Film Capacitors – Power Factor Correction

HomeCap Capacitors

Series/Type: MKP
Ordering code: B32340C.....Jxxx
Date: November 2010
Version: 4

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**Construction**
- Dielectric: Polypropylene film
- Internally insulated, no grounding required
- Soft polyurethane resin, non PCB (NPCB)
- Aluminum can

**Features**
- Self-healing properties
- Low dissipation factor
- Overpressure disconnection device
- High insulation resistance

**Typical applications**
- Residential power factor correction unit

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

**Product composition**
- Cable
- Plastic terminal protection cover
- Capacitor file 106388

**Cable**
- Cross section: 1.5 mm² (14AWG)
- Length: 300 mm
- Rated voltage: 600 V AC
- Operation temperature: +105 ºC
- Material: Electrolytic copper with PVC insulation
Technical data and specifications

<table>
<thead>
<tr>
<th>Characteristics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated capacitance $C_N$</td>
<td>According to dimension table, 5 to 33 µF</td>
</tr>
<tr>
<td>Tolerance</td>
<td>$-5 / +10%$</td>
</tr>
<tr>
<td>Connection</td>
<td>Cables</td>
</tr>
<tr>
<td>Rated voltage $V_R$</td>
<td>400 V (application voltage 127 ... 400 V)</td>
</tr>
<tr>
<td>Rated frequency $f_N$</td>
<td>50 Hz / 60 Hz</td>
</tr>
<tr>
<td>Output</td>
<td>According to dimension table</td>
</tr>
<tr>
<td></td>
<td>$0.02 \ldots 1.66$ kvar</td>
</tr>
<tr>
<td>Rated current $I_R$</td>
<td>According to power rating</td>
</tr>
<tr>
<td>$\tan \delta$ (dielectric)</td>
<td>0.5 W / kvar</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maximum ratings</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{\text{max}}$ (up to 8 h daily)</td>
<td>1.1 $\cdot$ VR</td>
</tr>
<tr>
<td>$V_{\text{max}}$ (up to 1 min)</td>
<td>1-3 $\cdot$ VR</td>
</tr>
<tr>
<td>$I_{\text{max}}$</td>
<td>1.3 $\cdot$ IR (A)</td>
</tr>
<tr>
<td>$I_S$</td>
<td>100 $\cdot$ $I_R$ (A)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test data</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{TT}$</td>
<td>$2.15 \times V_R$, 60 s (type test)</td>
</tr>
<tr>
<td>$V_{TC}$</td>
<td>$3000$ V AC / $50$ Hz during 60 s</td>
</tr>
<tr>
<td>$\tan \delta$ (120 Hz) at $20 , ^\circ$C</td>
<td>$\leq 1.0 \times 10^{-3}$</td>
</tr>
<tr>
<td>*Without discharge resistor</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Design data</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions (d x h)</td>
<td>d1: $42.5 \pm 1$ mm</td>
</tr>
<tr>
<td></td>
<td>h: see product table</td>
</tr>
<tr>
<td></td>
<td>L1: $10 \pm 1$ mm</td>
</tr>
<tr>
<td></td>
<td>L2: $58 \pm 1$ mm</td>
</tr>
<tr>
<td></td>
<td>L3: $50 \pm 5$ mm</td>
</tr>
<tr>
<td></td>
<td>L4: $10 \pm 2$ mm</td>
</tr>
<tr>
<td>Weight approx</td>
<td>See product table</td>
</tr>
<tr>
<td>Impregnation</td>
<td>Non PCB, soft polyurethane resin</td>
</tr>
<tr>
<td>Fixing</td>
<td>Al can stud or bracket</td>
</tr>
<tr>
<td>Max. torque (Al can stud)</td>
<td>4 Nm</td>
</tr>
<tr>
<td>Mounting position</td>
<td>Any mounting position possible</td>
</tr>
</tbody>
</table>
Mean life expectancy

$\tau_{LD}$ up to 100 000 hours

Max. 5000 switchings per year acc. to IEC 60831

Terminals

Protection degree IP53, indoor mounting

Terminal cross section 16 mm$^2$

Maximum terminal current 15 A

Creepage distance (min) 12.7 mm

Clearance (min) 9.5 mm

Safety

Mechanical safety Overpressure disconnector

Max. short circuit current (AFC: 10 kA)

Climatic category –25/D

$\theta_{min}$ –25 °C

$\theta_{max}$ +55 °C

Storage temperature –40 °C…+85 °C

Humidity av. rel. < 65%

Maximum altitude 4 000 m above sea level

Degree of protection IP 20

Reference standards

IEC 60831–1/2, UL 810-5th edition

Discharge resistors are available upon request. Discharge resistor time according to IEC specification for specific types.
<table>
<thead>
<tr>
<th>C_r</th>
<th>400 V AC kvar 50 Hz</th>
<th>240 V AC kvar 50 Hz</th>
<th>220 V AC kvar 50 Hz</th>
<th>127 V AC kvar 50 Hz</th>
<th>Dimensions d x h mm</th>
<th>Weight kg</th>
<th>Ordering Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>0.25</td>
<td>0.09</td>
<td>0.08</td>
<td>0.025</td>
<td>40 x 70</td>
<td>0.15</td>
<td>B32340C4056J000</td>
</tr>
<tr>
<td>7</td>
<td>0.35</td>
<td>0.13</td>
<td>0.14</td>
<td>0.13</td>
<td>40 x 70</td>
<td>0.15</td>
<td>B32340C4076J000</td>
</tr>
<tr>
<td>10</td>
<td>0.50</td>
<td>0.22</td>
<td>0.20</td>
<td>0.18</td>
<td>40 x 70</td>
<td>0.15</td>
<td>B32340C4106J000</td>
</tr>
<tr>
<td>15</td>
<td>0.75</td>
<td>0.33</td>
<td>0.23</td>
<td>0.18</td>
<td>40 x 80</td>
<td>0.16</td>
<td>B32340C4156J000</td>
</tr>
<tr>
<td>20</td>
<td>1.00</td>
<td>0.43</td>
<td>0.36</td>
<td>0.10</td>
<td>40 x 105</td>
<td>0.18</td>
<td>B32340C4206J000</td>
</tr>
<tr>
<td>25</td>
<td>1.25</td>
<td>0.54</td>
<td>0.46</td>
<td>0.15</td>
<td>40 x 105</td>
<td>0.18</td>
<td>B32340C4256J000</td>
</tr>
<tr>
<td>30</td>
<td>1.50</td>
<td>0.65</td>
<td>0.55</td>
<td>0.18</td>
<td>40 x 125</td>
<td>0.20</td>
<td>B32340C4306J000</td>
</tr>
<tr>
<td>33</td>
<td>1.66</td>
<td>0.72</td>
<td>0.60</td>
<td>0.17</td>
<td>40 x 125</td>
<td>0.20</td>
<td>B32340C4336J000</td>
</tr>
</tbody>
</table>

*) Types of products range by code identity.

Without studs in the aluminum can, cable length 300 mm: Jxx0.
Without studs in the aluminum can, aluminum can with PVC cover 180 um thickness, cable length 300 mm: Jxx1.
Without studs in the aluminum can, cable length 500 mm: Jxx2.
Without studs in the aluminum can, aluminum can with PVC cover 180 um thickness, cable length 500 mm: Jxx3.
With studs in the aluminum can, cable length 300 mm: Jxx4.
With studs in the aluminum can, aluminum can with PVC cover 180 um thickness, cable length 300 mm: Jxx5.
With studs in the aluminum can, cable length 500 mm: Jxx6.
With studs in the aluminum can, aluminum can with PVC cover 180 um thickness, cable length 500 mm: Jxx7.
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.
- In case of oil leakages, capacitors must not be used at all.
- 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 overcurrent and short circuit.
- Failure to follow cautions may result, worst case, in premature failures, bursting or fire.

Discharging
Capacitors must be discharged to a maximum of 10% of rated voltage before they are switched on again. This prevents an electric impulse discharge in the application, influences the capacitor’s service life, and protects against electric shock.

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 in bursting of the capacitor or in 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 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:

<table>
<thead>
<tr>
<th>Test Duration</th>
<th>6 h*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency range</td>
<td>10 ... 55 Hz*</td>
</tr>
<tr>
<td>Displacement amplitude</td>
<td>0.75 mm*</td>
</tr>
</tbody>
</table>

*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 4Nm.

**Maintenance**
- 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.
- 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.
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