Film Capacitors – Power Factor Correction

PoleCap capacitor

Series/Type: **MKK400-D-10-P**
Ordering code: **B25671A3207A375**

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Construction



- Dielectric: Polypropylene film
- Gas impregnated / dry type
- 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
- Outdoor mounting

Ambient

- Highest insulation strength for outdoor applications (to IEC60831, 15 kV)
- Terminal cover, cable gland and connection cable made of material resistant to weather, UV radiation and aging
- Cable UV-resistant
- Housing of pure aluminum (corrosion-free operation)
- Double housing of terminals for protection against hazardous parts, ingress of solid foreign bodies, dust and harmful effects of water

Label design



Technical data and specifications

Characteristics		
Rated capacitance C_R	3 • 69 µF	
Tolerance	–5 / +10%	
Connection	D (Delta)	
Rated voltage V_R	400 V AC	
Rated frequency f_R	50 Hz	60 Hz
Output	10.4 kvar	12.5 kvar
Rated current I_R	15 A	18 A
tan δ (dielectric)	0.2 W / kvar	

Maximum ratings	
V_{max} (up to 8 h daily)	440 V AC
V_{max} (up to 1 min)	520 V AC
I_{max}	1.3 • I_R (A) (including combined effects of harmonics, overvoltages and capacitance tolerance)
I_S	200 • I_R (A)

Test data	
V_{TT}	900 V AC / 50 Hz during 10 s
V_{TC}	3000 V AC / 50 Hz during 10 s
tan δ (50 Hz)*	≤ 0.5 W / kvar

* Without discharge resistor & cable

Climatic category	–40/D
T_{min}	–40 °C
T_{max}	+55 °C
Humidity	av. rel. < 95%
Maximum altitude	4000 m

Mean life expectancy	
Mean life expectancy t_{LD}	Up to 100 000 h
Max. 5000 switchings per year to IEC60831	

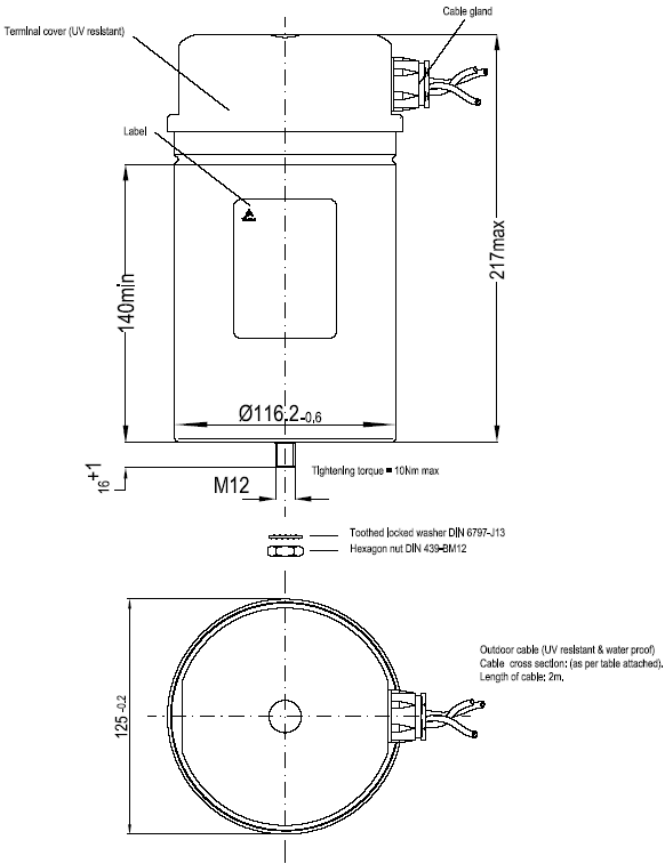
Design data	
Dimensions (d × l)	125 × 217 mm
Weight approx	1.7 kg
Impregnation	Dry, inert gas, no PCB
Fixing	Threaded bolt M12
Max. torque (Al can stud)	10 Nm
Mounting position	Upright or horizontal mounting position possible. See “Maintenance and Installation Manual” for further details.

Terminals	
Enclosure	IP54 internally protected
Connection cables	Length 2 m (UV resistant and water proof)
Cable cross section / Cable gland	4 mm^2 / PG13.5
Maximum terminal current	50 A

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

Reference standards
IEC60831–1/2

Dimensional drawing



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 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. PoleCap-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.

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.

Choosing the best spot for mounting

Especially in regions with long periods of sunshine and high temperatures, the PoleCap should be installed in such a way that it is located in the shadow of the pole for most of the daylight. The combination of the natural cooling by the wind and the single-housing of the capacitor helps to keep the hot spot temperature at the lowest level possible.

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 50 V or less.
- 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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