Power Electronic Capacitors

General Technical Information
DC-Capacitors
AC-Filter Capacitors
GTO-Capacitors
Commutation and Damping Capacitors

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- Standard, Fast and Ultra-Fast Recovery (single, dual)
- Clamper/Damper
- Bridge
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- Solid Tantalum Capacitors
- Wet Tantalum Capacitors
- Ceramic Capacitors
- Multilayer Chip Capacitors
- Disc Capacitors
- Film Capacitors
- Power Capacitors
- Heavy Current Capacitors
- Aluminum Capacitors

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- Film Resistors
- Thin Film Resistors
- Thick Film Resistors
- Metal Oxide Film Resistors
- Carbon Film Resistors
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- Transducer-Class®
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Manufacturer of the World's Brodest Line of Discrete Semiconductors and Passive Components
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MKP DIELECTRIC
A metallic layer is vacuum-metallized on one side of the corresponding polypropylene base film by means of a special process.
The thickness of the metallic layer varies over the distance of the film width.
At the connection area, the metallic layer is thicker to reduce losses occurring at this point due to high current densities.
Self-healing characteristics and series resistance are optimized by the metallization arrangement. This metallization arrangement principle is shown in Fig. 1. The actual arrangement however is adapted to the corresponding capacitor demands.

MKP = METALLIZED POLYPROPYLENE

SELF-HEALING
As a result of the self-healing effect, the capacitor is fully operational after an electrical breakdown. A breakdown generates a small electric arc which evaporates the metallization around the area of the breakdown in only a few microseconds.
The localized increase in gas pressure caused by the high temperature, blows off the gaseous metallization away from the breakdown point. By means of this process, a metallic free non-conductive isolation crescent is formed which enables continuous full operation of the capacitor.

PROTECTION OF SELF-HEALING CAPACITORS
Since no low resistance short circuit occurs on failure of self healing capacitors, line-side fuses cannot offer any protection against bursting of the case.
Therefore, in addition to segmentation (exclusively for DC capacitors) there is also a fuse for MKP capacitors which reacts to overpressure.
A capacitor failure generally occurs due to a weak point in the dielectric, an overload or degradation. If it is not taken off line, over-heating of the dielectric occurs at the defect point. This over-heating leads to the formation of gas and a quick increase in pressure on the inside of the capacitor case. In cylindrical cases, this takes the form of an elongation causing a crowning of the cover or stretching of the expansion bead.

SEGMENTATION
Self-healing DC capacitors without tear-off fuses can be manufactured with a segmented metallized polypropylene film. Various segmental designs are available which are applied in accordance with the mode of application and the specification. All segmented metallizations being applied are produced in accordance with the Vishay specification.

MODE OF FUNCTIONING
If a non-self-healing breakdown occurs in the dielectric, the segment affected by this error will be disconnected.
Due to the high number of segments per capacitor element, the disconnection of a partial segment causes a practically non-measurable change of capacitance. The application of this technology essentially allows the dielectric's field strength to increase and, consequently, reduce to a minimum the capacitor volume and capacitor weight.
OVERPRESSURE TEAR-OFF FUSE

On over-running or on reaching the limits of the expected capacitor lifetime, punctures can occur, causing localized bridging and the formation of gas. An overpressure tear-off fuse disconnects the capacitors element from the line side thereby preventing bursting.

CONTACTING OF THE WINDING ELEMENT

For capacitors with metallized film winding elements (MKP-technology), the contacting of the windings is accomplished by a special metal spray method ("schooping"). The vacuum-metallized layers stretch to the edge of the dielectric on the contacting side.

For contacting purposes a solderable lead-free metal base layer is sprayed onto the front side of the winding. One designates this process as "schooping". The leads are then soldered onto the schoopenved surface.

OVERPRESSURE SENSOR

For capacitors in rectangular cans, pressure sensors are available which can activate a line-side switch via a signal contact.

The connection of the winding is accomplished by means of a highly flexible conductive material with low inductive characteristics.

In this way the capacitors are able to fulfill the highest demands for current carrying capabilities, low inductive characteristics and vibration protection.
FILLERS
There are various fillers for the capacitors listed in the catalog.

DRY CASTING
Almost all self-healing capacitors in rectangular cases and a number of capacitors in cylindrical cans can be constructed as dry capacitors.

A casting compound developed by VISHAY is utilized which remains elastic throughout the entire lifetime of the capacitor.

This elastic casting compound offers outstanding vibration protection for the internal structure and long-lasting protection against the penetration of moisture into the electrical components of the capacitor.

A very good heat conductivity (see table 1) of the casting compound enables maximum capacitor loads under high temperature stress conditions.

The casting compound can be disposed of as normal refuse.

OIL
For capacitors equipped with tear-off protection, preference is given to impregnation using a specially produced and stabilized vegetable oil.

The highly non-flammable insulating oil is fully biodegradable and non-toxic.

There are no disposal requirement regulations and the oil can therefore be disposed off as normal refuse.

INERT GAS
For various applications, the utilization of oil for capacitors with tear-off protection is permitted. Such capacitors can also be supplied as dry capacitors.

Instead of oil, the capacitors are filled with an inert gas.

CHARACTERISTICS OF THE DIELECTRIC
“MKP” Metallized film, Polypropylene

<table>
<thead>
<tr>
<th>AIR/GAS</th>
<th>0.015 - 0.020W/mK</th>
</tr>
</thead>
<tbody>
<tr>
<td>POLYPROPYLENE</td>
<td>0.22W/mK</td>
</tr>
<tr>
<td>VERMICULITE</td>
<td>0.061W/mK</td>
</tr>
<tr>
<td>CASTOR OIL</td>
<td>0.15W/mK</td>
</tr>
<tr>
<td>POLYURETHANE</td>
<td>0.015 - 0.2W/mK</td>
</tr>
</tbody>
</table>

TABLE 1
CAPACITOR LOSSES
In order to prove reliable functioning and the life expectancy of a capacitor at maximum ambient temperature, the maximum surface temperature of the casing has to be ascertained.

In general, the capacitors are designed for a maximum casing temperature of 80°C at short time operation and 65°C at continuous operation. In case of higher calculated casing temperature, please contact our offices for a special design according to your specifications.

The surface temperature of the capacitor can be ascertained by means of the data concerning the temperature loading, the series resistance, and the loss factor.

EXEMPLARY CALCULATION

OPERATING DATA

\[ \begin{align*}
U_n &= 1900\text{VDC} \\
U_{\text{ripple}} &= 20\text{Vrms} \\
F &= 500\text{Hz} \\
T_{\text{max}} &= 70^\circ\text{C (10\% of operating time)} \\
T_{\text{min}} &= -40^\circ\text{C}
\end{align*} \]

CAPACITOR DATA

\[ \begin{align*}
U_n &= 1900\text{VDC} \\
C_n &= 4000\mu\text{F} \\
I_n &= 300\text{A} \\
R_s &= 0.5\text{m}\Omega \\
\tan\delta_{\text{dielectric}} &= < 2 \times 10^{-4} \\
&< 5 \times 10^{-4} \ (1\text{kHz}) \\
\tan\delta_{\text{total}} &= < 3 \times 10^{-4} \ (50\text{Hz}) \\
\text{capacitor dimensions} &= 340 \times 175 \times 520\text{mm (l x w x h)}
\end{align*} \]

CALCULATION OF OVERTEMPERATURE BASED ON OPERATING DATA

\[ \begin{align*}
I &= U \times 2\pi \times f \times C \\
I &= 20\text{V} \times 2\pi \times 500\text{Hz} \times 4000 \times 10^{-6}\text{F} \\
I &= 251\text{A} \\
Q &= I \times U_{\text{ripple}} \\
Q &= 251\text{A} \times 20\text{V} \\
Q &= 5000\text{var} \\
\Delta\phi &= \frac{P_{\text{total}}}{0.1 \times A} \\
\Delta\phi &= 32.5\text{W/}((0.1\text{W} \times 65.5\text{dm}^2)/(\text{K} \times \text{dm}^2)) \\
\Delta\phi &= 4.96\text{K}
\end{align*} \]

Maximum casing temperature:

RESULT

A calculated maximum case temperature of 75°C (based on operating data) allows unrestricted operation of the capacitor for above specified short time operation.
APPLICATION CLASSES

Capacitors are divided into application classes according to their permissible exposure to climatic conditions and physical wear and tear. The application classes are defined in DIN 40040. DIN 40040 also defines the criteria determining the reliability of capacitors.

CLIMATIC EXPOSURE

Permissible exposure to temperature and humidity depends on the particular model and is designated as follows according to DIN 40040.

<table>
<thead>
<tr>
<th>1st letter</th>
<th>I</th>
<th>H</th>
<th>G</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>minimum temperature</td>
<td>-10°C</td>
<td>-25°C</td>
<td>-40°C</td>
<td>-55°C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2nd letter</th>
<th>V</th>
<th>U</th>
<th>S</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>maximum temperature</td>
<td>+55°C</td>
<td>+60°C</td>
<td>+70°C</td>
<td>+85°C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3rd letter</th>
<th>F</th>
<th>E</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>mean annual humidity</td>
<td>≤75%</td>
<td>≤75%</td>
<td>≤95%</td>
</tr>
<tr>
<td>30 days max. per year continuous</td>
<td>95%</td>
<td>95%</td>
<td>-</td>
</tr>
<tr>
<td>occasionally on the other days</td>
<td>85%</td>
<td>85%</td>
<td>100%</td>
</tr>
<tr>
<td>dew</td>
<td>none</td>
<td>seldom</td>
<td>present</td>
</tr>
</tbody>
</table>

FAILURE RATE

The failure rate is the number of permissible failures per 10⁹ component hours.

<table>
<thead>
<tr>
<th>4th letter</th>
<th>K</th>
<th>L</th>
<th>M</th>
<th>N</th>
<th>P</th>
<th>Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>failure rate (failure per 10⁹ comp. hrs)</td>
<td>100</td>
<td>300</td>
<td>1000</td>
<td>3000</td>
<td>10000</td>
<td>30000</td>
</tr>
</tbody>
</table>

LOAD DURATION

The duration of exposure is the actual total time subjected to nominal voltage.

<table>
<thead>
<tr>
<th>5th letter</th>
<th>R</th>
<th>S</th>
<th>T</th>
<th>U</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load duration (h)</td>
<td>100000</td>
<td>30000</td>
<td>10000</td>
<td>3000</td>
<td>1000</td>
</tr>
</tbody>
</table>

EXAMPLE OF HOW AN APPLICATION CLASS IS SPECIFIED:

Code letter

- Minimum temperature - 25°C
- Maximum temperature + 60°C
- Mean annual humidity 95%
- Failure rate per 10⁹ comp. hrs. 3000
- Load duration 10000 hrs.
BUSHINGS

Ceramic and plastic types of construction material are offered. Both materials have been selected to conform with Standard CTI 600.
RULES, REGULATIONS AND DEFINITIONS
The type of capacitors listed in this catalog are subject to the relevant rules:

General specifications for capacitors:
VDE 0560 Part 1/12.69
DC-capacitors: EN 61071-1
Commutation capacitors: VDE 0560 part 12
EN 61071-1

TERMS:
Rated capacitance (C_N)
of a capacitor is the capacitance by which it is designated. The term is related to 20°C capacitor temperature, 50Hz and rated voltage.

Tolerance on capacitance is the capacitance range within which the actual capacitance may differ from rated capacitance (C_N).

Rated Voltage (U_N)
is the maximum of mixed voltages or the peak of AC voltages for which the dielectric of capacitors is designed, adhering to the characteristics and other rated values specified. Rated voltage is not the rms value but the maximum or peak capacitor voltage.

Rated voltage (U_N) DC-capacitors is the maximum operating peak voltage of either polarity but of a non-reversing type waveform, for which the capacitors have been designed, for continuous operation.

Periodic peak voltage (U_S) is the periodically permissible peak voltage. The characteristic and permissible duration of exposure are given.

Peak voltage (U_{max}) is the maximum voltage which may be allowed to occur across the capacitor sporadically for a short period e.g. in the event of a fault. The characteristic and permissible load duration are given in most cases.

Ratio of voltage reversal (D)
is the ratio between the second voltage peak and the first voltage peak for dampened dying-out surge discharge, expressed as a percentage.

Rated insulation voltage (U_i) is the rms AC voltage for which the insulation of the capacitor is designed and designed with terminal connected to case.

Rated current (I_N) is the current by which the capacitor is designated and in particular for which its current paths are designed. Rated current is the maximum rms level of steady-state current.

Peak surge current (I_s) is the maximum level of current which may be allowed to occur across the capacitor sporadically for a short period e.g. in the event of a fault. The characteristic and permissible duration are given.

Dielectric loss factor (\tan \delta_o) is the loss factor of the dielectric which is assumed to be constant for the normal dielectrics and their operating frequency range.

DEFINITIONS:
Minimum temperature The lowest temperature at the surface of the capacitor case (ready for operation) at which the capacitor may be switched on. Lower temperatures are usually permissible for transport and storage.

Maximum temperature The highest temperature which the hottest point of the capacitor case may reach during operation, including self-heating.

Reliability The operating reliability of the capacitor is determined by the number of failures within an adequately large batch expected to occur after a specified time (life expectancy). DIN 40040 has replaced the previous term “operating reliability” by the new term “reference reliability”.

Reference reliability Reference reliability is expressed in terms of failure quota and respective load duration (not including storage times).

Reference reliability is the reliability for defined load (reference load). The reference exposure figure quoted relates to operation under nominal conditions and the application class given in the data lists.

Failure ratio The failure ratio is the relationship between the number of failed capacitors and the total number of capacitors used. It applies to a particular capacitor only and the load duration cited (life expectancy). The figure quoted in the data lists is an average which is generally not exceeded if examining an adequately large number of capacitors.

FIT FIT = failures in time The failure rate in FIT indicates the maximum failed components within 1 x 10^9 component operation hours.
# RFQ Capacitors

Vishay ESTA

## Request for Quotation  DC-Filter-Capacitors

<table>
<thead>
<tr>
<th></th>
<th><strong>VALUE</strong></th>
<th><strong>CONDITION/TIME</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>CAPACITANCE</strong></td>
<td>μF</td>
</tr>
<tr>
<td></td>
<td>Tolerance on capacitance</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>Tolerance after expected life time</td>
<td>%</td>
</tr>
<tr>
<td>2</td>
<td><strong>VOLTAGE</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rated AC-voltage</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>Rated DC-voltage</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>Superimposed ripple voltage</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>Frequency of ripple voltage</td>
<td>Hz</td>
</tr>
<tr>
<td></td>
<td>Maximum recurrent peak voltage</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>Maximum recurrent surge voltage</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>Maximum surge voltage</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>Voltage raise (repetitive)</td>
<td>V μS</td>
</tr>
<tr>
<td>3</td>
<td><strong>CURRENT</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rated rms-current</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Maximum rms-current</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Maximum peak surge current</td>
<td>A</td>
</tr>
<tr>
<td>4</td>
<td><strong>MAXIMUM PERMISSIBLE INDUCTANCE</strong></td>
<td>nH</td>
</tr>
<tr>
<td>5</td>
<td><strong>CLIMATIC CONDITIONS</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Capacitor ambient temperature min/max</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td>Temperature distribution over the year</td>
<td>temperature</td>
</tr>
<tr>
<td></td>
<td>days</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Forced cooling</td>
<td>m/s</td>
</tr>
<tr>
<td></td>
<td>Natural cooling</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td><strong>EXPECTED LIFE TIME</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>hours</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td><strong>INSTALLATION</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Traction</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Fixed installation</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td><strong>MECHANICAL REQUIREMENTS</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maximum dimensions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mounting position</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flash over distance of bushings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Creepage distance of bushings</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td><strong>FURTHER REQUIREMENTS</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Delivery (quantity)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Start of Delivery:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Specialities</td>
<td></td>
</tr>
</tbody>
</table>

Your address:

Please copy, complete and return to:

Vishay Electronic GMBH  
Division Roederstein ESTA and Hybrids  
HOFMARK-AICH-STRASSE 36  
D-84030 LANDSHUT  
www.vishay.com  
E-mail to : pdesta@vishay.com /or  
E-mail to : cmesta@vishay.com /or  
E-mail to : meesta@vishay.com
MKP-DC Filter Capacitors General Information

Vishay ESTA

MKP-DC-Filter Capacitors, Dry, Self-healing, Segmented

VOLTAGE RANGE: UP TO 10kV
CAPACITANCE RANGE: UP TO 20mF

MAIN CHARACTERISTICS

• High energy density and minimum dimensions
• High rms currents and peak currents
• Absolutely vibration proof
• Flexible mechanical designs

APPLICATION

These capacitors have been developed mainly for applications in DC-link filters and in resonant filter circuits. Other applications, such as energy storage capacitors, are also possible.

The low-inductive and impulse current resistant capacitors are offered specifically for applications with IGBT-type thyristors in all voltage ranges.

The MKP-type capacitors described in this catalog are suitable for rated voltages up to 10kV. For applications requiring capacitor voltages above 10kV, oil-impregnated film capacitors should be used. This technology and the respective capacitors are described in detail in a separate Vishay ESTA catalog (No: E 03-03E/01).

DESIGN

Models in welded rectangular casings, or in aluminum round casing, and in plastic casings, (terminal distance 37.5mm), are available.

The specific mechanical design of the different versions is described in detail on the following pages.

In principle, however, the capacitors are manufactured for individual types of application in accordance with the customer’s specification.

To specify your requirements please see the request for quotation form.

TECHNOLOGY

Metallized and segmented polypropylene film (MKP) is used for the dielectric (see general information, document number 13017). This dielectric is particularly characterized by a low loss factor and by a very high voltage loading capacity.

Highest current loading capacity for all capacitors is guaranteed by both specific procedures at the production of the film and the optimized internal construction of the capacitor.

All capacitors for this type of application are manufactured in accordance with the dry technology and have a firm filling. This design guarantees vibration-proof construction of the capacitor especially when used in traction applications. In addition, the firm filling ensures absolute safety against leaking and, consequently, a constant lifetime in case of eventual leakage of the casing.

Using this technology, the maximum energy density with minimum dimensions is achieved. Continuous development in our production department results in permanent improvements in our range of capacitors.
MKP-DC-Filter Capacitors, Dry, Self-Healing, Segmented

RECTANGULAR CASE CAPACITORS

GENERAL

The capacitors are mounted into welded stainless steel cases. The standard dimensions for the cases are 340mm x 175mm, or 340mm x 135mm. The maximum case height is 1200mm. Deviations from these dimensions are available on request, and the capacitors can be adapted to different mounting conditions specified by the customer.

Fastening brackets may also be attached to the casing in accordance with the customer’s request, taking into account that the capacitor’s narrow faces are preferred for the fastening.

Various types of screw type terminals can be attached for the electrical connection. Depending on the type of application, either plastic or ceramic terminals can be mounted.

See appropriate datasheets for specific styles/options.

NOMINAL RATINGS

<table>
<thead>
<tr>
<th>Property</th>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacitance / tolerance</td>
<td>CN</td>
<td>up to 20mF</td>
</tr>
<tr>
<td>Rated DC voltage</td>
<td>UN</td>
<td>up to 10kVDC</td>
</tr>
<tr>
<td>Nominal current</td>
<td>IN</td>
<td>up to 600A</td>
</tr>
<tr>
<td>Peak current</td>
<td>Is</td>
<td>up to 500kA</td>
</tr>
<tr>
<td>Self inductance</td>
<td>Ls</td>
<td>&gt; = 30nH</td>
</tr>
<tr>
<td>Loss factor diel. 50Hz</td>
<td>tan</td>
<td>&lt; 2 x 10^-4</td>
</tr>
</tbody>
</table>

OVERVOLTAGES ACCORDING TO IEC 61071-1

<table>
<thead>
<tr>
<th>Overvoltage</th>
<th>Duration</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.15 x Un</td>
<td>30min/day</td>
<td>U1</td>
</tr>
<tr>
<td>1.2 x Un</td>
<td>5min/day</td>
<td>U2</td>
</tr>
<tr>
<td>1.3 x Un</td>
<td>1min/day</td>
<td>U3</td>
</tr>
<tr>
<td>1.5 x Un</td>
<td>100ms/day</td>
<td>U4</td>
</tr>
</tbody>
</table>

ROUTINE TESTS

<table>
<thead>
<tr>
<th>Test</th>
<th>Term.: Term.</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test voltage</td>
<td>UT/T</td>
<td>1.5 * UN, DC, 10s</td>
</tr>
<tr>
<td>Test voltage</td>
<td>UT/C</td>
<td>min. 2 * Ui + 1000V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50Hz, 10s</td>
</tr>
<tr>
<td>Measurement of capacitance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measurement of loss factor</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OPERATING TEMPERATURE

Minimum ambient temperature: Tmin up to -40°C
Maximum ambient temperature: Tmax up to +70°C

STORAGE TEMPERATURE

Minimum temperature: Tmin - 40°C
Maximum temperature: Tmax + 85°C

TECHNOLOGY

Dielectric: Polypropylene, self-healing segmented
Filling material: Resin, polyurethane dry

DESIGN DATA

Material of casing: Stainless steel, antimagnetic
Paint: RAL 7033
Mounting positions: All

LIFE EXPECTANCY:

> 100000h

FAILURE RATE:

300 FIT

SPECIFICATIONS:

IEC 1071-1
EN 61071-1
customer specification
GMKPg 0.9/12.0mF/X
Vishay ESTA

MKP-DC-Filter Capacitors, Dry, Self-healing, Segmented

PART NO. ART. NO. GMKPg 0.9/12.0mF/X 39864

NOMINAL RATINGS
Capacitance/Tolerance CN 12000uF ± 5%
Rated voltage UN 900VDC

OVER VOLTAGES ACCORDING IEC 61071-1
1.1 x Un U1 990V (30% of the working time)
1.15 x Un U2 1035V (30min/day)
1.2 x Un U3 1090V (5min/day)
1.3 x Un U4 1170V (1min/day)
1.5 x Un U4 1350V (100ms/day)

Voltage rate of rise du/dt 35V/us
Nominal current IN 300A
Short time current 700A
Peak current Is 420kA
Self Inductance Ls < 40nH
Series resistance RESR < 0.8mΩ
Loss factor 50Hz tan < 5 x 10^-4
Loss factor diel. 50Hz tan < 2 x 10^-4

ROUTINE TESTS
Test voltage Terminal/Terminal UT/T 1350V, DC, 10s
Test voltage Terminal/Casing UT/C 6000V, 50Hz, 60s
Measurement of capacitance 320V/50Hz
Measurement of loss factor 320V/50Hz

OPERATING TEMPERATURE
Minimum ambient temperature Tmin - 40°C
Maximum ambient temperature Tmax + 70°C

TECHNOLOGY
Dielectric Polypropylene, self-healing segmented
Filling material Resin, polyurethane dry

BUSHING
Type D-216
Flash over distance 38mm
Creepage distance 61mm
Connection M 12
Max. torque 25Nm

DESIGN DATA
Dimensions: 500 x 175 x 365mm
Drawing: 07-B-778
Weight: 45kg
Material of casing: Stainless steel, antimagnetic
Paint: RAL 7033
Mounting position: All

LIFE EXPECTANCY: 200000h/65°C

FAILURE RATE: 300 FIT

SPECIFICATION: IEC 61071-1 customer specification

DIMENSIONS

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12 Document Number: 13065 Revision 24-Jun-03
MKP-DC-Filter Capacitors, Dry, Self-healing, Segmented

PART NO. GMKPg 1.0/9.0mF/X
ART. NO. 43390

NOMINAL RATING
Capacitance/Tolerance CN 9000uF ± 10%
Rated voltage UN 1000VDC

OVER VOLTAGES ACCORDING IEC 61071-1
1.1 x Un U1 1100V (30% of the working time)
1.15 x Un U2 1150V (30min/day)
1.2 x Un U3 1200V (5min/day)
1.3 x Un U4 1300V (1min/day)
Surge voltage Us 1500V (100ms/day)
Voltage rate of rise du/dt 50V/μs
Rated current In 300A
Peak current Is 450000A
Self Inductance Ls < 40nH
Series resistance RESR < 0.5mΩ
Loss factor 50Hz tan δ < 5 x 10^-4
Loss factor dielectric 50Hz tan δ < 2 x 10^-4

ROUTINE TEST
Test voltage Terminal/Terminal UT/T 1500V, DC, 10s
Test voltage Terminal/Casing UT/C 6000V, AC, 60s
Measurement of capacitance
Measurement of loss factor

OPERATING TEMPERATURE
Minimum ambient temperature Tmin - 40°C
Maximum ambient temperature Tmax + 60°C

STORAGE TEMPERATURE
Minimum temperature Tmin - 40°C
Maximum temperature Tmax + 85°C

TECHNOLOGY
Dielectric Polypropylene, self-healing segmented
Filling material Resin, polyurethane dry

BUSHING
Type D-242
Flash over distance 38mm
Creepage distance 61mm
Terminal M 8 Internal thread
Max. torque 10.0Nm

DESIGN DATA
Dimensions: 650*175*210mm
Drawing: 07-B-824
Weight: 34kg
Casing material: Stainless steel, antimagnetic
Paint: RAL 7033
Mounting positions: ALL

LIFE EXPECTANCY: > 100000h at 50°C

FAILURE RATE: 300 FIT

SPECIFICATIONS:
IEC 61071-1
IEC 60077
customer specification

DIMENSIONS - STANDARD DESIGN

DIMENSIONS - ALTERNATIVE DESIGN
GMKPg 1.9/4.0mF/X
Vishay ESTA

MKP-DC-Filter Capacitors, Dry, Self-healing, Segmented

PART NO. GMKPg 1.9/4.0mF/X
ART. NO. 35133

**NOMINAL RATINGS**
- Capacitance/Tolerance: CN 4000uF ± 5%
- Rated voltage: UN 1900VDC

**OVER VOLTAGES ACCORDING IEC 61071-1**
- 1.1 x Un U1 2090V (30% of the working time)
- 1.15 x Un U2 2185V (30min/day)
- 1.2 x Un U3 2280V (5min/day)
- 1.3 x Un U4 2470V (1min/day)
- 1.5 x Un U4 2850V (100ms/day)

- Voltage rate of rise du/dt 100V/us
- Nominal current IN 500A
- Peak current Is 400kA
- Self Inductance Ls < 50nH
- Series resistance RESR < 0.5mΩ
- Loss factor 50Hz tan < 2x10^-4
- Loss factor dielectric 50Hz tan < 2x10^-4

**ROUTINE TESTS**
- Test voltage Terminal/Terminal UT/T 2850V, DC, 10s
- Test voltage Terminal/Casing UT/C 6000V, 50Hz, 60s
- Measurement of capacitance 320V/50Hz
- Measurement of loss factor 320V/50Hz

**OPERATING TEMPERATURE**
- Minimum ambient temperature Tmin - 40°C
- Maximum ambient temperature Tmax + 70°C

**TECHNOLOGY**
- Dielectric: Polypolypropylene, self-healing segmented
- Filling Material: Resin, polyurethane dry

**BUSHING**
- Type: D-216
- Flash over distance: 38mm
- Creepage Distance: 61mm
- Connection: M12
- Max. Torque: 25Nm

**DESIGN DATA:**
- Dimension: 340*175*510mm
- Drawing: 07-B-649
- Weight: 39kg
- Material of casing: Stainless steel, antimagnetic
- Paint: RAL 7033
- Mounting position: All

**LIFE EXPECTANCY:**
- 150000 hours/at 60°C

**FAILURE RATE:**
- 200 FIT

**SPECIFICATIONS:**
- IEC 61071-1
customer specification

**DIMENSIONS**

![Diagram of bushing and design data](image-url)
## NOMINAL RATINGS

<table>
<thead>
<tr>
<th>Capacitance/Tolerance</th>
<th>CN</th>
<th>4400μF ± 5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage</td>
<td>UN</td>
<td>2600VDC</td>
</tr>
</tbody>
</table>

## OVER VOLTAGES ACCORDING IEC 61071-1

- **1.1 x Un**
  - Voltage rise: U1 2860V (30% of the working time)
- **1.15 x Un**
  - Voltage rise: U2 2990V (30min/day)
- **1.2 x Un**
  - Voltage rise: U3 3120V (5min/day)
- **1.3 x Un**
  - Voltage rise: U4 3380V (1min/day)
- **Surge voltage**
  - Voltage rise: Us 3900V (100ms/day)

## ROUTINE TESTS

- **Test voltage Terminal/Terminal**
  - Test voltage: UT/T 3900V, DC, 10s
- **Test voltage Terminal/Casing**
  - Test voltage: UT/C 10000V, 50Hz, 60s

## OPERATING TEMPERATURE

- **Minimum ambient temperature** (Tmin): -40°C
- **Maximum ambient temperature** (Tmax): +65°C

## STORAGE TEMPERATURE

- **Minimum temperature** (Tmin): -40°C
- **Maximum temperature** (Tmax): +85°C

## TECHNOLOGY

- **Dielectric**: Polypropylene, self-healing, segmented
- **Filling material**: Resin, polyurethane dry

## DESIGN DATA:

- **Dimensions**: 340 x 175 x 980mm
- **Drawing**: 07-B-687
- **Weight**: 72kg
- **Casing material**: Stainless steel, antimagnetic
- **Paint**: RAL 7033
- **Mounting position**: All

## LIFE EXPECTANCY:

> 100000h at 60°C

## FAILURE RATE:

100 FIT

## SPECIFICATIONS:

- IEC 61071-1
- IEC 60077
- Customer specification

## DIMENSIONS

![Dimensional Drawing]

- **Bushing Type**: D-195
- **Flash over distance**: 35mm
- **Creepage Distance**: 50mm
- **Terminal**: M 12
- **Max. torque**: 20.0Nm

- **Self inductance**: Ls < 150nH
- **Series resistance**: RESR < 0.5mΩ
- **Loss factor 50Hz**: tan < 10 x 10^-4
- **Loss factor dielectric 50Hz**: tan < 2 x 10^-4
- **Overtemperature casing at 600A**: 18K
GMKPg 3.6/1114uF
Vishay ESTA

**MKP-DC-Filter Capacitors, Dry, Self-healing, Segmented**

**PART NO.**

<table>
<thead>
<tr>
<th>ART. NO.</th>
<th>GMKPg 3.6/1114uF</th>
</tr>
</thead>
<tbody>
<tr>
<td>38200</td>
<td></td>
</tr>
</tbody>
</table>

**NOMINAL RATINGS**

- Capacitance/Tolerance: Cn 1114uF ± 8%
- Rated voltage: Un 3600VDC

**OVER VOLTAGES ACCORDING IEC 61071-1**

- 1.1 x Un: U1 3960V (30% of the working time)
- 1.15 x Un: U2 4140V (30min/day)
- 1.2 x Un: U3 4320V (5min/day)
- 1.3 x Un: U4 4680V (1min/day)
- Surge voltage: Us 5400V (100ms/day)

**Voltage rate of rise**: du/dt 50V/µs
**Rated current**: In 160A
**Peak current**: Is 55.7kA

**Self Inductance**: Ls < 150nH
**Series resistance**: RESR < 2.0mΩ

**Loss factor 50Hz**: tan δ < 10 x 10^-4
**Loss factor diel. 50Hz**: tan δ < 2 x 10^-4

**ROUTINE TESTS**

- Test voltage Terminal/Terminal: UT/T 5400V, DC, 10s
- Test voltage Terminal/Casing: UT/C 10000V, 50Hz, 60s

**OPERATING TEMPERATURE**

- Minimum ambient temperature: Tmin - 40°C
- Maximum ambient temperature: Tmax + 60°C

**STORAGE TEMPERATURE**

- Minimum temperature: Tmin - 40°C
- Maximum temperature: Tmax + 85°C

**TECHNOLOGY**

- Dielectric: Polypropylene, self-healing
- Filling material: Resin, polyurethane

**BUSHING**

- Type: D-229
- Flash over distance: 47mm
- Creepage Distance: 90mm
- Terminal: M 16
- Max. torque: 25.0Nm

**DESIGN DATA**

- Dimensions: 340 x 175 x 671mm
- Drawing: 07-B-779
- Weight: 55kg
- Casing material: Stainless steel, antimagnetic
- Paint: RAL 7033
- Mounting position: All

**LIFE EXPECTANCY:** > 100000h at 60°C

**FAILURE RATE:** 300 FIT

**SPECIFICATIONS:**

- IEC 61071-1
- IEC 60077
- customer specification

**DIMENSIONS**

[Diagram of the capacitor dimensions]
PART NO. GMKPg 4.05/1000uF
ART. NO. 31817

NOMINAL RATINGS
Capacitance/Tolerance Cn 1000uF ± 5%
Rated voltage Un 4050VDC

OVER VOLTAGES ACCORDING IEC 61071-1
1.1 x Un U1 4455V (30% of the working time)
1.15 x Un U2 4658V (30min/day)
1.2 x Un U3 4860V (5min/day)
1.3 x Un U4 5265V (1min/day)
Surge voltage Us 6075V (100ms/day)

Voltage rate of rise du/dt 80V/µs
Rated current In 240A
Peak current Is 80kA

Self Inductance Ls < 50nH
Series resistance RESR < 1.0mΩ
Loss factor 50Hz tan < 10 x 10^-4
Loss factor diel. 50Hz tan < 2 x 10^-4

ROUTINE TESTS
Test voltage Terminal/Terminal UT/T 6075V, DC, 10s
Test voltage Terminal/Casing UT/C 10000V, 50Hz, 60s
Measurement of capacitance
Measurement of loss factor

OPERATING TEMPERATURE
Minimum ambient temperature Tmin - 50°C
Maximum ambient temperature Tmax + 75°C

STORAGE TEMPERATURE
Minimum temperature Tmin - 50°C
Maximum temperature Tmax + 85°C

TECHNOLOGY
Dielectric Polypropylene, self-healing segmented
Filling material Resin, polyurethane dry

BUSHING
Type D-195
Flash over distance 35mm
Creepage Distance 50mm
Terminal M 12
Max. torque 20.0Nm

DESIGN DATA
Dimensions: 340 x 175 x 700mm
Drawing: 07-B-706
Weight: 54kg
Casing material: Stainless steel, antimagnetic
Paint: RAL 7033
Mounting positions: All

LIFE EXPECTANCY: > 100000h

FAILURE RATE: 100 FIT

SPECIFICATIONS: IEC 61071-1
IEC 60077
customer specification

DIMENSIONS

Document Number: 13070 www.vishay.com
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MKP-DC-Filter Capacitors, Dry, Self-healing, Segmented

PART NO. GMKPg 10.0/128.6uF ART. NO. 31760

NOMINAL RATINGS

<table>
<thead>
<tr>
<th>Capacitance/Tolerance</th>
<th>Cn</th>
<th>128.6uF ± 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage</td>
<td>Un</td>
<td>10000VDC</td>
</tr>
</tbody>
</table>

OVER VOLTAGES ACCORDING IEC 61071-1

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Un</th>
<th>Voltage</th>
<th>Un</th>
<th>Voltage</th>
<th>Un</th>
<th>Voltage</th>
<th>Un</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 x</td>
<td>U1</td>
<td>11000V</td>
<td>(30% of the</td>
<td>working time)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.15 x</td>
<td>U2</td>
<td>11500V</td>
<td>(30min/day)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2 x</td>
<td>U3</td>
<td>12000V</td>
<td>(5min/day)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3 x</td>
<td>U4</td>
<td>13000V</td>
<td>(1min/day)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surge</td>
<td>Us</td>
<td>15000V</td>
<td>(100ms/day)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Voltage rate of rise du/dt 150V/µs
Rated current In 100A
Peak current Is 19.3kA

Self Inductance Ls < 400nH
Series resistance RESR < 5.0mΩ
Loss factor 50Hz tan < 10 x 10^-4
Loss factor diel. 50Hz tan < 2 x 10^-4

ROUTINE TESTS

| Test voltage | Terminal/Terminal | UT/T | 17500V, DC, 10s |
| Test voltage | Terminal/Casing   | UT/C | 28000V, 50Hz, 60s |

Measurement of capacitance
Measurement of loss factor

OPERATING TEMPERATURE

Minimum ambient temperature Tmin - 25°C
Maximum ambient temperature Tmax + 50°C

STORAGE TEMPERATURE

Minimum temperature Tmin - 40°C
Maximum temperature Tmax + 85°C

TECHNOLOGY

Dielectric Polypropylene, self-healing segmented
Filling material Resin, polyurethane dry

BUSHING

<table>
<thead>
<tr>
<th>Type</th>
<th>D-173</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flash over distance</td>
<td>81mm</td>
</tr>
<tr>
<td>Creepage Distance</td>
<td>98mm</td>
</tr>
<tr>
<td>Terminal</td>
<td>M 12</td>
</tr>
<tr>
<td>Max. torque</td>
<td>15.5Nm</td>
</tr>
</tbody>
</table>

DESIGN DATA

Dimensions: 485 x 175 x 750mm
Drawing: 07-B-719
Weight: 80kg
Casing material: Stainless steel, antimagnetic
Paint: RAL 7033
Mounting positions: All

LIFE EXPECTANCY: > 200000h at 50°C

FAILURE RATE: 300 FIT

SPECIFICATIONS:

IEC 61071-1
IEC 60077
customer specification

DIMENSIONS

[Diagram of MKP-DC-Filter Capacitors, Dry, Self-healing, Segmented]
MKP-DC-Filter Capacitors, Dry, Self-Healing, Segmented

TUBULAR CASE

GENERAL
The capacitors are mounted in deep-drawn aluminum round cases. A multiplicity of sizes, up to a maximum diameter of 84mm, are available.

In the connection area, covers made of brass or aluminum and screwed or soldered-on terminals are fitted.

For special types of application, capacitors in plastic cases can be offered.

Please see appropriate datasheets for different styles.

NOMINAL RATINGS
Capacitance / tolerance CN up to 1mF
Rated DC voltage UN up to 5kVDC
Nominal current IN up to 80A
Peak current Is up to 20kA
Self inductance Ls >= 30nH
Loss factor dielectric tan < 2x10^-4

OVERVOLTAGES ACCORDING IEC 61071-1
1.15 x Un (30min/day) U1
1.2 x Un (5min/day) U2
1.3 x Un (1min/day) U3
1.5 x Un (100ms/day) U4

ROUTINE TESTS
Test voltage Term./Term UT/T 1.5*UN, DC, 10s
Test voltage Term./Casing UT/C min. 2*Ui + 1000V, 50Hz, 10s
Measurement of capacitance
Measurement of loss factor

OPERATING TEMPERATURE
Minimum ambient temperature T<sub>min</sub> up to -40°C
Maximum ambient temperature T<sub>max</sub> up to +70°C

STORAGE TEMPERATURE
Minimum temperature T<sub>min</sub> - 40°C
Maximum temperature T<sub>max</sub> + 85°C

TECHNOLOGY
Dielectric Polypropylene, self-healing
Filling material Resin, polyurethane dry

DESIGN DATA
Case Material: Aluminum
Mounting positions: All

LIFE EXPECTANCY: > 100000h

FAILURE RATE: 300 FIT

SPECIFICATIONS:
IEC 1071-1
EN 61071-1
customer specification
## GMKPg 900-500 IBY

**Vishay ESTA**

### MKP-DC-Filter Capacitors, Dry, Self-healing, Segmented

<table>
<thead>
<tr>
<th>NOMINAL RATINGS</th>
<th>GMKPg 900-500 IBY</th>
<th>44374</th>
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</thead>
<tbody>
<tr>
<td>PART NO.</td>
<td>ART. NO.</td>
<td></td>
</tr>
<tr>
<td>Capacitance/Tolerance</td>
<td>Cn 500uF ± 5%</td>
<td></td>
</tr>
<tr>
<td>Rated voltage</td>
<td>Un 900VDC</td>
<td></td>
</tr>
</tbody>
</table>

### OVER VOLTAGES ACCORDING IEC 61071-1

- **1.1 x Un**
  - U1 990V (30% of the working time)

- **1.15 x Un**
  - U2 1035V (30min/day)

- **1.2 x Un**
  - U3 1080V (5min/day)

- **1.3 x Un**
  - U4 1170V (1min/day)

- **1.5 x Un**
  - U4 1350V (100ms/day)

### DESIGN DATA

- **Type**
  - D-214

- **Flash over distance**
  - 11mm

- **Creepage Distance**
  - 16mm

- **Connection**
  - bolt M 8

- **Max. torque**
  - 8Nm

- **Dimensions**
  - 84.4 x 190mm

- **Drawing**
  - 20-B-068

- **Weight**
  - 1.00kg

- **Casing Material**
  - Aluminum

- **Mounting positions**
  - All

### SPECIFICATIONS

- **IEC 61071-1**

### OPERATING TEMPERATURE

- **Minimum ambient temperature**
  - Tmin - 40°C

- **Maximum ambient temperature**
  - Tmax + 70°C

### STORAGE TEMPERATURE

- **Minimum temperature**
  - Tmin - 40°C

- **Maximum temperature**
  - Tmax + 80°C

### TECHNOLOGY

- **Dielectric**
  - Polypropylene, self-healing segmented

- **Filling material**
  - Resin, polyurethane dry

### ROUTINE TESTS

- **Test voltage Terminal/Terminal**
  - UT/T 1350V, DC, 10s

- **Test voltage Terminal/Casing**
  - UT/C 4000V, 50Hz, 60s

- **Measurement of capacitance**

- **Measurement of loss factor**

### LIFE EXPECTANCY

- > 200000h at 60°C

### FAILURE RATE

- 300 FIT

### DIMENSIONS

![MKP-DC-Filter Capacitors, Dry, Self-healing, Segmented](image-url)
MKP-DC-Filter Capacitors, Dry, Self-healing, Segmented

**PART NO.**
GMKPg 1100-220 IBY
30496

**ART. NO.**
GMKPg 1100-220 IBY
30496

**NOMINAL RATINGS**
Capacitance/Tolerance
Cn 200uF - 2 + 3%
Rated voltage
Un 1100VDC

**OVER VOLTAGES ACCORDING IEC 61071-1**
1.1 x Un
U1 1210V (30% of the working time)
1.15 x Un
U2 1265V (30min/day)
1.2 x Un
U3 1320V (5min/day)
1.3 x Un
U4 1430V (1min/day)
1.5 x Un
U4 1650V (100ms/day)

Voltage rate of rise du/dt 25V/µs
Nominal current In 40A
Peak current Is 5.5kA
Self Inductance Ls < 45nH
Series resistance RESR < 3.0mΩ
Loss factor 50Hz tan < 3 x 10^-4
Loss factor dielectric 50Hz tan < 2 x 10^-4

**ROUTINE TESTS**
Test voltage Terminal/Terminal UT/T 1650V, DC, 10s
Test voltage Terminal/Casing UT/C 4000V, 50Hz, 60s
Measurement of capacitance
Measurement of loss factor

**OPERATING TEMPERATURE**
Minimum ambient temperature Tmin - 40°C
Maximum ambient temperature Tmax + 70°C

**STORAGE TEMPERATURE**
Minimum temperature Tmin - 40°C
Maximum temperature Tmax + 80°C

**TECHNOLOGY**
Dielectric Polypropylene, self-healing segmented
Filling material Resin, polyurethane dry

**BUSHING**
Type D-214
Flash over distance 11mm
Creepage Distance 16mm
Connection bolt M 8
Max. torque 8Nm

**DESIGN DATA**
Dimensions: 84.4 x 130mm
Drawing: 20-B-068
Weight: 0.72kg
Casing Material: Aluminum

**LIFE EXPECTANCY:** > 200000h at 50°C

**FAILURE RATE:** 200 FIT

**SPECIFICATIONS:** IEC 61071-1

**DIMENSIONS**
GMKPg 1200-300 IBY
Vishay ESTA

MKP-DC-Filter Capacitors, Dry, Self-healing, Segmented

**PART NO.**
GMKPg 1200-300 IBY
**ART. NO.** 30499

**NOMINAL RATINGS**
- Capacitance/Tolerance: Cn 300uF ± 5%
- Rated voltage: Un 1200VDC

**OVER VOLTAGES ACCORDING IEC 61071-1**
- 1.1 x Un U1 1320V (30% of the working time)
- 1.15 x Un U2 1385V (30min/day)
- 1.2 x Un U3 1440V (5min/day)
- 1.3 x Un U4 1560V (1min/day)
- 1.5 x Un U4 1800V (100ms/day)

**Voltage rate of rise**
- du/dt 25V/μs

**Nominal current**
- In 50A

**Peak current**
- Is 7.5kA

**Self Inductance**
- Ls < 40nH

**Series resistance**
- RESR < 3.0mΩ

**Loss factor 50Hz**
- tan < 5 x 10^-4

**Loss factor diel. 50Hz**
- tan < 2 x 10^-4

**ROUTINE TESTS**
- Test voltage Terminal/Terminal UT/T 1800V, DC, 10s
- Test voltage Terminal/Casing UT/C 4000V, 50Hz, 60s

**Measurement of capacitance**
**Measurement of loss factor**

**OPERATING TEMPERATURE**
- Minimum ambient temperature: Tmin - 40°C
- Maximum ambient temperature: Tmax + 70°C

**STORAGE TEMPERATURE**
- Minimum temperature: Tmin - 40°C
- Maximum temperature: Tmax + 80°C

**TECHNOLOGY**
- Dielectric: Polypropylene, self-healing segmented
- Filling material: Resin, polyurethane dry

**BUSHING**
- Type: D-214
- Flash over distance: 11mm
- Creepage Distance: 16mm
- Connection: bolt M 8
- Max. torque: 8Nm

**DESIGN DATA**
- Dimensions: 84.4 x 190mm
- Drawing: 20-B-068
- Weight: 1.00kg
- Case Material: Aluminum
- Mounting position: All

**LIFE EXPECTANCY:**
- > 200000h at 50°C

**FAILURE RATE:**
- 300 FIT

**SPECIFICATIONS:**
- IEC 61071-1

**DIMENSIONS**

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Document Number: 13075
Revision 24-Jun-03
MKP-DC-Filter Capacitors, Dry, Self-Healing, Segmented

RECTANGULAR CASE:
SPACE BETWEEN TERMINALS 37.5MM

OVERVOLTAGES ACCORDING IEC 61071-1
1.15 x Un (30min/day) U1
1.2 x Un (5min/day) U2
1.3 x Un (1min/day) U3
1.5 x Un (100ms/day) U4

ROUTINE TESTS
Test voltage Terminal/Terminal UT/T 1.5*UN, DC, 10s
Test voltage Terminal/Casing UT/C -
Measurement of capacitance
Measurement of loss factor

OPERATING TEMPERATURE
Minimum ambient temperature Tmin up to - 40°C
Maximum ambient temperature Tmax up to + 75°C

STORAGE TEMPERATURE
Minimum temperature Tmin - 40°C
Maximum temperature Tmax + 85°C

TECHNOLOGY
Dielectric Polypropylene, self-healing segmented
Filling material Resin, polyurethane dry

DESIGN DATA
Case Material: Plastic (ABS) blank
Mounting position: All

LIFE EXPECTANCY > 100000h

FAILURE RATE: 300 FIT

SPECIFICATIONS:
IEC 61071-1
EN 61071-1 customer specification

GENERAL
These capacitors were developed for mounting on printed circuit boards. Their outstanding features are a compact structural shape and high mechanical stability.

This series of capacitors is available in a plastic case only and the standard dimensions of the casing is 42 x 28 x 40mm. Upon request, casings of other dimensions can be supplied.

The pin connections have a wire diameter of 1.2mm and their raster dimension is 37.5mm. The 2-pin version is the standard, however, a 4-pin version can also be provided upon request.

Please see appropriate Data sheets showing examples of possible capacitor designs.

GENERAL TECHNICAL DATA

NOMINAL RATINGS
Capacitance / tolerance CN up to 18uF ± 10%
Rated DC voltage UN up to 1200VDC
Nominal current IN up to 4A
Peak current Is up to 10kA
Self inductance Ls > = 30nH
Loss factor diel. 50Hz tan < 2x10^-4

REFERENCES
MKP-DC-Filter Capacitors, Dry, Self-healing, Segmented

PART NO. GMKPg 450/18/37.5
ART. NO. 38410

NOMINAL RATINGS
Capacitance/Tolerance Cn 18uF ± 10%
Rated voltage Un 450VDC

OVER VOLTAGES ACCORDING IEC 61071-1
1.1 x Un U1 495V (30% of the working time)
1.15 x Un U2 518V (30min/day)
1.2 x Un U3 540V (5min/day)
1.3 x Un U4 585V (1min/day)
1.5 x Un U4 675V (100ms/day)

Voltage rate of rise du/dt 55V/µs
Nominal current In 4.0A
Peak current Is 10kA
Self Inductance Ls < 30nH

Series resistance RESR < 5.0mΩ
Loss factor 50Hz tan < 3 x 10^-4
Loss factor diel. 50Hz tan < 2 x 10^-4

ROUTINE TESTS
Test voltage Terminal/Terminal UT/T 675V, DC, 10s
Test voltage Terminal/Casing UT/C -
Measurement of capacitance
Measurement of loss factor

OPERATING TEMPERATURE
Minimum ambient temperature Tmin - 40°C
Maximum ambient temperature Tmax + 70°C

STORAGE TEMPERATURE
Minimum temperature Tmin - 40°C
Maximum temperature Tmax + 85°C

TECHNOLOGY
Dielectric Polypropylene, self-healing segmented
Filling material Resin, polyurethane dry

BUSHING
Number of pins 2
pin distance 37.5 ± 0.4mm
length of pins 4.0 ± 0.5mm
diameter of pins 1.2 ± 0.05mm

DESIGN DATA
Dimensions: 42 x 28 x 40mm
Drawing: 20-B-084
Weight: 0.1kg
Case Material: Plastic (ABS)
Mounting position: All

LIFE EXPECTANCY: > 100000h at 70°C

FAILURE RATE: 300 FIT

SPECIFICATION: IEC 61071-1

DIMENSIONS
# MKP-DC-Filter Capacitors, Dry, Self-healing, Segmented

**PART NO.**

<table>
<thead>
<tr>
<th>ART. NO.</th>
<th>GMKPg 1200/6.8/37.5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>44725</td>
</tr>
</tbody>
</table>

## NOMINAL RATINGS

- **Capacitance/Tolerance (Cn):** 6.8µF ± 10%
- **Rated voltage (Un):** 1200VDC

## OVER VOLTAGES ACCORDING IEC 61071-1

- **1.1 x Un (U1):** 1320V (30% of the working time)
- **1.15 x Un (U2):** 1380V (30min/day)
- **1.2 x Un (U3):** 1440V (5min/day)
- **1.3 x Un (U4):** 1560V (1min/day)
- **1.5 x Un (U4):** 1800V (100ms/day)

## Voltage rate of rise (du/dt)

**55V/µs**

## Nominal current (In)

**2.0A**

## Peak current (Is)

**10kA**

## Self Inductance (Ls)

< 30nH

## Series resistance (RESR)

< 5.0mΩ

## Loss factor 50Hz

**tan < 3 x 10^-4**

## Loss factor diel. 50Hz

**tan < 2 x 10^-4**

## ROUTINE TESTS

- **Test voltage Terminal/Terminal (UT/T):** 1800V, DC, 10s
- **Test voltage Terminal/Casing:** -

## OPERATING TEMPERATURE

- **Minimum ambient temperature (Tmin):** -40°C
- **Maximum ambient temperature (Tmax):** +70°C

## STORAGE TEMPERATURE

- **Minimum temperature:** Tmin - 40°C
- **Maximum temperature:** Tmax + 85°C

## TECHNOLOGY

- **Dielectric:** Polypropylene, self-healing
- **Segmented:**
- **Filling material:** Resin, polyurethane, dry

## BUSHING

- **Number of pins:** 2
- **Pin distance:** 37.5 ± 0.4mm
- **Length of pins:** 4.0 ± 0.5mm
- **Diameter of pins:** 1.2 ± 0.05mm

## DESIGN DATA

- **Dimensions:** 42 x 28 x 40mm
- **Drawing:** 20-B-084
- **Weight:** 0.1kg
- **Case Material:** Plastic (ABS)

## Mounting position:

All

## LIFE EXPECTANCY

**> 100000h at 70°C**

## FAILURE RATE:

**300 FIT**

## SPECIFICATIONS:

IEC 61071-1

## DIMENSIONS

![Dimensions Diagram](image-url)
MKP-AC Filter Capacitors General Information

Vishay ESTA

MKP-AC-Filter Capacitors, Self-healing, Dry

VOLTAGE RANGE: UP TO 1.4kV
CAPACITANCE RANGE: UP TO 5mF

MAIN CHARACTERISTICS
- 1-phase-, delta- and star connected
- Lowest volume at maximum power
- Flexible mechanical design

APPLICATIONS
These capacitors are mainly used as harmonic filters in frequency converters however, they are also suitable for a variety of power factor correction applications in general drive and system technology products.

The MKP-type capacitors described in this catalogue are suitable for rated voltages up to 1.4kV. For applications requiring capacitor voltages above 1.4kV, oil-impregnated film capacitors should be used. The capacitors manufactured by Vishay ESTA which use this technology are described in detail in a separate catalogue which can be provided on request.

DESIGN
The range comprises both single-phase and three-phase capacitors with delta and star connections. Also available are versions in a soldered rectangular or in round aluminum cases.

The specific mechanical design of the different versions is described in detail in the appropriate datasheets, in principle, however, the capacitors are custom manufactured for individual applications in accordance with the customer’s requirements.

Please see the request for quotation form

In addition to the capacitors listed in this catalogue, there exists a standard product line for power factor correction capacitors in the voltage range 230V to 690V, also in single-phase and three-phase design. This catalogue can be sent on request.

TECHNOLOGY
Metallized polypropylene film (MKP) is used for the dielectric. (for explanations, refer to general information document number 13017). This dielectric is particularly characterized by a low loss factor and by a very high voltage loading capacity. Highest current loading capacity for all capacitors is guaranteed by both specific procedures at the production of the film and the optimized internal construction of the capacitor.

The capacitors in the rectangular casing contain a firm filler (for full description see general information document number 13017). A pressure switch is incorporated for the capacitors’ protection. In case of an inadmissible increase of pressure due to a defect or at the end of service life, the signal given by the pressure switch should be understood as indication that the capacitor has to be disconnected from the network.

The capacitors in a round aluminum case contain oil or a gaseous filler. An overpressure tear-off fuse (for explanations, refer to general information) will disconnect the capacitor from the network in case of a defect.

The capacitors in a round aluminum case containing resin-filler are not tear-off fused. Safety of these capacitors is determined only by the self-healing performance of the metallized polypropylene film.
MKP-AC Rectangular Case General Information

MKP-AC-Filter Capacitors, Self-healing, Dry

General

These capacitors are mounted into welded stainless steel cases. The standard dimensions for the cases are 340mm x 175mm, or 340mm x 135mm. The maximum case height is 1200mm. Deviations from these dimensions are available by special order and the capacitors can also be adapted to most different mounting conditions required by the customer.

Fastening brackets may be attached to the casing in accordance with the customer’s request, taking into account that the capacitor’s narrow faces are to be given preference for the fastening.

Various types of screw type terminals are available for the electrical connection. Depending on the type of application, either plastic terminals or ceramic terminals are used.

Please see appropriate data sheets giving examples of possible capacitor designs.

General Technical Data

Ratings

<table>
<thead>
<tr>
<th>Capacitance/Tolerance</th>
<th>Cn</th>
<th>4000uF ± 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated power</td>
<td>Qn</td>
<td>up to 400kvar</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>Un</td>
<td>up to 1400Vrms</td>
</tr>
</tbody>
</table>

Overvoltages According IEC 608711 / 60831-1

<table>
<thead>
<tr>
<th>Voltage (Un)</th>
<th>U1</th>
<th>(12 Std/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 x Un</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.15 x Un</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2 x Un</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3 x Un</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Routine Tests

<table>
<thead>
<tr>
<th>Test Voltage</th>
<th>Ut/t</th>
<th>2.15*Un V, AC, 10s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Voltage</td>
<td>Ut/c</td>
<td>Ui V, AC, 60s</td>
</tr>
</tbody>
</table>

Operating Temperature

| Minimum Ambient Temperature | Tmin | up to - 40°C |
| Maximum Ambient Temperature | Tmax | up to + 70°C |

Storage Temperature

| Minimum Temperature | Tmin | - 40°C |
| Maximum Temperature | Tmax | + 85°C |

Technology

Dielectric: Polypropylene film, metallized, self-healing
Filling material: resin, polyurethane dry
Safety system: overpressure monitoring device

Casing

Case material: stainless steel, antimagnetic
Paint: RAL 7033
Mounting positions: vertical, horizontal
Life time failure rate: > 200000h at 60°C 300 FIT

Specifications

IEC 60831-1, IEC 60871-1 customer specification
**MKP-AC-Filter Capacitors, Self-healing, Dry**

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>PhMKPg 440-1248uF/3</th>
</tr>
</thead>
<tbody>
<tr>
<td>ART. NO.</td>
<td>44534</td>
</tr>
</tbody>
</table>

**RATINGS**

- Capacitance/Tolerance: Cn \(3 \times 416\mu F \pm 5\%\)
- Rated power: Qn 76kvar
- Rated voltage: Un 440Vrms

**OVERVOLTAGES ACCORDING IEC 60871-1 60831-1**

- 1.1 x Un: U1 484V (12 Std/Tag)
- 1.15 x Un: U2 506V (30min/Tag)
- 1.2 x Un: U3 528V (5min/Tag)
- 1.3 x Un: U4 572V (1min/Tag)

**RATED FREQUENCY**

- fn 50Hz

**RATED CURRENT**

- ln 3* 123A

**PEAK CURRENT**

- Is 3* 6000A

**CAPACITANCE TERMINAL / CASING**

- Capacitance terminal / casing 10nF

**SELF INDUCTANCE**

- Ls app. 0.5uH

**SERIES RESISTANCE**

- RESR < 2.0mΩ

**LOSS FACTOR**

- tan 5 x 10^-4

**DIELECTRIC LOSS FACTOR**

- tan 2 x 10^-4

**ROUTINE TESTS**

- Test voltage terminal/terminal Ut/ 946V, AC, 10s
- Test voltage terminal/casing UT/c 6000V, AC, 60s

**OPERATING TEMPERATURE**

- Minimum ambient temperature: Tmin - 40°C
- Maximum ambient temperature: Tmax + 70°C

**STORAGE TEMPERATURE**

- Minimum temperature: Tmin - 40°C
- Maximum temperature: Tmax + 85°C

**TECHNOLOGY**

- Dielectric: Polypropylene film, metallized, self-healing
- Filling material: resin, polyurethane
- Safety system: overpressure monitoring device

**BUSHING**

- Type: D-197
- Flash over distance: 47mm
- Creepage distance: 90mm
- Connection: M 12
- Max. torque: 20.0Nm

**CASING**

- Dimensions: 345 x 135 x 220mm
- Drawing: 07-B-849
- Weight: 15kg
- Case material: stainless steel, antimagnetic
- Paint: RAL 7033
- Mounting position: All

**LIFE TIME**

- > 200000h at 60°C 300 FIT

**FAILURE RATE**

- SPECIFICATION: IEC 60831-1

**DIMENSIONS**

- [Diagram showing dimensions]
**MKP-AC-Filter Capacitors, Self-healing, Dry**

**PART NO.** PhMKPg 690-1600uF  
**ART. NO.** 44503

**RATINGS**
- Capacitance/Tolerance: Cn 1600uF ± 5%
- Rated power: Qn 404kvar
- Rated voltage: Un 690Vrms

**OVERVOLTAGES ACCORDING IEC 60831-1**
- 1.1 x Un: U1 759V (12 Std/day)
- 1.15 x Un: U2 794V (30min/day)
- 1.2 x Un: U3 828V (5min/day)
- 1.3 x Un: U4 897V (1min/day)

**RATED FREQENCY** fn 50Hz  
**RATED CURRENT** In 350A  
**PEAK CURRENT** Is 25kA  
**CAPACITANCE TERMINAL / CASING** 10nF  
**SELF INDUCTANCE** Ls app. 0.5uH  
**SERIES RESISTANCE** RESR < 2.0mΩ  
**LOSS FACTOR 50 Hz** tan < 5 x 10^-4  
**DIELECTRIC LOSS FACTOR 50 Hz** tan < 2 x 10^-4

**ROUTINE TESTS**
- Test voltage terminal/terminal: Ut/ 1484V, AC, 10s
- Test voltage terminal/casing: UT/c 6000V, AC, 60s
- Measurement of capacitance
- Measurement of loss factor

**OPERATING TEMPERATURE**
- Minimum ambient temperature: Tmin - 40°C
- Maximum ambient temperature: Tmax + 60°C

**STORAGE TEMPERATURE**
- Minimum temperature: Tmin - 40°C
- Maximum temperature: Tmax + 85°C

**TECHNOLOGY**
- Dielectric: Polypropylene film, metallized, self-healing
- Filling material: resin, polyurethane dry
- Safety system: overpressure monitoring device

**BUSHING**
- Type: D-197
- Flash over distance: 47mm
- Creepage distance: 90mm
- Connection: M 12
- Max. torque: 20.0Nm
MKP-AC Tubular Case with Fuse General Information

Vishay ESTA

MKP-AC-Filter Capacitors, Dry, Self-healing, With Fuse

TUBULAR CASINGS

GENERAL
The capacitors are mounted in deep-drawn aluminum round case. A multiplicity of dimensions, up to a maximum diameter of 84mm, are available.

At the connection area, covers made of brass or aluminum and screwed-on or soldered-on terminals are fitted.

See appropriate data sheets giving examples of possible capacitor designs.

GENERAL TECHNICAL DATA

RATINGS
Capacitance/Tolerance Cn up to 900 uF ± 10%
Rated power Qn up to 30kvar
Rated voltage Un up to 1400Vrms

OVERVOLTAGES ACCORDING IEC 60871-1 / 60831-1
1.1 x Un U1 (12 Std/day)
1.15 x Un U2 (30min/day)
1.2 x Un U3 (5min/day)
1.3 x Un U4 (1min/day)
Rated frequency fn 50/60Hz
Rated current In up to 80A
Peak current Is up to 1000A
Series resistance RESR < 3.0mΩ
Loss factor 50 Hz tan < 5 x 10^-4
Dielectric loss factor 50 Hz tan < 2 x 10^-4

ROUTINE TESTS
Test voltage terminal/terminal Ut/t 2.15* Un V, AC, 10s
Test voltage terminal/casing UT/c Ui*) V, AC, 60 s
Measurement of capacitance
Measurement of loss factor

OPERATING TEMPERATURE
Minimum ambient temperature Tmin up to - 40°C
Maximum ambient temperature Tmax up to + 70°C

STORAGE TEMPERATURE
Minimum temperature Tmin - 40°C
Maximum temperature Tmax + 85°C

TECHNOLOGY
Dielectric Polypropylene film, metallized, self-healing
Filling material inert gas
Safety system tear off fuse

CASING
Casing material aluminum
Mounting position vertical, horizontal

LIFE TIME
Failure rate > 200000h at 60°C 300 FIT

RECOMMENDATION
IEC 60871-1/60831-1, customer specification
*) according IEC and VDE standard
MKP-AC-Filter Capacitors, Dry, Self-healing, With Fuse

**PART NO.** PhMKPg 1400-33IB
**ART. NO.** 45445

**RATINGS**
- **Capacitance/Tolerance** $C_n = 33 \mu F \pm 10\%$
- **Rated power** $Q_n = 20 \text{kvar}$
- **Rated voltage** $U_n = 1400 \text{Vrms}$

**OVERVOLTAGES ACCORDING IEC 60871-1**
- $1.1 \times U_n$ $U_1 = 1540 \text{V} (12 \text{ Std/day})$
- $1.15 \times U_n$ $U_2 = 1610 \text{V} (30\text{min/day})$
- $1.2 \times U_n$ $U_3 = 1680 \text{V} (5\text{min/day})$
- $1.3 \times U_n$ $U_4 = 1820 \text{V} (1\text{min/day})$

**RATED FREQUENCY/CURRENT**
- **Rated frequency** $f_n = 50 \text{Hz}$
- **Rated current** $I_n = 55 \text{A}$
- **Peak current** $I_s = 300 \text{A}$

**Series resistance** $\text{RESR} < 6.0 \text{m\Omega}$

**Loss factor 50Hz** $\tan \delta < 5 \times 10^{-4}$

**Dielectric loss factor 50Hz** $\tan \delta < 2 \times 10^{-4}$

**ROUTINE TESTS**
- **Test voltage terminal/terminal** $U/t = 3010 \text{V, AC, 10s}$
- **Test voltage terminal/casing** $U/T/c = 6000 \text{V, AC, 60s}$

Measurement of capacitance
Measurement of loss factor

**OPERATING TEMPERATURE**
- **Minimum ambient temperature** $T_{\text{min}} = -40 \degree \text{C}$
- **Maximum ambient temperature** $T_{\text{max}} = +60 \degree \text{C}$

**STORAGE TEMPERATURE**
- **Minimum temperature** $T_{\text{min}} = -40 \degree \text{C}$
- **Maximum temperature** $T_{\text{max}} = +85 \degree \text{C}$

**TECHNOLOGY**
- **Dielectric** Polypropylene film, metallized, self-healing
- **Filling material** inert gas
- **Safety system** tear off fuse

**BUSHING**
- **Type** D-138
- **Flash over distance** 16mm
- **Creepage distance** 23mm
- **Connection** M 10
- **Max. torque** 10.0Nm

**CASING**
- **Dimension** 84.4 * 340mm
- **Drawing** 20-B-010
- **Weight** 2.5kg
- **Casing material** aluminum
- **Mounting position** vertical, horizontal

**LIFE TIME**
- > 200000h at 60\degree \text{C} 300 FIT

**FAILURE RATE**

**RECOMMENDATION**
- IEC 60871-1
customer specification

**DIMENSIONS**
MKP-AC-Filter Capacitors, Dry, Self-healing, With Fuse

PART NO. PhMKPg 440.3.30
ART. NO. 35470

RATINGS
Capacitance/Tolerance Cn 3 x 164.4uF ± 10%
Connection 3 phase, delta
Rated power Qn 30kvar
Rated voltage Un 440Vrms

OVERVOLTAGES ACCORDING IEC 60871-1  60831-1
1.1 x Un U1 484V (12 Std/day)
1.15 x Un U2 506V (30min/day)
1.2 x Un U3 528V (5min/day)
1.3 x Un U4 572V (1min/day)

Rated frequency fn 50Hz
Rated current In 3* 40A
Peak current Is 3*300A

Series resistance RESR < 7.5mΩ
Loss factor 50Hz tan < 5 x 10^-4
Dielectric loss factor 50Hz tan < 2 x 10^-4

ROUTINE TESTS
Test voltage terminal/terminal Ut/t 946V, AC, 10s
Test voltage terminal/casing Ut/c 6000V, AC, 60s

Measurement of capacitance
Measurement of loss factor

OPERATING TEMPERATURE
Minimum ambient temperature Tmin - 40°C
Maximum ambient temperature Tmax + 60°C

STORAGE TEMPERATURE
Minimum temperature Tmin - 40°C
Maximum temperature Tmax + 85°C

TECHNOLOGY
Dielectric Polypropylene film, metallized, self-healing
Filling material inert gas
Safety system tear off fuse

BUSHING
Type D-203
Flash over distance 24mm
Creepage distance 28mm
Connection M 5
Max. torque 2.0Nm

DIMENSIONS

CASING
Dimension 84.4 * 340mm
Drawing ME 131-400-007
Weight 2.5kg
Casing material aluminum
Mounting position vertical, horizontal

LIFE TIME FAILURE RATE
> 200000h at 60°C 300 FIT

RECOMMENDATION IEC 60831
customer specification

www.vishay.com
32 Document Number: 13084
Revision 24-Jun-03
MKP-AC Tubular Case Without Fuse General Information

MKP-AC-Filter Capacitors, Dry, Self-healing, Without Fuse

TUBULAR CASINGS

GENERAL
The capacitors are produced in deep-drawn aluminum round casings. A variety of different dimensions, up to a maximum diameter of 84mm and a length of 240mm, is available. In the range of the capacitor’s connection, no metal cover will be mounted. The filling material used tightens the capacitor connections hermetically against external influences.

Threaded studs M5, M6, and M8 are available for the electrical connection.

Please see appropriate data sheets showing examples of possible capacitor designs.

GENERAL TECHNICAL DATA

NOMINAL RATINGS
- Capacitance/Tolerance CN up to 600uF
- Rated power QN up to 15kvar
- Rated voltage UN up to 400Vrms

OVERVOLTAGES ACCORDING IEC 60831-1
- 1.1 x Un U1 (12 Std/day)
- 1.15 x Un U2 (30min/day)
- 1.2 x Un U3 (5min/day)
- 1.3 x Un U4 (1min/day)

- Rated frequency fn 50/60Hz
- Rated current In up to 50A
- Peak current Is up to 6000A
- Series resistance RESR < 3.0mΩ
- Loss factor 50Hz tand < 3*10^-4
- Dielectric loss factor 50Hz tand < 2*10^-4

ROUTINE TESTS
- Test voltage terminal/terminal UT/T 2,15* Un VAC, 10s
- Test voltage terminal/casing UT/C Ui*)VAC, 2s
- Measurement of capacitance
- Measurement of loss factor

OPERATING TEMPERATURE
- Minimum ambient temperature Tmin - 25°C
- Maximum ambient temperature Tmax + 75°C

STORAGE TEMPERATURE
- Minimum temperature Tmin - 40°C
- Maximum temperature Tmax + 85°C

TECHNOLOGY
- Dielectric Polypropylene, self-healing
- Filling material resin, polyurethane dry

DESIGN DATA
- Case material aluminum
- Mounting position every position

LIFE EXPECTANCY
- > 100000 Std

FAILURE RATE
- 300 FIT

RECOMMENDATION
- IEC 60831-1
- VDE 0560/46

*) according IEC and VDE standard
MKP-AC-Filter Capacitors, Dry, Self-healing, Without Fuse

**RECTANGULAR CASE:**
SPACING BETWEEN TERMINALS 37.5MM

**GENERAL**
The capacitors are mounted into welded stainless steel casings. The standard dimensions for the cases are 340mm x 175mm, or 340mm x 135mm. The maximum standard case height is 1200mm. Deviating from these dimensions, the capacitors can also be adapted to many different mounting configurations as required by the customer.

Fastening brackets may be attached to the casing in accordance with the customer’s request, taking into account that the capacitor’s narrow faces are preferred for the fastening.

Various types of screw-type terminals are available for the electrical connection. Depending on the type of application, either plastic terminals or ceramic terminals can be mounted.

Please see the appropriate Vishay ESTA data sheets giving examples of possible capacitor designs.

**GENERAL TECHNICAL DATA**

**NOMINAL RATINGS**
- Capacitance / tolerance: $C_n$ up to 18uF ± 10%
- Rated power: $Q_n$ up to 0.5kvar
- Rated voltage: $U_n$ up to 400V/AC

**OVERVOLTAGES ACCORDING IEC 60831-1**
- $1.1 \times U_n$ $U_1$ (12 Std/Tag)
- $1.15 \times U_n$ $U_2$ (30min/Tag)
- $1.2 \times U_n$ $U_3$ (5min/Tag)
- $1.3 \times U_n$ $U_4$ (1min/Tag)

- Rated frequency: $f_n$ 50/60Hz
- Rated current: $I_n$ up to 4A
- Peak current: $I_s$ up to 1kA

- Series resistance: $RISE < 5 \Omega$
- Loss factor 50Hz: $\tan < 3 \times 10^{-4}$
- Dielectric loss factor: $\tan < 2 \times 10^{-4}$

**ROUTE TESTS**
- Test voltage terminal/terminal: $U_{t/t}$ $2.15 \times U_n$, AC, 10s
- Measurement of capacitance
- Measurement of loss factor

**OPERATING TEMPERATURE**
- Minimum ambient temperature: $T_{min}$ up to -40°C
- Maximum ambient temperature: $T_{max}$ up to +70°C

**STORAGE TEMPERATURE**
- Minimum temperature: $T_{min}$ up to -40°C
- Maximum temperature: $T_{max}$ up to +85°C

**INTERNAL DESIGN**
- Dielectric: Polypropylene, self-healing
- Filling material: Resin, polyurethane dry

**DESIGN DATA**
- Case material: Plastic (ABS), black
- Mounting position: Every position

**LIFE EXPECTANCY**
- > 100000h

**FAILURE RATE**
- 300 FIT
MKP-AC-Filter Capacitors, Dry, Self-healing, Without Fuse

**PART NO.**  PhMKP 250-200 IBR/X  **ART. NO.**  44546

**RATINGS**
- Capacitance / tolerance: $C_n = \pm 10\%$
- Rated power: $Q_n = 4\text{kvar}$
- Rated voltage: $U_n = 250\text{Vrms}$

**OVERVOLTAGES ACCORDING IEC 60831-1**
- $1.1 \times U_n$: $U_1 = 275\text{V (12 Std/day)}$
- $1.15 \times U_n$: $U_2 = 288\text{V (30min/day)}$
- $1.2 \times U_n$: $U_3 = 300\text{V (5min/day)}$
- $1.3 \times U_n$: $U_4 = 325\text{V (1min/day)}$

**RATED FREQUENCY**
- $f_n = 50\text{Hz}$

**RATED CURRENT**
- $I_n = 16\text{A}$
- Peak current: $I_s = 2\text{kA}$

**Series resistance**
- $\text{RESR} < 3.0\text{m}\Omega$

**LOSS FACTOR 50Hz**
- $\tan \alpha < 3 \times 10^{-4}$

**DIELECTRIC LOSS FACTOR 50Hz**
- $\tan \delta < 2 \times 10^{-4}$

**ROUTINE TESTS**
- Test voltage terminal/terminal: $U/t = 946\text{V, AC, 10s}$
- Test voltage terminal/casing: $U/t = 6000\text{V, AC, 2s}$

**OPERATING TEMPERATURE**
- Minimum ambient temperature: $T_{\text{min}} = -25\degree\text{C}$
- Maximum ambient temperature: $T_{\text{max}} = +75\degree\text{C}$

**STORAGE TEMPERATURE**
- Minimum temperature: $T_{\text{min}} = -40\degree\text{C}$
- Maximum temperature: $T_{\text{max}} = +80\degree\text{C}$

**TECHNOLOGY**
- Dielectric: Polypropylene film, metallized, self-healing
- Filling material: resin, polyurethane dry

**BUSHING**
- Flash over distance: 13mm
- Creepage distance: 13mm
- Connection: M6
- Max. torque: 5Nm
PhMKP 250-600 IBR
Vishay ESTA

MKP-AC-Filter Capacitors, Dry, Self-healing, Without Fuse

PART NO.  PhMKP 250-600 IBR
ART. NO.  33385

RATINGS
Capacitance/Tolerance  Cn  600uF ± 10%
Rated power  Qn  11.8kvar
Rated voltage  Un  250Vrms

OVERVOLTAGES ACCORDING IEC 60831-1
1.1 x Un  U1  275V (12 Std/day)
1.15 x Un  U2  288V (30min/day)
1.2 x Un  U3  300V (5min/day)
1.3 x Un  U4  325V (1min/day)
Voltage rate of rise  du/dt  50V/us
Rated current  In  48A
Peak current  Is  6kA
Series resistance  RESR  < 3mΩ
Loss factor 50Hz  tan  < 3*10^-4
Dielectric loss factor  tan  < 2*10^-4

ROUTINE TESTS
Test voltage terminal/terminal  Ut/t  538V, AC, 10s
Test voltage terminal/casing  UT/c  3600V, AC, 2s
Measurement of capacitance
Measurement of loss factor

OPERATING TEMPERATURE
Minimum ambient temperature  Tmin  - 25°C
Maximum ambient temperature  Tmax  + 75°C

STORAGE TEMPERATURE
Minimum temperature  Tmin  - 40°C
Maximum temperature  Tmax  + 80°C

TECHNOLOGY
Dielectric  Polypropylene film, metallized, self-healing
Filling material  resin, polyurethane dry

BUSHING
Flash over distance  19mm
Creepage distance  19mm
Connection  M 10
Max. torque  8Nm

DESIGN DATA
Diameter  84.4mm
Height  240mm
Drawing  20-B-076
Weight  1.9kg
Casing material  aluminum
Mounting position  every position

LIFE EXPECTANCY  > 100000h
FAILURE RATE  300 FIT
RECOMMENDATION  IEC 60831-1/VDE 0560/46

DIMENSIONS
MKP-AC-Filter Capacitors, Dry, Self-healing, Without Fuse

**PART NO.** PhMKPg 250/14/37.5

**ART. NO.** 44276

**RATINGS**
- Capacitance / tolerance $C_n$ 14uF ± 10%
- Rated power $Q_n$ 0.3kvar
- Rated voltage $U_n$ 250Vrms

**OVERVOLTAGES ACCORDING IEC 60831-1**
- $1.1 \times U_n$ $U_1$ 275V (12 Std/day)
- $1.15 \times U_n$ $U_2$ 288V (30min/day)
- $1.2 \times U_n$ $U_3$ 300V (5min/day)
- $1.3 \times U_n$ $U_4$ 325V (1min/day)

**Rated frequency** $f_n$ 50Hz
**Rated current** $I_n$ 3.5A
**Peak current** $I_s$ 1kA

**Series resistance** $R_{SR}$ < 3mΩ
**Loss factor 50Hz** $\tan \phi$ < 2 x 10^-4
**Dielectric loss factor** $\tan \phi$ < 2 x 10^-4

**ROUTINE TESTS**
- Test voltage terminal/terminal $U/t$ 538V, AC, 10s
- Measurement of capacitance
- Measurement of loss factor

**OPERATING TEMPERATURE**
- Minimum ambient temperature $T_{min}$ - 40°C
- Maximum ambient temperature $T_{max}$ + 75°C

**STORAGE TEMPERATURE**
- Minimum temperature $T_{min}$ - 40°C
- Maximum temperature $T_{max}$ + 80°C

**TECHNOLOGY**
- Dielectric Polypropylene, self-healing
- Filling material resin, polyurethane dry

**BUSHING**
- Number of pins 2
- Pin distance 37.5 ± 0.4mm
- Length of pins 4.0 ± 0.5mm
- Diameter of pins 1.2 ± 0.05mm

**DESIGN DATA**
- Dimension 42 * 28 * 40mm
- Drawing 20-B-084
- Weight 0.1kg
- Casing Material plastic (ABS)
- Mounting position every position

**LIFE EXPECTANCY** > 100000h at 70°C

**FAILURE RATE** 300 FIT

**RECOMMENDATION** IEC 60831-1

**DIMENSIONS**
MKP-AC-Filter Capacitors, Dry, Self-healing, Without Fuse

PART NO. PhMKPg 400/6/37.5
ART. NO. 44727

RATINGS
Capacitance/Tolerance Cn 6uF ± 10%
Rated power Qn 0.3kvar
Rated voltage Un 400Vrms

OVERVOLTAGES ACCORDING IEC 60831-1
1.1 x Un U1 440V (12 Std/day)
1.15 x Un U2 460V (30min/day)
1.2 x Un U3 480V (5min/day)
1.3 x Un U4 520V (1min/day)

Rated frequency fn 50/60Hz
Rated current In 2A
Peak current Is 0.5kA
Series resistance RESR < 3mΩ
Loss factor 50 Hz tan < 2*10^-4
Dielectric loss factor tan < 2*10^-4

ROUTINE TESTS
Test voltage terminal/terminal Ut/t 860V, AC, 10s
Measurement of capacitance
Measurement of loss factor

OPERATING TEMPERATURE
Minimum ambient temperature Tmin - 25°C
Maximum ambient temperature Tmax + 75°C

STORAGE TEMPERATURE
Minimum temperature Tmin - 40°C
Maximum temperature Tmax + 85°C

TECHNOLOGY
Dielectric Polypropylene, self-healing,
Filling material resin, polyurethane dry

BUSHING
Number of pins 2
pin distance 37.5 ± 0.4mm
length of pins 4.0 ± 0.5mm
diameter of pins 1.2 ± 0.05mm

DESIGN DATA
Dimension 42 * 28 * 40mm
Drawing 20-B-084
Weight 0.1 kg
Casing Material plastic (ABS)
Mounting position every position

LIFE EXPECTANCY > 100000h at 70°C

FAILURE RATE 300 FIT

RECOMMENDATION IEC 60831-1

DIMENSIONS
MKP-HC, High Current Capacitors, Dry, Self-healing

VOLTAGe RANGE: UP TO 3000V
CAPACITANCE RANGE: UP TO 280µF

MAIN CHARACTERISTICS
• High rms current and peak current
• Maximum capacitance at minimum dimensions
• Radial terminals

APPLICATIONS
Capacitors of this design have been developed for all snubber applications in the power electronics, which require both a high current carrying capacity and a high capacitance.

DESIGN
The capacitors are produced in a case made of a combination of plastic and aluminum. This type of casing guarantees optimum heat dissipation. The plastic material used is fire resistant according to UL-94-VO.

The case diameter is preferably 84mm with a height varying from 55mm to 130mm. The customer’s specific requirements can also be met, when manufacturing these capacitors.

For the electrical connection, preferably four screw-type bolts are use; upon request, the capacitor can also be supplied with two connection bolts only.

Data sheets giving examples of possible capacitor designs are available and an RFQ form can be used to outline your requirements.

TECHNOLOGY
Metallized and segmented polypropylene film (MKP) is used for the dielectric. The segmentation guarantees an absolutely uncritical failure performance at the end of service life. (For explanations, refer to - general information).

For this type of application, the metallization has been optimized to the highest possible current carrying capacity at low losses. As a consequence, maximum capacitor currents up to 120A per unit are possible.

All capacitors of this design are produced in accordance with dry-type technology and are sealed with a resin filling.

The filling ensures the capacitor is absolutely leakproof and thus guarantees a consistent life expectancy in case of eventual case leakage.

GENERAL TECHNICAL DATA

<table>
<thead>
<tr>
<th>NOMINAL RATINGS</th>
<th>Capacitance/Tolerance</th>
<th>CN up to 280uF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated DC voltage</td>
<td>UN up to 3kVDC</td>
<td>UN up to 3kVDC</td>
</tr>
<tr>
<td>Rated AC voltage</td>
<td>UN up to 1.5kVAC</td>
<td>UN up to 1.5kVAC</td>
</tr>
<tr>
<td>Nominal current</td>
<td>IN up to 120A</td>
<td>IN up to 120A</td>
</tr>
<tr>
<td>Peak current</td>
<td>Is up to 50kA</td>
<td>Is up to 50kA</td>
</tr>
<tr>
<td>Self inductance</td>
<td>Ls &lt; = 30mH</td>
<td>Ls &lt; = 30mH</td>
</tr>
<tr>
<td>Loss factor diel. 50Hz</td>
<td>tan &lt; 2x10^-4</td>
<td>tan &lt; 2x10^-4</td>
</tr>
</tbody>
</table>

OVER VOLTAGES ACCORDING IEC 61071-1

<table>
<thead>
<tr>
<th></th>
<th>1.15x Un (30min/day)</th>
<th>U1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.2 x Un (5min/day)</td>
<td>U2</td>
</tr>
<tr>
<td></td>
<td>1.3 x Un (1min/day)</td>
<td>U3</td>
</tr>
<tr>
<td></td>
<td>1.5 x Un (100ms/day)</td>
<td>U4</td>
</tr>
</tbody>
</table>

ROUTINE TESTS

| Test voltage Terminal/Terminal | UT/T | 1.5 * UN, DC, 10s |
| Test voltage Terminal/Casing  | UT/C | 10000V, AC, 10s   |
| Measurement of capacitance    |      |                 |
| Measurement of loss factor    |      |                 |

THERMAL RESISTANCE

| Rth          | 3.3k/W |

OPERATING TEMPERATURE

| Minimum ambient temperature | Tmin | up to - 40°C |
| Maximum ambient temperature | Tmax | up to + 70°C |

STORAGE TEMPERATURE

| Minimum temperature | Tmin | - 50°C |
| Maximum temperature | Tmax | + 85°C |

TECHNOLOGY

Dielectric Polypropylene, self-healing, segmented
Filling material resin, polyurethane dry

DESIGN DATA

Case material plastic according to UL-94-V0 and aluminum

Mounting position every position

LIFE EXPECTANCY > 100000h

FAILURE RATE 300 FIT

RECOMMENDATION IEC 61071-1
EN 61071-1 customer specification
GMKPg 1000-42uF
Vishay ESTA

MKP-High-Current Capacitors, Dry, Selfhealing, Segmented

PART NO.    ART. NO.
GMKPg 1000-42uF  33747

NOMINAL RATINGS
Capacitance/Tolerance  Cn  42uF ± 5%
Rated voltage  Un  1000VDC
500Vrms

OVERVOLTAGES ACCORDING IEC 61071-1
1.1 x Un  U1  1100V (30% of the working time)
1.15 x Un  U2  1150V (30min/day)
1.2 x Un  U3  1200V (5min/day)
1.3 x Un  U4  1300V (1min/day)
Surge voltage  Us  1500V (100ms/day)

Voltage rate of raise  du/dt  200V/µs
Rated current  In  100A
Peak current periodical  I  8400A
Peak current non periodical  Is  20kA
Self inductance  Ls  < 16nH
Series resistance  RESR  < 0.6mΩ
Loss factor 50Hz  tan  < 5 x 10^-4
Loss factor diel. 50Hz  tan  < 2 x 10^-4
Thermal resistance  3.3k/W

ROUTINE TESTS
Test voltage terminal/terminal  UT/T  1500V, DC, 10s
Test voltage terminal/casing  UT/C  10000V, AC, 60s
Measurement of capacitance  
Measurement of loss factor  

OPERATING TEMPERATURE
Minimum ambient temperature  Tmin  - 40°C
Maximum ambient temperature  Tmax  + 70°C

STORAGE TEMPERATURE
Minimum temperature  Tmin  - 50°C
Maximum temperature  Tmax  + 85°C

TECHNOLOGY
Dielectric  Polypropylene, self-healing, segmented
Filling material  resin, polyurethane dry

BUSHING
Flash over distance  28mm
Creepage distance  40mm
Terminal  M 6
Max. torque  3.0Nm

DESIGN DATA
Dimensions  dia. 84.4 * 90mm
Drawing  20-B-078
Weight  0.6kg
Casing material  plastic according to UL-94-V0
Mounting position  every position

LIFE EXPECTANCY  > 100000h
FAILURE RATE  300 FIT

RECOMMENDATION  IEC 61071-1
IEC 60077

DIMENSIONS
MKP-High-Current Capacitors, Dry, Selfhealing, Segmented

PART NO.  GMKPg 3000-9uF
ART. NO.  44701

**NOMINAL RATINGS**
- Capacitance/Tolerance  \( C_n \) 9uF ± 5%
- Rated voltage  \( U_n \) 3000VDC 1500Vrms

**OVERVOLTAGES ACCORDING IEC 61071-1**
- \( U_1 \) 3300V (30% of the working time)
- \( U_2 \) 3450V (30min/day)
- \( U_3 \) 3600V (5min/day)
- \( U_4 \) 3900V (1min/day)
- Surge voltage  \( U_s \) 4500V (100ms/day)

**Voltage rate of rise**  \( \frac{du}{dt} \) 200V/\( \mu \)s

**Rated current**  \( I_n \) 40A

**Peak current periodical**  \( I \) 1800A

**Peak current non periodical**  \( I_s \) 10kA

**Self inductance**  \( L_s \) < 30nH

**Series resistance**  \( R_{ESR} \) < 0.8mΩ

**Loss factor** 50Hz  \( \tan \) < 5 x 10^-4

**Loss factor** diel. 50Hz  \( \tan \) < 2 x 10^-4

**Thermal resistance** 3.3k/W

**ROUTINE TESTS**
- Test voltage terminal/terminal  \( U_{TT} \) 4500V, DC, 10s
- Test voltage terminal/casing  \( U_{TC} \) 10000V, AC, 60s

**OPERATING TEMPERATURE**
- Minimum ambient temperature  \( T_{min} \) - 40°C
- Maximum ambient temperature  \( T_{max} \) + 65°C

**STORAGE TEMPERATURE**
- Minimum temperature  \( T_{min} \) - 50°C
- Maximum temperature  \( T_{max} \) + 85°C

**TECHNOLOGY**
- Dielectric  Polypropylene, self-healing segmented
- Filling material  resin, polyurethane dry

**BUSHING**
- Flash over distance  28mm
- Creepage distance  40mm
- Terminal  M 6
- Max. torque  3.0Nm

**DESIGN DATA**
- Dimensions  dia. 84.4 * 130mm
- Drawing  20-B-078
- Weight  0.9kg
- Casing material  plastic according to UL-94-V0 aluminum
- Mounting position  every position

**LIFE EXPECTANCY**  > 100000h

**FAILURE RATE**  300 FIT

**RECOMMENDATION**  IEC 61071-1 IEC 60077

**DIMENSIONS**
GTO Oil Impregnated General Information

Vishay ESTA

GTO Snubber Capacitors, Oil Impregnated

VOLTAGE RANGE: 4500V / 6000V
CAPACITANCE RANGE: 0.125µF - 7µF

MAIN CHARACTERISTICS
- High rms current and peak current
- High current at small capacitances
- Lowest inductance
- Axial terminals

APPLICATION
These capacitors are mainly used for protecting Gate Turn Off Thyristors. They are also suitable for other fields of application, for which the specific features of these capacitors are required.

DESIGN
The capacitors are produced in a case made of plastic. The plastic material used according to Norme Francaise, NF F 16-101 offers highest protection against inflammability.

TECHNOLOGY
The applied All-film dielectric is made of TUS or multiple-layer polypropylene film. The film is hazed by means of a specific surface treatment. This allows an even and thorough impregnation. Aluminum foil is used for the electrodes so these capacitors are not self-healing. All-film capacitors excel in very low dielectric losses and low series resistance. Due to the low losses, they are also suitable for very high current loads, even at low capacity.

GENERAL TECHNICAL DATA

<table>
<thead>
<tr>
<th>NOMINAL RATINGS</th>
<th>Capacitance/Tolerance CN 0.125µF to 7µF ( \pm 5% )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage</td>
<td>UN 4500V 6000V</td>
</tr>
<tr>
<td>Rated DC voltage</td>
<td>UDC 3300VDC 4400VDC</td>
</tr>
<tr>
<td>Rated rms voltage</td>
<td>Urms 1400VAC 1880VAC</td>
</tr>
<tr>
<td>peak voltage period.</td>
<td>Us 4500V 6000V</td>
</tr>
<tr>
<td>peak voltage non period.</td>
<td>Usmax 4900V 6550V</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ROUTINE TESTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test voltage terminal/terminal UT/T 1/62 * UN, DC, 10s</td>
</tr>
<tr>
<td>Measurement of capacitance</td>
</tr>
<tr>
<td>Measurement of loss factor</td>
</tr>
</tbody>
</table>

OPERATING TEMPERATURE

<table>
<thead>
<tr>
<th>Minimum ambient temperature</th>
<th>Tmax up to (-25)°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum ambient temperature</td>
<td>Tmin up to (+60)°C</td>
</tr>
</tbody>
</table>

STORAGE TEMPERATURE

<table>
<thead>
<tr>
<th>Minimum temperature</th>
<th>Tmax (-45)°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum temperature</td>
<td>Tmin (+85)°C</td>
</tr>
</tbody>
</table>

TECHNOLOGY

Dielectric Polypropylene film non self-healing oil, NON PCB

BUSHINGS

Internal thread M8, depth 15mm
Max. torque 8.5Nm

DESIGN DATA

Casing material Lathene
Drawing 20-B-043
Mounting position every position

LIFE EXPECTANCY

> 100000h

FAILURE RATE

300 FIT
GTO Snubber Capacitors, Oil Impregnated

PART NO.  GTO 4500-6.0P
ART. NO.  10726

NOMINAL RATINGS
Capacitance/Tolerance  CN  6uF ± 5%
Rated voltage  UN  4500V
Rated DC voltage  Udc  3300VDC
Rated RMS voltage  Urms  1400VAC
Peak voltage period.  Us  4500VDC
Peak voltage not period.  Usmax  4900VDC
Voltage raise  du/dt  1200V/us
Rated current  In  160A
Peak current  Is  7200A
Inductance  Ls  < 15nH
Loss factor diel.  tanδ  < 2.0*10^-4
Loss factor 50Hz  tanδ  < 2.0*10^-4
1kHz  tanδ  < 4.0*10^-4

ROUTINE TESTS
Test voltage terminal/terminal  UT/T  7300VDC, 10s

OPERATING TEMPERATURE
Minimum ambient temperature  Ta min  -25°C
Maximum ambient temperature  Ta max  60°C
Minimum casing temperature  Tc min  -25°C
Maximum casing temperature  Tc max  70°C

STORAGE TEMPERATURE
Minimum temperature  Tmin  -50°C
Maximum temperature  Tmax  +85°C

TECHNOLOGY
Dielectric  Polypropylene film
Impregnation  oil, NON PCB

BUSHING
Internal thread  M8 depth 15mm
Air distance  217mm
Creepage distance  217mm

DESIGN DATA
Diameter  91mm
Height  161mm
Drawing  20-B-043
Weight  1.2kg
Casing material  Lathene
Mounting  every position

LIFE EXPECTANCY  > 100000 Std

FAILURE RATE  300 FIT

DIMENSIONS

<table>
<thead>
<tr>
<th>Type</th>
<th>C [µF]</th>
<th>Is [A]</th>
<th>Dimensions Ø d x h (mm)</th>
<th>Weight [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>GTO 4500 - 0.25 P</td>
<td>0.25</td>
<td>300</td>
<td>92 x 91</td>
<td>0.59</td>
</tr>
<tr>
<td>GTO 4500 - 0.50 P</td>
<td>0.50</td>
<td>600</td>
<td>92 x 91</td>
<td>0.59</td>
</tr>
<tr>
<td>GTO 4500 - 1.00 P</td>
<td>1.00</td>
<td>1200</td>
<td>92 x 91</td>
<td>0.59</td>
</tr>
<tr>
<td>GTO 4500 - 2.00 P</td>
<td>2.00</td>
<td>2400</td>
<td>92 x 91</td>
<td>0.59</td>
</tr>
<tr>
<td>GTO 4500 - 3.00 P</td>
<td>3.00</td>
<td>3600</td>
<td>92 x 141</td>
<td>0.92</td>
</tr>
<tr>
<td>GTO 4500 - 4.00 P</td>
<td>4.00</td>
<td>4800</td>
<td>92 x 141</td>
<td>0.92</td>
</tr>
<tr>
<td>GTO 4500 - 5.00 P</td>
<td>5.00</td>
<td>6000</td>
<td>92 x 141</td>
<td>0.92</td>
</tr>
<tr>
<td>GTO 4500 - 6.00 P</td>
<td>6.00</td>
<td>7200</td>
<td>92 x 161</td>
<td>1.05</td>
</tr>
<tr>
<td>GTO 4500 - 7.00 P</td>
<td>7.00</td>
<td>8400</td>
<td>92 x 181</td>
<td>1.18</td>
</tr>
</tbody>
</table>

- Other values upon request.
- Above capacitors types are usually available ex stock.
- All other types have to be manufactured in accordance with specific orders, however certain minimum order quantities may be requested depending on the capacitor type.
- The dimensions may be changed due to technical advances without notice.
GTO 6000-0.65P

Vishay ESTA

GTO Snubber Capacitors, Oil Impregnated

PART NO. GTO 6000-0.65 P
ART. NO. 44855

NOMINAL RATINGS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacitance/Tolerance</td>
<td>CN 0.65μF ± 5%</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>UN 6000V</td>
</tr>
<tr>
<td>Rated DC voltage</td>
<td>Udc 4400VDC</td>
</tr>
<tr>
<td>Rated RMS voltage</td>
<td>Urms 1880VAC</td>
</tr>
<tr>
<td>Peak voltage period.</td>
<td>Us 6000VDC</td>
</tr>
<tr>
<td>Peak voltage not period.</td>
<td>Umax 6550VDC</td>
</tr>
<tr>
<td>Voltage raise</td>
<td>du/dt 1200V/us</td>
</tr>
<tr>
<td>Rated current</td>
<td>In 70A</td>
</tr>
<tr>
<td>Peak current</td>
<td>Is 780A</td>
</tr>
<tr>
<td>Inductance</td>
<td>Ls &lt; 20nH</td>
</tr>
<tr>
<td>Loss factor diel.</td>
<td>tanδ &lt; 2.0*10^-4</td>
</tr>
<tr>
<td>Loss factor 50Hz</td>
<td>tanδ &lt; 2.0*10^-4</td>
</tr>
<tr>
<td></td>
<td>tanδ &lt; 6.0*10^-4</td>
</tr>
</tbody>
</table>

DESIGN DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter</td>
<td>92mm</td>
</tr>
<tr>
<td>Height</td>
<td>151mm</td>
</tr>
<tr>
<td>Drawing</td>
<td>20-B-043</td>
</tr>
<tr>
<td>Weight</td>
<td>1.2kg</td>
</tr>
<tr>
<td>Case material</td>
<td>Lathene</td>
</tr>
<tr>
<td>Mounting</td>
<td>every position</td>
</tr>
</tbody>
</table>

LIFE EXPECTANCY

> 100000 Std

FAILURE RATE

300 FIT

ROUTINE TESTS

| Test voltage terminal/terminal | UT/T 9720VDC, 10s |

OPERATING TEMPERATURE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum ambient temperature</td>
<td>Ta min - 25°C</td>
</tr>
<tr>
<td>Maximum ambient temperature</td>
<td>Ta max 60°C</td>
</tr>
<tr>
<td>Minimum casing temperature</td>
<td>Tc min - 25°C</td>
</tr>
<tr>
<td>Maximum casing temperature</td>
<td>Tc max 70°C</td>
</tr>
</tbody>
</table>

STORAGE TEMPERATURE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum temperature</td>
<td>T min - 50°C</td>
</tr>
<tr>
<td>Maximum temperature</td>
<td>T max 85°C</td>
</tr>
</tbody>
</table>

TECHNOLOGY

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dielectric</td>
<td>Polypropylene film, non self-healing</td>
</tr>
<tr>
<td>Impregnation</td>
<td>oil, NON PCB</td>
</tr>
</tbody>
</table>

BUSHING

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal thread</td>
<td>M8 depth 15mm</td>
</tr>
<tr>
<td>Air distance</td>
<td>207mm</td>
</tr>
<tr>
<td>Creepage distance</td>
<td>207mm</td>
</tr>
</tbody>
</table>

DIMENSIONS

www.vishay.com

Document Number: 13095
Revision 31-Jan-02
GTO Snubber Capacitors, Dry, Self-healing

VOLTAGE RANGE: 1200V / 4000V
CAPACITANCE RANGE: 0.1µF - 6.0µF

MAIN CHARACTERISTICS
• Wide voltage range
• Lowest inductance
• Axial terminals

APPLICATIONS
These capacitors are mainly used for protecting Gate Turn Off Thyristors (GTO).
This application requires capacitors with a very low inductance and a high current carrying capability. The capacitors are also suitable for other applications, which require these features.

DESIGN
The capacitors are produced in a case made of plastic. The case diameter varies between 40mm and 88mm with a height varying from 49mm to 61mm.
For this series of capacitors, the customer’s specific requirements can also be met.
For the electrical connection, internal M6 and M8 threads are used; these internal threads can also be used for mounting purposes.
Data sheets giving examples of feasible capacitor designs are available and the Request for Quotation form can be used to outline your customized requirements.

TECHNOLOGY
Metallized polypropylene film (MKP) is used for the dielectric. For this type of application, the metallization has been optimized to the highest possible current carrying capacity at low losses. Consequently, maximum capacitor currents up to 80A per unit are possible. (For an explanation of these terms, please see General Information document).
All capacitors of this design are produced in accordance with the dry-type technology and are sealed with a firm filling. This design guarantees a vibration resistant capacitor. In addition, the fixed filling, ensures the capacitor is absolutely leakproof and thus guarantees a consistent life expectancy. These features are vital characteristics in traction applications.

GENERAL TECHNICAL DATA

<table>
<thead>
<tr>
<th>NOMINAL RATINGS</th>
<th>CN 0.1µF to 6µF±5%</th>
<th>UN 1200V to 4000V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage</td>
<td></td>
<td>UDC up to 3000V DC</td>
</tr>
<tr>
<td>Rated DC voltage</td>
<td></td>
<td>U rms up to 1400V AC</td>
</tr>
<tr>
<td>Rated rms voltage</td>
<td></td>
<td>Us up to 4000V</td>
</tr>
<tr>
<td>peak voltage period.</td>
<td></td>
<td>Us max up to 4600V</td>
</tr>
<tr>
<td>peak voltage non period.</td>
<td></td>
<td>tan&lt; 2 x 10^-4</td>
</tr>
<tr>
<td>Nominal current</td>
<td>IN up to 80A</td>
<td></td>
</tr>
<tr>
<td>Peak current</td>
<td>Is up to 10kA</td>
<td></td>
</tr>
<tr>
<td>Self inductance</td>
<td>Ls&lt; 10nH</td>
<td></td>
</tr>
<tr>
<td>Loss factor diel. 50Hz</td>
<td>tan&lt; 2 x 10^-4</td>
<td></td>
</tr>
<tr>
<td>Loss factor 50Hz</td>
<td>tan&lt; 2 x 10^-4</td>
<td></td>
</tr>
<tr>
<td>Loss factor 1kHz</td>
<td>tan&lt; 10 x 10^-4</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ROUTINE TESTS</th>
<th>Test voltage terminal/terminal UT/T 2 * UN, DC, 10s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement of capacitance</td>
<td></td>
</tr>
<tr>
<td>Measurement of loss factor</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OPERATING TEMPERATURE</th>
<th>Tmin up to -40°C</th>
<th>Tmax up to +70°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage temperature</td>
<td>Tmin -45°C</td>
<td>Tmax +85°C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TECHNOLOGY</th>
<th>Polypropylene film metallized, self-healing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filling material</td>
<td>resin, polyurethane dry</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TERMINALS</th>
<th>M6, depth 6mm, 6Nm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M8, depth 8mm, 8Nm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DESIGN DATA</th>
<th>Plastic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting position</td>
<td>every position</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LIFE EXPECTANCY</th>
<th>&gt; 100000h</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAILURE RATE</td>
<td>300 FIT</td>
</tr>
</tbody>
</table>
GTO Snubber Capacitors, Dry Self-healing

PART NO. GTO 1200-2R
ART. NO. 15915

NOMINAL RATINGS
Capacitance/Tolerance CN 2 uF ± 5%
Rated voltage UN 1200V
Rated DC voltage Udc 800VDC
Rated RMS voltage Urms 500VAC
Peak voltage period. Us 1200VDC
Peak voltage not period. Usmax 1700VDC
Voltage raise du/dt 2000V/us
Rated current In 32A
Peak current Is 4000A
Inductance Ls < 10nH
Loss factor diel. tanδ < 2*10^-4
Loss factor 50 Hz tanδ < 2*10^-4
Loss factor 1 kHz tanδ < 10.0*10^-4

ROUTINE TESTS
Test voltage terminal/terminal UT/T 1600V, DC, 10s

OPERATING TEMPERATURE
Minimum ambient temperature Ta min - 40°C
Maximum ambient temperature Ta max 60°C
Minimum casing temperature Tc min - 40°C
Maximum casing temperature Tc max 70°C

Storage temperature
Minimum temperature Tmin - 50°C
Maximum temperature Tmax 85°C

TECHNOLOGY
Dielectric Polypropylene film metallized, self-healing
Filling material resin, polyurethane dry

BUSHING
Internal thread M6 depth 8mm
Max. torque 6Nm
Air distance 76mm
Creepage distance 76mm

DESIGN DATA
Diameter 60mm
Height 49mm
Drawing 20-B-050
Weight 0.1kg
Case material plastic
Mounting every position

LIFE EXPECTANCY > 100000 Std

FAILURE RATE 300 FIT

DIMENSIONS

www.vishay.com
Document Number: 13097
Revision 25-Mar-02
GTO Snubber Capacitors, Dry Self-healing

PART NO.   GTO 4000-0.12 R
ART. NO.    42844

NOMINAL RATINGS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacitance/Tolerance</td>
<td>CN 0.12μF ± 5%</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>UN 4000V</td>
</tr>
<tr>
<td>Rated DC voltage</td>
<td>Udc 3000VDC</td>
</tr>
<tr>
<td>Rated RMS voltage</td>
<td>Urms 1400VAC</td>
</tr>
<tr>
<td>Peak voltage period.</td>
<td>Us 4000VDC</td>
</tr>
<tr>
<td>Peak voltage not period.</td>
<td>Usmax 4600VDC</td>
</tr>
<tr>
<td>Voltage raise</td>
<td>du/dt 4000V/us</td>
</tr>
<tr>
<td>Rated current</td>
<td>ln 20A</td>
</tr>
<tr>
<td>Peak current</td>
<td>ls 480A</td>
</tr>
<tr>
<td>Inductance</td>
<td>Ls &lt; 10nH</td>
</tr>
<tr>
<td>Loss factor diel.</td>
<td>tand &lt; 2 * 10^-4</td>
</tr>
<tr>
<td>Loss factor 50Hz</td>
<td>tand &lt; 2 * 10^-4</td>
</tr>
<tr>
<td>Loss factor 1kHz</td>
<td>tand &lt; 10.0 * 10^-4</td>
</tr>
</tbody>
</table>

ROUTINE TESTS

Test voltage terminal/terminal UT/T 6000V, DC, 10s

OPERATING TEMPERATURE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum ambient temperature</td>
<td>T_min -40°C</td>
</tr>
<tr>
<td>Maximum ambient temperature</td>
<td>T_max 70°C</td>
</tr>
<tr>
<td>Minimum casing temperature</td>
<td>T_c_min -40°C</td>
</tr>
<tr>
<td>Maximum casing temperature</td>
<td>T_c_max 75°C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td></td>
</tr>
<tr>
<td>Minimum temperature</td>
<td>T_min -50°C</td>
</tr>
<tr>
<td>Maximum temperature</td>
<td>T_max 85°C</td>
</tr>
</tbody>
</table>

TECHNOLOGY

Dielectric                Polypropylene film
                           metallized, self-healing
Filling material          resin, polyurethane
                           dry

BUSHING

Internal thread            M6 depth 8mm
Max. torque                6Nm
Air distance               79mm
Creepage distance          79mm
GTO Dry General Information
Vishay ESTA

GTO Clamping Capacitors, Self-healing, Segmented

VOLTAGE RANGE: 1200V-4000V
CAPACITANCE RANGE: 5µF - 80µF

MAIN CHARACTERISTICS
• High capacitance and small dimensions
• Lowest inductance
• Axial terminals

APPLICATION
GTO - Clamping capacitors are mainly used as energy storage capacitors in applications with Gate Turn Off Thyristors (GTO).

This application requires capacitors with a very low inductance and a high current carrying capability.

These capacitors are also suitable for other fields of application where these features are desirable

DESIGN
The capacitors are enclosed in a casing made of a plastic material according to Norme Francaise, NF F 16-101 which offers the highest level of resistance against inflammability.

The casing diameter of the standard product is 92mm with a height varying from 111mm to 161mm. Custom sizes can also be produced.

For the electrical connection internal M8 threads are used and the internal threads can be used for customer mounting purposes.

Data sheets giving examples of feasible capacitor designs are available and the Request for Quotation form can be used to outline your customized requirements.

TECHNOLOGY
Metallized and segmented polypropylene film (MKP) is used for the dielectric. This metallization is especially designed to offer best results during use. The segmentation guarantees an absolutely uncritical failure performance at the end of service life. (For an explanation, refer to General Information).

All capacitors of this design are manufactured with the dry-type technology and are sealed with a firm filling. The design ensures, particularly in traction applications, a vibration resistant capacitor. In addition, the fixed filling ensures the capacitor is absolutely leakproof and thus guarantees a consistent life expectancy.

GENERAL TECHNICAL DATA

NOMINAL RATINGS
Capacitance/Tolerance  CN  5uF to 80uF/± 5%
Rated voltage  UN  1200V to 4000V
Rated DC voltage  UDC  up to 4000VDC
peak voltage period.  Us  up to 4800V
peak voltage non period.  Umax  up to 5200V
Nominal current  IN  up to 80A
Peak current  Is  up to 5kA
Self inductance  LS  ≤ 20nH
Loss factor diel. 50Hz  tan δ < 2 x 10^-4
Loss factor 50Hz  tan δ < 2 x 10^-4
Loss factor 1kHz  tan δ < 10 x 10^-4

ROUTINE TESTS
Test voltage Term./Term.  UT/T  2 * UN, DC, 10s
Measurement of capacitance
Measurement of loss factor

OPERATING TEMPERATURE
Minimum ambient temperature  Tmin  up to - 40°C
Maximum ambient temperature  Tmax  up to + 70°C

STORAGE TEMPERATURE
Minimum temperature  Tmin  - 45°C
Maximum temperature  Tmax  + 85°C

TECHNOLOGY
Dielectric  Polypropylene film
metallized, self-healing
segmented
Filling material  resin, polyurethane
dry

Terminals
Internal thread  M8, depth 15mm
Max. Torque  8.5Nm

DESIGN DATA
Casing material:  Lathene
Mounting position:  All
LIFE EXPECTANCY  > 100000h
FAILURE RATE  300 FIT
GTO Clamping Capacitors, Self-healing, Segmented

PART NO. GTO 2940-12RP
ART. NO. 20914

NOMINAL RATINGS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacitance/Tolerance</td>
<td>CN 12uF ± 5%</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>UN 2940V</td>
</tr>
<tr>
<td>Rated DC voltage</td>
<td>Udc 2940VDC</td>
</tr>
<tr>
<td>Peak voltage period.</td>
<td>Us 3600VDC</td>
</tr>
<tr>
<td>Peak voltage not period.</td>
<td>Usmax 4100VDC</td>
</tr>
<tr>
<td>Voltage raise</td>
<td>du/dt 200V/us</td>
</tr>
<tr>
<td>Rated current</td>
<td>In 50A</td>
</tr>
<tr>
<td>Peak current</td>
<td>Is 2400A</td>
</tr>
<tr>
<td>Inductance</td>
<td>Ls &lt; 20nH</td>
</tr>
<tr>
<td>Loss factor diel.</td>
<td>tanδ &lt; 2*10^-4</td>
</tr>
<tr>
<td>Loss factor 50Hz</td>
<td>tanδ &lt; 2*10^-4</td>
</tr>
<tr>
<td>Loss factor 1kHz</td>
<td>tanδ &lt; 10.0*10^-4</td>
</tr>
</tbody>
</table>

ROUTINE TESTS

Test voltage terminal/terminal UT/T 5880V, DC, 10s

OPERATING TEMPERATURE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum ambient temperature</td>
<td>Tamin - 40°C</td>
</tr>
<tr>
<td>Maximum ambient temperature</td>
<td>Tmax 70°C</td>
</tr>
<tr>
<td>Minimum casing temperature</td>
<td>Tcmin - 40°C</td>
</tr>
<tr>
<td>Maximum casing temperature</td>
<td>Tcmax 70°C</td>
</tr>
</tbody>
</table>

STORAGE TEMPERATURE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum temperature</td>
<td>Tmin - 50°C</td>
</tr>
<tr>
<td>Maximum temperature</td>
<td>Tmax 85°C</td>
</tr>
</tbody>
</table>

TECHNOLOGY

Dielectric Polypropylene film, metallized, self-healing segmented
Filling material resin, polyurethane dry

BUSHING

Internal thread M8 depth 15mm
Max. torque 8.5Nm
Air distance 217mm
Creepage distance 217mm

DIMENSIONS
General Information Standard Capacitors
Vishay ESTA

Standard Capacitors In Cylindrical Casing, Oil Impregnated, Self-healing, With Fuse

DESIGN

These capacitors are housed in aluminum casings of cylindrical deep-drawn shape.

A gasproof lid is flanged onto the casing. The electrical terminals may be either rubber-seal ceramic bushings with fast-on contacts 6.3 x 0.8mm, or solder-sealed ceramic bushings with screw-type terminals. The electrical connection must be made only by means of flexible conductors in order to avoid horizontal mechanical stresses on the bushings, and to allow a variation of the axial length of the aluminum casing by approximately + 20mm. This adjustment of length is necessary for the reliable functioning of the internal tear-off fuse. For the purpose of mechanical mounting, the capacitors are provided with a threaded bolt at the bottom of the casing. This bolt, marked according to DIN 40011, can be used as an earth connection.

TECHNOLOGY

The dielectric is a metallized polypropylene film using self-healing technology (for explanations refer to general information).

These self-healing capacitors are provided with an overpressure tear-off fuse which will guarantee both safe disconnection and tightness of the capacitor in case of an internal short-circuit (for explanations refer to general information).
Power Electronic, Standard AC Capacitors

STANDARD CAPACITORS IN CYLINDRICAL CASING, OIL IMPREGNATED, SELF-HEALING, WITH FUSE

AC-CAPACITORS, COMMUTATION AND DAMPING CAPACITORS

Series KMKP/KA 900 V - 3500 V, higher voltages upon request.
Capacitance range from 0.1 to 100µF, in relation to rated voltage and dimension. Other capacitance values, upon request.

GENERAL
Vishay ESTA Commutation capacitors are used in static frequency changers. They act, for example, as quenching capacitors taking over for a short time the current of the main thyristor thus making sure that the latter will safely block when the voltage returns.

The current load is very high on commutation and damping capacitors. Owing to the non-sinusoidal characteristic of the voltage path, high pulse-shaped recharge currents occur. With regard to ohmic and dielectric losses, the commutation capacitors have to be of a particularly high quality. Since modern low-loss dielectrics are applied and also the current paths are generously dimensioned, Vishay ESTA commutation capacitors are ideal for such extreme loads.

TECHNICAL DATA
OPERATING MODE
continuous operation

CLASS OF APPLICATION
HSF (refer to general information)

IMPREGNATION
Oil (NON-PCB, refer general information)

PERMISSIBLE TEMPERATURE RANGE
Min./max. casing temperature: -25 °/70 °C
Min./max. storage temperature: -40 °/85 °C

SELF-DISCHARGE TIME CONSTANT
> 10.000 s

PERMISSIBLE RELATIVE AIR HUMIDITY
95 %

LIFE EXPECTANCY WITH 3% FAILURE RATE
100000h

.getConnections
AMP plugs 6.3 x 0.8
Threaded bolts M10

MOUNTING POSITION
Vertical/Horizontal
Upside down position, upon request only

PROTECTION
Overpressure tear-off fuse, refer to general information

LOSS FACTOR
(50 Hz) 1.5 x 10⁻⁴
(10k Hz) 5.0 x 10⁻⁴

CAPACITANCE TOLERANCE
± 10 %

TEST VOLTAGE
terminal/terminal 2.15 x Un/√2 AC/10 s.
terminal/casing 2 x Un/√2 + 1000 VAC/60 s
min. 3.000VAC/10 sec.

PEAK CURRENT (periodical) du/dt x C [A]

STANDARD
VDE 0560/12 IEC 61071-1 EN 61071-1

DIELECTRIC
metallized polypropylene film, refer to general information
KMKP/KA
Vishay ESTA  Power Electronic, Standard AC Capacitors

STANDARD CAPACITORS IN CYLINDRICAL CASING, OIL IMPREGNATED, SELF-HEALING, WITH FUSE

AC-CAPACITORS, COMMUTATION AND DAMPING
CAPACITORS SERIES KMKP/KA 900 V - 3500 V

RATED VOLTAGE $U_r$, 900 V
RMS voltage $U_{rms}$, 640 V
Peak voltage (periodical) $U_p$, 1344 V
Surge peak voltage (not periodical) $U_{smax}$, 2688 V
DC voltage $U_{DC}$, 1800 V

<table>
<thead>
<tr>
<th>MODEL</th>
<th>C $\mu$F</th>
<th>I A</th>
<th>du / dt V / $\mu$s</th>
<th>DIMENSIONS $\phi$ d x h (mm)</th>
<th>WEIGHT kg</th>
<th>FIGURE*</th>
</tr>
</thead>
<tbody>
<tr>
<td>KMKP 900 - 0.10 IA</td>
<td>0.10</td>
<td>12.0</td>
<td>750</td>
<td>30 x 52</td>
<td>0.04</td>
<td>1</td>
</tr>
<tr>
<td>KMKP 900 - 0.22 IA</td>
<td>0.22</td>
<td>12.0</td>
<td>750</td>
<td>30 x 52</td>
<td>0.04</td>
<td>1</td>
</tr>
<tr>
<td>KMKP 900 - 0.33 IA</td>
<td>0.33</td>
<td>12.0</td>
<td>600</td>
<td>30 x 52</td>
<td>0.04</td>
<td>1</td>
</tr>
<tr>
<td>KMKP 900 - 0.47 IA</td>
<td>0.47</td>
<td>12.0</td>
<td>500</td>
<td>30 x 52</td>
<td>0.04</td>
<td>1</td>
</tr>
<tr>
<td>KMKP 900 - 0.68 IA</td>
<td>0.68</td>
<td>15.0</td>
<td>500</td>
<td>30 x 52</td>
<td>0.04</td>
<td>1</td>
</tr>
<tr>
<td>KMKP 900 - 1.0 IA</td>
<td>1.0</td>
<td>16.0</td>
<td>500</td>
<td>35 x 52</td>
<td>0.05</td>
<td>1</td>
</tr>
<tr>
<td>KMKP 900 - 2.2 IA</td>
<td>2.2</td>
<td>16.0</td>
<td>500</td>
<td>35 x 72</td>
<td>0.07</td>
<td>1</td>
</tr>
<tr>
<td>KMKP 900 - 3.3 IA</td>
<td>3.3</td>
<td>16.0</td>
<td>500</td>
<td>35 x 82</td>
<td>0.08</td>
<td>1</td>
</tr>
<tr>
<td>KMKP 900 - 4.7 IA</td>
<td>4.7</td>
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*See dimensional drawings document number :13104

Other values available upon request. Standard capacitors types usually, available ex stock. Non-standard and custom styles to be manufactured in accordance with specific orders. Minimum order quantities are applicable depending on the various capacitor types. Vishay reserve the right to change any dimensions without notice.
STANDARD CAPACITORS IN CYLINDRICAL CASING, OIL IMPREGNATED, SELF-HEALING, WITH FUSE

AC-CAPACITORS, COMMUTATION AND DAMPING
CAPACITORS SERIES KMKP/KA 900 V - 3500 V

RATED VOLTAGE

<table>
<thead>
<tr>
<th>MODEL</th>
<th>C µF</th>
<th>I A</th>
<th>du / dt V / µs</th>
<th>DIMENSIONS Ø d x h (mm)</th>
<th>WEIGHT kg</th>
<th>FIGURE</th>
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<tbody>
<tr>
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<td>KMKP 1400 - 0.33 SA</td>
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<td>900</td>
<td>40 x 52</td>
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<td>50 x 127</td>
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<tr>
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<td>KMKP 1400 - 15 IB</td>
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<td>KMKP 1400 - 22 IB</td>
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<td>900</td>
<td>40 x 52</td>
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<td>KMKP 1400 - 0.47 IAX</td>
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<td>40 x 75</td>
<td>0.09</td>
<td>2</td>
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RATED VOLTAGE

<table>
<thead>
<tr>
<th>MODEL</th>
<th>C µF</th>
<th>I A</th>
<th>du / dt V / µs</th>
<th>DIMENSIONS Ø d x h (mm)</th>
<th>WEIGHT kg</th>
<th>FIGURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>KMKP 3500 - 0.10 SA</td>
<td>0.10</td>
<td>12.0</td>
<td>1900</td>
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<td>900</td>
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<td>15.0</td>
<td>750</td>
<td>50 x 127</td>
<td>0.25</td>
<td>3</td>
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<tr>
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<td>15.0</td>
<td>750</td>
<td>60 x 127</td>
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<td>400</td>
<td>84 x 190</td>
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<td>KA 3500 - 2.0 SB</td>
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<td>80.0</td>
<td>400</td>
<td>84 x 190</td>
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<td>KA 3500 - 3.0 SB</td>
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<td>84 x 210</td>
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*See dimensional drawings document number :13104

Other values available upon request. Standard capacitors types usually, available ex stock. Non-standard and custom styles to be manufactured in accordance with specific orders. Minimum order quantities are applicable depending on the various capacitor types. Vishay reserve the right to change any dimensions without notice.
GMKP
Vishay ESTA

Power Electronic, DC Capacitors

STANDARD CAPACITORS IN CYLINDRICAL CASING, OIL IMPREGNATED, SELF-HEALING, WITH FUSE

DC CAPACITORS

Series GMKP 1000 V - 3000 V, higher voltages upon request.

Capacitance range 1-400 µF, in relation to rated voltage and dimension. Other capacitance values upon request.

GENERAL

VISHAY ESTA DC-capacitors may be loaded with a comparatively high component of alternating voltage or alternating current due to the low ohmic and low dielectric losses. Thus the capacitors can equally be employed for all DC applications.

The capacitors can also be applied as AC capacitors at a rated frequency of 50 Hz for the quoted root-mean-square voltages.

TECHNICAL DATA

OPERATING MODE
continuous operation

CLASS OF APPLICATION
HSF (refer to general information)

IMPREGNATING AGENT
Oil (NON-PCB, refer to general information)

PERMISSIBLE TEMPERATURE RANGE
Min./max. casing temperature: -25 °C/70 °C
Min./max. storage temperature: -40 °C/85 °C

SELF-DISCHARGE TIME CONSTANT
> 10.000 s

PERMISSIBLE RELATIVE AIR HUMIDITY
95 %

LIFE EXPECTANCY WITH 3% FAILURE RATE
100,000 h

NUMBER OF DISCHARGES
upon request

TIME INTERVAL BETWEEN 2 DISCHARGES
With a periodic discharge: 2 sec.
With oscillating discharge: upon request

TERMINALS
AMP plugs 6.3 x 0.8 or
Threaded bolts M10

MOUNTING POSITION
vertical/horizontal
upside down position, upon request only

PROTECTION
Overpressure tear-off fuse, refer to general information

LOSS FACTOR
(50 Hz) \(1.5 \times 10^{-4}\)
(14 kHz) \(2.0 \times 10^{-4}\)

CAPACITANCE TOLERANCE
± 10 %

OVERVOLTAGES
1.1 x Un 1.15 x Un
30% operation 30 min./day
1.2 x Un 1.3 x Un 1.5 x Un
5 min./day 1 min./day 100 ms/day

TEST VOLTAGE
terminal/terminal 1.5 x Un DC/10 sec.
terminal/casing 2.0 x Un \(\sqrt{2} + 1000\) VAC/10 s
(min. 2000 VAC/10 s)

PEAK CURRENT (periodical) \(du/dt \times C\) [A]

STANDARD
IEC 61071-1 EN 61071

DIELECTRIC
metallized polypropylene film (refer to general information)
## DC CAPACITORS
### SERIES GMKP 1000 V - 3000 V

**Rated voltage 1000 VDC**

<table>
<thead>
<tr>
<th>MODEL</th>
<th>C</th>
<th>I</th>
<th>du / dt</th>
<th>L</th>
<th>DIMENSIONS</th>
<th>WEIGHT</th>
<th>FIGURE*</th>
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<td>30 x 52</td>
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<td>12.0</td>
<td>500</td>
<td>&lt; 150</td>
<td>40 x 72</td>
<td>0.09</td>
<td>1</td>
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<tr>
<td>GMKP 1000 - 10 IA</td>
<td>10.0</td>
<td>15.0</td>
<td>500</td>
<td>&lt; 150</td>
<td>50 x 72</td>
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<td>50 x 72</td>
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<td>GMKP 1000 - 20 IA</td>
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<td>15.0</td>
<td>300</td>
<td>&lt; 150</td>
<td>50 x 97</td>
<td>0.18</td>
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<td>GMKP 1000 - 32 IA</td>
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<td>6 I</td>
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<td>84 x 140</td>
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**Rated voltage 1800 VDC**

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<th>C</th>
<th>I</th>
<th>du / dt</th>
<th>L</th>
<th>DIMENSIONS</th>
<th>WEIGHT</th>
<th>FIGURE*</th>
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<td>64 x 140</td>
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<td>&lt; 120</td>
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**Rated voltage 3000 VDC**

<table>
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<th>DIMENSIONS</th>
<th>WEIGHT</th>
<th>FIGURE*</th>
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<td>50 x 127</td>
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<td>500</td>
<td>&lt; 150</td>
<td>64 x 140</td>
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<td>GMKP 3000 - 10 IA</td>
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<td>&lt; 200</td>
<td>64 x 190</td>
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<td>&lt; 200</td>
<td>64 x 240</td>
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<td>GMKP 3000 - 20 IB</td>
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<td>84 x 190</td>
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<td>&lt; 250</td>
<td>84 x 240</td>
<td>1.33</td>
<td>6 II</td>
</tr>
</tbody>
</table>

*See dimensional drawings document number :13105

Other values available upon request. Standard capacitors types usually, available ex stock. Non-standard and custom styles to be manufactured in accordance with specific orders. Minimum order quantities are applicable depending on the various capacitor types. Vishay reserve the right to change any dimensions without notice.
Dimensional Drawings
Vishay ESTA

Power Electronic Capacitors

STANDARD CAPACITORS IN CYLINDRICAL CASING, OIL IMPREGNATED, SELFHEALING, WITH FUSE

DIMENSIONAL DRAWINGS

Design IA

Dimensional drawings of the bushings on last page of this datasheet,
Design IAX

Design SA

Design IA

FIGURE 1

FIGURE 2

FIGURE 3

FIGURE 4
STANDARD CAPACITORS IN CYLINDRICAL CASING, OIL IMPREGNATED, SELFHEALING, WITH FUSE

DIMENSIONAL DRAWINGS

Design IS

Design SB

Fastening bolt

Diameter of cylindrical case

< 50mm

≥ 50mm

Fastening bolt

M 8/8mm

M 12/12mm

Permissible tightening torque

4Nm

10Nm
**DIMENSIONAL DRAWINGS**

**BUSHINGS**

The voltage limit of the bushings for the types of capacitor listed in this catalogue is based on the “Rules for Proportioning Clearance and Creepage Distances in Electrical Equipment”, VDE 0110.

<table>
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<th>Model</th>
<th>Air Distance</th>
<th>Creepage Distance</th>
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<td>D-142</td>
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<tr>
<td>D-147</td>
<td>10mm</td>
<td>10mm</td>
</tr>
<tr>
<td>D-203</td>
<td>24mm</td>
<td>28mm</td>
</tr>
<tr>
<td>D-138</td>
<td>16mm</td>
<td>23mm</td>
</tr>
<tr>
<td>D-161</td>
<td>32mm</td>
<td>54mm</td>
</tr>
</tbody>
</table>
CERTIFICATE

Registration-Number: 2556/QM/03.94

This is to certify that the company

VISHAY

VISHAY ELECTRONIC GmbH
Division ESTA

at the following locations
Riegrova 1231, CZ-38801 Blatna
Pasticka 1243, CZ-38801 Blatna
Hofmark-Aich-Straße 36, D-84030 Landshut

has implemented and maintains a
Quality-Management System for the following scope:

Heavy Current Capacitors
High Voltage Units

This QM-System complies with the requirements of:

DIN EN ISO 9001:2000

This Certificate is valid until 19.03.2006

VDE Testing and Certification Institute
Certification

D-63069 Offenbach/Main, Merianstraße 28
Date: 02.04.2003
2556-9110-0004/27625

The VDE Testing and Certification Institute is accredited by DAR Accreditation Bodies
according to DIN EN 45012 and notified in the EU under ID. No. 0366.
For product information and a current list of sales reps and distributors, visit our website:

www.vishay.com