



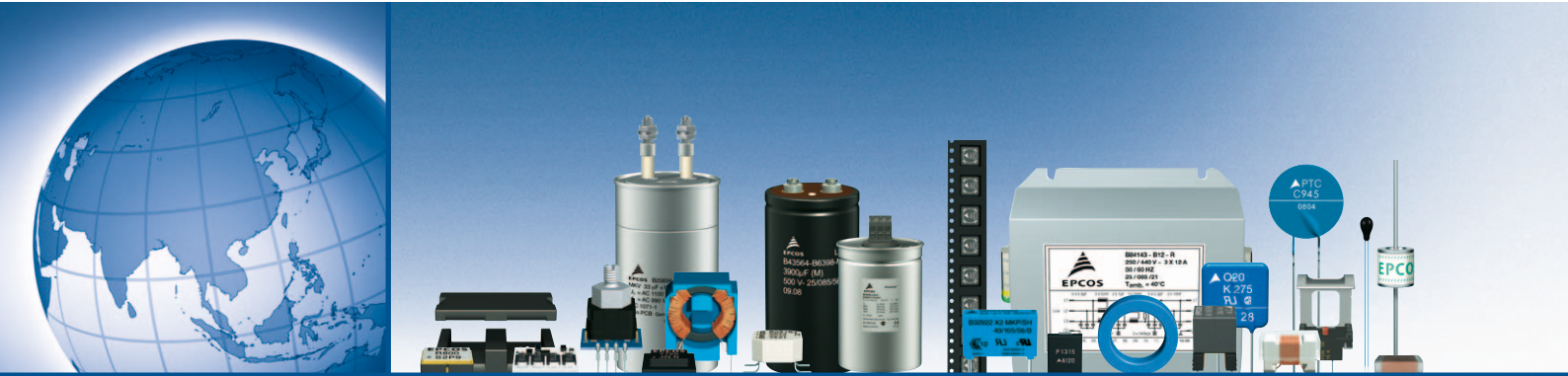
Product Profile 2011



MotorCap DM

AC Film Capacitors for
Motor Run Applications

Welcome to the World of Electronic Components and Modules



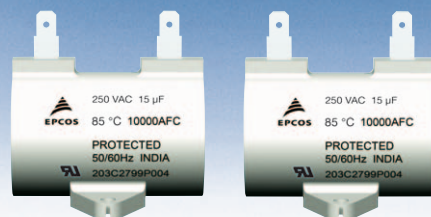
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EPCOS has design, manufacturing and marketing facilities in Europe, Asia and the Americas. We are continuously strengthening our global research and development network by expanding R&D activities at our production locations, primarily in Eastern Europe, China and India. With our global presence we are able to provide our customers with local development and manufacturing know-how and support in the early phases of their projects.

EPCOS is continually improving its processes and thus the quality of its products and services. The Group is ISO/TS 16949 certified and remains committed to constantly reviewing and systematically improving its quality management system.

MotorCap DM

AC Film Capacitors for Motor Run Applications



For film capacitors, the metalized technology is applied. An extremely thin metal film is deposited in a high vacuum onto the low-loss polypropylene film. Then two layers of metalized film are wound to form the electrodes. The impulse resistance is possible due to the so called self-healing effect. By using polypropylene as the dielectric they have particularly a low dissipation factor. AC film capacitors are usable for general sine-wave applications as filters, inverters, UPS devices etc., but are also particularly suitable for the operation of asynchronous electric motors and electric compressors.

As motor run capacitors, they assure smooth and energy-saving operation of electric motors used in applications such as refrigerators, freezers, electric compressors, washers, dryers, air-conditioning appliances, ventilators, pumps, electric lawn mowers, electric doors and drives.

This product profile presents the latest MotorCap™ DM series of motor run capacitors in a very compact end efficient design. It is addressed particularly to manufacturers of e.g. washers, refrigerators, but also fans and ventilation systems. The usage is widely applied to running of AC single-phase synchronism motors at 50/60 Hz frequency power for varied applications. Make use of the advantages of leading technology.

Important Notes

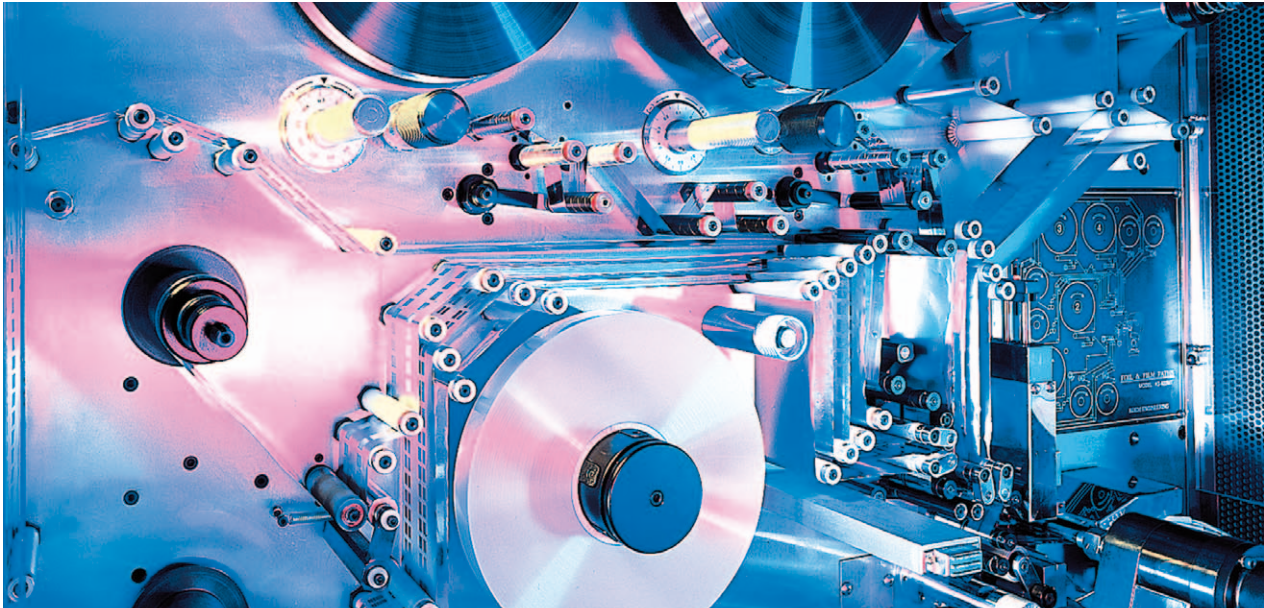
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1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application**. As a rule, EPCOS is either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether an EPCOS product with the properties described in the product specification is suitable for use in a particular customer application.
2. We also point out that **in individual cases, a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified**. In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g. in accident prevention or life-saving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.
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4. In order to satisfy certain technical requirements, **some of the products described in this publication may contain substances subject to restrictions in certain jurisdictions (e.g. because they are classed as hazardous)**. Useful information on this will be found in our Material Data Sheets on the Internet (www.epcos.com/material). Should you have any more detailed questions, please contact our sales offices.
5. We constantly strive to improve our products. Consequently, **the products described in this publication may change from time to time**. The same is true of the corresponding product specifications. Please check therefore to what extent product descriptions and specifications contained in this publication are still applicable before or when you place an order.

We also **reserve the right to discontinue production and delivery of products**. Consequently, we cannot guarantee that all products named in this publication will always be available.

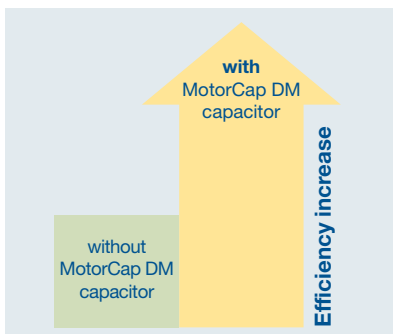
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MotorCap DM



The DM series of MotorCaps uses the advantages of MKP technology. In the metal coating procedure, an extremely thin metal film is vapor-deposited onto the pretreated side of the capacitor foil in a high vacuum. Capacitors manufactured by this technology are small and impulse-resistant.

Improving the efficiency of electric motors



Efficiency of asynchronous motors or compressors

Motor run capacitors are AC voltage capacitors that allow the operation of asynchronous induction motors. The use of MotorCap DM capacitors increases the energy efficiency of motors and compressors by up to 12%. They also significantly improve the torque response of these appli-

ances. This is particularly important for motors and compressors in continuous operation and thus applies especially to compressors in refrigerators and air-conditioning units.

Safety classes within the scope of IEC 60252-1

The IEC/EN 60252-1 2001 standard applies to all motor run capacitors. All MotorCap DM capacitors manufactured by EPCOS are designed on the basis of this standard.

This standard divides the capacitors into the following safety classes:

P0

Without safety protection: Indicates that the capacitor type has no specific failure protection.

P1

With internal safety protection: Indicates that the capacitor may fall in open-circuit or short-circuit mode and is protected against fire or shock hazards.

P2

With internal safety protection: Indicates that the capacitor type has been designed to fail in the open-circuit mode only and is protected against fire and electrical shock hazards.

UL 810 construction only

Construction approval of materials only.

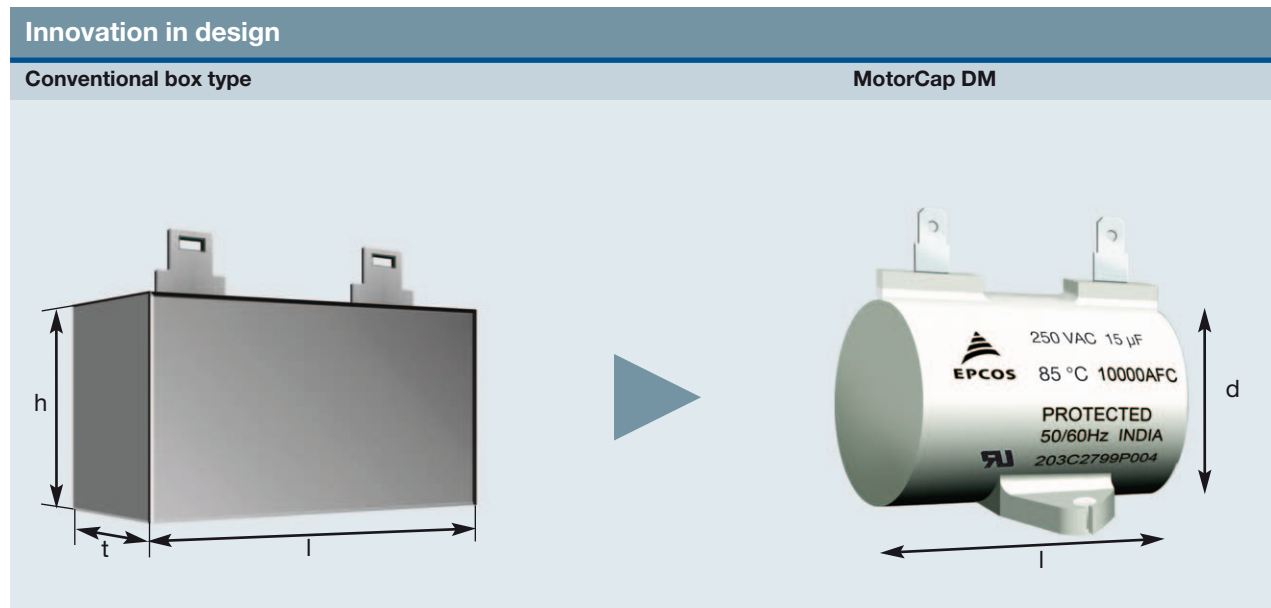
UL 810 components, 10000 AFC

The capacitor has additional internal protection designed to prevent case rapture under fault conditions.

Requirements of IEC 60335-1

Domestic appliances are subject to the IEC 60335-1 standard. If a motor run capacitor is used in a domestic appliance subject to this standard, there may be additional requirements on the capacitor. These refer essentially to the materials used as well as to the creepage and clearance distances. This approval generally applies to the complete capacitor assembly and not only to individual raw materials. The materials as well as the creepage and clearance distances selected for the EPCOS MotorCap DM make it ideal for use in domestic appliances.

Technology and Advantages

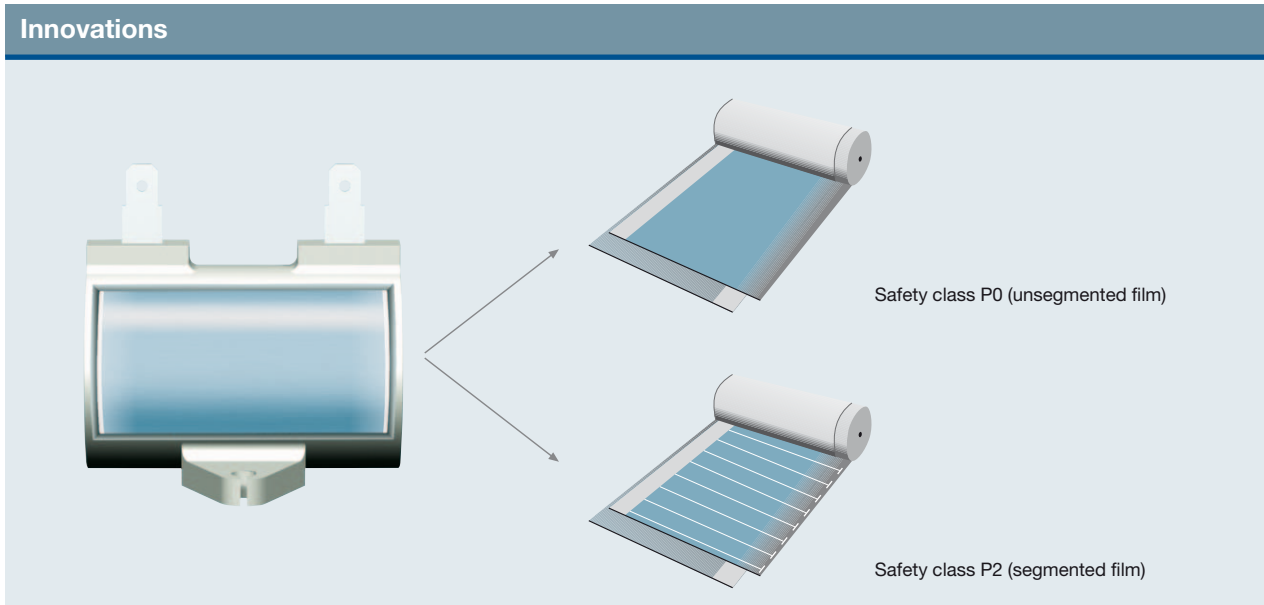


Comparison between typical box type and direct mould							
Capacitor	Capacitance C_R	Voltage V AC @ +85 °C	Safety class	Dimensions mm	Vol. cm ³	Dimensional savings	
Conventional box type	4 µF	450	P0	t x h x l	22.5 x 35 x 58	45	-55%
MotorCap DM				d x l	24 x 43	20	
Conventional box type	6 µF	450	P0	t x h x l	23.5 x 37 x 58	50	-44%
MotorCap DM				d x l	29 x 43	28	
Conventional box type	10 µF	250	P2	t x h x l	22.5 x 31.5 x 48	34	-41%
MotorCap DM				d x l	24 x 43	20	
Conventional box type	12 µF	250	P2	t x h x l	21 x 31 x 58	38	-27%
MotorCap DM				d x l	29 x 43	28	
Conventional box type	15 µF	250	P2	t x h x l	23.5 x 37 x 58	50	-44%
MotorCap DM				d x l	29 x 43	28	

Advantages of new design:

- Smallest size: Up to 44% less in volume means more comfortable mounting and reduced costs.
- Totally hermetically sealing through molding process (embedded sealing). This means highest protection against immersion and humidity
- Fully automated process: high volume, reduced cost
- Safety according to UL 810 and IEC 60252-1 2001 in one capacitor
- Ambient temperature up to +85 °C
- Usable for various applications due to full voltage range up to 450 V AC
- Dry technology: No liquid or semi-liquid materials are used inside the capacitor. This allows it to be placed in any desired orientation. Also, no flammable materials can leak out of dry capacitor
- Fully compliant to IEC 60335-1 which makes this capacitor perfect for domestic appliances
- Terminal options
 - fast-on
 - wires

Technology and Advantages



The best of two technologies

Motor run capacitors were conventionally constructed as aluminum cans in Class P2 (with safety protection) or in plastic cases with Safety Class P0 (without safety protection). The MotorCap DM combines the advantages of both these technologies in an innovative product:

- Safety Class P0 or P2 to IEC 60252-1 2001
- Rugged plastic case
- Self-healing design
- Low dissipation factor
- Dry type, hence no oil or flammable fluids in the capacitor
- Life expectancy up to 10 000 h
- Insulating plastic case: no complex case grounding required
- Hermetic sealing by fully automatic direct molding process
- Excellent price/performance ratio
- Significantly reduced size and weight
- Flame retardant plastic housing to IEC 60335-1

All these advantages are ensured by the metalized polypropylene film developed by EPCOS specifically for this application.

Safety class P2 by segmented film

In this film, the two metalizations forming the capacitor are subdivided into individual segments, and fuses are incorporated into the structure of each of them. In the event of an overload, these fuses open and switch off the segments. Thanks to the integration of these fuses into the film, the protective function is decoupled from the case construction.

Construction

- Dielectric: Polypropylene film
- Electrode: Segmented metalized film
- Totally hermetically sealed by molding technology
- Flame retardant plastic housing to IEC 60335-1
- Dry type

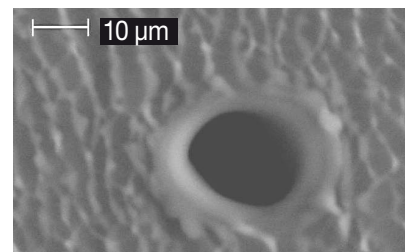
Dry technology

The MotorCap DM is of the dry type. No liquid or semi-liquid materials are used inside the capacitor. This allows placing it in any desired orientation. Also, no flammable materials can leak out of dry capacitors in the event of mechanical damage.

Self-healing technology

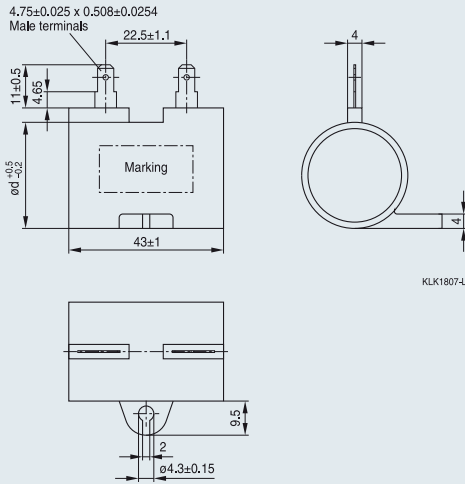
An electric breakdown is possible as the result of thermal or electric overload or at the end of service life. This results in a small arc that evaporates the metalization in the area of the breakdown as a matter of microseconds.

The gas pressure caused by the high temperature at this spot blows the metal vapour away from the breakdown area. Thus a non-conducting isolation area free of metalization is formed here. During and after the breakdown, the capacitor is fully functional. The reduction in capacitance caused by self-healing is less than 100 pF, i.e. of an order that can only be verified by a precision measuring instrument.

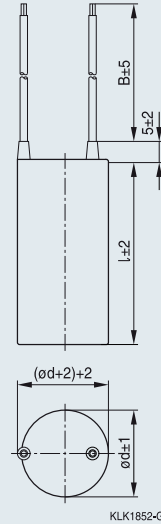


Dimensional Drawing and Product Line

B32318/B32358, fast-on



B32317/B32357, wire terminals



Product line portfolio

MotorCap DM with fast-on terminals		Safety Class: P2		Safety Class: P0	
V _R V AC	C _R µF	Dimensions (Ø d x l) mm	Ordering code	Dimensions (Ø d x l) mm	Ordering code
250	10	24 x 43	B32358A1106J011	24 x 43	B32318A1106J011
	12	29 x 43	B32358A1126J011	29 x 43	B32318A1126J011
	15	29 x 43	B32358A1156J011	29 x 43	B32318A1156J011
450	1.2	19.5 x 43	B32358A6125J011	19.5 x 43	B32318A6125J011
	2	19.5 x 43	B32358A6205J011	19.5 x 43	B32318A6205J011
	2.5	19.5 x 43	B32358A6255J011	19.5 x 43	B32318A6255J011
	3.0	24 x 43	B32358A6305J011	24 x 43	B32318A6305J011
	4.0	24 x 43	B32358A6405J011	24 x 43	B32318A6405J011
	6.0	29 x 43	B32358A6605J011	29 x 43	B32318A6605J011

MotorCap DM with wire terminals		Safety Class: P2		Safety Class: P0	
V _R V AC	C _R µF	Dimensions (Ø d x l) mm	Ordering code	Dimensions (Ø d x l) mm	Ordering code*
250	10	24 x 43	B32357A1106J011	24 x 43	B32317A1106J011
	12	29 x 43	B32357A1126J011	29 x 43	B32317A1126J011
	15	29 x 43	B32357A1156J011	29 x 43	B32317A1156J011
450	1.2	19.5 x 43	B32357A6125J011	19.5 x 43	B32317A6125J011
	2	19.5 x 43	B32357A6205J011	19.5 x 43	B32317A6205J011
	2.5	19.5 x 43	B32357A6255J011	19.5 x 43	B32317A6255J011
	3.0	24 x 43	B32357A6305J011	24 x 43	B32317A6305J011
	4.0	24 x 43	B32357A6405J011	24 x 43	B32317A6405J011
	6.0	29 x 43	B32357A6605J011	29 x 43	B32317A6605J011

* Wire length B = 100 ± 5 mm

Technical Data

Specifications		
Reference standards		IEC 60252-1 2001-02 / EN 60252 2001
Safety class to IEC 60252-1 2001-02		P0 or P2
Life expectancy to IEC 60252 2001		250 V/85 °C: 10 000 h (class B) 450 V/85 °C: 10 000 h (class B)
Rated capacitance	C_R	See dimensions table
Tolerance		±5%
Rated voltage	V_R	250, 450 V AC
Rated frequency	f_R	50/60 Hz
Maximum ratings		
Maximum permissible voltage	V_{max}	$1.1 \cdot V_R$ (V_R = rated voltage)
Maximum permissible current	I_{max}	$1.3 \cdot I_R$ (I_R = rated current)
Test data		
AC test voltage terminal to terminal	V_{TT}	$2 \cdot V_R$, 2 s (routine test) $2 \cdot V_R$, 60 s (type test)
Insulation resistance R_{ins} or time constant τ at 20 °C, rel. humidity ≤ 65% (minimum as-delivered values)	s	3000
Dissipation factor $\tan \delta$ at 20 °C		≤ $1.0 \cdot 10^{-3}$ (120 Hz)
Maximum rate of voltage rise	dV/dt_{max}	10 V/ms
Climatic data		
Climatic category		25/085/21 to IEC 60068-1
Lower category	T_{min}	-25 °C
Upper category	T_{max}	+85 °C
Damp heat test	t_{test}	21 days
Mechanical and thermal properties		
Ball pressure test to IEC 60309-1 sec. 27.3		20 N at 125 °C
Plastic can and top disk material		Compliant to EN 60252
- UL 94 V2 compatible - Glow wire test to IEC 60695-2-1/0 and -2-1/1 Test temperature 550 °C for $I_R \leq 0.5$ A Test temperature 750 °C for $I_R > 0.5$ A - Part is compatible to EN 60335-1		Self-extinguish within 2 seconds of withdrawing glow wire without igniting wrapping tissue to GWIT
Tracking Test to IEC 60112 solution A		> 250 V
Approvals		
VDE - 400 V/85 °C: 10 000 h (class B)		In progress
VDE - 450 V/85 °C: 3 000 h (class C)		In progress
UL 810 10000 AFC		Approved (file No. E106388)

MotorCap DM



Tested Safety

Process reliability is ensured by a fully automatic production flow from winding to direct molding. This molding process ensures that the capacitor is totally hermetically sealed.

All EPCOS MotorCap series are continuously tested throughout manufacture and are 100% checked before delivery.

TQMS – Total Quality Management System

All locations producing MotorCap DM capacitors are additionally certified to ISO/TS16949:2002.

Environment

MotorCap DM capacitors are of the non-impregnated dry type. This means they do not include PCB or other impregnated materials. No flammable materials can leak out of dry capacitors in the event of mechanical damage.

The EPCOS Group operates an environmental management system that conforms to the requirements of ISO 14001. Our locations in Europe and the Americas, as well as most of those in Asia, are currently certified to this standard.

Applications motor run

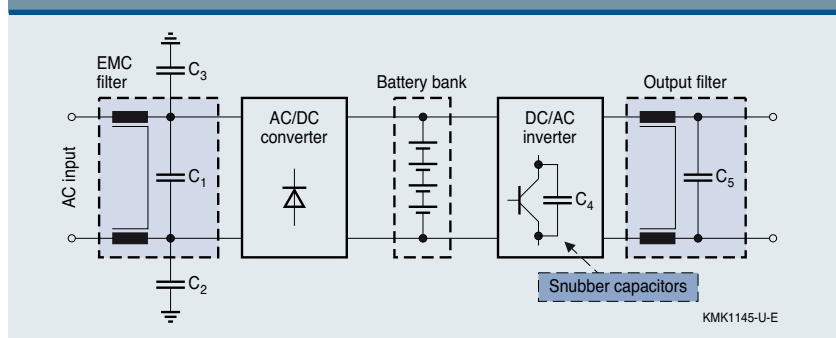
The MotorCap DM is simply plugged into the auxiliary winding of the motor or compressor and can remain permanently connected there. There is no need for a turn-off function or a separate fuse. MotorCap DM capacitors are designed for continuous operation and optimized for use in the following applications, but may be used equally well for general drive motors.

- Refrigerators and freezers
- Electrical compressors
- Washing machines and dryers
- Dishwashers
- Air conditioners & fans
- Awning drives
- Pumps

Applications UPS/Inverter

MotorCap DM is also usable as an output filter (Position C5 in block diagram). The basic purpose of an output filter is to protect the motor connected to the output by filtering the RF components coming from the inverter and to withstand the current peaks caused by pulses of rapidly changing voltages.

UPS: example of block diagram



Cautions and Warnings

- The MotorCap DM should be operated in line with its typical approved usage.
- Handle the capacitor units carefully, as they may be charged even after disconnection.
- Observe the appropriate engineering practice.
- The capacitor terminals, connected busbars and cables as well as any other devices connected to them must be regarded as live. The device is electrically charged.

Storage and operating conditions

Do not use or store capacitors in a corrosive atmosphere, especially where chloride gas, sulfide gas, acids, alkalis, salts or similar substances are present. In a dusty environment, regular maintenance and cleaning, especially of the terminals, is required to avoid formation of a conductive path between phases and/or phases and ground.

Ambient temperature

The capacitor must not be exposed to direct heat or fire. The permissible range of minimum and maximum temperatures is specified on the capacitor, i.e.

25/70/21 = minimum permissible temperature: $-25\text{ }^{\circ}\text{C}$, max. permissible temperature: $70\text{ }^{\circ}\text{C}$.

25/85/21 = minimum permissible temperature: $-25\text{ }^{\circ}\text{C}$, max. permissible temperature: $85\text{ }^{\circ}\text{C}$.

Temperature is one of the main stress factors for polypropylene type capacitors. It has a major influence on their useful operating life. It should be noted that this useful life is considerably shorter in the case of higher temperature requirements. If the maximum permissible temperature is exceeded, the safety device may become inoperative.

Installation

Mounting orientation

The MotorCap DM may be mounted in any orientation.

Fixing

The MotorCap DM must be installed in a cool and well-ventilated place and should not be placed close to objects that radiate heat.

Connectors

In case of fast-on terminals, the female connectors must be of suitable design to ensure a good contact. Do not solder cables directly onto the fast-on terminals, as the terminal may overheat, causing the capacitor safety device to malfunction.

Connecting cable

The cable used for connecting capacitors must be capable of carrying at least 1.5 times the rated current of the capacitor. It must exert no mechanical force on the capacitor terminal. Any mechanical force applied to these terminals may result in damage.

Harmonics

Harmonics are sinusoidal voltages and currents whose frequencies are multiples of a 50 Hz or 60 Hz power supply frequency. They result from the operation of electrical loads with nonlinear voltage-current characteristics. These loads are largely associated with modern electronic devices such as converters, electrical drives, welding machines and uninterruptible power supplies (UPS).

Harmonics may cause a higher than rated current to flow through the capacitors, which may overheat and become damaged. This may cause operational failures, bursting and fire. The maximum permissible current (incl. fundamental and harmonic currents) specified in the technical data of the relevant series must not be exceeded under any circumstances.

Operating voltage V_{op}

These capacitors have been designed for continuous operation at the rated voltage stated on the label. This voltage may be exceeded only within the limits permitted by the applicable standards at room temperature:

V_{op}	Operating duration
$1.1 \cdot V_R$	24 h/day
$1.15 \cdot V_R$	6 h/day
$1.2 \cdot V_R$	5 min/day
$1.3 \cdot V_R$	1 min/day

Fuses for film capacitors B32357/B32358

Electrical components do not have an unlimited life expectancy; this also applies to self-healing capacitors. MotorCap DM capacitors are equipped with a film containing built-in fuses. If numerous electrical breakdowns occur at the end of its life or as the result of electrical overload, the capacitor's fuses switch sequentially in segments. When all its fuses have opened, the capacitor is disconnected from the power line.

Maintenance

There are no serviceable or repairable parts inside the capacitor, so please refrain from opening it.

For more details, please refer to the current "Applications Warning, Installation and Maintenance Instructions" at www.epcos.com/ac_capacitors

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