

2011
REV 01



POWER ELECTRONICS CAPACITORS

MKP SERIES

*Self healing
metallized polypropylene
film capacitors for
AC applications*



Certificato UNI EN ISO 9001:2008


ICAR
technology looking ahead

1. COMPANY PROFILE



OUR MISSION:

“Develop and supply high-quality capacitors, providing all the customers with full assistance from the design through the delivery.

We will take care to any particular needs that the customer may have.”

Established in 1946, ICAR has rapidly reached, and since then maintained, a leadership position in the research and development of new capacitors and components of which capacitors are key parts.

In the early 60's, first in the world, ICAR started the production of metallized polypropylene film capacitors, by developing the film metallization by its own.

ICAR group nowadays controls all the manufacturing phases of the capacitor: from the polypropylene film extrusion through its metallization, to the production of the finished capacitor. The know-how accrued in almost 50 years of metallized film production, has enabled ICAR to bring to the market innovative products.

Today ICAR Group is a leader in the production of capacitors, both for power electronics applications and for low and medium voltage power factor correction.

ICAR Group today offers a wide range of products, all manufactured at its 6 plants located in Europe, that includes:

- power electronics and special capacitors
- lighting capacitors
- motor run capacitors
- Power Factor Correction capacitors and Systems
- L.V. and M.V. voltage stabilizers
- transformers and chokes

2. ICAR GROUP PRODUCT RANGE



POWER ELECTRONICS AND SPECIAL CAPACITORS

Polypropylene film capacitors for:

- DC link input filter both for industrial and traction inverters (LNK series and BIOENERGY D series)
- AC filter for inverters and UPS (MKV, MKP series)
- snubber capacitors for semiconductors (THY and MKV series)
- all purpose AC and DC capacitors (MKV, MKP and BIOENERGY A series)
- medium frequency furnaces (BIOFURN Series) and medical application
- special capacitors for energy storage

M.V. PFC CAPACITORS AND BANKS

Wide range of M.V. power capacitors, with powers from 50 to 800 kvar, available in single and three phase versions, up to 24 kV rated voltage.

Capacitor banks up to 150 kV both for indoor and outdoor installation can be supplied on customer need.



LIGHTING CAPACITORS

ICAR series of lighting capacitors are suitable for parallel and series power factor correction applications in both fluorescent and discharge light fittings.

Moreover Plastic Case Type A and Metal Case Type B capacitors can be equipped with a wide range of fixing devices and terminals options.

ENEC and UL approvals certify that ICAR lighting capacitors are in compliance with the latest standards and assures customers of an ICAR product with high levels of quality and reliability.

MOTOR RUN CAPACITORS

ICAR motor run capacitor product range is one of the largest on the market.

The polypropylene film capacitors are available for different levels of voltage from 250V up to 500V with long life ratings up to 30.000 hours.

The variety of terminations and fixings shown in our catalogue gives the possibility to use these capacitors in any kind of application. The special design of ICAR capacitors distinguishes these components both for their quality and for their reliability.

IMQ, VDE and UL approvals guarantee the ICAR motor capacitor range meets with international standards.



POWER CAPACITORS AND PFC CONTROLLERS

Aluminium can three phase capacitors of the CRT range are available for voltages from 230V to 800V and reactive powers ranging from 1 to 40 kvar.

Power Factor Correction Controllers of 5 to 12 steps, enjoys features like incorporated temperature sensors and control, alarms and protection functions.

PFC SYSTEMS AND HARMONIC FILTERS

Range is complete of fix and automatic LV power factor correction systems, standard and detuned, active and passive harmonic absorption filters.

All of automatic systems have undergone type tests at International Laboratories





VOLTAGE STABILISERS

Electrodynamics and static voltage stabilisers, single-phase and three-phase, LV and MV from 1 up to 4000kVA with microprocessor control system. Electrodynamics line conditioners, single-phase and three-phase, LV and MV from 1 up to 2000kVA with microprocessor control system.

TRANSFORMERS AND CHOKES

Single-phase and three-phase MV and LV Electric Transformers for galvanic isolation, UPS and rectifiers.

Epoxy resin MV Transformers for distribution and rectifiers.

Single-phase and Three-phase MV and LV reactors and chokes for power correction system and AC/DC filters.



3. QUALITY POLICY



ICAR, a synonym for capacitor since 1946, has always considered the quality and the effectiveness of its internal processes as a key-factor in the company strategy.

The compliance with International Standards has always been kept as a fundamental reference for offering products and processes which completely match customers' requirements and expectations.

ICAR Quality System is certified according to EN ISO 9001:2008 standard.

ICAR representatives are members of the most important international standard committees, in charge for issuing the reference standards for the capacitor industry.

In order to comply with the international regulations and with the most severe customers acceptance criteria, products are submitted to tests both in the internal laboratories and in the most important internationally recognized laboratories



4. SELECTION RULES AND DEFINITIONS



SELECTION RULES

VOLTAGE

Select a capacitor with surge peak voltage (U_s), rated voltage (U_{NDC}) and rms voltage (U_{rms}) higher than the operating ones.

Consider that the rated voltage U_{NDC} shall be higher than the sum of the DC component and the repetitive peak of the AC component.

It is possible, within certain limits, to work above the rated voltage but this reduces the expected life of the capacitor.

During switching working condition, residual voltage before re-energizing shall not exceed 10% the rated voltage.

CURRENT AND FREQUENCY RANGE

Select a capacitor with maximum current I_{max} , higher than the operating I_{RMS}

Consider that:

- a thermal check shall be performed in order to verify that the chosen capacitor does not exceed the max operating temperature at operating I_{RMS}
- the I_{max} of the capacitors has been calculated for a $\vartheta_h - \vartheta_0$ of about 25°C and considering a voltage waveform composed by:
 - a 50Hz fundamental with rms value U_{rms} , having an impact both on conduction losses (P_C) and dielectric losses ($Q \tan \delta_0$)
 - a voltage harmonics contents affecting only the conduction losses (P_C).

$$P_C = R_S * I_{rms}^2 \quad \text{for MKP single phase cap.}$$

$$P_C = 3 * R_S * I_{rms}^2 \quad \text{for MKP-3P three phase cap.}$$

In reality the harmonics content affects also the dielectric losses but this can be only evaluated starting from an estimated or measured harmonics spectrum.

THERMAL CHECK

The dissipated power consists of dielectric losses ($Q \tan \delta_0$) due to the polypropylene film and conduction losses (P_C) due to the resistance of the electrodes and the connections.

Consider that :

the hot spot temperature can be estimated as follows:

$$\vartheta_h = R_{th} * P + \vartheta_0$$

the total dissipated power can be calculated as follows:

$$P = Q \tan \delta_0 + P_C$$

During stationary operation ϑ_h must not exceed 85°C. Power losses shall be strongly reduced when operating at an ambient temperature equal to 85°C. Please contact ICAR Tech. Dept. for derating according to ambient temperature.

At rated duty and hot spot temperature of 70°C the expected lifetime is 100.000 hours with a statistical failure rate of 300FIT (97% survival).

WARNING

The thermal check is based on the hypothesis that the heat generated into the capacitor is transmitted to the environment through the case surface. Possible localised overheating (poor connections, hot components in the nearby as other capacitors, operation with high harmonics frequency etc.) would bring the capacitor to a dramatic failure or to a reduction of the expected life. Special tests by means of thermocouples should be conducted to be sure that the maximum hot spot temperature is not exceeded even under the most critical ambient circumstances.

DEFINITIONS

C_N	Rated Capacitance measured at 20°C.
U_{rms}	Rated rms voltage
U_N	Maximum operating peak recurrent voltage of either polarity of a reversing type waveform for which the capacitor has been designed.
U_{NDC}	Maximum operating peak voltage of either polarity of a non reversing type waveform for which the capacitor has been designed for continuous operation.
U_s	Surge (not repetitive) peak voltage
U_i	Rated insulation voltage. Rms value of the AC voltage for which the terminal to case insulation has been designed and tested. Unless stated otherwise, the rated insulation voltage should be considered equal to the capacitor's rated rms voltage.
I_{MAX}	Maximum rms current value for continuous operation. Its value depends on the ambient temperature.
Clearance	Shortest distance in air between terminals conducting parts or between terminal and case
Creepage	Shortest distance along an insulated surface between terminals conducting parts or between terminal and case
Q	Reactive power $2\pi \times F_N \times C \times U_{rms}^2$ for MKP single phase cap. $3 \times 2\pi \times F_N \times C \times U_{rms}^2$ for MKP-3P three phase cap.
F_N	Fundamental frequency
R_S	Series resistance i.e. the resistance responsible for the current heat losses (P_C) in the capacitor.
$\tan \delta_0$	Dielectric dissipation factor. It can be considered constant in the normal working frequency range. Typical value for polypropylene is 2×10^{-4}
dv/dt	Maximum slope of the voltage waveform
I_{PK}	Peak current $I_{PK} = C \, dv/dt$.
P	Active power (losses) $Q \times \tan \delta_0 + R_S \times I_{rms}^2$ for MKP single phase cap. $Q \times \tan \delta_0 + 3 \times R_S \times I_{rms}^2$ for MKP - 3P three phase cap.
R_{th}	Thermal resistance between the hot-spot in the winding and the environment (natural cooling), so that: $P = (\vartheta_h - \vartheta_0) / R_{th}$ In case of forced air cooling the thermal resistance will be reduced of 20%.
ϑ_h	Hottest point in the capacitor winding = $R_{th} \times P + \vartheta_0$
ϑ_0	Operating ambient temperature. It is the air temperature measured under steady conditions, with natural convection at 0,1m from the capacitor case and at two-thirds of the height from its base.
T_C	Temperature coefficient of capacitance. The coefficient is equal to -260 ppm/°C
τ_C	Time constant between terminals: it is the product of insulation resistance between terminals at 20°C and the value of capacitance. The time constant between terminals for the MKP series is in general greater than 3000 s
Ha	Maximum altitude. The max. altitude shall not exceed 2000m corresponding to 0.7 bar
Ln	Expected life at rated voltage U_{rms} and hot-spot temperature of 70°C
L	Expected life at the actual working conditions
L_s	Self inductance of the capacitor. It is due to the internal connections, terminals, winding characteristics and physical dimensions.
λ	Failure rate (FIT) = $10^9 \times \text{failures/component} \times \text{hour}$

5. TECHNICAL INFORMATION



Ratings

Capacitance tolerance: $\pm 10\%$, other tolerances available on request
Useful life: 100.000hrs at 70°C hot-spot, Failure rate: 300FIT

Application

Expressly designed for AC applications.
Single phase MKP capacitors may be used with dc voltage up to U_{NDC}

Environmental conditions

Operating temperature

$\vartheta_{min} = -25^{\circ}\text{C}$, $\vartheta_{max} = +85^{\circ}\text{C}$

ϑ_{max} temperature of the hottest point on the case at which the capacitor may operate.

For further indications see Selection Rules at par. 4;

ϑ_{min} minimum operating ambient temperature at which the capacitor may operate;

Storage temperature

$\vartheta_{min} = -40^{\circ}\text{C}$, $\vartheta_{max} = +85^{\circ}\text{C}$

ϑ_{max} maximum ambient temperature at which the capacitor may be continuously maintained non-operating;

ϑ_{min} minimum ambient temperature at which the capacitor may be continuously maintained non-operating;

Humidity class

Class F. Max relative humidity 75% annual on average, 95% 30 days per year, condensation not permitted

Design

The capacitor consists of metalized polypropylene windings filled with dry resin.

This technology gives many advantages:

- high AC voltage load capability
- high specific ratio capacitance to volume
- high capability to withstand surge currents
- very good self healig characteristics
- no risk of oil or gas leakage
- safe operation by means of an integrated overpressure disconnecter

Case material and filler

Case: aluminium

Filler: resin

Low smoke and toxicity emission in accordance to UNI CEI 11170-3 GUIDELINES FOR FIRE PROTECTION OF RAILWAY VEHICLES: ACCEPTABILITY LIMITS.

Environmental Compatibility

MKP series do not contain PCB and is manufactured in accordance to RohS restrictions

Protection against accidental contact

MKP single phase capacitors are NOT protected against accidental contact.

MKP -3P three phase capacitors are equipped with a touch proof screw terminals board rated IP20

Discharge

All the capacitors are NOT provided with internal/external discharge device

Assembly/Cooling

The useful life of a capacitor can be dramatically reduced if exposed to excessive heat. In general, an increase in the ambient temperature of 5°C will halve the expected lifetime. Capacitors must be allowed to cool and should be shielded from external heat sources.

Capacitors shall not be placed near to heat source and a minimum clearance of 20mm between the capacitors shall be maintained.

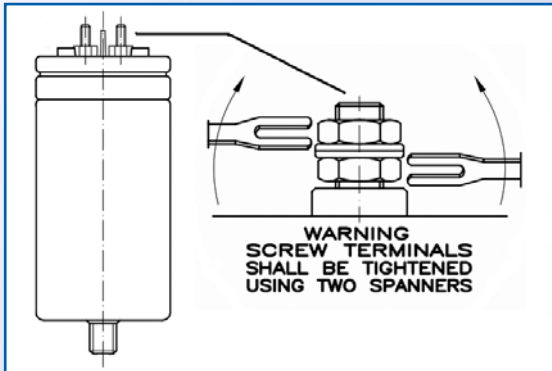
Overvoltages according to IEC 61071

Overvoltage	Maximum duration
$1,1 \times U_{NDC}$	30% of on load duration
$1,15 \times U_{NDC}$	30 min / day
$1,2 \times U_{NDC}$	5 min / day
$1,3 \times U_{NDC}$	1 min /day
$1,5 \times U_{NDC}$	30 ms, no more than 1000 times in the lifetime



Mounting: position, fixing and connection

Capacitors shall be preferably mounted upright, i.e. terminals on top.
The capacitor shall be fixed using the mounting stud present at the base of the can.



Max tightening torque for mounting stud

M8	4 Nm
M12:	10 Nm

To avoid torque trasmission to the capacitor lid during cable connection terminals should be tightened using two spanners.

Recommended torque for screw connections:

M6:	3 Nm
M8:	5 Nm

Recommended torque for MKP -3P screw terminal board : 3Nm

Failure criteria

Capacitors are considered failed when one of the following conditions happens:

- a - short circuit;
- b - open circuit;
- c - capacitance reduction higher than 3% of the initial value;
- d - $\tan\delta$ increase over 2 times the initial value

Operating life

The capacitor lifetime depends on the hot spot temperature and dielectric stress applied during operation. The capacitors have been designed for an average probable service life of 100.000hrs at rated duty (voltage, temperature and frequency). During the life of the product the probable failure rate is 300FIT. Failures are considered short circuits, interruptions, capacitance drifts, reduction in the insulation between terminals and casing.

Lifetime is a statistical value calculated on the basis of experience and on theoretical evaluations. It does not have an absolute value and it is not possible to transfer automatically data coming from a limited quantity of capacitors to a whole population or even to a single batch of capacitors.

Please consult our technical department in case of working condition different from the rated ones.

Routine dielectric tests

The performed tests before delivery are the following:

- a) capacitance and $\tan \delta$ measurement with LRC low voltage bridge, 100 Hz frequency;
- b) A.C. voltage test between terminals ($2.15 U_{rms}$ for 10s);
- c) A.C. voltage test between terminals and case
 - $1.415 \times U_{NDC} + 1000V$ for 10s but not less than 2000 V for MKP
 - $2 \times U_{rms} + 1000V$ for 10s but not less than 2000 V for MKP -3P

Risk Of Explosion And Fire

Capacitors consist mainly of polypropylene film. The film may ignite as a result of internal fault or external overload. Appropriate measures should be ensured to avoid any risk of hazard in the event of failure.

FIRE LOAD: 46MJ/kg, EXTINGUISH WITH: solid extinguish agent, CO2, foam

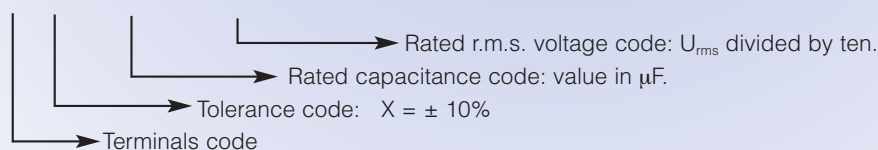
Reference standard

IEC 61071

Code and Type Designation

The capacitor designation is the following:

MKP - D1X - 47 - 45



- B1**: double faston 6.3 x 0.8 mm
- C1**: M6 screw
- D1**: M8 screw
- 3P**: three phases terminal board



Type of protection.

Over pressure disconnecter

In case of overvoltage, thermal overload or ageing at the end of the capacitor's service life a consistent self-healing activity may generate gases inside the capacitor with a consequent internal pressure rise.

To prevent the metallic case bursting the MKP and MKP-3P capacitors are equipped with an internal over pressure disconnecter. This safety equipment is based on a weakened point in the internal copper wires. When gases are developed and the internal pressure rises the case begins to expand in the following way:

- can elongation for MKP single phase capacitor
- lid expansion for MKP-3P three phase capacitor

The final result of this expansion is the breaking of the internal copper connections with the current path interruption.

The over pressure disconnecter can act properly only within the permitted limits of loads and overloads.

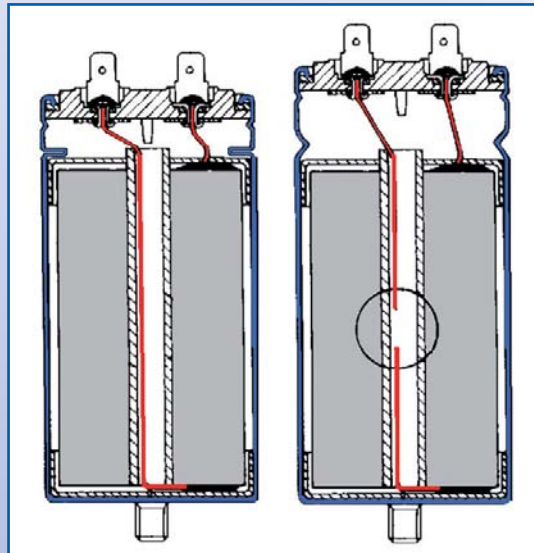
The over pressure disconnecter can perform its duty only if the capacitors are:

- connected using flexible cable allowing the correct capacitor elongation. For a proper operation do not make use of rigid connections.
- installed with enough room on their top in order to avoid any mechanical interferences during the expansion.

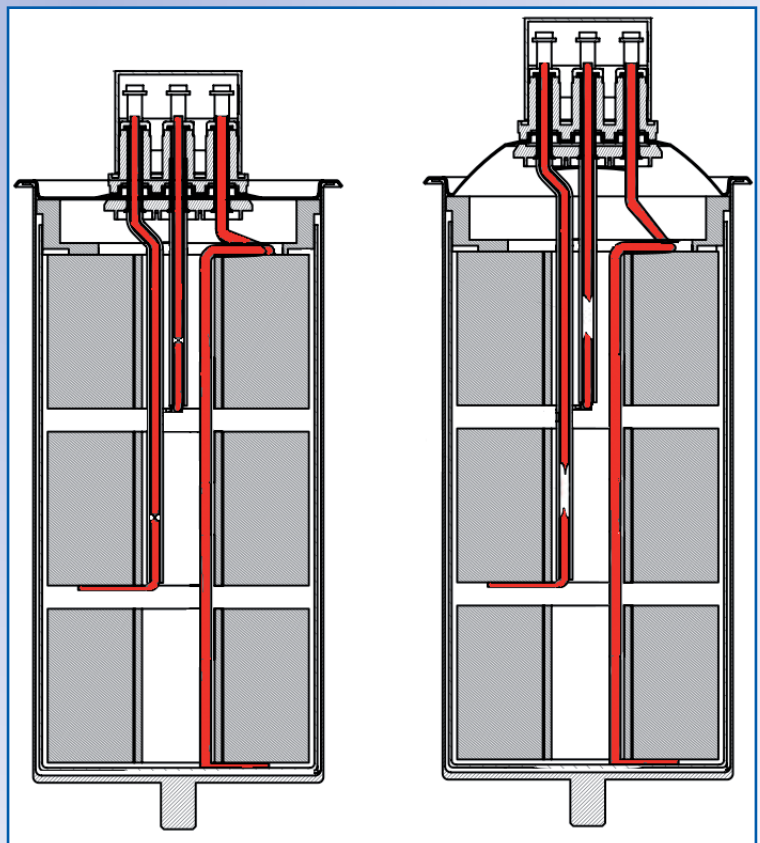
The total elongation of the metallic case, after the over-pressure disconnecter release, is about:

- 10 mm for single phase MKP capacitor
- 15 mm for three phase MKP-3P capacitor.

Over pressure disconnecter for single phase MKP capacitors



Over pressure disconnecter for three phase MKP-3P capacitors



MKP-... Single phase AC filter capacitors



U_{rms} : 300V U_N : 420V

Model	C _N μF	U _{NDC} V	U _S V	I _{MAX} Arms	I _{PK} A	R _S mΩ	R _{th} °C/W	L _S nH	Fig.	Ø mm	H mm	Weight gr	Stud	h mm	l mm	Creepage mm	Clearance mm	Pcs /Box	Box dimensions
MKP-B1X-20-30	20	700	1050	12	350	9,5	16,7	70	1	35	78	100	M8	10,0	13,4	8	6	81	370x370x115
MKP-B1X-30-30	30	700	1050	14	450	7,7	14,3	70	1	40	78	130	M8	10,0	13,4	8	6	64	370x370x115
MKP-B1X-40-30	40	700	1050	16	600	6,6	12,5	70	1	45	78	160	M8	10,0	17,3	12	10	49	370x370x115
MKP-B1X-62,5-30	62,5	700	1050	16	950	5,5	10	70	1	55	78	230	M12	12,5	17,3	12	10	36	370x370x115
MKP-B1X-75-30	75	700	1050	16	1150	5,1	9,5	70	1	60	78	270	M12	12,5	17,3	12	10	36	370x370x115
MKP-B1X-100-30	100	700	1050	16	950	7,1	8,5	90	1	55	103	290	M12	12,5	17,3	12	10	36	370x370x161
MKP-B1X-120-30	120	700	1050	16	1150	6,5	8,2	90	1	60	103	350	M12	12,5	17,3	12	10	36	370x370x161
MKP-C1X-40-30	40	700	1050	20	600	4,3	11,5	80	2	45	87	180	M8	10,0	18,0	12	10	49	370x370x131
MKP-C1X-62,5-30	62,5	700	1050	27	950	3,1	9,5	80	2	55	87	250	M12	12,5	18,0	16	11	36	370x370x131
MKP-D1X-80-30	80	700	1050	33	1200	2,2	8,5	80	3	65	87	340	M12	12,5	24,0	20	12	25	370x370x131
MKP-C1X-100-30	100	700	1050	24	950	4,2	8,5	100	2	55	112	320	M12	12,5	18,0	16	11	36	370x370x161
MKP-D1X-130-30	130	700	1050	28	1200	3,0	7,8	100	3	65	112	430	M12	12,5	24,0	20	12	25	370x370x161
MKP-D1X-210-30	210	700	1050	32	2000	2,1	7,3	100	3	80	112	640	M12	16,0	24,0	26	16	16	370x370x161
MKP-D1X-270-30	270	700	1050	45	4000	1,2	6,3	70	3	80	144	850	M12	16,0	24,0	26	16	16	370x370x200

U_{rms} : 360V U_N : 500V

Model	C _N μF	U _{NDC} V	U _S V	I _{MAX} Arms	I _{PK} A	R _S mΩ	R _{th} °C/W	L _S nH	Fig.	Ø mm	H mm	Weight gr	Stud	h mm	l mm	Creepage mm	Clearance mm	Pcs /Box	Box dimensions
MKP-B1X-20-36	20	850	1275	13	370	8,6	14,5	70	1	40	78	130	M8	10,0	13,4	8	6	64	370x370x115
MKP-B1X-28-36	28	850	1275	15	500	7,3	12,5	70	1	45	78	160	M8	10,0	17,3	12	10	49	370x370x115
MKP-B1X-43-36	43	850	1275	16	800	5,9	10	70	1	55	78	230	M12	12,5	17,3	12	10	36	370x370x115
MKP-B1X-53-36	53	850	1275	16	950	5,4	9,3	70	1	60	78	270	M12	12,5	17,3	12	10	36	370x370x115
MKP-B1X-65-36	65	850	1275	16	800	7,7	8,6	90	1	55	103	290	M12	12,5	17,3	12	10	36	370x370x161
MKP-B1X-80-36	80	850	1275	16	950	7	8,2	90	1	60	103	350	M12	12,5	17,3	12	10	36	370x370x161
MKP-B1X-100-36	100	850	1275	15	760	10	7,8	120	1	55	138	380	M12	12,5	17,3	12	10	36	370x370x181
MKP-C1X-28-36	28	850	1275	19	500	4,9	11,5	80	2	45	87	180	M8	10,0	18,0	12	10	49	370x370x131
MKP-C1X-42-36	42	850	1275	25	800	3,6	9,5	80	2	55	87	250	M12	12,5	18,0	16	11	36	370x370x131
MKP-D1X-55-36	55	850	1275	30	1000	2,5	8,5	80	3	65	87	340	M12	12,5	24,0	20	12	25	370x370x131
MKP-C1X-65-36	65	850	1275	22	800	4,9	8,5	100	2	55	112	320	M12	12,5	18,0	16	11	36	370x370x161
MKP-D1X-85-36	85	850	1275	26	1000	3,5	7,9	100	3	65	112	430	M12	12,5	24,0	20	12	25	370x370x161
MKP-D1X-110-36	110	850	1275	20	850	5,5	7,3	130	3	65	147	550	M12	12,5	24,0	20	12	25	370x370x200
MKP-D1X-145-36	145	850	1275	30	1650	2,4	7,3	100	3	80	112	640	M12	16,0	24,0	26	16	16	370x370x161
MKP-D1X-185-36	185	850	1275	43	3300	1,3	6,4	70	3	80	144	850	M12	16,0	24,0	26	16	16	370x370x200

The thermal resistance is estimated considering the capacitor alone, not fixed and in free air condition (natural convection)

MKP-... Single phase AC filter capacitors



U_{rms} : 480V U_N : 680V

Model	C _N μF	U _{NDC} V	U _S V	I _{MAX} Arms	I _{PK} A	R _S mΩ	R _{th} °C/W	L _S nH	Fig.	Ø mm	H mm	Weight gr	Stud	h mm	l mm	Creepage mm	Clearance mm	Pcs /Box	Box dimensions
MKP-B1X-8-48	8	1100	1650	10	200	13	16,7	70	1	35	78	100	M8	10,0	13,4	8	6	81	370x370x115
MKP-B1X-11,5-48	11,5	1100	1650	12	300	10	14,5	70	1	40	78	130	M8	10,0	13,4	8	6	64	370x370x115
MKP-B1X-15-48	15	1100	1650	14	360	8,6	12,5	70	1	45	78	160	M8	10,0	17,3	12	10	49	370x370x115
MKP-B1X-37-48	37	1100	1650	16	560	9	8,6	90	1	55	103	290	M12	12,5	17,3	12	10	36	370x370x161
MKP-B1X-45-48	45	1100	1650	16	700	8	8,2	90	1	60	103	350	M12	12,5	17,3	12	10	36	370x370x161
MKP-B1X-55-48	55	1100	1650	14	560	12	7,9	120	1	55	138	380	M12	12,5	17,3	12	10	36	370x370x181
MKP-B1X-70-48	70	1100	1650	14	700	10	7,7	120	1	60	138	450	M12	12,5	17,3	12	10	36	370x370x181
MKP-C1X-24-48	24	1100	1650	22	560	4,4	9,4	80	2	55	87	250	M12	12,5	18,0	11	11	36	370x370x131
MKP-D1X-30-48	30	1100	1650	28	750	3,2	8,4	80	3	65	87	340	M12	12,5	24,0	12	12	25	370x370x131
MKP-C1X-37-48	37	1100	1650	20	560	6,1	8,3	100	2	55	112	320	M12	12,5	18,0	11	11	36	370x370x161
MKP-D1X-48-48	48	1100	1650	23	750	4,5	7,9	100	3	65	112	430	M12	12,5	24,0	20	12	25	370x370x161
MKP-D1X-80-48	80	1100	1650	27	1250	3	7,3	100	3	80	112	640	M12	16,0	24,0	26	16	16	370x370x161
MKP-D1X-100-48	100	1100	1650	40	2450	1,5	6,3	70	3	80	144	850	M12	16,0	24,0	26	16	16	370x370x200
MKP-D1X-160-48	160	1100	1650	36	2450	2	5,1	80	3	80	194	1100	M12	16,0	24,0	26	16	4	370x370x106

U_{rms} : 600V U_N : 850V

Model	C _N μF	U _{NDC} V	U _S V	I _{MAX} Arms	I _{PK} A	R _S mΩ	R _{th} °C/W	L _S nH	Fig.	Ø mm	H mm	Weight gr	Stud	h mm	l mm	Creepage mm	Clearance mm	Pcs /Box	Box dimensions
MKP-B1X-5-60	5	1200	1800	9	200	16	16,7	70	1	35	78	100	M8	10,0	13,4	8	6	81	370x370x115
MKP-B1X-7,5-60	7,5	1200	1800	11	250	12	14,5	70	1	40	78	130	M8	10,0	13,4	8	6	64	370x370x115
MKP-B1X-10-60	10	1400	2100	13	300	10	12,5	70	1	45	78	160	M8	10,0	17,3	12	10	49	370x370x115
MKP-B1X-15-60	15	1400	2100	16	450	7,7	10	70	1	55	78	230	M12	12,5	17,3	12	10	36	370x370x115
MKP-B1X-23-60	23	1400	2100	15	450	10	8,6	90	1	55	103	290	M12	12,5	17,3	12	10	36	370x370x161
MKP-B1X-30-60	30	1400	2100	16	550	9	8,2	90	1	60	103	350	M12	12,5	17,3	12	10	36	370x370x161
MKP-B1X-44-60	44	1400	2100	13	550	12	7,7	120	1	60	138	450	M12	12,5	17,3	12	10	36	370x370x181
MKP-C1X-15-60	15	1400	2100	20	450	5,3	9,4	80	2	55	87	250	M12	12,5	18,0	11	11	36	370x370x131
MKP-D1X-20-60	20	1400	2100	25	600	3,9	8,4	80	3	65	87	340	M12	12,5	24,0	12	12	25	370x370x131
MKP-C1X-23-60	23	1400	2100	18	450	7,4	8,3	100	2	55	112	320	M12	12,5	18,0	16	11	36	370x370x161
MKP-D1X-30-60	30	1400	2100	20	600	5,4	7,9	100	3	65	112	430	M12	12,5	24,0	20	12	25	370x370x161
MKP-D1X-50-60	50	1400	2100	25	1000	3,6	7,3	100	3	80	112	640	M12	16,0	24,0	26	16	16	370x370x161
MKP-D1X-65-60	65	1400	2100	38	1950	1,7	6,4	70	3	80	144	850	M12	16,0	24,0	26	16	16	370x370x200
MKP-D1X-100-60	100	1400	2100	33	1950	2,3	5,1	80	3	80	194	1100	M12	16,0	24,0	26	16	4	370x370x106

The thermal resistance is estimated considering the capacitor alone, not fixed and in free air condition (natural convection)

MKP - ... Single phase AC filter capacitors



U_{rms} : 750V U_N : 1060V

Model	C _N μF	U _{ndc} V	U _s V	I _{max} Arms	I _{pk} A	R _s mΩ	R _{th} °C/W	L _s nH	Fig.	∅ mm	H mm	Weight gr	Stud	h mm	l mm	Creepage mm	Clearance mm	Pcs/Box	Box dimensions
MKP-B1X-3,2-75	3,2	1200	1800	12	300	8,7	16,7	70	1	35	78	100	M8	10,0	13,4	8	6	81	370x370x115
MKP-B1X-4,5-75	4,5	1200	1800	14	380	7,1	14,5	70	1	40	78	130	M8	10,0	13,4	8	6	64	370x370x115
MKP-B1X-6-75	6	1400	2100	16	500	6,2	12,5	70	1	45	78	160	M8	10,0	17,3	12	10	49	370x370x115
MKP-B1X-9,5-75	9,5	1400	2100	16	800	5,2	10	70	1	55	78	230	M12	12,5	17,3	12	10	36	370x370x115
MKP-B1X-12-75	12	1400	2100	16	950	4,9	9,3	70	1	60	78	270	M12	12,5	17,3	12	10	36	370x370x115
MKP-B1X-19-75	19	1400	2100	16	950	6,3	8,2	90	1	60	103	350	M12	12,5	17,3	12	10	36	370x370x161
MKP-C1X-6-75	6	1400	2100	22	500	3,8	11,5	80	2	45	87	180	M8	10,0	18,0	12	10	49	370x370x131
MKP-C1X-9,5-75	9,5	1700	2550	28	800	2,9	9,4	80	2	55	87	250	M12	12,5	18,0	11	11	36	370x370x131
MKP-D1X-12-75	12	1700	2550	35	1000	2	8,4	80	3	65	87	340	M12	12,5	24,0	20	12	25	370x370x131
MKP-C1X-15-75	15	1700	2550	24	800	4	8,3	100	2	55	112	320	M12	12,5	18,0	16	11	36	370x370x161
MKP-D1X-20-75	20	1700	2550	28	1000	2,8	7,9	100	3	65	112	430	M12	12,5	24,0	20	12	25	370x370x161
MKP-D1X-32-75	32	1700	2550	34	1650	2	7,3	100	3	80	112	640	M12	16,0	24,0	26	16	16	370x370x161
MKP-D1X-40-75	40	1700	2550	47	3300	1,1	6,3	70	3	80	144	850	M12	16,0	24,0	26	16	16	370x370x200
MKP-D1X-65-75	65	1700	2550	42	3300	1,5	5,1	80	3	80	194	1100	M12	16,0	24,0	26	16	4	370x370x106

U_{rms} : 850V U_N : 1200V

Model	C _N μF	U _{ndc} V	U _s V	I _{max} Arms	I _{pk} A	R _s mΩ	R _{th} °C/W	L _s nH	Fig.	∅ mm	H mm	Weight gr	Stud	h mm	l mm	Creepage mm	Clearance mm	Pcs/Box	Box dimensions
MKP-B1X-2,3-85	2,3	1200	1800	12	250	9,6	16,7	70	1	35	78	100	M8	10,0	13,4	8	6	81	370x370x115
MKP-B1X-3,3-85	3,3	1200	1800	14	350	7,8	14,5	70	1	40	78	130	M8	10,0	13,4	8	6	64	370x370x115
MKP-B1X-7-85	7	1400	2100	16	450	9,1	10	90	1	45	103	200	M8	10,0	17,3	12	10	49	370x370x161
MKP-B1X-8,5-85	8,5	1400	2100	16	850	5,1	9,3	70	1	60	78	270	M12	12,5	17,3	12	10	36	370x370x115
MKP-B1X-11-85	11	1400	2100	16	660	7,3	8,6	90	1	55	103	290	M12	12,5	17,3	12	10	36	370x370x161
MKP-B1X-13,5-85	13,5	1400	2100	16	850	6,7	8,2	90	1	60	103	350	M12	12,5	17,3	12	10	36	370x370x161
MKP-C1X-4,5-85	4,5	1400	2100	20	450	4,3	11,5	80	2	45	87	170	M8	10,0	18,0	12	10	49	370x370x131
MKP-C1X-7-85	7	2000	3000	27	660	3,2	9,4	80	2	55	87	250	M12	12,5	18,0	16	11	36	370x370x131
MKP-C1X-11-85	11	2000	3000	24	660	4,5	8,3	100	2	55	112	320	M12	12,5	18,0	16	11	36	370x370x161
MKP-D1X-14-85	14	2000	3000	28	850	3,2	7,9	100	3	65	112	430	M12	12,5	24,0	20	12	25	370x370x161
MKP-D1X-24-85	24	2000	3000	33	1450	2,2	7,3	100	3	80	112	640	M12	16,0	24,0	26	16	16	370x370x161
MKP-D1X-30-85	30	2000	3000	47	2900	1,2	6,3	70	3	80	144	850	M12	16,0	24,0	26	16	16	370x370x200
MKP-D1X-47-85	47	2000	3000	42	2900	1,6	5,1	80	3	80	194	1100	M12	16,0	24,0	26	16	4	370x370x106

The thermal resistance is estimated considering the capacitor alone, not fixed and in free air condition (natural convection)



MKP - 3P... Three phase AC filter capacitors

$U_{rms} : 450V$ $U_N : 640V$

Model	3 x C_N μF	U_s V	I_{MAX} Arms	I_{PK} A	R_s m Ω	R_{th} $^{\circ}C/W$	Fig.	\varnothing mm	H mm	Weight gr	Pcs /Box	Box dimensions
MKP-3PX-35-45	3 x 35	1350	15	1000	1,44	11,2	4	75	208	950	5	370x370x106
MKP-3PX-45-45	3 x 45	1350	18	1300	1,22	8,6	4	85	208	1250	4	370x370x106
MKP-3PX-50-45	3 x 50	1350	18	1450	1,16	8,6	4	85	208	1250	4	370x370x106
MKP-3PX-65-45	3 x 65	1350	28	1850	0,84	5,6	4	100	208	1650	3	370x370x106
MKP-3PX-75-45	3 x 75	1350	26	2150	0,78	5,6	4	100	208	1750	3	370x370x106
MKP-3PX-90-45	3 x 90	1350	40	2550	0,72	3,6	4	116	208	2250	3	370x370x125
MKP-3PX-100-45	3 x 100	1350	40	2850	0,70	3,6	4	116	208	2350	3	370x370x125

$U_{rms} : 600V$ $U_N : 850V$

Model	3 x C_N μF	U_s V	I_{MAX} Arms	I_{PK} A	R_s m Ω	R_{th} $^{\circ}C/W$	Fig.	\varnothing mm	H mm	Weight gr	Pcs /Box	Box dimensions
MKP-3PX-20-60	3 x 20	1800	13	750	1,75	11,2	4	75	208	950	5	370x370x106
MKP-3PX-30-60	3 x 30	1800	15	1100	1,33	8,6	4	85	208	1250	4	370x370x106
MKP-3PX-45-60	3 x 45	1800	23	1600	0,90	5,6	4	100	208	1750	3	370x370x106
MKP-3PX-55-60	3 x 55	1800	36	1950	0,80	3,6	4	116	208	2250	3	370x370x125
MKP-3PX-68-60	3 x 68	1800	32	2450	0,74	3,6	4	116	208	2350	3	370x370x125

$U_{rms} : 760V$ $U_N : 1080V$

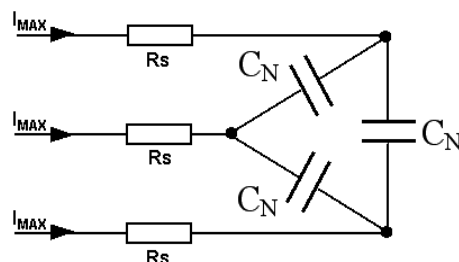
Model	3 x C_N μF	U_s V	I_{MAX} Arms	I_{PK} A	R_s m Ω	R_{th} $^{\circ}C/W$	Fig.	\varnothing mm	H mm	Weight gr	Pcs /Box	Box dimensions
MKP-3PX-10-76	3 x 10	2250	18	1150	1,17	11,2	4	75	208	950	5	370x370x106
MKP-3PX-14-76	3 x 14	2250	22	1600	0,97	8,6	4	85	208	1250	4	370x370x106
MKP-3PX-22-76	3 x 22	2250	33	2450	0,64	5,6	4	100	208	1750	3	370x370x106
MKP-3PX-30-76	3 x 30	2250	46	3350	0,60	3,6	4	116	208	2350	3	370x370x125
MKP-3PX-45-76	3 x 45	2250	53	5000	0,40	3,0	4	136	208	3250	2	370x370x161

$U_{rms} : 850V$ $U_N : 1200V$

Model	3 x C_N μF	U_s V	I_{MAX} Arms	I_{PK} A	R_s m Ω	R_{th} $^{\circ}C/W$	Fig.	\varnothing mm	H mm	Weight gr	Pcs /Box	Box dimensions
MKP-3PX-7,5-85	3 x 7,5	2550	18	960	1,25	11,2	4	75	208	950	5	370x370x106
MKP-3PX-11-85	3 x 11	2550	22	1450	1,00	8,6	4	85	208	1250	4	370x370x106
MKP-3PX-16-85	3 x 16	2550	33	2050	0,70	5,6	4	100	208	1750	3	370x370x106
MKP-3PX-24-85	3 x 24	2550	45	3050	0,60	3,6	4	116	208	2350	3	370x370x125
MKP-3PX-34-85	3 x 34	2550	54	4350	0,42	3,0	4	136	208	3250	2	370x370x161

The thermal resistance R_{th} is estimated considering the capacitor alone, not fixed and in free air condition (natural convection)

MKP-3P equivalent circuit.

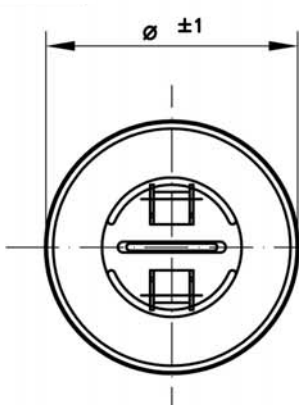


R_s represent the series resistance responsible of the current heat losses (P_c) in the capacitor.

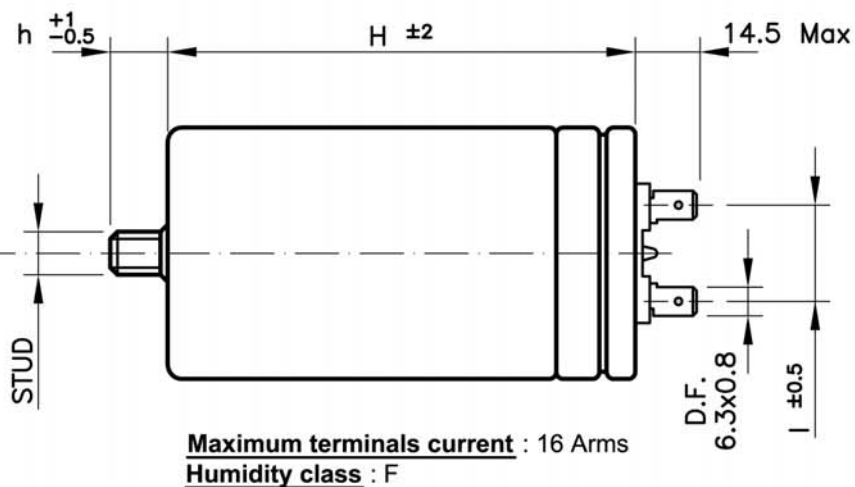
Capacitors are not equipped with discharge resistors



Fig. 1

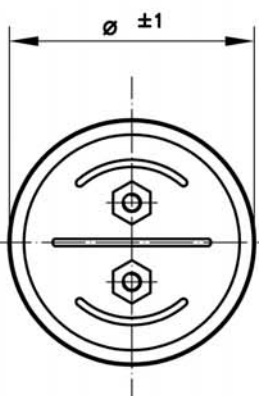


Type : double faston 6.3 x 0.8 mm
Degree of protection : IP00

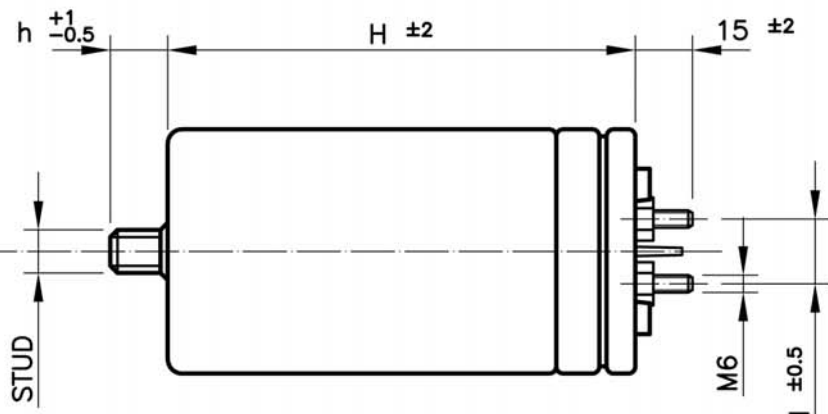


Maximum terminals current : 16 Arms
Humidity class : F

Fig. 2

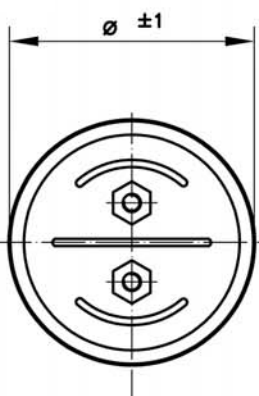


Type : M6 screw
Degree of protection : IP00

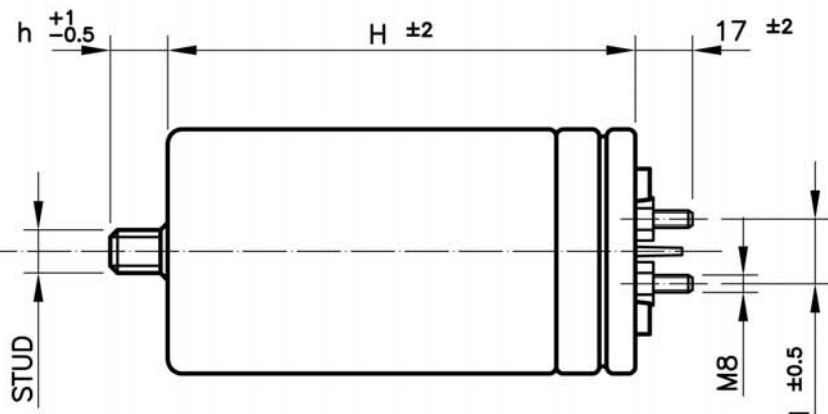


Maximum terminals current : 40 Arms
Humidity class : F

Fig. 3



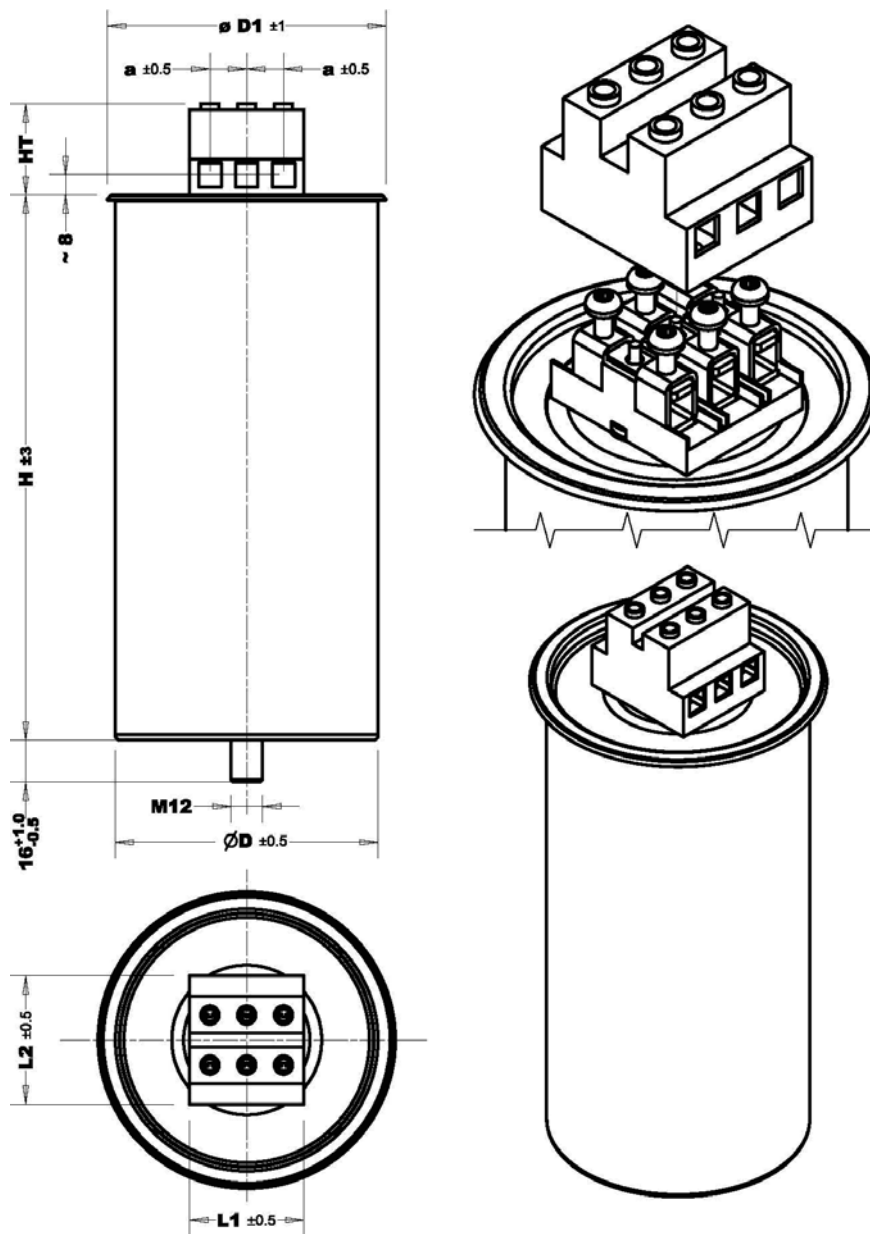
Type : M8 screw
Degree of protection : IP00



Maximum terminals current : 70 Arms
Humidity class : F



Fig. 4



Aluminium finishing: black painted for diameter $\varnothing D$ 100, $\varnothing D$ 116, $\varnothing D$ 136.
naked for diameter $\varnothing D$ 75, $\varnothing D$ 85

Terminals : 25mm² for $\varnothing D$ 85, $\varnothing D$ 100, $\varnothing D$ 116, $\varnothing D$ 136
16mm² for $\varnothing D$ 75

Maximum terminals current : 25mm² 58Arms
16mm² 35Arms

Degree of protection: IP20

Creepage 19 mm

Clearance 19mm

Humidity class: F

	$\varnothing D1$	L1	L2	HT	a
$\varnothing D$ 75.....	81	39,0	45,0	32±1	13
$\varnothing D$ 85.....	91	43,5	49,0	35±1	14
$\varnothing D$ 100.....	106	43,5	49,0	35Max	14
$\varnothing D$ 116.....	122	43,5	49,0	35Max	14
$\varnothing D$ 136.....	142	43,5	49,0	35Max	14



WARNING

DO NOT MISAPPLY CAPACITORS FOR POWER ELECTRONICS

Icar is not responsible for any kind of possible damages to persons or things, derived from the improper installation and application of Power Electronics capacitors

Most common misapplication forms:

- Ripple current and peak current beyond specification or not according with the maximum power that can be dissipated.
- Surge or working voltage beyond specified value.
- Hot spot or storage temperature beyond the specified limits or not according with the maximum power that can be dissipated.
- Incorrect mounting or wrong installation
 - installation nearby hot components or heat sources
 - not suitable connections (not adequate cable or busbars cross section)
 - nuts and washers material, shape or size not suitable for the application
 - tightening torque not according to the specification
- Unusual service conditions as:
 - mechanical shock and vibrations,
 - corrosive or abrasive conductive parts in cooling air,
 - oil or water vapour or corrosive substances,
 - explosive gas or dust,
 - radioactivity,
 - excessive and fast variations of ambient conditions,
 - service areas higher than 2000 m above sea level.

Periodic check of the connection conditions and tightening torque is strongly recommended.

In case of doubt in choice or in performances of the capacitors **Icar technical service MUST be contacted.**

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