ICAR

technology looking ahead

POWER | **MKV**
ELECTRONICS |
CAPACITORS | SERIES

Heavy Duty AC Applications
Bi-metallized Paper
Self Healing

IRIS Certification — CSQ — QNet

MKV-E2X-0.22-240
0.22μF ± 10%
...
3600 Vac
...
2400 Vac
3050 Vac
-25 +85°C   IEC 61071
Terminal Torque Max 3 Nm
PROTECTED
13-09

MKV - D1X - 47 - 45
C   47 μF ± 10%
Un   640 Vac
Urms   450 Vac
UI   570 Vac
-25 +85 °C   IEC 61071
Terminal Torque Max 8 Nm
PROTECTED   SH
11-36

MKV - B1X - 1 - 85
1 μF ± 10%
...
1200 Vac
850 Vac
950 Vac
-25 +85 °C   IEC 61071
PROTECTED
11-42

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

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 SISTEMS 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.

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 and for the products used in railways applications according to IRIS 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.

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 reenergizing 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 selected capacitor does not exceed the max operating temperature at operating I_{RMS}
- the I_{max} of the capacitors has been calculated for a ϑ_h - ϑ_0 of about 30°C and considering a voltage waveform composed by:
  - a 50Hz fundamental with rms value U_{rms}, having an impact both on conduction losses ($R_s * I_{rms}^2$) and dielectric losses ($Q \tan \delta_0$)
  - a voltage harmonics contents affecting only the conduction losses ($R_S * I_{rms}^2$). Actually the harmonics content affects also the dielectric losses but these 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 ($R_S * I_{rms}^2$) 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:

$P = Q \tan \delta_0 + R_S I_{rms}^2$

At rated duty and hot spot temperature of 85°C the expected lifetime is 100.000 hours with a statistical failure rate of 500FIT (95% 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.

In case of doubt, 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. It is measured at 20°C, 50Hz, rated U_{rms} voltage
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 for
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	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 = $2 \times \pi \times f \times C \times U^2_{rms}$
f	Fundamental frequency
R_S	Series resistance representing the sum of all ohmic resistances in the capacitor. Rs is a typical estimated value based on average film metallization parameters
ESR	Equivalent Series Resistance defined as $ESR = R_S + \tan\delta_0 /(2 \times \pi \times f \times C)$
$\tan \delta_0$	Dielectric dissipation factor. It can be considered constant in the normal working frequency range. Typical value for polypropylene is 2×10^{-4}

$\tan \delta$	Dissipation factor calculated as follows: $\tan \delta_0 + 2 \times \pi \times f \times C \times R_S$
dv/dt	Maximum slope of the voltage waveform
I_{PK}	Peak current $I_{PK} = C\, dV/dt$
P	Active power (losses)$= Q \times \tan \delta_0 + R_s \times I^2_{rms}$
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%. R_{th} is a global parameter that doesn't consider localized overheating due to high frequency current.
ϑ_h	Hottest point in the capacitor winding $= R_{th} \times P + \vartheta_0$ During stationary operation ϑ_h must not exceed 85° C.
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
Tc	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 MKV series is in general greater then 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 85°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 x failures/component x hour

Technical Information

Ratings
Capacitance tolerance: ±10%, ±5% on request
Useful life: 100.000hrs at 85°C hot-spot, Failure rate: 500FIT

Application
Expressly designed for heavy duty AC applications.
MKV capacitors may be used with dc voltage up to U_{NDC}

Environmental conditions
Operating temperature
ϑ_{min} =-25°C, ϑ_{max} =+85°C (considering mounting position with terminals to the top)
ϑ_{max} is the temperature of the hottest point on the case at which the capacitor may operate, for further indication see Selection Rules;
ϑ_{min} is the minimum operating ambient temperature at which the capacitor may operate;

Storage temperature
ϑ_{min} = -40°C, ϑ_{max} =+85°C
ϑ_{max} is the maximum operating ambient temperature at which the capacitor may be continuously maintained non-operating;
ϑ_{min} is the minimum operating ambient temperature at which the capacitor may be continuously maintained non-operating;

Humidity class
MKV - B1/C1/D1 series: Class F. Max relative humidity 75% annual on average, 95% 30 days per year, condensation not permitted
MKV - B2/E1/E2 series: Class C. Max relative humidity 95% annual on average, 100% occasional, condensation permitted.

Design
The winding consists of alternating layers of polypropylene and bi-metallized paper impregnated with oil.
The paper does not work as dielectric but it is the means of impregnation and supports the metallization.
This technology gives many advantages:
- good impregnation, i.e. long life
- very low losses
- good capability to withstand inrush currents
- reduction of the field strength at the edges of the electrodes

Case material, filler and non metallic parts
Case: aluminium.
Filler and non metallic parts: low smoke and toxicity emission in accordance to UNI CEI 11170-3 GUIDELINES FOR FIRE PROTECTION OF RAILWAY VEHICLES: ACCEPTABILITY LIMITS

Environmental Compatibility
MKV - B1/C1/D1 series: do not contain PCB and are manufactured in accordance to RohS restrictions
MKV - B2/E1/E2 series: do not contain PCB

Protection against accidental contact
All the capacitors are NOT protected against accidental contact

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

Type of protection
Protected: presence of overpressure disconnector.
The over-pressure disconnector prevents the case bursting due to excess pressure when the capacitor is overloaded or at the end of its life.
Total elongation of the case is about 7mm after the over-pressure disconnector release.
Don't make use of rigid connections.

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.

Overvoltage	Maximum duration
1,1 x U_{NDC}	30% of on load duration
1,15 x U_{NDC}	30 min / day
1,2 x U_{NDC}	5 min / day
1,3 x U_{NDC}	1 min /day
1,5 x 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.
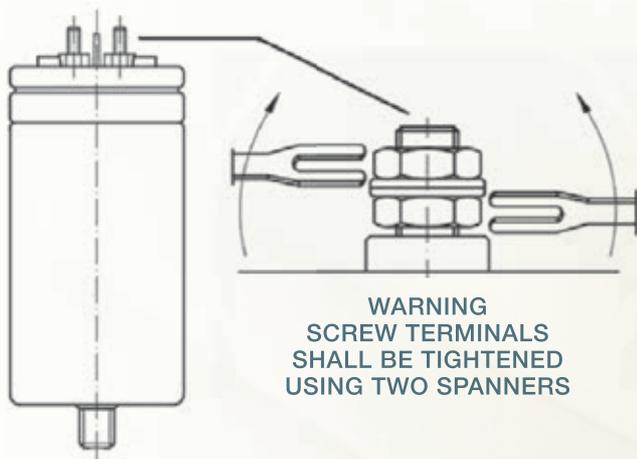
Max tightening torque for mounting stud
- M8:   4 Nm
- M12:   10 Nm

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
- M10:   7 Nm

WARNING
SCREW TERMINALS
SHALL BE TIGHTENED
USING TWO SPANNERS

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 δ increase over 1.5 times the initial value
- e. insulation resistance between terminals and casing less than 10 Gohm.

Operating life

The lifetime of a capacitor depends on the hot spot temperature and on the field strength in its dielectric 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 500FIT. 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 δ 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 U_{NDC} + 1000V for 10s but not less than 2000 V);

d) Sealing test (90°C, 4 h).

Risk Of Explosion And Fire

Capacitors consist mainly on 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:

MKV - D1X - 47 - 45

Rated r.m.s. voltage code: Urms divided by ten.

Rated capacitance code: value in µF.

Tolerance code: X=±10% J=±5%

Terminal code:
B1 : DF 6.3 x 0.8 mm (plastic lid, two double flat tags)
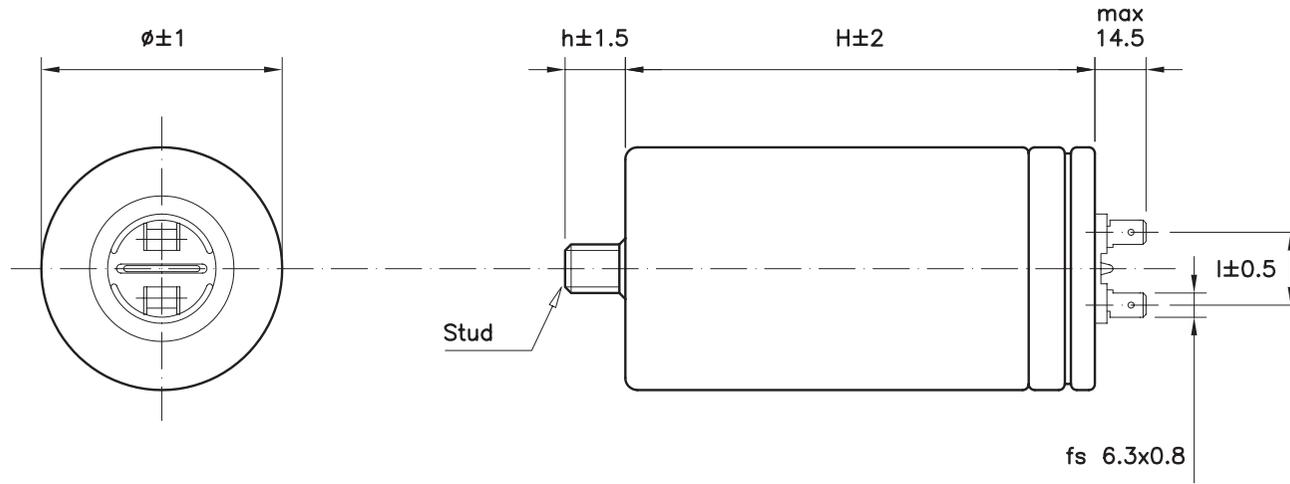**B2 :** SF 6.3 x 0.8 mm (plastic lid, one single flag tag)
C1 : M6 screw (plastic lid,two M6 screws)
D1 : M8 screw (plastic lid,two M8 screws)
E1 : M10 screw (metal lid, two ceramic insulators)
E2 : M8 screw (metal lid, one ceramic insulator)

Type: double faston 6.3 x 0.8 mm
Degree of protection: IP00
Maximum terminals current: 16 Arms
Humidity class: F

MKV-B1X

MODEL	C_N µF	U_{rms} V_{rms}	U_N V	U_{NDC} V	U_s V	I_{MAX} Arms	I_{MAX} Terminals Arms	I_{PK} A	R_S mΩ	R_{th} °C/W	L_S nH	Ø mm	H mm	Weight gr	Stud	h mm	l mm	Creepage mm	Clearance mm
MKV-B1X-22-50	22	500	700	1000	1500	16,0	16	1700	7,9	7,5	120	60	138	450	M12	12,5	17,3	12	10
MKV-B1X-2.2-66	2,2	660	930	1200	1800	13,5	16	450	8,9	15,5	70	35	83	100	M8	10	13,4	8	6
MKV-B1X-15-66	15	660	930	1200	1800	16,0	16	1450	7,8	8	120	55	128	350	M12	12,5	17,3	12	10
MKV-B1X-20-66	20	660	930	1200	1800	16,0	16	1800	7,9	7,5	120	60	138	450	M12	12,5	17,3	12	10
MKV-B1X-12-75	12	750	1060	1400	2100	16,0	16	1250	8,9	7,5	120	60	138	450	M12	12,5	17,3	12	10
MKV-B1X-0.1-85	0,1	850	1200	1200	1800	7,5	16	100	18,6	24,0	60	30	63	55	M8	10	13,4	8	6
MKV-B1X-0.22-85	0,22	850	1200	1200	1800	8,5	16	130	14,8	24,0	60	30	63	55	M8	10	13,4	8	6
MKV-B1X-0.33-85	0,33	850	1200	1200	1800	10,0	16	200	10,6	24,0	60	30	63	55	M8	10	13,4	8	6
MKV-B1X-0.47-85	0,47	850	1200	1200	1800	10,5	16	250	9,0	24,0	60	30	63	55	M8	10	13,4	8	6
MKV-B1X-0.68-85	0,68	850	1200	1200	1800	9,5	16	200	15,9	18,0	70	30	83	70	M8	10	13,4	8	6
MKV-B1X-1-85	1	850	1200	1200	1800	12,5	16	350	10,4	15,5	70	35	83	100	M8	10	13,4	8	6
MKV-B1X-1.5-85	1,5	850	1200	1200	1800	11,0	16	300	14,9	13,0	90	35	103	120	M8	10	13,4	8	6
MKV-B1X-2.2-85	2,2	850	1200	1200	1800	13,5	16	450	11,3	11,5	90	40	103	150	M8	10	13,4	8	6
MKV-B1X-3.3-85	3,3	850	1200	1400	2100	14,5	16	550	12,5	9,0	120	45	128	230	M8	10	17,3	12	10
MKV-B1X-4.7-85	4,7	850	1200	1400	2100	15,5	16	700	11,0	9,0	120	45	128	230	M8	10	17,3	12	10
MKV-B1X-6.8-85	6,8	850	1200	1400	2100	16,0	16	1050	9,2	8,0	120	55	128	350	M12	12,5	17,3	12	10
MKV-B1X-8.2-85	8,2	850	1200	1400	2100	16,0	16	1100	9,5	7,5	120	60	138	450	M12	12,5	17,3	12	10
MKV-B1X-10-85	10	850	1200	1400	2100	16,0	16	1350	8,8	7,5	120	60	138	450	M12	12,5	17,3	12	10

The thermal resistance is estimated considering the capacitor alone, not fixed and in free air condition (natural convection)
I_{max} has been calculated for a thermal rise $\vartheta_h - \vartheta_0$ within about 30°C (for more details see " Selection rules and definitions")

Type: ceramic insulator, single flag tag 6.3 x 0.8
Degree of protection: IP00
Maximum terminals current: 16 Arms
Humidity class: C

h +1/-0,5   H ± 2   H2 ± 2

12 ± 1

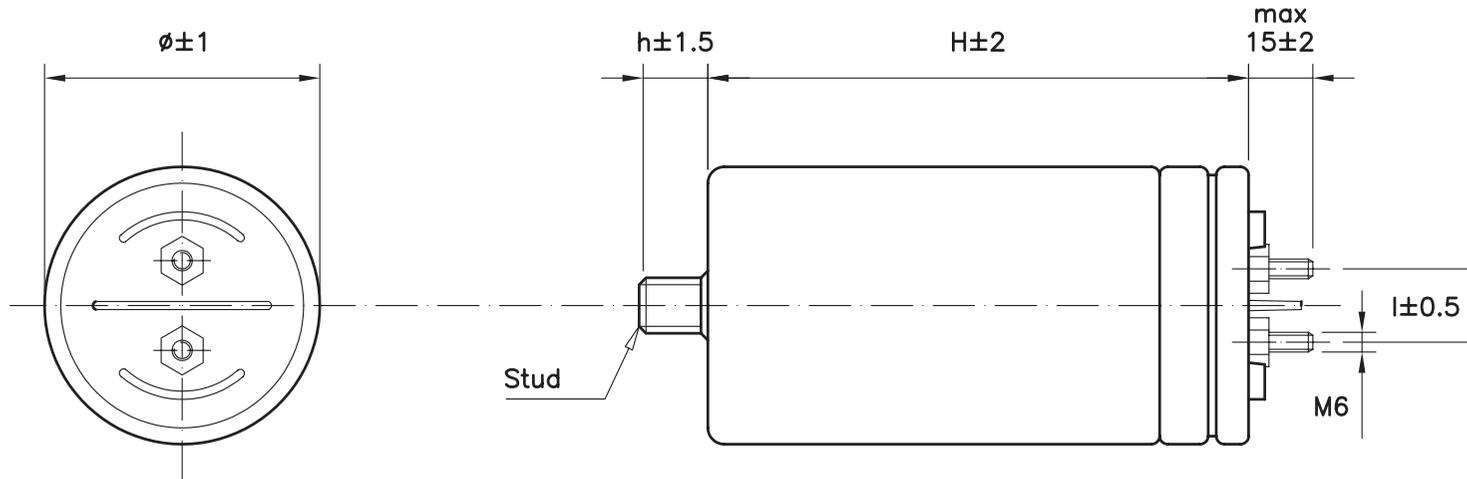ØD ± 1

Flag tag 6.3 x 0.8

MKV-B2X

MODEL	C_N µF	U_{rms} V_{rms}	U_N V	U_{NDC} V	U_S V	I_{MAX} Arms	I_{MAX} Terminals Arms	I_{PK} A	R_S mΩ	R_{th} °C/W	L_S nH	Ø mm	H mm	Weight gr	Stud	h mm	H2 mm	Creepage mm	Clearance mm
MKV-B2X-0,68-64	0,68	640	900	1100	1500	11	16	240	10	25	120	30	76	75	M8	10	34	16,5	16,5
MKV-B2X-1-64	1,00	640	900	1100	1500	13	16	360	7,5	22	120	35	76	100	M8	10	34	16,5	16,5
MKV-B2X-2,2-64	2,20	640	900	1100	1500	16	16	780	5	17	120	45	76	150	M8	10	34	16,5	16,5
MKV-B2X-4,7-64	4,70	640	900	1100	1500	16	16	1700	4	13	120	65	76	280	M12	12,5	34	16,5	16,5
MKV-B2X-0,47-100	0,47	1000	1400	1800	2400	8	16	140	21	21	145	30	95	95	M8	10	34	16,5	16,5
MKV-B2X-0,68-100	0,68	1000	1400	1800	2400	10	16	200	15	18	145	35	95	115	M8	10	34	16,5	16,5
MKV-B2X-1-100	1,00	1000	1400	1800	2400	11	16	300	11,5	18	145	35	95	120	M8	10	34	16,5	16,5
MKV-B2X-2,2-100	2,20	1000	1400	1800	2400	16	16	680	7	12	145	55	95	250	M12	12,5	34	16,5	16,5
MKV-B2X-4,7-100	4,70	1000	1400	1800	2400	16	16	1480	5	10	145	65	95	350	M12	12,5	34	16,5	16,5
MKV-B2X-0,47-130	0,47	1300	1840	2200	3000	11	16	340	14	15	175	35	120	150	M8	10	34	16,5	16,5
MKV-B2X-0,68-130	0,68	1300	1840	2200	3000	14	16	480	11	13	175	40	120	190	M8	10	34	16,5	16,5
MKV-B2X-1-130	1,00	1300	1840	2200	3000	16	16	720	9	12	175	45	120	230	M8	10	34	16,5	16,5
MKV-B2X-2,2-130	2,20	1300	1840	2200	3000	16	16	1580	6	9	175	65	120	450	M12	12,5	34	16,5	16,5

The thermal resistance is estimated considering the capacitor alone, not fixed and in free air condition (natural convection)
I_{max} has been calculated for a thermal rise $\vartheta_h - \vartheta_0$ within about 30°C (for more details see " Selection rules and definitions")

Type: M6 screw
Degree of protection: IP00
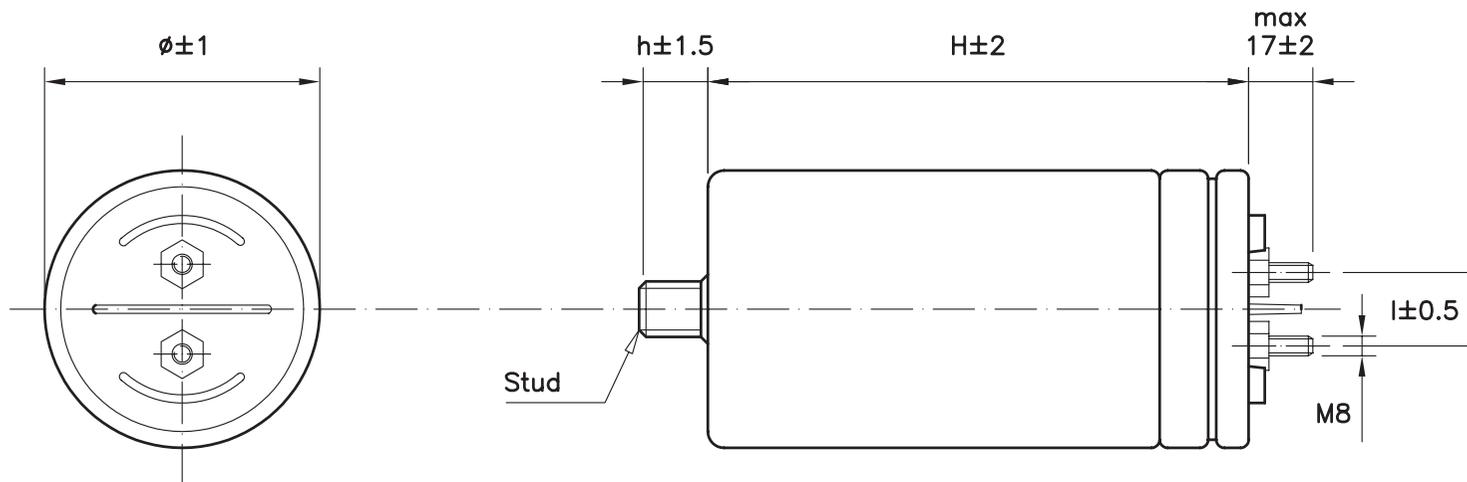Maximum terminals current: 40 Arms
Humidity class: F

MKV-C1X

MODEL	C_N μF	U_{rms} V_{rms}	U_N V	U_{NDC} V	U_S V	I_{MAX} Arms	I_{MAX} Terminals Arms	I_{PK} A	R_S mΩ	R_{th} °C/W	L_S nH	Ø mm	H mm	Weight gr	Stud	h mm	I mm	Creepage mm	Clearance mm
MKV-C1X-20-50	20	500	700	1000	1500	25,5	40	1550	4,7	7,6	130	55	147	410	M12	12,5	18,0	16	11
MKV-C1X-10-75	10	750	1060	1400	2100	23,5	40	1150	5,3	7,7	120	55	137	380	M12	12,5	18,0	16	11
MKV-C1X-12-75	12	750	1060	1400	2100	23,5	40	1250	5,4	7,6	130	55	147	400	M12	12,5	18,0	16	11
MKV-C1X-1-85	1	850	1200	1400	2100	22,5	40	600	3,5	14,0	65	45	72	140	M8	10	18,0	12	10
MKV-C1X-1.5-85	1,5	850	1200	1400	2100	19,0	40	500	6,0	11,0	80	45	92	180	M8	10	18,0	12	10
MKV-C1X-2.2-85	2,2	850	1200	1400	2100	19,0	40	550	6,3	10,5	90	45	100	190	M8	10	18,0	12	10
MKV-C1X-3.3-85	3,3	850	1200	1400	2100	19,5	40	700	6,3	10,0	100	45	112	210	M8	10	18,0	12	10
MKV-C1X-4.7-85	4,7	850	1200	1400	2100	17,0	40	650	9,6	8,5	130	45	147	270	M8	10	18,0	12	10
MKV-C1X-6.8-85	6,8	850	1200	1700	2550	23,0	40	1050	5,9	7,7	120	55	137	380	M12	12,5	18,0	16	11
MKV-C1X-8.2-85	8,2	850	1200	1700	2550	22,5	40	1100	6,2	7,6	130	55	147	400	M12	12,5	18,0	16	11

The thermal resistance is estimated considering the capacitor alone, not fixed and in free air condition (natural convection)
I_{max} has been calculated for a thermal rise $\vartheta_h - \vartheta_0$ within about 30°C (for more details see " Selection rules and definitions")

Type: M8 screw
Degree of protection: IP00
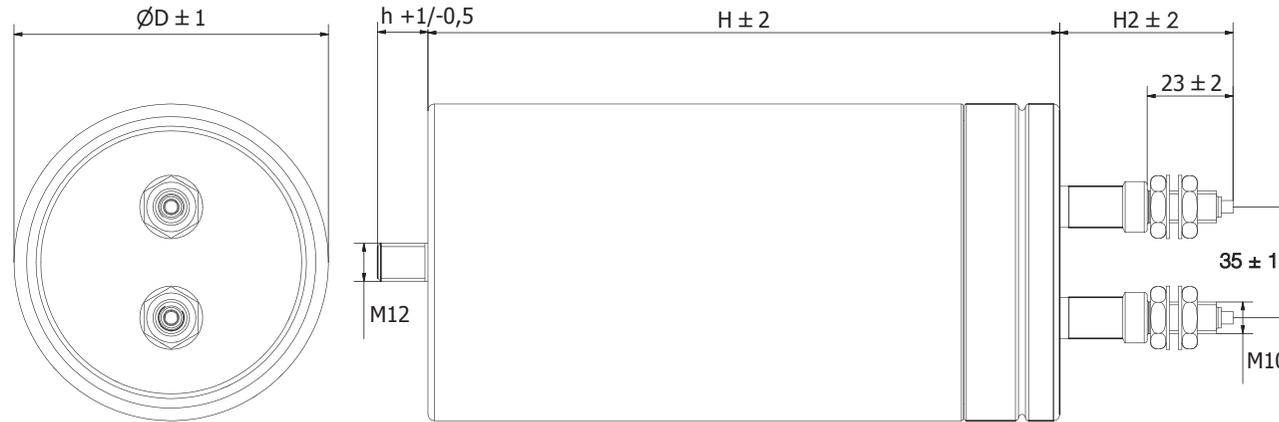Maximum terminals current: 70 Arms
Humidity class: F

MKV-D1X

MODEL	C_N μF	U_{rms} V_{rms}	U_N V	U_{NDC} V	U_S V	I_{MAX} Arms	I_{MAX} Terminals Arms	I_{PK} A	R_S mΩ	R_{th} °C/W	L_S nH	Ø mm	H mm	Weight gr	Stud	h mm	I mm	Creepage mm	Clearance mm
MKV-D1X-47-45	47	450	640	800	1200	37	70	3150	2,3	6,8	120	80	137	820	M12	16	24,0	26	16
MKV-D1X-33-50	33	500	700	930	1400	35,0	70	2550	2,7	6,8	120	80	137	820	M12	16	24,0	26	16
MKV-D1X-22-66	22	660	930	1200	1800	33,0	70	2150	3	6,8	120	80	137	820	M12	16	24,0	26	16
MKV-D1X-15-75	15	750	1060	1400	2100	31,0	70	1800	3,5	6,8	120	80	137	820	M12	16	24,0	26	16
MKV-D1X-20-75	20	750	1060	1400	2100	34,0	70	2350	2,9	6,8	120	80	137	810	M12	16	24,0	26	16
MKV-D1X-12-85	12	850	1200	1700	2550	31	70	1800	3,5	6,8	120	80	137	810	M12	16	24	26	16

The thermal resistance is estimated considering the capacitor alone, not fixed and in free air condition (natural convection)
I_{max} has been calculated for a thermal rise $\vartheta_h - \vartheta_0$ within about 30°C (for more details see " Selection rules and definitions")

MKV-E1X

MODEL	C_N µF	U_{rms} V_{rms}	Un V	Undc V	Us V	I_{MAX} Arms	I_{MAX} Terminals Arms	Ipk A	Rs mΩ	R_{th} °C/W	Ls nH	Ø mm	H mm	Weight gr	Stud	h mm	H2 mm	I mm	Creepage mm	Clearance mm
MKV-E1X-12.5-90	12,5	900	1275	1800	2700	45	80	2750	2,0	6,5	115	90	117	750	M12	16	54,5	35	19	15
MKV-E1X-17-90	17	900	1275	1800	2700	42	80	2750	2,5	5,5	130	90	142	950	M12	16	54,5	35	19	15
MKV-E1X-22-90	22	900	1275	1800	2700	45	80	3500	2,1	5,1	130	100	142	1150	M12	16	54,5	35	19	15
MKV-E1X-18.5-90	18,5	900	1275	1800	2700	55	80	4050	1,8	4,4	140	80	199	1050	M12	16	54,5	35	19	15
MKV-E1X-25-90	25	900	1275	1800	2700	60	80	5450	1,6	4,1	140	90	199	1350	M12	16	54,5	35	19	15
MKV-E1X-32-90	32	900	1275	1800	2700	65	80	7050	1,4	3,8	140	100	199	1650	M12	16	54,5	35	19	15
MKV-E1X-44-90	44	900	1275	1800	2700	65	80	7050	1,7	3,1	155	100	249	2050	M12	16	54,5	35	19	15
MKV-E1X-7-100	7	1000	1415	2100	3000	35	80	1800	2,7	7,0	115	80	117	600	M12	16	54,5	35	19	15
MKV-E1X-9.5-100	9,5	1000	1415	2100	3000	42	80	2450	2,2	6,5	115	90	117	750	M12	16	54,5	35	19	15
MKV-E1X-13-100	13	1000	1415	2100	3000	40	80	2450	2,7	5,5	130	90	142	950	M12	16	54,5	35	19	15
MKV-E1X-16.5-100	16,5	1000	1415	2100	3000	45	80	3150	2,3	5,1	130	100	142	1150	M12	16	54,5	35	19	15
MKV-E1X-14-100	14	1000	1415	2100	3000	55	80	3650	1,9	4,4	140	80	199	1050	M12	16	54,5	35	19	15
MKV-E1X-19-100	19	1000	1415	2100	3000	60	80	4900	1,6	4,1	140	90	199	1350	M12	16	54,5	35	19	15

The thermal resistance is estimated considering the capacitor alone, not fixed and in free air condition (natural convection)
I_{max} has been calculated for a thermal rise $\vartheta_h - \vartheta_0$ within about 30°C (for more details see " Selection rules and definitions")
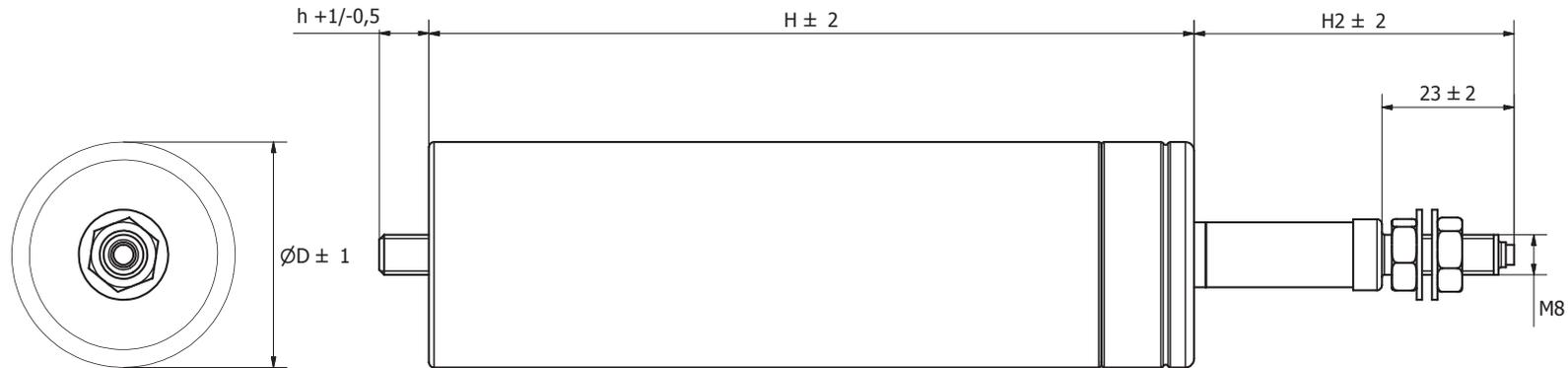
MKV-E1X

MODEL	C_N µF	U_{rms} V_{rms}	Un V	Undc V	Us V	I_{MAX} Arms	I_{MAX} Terminals Arms	Ipk A	Rs mΩ	R_{th} °C/W	Ls nH	Ø mm	H mm	Weight gr	Stud	h mm	H2 mm	I mm	Creepage mm	Clearance mm
MKV-E1X-24-100	24	1000	1415	2100	3000	65	80	6300	1,5	3,8	140	100	199	1650	M12	16	54,5	35	19	15
MKV-E1X-34-100	34	1000	1415	2100	3000	65	80	6300	1,8	3,1	155	100	249	2050	M12	16	54,5	35	19	15
MKV-E1X-2.7-140	2,7	1400	1980	2850	4200	35	80	2350	2,6	6,9	120	80	119	650	M12	16	54,5	35	19	15
MKV-E1X-3.7-140	3,7	1400	1980	2850	4200	44	80	3150	2,2	6,4	120	90	119	850	M12	16	54,5	35	19	15
MKV-E1X-4.8-140	4,8	1400	1980	2850	4200	35	80	2350	3,5	5,4	140	80	159	850	M12	16	54,5	35	19	15
MKV-E1X-6.5-140	6,5	1400	1980	2850	4200	42	80	3150	2,9	5,0	140	90	159	1100	M12	16	54,5	35	19	15
MKV-E1X-8.2-140	8,2	1400	1980	2850	4200	45	80	4050	2,5	4,6	140	100	159	1350	M12	16	54,5	35	19	15
MKV-E1X-9-140	9	1400	1980	2850	4200	40	80	3150	3,6	4,1	165	90	199	1350	M12	16	54,5	35	19	15
MKV-E1X-16-140	16	1400	1980	2850	4200	45	80	4050	3,8	3,1	190	100	249	2050	M12	16	54,5	35	19	15
MKV-E1X-2,2-160	2,2	1600	2260	3200	4800	35	80	2150	2,8	6,9	125	80	119	650	M12	16	64,5	35	29	15
MKV-E1X-3-160	3	1600	2260	3200	4800	40	80	2900	2,4	6,4	125	90	119	850	M12	16	64,5	35	29	15
MKV-E1X-4-160	4	1600	2260	3200	4800	35	80	2150	3,8	5,4	145	80	159	850	M12	16	64,5	35	29	15
MKV-E1X-5,2-160	5,2	1600	2260	3200	4800	40	80	2900	3,1	5,0	145	90	159	1100	M12	16	64,5	35	29	15
MKV-E1X-6,8-160	6,8	1600	2260	3200	4800	45	80	3750	2,7	4,6	145	100	159	1350	M12	16	64,5	35	29	15
MKV-E1X-7,5-160	7,5	1600	2260	3200	4800	40	80	2950	3,9	4,1	170	90	199	1350	M12	16	64,5	35	29	15
MKV-E1X-13-160	13	1600	2260	3200	4800	42	80	3750	4,0	3,1	195	100	249	2050	M12	16	64,5	35	29	15
MKV-E1X-1,8-180	1,8	1800	2550	3600	5400	35	80	2000	2,9	6,9	125	80	119	650	M12	16	64,5	35	29	15
MKV-E1X-2.5-180	2,5	1800	2550	3600	5400	40	80	2700	2,5	6,4	125	90	119	850	M12	16	64,5	35	29	15
MKV-E1X-3,2-180	3,2	1800	2550	3600	5400	35	80	2000	3,9	5,4	145	80	159	850	M12	16	64,5	35	29	15
MKV-E1X-4,3-180	4,3	1800	2550	3600	5400	40	80	2700	3,3	5,0	145	90	159	1100	M12	16	64,5	35	29	15
MKV-E1X-5,5-180	5,5	1800	2550	3600	5400	44	80	3500	2,8	4,6	145	100	159	1350	M12	16	64,5	35	29	15
MKV-E1X-6,2-180	6,2	1800	2550	3600	5400	38	80	2700	4,1	4,1	170	90	199	1350	M12	16	64,5	35	29	15
MKV-E1X-8-180	8	1800	2550	3600	5400	42	80	3500	3,5	3,8	170	100	199	1650	M12	16	64,5	35	29	15
MKV-E1X-11-180	11	1800	2550	3600	5400	42	80	3500	4,2	3,1	195	100	249	2050	M12	16	64,5	35	29	15
MKV-E1X-1,4-200	1,4	2000	2830	4000	6000	35	80	1800	3,1	6,9	125	80	119	650	M12	16	64,5	35	29	15
MKV-E1X-1,9-200	1,9	2000	2830	4000	6000	40	80	2400	2,6	6,4	125	90	119	850	M12	16	64,5	35	29	15
MKV-E1X-2,5-200	2,5	2000	2830	4000	6000	34	80	1800	4,3	5,4	145	80	159	850	M12	16	64,5	35	29	15
MKV-E1X-3,3-200	3,3	2000	2830	4000	6000	38	80	2400	3,5	5,0	145	90	159	1100	M12	16	64,5	35	29	15
MKV-E1X-4,3-200	4,3	2000	2830	4000	6000	42	80	3100	3,0	4,6	145	100	159	1350	M12	16	64,5	35	29	15
MKV-E1X-4,8-200	4,8	2000	2830	4000	6000	35	80	2400	4,4	4,1	170	90	199	1350	M12	16	64,5	35	29	15
MKV-E1X-8,5-200	8,5	2000	2830	4000	6000	40	80	3100	4,6	3,1	195	100	249	2050	M12	16	64,5	35	29	15

The thermal resistance is estimated considering the capacitor alone, not fixed and in free air condition (natural convection)
I_{max} has been calculated for a thermal rise $\vartheta_h - \vartheta_0$ within about 30°C (for more details see " Selection rules and definitions")

Type: ceramic insulator M8 screw
Degree of protection: IP00
Maximum terminals current: 40 Arms
Humidity class: C

MKV-E2X

MODEL	C_N µF	U_{rms} V_{rms}	Un V	Undc V	Us V	I_{MAX} Arms	I_{MAX} Terminals Arms	Ipk A	Rs mΩ	R_{th} °C/W	Ls nH	Ø mm	H mm	Weight gr	Stud	h mm	H2 mm	Creepage mm	Clearance mm
MKV-E2X-0,22-240	0,22	2400	3400	4300	5800	11	40	280	21	11	250	35	160	200	M8	10	64,5	29	29
MKV-E2X-0,33-240	0,33	2400	3400	4300	5800	13	40	420	15	10	250	40	160	250	M8	10	64,5	29	29
MKV-E2X-0,47-240	0,47	2400	3400	4300	5800	16	40	600	11,5	9	250	45	160	320	M8	10	64,5	29	29
MKV-E2X-0,68-240	0,68	2400	3400	4300	5800	20	40	880	9	8	250	55	160	450	M12	12,5	64,5	29	29

The thermal resistance is estimated considering the capacitor alone, not fixed and in free air condition (natural convection)
I_{max} has been calculated for a thermal rise $\vartheta_h - \vartheta_0$ within about 30°C (for more details see " Selection rules and definitions ")

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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Most common risks are related to combustible gas generation, explosion, fire, electrocution or abnormal operation of the capacitor. Not all the possible risks and safety measures are mentioned in this catalogue, further information are available on request.
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ICAR S.p.A.
Via Isonzo, 10
20900 Monza (MB) - Italy
tel. +39 039 83.951
fax +39 039 83.32.27
www.icar.com
sales@icar.com