# Film Capacitors – Power Factor Correction

## DeltaCap Capacitors

| | |
|---|---|
| **Series/Type:** | **MKDxxx-I-xx** |
| **Ordering code:** | **B32300A*/ B32301A****A***/ B32301A****B*** |
| Date: | May 2016 |
| Version: | 6 |

## Construction and general data

- Dielectric: Polypropylene film
- Non-PCB, Semi-dry biodegradable resin
- Extruded round aluminum can with stud
- Degree of protection: IP00 (optionally IP54 with terminal cover; additional cable gland at cable entry required)


## Features

- Single-phase, provided with discharge resistors
- Double safety system:
  overpressure disconnector, self-healing technology
- Naturally air cooled (or forced air cooling)
- Indoor mounting

## Typical applications

- For Power Factor Correction

## Terminals

- Fast-on terminals B32300A* series
- Screw terminals B32301A* series

## Mounting

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

## Technical data and specifications

| Characteristics | |
|---|---|
| Rated capacitance $C_R$ | According to specification table |
| Tolerance | –5 / +10% |
| Rated voltage $V_R$ | According to specification table |
| Rated frequency $f_R$ | 50 and 60 Hz |
| Output | According to specification table |
| Rated current $I_R$ | According to specification table |

| Maximum ratings | |
|---|---|
| $V_{max}$ | $V_R$ + 10 % (up to 8 h daily) / $V_R$ + 15 % (up to 30 min daily) / $V_R$ + 20 % (up to 5 min daily) / $V_R$ + 30 % (up to 1 min daily) |
| $I_{max}$ | Up to 1.3 • $I_R$ (up to 1.5• $I_R$ including combined effects of harmonics, overvoltages and capacitance tolerance) |
| $I_S$ | Up to 200 • $I_R$ (A) |
| *Power dissipation | ≤ 0.2 W/kvar (dielectric) and ≤ 0.45 W / kvar (total) |

* Without discharge resistor

| Test data | |
|---|---|
| $V_{TT}$ | 2.15 • $V_R$ during 2 s |
| $V_{TC}$ | 3000 V AC / 50 Hz during 10 s |
| *tan δ (50 Hz) | ≤ 1.0 • $10^{-3}$ |

* Without discharge resistor

| Climatic category –40/D | |
|---|---|
| $T_{min}$ | -40 ºC |
| $T_{max}$ | +55 ºC |
| Storage temperature | -40 °C … +85 °C |
| $T_{max\ Hotspot}$ | +85 ºC |
| Humidity | Av. rel. < 95% |
| Degree of protection | IP00 (optionally IP54 with terminal cover; additional cable gland at cable entry required) |
| Maximum altitude | 4000 m |

| Mean life expectancy | |
|---|---|
| $t_{LD}$ | Up to 135000 hours at temperature class -40/C<br>Up to 100000 hours at temperature class -40/D |
| Max. 5000 switchings per year acc. to IEC 60831 | |

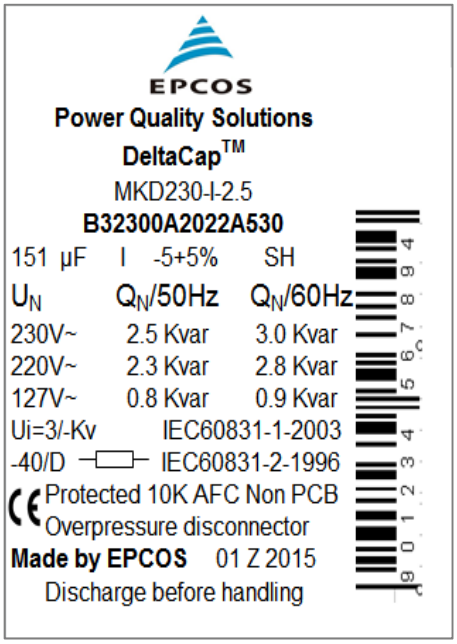
| Design data | |
|---|---|
| Dimensions (d × h) | According to specification table |
| Weight approx | According to specification table |
| Impregnation | Non PCB, resin filling: soft polyurethane resin |
| Fixing | Threaded bolt M12 |
| Max. torque (Al can stud) | 10 Nm |
| Mounting position | Only in the vertical position.<br>See “Maintenance and Installation Manual” for further details. |

| Terminals | |
|---|---|
| Protection degree | IP00 for B32300 (optional IP54 with plastic terminal cap, additional cable gland at cable entry required); IP20 for B32301 |
| Maximum terminal current | 15 A (fast-on terminals) / 50 A (screw terminals) |
| Creepage distance (min) | 12.7 mm |
| Clearance (min) | 9.6 mm |

| Safety | |
|---|---|
| Mechanical safety | Overpressure disconnector |
| Max. short circuit current | (AFC: 10 kA according UL 810 standard) |
| Discharge resistor time | ≤ 60 s to 75 V or less |

| Reference standards |
|---|
| IEC 60831–1/2, UL 810-5th edition |

## Label design



## Ordering codes

| Type | 50 Hz | | 60 Hz | | $C_R$ | d × h | Weight | Ordering code | Packing unit |
|---|---|---|---|---|---|---|---|---|---|
| | Output kvar | $I_R$ A | Output kvar | $I_R$ A | µF | mm | kg | | pcs |
| **Rated voltage 230 V AC, 50/60 Hz, single phase** | | | | | | | | | |
| MKD230-I-0.8 | 0.8 | 3.5 | 1.0 | 4.2 | 48 | 63.5 x 64.5 | 0.3 | B32300A2002A830 | 12 |
| MKD230-I-1.7 | 1.7 | 7.4 | 2.0 | 8.9 | 102 | 63.5 x 102 | 0.4 | B32300A2012A730 | 12 |
| MKD230-I-2.5 | 2.5 | 10.9 | 3.0 | 13.1 | 151 | 63.5 x 127 | 0.5 | B32300A2022A530 | 12 |
| **Rated voltage 250 V AC, 50/60 Hz, single phase** | | | | | | | | | |
| MKD250-I-0.8 | 0.8 | 3.2 | 1.0 | 3.8 | 41 | 50 x 77 | 0.2 | B32300A2002A850 | 50 |
| MKD250-I-1.7 | 1.7 | 6.8 | 2.0 | 8.2 | 87 | 63.5 x 92 | 0.4 | B32300A2012A750 | 12 |
| MKD250-I-2.0 | 2.0 | 7.8 | 2.4 | 9.4 | 100 | 63.5 x 92 | 0.4 | B32300A2022A050 | 12 |
| MKD250-I-2.5 | 2.5 | 10.0 | 3.0 | 12.0 | 127 | 63.5 x 102 | 0.5 | B32300A2022A550 | 12 |
| MKD250-I-5.0 | 5.0 | 20.0 | 6.0 | 24.0 | 255 | 75 x 166 | 0.7 | B32301A2052#050* | 6 |
| MKD250-I-7.5 | 7.5 | 30.0 | 9.0 | 36.0 | 382 | 85 x 196 | 1.1 | B32301A2072#550* | 4 |
| MKD250-I-10 | 10.0 | 40.0 | 12.0 | 48.0 | 510 | 85 x 216 | 1.2 | B32301A2102#050* | 4 |
| **Rated voltage 400 V AC, 50/60 Hz, single phase** | | | | | | | | | |
| MKD400-I-0.8 | 0.8 | 2.0 | 1.0 | 2.4 | 16 | 50 x 64.5 | 0.2 | B32300A4002A800 | 50 |
| MKD400-I-1.7 | 1.7 | 4.3 | 2.0 | 5.2 | 34 | 63.5 x 62.5 | 0.3 | B32300A4012A700 | 12 |
| MKD400-I-2.5 | 2.5 | 6.3 | 3.0 | 7.6 | 50 | 63.5 x 77 | 0.3 | B32300A4022A500 | 12 |
| MKD400-I-3.3 | 3.3 | 8.3 | 4.0 | 10.0 | 66 | 63.5 x 102 | 0.4 | B32300A4032A300 | 12 |
| MKD400-I-4.2 | 4.2 | 10.5 | 5.0 | 12.6 | 84 | 63.5 x 102 | 0.4 | B32300A4051A000 | 12 |
| MKD400-I-5.0 | 5.0 | 12.5 | 6.0 | 15.0 | 100 | 63.5 x 127 | 0.5 | B32300A4052A000 | 12 |
| **Rated voltage 415 V AC, 50/60 Hz, single phase** | | | | | | | | | |
| MKD415-I-0.8 | 0.8 | 1.9 | 1.0 | 2.3 | 15 | 50 x 64.5 | 0.2 | B32300A4082A810 | 50 |
| MKD415-I-1.7 | 1.7 | 4.0 | 2.0 | 4.8 | 31 | 63.5 x 64.5 | 0.3 | B32300A4012A710 | 12 |
| MKD415-I-2.5 | 2.5 | 6.0 | 3.0 | 7.2 | 46 | 63.5 x 102 | 0.4 | B32300A4022A510 | 12 |
| MKD415-I-3.3 | 3.3 | 8.0 | 4.0 | 9.6 | 61 | 63.5 x 102 | 0.4 | B32300A4032A310 | 12 |
| MKD415-I-5.0 | 5.0 | 12.0 | 6.0 | 14.4 | 92 | 63.5 x 127 | 0.6 | B32300A4052A010 | 12 |
| **Rated voltage 440 V AC, 50/60 Hz, single phase** | | | | | | | | | |
| MKD440-I-0.7 | 0.7 | 1.6 | 0.8 | 1.9 | 12 | 50 x 64.5 | 0.2 | B32300A4001A840 | 50 |
| MKD440-I-1.4 | 1.4 | 3.2 | 1.7 | 3.8 | 23 | 63.5 x 64.5 | 0.3 | B32300A4011A740 | 12 |
| MKD440-I-2.1 | 2.1 | 4.8 | 2.5 | 5.8 | 35 | 63.5 x 77 | 0.3 | B32300A4021A540 | 12 |
| MKD440-I-2.8 | 2.8 | 6.4 | 3.4 | 7.7 | 46 | 63.5 x 102 | 0.4 | B32300A4031A340 | 12 |
| MKD440-I-3.3 | 3.3 | 7.5 | 4.0 | 9.0 | 54 | 63.5 x 102 | 0.4 | B32300A4032A340 | 12 |
| MKD440-I-4.2 | 4.2 | 9.5 | 5.0 | 11.4 | 69 | 63.5 x 127 | 0.5 | B32300A4051A040 | 12 |
| MKD440-I-5.0 | 5.0 | 11.4 | 6.0 | 13.7 | 82 | 63.5 x 127 | 0.5 | B32300A4052A040 | 12 |

* Available either as B32301A****A*** series (2-terminal design, integrated resistor) or B32301A****B*** series (4-terminal design, pluggable ceramic resistor). Please replace # with the right character before ordering.

| Type | 50 Hz | | 60 Hz | | $C_R$ | d × h | Weight | Ordering code | Packing unit |
|---|---|---|---|---|---|---|---|---|---|
| | Output kvar | $I_R$ A | Output kvar | $I_R$ A | µF | mm | kg | | pcs |
| **Rated voltage 480 V AC, 50/60 Hz, single-phase** | | | | | | | | | |
| MKD480-I-0.7 | 0.7 | 1.5 | 0.8 | 1.8 | 10 | 50 x 64.5 | 0.2 | B32300A4001A880 | 50 |
| MKD480-I-1.4 | 1.4 | 2.9 | 1.7 | 3.5 | 19 | 63.5 x 64.5 | 0.3 | B32300A4011A780 | 12 |
| MKD480-I-2.1 | 2.1 | 4.4 | 2.5 | 5.3 | 29 | 63.5 x 77 | 0.3 | B32300A4021A580 | 12 |
| MKD480-I-2.8 | 2.8 | 5.8 | 3.4 | 7.0 | 39 | 63.5 x 102 | 0.4 | B32300A4031A380 | 12 |
| **Rated voltage 525 V AC, 50/60 Hz, single-phase** | | | | | | | | | |
| MKD525-I-1.4 | 1.4 | 2.7 | 1.7 | 3.2 | 16 | 63.5 x 64.5 | 0.3 | B32300A5011A720 | 12 |
| MKD525-I-2.8 | 2.8 | 5.3 | 3.4 | 6.4 | 32 | 63.5 x 102 | 0.4 | B32300A5031A320 | 12 |
| MKD525-I-3.3 | 3.3 | 6.3 | 4.0 | 7.6 | 38 | 63.5 x 102 | 0.4 | B32300A5032A320 | 12 |
| MKD525-I-4.2 | 4.2 | 8.0 | 5.0 | 9.6 | 49 | 63.5 x 127 | 0.5 | B32300A5051A020 | 12 |
| MKD525-I-25.0 | 25.0 | 46.7 | 30.0 | 57.1 | 289 | 116 x 200 | 1.9 | B32301A5252#025* | 4 |

* Available either as B32301A****A*** series (2-terminal design, integrated resistor) or B32301A****B*** series (4-terminal design, pluggable ceramic resistor). Please replace # with the right character before ordering.

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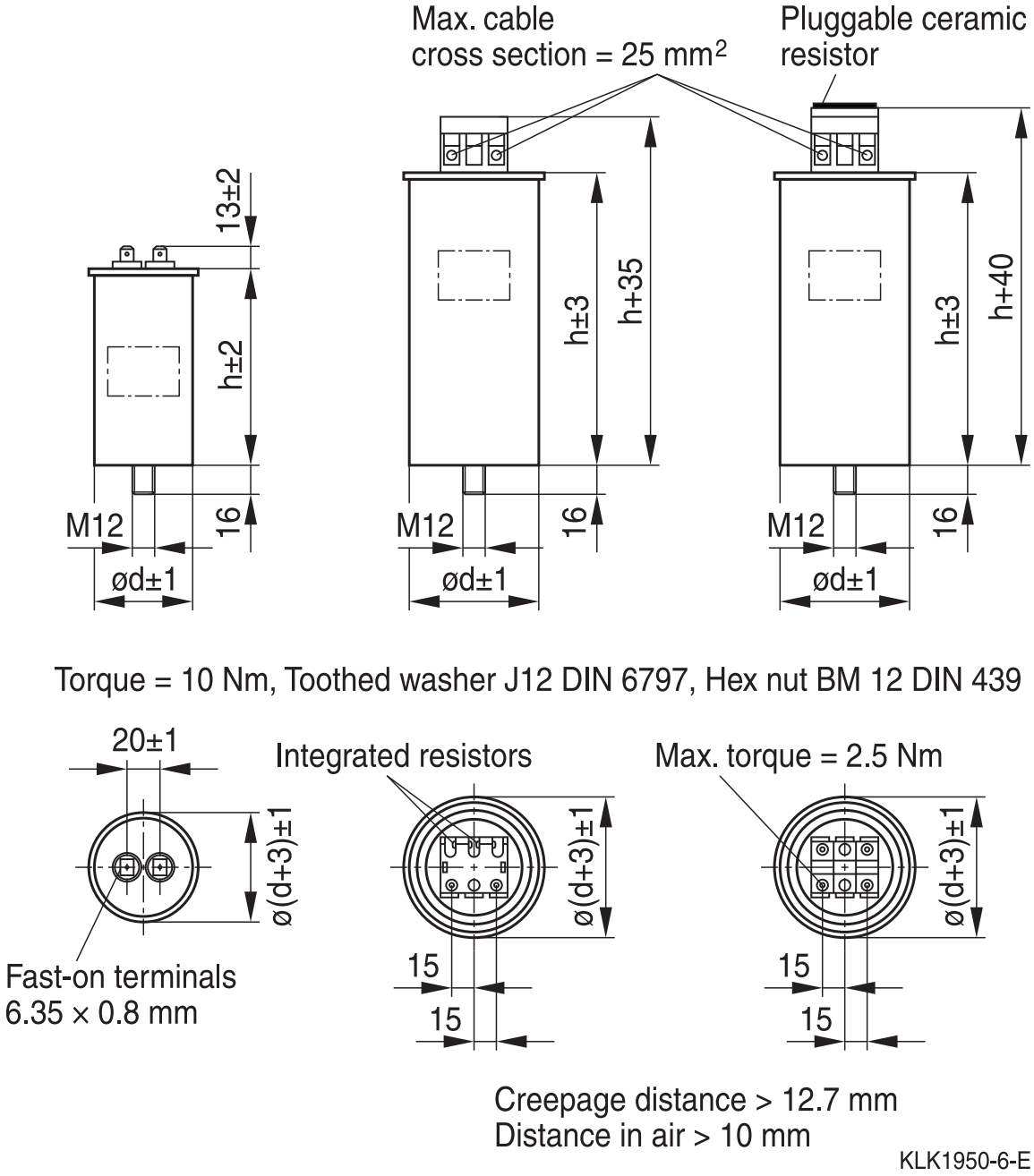
### Important remark

Hereafter mentioned capacitors with the wildcard character "**#**" are available either with integrated resistors with 2 terminals (B32301*****A*** series) or with pluggable ceramic base discharge resistor with 4 terminals (B32301*****B*** series).

The main difference between B32301A****A*** series and B32301A****B*** series is the way of assembling the discharge resistor. The resistor of B32301A****A*** series is assembled inside of capacitor terminal cover, the ceramic resistor of B32301A****B*** is plugged into the terminal pin.

## Dimensional drawings

B32300A* B32301A****A*** B32301A****B***



## Cautions and Warnings

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.

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 ≤ 60 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 EPCOS PFC Product Profile.

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