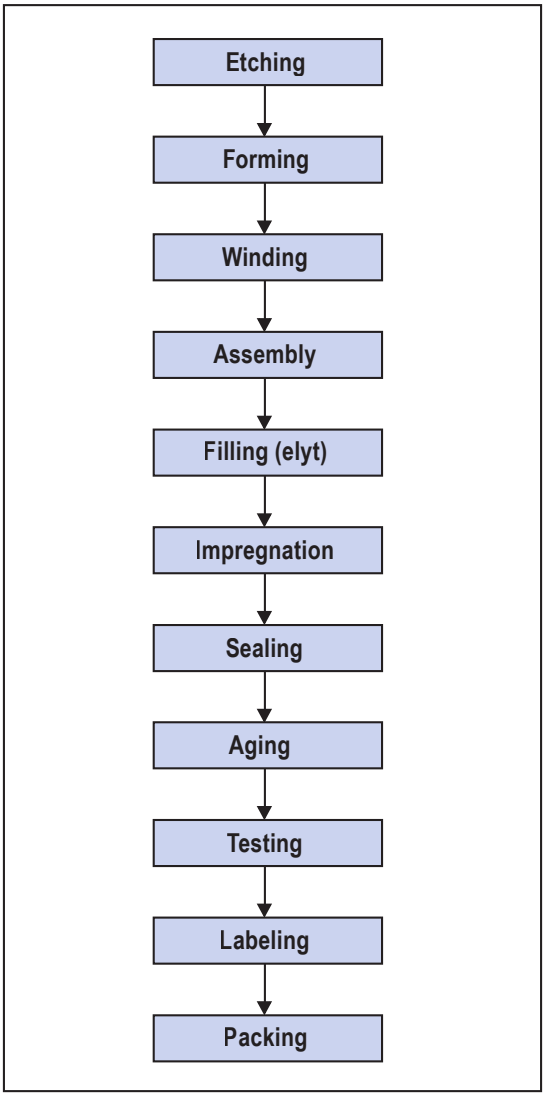
Each capacitor is aged and tested before being packed. The purpose of aging is to repair any damage in the oxide layer and thus reduce the leakage current to a very low level. Aging is carried out at elevated temperature and is accomplished by applying voltage to the device while carefully controlling the supply current. The process takes between 2 and 20 hours, depending on voltage rating.



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Mechanical/Visual:

- Pull strength test of wire terminals
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- Box labels
- Packaging, including packed quantity

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