



Film Capacitors – Power Factor Correction

PhaseCap Super Heavy Duty (SHD) capacitors

Series/Type:	MKK
Ordering code:	B25673L*
Date:	2019-05-03
Version:	9.0

Construction

- Dielectric: Polypropylene film
- Non-PCB, semi-dry biodegradable resin
- Concentric winding / Stack construction #
- Wave cut
- Extruded round aluminum can with stud
- Provided with ceramic discharge module
- Overpressure disconnecter

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 _N -D-V _N -01	
Rated capacitance C _N	As per table	
Tolerance	-5 / +10%	
Connection	D (Delta)	
Rated voltage U _N	As per table	
Rated frequency f _N	50 Hz	60 Hz
Output Q _N	As per table	As per table
Rated current I _N	As per table	As per table
tan δ (dielectric)	~0.2 W / kvar	
*tan δ (50 Hz)	≤ 0.45 W / kvar	

* Without discharge resistor

Maximum ratings	
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	$400 \cdot I_N$ (A)
$V_{TC \text{ imp}}$	8000 Vpk (Standard 1.2/50 μ s impulse)

Test data	
V_{TT}	$2.15 \cdot V$ AC rms / 50 Hz for 10 s
V_{TC}	3000 V AC rms / 50 Hz for 10 s

Design data	
Dimensions (d x h)	As per table
Weight approx	As per table
Impregnation	Non PCB, Semi-dry biodegradable resin
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.

Climatic category	–40/60
Θ_{\min}	–40 °C
Θ_{\max}	60 °C
Storage temperature	–40 °C.....+85 °C
$\Theta_{\text{hotspot max.}}$	85 °C
Humidity	Av. rel. < 95%
Degree of protection	IP 20
Maximum altitude	4000 m

Mean life expectancy	
t_{LD}	Up to 200 000 hours (temperature class –40/C) ; $\Theta_{HS} \leq 70$ °C Up to 150 000 hours (temperature class –40/60) ; $\Theta_{HS} \leq 70$ °C
Max. 10000 switching's per year	

Terminals

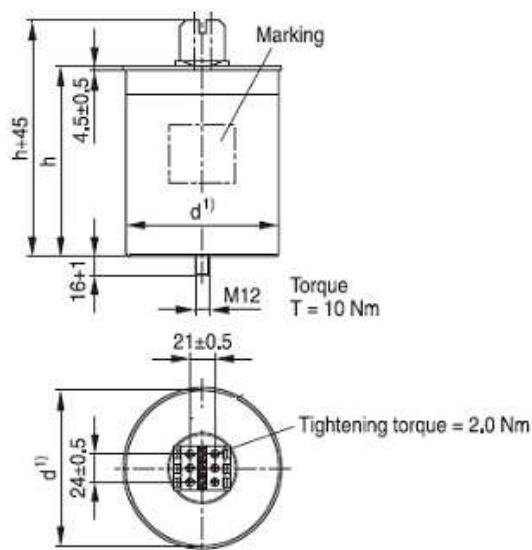
Protection degree	Isolated terminals, IP20
Max. torque	2.0 Nm
Terminal cross section	25 mm ²
Maximum terminal current	80 A
Creepage distance (min)	12.7 mm
Clearance (min)	9.6 mm

Safety

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

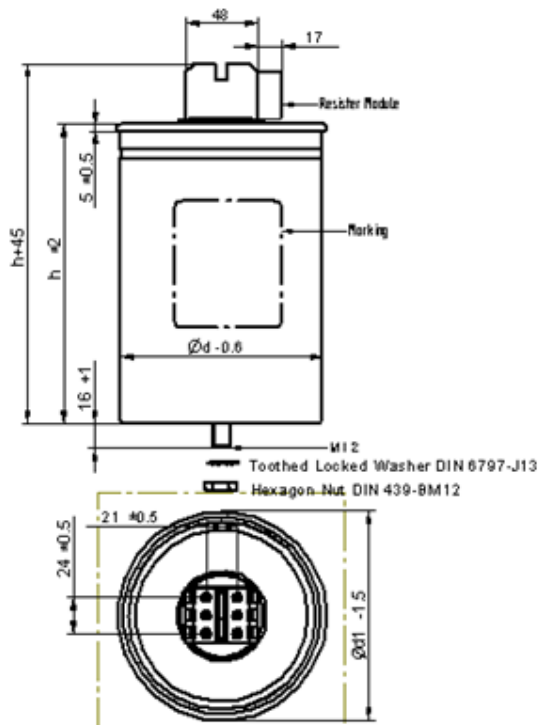
Reference standards

IS 13340 (2012) / IEC 60831 (2002), IEC60831–1/2.

Dimensional drawing:
For Voltage ratings Upto 525V

 Creepage distance 12.7 mm min.
 Clearance 9.6 mm min.

1) Seaming adds 5.5 mm in diameter

KLK1841-1-E

For Voltage ratings of 800V

Label:

 EPCOS Power Quality Solutions		PhaseCap[®] Super Heavy Duty	
MKK440-D-25-02 B25673L4252A040			
$C_N = 3 \times 137.1 \mu\text{F}$	$+10/-5 \%$	Δ	SH
U_N	$Q_N/50\text{Hz}$	$Q_N/60\text{Hz}$	
440V	25.0 kvar	30.0 kvar	
415V	22.2 kvar	26.7 kvar	
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$U_i = 3/8 \text{ kV}$	-40/60		
Overpressure disconnectors			
IEC 60831-1:2014			
Non PCB			
Ref. Standard			
		 IS:13340 (Part1)/ IEC 60831-1	
		 CM/L-1432640	
IS13340 (Part-1):2012 / IEC 60831-1:2002			
Made by EPCOS		10.18 N	
WARNING: WAIT 5 MINUTES AFTER ISOLATING SUPPLY BEFORE HANDLING			

Ordering codes:

Ordering code	Series/Type:	Rated capacitance C_N μF	Rated voltage V_N V	Output & Rated current at 50Hz		Output & Rated current at 60Hz		Dimensions (d x h) mm	Weight approx kg
				Kvar	In A	Kvar	In A		
B25673L4052A010	MKK415-D-5-02	3X30.8	415	5	7	6	8.3	85 x 125	0.7
B25673L4062A010	MKK415-D-6.2-02	3X38.2	415	6.2	8.6	7.44	10.3	85 x 162	1
B25673L4072A510	MKK415-D-7.5-02	3X46.2	415	7.5	10.4	8.99	12.5	85 x 162	1
B25673L4102A010	MKK415-D-10.4-02	3X64.1	415	10.4	14.5	12.48	17.4	100 x 162	1.4
B25673L4122A510	MKK415-D-12.5-02	3X77	415	12.5	17.4	14.99	20.9	100 x 200	1.7
B25673L4152A010	MKK415-D-15-02	3X92.5	415	15	20.9	18.01	25.1	100 x 200	1.7
B25673L4202A810	MKK415-D-20.8-02	3X128.2	415	20.8	28.9	24.96	34.7	116 x 200	2.2
B25673L4252A011	MKK415-D-25-02	3X154.1	415	25	34.8	30	41.7	136 x 200	3.2
B25673L4052A040	MKK440-D-5-02	3X27.4	440	5	6.6	6	7.9	85 x 125	0.8
B25673L4072A540	MKK440-D-7.5-02	3X41.1	440	7.5	9.8	8.99	11.8	85 x 162	1
B25673L4102A040	MKK440-D-10.4-02	3X57	440	10.4	13.6	12.47	16.4	100 x 162	1.4
B25673L4122A540	MKK440-D-12.5-02	3X68.5	440	12.5	16.4	14.99	19.7	100 x 162	1.4
B25673L4152A040	MKK440-D-15-02	3X82.2	440	15	19.7	17.99	23.6	100 x 200	1.7
B25673L4202A040	MKK440-D-20-02	3X109.7	440	20	26.3	24.01	31.5	116 x 200	2.2
B25673L4252A040	MKK440-D-25-02	3X137.1	440	25	32.8	30	39.4	116 x 200	2.2
B25673L4302A041	MKK440-D-30-02	3X164	440	30	39.2	35.89	47.1	136 x 200	3.2
B25673L4332A041	MKK440-D-33-02	3X181	440	33	43.3	39.61	52	136 x 200	3.2
B25673L4052A580	MKK480-D-5.5-02	3X25.3	480	5.5	6.6	6.59	7.9	85 x 125	0.7
B25673L4062A380	MKK480-D-6.3-02	3X29	480	6.3	7.6	7.55	9.1	85 x 162	1
B25673L4082A380	MKK480-D-8.3-02	3X38.2	480	8.3	10	9.95	12	85 x 162	1
B25673L4112A080	MKK480-D-11-02	3X50.7	480	11	13.2	13.2	15.9	100 x 162	1.7
B25673L4132A880	MKK480-D-13.8-02	3X63.6	480	13.8	16.6	16.56	19.9	100 x 200	1.7
B25673L4162A780	MKK480-D-16.7-02	3X76.9	480	16.7	20.1	20.03	24.1	100 x 200	1.7
B25673L4222A080	MKK480-D-22-02	3X101.4	480	22	26.5	26.41	31.8	116 x 200	2.2
B25673L4252A081	MKK480-D-25-02	3X115.2	480	25	30	30	36	136 x 200	3.2
B25673L4282A081	MKK480-D-28-02	3X128	480	28	33.4	33.34	40.1	136 x 200	3.2
B25673L5062A620	MKK525-D-6.6-02	3X25.4	525	6.6	7.3	7.91	8.7	85 x 162	1
B25673L5082A320	MKK525-D-8.3-02	3X32	525	8.3	9	10	11	100 x 162	1.7
B25673L5102A020	MKK525-D-10-02	3X38.5	525	10	11	12	13.2	100 x 162	1.7
B25673L5122A520	MKK525-D-12.5-02	3x48.1	525	12.5	13.7	15	16.5	100 x 200	1.7
B25673L5132A220	MKK525-D-13.2-02	3X50.8	525	13.2	14.5	15.83	17.4	100 x 200	1.7
B25673L5152A020	MKK525-D-15-02	3x57.8	525	15	16.5	18	19.8	100 x 200	1.7
B25673L5162A720	MKK525-D-16.7-02	3X64.3	525	16.7	18.4	20.03	22	116 x 200	2.2
B25673L5202A020	MKK525-D-20-02	3X77	525	20	22	23.99	26.4	116 x 200	2.2
B25673L5252A020	MKK525-D-25-02	3x96.3	525	25	27.5	30	33	136 x 200	3.2
B25673L5262A521	MKK525-D-26.5-02	3X102.1	525	26.5	29.2	31.81	35	136 x 200	3.2
B25673L5302A020	MKK525-D-30-02	3x115.5	525	30	33	--	--	136 x 200	3.2
B25673S5332L120 #	MKK525-D-33.1-02A	3x127.5	525	33.1	34.6	--	--	136 x 224	3.6
B25673S5372L120 #	MKK525-D-37.1-02A	3x142.9	525	37.1	40.8	--	--	136 x 224	3.6

Ordering code	Series/Type:	Rated capacitance C_N μF	Rated voltage V_N V	Output & Rated current at 50Hz		Output & Rated current at 60Hz		Dimensions (d x h) mm	Weight approx kg
				Kvar	In A	Kvar	In A		
B25673L8122A500	MKK800-D-12.5-02	3x20.7	800	12.5	9.0	15.0	10.8	116x164	2.1
B25673L8202A000	MKK800-D-20-02	3x33.2	800	20.0	14.4	24.0	17.3	136x200	3.2
B25673L8252A000	MKK800-D-25-02	3x41.4	800	25.0	18.0	30.0	21.7	136x200	3.2

Display of ordering codes for TDK Electronics products

The ordering code for one and the same product can be represented differently in data sheets, data books, other publications, on the company website, or in order-related documents such as shipping notes, order confirmations and product labels. **The varying representations of the ordering codes are due to different processes employed and do not affect the specifications of the respective products.** Detailed information can be found on the Internet under www.tdk-electronics.tdk.com/orderingcodes.

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 75 V or less within 3 minutes. There must be not any switch, fuse or any other disconnecting device in the circuit between the power capacitor and the discharging device. PhaseCap Compact-capacitors have a pre-mounted 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 ≤ 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.**
4. In order to satisfy certain technical requirements, **some of the products described in this publication may contain substances subject to restrictions in certain jurisdictions (e.g. because they are classed as hazardous)**. Useful information on this will be found in our Material Data Sheets on the Internet (www.tdk-electronics.tdk.com/material). Should you have any more detailed questions, please contact our sales offices.
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.

We also **reserve the right to discontinue production and delivery of products**. Consequently, we cannot guarantee that all products named in this publication will always be available. The aforementioned does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.

6. Unless otherwise agreed in individual contracts, **all orders are subject to our General Terms and Conditions of Supply**.
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.

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