Film Capacitors – Power Factor Correction

PhaseCap Super Heavy Duty Resin filled Capacitors

Series/Type: **MKK**
Ordering code: **B25675L***

Date: January 2017
Version: 4.0

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Construction

- Dielectric: Polypropylene film
- Non PCB, Soft biodegradable resin
- Wave cut
- Extruded round aluminium can with stud
- Provided with ceramic discharge module or discharge module block
- Over pressure disconnector for **all 3** phases in metal top – 5 to 33.1 kvar and 2 phases in plastic top – 1 to 4 kvar

1 to 4kvar

5 to 33.1kvar

Features

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

Typical applications

- For Power Factor Correction

Terminals

- Sigut terminals for metal top – 5 to 33.1 kvar
- Fast on terminals for plastic top – 1 to 4 kvar

Mounting

- Threaded stud at bottom of can (max. torque for M8 = 4 Nm & M12 = 10 Nm)

Technical data and specifications

Characteristics	B25675L*	
Rated capacitance C_N	See table in page 9 to 11	
Tolerance	–5 / +5%	
Connection	D (Delta)	
Rated voltage V_N	Up to 690Vrms (Details as per table in page 9 to 11)	
Rated frequency f_N	50 Hz	60 Hz
Output	Up to 33.1kVAr (Details as per table in page 9 to 11)	
Rated current I_R	As per table in page 9 to 11	
Dimensions (d x h)	As per table in page 9 to 11	
Weight (approx.)	As per table in page 9 to 11	

Maximum ratings	
Maximum permissible voltage (V_{max})	VR +10% (up to 8 h daily) VR +15% (up to 30 min. daily) VR +20% (up to 5 min. daily) VR +30% (up to 1 min. daily)
Maximum permissible current (I_{max})	Up to 1.6 …2.0 • I_R (A) (including combined effects of harmonics, overvoltages and capacitance tolerance) depending on the individual type
Maximum Inrush current (I_S)	≤ 500 I_R (A) depending on the individual type Max. 15000 switching's per year

Test data	
Voltage Test between terminals (V_{TT})	2.15 * V_N VAC / 50 Hz, 2s
Voltage Test between terminals and container (V_{TC})	3600 VAC / 50 Hz, 2 s upto V_N = 525 VAC 6000 VAC / 50 Hz, 2 s above V_N = 525 VAC

Design data	
Dielectric losses	0.2 W / kVAr
* Total Losses	0.45 W / kVAr
Impregnation	Non PCB, Soft biodegradable resin

* Without discharge resistor

Climatic category	
Θ Minimum	- 40°C
Θ Maximum	+ 60°C
Ambient Temperature	Class -40/60: Max. short time: + 60°C, max. mean 24h: +45°C; max mean 1 year: +35°C; lowest temperature: - 40°C
Storage Temperature	- 40°C …. + 85°C
$\Theta_{Hotspot}$ Max.	+ 85°C
Humidity	Average relative < 95%

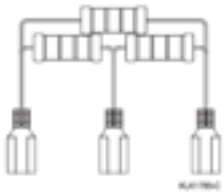
Mean life expectancy	
t_{LD}	Upto 200 000 hours (temperature class –40/D) ; Upto 180 000 hours (temperature class –40/60) ; $\Theta_{HS} \leq 70°C$ (Max. mean ambient temperature per year = +35°C) Failure rate < 3%

Terminals			
Protection degree	IP00 for plastic top – 1 to 4 kvar, indoor mounting IP20 for metal top – 5 to 33.1 kvar, indoor mounting, VDE 0106 part 100		
Terminal Type	Terminal Type A & C	Terminal Type B & D	Terminal Type E
Max. torque	1.2 Nm	2.0 Nm	-
Terminal cross section	16 mm^2 (without cable and lug)	25 mm^2 (without cable and lug)	-
Maximum terminal current	50 A	80 A	-
Creepage distance (min)	12.7 mm		10.5 mm (For d = 53) 10.0 mm (For d = 63.5)
Clearance (min)	9.6 mm		13.0 mm (For d = 53) 16.5 mm (For d = 63.5)

Mounting	
Fixing	Threaded bolt M12 except M8 for d = 53mm
Max. torque (Al can stud)	10 Nm except 4 Nm for d = 53mm
Mounting position	Upright/Horizontal See “Maintenance and Installation Manual” for further details.
Maximum altitude	4 000 m

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

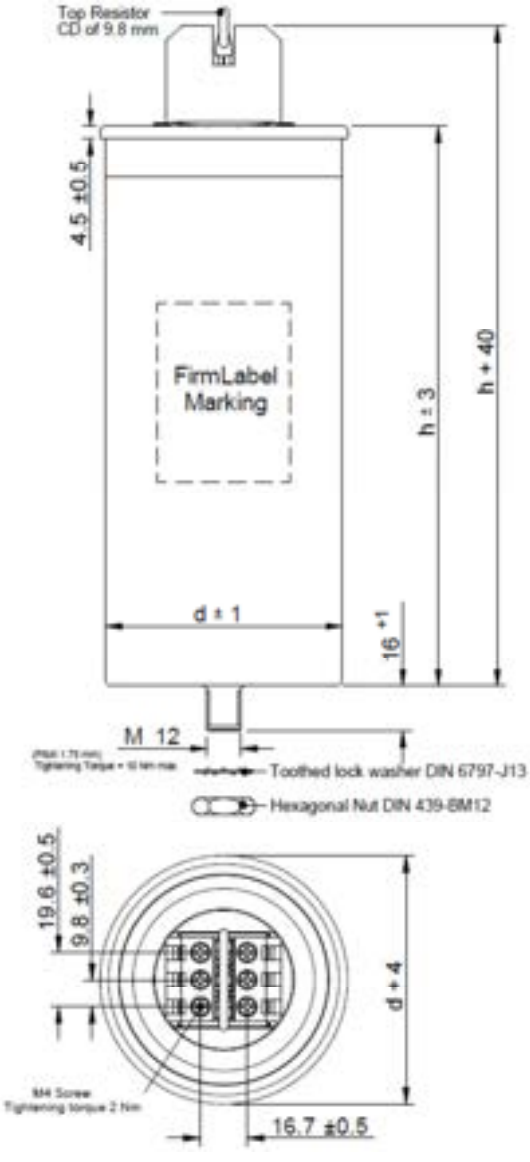
Three phase resistor, included in the extend of delivery for 1 to 4 kvar only.



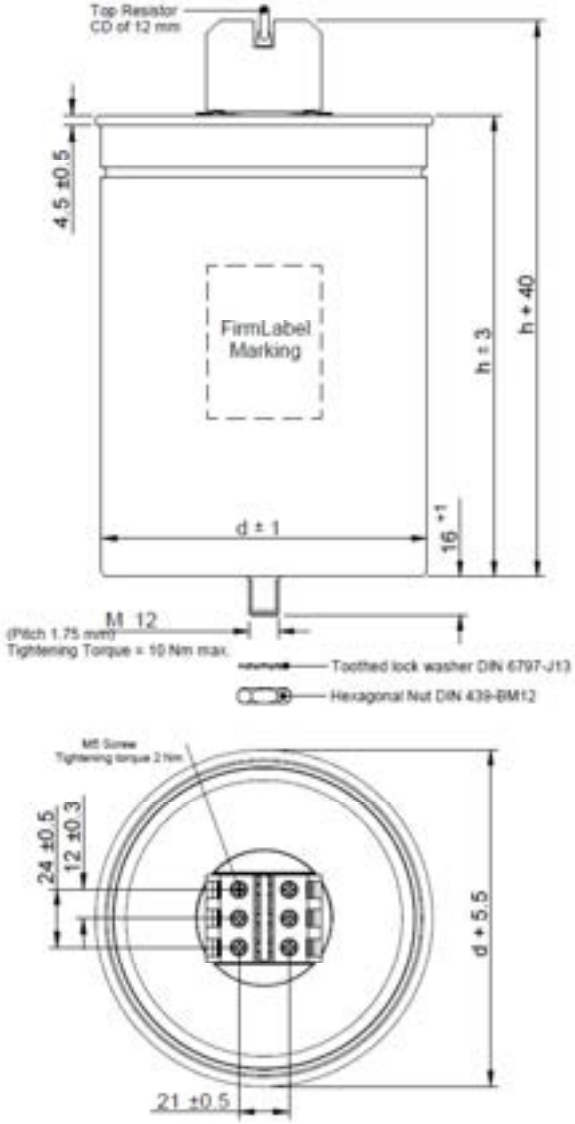
Approvals/Reference standards		
Approval Mark	**Standard of reference**	**Certificate**
CE	IEC 60831–1/2 Edition 3.0 (2014)	-
IS: 13340 ISI CM/L: AAAAAAAA	IS 13340–1/2 (1993, 2012)	-

Dimensional drawing

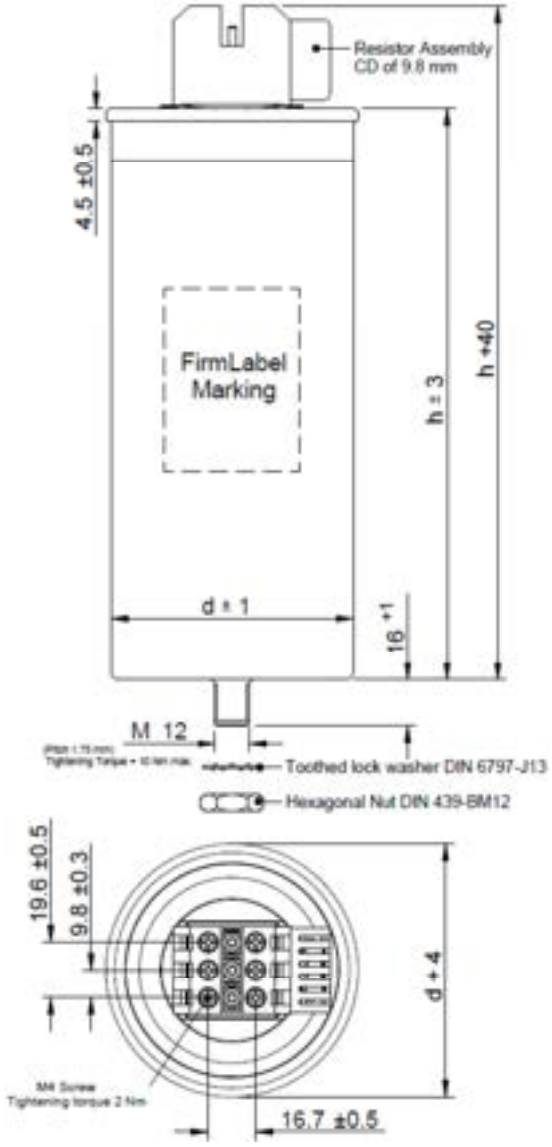
Terminal Type A



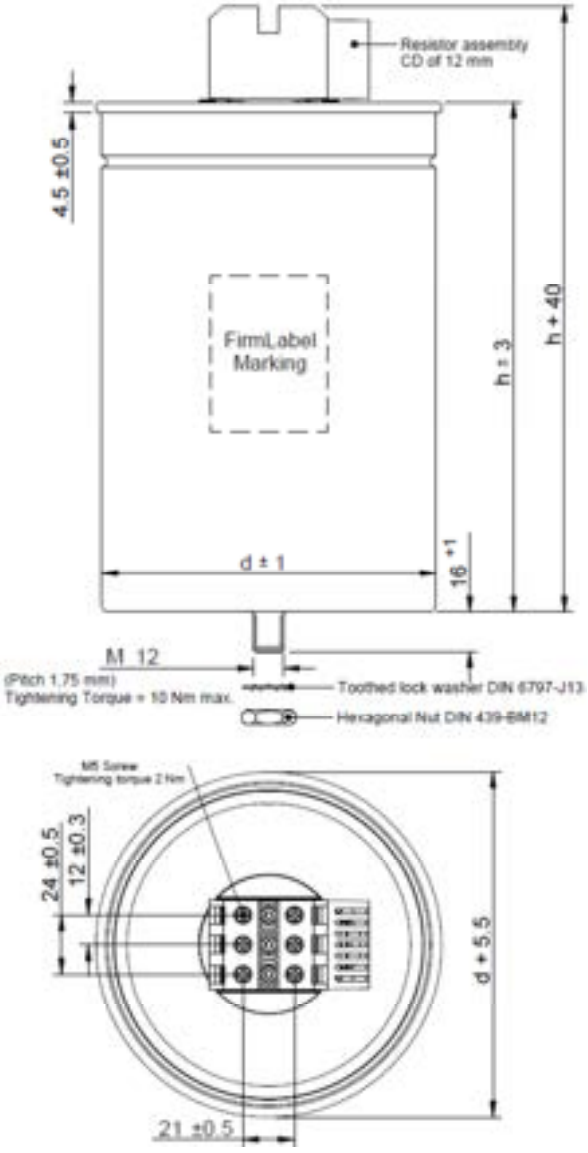
Terminal Type B



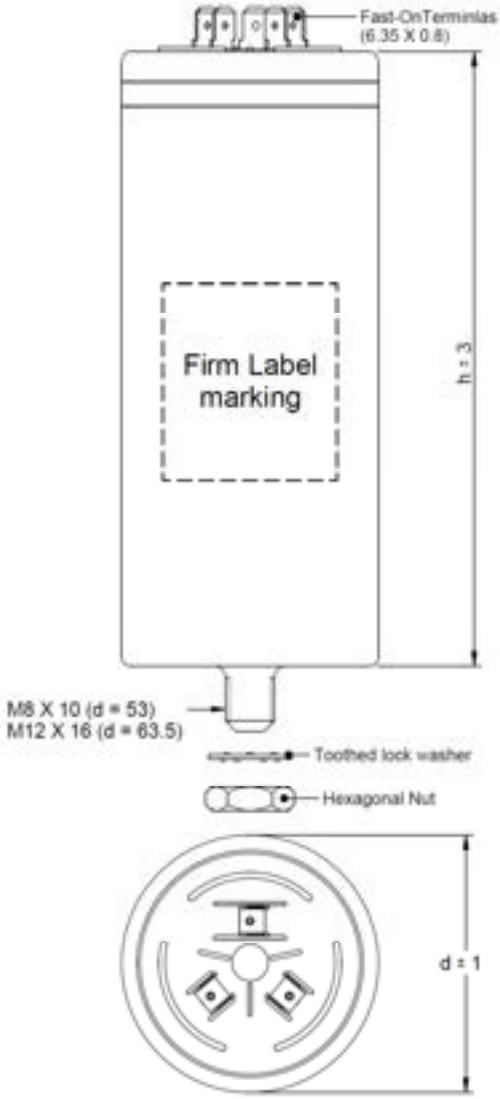
Terminal Type C



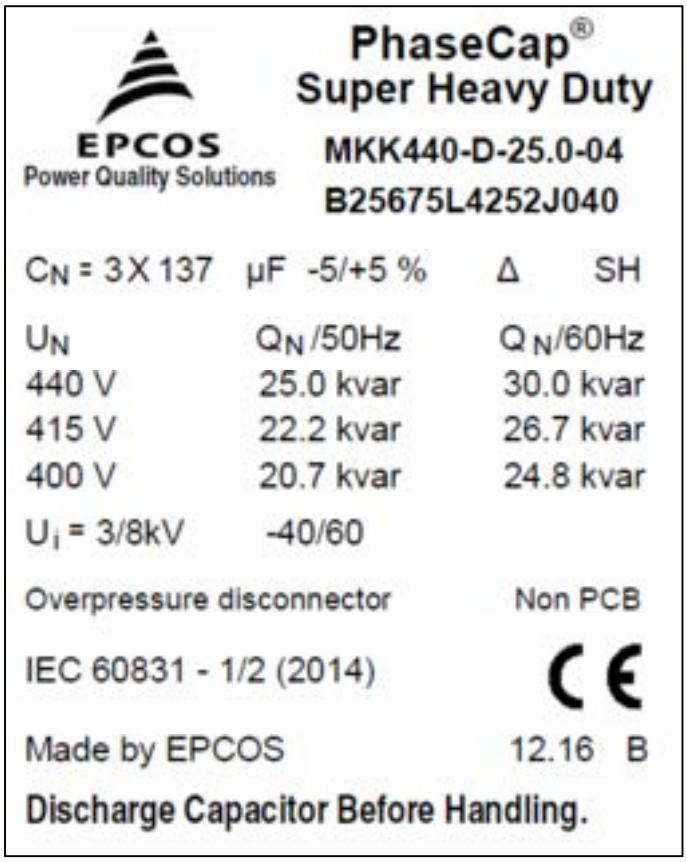
Terminal Type D



Terminal Type E



Label design:



Ordering codes:

Ordering code	Series/Type:	Rated capacitance C_N	Rated voltage V_N	Output & Rated current at 50Hz		Output & Rated current at 60Hz		Dimensions (d × h)	Weight approx	Terminal Type
		µF	V	kvar	In A	kvar	In A	mm	kg	
Rated Voltage 415VAC, delta connection										
B25675L4052J015	MKK415-D-5.0-04	3 x 30.8	415	5.0	7.0	6.0	8.3	**75x164**	0.9	A
B25675L4062J315	MKK415-D-6.3-04	3 x 38.8	415	6.3	8.8	7.6	10.6	**75x164**	0.9	A
B25675L4072J515	MKK415-D-7.5-04	3 x 46.2	415	7.5	10.4	9.0	12.5	**75x200**	1.1	A
B25675L4102J415	MKK415-D-10.4-04	3 x 64.1	415	10.4	14.5	12.5	17.4	**75x200**	1.1	A
B25675L4122J515	MKK415-D-12.5-04	3 x 77.0	415	12.5	17.4	15.0	20.9	**85x200**	1.3	A
B25675L4152J015	MKK415-D-15.0-04	3 x 92.4	415	15.0	20.9	18.0	25.0	**85x200**	1.3	A
B25675L4202J015	MKK415-D-20.0-04	3 x 123.2	415	20.0	27.8	24.0	33.4	**100x207**	1.9	B
B25675L4252J015	MKK415-D-25.0-04	3 x 154.0	415	25.0	34.8	30.0	41.7	**116x192**	2.4	B
B25675L4282J115	MKK415-D-28.1-04	3 x 173.1	415	28.1	39.1	-	-	**116x207**	2.6	B
B25675L4302J015	MKK415-D-30.0-04	3 x 184.8	415	30.0	41.7	-	-	**116x207**	2.6	B
B25675L4332J015	MKK415-D-33.0-04	3 x 203.3	415	33.0	45.9	-	-	**116x224**	2.8	B
Rated Voltage 440VAC, delta connection										
B25675L4012J040	MKK440-D-1.0-04	3 x 5.5	440	1.0	1.3	1.2	1.6	**53x117**	0.3	E
B25675L4022J040	MKK440-D-2.0-04	3 x 11.0	440	2.0	2.6	2.4	3.1	**53x129**	0.4	E
B25675L4032J040	MKK440-D-3.0-04	3 x 16.4	440	3.0	3.9	3.6	4.7	**53x129**	0.4	E
B25675L4042J040	MKK440-D-4.0-04	3 x 21.9	440	4.0	5.2	4.8	6.3	**63.5x152**	0.5	E
B25675L4052J040	MKK440-D-5.0-04	3 x 27.4	440	5.0	6.6	6.0	7.9	**75x164**	0.9	A
B25675L4072J540	MKK440-D-7.5-04	3 x 41.1	440	7.5	9.8	9.0	11.8	**75x200**	1.1	A
B25675L4102J040	MKK440-D-10.0-04	3 x 54.8	440	10.0	13.1	12.0	15.7	**75x200**	1.1	A
B25675L4102J440	MKK440-D-10.4-04	3 x 57	440	10.4	13.6	12.5	16.4	**85x200**	1.3	A
B25675L4122J540	MKK440-D-12.5-04	3 x 68.5	440	12.5	16.4	15.0	19.7	**85x200**	1.3	A
B25675L4152J040	MKK440-D-15.0-04	3 x 82.2	440	15.0	19.7	18.0	23.6	**85x218**	1.5	A
B25675L4202J040	MKK440-D-20.0-04	3 x 109.6	440	20.0	26.2	24.0	31.5	**100x207**	1.9	B
B25675L4252J040	MKK440-D-25.0-04	3 x 137.0	440	25.0	32.8	30.0	39.4	**116x192**	2.4	B
B25675L4282J140	MKK440-D-28.1-04	3 x 154.0	440	28.1	36.9	-	-	**116x207**	2.6	B
B25675L4302J040	MKK440-D-30.0-04	3 x 164.4	440	30.0	39.4	-	-	**125x192**	2.8	B
B25675L4332J140	MKK440-D-33.1-04	3 x 181.4	440	33.1	43.4	-	-	**116x224**	2.8	B

Ordering code	Series/Type:	Rated capacitance C_N	Rated voltage V_N	Output & Rated current at 50Hz		Output & Rated current at 60Hz		Dimensions (d × h)	Weight approx	Terminal Type
		µF	V	kvar	In A	kvar	In A	mm	kg	
Rated Voltage 480VAC, delta connection										
B25675L4052J080	MKK480-D-5.0-04	3 x 23.0	480	5.0	6.0	6.0	7.2	**75x164**	0.9	A
B25675L4062J380	MKK480-D-6.3-04	3 x 29.0	480	6.3	7.6	7.6	9.1	**75x164**	0.9	A
B25675L4082J380	MKK480-D-8.3-04	3 x 38.2	480	8.3	10.0	10.0	12.0	**75x200**	1.1	A
B25675L4102J480	MKK480-D-10.4-04	3 x 47.9	480	10.4	12.5	12.5	15.0	**75x200**	1.1	A
B25675L4112J080	MKK480-D-11.0-04	3 x 50.7	480	11.0	13.2	13.2	15.9	**85x200**	1.3	A
B25675L4122J580	MKK480-D-12.5-04	3 x 57.6	480	12.5	15.0	15.0	18.0	**85x200**	1.3	A
B25675L4132J880	MKK480-D-13.8-04	3 x 63.5	480	13.8	16.6	16.6	20.0	**85x200**	1.3	A
B25675L4152J080	MKK480-D-15.0-04	3 x 69.1	480	15.0	18.0	18.0	21.7	**100x207**	1.9	B
B25675L4162J780	MKK480-D-16.7-04	3 x 76.9	480	16.7	20.1	20.0	24.1	**100x207**	1.9	B
B25675L4182J780	MKK480-D-18.7-04	3 x 86.1	480	18.7	22.5	22.4	26.9	**100x207**	1.9	B
B25675L4202J080	MKK480-D-20.0-04	3 x 92.1	480	20.0	24.1	24.0	28.9	**100x207**	1.9	B
B25675L4202J880	MKK480-D-20.8-04	3 x 95.8	480	20.8	25.0	25.0	30.1	**116x207**	2.6	B
B25675L4222J080	MKK480-D-22.0-04	3 x 101.3	480	22.0	26.5	26.4	31.8	**116x207**	2.6	B
B25675L4252J080	MKK480-D-25.0-04	3 x 115.1	480	25.0	30.1	30.0	36.1	**116x192**	2.4	B
B25675L4282J180	MKK480-D-28.1-04	3 x 129.4	480	28.1	33.8	-	-	**116x207**	2.6	B
B25675L4312J080	MKK480-D-31-04	3 x 142.7	480	31	37.3	-	-	**116x224**	2.8	B
B25675L4332J080	MKK480-D-33.0-04	3 x 152.0	480	33.0	39.7	-	-	**116x224**	2.8	B
Rated Voltage 525VAC, delta connection										
B25675L5052J025	MKK525-D-5.0-04	3 x 19.2	525	5.0	5.5	6.0	6.6	**75x164**	0.9	A
B25675L5062J325	MKK525-D-6.3-04	3 x 24.2	525	6.3	6.9	7.6	8.4	**75x164**	0.9	A
B25675L5082J325	MKK525-D-8.3-04	3 x 31.9	525	8.3	9.1	10.0	11.0	**75x200**	1.1	A
B25675L5102J425	MKK525-D-10.4-04	3 x 40.0	525	10.4	11.4	12.5	13.7	**85x185**	1.2	A
B25675L5122J525	MKK525-D-12.5-04	3 x 48.1	525	12.5	13.7	15.0	16.5	**85x200**	1.3	A
B25675L5132J225	MKK525-D-13.2-04	3 x 50.8	525	13.2	14.6	15.8	17.4	**85x200**	1.3	A
B25675L5152J025	MKK525-D-15.0-04	3 x 57.7	525	15.0	16.5	18.0	19.8	**85x218**	1.5	A
B25675L5162J725	MKK525-D-16.7-04	3 x 64.3	525	16.7	18.4	20.0	22.0	**100x207**	1.9	B
B25675L5202J025	MKK525-D-20.0-04	3 x 77.0	525	20.0	22.0	24.0	26.4	**100x224**	2.1	B
B25675L5252J025	MKK525-D-25.0-04	3 x 96.2	525	25.0	27.5	30.0	33.0	**116x207**	2.6	B
B25675L5262J525	MKK525-D-26.5-04	3 x 102.0	525	26.5	29.1	31.8	35.0	**116x207**	2.6	B
B25675L5332J125	MKK525-D-33.1-04	3 x 127.4	525	33.1	36.4	-	-	**136x192**	3.3	B

Ordering code	Series/Type:	Rated capacitance C_N	Rated voltage V_N	Output & Rated current at 50Hz		Output & Rated current at 60Hz		Dimensions (d × h)	Weight approx	Terminal Type
		µF	V	kvar	In A	kvar	In A	mm	kg	
Rated Voltage 550VAC, delta connection										
B25675L5222J850	MKK550-D-22.8-04	3 x 80.0	550	22.8	23.9	27.4	28.8	**136x192**	3.3	D
Rated Voltage 690VAC, delta connection										
B25675L6052J390	MKK690-D-5.3-04	3 x 11.8	690	5.3	4.4	6.4	5.4	**75x185**	1.0	C
B25675L6062J990	MKK690-D-6.9-04	3 x 15.4	690	6.9	5.8	8.3	6.9	**75x200**	1.1	C
B25675L6102J490	MKK690-D-10.4-04	3 x 23.2	690	10.4	8.7	12.5	10.5	**75x200**	1.1	C
B25675L6122J590	MKK690-D-12.5-04	3 x 27.9	690	12.5	10.5	15.0	12.6	**85x200**	1.3	C
B25675L6142J690	MKK690-D-14.6-04	3 x 32.5	690	14.6	12.2	17.5	14.6	**100x207**	1.9	D
B25675L6202J090	MKK690-D-20.0-04	3 x 44.6	690	20.0	16.7	24.0	20.1	**100x207**	1.9	D
B25675L6252J090	MKK690-D-25.0-04	3 x 55.7	690	25.0	20.9	30.0	25.1	**116x192**	2.4	D
B25675L6282J090	MKK690-D-28.0-04	3 x 62.4	690	28.0	23.4	-	-	**116x207**	2.6	D

Display of ordering codes for EPCOS products

The ordering code for one and the same EPCOS product can be represented differently in data sheets, data books, other publications, on the EPCOS 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.epcos.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.
- This applies also in cases of oil leakages.
- To ensure the full functionality of the overpressure disconnector, 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 1 minute. There must be not any switch, fuse or any other disconnecting device in the circuit between the power capacitor and the discharging device. PhaseCap Energy-capacitors have a pre-mounted ceramic discharge module; alternatively discharge reactors are available from EPCOS. 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 disconnector

To ensure full functionality of an overpressure disconnector, 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 disconnector 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 maximum total RMS 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 the maximum total RMS 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 are 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 for M12 stud.

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 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 EPCOS 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, EPCOS is 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 an EPCOS 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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