



## Film Capacitors – Power Factor Correction

PhaseCap Premium capacitors

<b>Series/Type:</b>	<b>MKK</b>
<b>Ordering code:</b>	<b>B25667L*</b>
Date:	2019-05-03
Version:	7.0

### Construction

- Dielectric: Polypropylene film
- Gas-impregnated, dry type, Non-PCB
- Concentric winding
- Wave cut
- Extruded round aluminum can with stud
- Provided with ceramic discharge module
- Triple safety system

### Features

- Three-phase, delta connected
- Self-healing technology
- Naturally air cooled (or forced air cooling)
- Indoor mounting

### Typical applications

- For Power Factor Correction

### Terminals

- Optimized capacitor safety terminals

### Mounting

- Threaded stud at bottom of can  
(max. torque for M12 = 10 Nm)



### Technical data and specifications

Characteristics	MKK U <sub>N</sub> -D-V <sub>N</sub> -01	
Rated capacitance C <sub>N</sub>	As per table	
Tolerance	-5 / +10%	
Connection	D (Delta)	
Rated voltage U <sub>N</sub>	As per table	
Rated frequency f <sub>N</sub>	50 Hz	60 Hz
Output Q <sub>N</sub>	As per table	As per table
Rated current I <sub>N</sub>	As per table	As per table
tan δ (dielectric)	0.2 W / kvar	
*tan δ (50 Hz)	≤ 0.5 W / kvar	

\* Without discharge resistor

<b>Maximum ratings</b>	
$V_{\max}$ (up to 8 h daily)	$V_N 10\% V_N V AC$
$V_{\max}$ (up to 1 min)	$V_N + 30\% \times V_N V AC$
$I_{\max}$	Up to $1.6 \cdot I_N$ (A) (including combined effects of harmonics, overvoltages and capacitance tolerance)
$I_S$	$300 \cdot I_N$ (A)

<b>Test data</b>	
$V_{TT}$	$2.15 \cdot V AC rms / 50 Hz$ for 2 s
$V_{TC}$	$3600 V AC rms / 50 Hz$ for 2 s

<b>Design data</b>	
Dimensions (d x h)	As per table
Weight approx	As per table
Impregnation	Non PCB, dry, inert gas
Fixing	Threaded bolt M12
Max. torque (Al can stud)	10 Nm
Mounting position	Any mounting position possible. See "Maintenance and Installation Manual" for further details.

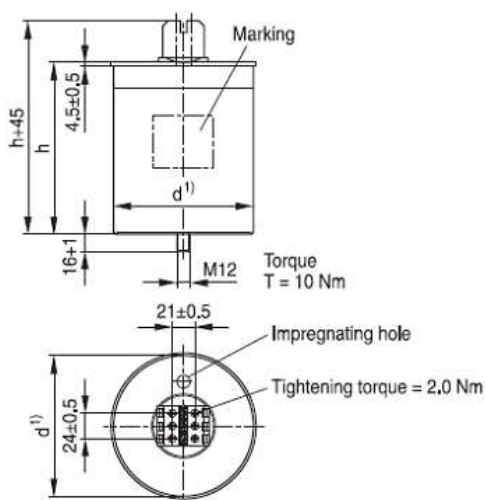
<b>Climatic category</b>	<b>-40/D</b>
$\Theta_{\min}$	-40 °C
$\Theta_{\max}$	+55 °C
Storage temperature	-40 °C.....+85 °C
$\Theta_{\text{hotspot max.}}$	85 °C
Humidity	Av. rel. < 95%
Degree of protection	IP 20
Maximum altitude	4,000 m

<b>Mean life expectancy</b>	
$t_{LD}$	Up to 180 000 hours (temperature class -40/C) ; $\Theta_{HS} \leq 70$ °C Up to 130 000 hours (temperature class -40/D) ; $\Theta_{HS} \leq 70$ °C
Max. 7500 switching's per year	

Terminals	
Protection degree	Isolated terminals, IP20
Max. torque	2.0 Nm
Terminal cross section	25 mm <sup>2</sup>
Maximum terminal current	80 A
Creepage distance (min)	12.7 mm
Clearance (min)	9.6 mm

Safety	
Mechanical safety	Overpressure disconnecter
Max. short circuit current	(AFC: 10 kA)
Discharge resistor time	≤ 60 s to 50 V or less

Reference standards
IS 13340 (2012) / IEC 60831 (2002), IEC60831-1/2.

**Dimensional drawing:**


Creepage distance 12.7 mm min.  
Clearance 9.6 mm min.

¹) Seaming adds 5.5 mm in diameter

KLK1841-1-E

**Label:**

**PhaseCap®**

**EPCOS**  
Power Quality Solutions

**MKK U<sub>N</sub>1-D-Q<sub>N</sub>X1-01**  
**B25667L---A---**

C<sub>N</sub> = 3 x C<sub>N</sub> μF +10/-5% Δ SH  
 U<sub>N</sub> Q<sub>N</sub> /50 Hz Q<sub>N</sub> /60 Hz  
 U<sub>N</sub>1V Q<sub>N</sub>X1 kvar Q<sub>N</sub>Y1 kvar  
 U<sub>N</sub>2V Q<sub>N</sub>X2 kvar Q<sub>N</sub>Y2 kvar  
 U<sub>N</sub>3V Q<sub>N</sub>X3 kvar Q<sub>N</sub>Y3 kvar  
 U<sub>i</sub> = 3/8 kV -40/D

Overpressure disconnecter  
 IEC 60831-1:2014  
 Non PCB, Dry, Inert Gas  
 Ref. Standard

IS:13340 (Part1)/ IEC 60831-1:2002  
 Made by EPCOS mm.yy N

**WARNING: WAIT 5 MINUTES AFETR ISOLATING SUPPLY BEFORE HANDLING**

IS:13340 (Part1)/ IEC 60831-1  
 CM/L-1432640

**Ordering codes:**

Ordering code	Series/Type:	Rated capacitance C <sub>N</sub> μF	Rated voltage V <sub>N</sub> V	Output & Rated current at 50Hz		Output & Rated current at 60Hz		Dimensions (d × h) mm	Weight approx kg
				Kvar	In A	Kvar	In A		
B25667L4926A375	MKK415-D-5-01	3 x 30.8	415	5	7	6	8	121.6 × 164	1.2
B25667L4117A375	MKK415-D-6.3-01	3 x 39	415	6.3	9	7.5	11	121.6 × 164	1.2
B25667L4197A375	MKK415-D-10.4-01	3 x 64.1	415	10.4	15	12.5	17	121.6 × 164	1.2
B25667L4237A375	MKK415-D-12.5-01	3 x 77	415	12.5	17	15	21	121.6 × 164	1.3
B25667L4277A375	MKK415-D-15-01	3 x 92.5	415	15	21	18	25	121.6 × 164	1.4
B25667L4307A375	MKK415-D-16.7-01	3 x 102.9	415	16.7	23	20	28	121.6 × 164	1.5
B25667L4387A375	MKK415-D-20.8-01	3 x 128.2	415	20.8	29	25	35	121.6 × 200	1.8
B25667L4467A375	MKK415-D-25-01	3 x 154.1	415	25	35	30	42	142 × 200	2.2
B25667L4826A375	MKK440-D-5-01	3 x 27.4	440	5	7	6	8	121.6 × 164	1.2
B25667L4127A375	MKK440-D-7.5-01	3 x 41.1	440	7.5	10	9	12	121.6 × 164	1.2
B25667L4177A375	MKK440-D-10.4-01	3 x 57.0	440	10.4	14	12.5	16	121.6 × 164	1.3
B25667L4207A375	MKK440-D-12.5-01	3 x 68.5	440	12.5	16	15	20	121.6 × 164	1.4
B25667L4237A365	MKK440-D-14.2-01	3 x 77.9	440	14.2	19	17	22	121.6 × 164	1.5
B25667L4247A375	MKK440-D-15-01	3 x 82.2	440	15	20	18	24	121.6 × 164	1.6
B25667L4347A375	MKK440-D-20.8-01	3 x 114.1	440	20.8	27	25	33	142 × 200	2.2
B25667L4417A375	MKK440-D-25-01	3 x 137.1	440	25	33	30	39	142 × 200	2.4
B25667L4696A375	MKK480-D-5-01	3 x 23	480	5	6	6	7	121.6 × 164	1.1
B25667L4866A375	MKK480-D-6.3-01	3 x 28.8	480	6.3	8	7.5	9	121.6 × 164	1.2
B25667L4107A375	MKK480-D-7.5-01	3 x 34.6	480	7.5	9	9	11	121.6 × 164	1.2
B25667L4117A365	MKK480-D-8.3-01	3 x 38.5	480	8.3	10	10	12	121.6 × 164	1.2
B25667L4147A375	MKK480-D-10.4-01	3 x 47.9	480	10.4	13	12.5	15	121.6 × 164	1.3
B25667L4177A365	MKK480-D-12.5-01	3 x 57.6	480	12.5	15	15	18	121.6 × 164	1.5
B25667L4207A365	MKK480-D-15-01	3 x 69.1	480	15	18	18	22	121.6 × 200	1.7
B25667L4237A355	MKK480-D-16.7-01	3 x 77	480	16.7	20	20	24	121.6 × 200	1.8
B25667L4287A375	MKK480-D-20.8-01	3 x 95.8	480	20.8	25	25	30	142 × 200	2.3
B25667L4347A365	MKK480-D-25-01	3 x 115.2	480	25	30	30	36	142 × 200	2.5
B25667L4387A365	MKK480-D-28-01	3 x 129	480	28	34	---	---	142 × 200	2.5
B25667L4427A375	MKK480-D-31-01	3 x 143	480	31	37	---	---	142 × 200	2.5
B25667L5726A375	MKK525-D-6.3-01	3 x 24.1	525	6.3	7	7.5	8	121.6 × 164	1.1
B25667L5966A375	MKK525-D-8.3-01	3 x 32.1	525	8.3	9	10	11	121.6 × 164	1.2
B25667L5127A375	MKK525-D-10.4-01	3 x 40.1	525	10.4	12	12.5	14	121.6 × 164	1.4
B25667L5147A375	MKK525-D-12.5-01	3 x 48.1	525	12.5	14	15	17	121.6 × 164	1.5
B25667L5177A375	MKK525-D-15-01	3 x 57.8	525	15	17	18	20	121.6 × 200	1.7
B25667L5197A375	MKK525-D-16.7-01	3 x 64.3	525	16.7	18	20	22	121.6 × 200	1.8
B25667L5247A375	MKK525-D-20.8-01	3 x 80.1	525	20.8	23	25	28	142 × 200	2.2
B25667L5287A375	MKK525-D-25-01	3 x 96.3	525	25	28	---	---	142 × 200	2.5
B25667L5347A375	MKK525-D-30-01	3 x 115.5	525	30	33	---	---	142 × 200	2.5

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### Cautions and warnings

- In case of dents of more than 1 mm depth or any other mechanical damage, capacitors must not be used at all.
- To ensure the full functionality of the overpressure disconnecter, elastic elements must not be hindered and a minimum space of 12 mm has to be kept above each capacitor.
- Do not handle the capacitor before it is discharged.
- Resonance cases must be avoided by appropriate application design in any case.
- Handle capacitors carefully, because they may still be charged even after disconnection due to faulty discharging devices.
- Protect the capacitor properly against over current and short circuit.
- Failure to follow cautions may result, worst case, in premature failures, bursting and fire.

### Discharging

Capacitors must be discharged to a maximum of 10% of rated voltage before they are switched in again. This prevents an electric impulse discharge in the application, influences the capacitor's service life and protects against electric shock. The capacitor must be discharged to 50 V or less within 60 sec. There must be not any switch, fuse or any other disconnecting device in the circuit between the power capacitor and the discharging device. PhaseCap-capacitors have a pre-mounted ceramic discharge module; alternatively discharge reactors are available from TDK. Discharge and short circuit capacitor before handling!

### Service life expectancy

Electrical components do not have an unlimited service life expectancy; this applies to self-healing capacitors too. The maximum service life expectancy may vary depending on the application the capacitor is used in.

### Safety

Electrical or mechanical misapplication of capacitors may be hazardous. Personal injury or property damage may result from bursting of the capacitor or from expulsion of oil or melted material due to mechanical disruption of the capacitor.

- Ensure good, effective grounding for capacitor enclosures.
- Provide means of disconnecting and insulating a faulty component/bank.
- The terminals of capacitors, connected bus bars and cables as well as other devices may also be energized.
- Follow good engineering practice.

### Thermal load/over-temperature

After installation of the capacitor it is necessary to verify that maximum hot-spot temperature is not exceeded at extreme service conditions.

### Overpressure disconnecter

To ensure full functionality of an overpressure disconnecter, the following must be observed:

1. The elastic elements must not be hindered, i.e.
  - Connecting lines must be flexible leads (cables).
  - There must be sufficient space (min. 12 mm) for expansion above the connections. This will enable a longitudinal extension of the can to secure the overpressure disconnecter work.
  - Folding beads must not be retained by clamps.
2. The maximum allowed fault current of 10000 A in accordance with UL 810 standard must be assured by the application.
3. Stress parameters of the capacitor must be within the IEC60831 specification.

### Overcurrent and short circuit protection

- Use HRC fuses or MCCBs for short circuit protection. Short circuit protection and connecting cables should be selected so that 1.5 times the rated capacitor current can be permanently handled.
- HRC fuses do not protect a capacitor against overload – they are only for short circuit protection.
- The HRC fuse rating should be 1.6 to 1.8 times rated capacitor current.
- Do not use HRC fuses to switch capacitors (risk of arcing).
- Use thermal magnetic over current relays for overload protection.

### Resonance cases

Resonance cases must be avoided by appropriate application design in any case. Maximum total RMS capacitor current (incl. fundamental harmonic current) specified in technical data must not be exceeded.

### Re-switching vs. phase-opposition

In case of voltage interruption, a sufficient discharge time has to be ensured to avoid phase-opposition and resulting high inrush currents.

### Vibration resistance

The resistance to vibration of capacitors corresponds to IEC 68, part 2–6.

Max. test conditions:

Test duration	6 h*
Frequency range 1	10 ... 55 Hz*
Displacement amplitude	0.75 mm*

\*corresponding to max. 98.1 m/s or 10 g



These figures apply to the capacitor alone. Because the fixing and the terminals may influence the vibration properties, it is necessary to check stability when a capacitor is built in and exposed to vibration. Irrespective of this, you are advised not to locate capacitors where vibration amplitude reaches the maximum in strongly vibrating equipment.

#### Mechanical protection

The capacitor has to be installed in a way that mechanical damages and dents in the aluminum can be avoided.

#### Grounding

The threaded bottom stud of the capacitor has to be used for grounding. In case grounding is done via metal chassis that the capacitor is mounted to, the layer of varnish beneath the washer and nut should be removed. The maximum tightening torque is 10 Nm.

#### Maintenance

- Check tightness of the connections/terminals periodically.
- Take current reading twice a year and compare with nominal current. Use a harmonic analyser or true effective RMS-meter.
- In case of current above the nominal current check your application for modifications.
- If a significant increase in the amount of non-linear loads has been detected, then a consultant has to be called in for a harmonic study.
- In case of the presence of harmonics installation of a de-tuned capacitor bank (reactors) must be considered.
- Check the discharge resistors/reactors and in case of doubt, check their function:
  - (1) Power the capacitor up and down.
  - (2) After  $\leq 90$  seconds the voltage between the terminals must decline to less than 75 V.
- Check the temperature of capacitors directly after operation for a longer period, but make sure that the capacitors have been switched off. In case of excessive temperature of individual capacitors, it is recommended to replace these capacitors, as this should be an indication for loss factor increase, which is a sign for reaching end of life.

#### Storage and operating conditions

Do not use or store capacitors in corrosive atmosphere, especially where chloride gas, sulfide gas, acid, alkali, salt or the like are present. In dusty environments regular maintenance and cleaning especially of the terminals is required to avoid conductive path between phases and/or phases and ground.

#### Note

For detailed information about PFC capacitors and cautions, refer to the latest version of TDK PFC Product Profile.

## Important notes

The following applies to all products named in this publication:

1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application**. As a rule we are either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether a product with the properties described in the product specification is suitable for use in a particular customer application.
2. We also point out that **in individual cases, a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified**. In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g. in accident prevention or life-saving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.
3. **The warnings, cautions and product-specific notes must be observed.**
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5. We constantly strive to improve our products. Consequently, **the products described in this publication may change from time to time**. The same is true of the corresponding product specifications. Please check therefore to what extent product descriptions and specifications contained in this publication are still applicable before or when you place an order.

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7. **Our manufacturing sites serving the automotive business apply the IATF 16949 standard**. The IATF certifications confirm our compliance with requirements regarding the quality management system in the automotive industry. Referring to customer requirements and customer specific requirements ("CSR") TDK always has and will continue to have the policy of respecting individual agreements. Even if IATF 16949 may appear to support the acceptance of unilateral requirements, we hereby like to emphasize that **only requirements mutually agreed upon can and will be implemented in our Quality Management System**. For clarification purposes we like to point out that obligations from IATF 16949 shall only become legally binding if individually agreed upon.

## Important notes

8. The trade names EPCOS, CeraCharge, CeraDiode, CeraLink, CeraPad, CeraPlas, CSMP, CTVS, DeltaCap, DigiSiMic, ExoCore, FilterCap, FormFit, LeaXield, MiniBlue, MiniCell, MKD, MKK, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, PowerHap, PQSine, PQvar, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, ThermoFuse, WindCap are **trademarks registered or pending** in Europe and in other countries. Further information will be found on the Internet at [www.tdk-electronics.tdk.com/trademarks](http://www.tdk-electronics.tdk.com/trademarks).

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