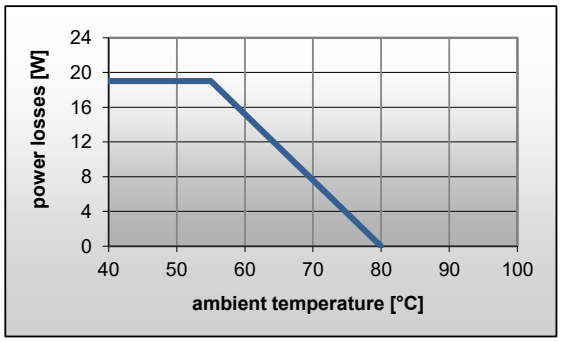
DATA SHEET

Capacitor for Power Electronics acc. to IEC 61071

- DRAFT -

Order code:	E57.A12-805017			
Application:	DC capacitor for general use in power electronics also for nonsinusoidal voltages and currents with low self inductance			
Standard:	acc. to IEC 61071:2017			
Characteristics				
Rated capacitance	C_N		8000 µF ±5%	**outline drawing**
Rated d.c. Voltage	U_{NDC}		800 V d.c.	
Ripple voltage	U_r		150 V	See drawing G57.A12-A00001 on page 2
Non-recurrent surge voltage	u_s		1200 V	
Rated energy	W_N		2560 Ws	
Maximum current	I_{max}		250 A	
Maximum peak current	$\hat{I}$		10 kA	
Maximum surge current	I_s		40 kA	
Series resistance	R_s		0.3 mΩ	
Tangent of the loss angle	$\tan\delta_o$		2 x10^{-4}	
Self discharge time const.	$C \times R_{is}$		10000 s	
Self inductance	Le	<	40 nH [1]	
Resonance frequency	f_{res}	~	9 kHz [1]	
Maximum permissible voltage				
(Maximum within one day)				
30% of on-load duration			880 V	
30min			920 V	
5min			960 V	
1min			1040 V	
100ms max. 1000 times per life-time			1200 V	
Routine test voltages				
Voltage test between terminals	U_{TT}		1200 V DC/10s	
Dimensions [2]				
Height of the case	H		235 mm	
Length of the case	L		380 mm	
Width of the case	W		150 mm	
Clearance in air	L		40 mm	
Creepage distance	K		40 mm	
Thermal conditions				
Lowest operating temperature	Θ_{min}		-25 °C	
Maximum operating temperature	Θ_{max}		80 °C	
Endurance type test temperature			55 °C	
Thermal resistance	R_{th}		1.3 K/W [1]	
Storage temperature	$\Theta_{storage}$		-40..+85 °C	
Humidity class			T1	
Statistical lifetime		>	100000 h	
Failure rate		<	250 FIT	
at $\Theta_{hotspot}$		≤	70 °C	

permitted power losses during continuous operation [1]



Mechanical characteristics

Dielectric	DC - metallized polypropylene capacitor, self-healing
Construction	Plastic case (V0 acc to UL94) RAL 5012, brass terminals,
Protection	unprotected, without internal fuse, to be used only in uncritical environment
Impregnant	dry type, filled with solidified resin (Non PCB)
Fire load	500MJ
Approx weight	16kg

1) Calculated value. Exact values can be verified by dedicated type test.
2) Draft. Exact dimensions and tolerances to be confirmed after completion of design and construction.

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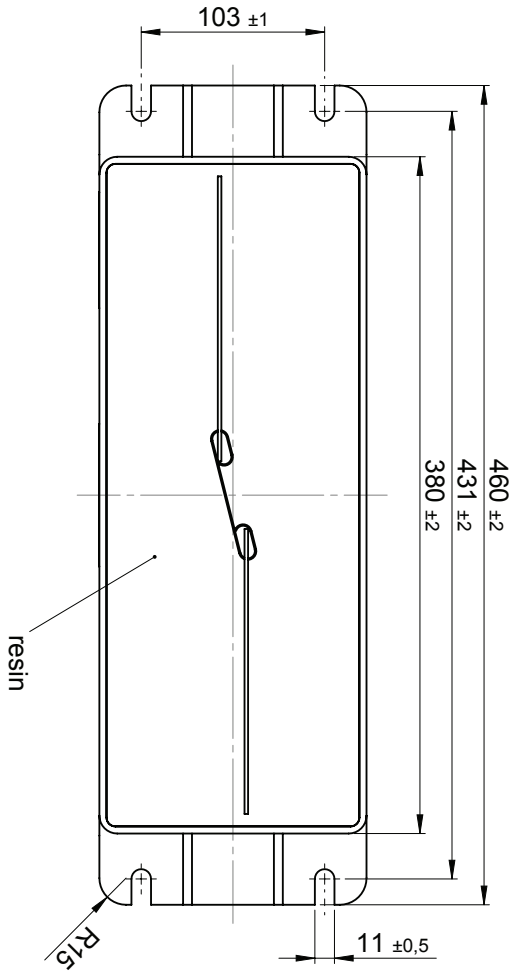

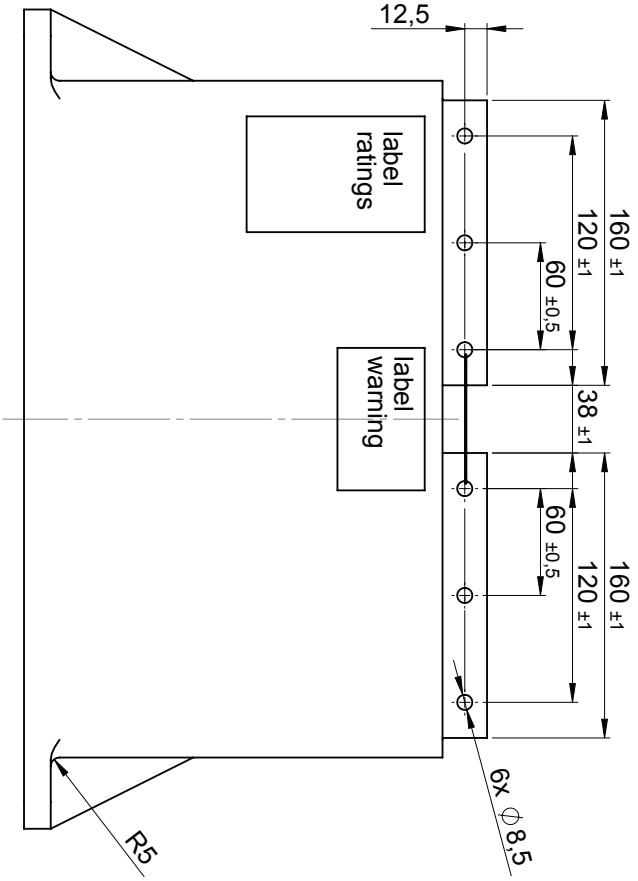

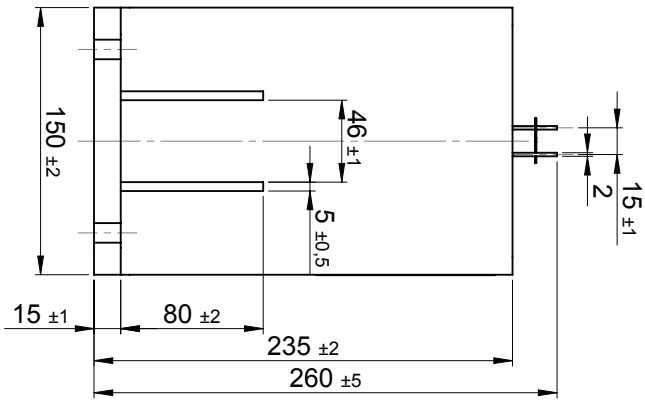

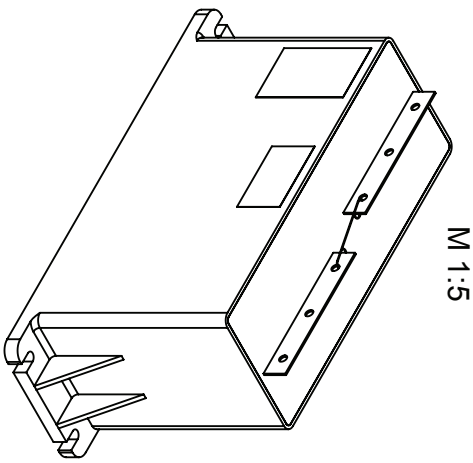

Index	B001			Grenzabweichung/ tolerances	Maßstab/scale 1:3
Änderung/amendment	GAVK4-318/14			DIN ISO 2768-c	Werkstoff/material
date	17.07.2014		date		
name	Ra	Bearb.	18.06.2012	name	Benennung/description
		Gepr.		Stahl	PEC 380x150x235
		Entw.			
ELECTRONICON Kondensatoren GmbH · Kesternstraße 2 · D-07546 Gera / Germany				Gewicht [g]	Zeichnung-Nr./drawing No. G57.A12-A00001
				Ers. f.	Ers. d.
				Format A3	Bl. Blatt/page

General

Our data sheets outline the typical technical and mechanical characteristics of the described capacitor. The stated values are based on reference type tests, as well as empirical and experimental experience. The real values of individual capacitors may differ within the stated, or commonly known, tolerances. Any information given in this data sheet therefore describes the component in general terms and does not constitute any guarantee of individual technical values.

Custom-made capacitors are designed to the best of our knowledge, based on the specifications and additional information received from the customer. The phrase “According to customer specification” means that such custom-designed capacitors are based on the parameters of the specification with the exception of deviations declared officially by Electronicon in writing (e.g. by CbC-protocol). ELECTRONICON cannot be held responsible for failures arising out of operation under circumstances unknown at the time of design.

It is the responsibility of the user to ensure the suitability and safety of operation of our components under the conditions of his application by dedicated tests.

Safe operation of the capacitors can be expected only if all safety recommendations as well as electrical and thermal specifications as stated on the label, in the data sheets, catalogues and the accompanying mounting instructions are strictly observed, and recommended safety devices are used as intended. Please consider the “General Safety Recommendations” of the power capacitor manufacturers organized in the German ZVEI (https://www.electronicon.com/en/downloads/application-notes-and-general-information). ELECTRONICON cannot accept responsibility for whatever damage may arise out of a non-observance.

MOUNTING AND OPERATING INSTRUCTIONS / DEFINITIONS

Mounting Location/Cooling

The useful life of a capacitor depends very much on the average operating temperature. The expected temperature rise of the capacitors can be calculated based on the technical data from this data sheet. The capacitors must be operated in such way that the maximum hotspot temperature stated in the data sheet is not exceeded even under the most critical ambient conditions. Failure to comply with these conditions may lead to drastic reduction of the expected life of the capacitor, or in the worst case failure of the safety mechanisms and rupture of the capacitor.

As a rule, the user has to ensure by his own type test in the application that the permitted maximum hotspot temperature of the capacitor is not exceeded even at worst ambient and operating conditions. If required, we can provide special type test samples with integrated temperature sensors (as standard: PT100). It should be noted that the internal heat balance of large capacitors is only reached after a couple of hours.

! The following recommendations apply if a type test in the application is not possible:

Natural convection cooling: leave 40 to 80mm clearance between and around the capacitors*; ensure sufficient spacing above the capacitors for unhindered air convection.

Forced air cooling: Leave 30 to 40mm clearance between the capacitors*. The cooling air shall have unimpeded access to the entire lateral surface.

The installation of the capacitors directly next to or above heat sources, such as reactors, shall be avoided.

**Mind that, even though the capacitors are filled with a solid resin, the capacitor width may increase by up to 10mm during operation (if not specified otherwise in the drawing or data sheet).*

Mounting Orientation

The capacitors do not contain liquid fillings and can be mounted in any orientation without restrictions. However, please mind that the mounting orientation may be restricted by mechanical reasons (e.g. bracket design, bracket position, case material and thickness, etc.).

Shock and Vibration Stress

Most of all, shock and vibration stresses affect the fixing elements and terminals. They must therefore be checked and tested in the real mounting position with cables, bus bars, brackets etc. attached.
The capacitors with a weight of up to 100kg comply with the following test standards:

- sinusoidal oscillation - test Fc 5..100Hz floating, 2g/amplitude 7.5mm / 10 cycles acc. to IEC 60068-2-6
- shock, semi-sinusoidal - test Ea 5g ,11ms / 6 shocks acc. to IEC 60068-2-27

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Connection

Flat copper terminals: no limit in torque, but bending has to be avoided
For threaded stud or internal thread please observe the following table.

Attention:

! Use standardized non-magnetic parts for fastening cables or bus bars to avoid inductive heating of the terminals. We recommend using nuts and screws either nickel-plated, or tinned with nickel barrier coating, to protect against electrochemical corrosion and the formation of whiskers.

! Capacitor terminals shall not be used as distribution points for cables or bus bars.

Recommended torque for screw connections (if not otherwise specified in the drawing or data sheet):

Terminal thread	Recommended torque
M5	1.5…2 Nm
M6	2.3…3 Nm
M8	3.8…5 Nm
M10	6.8…9 Nm
M12	10…14 Nm
M16	19…25 Nm

Discharge

If there is no discharge of the capacitors provided by external circuits, the capacitors should be provided with discharge resistors. In any event, the poles of the capacitors must be short-circuited before being touched. Note that capacitors with nominal voltages above 750Vac or 2000Vdc in particular may regenerate new voltage at their terminals after having been short-circuited just for short periods. This condition results from the internal series connection of the capacitor elements and will be avoided by storing them permanently short-circuited.

! **Attention: The capacitors for power electronics are not contain discharge resistors as standard!**

Environment for Operation and Storage

Capacitors shall be stored and operated in dry environment and in conformance with the specified climatic class. Do not expose capacitors to rain or direct sun. Do not store or operate capacitors in, or close to, aggressive environments and corrosive atmosphere, e.g. acids, sulphide, chlorine/chlorides, salt mist, etc.

Avoid the deposition of dust and dirt on the capacitors which may obstruct the creepage distances between terminals.

Principally, capacitors made of metallized polypropylene do not have a limited shelf life if stored properly. However please note that capacitors in non-hermetical housing may suffer from humidity and other environmental factors if left unused for a long period. Please consult us if in doubt about the condition of your capacitors after long storage or storage under doubtful circumstances.

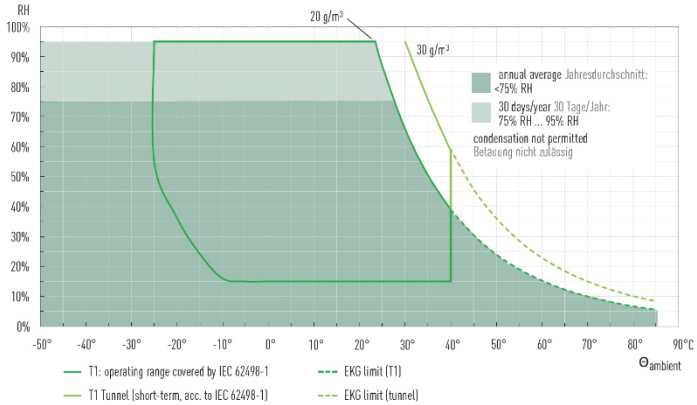
Environmental Conditions

The humidity class (T1 or TX) stated in the data sheet is based on railway standard IEC 62498-1. These values shall not be exceeded during storage and operation.

The classes refer to the atmospheric conditions of the operating environment. Separately, the limits for the hotspot temperature as stated in the catalogues or data sheets must never be exceeded. The humidity values are based on long-year empirical experience and are hard to be simulated by specific accelerated tests. Please consult us if in doubt about the suitability of our components for specific ambient conditions.

The specified limits of humidity must not be exceeded during operation and storage of the capacitors.

Humidity Classes T1 acc. to IEC 62498 1



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Appearance

Despite careful handling and strict quality control, traces of production and handling may be left on the surface of the capacitors. Superficial flaws such as slight scratches, colour variations of the material, finger prints, small dents or slight unevenness of the surface do not represent a fault and cannot be accepted as a reason for rejects or claims under warranty.

FIT RATE (Failures In Time)

The FIT rate reflects the probability of failures during the operating period under selected operating conditions. Any failure rate of a capacitor is very closely linked with the operating temperature and the applied operating voltage. As standard, the FIT rates stated in our data sheets are assuming a capacitor hotspot temperature of 70°C and operation at rated voltage. Unless stated otherwise, they are related to a reference operating interval of t=100,000 hours. After the reference interval, the capacitors will continue operating; however the probability of failures may change and the FIT rate may rise.

! Note: The FIT rate cannot give information about the individual lifespan or the expected moment of failure of a capacitor. Service cycles may be calculated based on the so-called MTBF value (mean time between failures): MTBF = 10^9/FIT.

The simultaneous operation of capacitors at highest permissible voltage and operating temperature should be avoided; otherwise, failure rates may increase beyond reasonable technical reliability.

CE identification

The capacitors are marked „CE“ when both of the following criteria apply:

- They conform to standard IEC / DIN EN 61071.
- At least one of the AC or DC voltage ratings does not exceed 1500V.

SAFETY IN OPERATION

Protection Against Overvoltages and External Short Circuits:

The capacitors are self-healing and regenerate themselves after breakdowns of the dielectric. For voltages within the permitted testing and operating maximum the capacitors are overvoltage-proof. They are also proof against occasional external short circuits as far as the resulting surge discharges do not exceed the specified current limits (I_S).

Hazards of Explosion

Capacitors consist mainly of polypropylene (up to 50% of the weight), i.e. their energy content is relatively high. As a result of internal faults or external overload (e.g. temperature, overvoltage, harmonic distortion) which can lead to the disintegration of the polypropylene dielectric, they may build up substantial amounts of explosive gasses leading to rising pressure inside.

Fire load

The capacitor dielectric and the PUR-resin have a fire load of ca. 40 MJ/kg.
Appropriate extinguishing agents are: dry powder, CO_2, foam

ENVIRONMENTAL COMPATIBILITY

Our capacitors do not contain PCB, solvents, or any other toxic or banned materials. They do not contain hazardous substances acc. to «Chemische Verbotsverordnung» (based on European Directive 2003/53/EC and Council Directive 76/769/EEC). The capacitors are not classified as «dangerous goods» acc. to transit rules. The capacitors do not have to be marked under the Regulations for Hazardous Goods. They are rated WGK 0 (water risk category 0 «no general threat to water»). No danger for health if used properly.
The capacitors comply with the specifications of the ROHS, REACH and SVHC directives.

DISPOSAL

Capacitors are components of electrical devices. They are NOT equipment or devices by themselves, and not subject to the Waste Electrical and Electronic Equipment Directive (WEEE). We recommend disposing of the capacitors through professional recycling centers for electric/electronic waste. Make also sure to consult your national rules and restrictions for waste and disposal.

The filling materials contain solidified polyurethane mixtures based on vegetable oil. The capacitors can be disposed of in accordance with European waste catalogue (EWC) No. 16 02 16 (“Components removed from discarded equipment other than those mentioned in 16 02 15”).

Caution: When touching or disposing capacitors, please consider that even after days and weeks these capacitors may still be charged with high voltages!

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DEFINITIONS

Rated capacitance C_N
Capacitance value rated at 20°C / 50 Hz.

Rated Voltage U_N
The maximum or peak voltage of either polarity of a reversing or non-reversing wave form for which the capacitor has been designed and rated (unlike other standards for AC capacitors, the rated voltage is not the rms value).

Non repetitive peak (surge) voltage U_S
Voltages beyond the rated voltage induced by switching or faults of the system or any part of it. Maximum count 1000 times with a duration of not more than 100 ms each.

rms voltage U_{eff}
Root mean square of the max. permissible value of sinusoidal AC voltage in continuous operation.

Ripple voltage U_r
The peak-to-peak alternating component of the unidirectional voltage.

Voltage test between terminals U_{TT}
Routine test of all capacitors conducted at room temperature, prior to delivery. A further test with 90% of the test voltage stated in the data sheet may be carried out once at the user's location.

Voltage test between terminals and case U_{TC}
Routine test of all capacitors between short-circuited terminals and case, conducted at room temperature. May be repeated at the user's location for one time only.

Maximum current I_{max}

Maximum rms value of permissible current in continuous operation. The values given in the data sheets are related to either the specified maximum power dissipation or the current limits of the connection terminals.

Peak current $\hat{I}$
Maximum permitted repetitive current amplitude during continuous operation.

Non-repetitive peak current (surge) $\hat{i}_S$
Maximum current that may occur non-repetitively and briefly in the event of a fault.

Equivalent series resistance R_S
Equivalent resistance representing the sum of all Ohmic resistances occurring inside the capacitor. Essential for calculation of the current dependent losses.

Self-inductance L_e
Represents the sum of all inductive elements which are – for mechanical and construction reasons – contained in any capacitor.

Resonant frequency f_{res}
The capacitance and self-inductance of any capacitor form a series resonant circuit. Above the resonant frequency, the inductive part of this LC-circuit prevails. The capacitor would then behave as an inductor.

Dielectric dissipation factor $\tan\delta_0$
Constant dissipation factor of the dielectric material for all capacitors in their rated frequency.

Thermal resistance R_{th}
The thermal resistance indicates by how many degrees the capacitor temperature rises at the hotspot due to dissipation losses. This temperature rise relates to the surrounding air in a distance of ca. 10cm from the case surface.

Maximum power dissipation P_{max}
Maximum permitted power dissipation for the capacitor's operation at a certain ambient temperature.

Ambient temperature Θ_{amb}
Temperature of the surrounding air, measured 10 cm away and at 2/3 of the case height of the capacitor.

Lower category temperature Θ_{min}
Lowest permissible ambient temperature at which a capacitor may be used.

Upper category temperature Θ_{max}
Highest permissible capacitor temperature during operation, i.e. temperature at the hottest point of the case.

Hotspot temperature $\Theta_{HOTSPOT}$
Temperature at the hottest spot inside the capacitor.

Rated energy contents E_N
Energy stored in the capacitor when charged at rated voltage.

Clearance in air L
The shortest distance between conducting parts of the terminals or between terminals and case.

Creepage distance K
The shortest distance along an insulated surface between conducting parts of the terminals or between terminals and case.

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