



Power Capacitors

Operating and Safety Instructions for AC and DC Power Capacitors

Series/Type: MKD, MKP, MKK
Ordering code: B25610, B25640, B25641, B25645, B25647, B25750
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Operating and Safety Instructions for AC and DC Power Capacitors

1. Scope

These operating instructions apply to capacitors for power electronics (PEC) of the series B25610 / B25640 / B25641 / B25645 / B25647 / B25750.

This document may be used also as reference for obsolete technologies of the series B25650 and B25655.

Their purpose is to describe the general conditions for transportation, storage, installation, operation, maintenance, and end of life disposal.

These instructions do not substitute any law or local regulation; therefore, the laws and safety regulations from the country where the capacitors are used must always be complied with. In case of discrepancies, the local laws and regulations shall prevail.

In addition to these operating instructions observe also the specific product data sheet.

2. Normative references:

- IEC 61071:2017 - Capacitors for power electronics.
- IEC 61881-1:2010 - Railway applications - Rolling stock equipment - Capacitors for power electronics - Part 1: Paper/plastic film capacitors.
- General Safety Recommendations and Requirements for the Usage of Power Capacitors – ZVEI, 16.03.2023.

3. General Safety Instructions

- When employed in power electronics the capacitors run with high energy content and high currents.



The energy stored in capacitors may be lethal. To prevent any risks of shocks, the capacitor shall be discharged with adequate means by qualified people and all terminals short-circuited to the case and properly earthed before handling. Discharging shall be performed between terminals, and also between terminals and case.

- In case of capacitors with non-metallic case, short-circuiting between all terminals to earth is enough.

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- The capacitor can contain dangerous residual charges even after long time without operation. For this reason, the electrical terminals must remain short-circuited to the case until the capacitors are connected to the operating circuit.
- Short-circuiting shall be performed by using conductive wires or similar means with an adequate cross-section area to withstand the residual charges that may contain the capacitor. In case the wire used to short circuit the capacitor is broken, the part must be treated as energized, and shall be handled only after it is discharged with adequate means by qualified people and short-circuited once more.

TDK cannot predict all possible stresses which a Power Electronic Capacitors can be subjected to. There is a remaining probability of Power Electronic Capacitors showing malfunction due to excess temperature, overvoltage, wrong application, wrong installation, faulty maintenance, mechanical damage, operation at the limits of the specification or other reasons.

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.

As a member of ZVEI, the German Electrical and Electronic Manufacturer Association, TDK is recommending the use of Power Electronic Capacitors equipped with appropriate protective devices, such as over-pressure switches and will be glad to provide concrete technical recommendations regarding protective devices during the creation of a Power Electronic Capacitors specification.

4. Transportation, storage, and handling

- TDK packs the capacitors to minimize possible damage.



During transportation, storage and handling, the capacitors must remain short-circuited between terminals and to the case.

- During transportation and handling the following must be avoided:
 - Mechanical stress on the terminals: the electrical terminals must not be used for grabbing or suspending the capacitor during handling. Adequate lifting points may be provided and agreed with customer. It is recommended to equally distribute the load when lifting the capacitors.
 - Setting down the capacitors or the packing containing the capacitors hardly.
 - Stressing of welded seams by sliding the capacitors along the ground or in racks.
 - High mechanical stresses on the cases (e.g. from lifting gear, hammering, stacking).
 - In open capacitors, special care should be taken to prevent damage of the resin surface.
- Capacitors must never be stored or used outside the specified temperature and humidity ranges. Please refer to conditions specified in the datasheet.
- Keep capacitors away from corrosive surroundings, for example when chlorides, sulfides, acids, alkalis, salts, organic solvents or similar substances are present.

5. Installation and operation

- During the installation process all risks must be assessed and occupational health and safety rules must be considered. Personal protective equipment (PPE) may be needed for some operations, please confirm necessary means with your OH&S (Occupational Health & Safety) coordinator.
- Capacitors that have sustained mechanical damage or has signs of electrical discharges must not be used. This applies also in case leakages are detected.
- The capacitors can be installed vertically or horizontally. Overhead installations are permissible only if this is referred to explicitly in the data sheet.
- Specified torques for electrical connections and fasteners must be respected. Specified torque values are defined in dry conditions, the usage of grease or any other lubricant for tightening electrical connections may result in excessive forces that provoke damages in the terminals.
- For the electrical connections it is recommended to use elements made of conductive material, such as tinned brass nuts and washers or bronze washers. The use of grease shall be avoided for the tightening of those conductive elements.
- The side walls of the capacitors can bend outwards. Please refer to capacitor drawing. A clearance of about 25 mm is required to allow this. This clearance is also required to ensure sufficient cooling of the capacitors.
- The capacitors shall be arranged so that they are not additionally heating by other circuit components (e.g. inductors, resistors, semiconductors, busbars, heat sinks). For permissible operating temperatures, please refer to the capacitor data sheet.
- Means of sufficient dissipation of heat loss (fan, cooling) or escaping gases and liquids in case of malfunction must be provided.
- The electrical terminals of capacitors shall not be stressed by mechanical tension, pressure or bending.
- The leads at the electrical terminals shall be as flexible and light as possible; they shall be supported again as close as possible to the terminal. This prevents the terminals from being mechanically overloaded in case of vibration.

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- The clearance and creepage distances of the electrical terminals must not be shortened by any mounting components.
- The cross section of the leads must be dimensioned large enough to avoid additional heat being conducted into the capacitor during current flow. The current should be equally distributed among the terminals of the capacitors.
- It is strongly recommended to keep the capacitor terminals cooler than the capacitor itself.
- The polarity of the electric terminals can be selected freely. If there are more than two terminals, observe the internal connection of the separate capacitances as per data sheet and drawing.



Capacitor protective devices must not be manipulated, removed or impaired in their function. Plugs, nuts or any other closing part of the capacitor shall neither be manipulated.

6. Maintenance

- If the capacitors operate in accordance with the specifications, no maintenance is required. Overstressing and overheating shorten the life of a capacitor, and therefore the operating conditions defined in the capacitor datasheet (temperature, humidity, voltages, currents, power, thermal resistances, frequencies, discharge times and switching frequencies) shall be strictly followed and controlled.
- The capacitance and dissipation factor of the capacitor should be checked regularly and, in case of relevant loss of capacitance or increase of the dissipation factor, the capacitor shall be replaced. It is recommended to perform this verification once a year.
- It is advisable to carry out a visual inspection of the cases and terminals of the capacitors, and check the proper tightening of the connections at regular intervals. This can be performed in the course of other maintenance operations.
- In case of excessive contamination in the region of the creepage paths, creepage currents or short circuits may occur. Therefore the capacitors must be cleaned at least in the region of the electrical connections at suitable time intervals.
- Residues of cleaning agents may result on reducing insulation resistance and risk of short circuits in the area of the terminals. Therefore the proper cleaning agents must be selected.

7. Return Procedure



**Danger
of death**
High voltage

In case of capacitor malfunction special care shall be taken for capacitor handling. Before capacitors are disassembled after operation, discharging between all terminals to case and earth must be performed and capacitor terminals must be short-circuited to the case and properly earthed prior to any manipulation.

The short circuit shall be performed with adequate conductive wires or similar means. Please refer to general safety instructions in chapter 2 of this document.

- During this operation, terminals and case must not be touched; if it cannot be avoided appropriate personal protective equipment may be needed. For further manipulation of failed parts earthing or personal protective equipment may also be needed. Please confirm with your OH&S coordinator.
- Capacitors shall be packed in closed boxes with the necessary filling material to avoid any kind of damage or crash, and the appropriate handling indications marked in the outer side of the box.
- In case of leakages, insert capacitors inside a sealed plastic bag to avoid contamination in the outer side of the packing.
- The boxes shall be placed on pallets and fixed to them by means of strapping belts or similar. Fumigated pallets may be needed for international shipments, please refer to International Standards for Phytosanitary Measures.
- Ensure the short-circuit between all terminals to case remains during transportation.

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, CarXield, CeraCharge, CeraDiode, CeraLink, CeraPad, CeraPlas, CSMP, CTVS, DeltaCap, DigiSiMic, FilterCap, FormFit, InsuGate, LeaXield, MediPlas, MiniBlue, MiniCell, MKD, MKK, ModCap, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, PiezoBrush, PlasmaBrush, PowerHap, PQSine, PQvar, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, SurfIND, ThermoFuse, WindCap, XieldCap 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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