Aluminium Electrolytic Capacitors

Sirectifier

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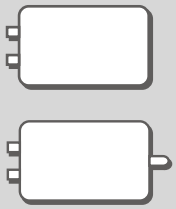
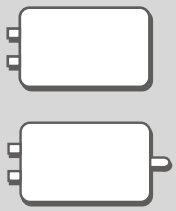
	KX085 screw terminals	220 µF - 1,500,000 µF	16V -500V DC	-40°C +85°C	17
	KX105 screw terminals	100 µF - 470,000 µF	16V -450V DC	-40°C +105°C	24
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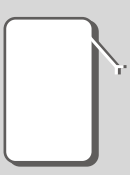
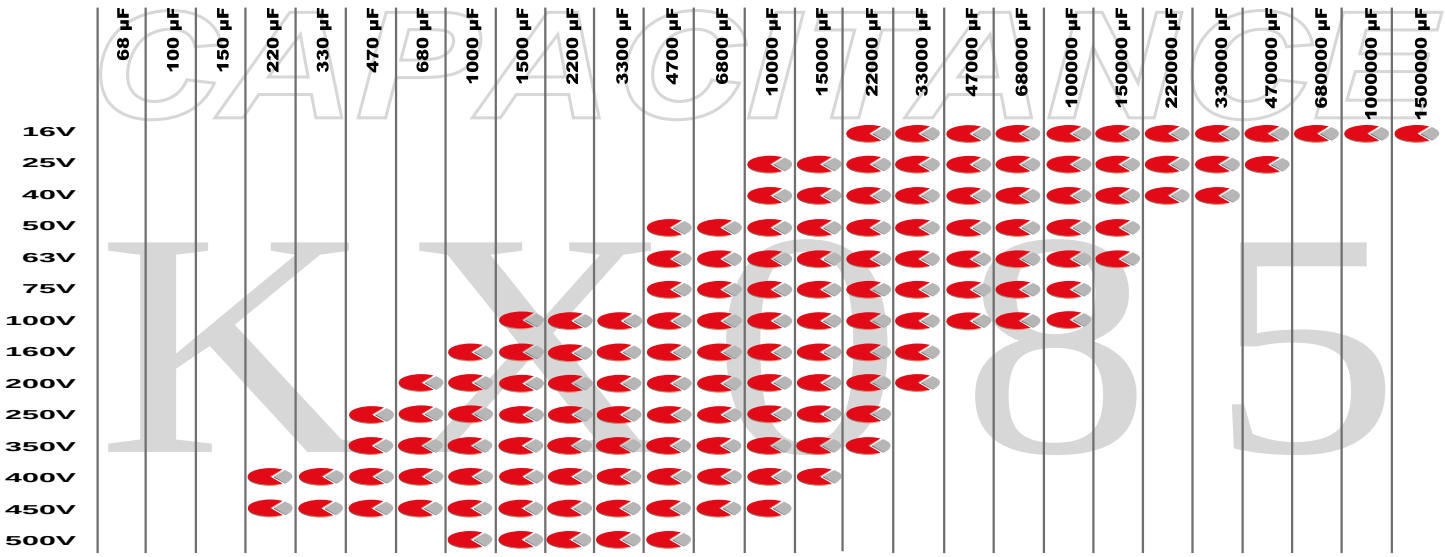
	KX13 fast on	25 µF - 800 µF	125V AC - 320V DC	-25°C +75°C	39

Specifications contained in this catalogue subject to change without notice.

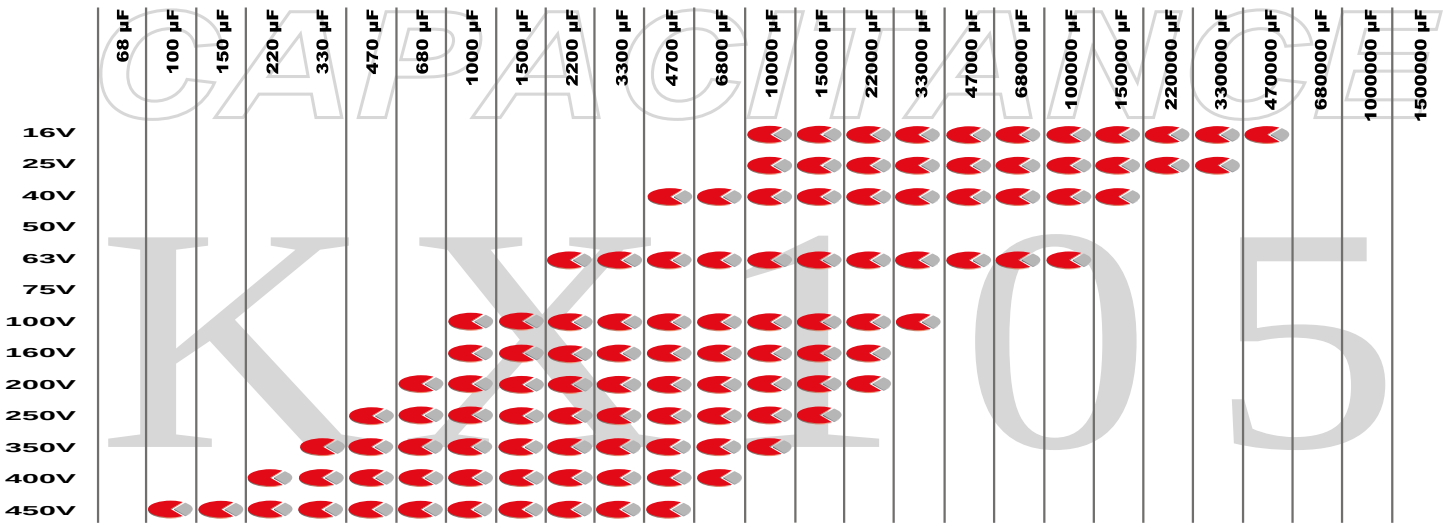
SCREW TERMINALS

KX085 TYPE



Note: Standard production range. Other values available upon request.

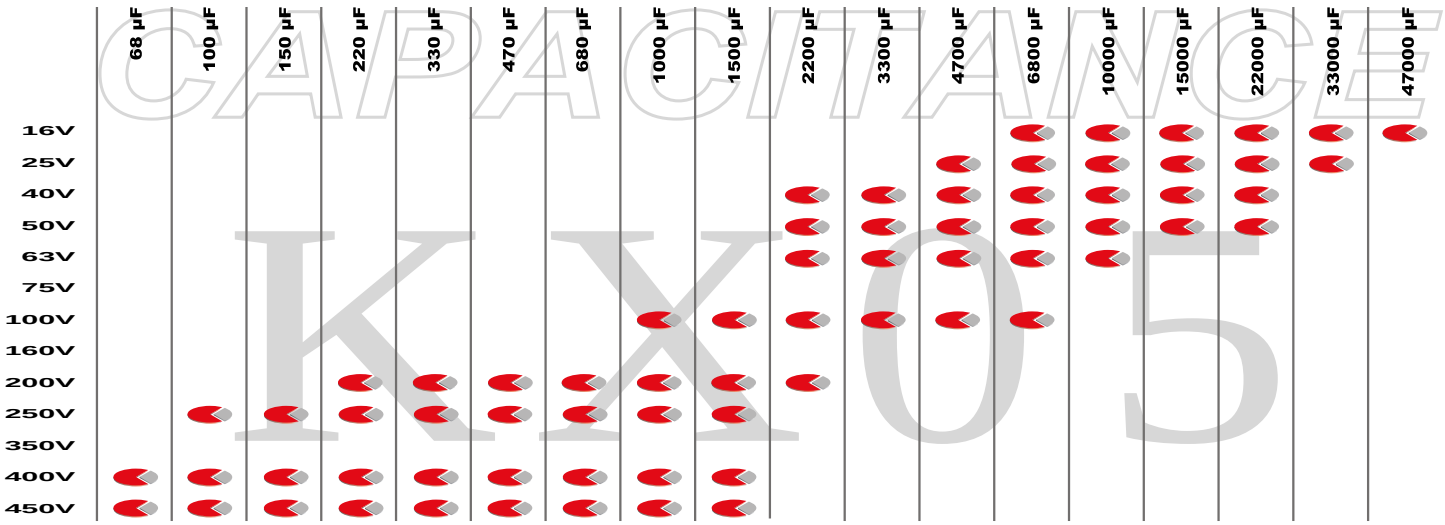
KX105 TYPE



Note: Standard production range. Other values available upon request.

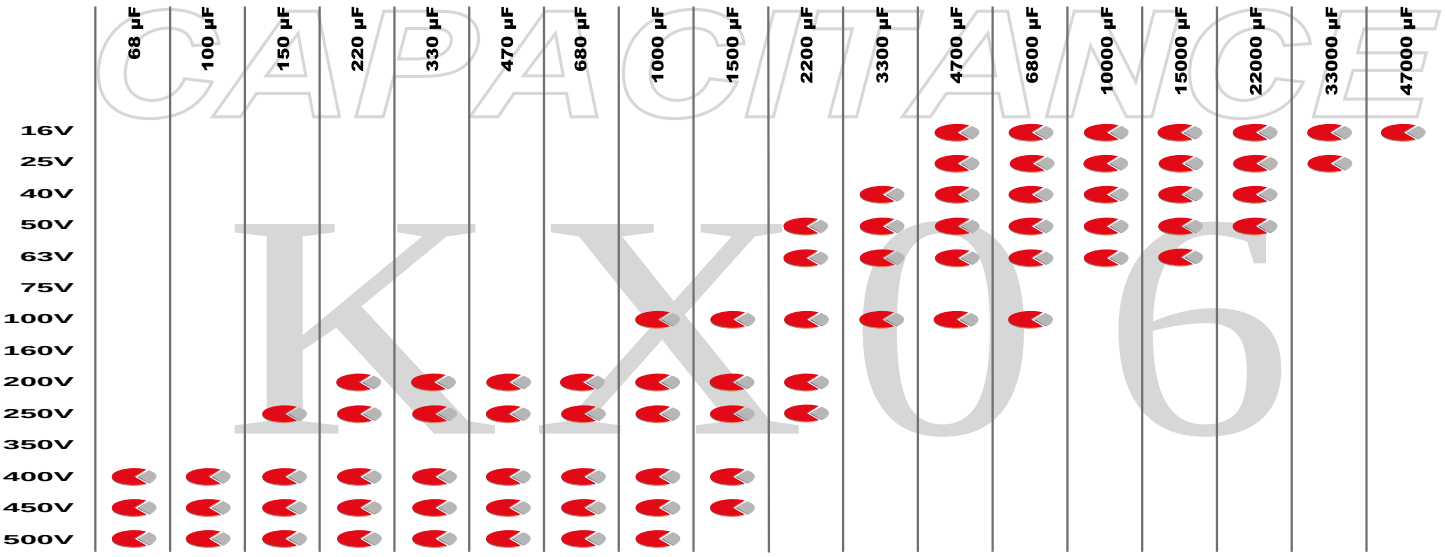
SNAP IN TERMINALS

KX05 TYPE



Note: Standard production range. Other values available upon request.

KX06 TYPE



Note: Standard production range. Other values available upon request.

Sirectifier®
Sirectifier Electronics Technology Corporation

BUILDING AN ELECTROLYTIC CAPACITOR

APPLICATIONS

A capacitor is an electrical component that stores a quantity of electrical charge defined with a linear relationship as:

$$Q = C \times V$$

where: Q = electrical charge [Coulomb] C = Capacitance [Farad] V = Voltage [Volt]

Usually values are indicated in a smaller unit called micro Farad [µF] that is one million times smaller.
An aluminium electrolytic capacitor is composed of one anode of aluminium foil (or one aluminium foil anode) having a dielectric oxidation on its surface, with semiconductor characteristics to prevent the current flow in one direction, and another aluminium foil cathode. There is also an electrolyte impregnated paper layer positioned between the anode and the cathode in order to avoid short circuits. Both the aluminium foils have been etched to obtain active surfaces, increasing their effective area. Aluminium tabs are then connected to the two foils to act as terminals. When in use the impregnated section is then closed inside an suitable case and sealed with a deck.
The matching of thin dielectric and a large surface area allows to create capacitors with exceptional high capacitance per volume.

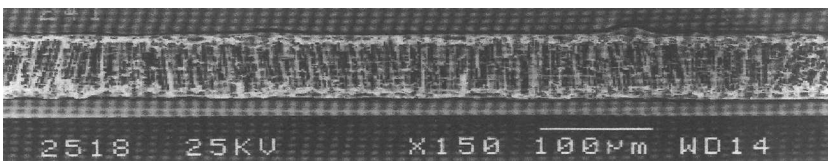
European (CECC) and International standards (IEC) have classified the capacitors in two categories. Electrolytic capacitors for high reliability applications (Long Life Grade): in addition of the possible over anodization (the difference between forming voltage and operating voltage) must generally satisfy high endurance requirements and a careful selection on materials is needed.
Such efforts are not required for capacitors standard version used for less severe reliability (General Purpose Grade).

The whole manufacturing process requested to build a Sirectifier electrolytic capacitor could be reasonably split into the following phases:

* Etching
* Winding
* Impregnation
* Sealing
* Ageing
* Production Inspections

ETCHING

Plates or electrodes are made of high purity, very thin aluminium foil (0.05 to 0.1 mm thickness).
To get the maximum capacitance for a given electrode surface area, an electrochemical process called “etching” is used to dissolve metal and increase the surface area of the foil in the form of a dense network of microscopic channels. The etching process consists of continuously running aluminium foil through a chloride solution with an AC, DC or AC/DC voltage applied between the etch solution and aluminium foil.
The increase in surface area is referred to as foil gain and can be increased as much as 100 times for foil being used in low voltage capacitor applications and 20 to 25 times for higher voltage applications.
The dielectric of the aluminium electrolytic capacitor is composed of a thin layer of aluminium oxide (Al2O3) which "forms" on the surface of the etched aluminium foil during a process called “formation”.



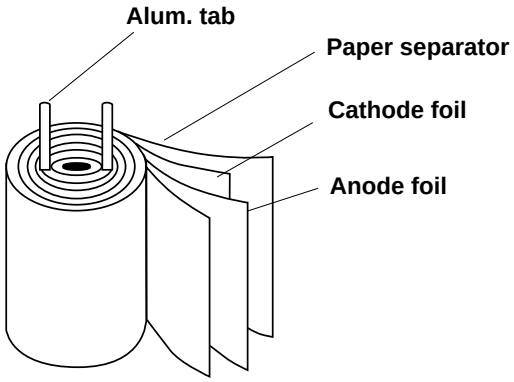
MICROGRAPHS VIEW OF ETCHED ALUMINIUM FOIL

Since capacitance is inversely proportional to the dielectric thickness and this is proportional to the forming voltage, the following relation is appliable:

Capacitance x Forming Voltage = Constant

This is true for high voltage foils with a relatively coarse etch structure. However, for foils with extremely fine structures, the process to convert aluminium to aluminium oxide has a significant smoothing effect on the structure that might be described by a non-linear relationship.

WINDING

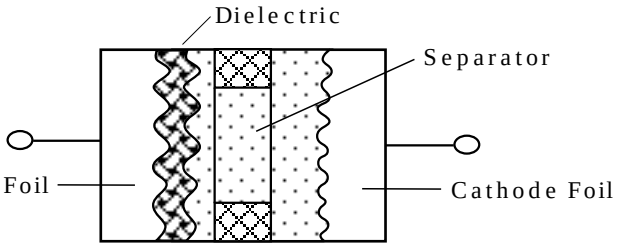


THE CAPACITOR ELEMENT

Each capacitor contains two foils, the positive foil is called the ANODE and the negative is called the CATHODE. Both foils, along with a separator paper are rolled into a cylinder.
The separator paper prevents anode and cathode foils from coming into contact with each other and shorting. As part of a highly automated winding process, aluminium tabs are attached to the anode and cathode foils. This completed assembly of etched and formed foil, together with separator paper and attached tabs is called the capacitor ELEMENT.

IMPREGNATION

The method of impregnation requires the winding element to be immersed into the electrolyte by either a vacuum/pressure cycle with or without applied heat or by simple absorption.
The electrolyte contains a solvent such as ethylene glycol and a solute such as ammonium borate.
Should the dielectric film be damaged, the presence of the electrolyte will allow the capacitor to heal itself by forming more oxide. By selecting different electrolytes, the capacitor characteristics such as operating temperature range, frequency response, shelf life and load life could be improved.



The cross section for a typical element

SEALING

After impregnation phase, the element is sealed into an aluminium can. Sealing deck materials may be rubber/bakelite or phenolic plastic.

AGEING

Before being sleeved and packed the capacitor is aged and tested, this being the final process of the production chain, usually called "ageing". A voltage greater than the rated voltage is then applied at very high temperatures. The purpose is to reform or to repair any oxide film which may have been damaged during the slitting, winding and assembly processes, thus reducing the leakage current to an acceptable low level.

PRODUCTION INSPECTIONS

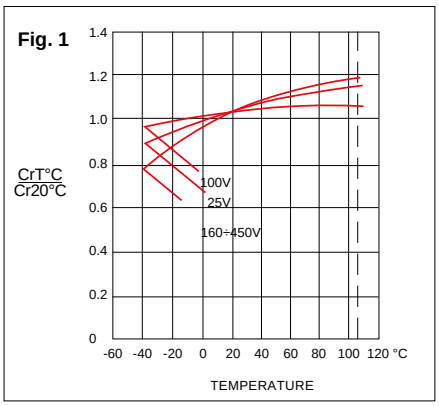
After ageing, capacitors are 100% tested. All electrical requirements are checked using highly advanced automated test equipment and any rejects are removed. Capacitors are also visually inspected, and only capacitors passing both tests are accepted for packaging.

ELECTRICAL CHARACTERISTICS

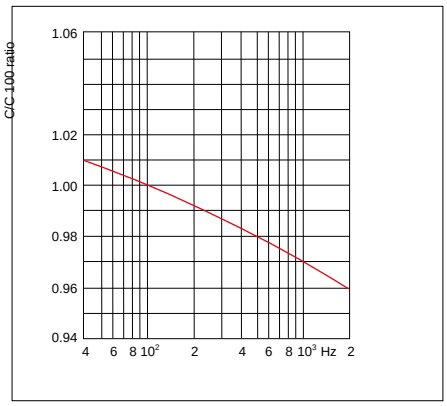
RATED CAPACITANCE

The rated capacitance, defined at 100 Hz and 20°C, is the capacitance of an equivalent circuit having capacitance and resistance series connected. The value is indicated on the external sleeve, specified in micro Farads [µF]. Typical capacitance drift versus temperature and frequency, see above.

CAPACITANCE DRIFT VERSUS TEMPERATURE



CAPACITANCE VERSUS FREQUENCY



RATED VOLTAGE (V_r)

The rated voltage is the value of voltage that could be applied continuously within the operating temperature range of capacitors. When using a capacitor with AC voltage superimposed on a DC voltage, care should be taken such that the peak value of AC voltage plus the DC voltage does not exceed the rated voltage.
Reverse polarization shall not exceed two times VDC value.
When capacitors are series connected, the voltage distribution across the series may not be the same. This is due to normal DC leakage distribution and should be considered in the design process either using a higher rated voltage capacitor or using balancing resistors in parallel with each series capacitor.

SURGE VOLTAGE (V_p)

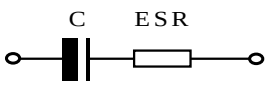
The surge voltage is the maximum overvoltage including DC, peak AC and transients to which the capacitor could be subjected for short periods of time (not more then 30 seconds in any 5 minute period).
Depending on applicable specifications, this test is usually performed at maximum operative temperature. A current limiting resistor of 1000 Ω should be used.
Charge is held for 30 seconds for 1000 cycles, then the capacitor is allowed to discharge without load for 5 minutes. Rated and surge voltage values for Sirectifier capacitors are listed in following table, where a different relation is applied depending on rated value (Vr).

	$V_p = 1.15\ V_r$										$V_p = 1.10\ V_r$			$V_p = 1.05\ V_r$
RATED VOLTAGE [V]	**16**	**25**	**40**	**50**	**63**	**75**	**100**	**160**	**200**	**250**	**350**	**400**	**450**	**500**
SURGE VOLTAGE [V]	**18**	**29**	**46**	**57**	**72**	**86**	**115**	**184**	**230**	**287**	**385**	**440**	**495**	**525**

EQUIVALENT SERIES RESISTANCE (ESR)

The equivalent series resistance is the resistance that a capacitor has to the alternating current flow. Various resistive components such as: electrolyte, paper foil, aluminium foil, tabs, and others determine the total ESR value. It is measured at 100 Hz and 20°C. It is related and dependant on temperature and frequency and generally when either these factors increase, a reduction in ESR results.
The construction technology of Sirectifier capacitors reduces significantly the ESR value.

Equivalent Standard Circuit



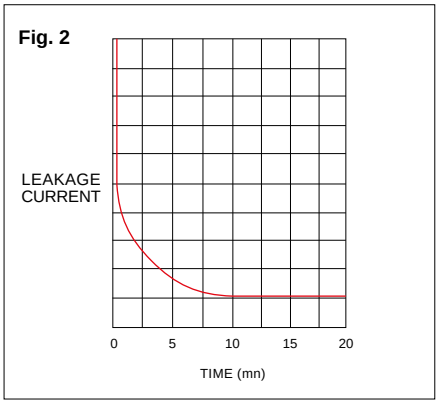
$ESR = R_1 + R_2 + R_3$
R_1 = **Resistance of aluminium oxide thickness**
R_2 = **Resistance of electrolyte, spacer**
R_3 = **Resistance due to materials: foil lenght, tabs, terminations contact resistance**

LEAKAGE CURRENT (I_L)

Measured at 20°C after 5 minutes under rated voltage.
It is the current flowing through the insulation resistance when a direct current is applied to the capacitor. After charging a capacitor to a set voltage we obtain, initially, a high current flow which decreases rapidly until a constant very small value is reached, the final leakage current. The leakage current value increases both with voltage and temperature. After a long storage period, the leakage current value can be exceeding the rated value and before the output measurement reanodization is necessary. For this reason it is advised to apply a rated voltage with a series resistor of 100Ω for Vr ≤100VDC and 1000Ω for Vr > 100 VDC. For typical leakage current versus time and temperature, see Fig. 2-3.

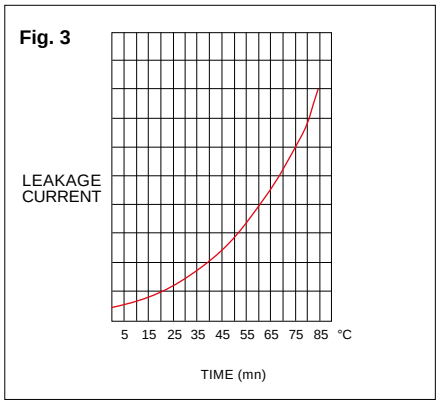
I_L DRIFT VERSUS TIME

Fig. 2



I_L DRIFT VERSUS TEMPERATURE

Fig. 3



DISSIPATION FACTOR (tan δ)

Dissipation factor or loss angle tangent (tan δ) is a main electrical characteristic of an electrolyte capacitor, a measure of the deviation from an ideal capacitance value.
Relationship is included in the following formula:

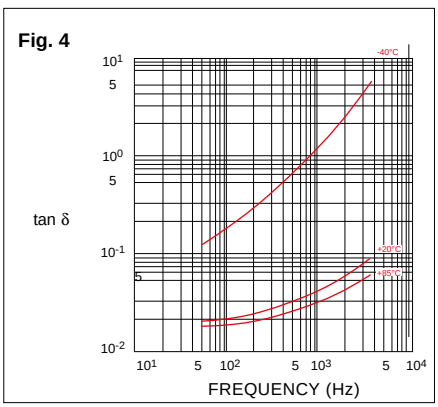
$$\text{Tan } \delta = 2 \pi f C \text{ ESR}$$

where f = frequency C= rated capacitance

Maximum values in the datasheets have been indicated at 100Hz and 20°C.
Drift versus frequency as Fig. 4-5.

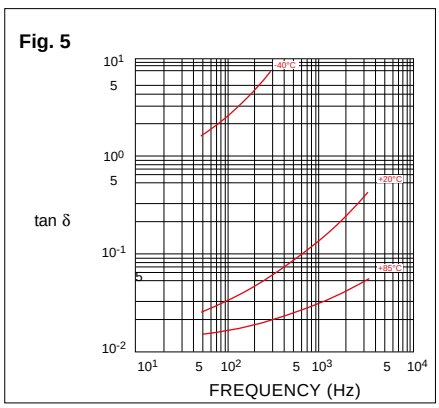
tg δ DRIFT VERSUS FREQUENCY LOW VOLTAGE (≤ 100 V_r d.c.)

Fig. 4



tg δ DRIFT VERSUS FREQUENCY HIGH VOLTAGE (> 100 V_r d.c.)

Fig. 5



INDUCTANCE

Some inductance is present in aluminium electrolytic capacitors, but values are usually less then few tens of nH.

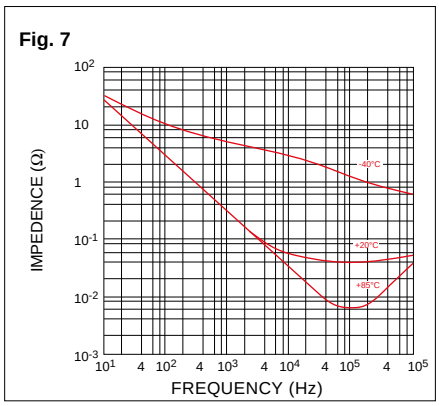
IMPEDANCE (Z)

$Z = \sqrt{ESR^2 + (X_L - X_C)^2}$

Impedance is dominated by the capacitive reactance (X_C) at low frequencies and by the inductive reactance (X_L) at high frequencies. At the point of series resonance Z=ESR.
Typical impedance drift versus frequency, see Fig. 6-7.

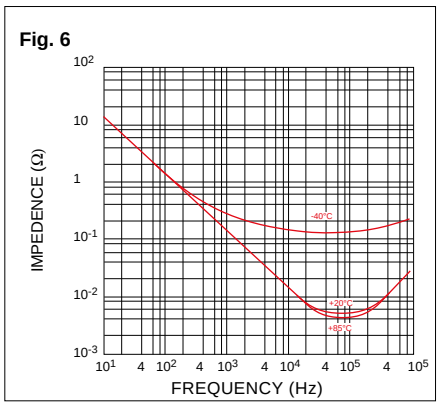
Z DRIFT VERSUS FREQUENCY HIGH VOLTAGE (> 100 Vr d.c.)

Fig. 7



Z DRIFT VERSUS FREQUENCY LOW VOLTAGE (≤ 100 Vr d.c.)

Fig. 6



RIPPLE CURRENT (Ir)

It is defined as the superimposed alternated ripple current (sinusoidal alternating current at 100 Hz). It depends mostly on an allowable temperature rise within a capacitor section due to the power relation formula: $I^2 \times R$. Heating occurs, due to an alternating current flowing through the equivalent series resistance of capacitor. Actual power must be considered when defining ripple current capability. The thermal gradient of an aluminium foil capacitor in an aluminium can is 10^{-3} Watt/cm^2/°C. Since the ripple current raises the temperature of the capacitor it has a significant effect on the operational life of the component. A diagram of useful life specifies life under given operating conditions of different temperatures values and ripple current values.

SHELF LIFE (Voltage free storage)

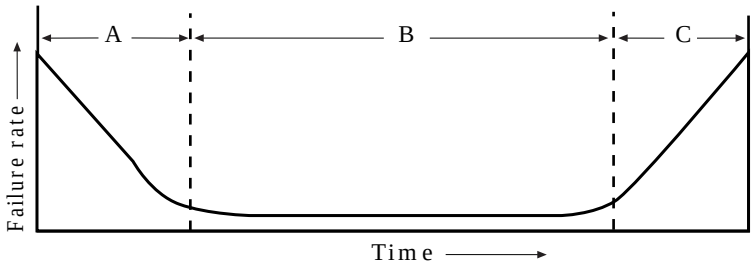
Capacitors generally can be stored at temperatures up to 50°C without any reduction of their reliability. Overall characteristics such as capacitance, ESR and impedance should show good performance with no sensitive changes while the leakage current will exhibit a slow drift upwords.
In practical use, we experienced the following scheme meaningful for voltage rated classes of capacitors:

THREE YEARS	TWO YEARS	ONE YEAR
<100V DC	<300V DC	>300V DC

After an extended storage period, the leakage current value may exceed the rated value and, before the output measurement, a reanodization process is required.
It could be realized by applying the rated voltage at room temperature for one hour.
In any case it is advisable to use a maximum charging current of 5mA or twice typical value specified for each series.

RELIABILITY

With the advancements in aluminium electrolytic capacitor technology, the capacitors used in equipments must have a very long life characteristics and must operate even under severe conditions. A careful choice of a capacitor for a particular application and an adequate installation in the circuit will assure a good service life. In any case any component will eventually fail, usually this occurs due to a slow, steady drift of parameters called wear-out; sometimes there is a sharp change in capacitor properties also called catastrophic failure. In general terms the failure rate of aluminium electrolytic capacitors follows a bathtub curve with time as shown here.



THE BATHTUB CURVE
Three different areas are defined where capacitor life could be observed: A, B, C.

(A) Initial Failure Period
This is the period during which failures are caused by deficiencies in design, structure, manufacturing processes or severe applications. Such failures occur soon after the components are exposed to circuit conditions. In aluminium electrolytic capacitors, these failures are either corrected through aging or found during the 100% inspection processes and do not reach the field.
Initial failures due to a bad application of the capacitor such as inappropriate ambient conditions, over voltage, reverse voltage or excessive ripple current can be avoided with an adequate circuit design and careful installation.

(B) Random Failure Period (USEFUL LIFE)
Here the failure rate is low. During this period a constant failure rate is shown.
These failures are not related to operating time but to application conditions.
This period of useful life is normally calculated with a confidence level of 60%.

(C) Wear-Out Failure Period
In this period the properties of a component gradually deteriorate and the failure rate increases with time. Aluminium electrolytic capacitors end their useful life during this period.
Criteria for judging failures varies with application design factors.

Reliability represents this measure of the expected failure rate during the useful life of the capacitor. Failure rate is defined as the number of components failing during a unit working time.
It is expressed by following formula:

1 fit = 1 10^{-9}/hours (failure in time) also indicated as percentage of failures in 1000 hours.

λ = number of failures / number of components tested

MTBF (Mean Time Before Failure) could be calculated according to failure rate following the relashionship:

MTBF= 1/λ

This value defines the failure frequency occurring on a large number of components inside an equipment, therefore is not suitable to predict failure on one single capacitor. Statistical calculations should be used instead. It is helpful as a design tool to determinate reliability features for components and complex systems.

EXAMPLE
A batch of 10000 capacitor tested, for 40000 operating hours, finding 4 failures.
λ= 4/10000 x 1/40000 h = 10 fit = 0.001% /1000 hours

The failure rate calculation is derived from endurance tests at specified temperatures, taking into account all measurable and non-measurable defects arised. Kind of measurable defects are meant for each type of capacitor endurance test point. While non-measurable defects are meant to be open and short circuit, safety valve break or electrolyte leakage. Ripple current and ambient temperature contribute to the internal temperature rise of the capacitor, so affecting its useful life. In general, every 10°C reduction in temperature carries a multiplier factor of two times the life value.

USEFUL LIFE

The typical useful life represents a period of time until the end of life of the capacitor. The end is caused by different incidents (or different failure modes) such as the following:

MECHANICAL FAILURES

operation of safety vent due to overpressure, splitting of PVC sleeve and damaged insulation, unusable terminals, external short circuiting of terminals due to spilling of electrolyte.

OVER FAILURES

when a short or open circuit occurs.

ELECTRICAL CHARACTERISTICS FAILURES

In a group of capacitors considered to have reached the end when 3% of them have failed, useful life is influenced by following failure criteria:

a) ESR > 3 times initial value
b) impedance > 3 times initial value
c) capacitance value change of greater than 50%
d) leakage current over initial limit.

In some cases, it is possible that even larger values of the above indicated could be applied without leading to failure, but generally capacitors tested in the laboratory at Sirectifier show standard behaviour around these limits. Obviously, when operating at lower voltages together with moderate temperature as well as lower values of current, the final life expectation should be better.
When an adequate cooling system has been provided, the overall performance is substantially better and the life of the capacitor is improved.

In normal conditions, statistics are produced after extensive endurance tests compliant to standard specifications. Depending of the type of capacitor, endurance tests have been undertaken over different lengths of time using capacitors coming from production batches. Data is collected and results summarized, so we have generated wide information displayed graphically for each model, which can be seen on each product datasheet.
The useful lifetime regarding the ambient temperature is given by following practical formula:

For $\Delta T \leq 10°C$

$$\text{USEFUL LIFETIME} = L_{OPMAX} \times 1.072^{95-(Ta-\Delta T)}$$

For $\Delta T > 10°C$

$$\text{USEFUL LIFETIME} = L_{OPMAX} \times 1.072^{95-(Ta-\Delta T)} \times 1.12^{-(\Delta T-10)}$$

Where:
USEFUL LIFETIME expressed in hours
L_{OPMAX} = Lifetime at max rated operating temperature (eg.: 10,000 hs at 85°C)
Ta = Actual operating temperature (°C)
ΔT = difference from capacitor temperature and ambient temperature

NOTE
Applicable temperature range is the temperature depending on the capacitor type characteristics, usually situated in the operating range of -40°C to +85°C or 105°C . Typically, each 10°C step carries a reduction factor of 2 times the lifetime value.

Useful life is also determined by ripple current.
It is advisable not to apply a ripple current exceeding the max ripple current allowed as this will shorten capacitor life and may result in opening of the vent or catastrophic failure.
It often happens that heating due to ripple current is even more severe than ambient temperature stress.

GUIDELINES FOR ALUMINIUM ELECTROLYTIC CAPACITORS

• POLARITY

In DC applications polarity is required; if polarity is reversed, the circuit life will be shortened or the capacitor may be damaged. Generally, an intermittent reverse voltage of 1V DC is allowed.
If during operation, it is possible that polarity could be reversed or unknown, extensive use of a bipolar capacitor is required.

• *CHARGE - DISCHARGE APPLICATIONS*

Sirectifier aluminium electrolytic capacitors are suitable for circuits in which a charge and discharge cycle is requested. The frequent cycles due to a charge or discharge operation could take some drop of capacitance value. In general one million of switching with rated voltage one cycle for second a time costant of 0.1 carries an overall capacitance decrease less then 10%.

• INSULATION

In general all aluminium electrolytic capacitors are covered with a PVC sleeve, that is also used for marking. The aluminium can is not insulated from the cathode, so when the internal element needs to be electrically insulated from the can, capacitors specially designed for insulation requirements should be used.

• *OPERATING TEMPERATURE*

A capacitor should be chosen with a maximum specified temperature greater than the operating temperature of the application; this will increase the capacitor useful lifetime.

• CLIMATIC CONDITIONS

All Sirectifier capacitors maintain good behaviour under any climatic conditions when operating conditions are within the design specifications limits of each product type.
Since each capacitor is hermetically sealed, the wet element inside impregnated with electrolyte will not be exposed to external conditions such as high pressure or vacuum.
Furthermore, all electrical parameters such as impedance, leakage current, ESR and capacitance, will not be significantly changed by these external conditions.

Temperature range of Sirectifier electrolytic capacitors (IEC 68-1):

Capacitor type	IEC 68-1 code	Temperature Range
KX085 screw	GP	-40°C + 85°C
KX105 screw	GM	-40°C +105°C
KX05 snap in	GM	-40°C +105°C
KX06 snap in	GP	-40°C + 85°C
KX13 fast on (lug)	HS	-25°C + 75°C

AIR PRESSURE
When operating at low values of external air pressure, there could also be an increase in the pressure inside the case. When an external vacuum exists, the pressure inside the capacitor could rise up to 1 bar. In these circumstances the internal vapour loss becomes greater resulting in an overall reduction in expected life.

ALTITUDE
When in extreme altitude situations, consideration must be given to the shortening of capacitor life due to the reduced air density, preventing heat from being adequately dissipated from the external surfaces of the capacitor leading to an increase in internal temperatures.

• *MECHANICAL STRESS*

If excessive force is applied to terminations, they may break or their connections with the inside element may be badly affected. The distance between terminations holes on the circuit board should be the same as the spacing between terminations on the capacitor.

SCREW TERMINAL - Sirectifier KX085/KX105 type

Excessive torque force applied in tightening the screws into terminals will result in stripping the threads and possibly increasing the contact resistance. On the other hand, if screws are not enough tightened enough, the high contact resistance will cause localized heating at terminals plus an early failure of the capacitor.

SNAP IN - **Sirectifier** KX05/KX06 type

Improper insertion into the circuit boards may break the terminals or impair their electrical connections with the internal elements. When provided, blank terminals of a multi-terminal capacitor should be considered to be at the same potential as the electrolyte, or cathode, and should therefore be isolated from the circuit.

APPLICATION OF TORQUE TO ALUMINIUM THREADS

Please note the max appliable torque strength to KX085 and KX105 capacitors:
With thread stud M5 = 2Nm
With thread stud M12 = 4Nm
Screw torque strength for hex nuts M8 = 4Nm
Screw torque strength for hex nuts M12 = 10Nm

• **SOLDERING**

Incorrect soldering may shrink or break the capacitor sleeve. Please read the following information carefully.
- When soldering a printed circuit board (PCB), the soldering temperature should not be excessive while time taken should be short. Otherwise it could have adverse effects on the electrical characteristics and insulating sleeves.
- During the soldering process, the sleeve may melt or break if it gets in contact with circuit board traces. Try to avoid this problem and do not locate circuit board traces under capacitor body.
- The sleeves may be melted by solder which migrates up through terminations holes in the circuit board.
- When soldering adjacent components to the capacitor, preheated lead wires or terminals may tear the capacitor sleeve if they come in contact with it. Therefore, capacitors are to be mounted carefully so that adjacent components terminations do not come into contact, particularly when mounting on through-hole circuit boards.

• *CLEANING*

Aluminium can be aggressively attacked by halide ions, particularly by chloride ions. Even small amounts of chloride ions inside the capacitor will cause corrosion which contributes to rapid capacitance drop and venting. Therefore, the prevention of chloride contamination is the most important check point for quality control in production. Solvent proof capacitors are required when chlorinated hydrocarbons are used for cleaning. If aluminium electrolytic capacitors without the solvent-proof construction are present on the circuit board, alcohol based solvents are recommended for cleaning. In this case, solvents such as methanol, ethanol, propanol and isopropanol should be used. Normal tests show that any detrimental effect is eliminated. An alkaline detergent may damage the aluminium metal and marking. Aqueous cleaning methods in conjunction with saponification are commonly used. However it is advisable to dry immediately with hot air, which is best achieved at 85°C for few minutes.

• **STORAGE**

After having a capacitor exposed to high temperatures such as direct sunlight or heating elements, the capacitor life may be adversely affected. Also when capacitors have been stored under humid conditions for a long period of time, humidity will cause terminals to oxidize. Therefore it is highly recommended they should be stored at room temperature, in a dry place, out of direct sunlight.
A voltage treatment process should be applied after some years storage period.
When capacitors have been stored above room temperature, the anode foil may react with the electrolyte causing increased leakage current values. Application of normal voltages to these capacitors may result in higher leakage current values, but in most cases, they will return to normal levels in short time.
However on occasion it is possible that a certain amount of gas will be generated which might cause the safety vent to open. Capacitors that have been stored for long time should be subjected to a voltage reforming process which will regenerate internal dielectric layers.

• *SAFETY*

When an escape of electrolyte has occurred, wash the affected area with hot water. Use rubber gloves to avoid skin contact. Any contact with eyes should be immediately irrigated with water and medical advise is sought. Sirectifier electrolyte blends do not contain materials currently listed as carcinogetic or mutagenic such as polychlrolinated biphenyls (PCB) or dimethylformamide (DMF). No Butyrolactone used as solvent.
Under exposure to electrolyte skin could become dry. Other irritations or effects may be caused to the mucous membranes particularly eyes, where conjunctivitis may result.

• BALANCING RESISTORS in series and parallel connections

The following explanation is given for a typical connection scheme, when two capacitors have been connected in series, this is a brief approach answering to the question *"How much could be the maximum voltage applied to a capacitor?"*

If we have two capacitors of 400V rated with ±20% tolerance range each, total voltage applied is 800V ($V_{circuit}$), in the best situation each capacitor is well balanced.
Anyway the maximum and minimum values due to the tolerance range is then put in the formula. It is easy to calculate the maximum exposing voltage to whom the minimum capacitor could be applied.

$$V_{MINCAP} = V_{circuit} \times (1+20\%) / (MIN_{tolerance} + MAX_{tolerance})$$

Using the values from example, we have: $V_{MINCAP} = 800 \times 1.2 / (0.8 + 1.2) = 480V$
This is the real maximum voltage value applied to the capacitor in a serial connection. It is strongly recommended to use a resistor that would share the over-voltage.
In the practical field of designing these kind of circuits, we have found that a good balancing system could be obtained using the following formula in which only the capacitor value is required.
We assume that a current from 15 to 20 times the leakage current value would be flowing in the resistor, therefore a simple relationship could be applied:

Balancing Resistor [kΩ] = 60,000 / Capacitance [µF]

The resistor should have very good characteristic, usually with tolerance range of ±5% but better tolerance range is preferred when dealing with high transients and a top level performance is required.
When designing high current applications, a parallel configuration should be preferred.

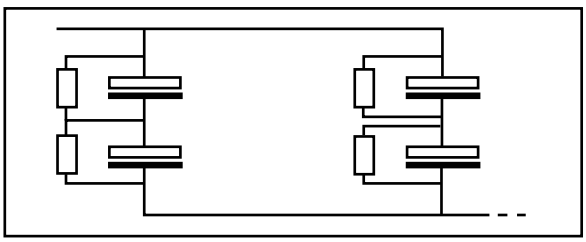
PRACTICAL TABLE

Capacitor	Balancing Resistor
470 µF	127 k Ω
680 µF	88 k Ω
1000 µF	60 k Ω
2200 µF	27 k Ω
4700 µF	13 k Ω
6800 µF	9 k Ω
10000 µF	6 k Ω

CONFIGURATION SCHEMES

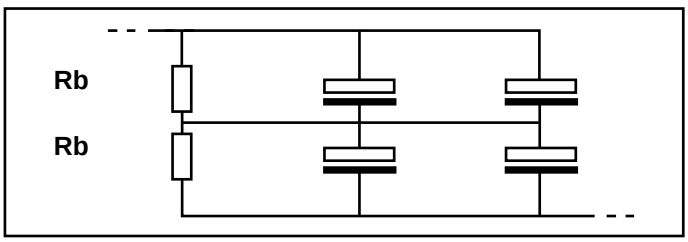
Two ways of connecting balancing resistors are implemented in the industry, depending on design and experience. Both of them have important features that must be borne in mind for the appropriate performances required.

Single balancing resistor



(+) Plus features
When one capacitor fails, the adjacent capacitor will probably fail too, but the other capacitor will remain undamaged.
(-) Minus features
There are many resistors to be placed in the circuit.

Two parallel resistors



(+) Plus features
A better balancing system is achieved with "the most parallel capacitors used".
The total leakage current as the sum of the single branches components gives a very good balancing system.This configuration needs only two resistors and since the delta LC would be a very small value, it could be realized also without any resistor.
(-) Minus features
When one capacitor fails, the parallel branch in which it is operating will also fail as the total voltage will be applied under operating voltage conditions.

• *FLAMMABILITY*

Some component parts of a capacitor are suitable to burn depending on ambient temperature and adjacent elements, being made of plastic, PVC or other, even when classified as non flammable material.
In the table you find the main materials with self extinguish capability under normal circumstances:

PART	USE	MATERIAL	
DECK	for screw type terminal KX085 KX105 for snap in type terminal KX05 KX06	Phenolic Rubber bakelite coupled	No ignition non flammable No ignition non flammable
CAN	for Motor Start type KX13 ONLY	Polycarbonate (plastic)	Ignition not self extinguishing
SLEEVE	all KX085 KX105 KX05 KX06	PVC	No ignition
VENT PLUG	for screw type terminal KX085 KX105 only	Silicone	Ignition non flammable
ELECTROLYTE	all internal wound elements in each capacitor	Glycol based (*)	not self extinguishing non flammable (*1) flash point 110°C higher then rated 85° or 105° class

(*) NOTE FOR ELECTROLYTE
Sirectifier uses glycol based electrolyte through all ranges of products.
The impregnation process is computer controlled with supervisor agent software to assure the correct time and level of electrolyte needed by each single capacitor.
Different kinds of electrolyte blends are being used, especially designed for low voltage, medium voltage and high voltage range.
Each production batch is controlled in the internal laboratory to test the specifications of recipes.

<120V	120V - 400V	>400V
LOW VOLTAGE	MEDIUM VOLTAGE	HIGH VOLTAGE

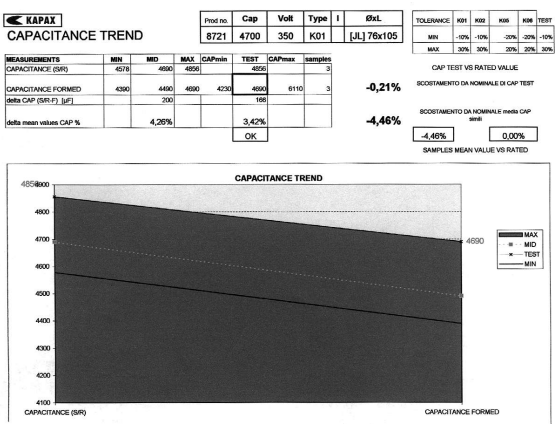
(*1) Flash point is defined as the lowest temperature at which a flame is ignited.
In our case, no flammable behaviour is possible as the rated class of capacitors are under that value.

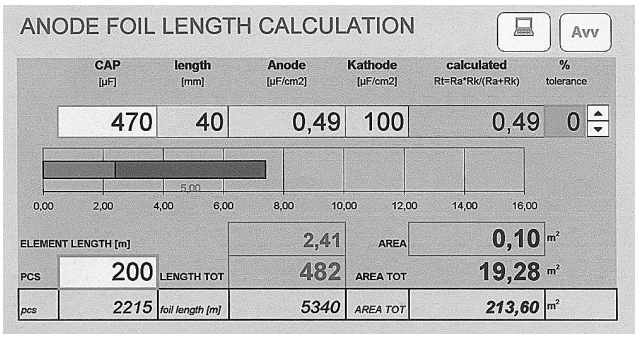
QUALITY

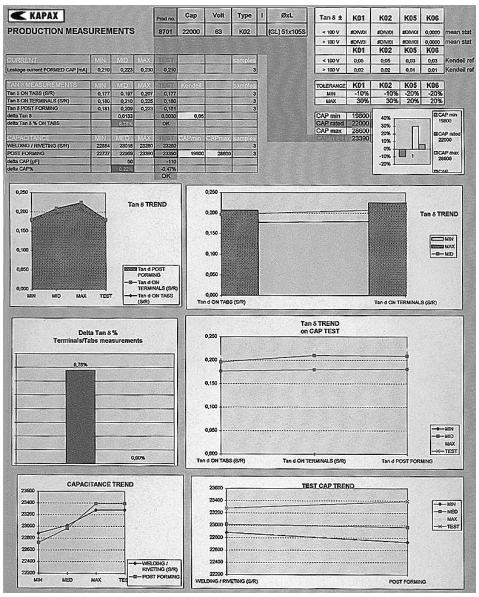
QUALITY MONITORING PROGRAM SCHEME

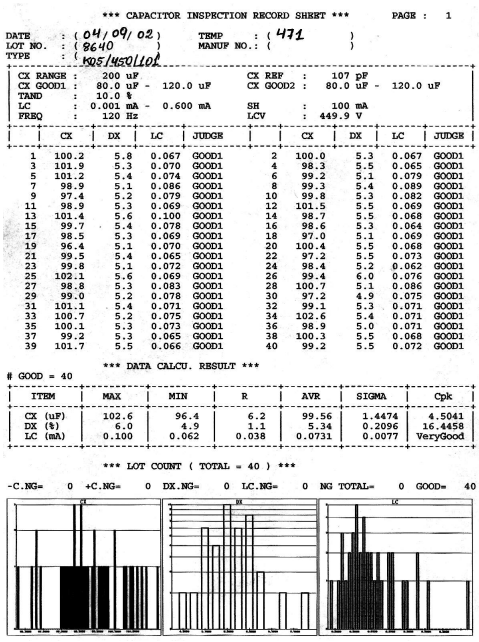
In **Sirectifier** a Q.M.P. is applied to the whole production process. A schematic description is available from the Manifacturer Control Flow (on back cover page) along with check points. The complete building cycle of an aluminium electrolytic capacitor consists in the single phases described previously in this catalogue (Winding, Impregnation, Welding, Riveting, Encapsulation, Ageing and Final inspection including marking and packing), we have a detailed production control sheet that goes on together with each batch produced. Every time the operators are requested to countersign the batch code and verify the appropriate parameters in order to accomplish a specific procedure. Good quality of products is achieved by measurements done at relevant moments of each phase. Further on some reports are generated and saved in records for future use. A computer based up-to-date production software has been introduced for trackability of the main critical components. Each batch is identified from the beginning to the end, that is from the initial raw material to the last capacitors box.

Sample sheets taken from actual on going program:









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                *** CAPACITOR INSPECTION RECORD SHEET ***        PAGE :  1

DATE     : ( 04/09/02 )          TEMP     : ( 471      )
LOT NO.  : ( 8640     )          MANUF NO.: (          )
TYPE     : ( K05/450/102 )

 CX RANGE :   200 uF                          CX REF  :   107 pF
 CX GOOD1 :    80.0 uF -  120.0 uF            CX GOOD2 :   80.0 uF -  120.0 uF
 TAND     :    10.0 %
 LC       :   0.001 mA -  0.600 mA           SH       :   100 mA
 FREQ     :   120 Hz                         LCV      :   449.9 V

|  |  CX  |  DX  |  LC  | JUDGE |  |  CX  |  DX  |  LC  | JUDGE |
|--|------|------|------|-------|--|------|------|------|-------|
|  1 | 100.2 |  5.8 | 0.067 | GOOD1 |  2 | 100.0 |  5.3 | 0.067 | GOOD1 |
|  3 | 101.9 |  5.3 | 0.070 | GOOD1 |  4 |  98.3 |  5.5 | 0.065 | GOOD1 |
|  5 | 101.2 |  5.4 | 0.074 | GOOD1 |  6 |  99.2 |  5.1 | 0.079 | GOOD1 |
|  7 |  98.9 |  5.1 | 0.086 | GOOD1 |  8 |  99.3 |  5.4 | 0.089 | GOOD1 |
|  9 |  97.4 |  5.2 | 0.079 | GOOD1 | 10 |  99.8 |  5.3 | 0.082 | GOOD1 |
| 11 |  98.9 |  5.3 | 0.069 | GOOD1 | 12 | 101.5 |  5.5 | 0.069 | GOOD1 |
| 13 | 101.4 |  5.6 | 0.100 | GOOD1 | 14 |  98.7 |  5.5 | 0.068 | GOOD1 |
| 15 |  99.7 |  5.4 | 0.078 | GOOD1 | 16 |  98.6 |  5.3 | 0.064 | GOOD1 |
| 17 |  98.5 |  5.3 | 0.069 | GOOD1 | 18 |  97.0 |  5.1 | 0.069 | GOOD1 |
| 19 |  96.4 |  5.1 | 0.070 | GOOD1 | 20 | 100.4 |  5.5 | 0.068 | GOOD1 |
| 21 |  99.5 |  5.4 | 0.065 | GOOD1 | 22 |  97.2 |  5.5 | 0.073 | GOOD1 |
| 23 |  99.8 |  5.1 | 0.072 | GOOD1 | 24 |  98.4 |  5.2 | 0.062 | GOOD1 |
| 25 | 102.1 |  5.6 | 0.069 | GOOD1 | 26 |  99.4 |  6.0 | 0.076 | GOOD1 |
| 27 |  98.8 |  5.3 | 0.083 | GOOD1 | 28 | 100.7 |  5.1 | 0.086 | GOOD1 |
| 29 |  99.0 |  5.2 | 0.078 | GOOD1 | 30 |  97.2 |  4.9 | 0.075 | GOOD1 |
| 31 | 101.1 |  5.4 | 0.071 | GOOD1 | 32 |  99.1 |  5.3 | 0.071 | GOOD1 |
| 33 | 100.7 |  5.2 | 0.075 | GOOD1 | 34 | 102.6 |  5.4 | 0.071 | GOOD1 |
| 35 | 100.1 |  5.3 | 0.073 | GOOD1 | 36 |  98.9 |  5.0 | 0.071 | GOOD1 |
| 37 |  99.2 |  5.3 | 0.065 | GOOD1 | 38 | 100.3 |  5.5 | 0.068 | GOOD1 |
| 39 | 101.7 |  5.5 | 0.066 | GOOD1 | 40 |  99.2 |  5.5 | 0.072 | GOOD1 |

                *** DATA CALCU. RESULT ***
# GOOD = 40

|  ITEM  |  MAX  |  MIN  |  R  |  AVR  |  SIGMA  |  Cpk  |
|--------|-------|-------|-----|-------|---------|-------|
| CX (uF) | 102.6 | 96.4 | 6.2 | 99.56 | 1.4474 | 4.5041 |
| DX (%) | 6.0 | 4.9 | 1.1 | 5.34 | 0.2096 | 16.4458 |
| LC (mA) | 0.100 | 0.062 | 0.038 | 0.0731 | 0.0077 | VeryGood |

                *** LOT COUNT ( TOTAL = 40 ) ***
-C.NG=  0  +C.NG=  0  DX.NG=  0  LC.NG=  0  NG TOTAL=  0  GOOD=  40
```

QUALITY AND LIFE TIME

Technical data specifications here given are computed from a large number of components, so that diagrams for useful life and failure rates characteristics have been realized on average production status basis, with manufacturing batches made up of identical items. Qualified tests applied to capacitors certify compliance to technical parameters as indicated, though the specification itself does not constitute a guarantee in a legal sense.

Each capacitor produced is free from defects in materials, design and workmanship. **Sirectifier** shall not be liable for any defect arising from accidents, negligent use, improper operations or defective storage or any further consequences brought out by a component failure. Customers may claim for the only replacement of goods when proved to be defective.

For a more detailed explanation, see further on this catalogue, before back cover, in “General warning”.

KX085 TYPE

- Surge-proof capacitor in aluminium can with insulation sleeve.
- Poles brought out to heavy duty screw terminals.
- To be mounted with ring clips or with threaded stud.

Very high CV for unit volume with low ESR.
High ripple current.
Excellent electricals data in small dimensions case size.

APPLICATIONS

Designed for professional power electronics. Switch mode power supplies, converters, filtering devices.

SPECIFICATIONS

GENERAL CHARACTERISTICS

Temperature Range	Operating: -40°C +85°C [Environmental classification 40/85/56 IEC-68] Storage : Preferably below +25°C, not exceeding +40°C
Rated Voltage Range (V_r)	from 16V to 500V DC
Surge Voltage (V_p)	$V_p = 1.15\ V_r$ ($V_r \le 250$V DC) $V_p = 1.10\ V_r$ ($V_r > 250$V DC)
Rated Capacitance Range	from 220 µF to 1,500,000 µF
Capacitance Tolerance	±20% at 100 Hz, 20°C [M class IEC-62] on request: -10% +30% at 100 Hz, 20°C [Q class IEC-62]
Leakage Current (I_L) *(mA, 5 min, 20°C)*	max $I_L = 0.006\ C_r\ V_r + 4$ µA Sirectifier product limit : $I_L = 0.003\ C_r\ V_r$ At 85°C max $I_L = 0.04\ C_r\ V_r$ µA
Ripple current (I_r)	Refer to table at 85°C and 100Hz. For different temperature and frequency multiplier must be used as follows:

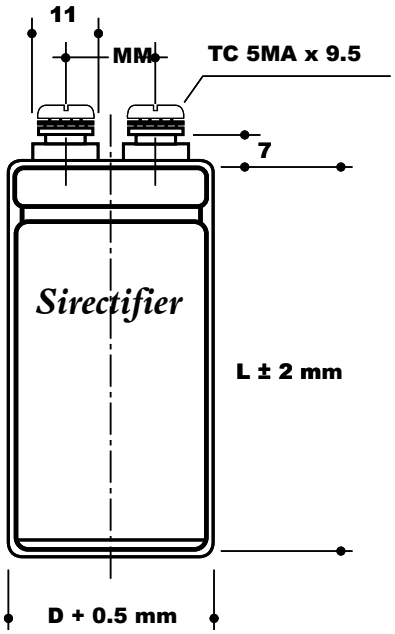
FREQUENCY	50Hz	100Hz	500 Hz	1000Hz	>10kHz
MULTIPLIER	0.8	1.0	1.2	1.3	1.5

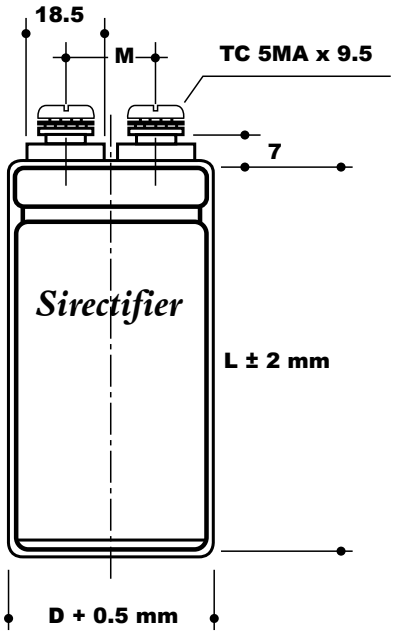
AMBIENT TEMP.	35°C	45°C	55°C	65°C	75°C	85°C
MULTIPLIER	2.2	2.1	1.8	1.6	1.4	1.0
Maximum internal temperature	98°C					

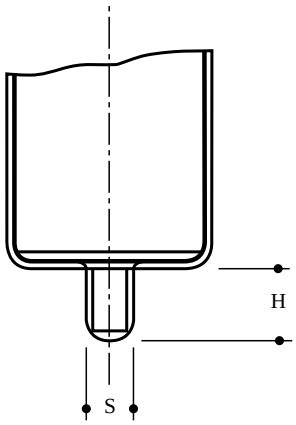
Due to the current load capability of the contact elements, the following limits must not be exceeded:

CAPACITOR DIAMETER	35mm	51mm	63mm	76mm	90mm
Maximum current	20A	30A	40A	50A	70A

Insulation Resistance	At 100V DC for 1 min is >100 MΩ across insulating sleeve and terminals.		
Vibration Resistance	Frequency range: 10 Hz to 55 Hz, amplitude 0.75 mm Capacitor length ≤ 143 : max acceleration 10g for 3x2 h Capacitor length > 143 : max acceleration 5g for 3x0.5 h		
Life test	After 2,000 hours application of rated voltage at 85°C capacitors meet characteristics aside	Cap change tan δ Leakage current (I_L) Impedance (Z)	≤ 20% ≤ 200% < initial limit ≤ 200%
Shelf life	After leaving capacitors under no load for 500 hours at 85°C, when restored at 20°C meet specifications aside	Cap change tan δ Leakage current (I_L)	≤ ±15% ≤ 150% < initial limit
Useful life	> 200,000 h at 40°C > 10,000 h at 85°C		
Failure percentage *Failure rate*	≤ 1% (during useful life) ≤ 40 fit ($40\ 10^{-9}$/h ($V_r \le 160$V DC) ≤ 70 fit ($70\ 10^{-9}$/h ($V_r > 160$V DC)		
Self inductance	Approx. 20 nH		
Reference standards	CECC 30.300 IEC 60384-4 LONG LIFE GRADE		



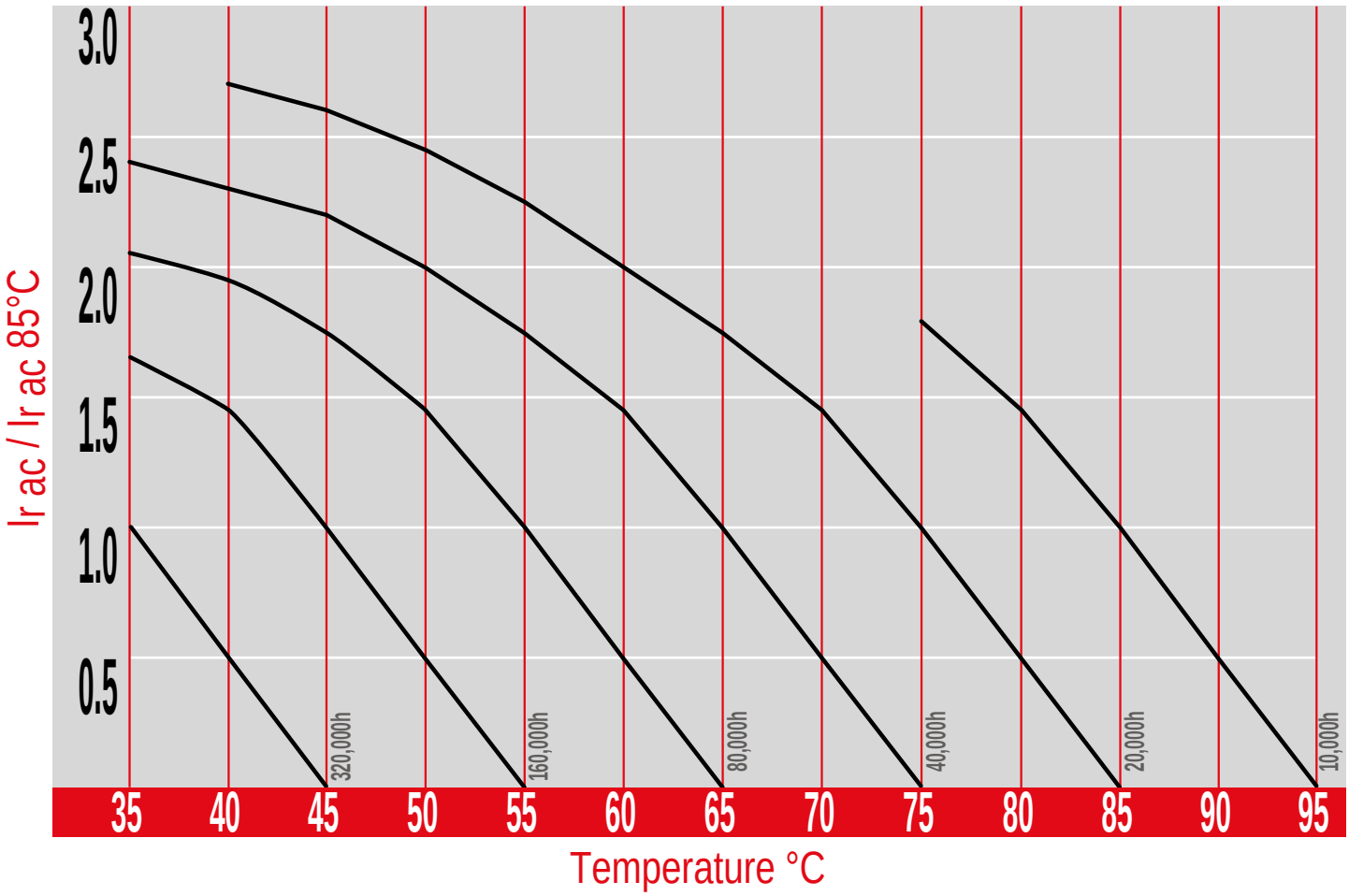




DIMENSIONS (mm)

D	L	M	S	H
35	51	12.7	M 8	12
35	60	12.7	M 8	12
35	79	12.7	M 8	12
35	105	12.7	M 8	12
51	60	22.2	M12	16
51	79	22.2	M12	16
51	105	22.2	M12	16
63	105	28.6	M12	16
76	105	31.8	M12	16
76	143	31.8	M12	16
76	222	31.8	M12	16
90	222	31.8	M12	16

USEFUL LIFE KX085



Sirectifier®
Sirectifier Electronics Technology Corporation

KX085 TYPE STANDARD RATINGS

RATED VOLTAGE V DC	CAPACITANCE μF	Ø x L mm	Tan δ MAX 100 Hz 20°C	ESR TYP m Ω 100 Hz 20°C	Z TYP m ΩA 10 kHz 20°C	Ir a.c. max 100 Hz 85°C	PART NUMBER stud and insert style excluded
16V	22000	35x60	0.35	18	16	6.6	KX085016223__M0EH
	33000	35x60	0.40	15	13	9.2	KX085016333__M0EH
	33000	35x79	0.40	15	13	10.2	KX085016333__M0EJ
	47000	35x79	0.55	13	12	10.8	KX085016473__M0EJ
	47000	51x79	0.55	13	12	12.5	KX085016473__M0GJ
	68000	51x79	0.60	12	11	15.7	KX085016683__M0GJ
	100000	51x79	0.80	10	11	16.5	KX085016104__M0GJ
	100000	51x105	0.80	10	10	18.7	KX085016104__M0GL
	150000	51x105	1.10	10	9	19.5	KX085016154__M0GL
	150000	63x105	1.10	10	9	21.5	KX085016154__M0HL
	220000	63x105	1.50	8	8	22.4	KX085016224__M0HL
	330000	63x105	1.90	8	8	23.3	KX085016334__M0HL
	330000	76x105	1.90	8	8	25.0	KX085016334__M0JL
	470000	76x105	1.90	5	5	28.5	KX085016474__M0JL
	470000	76x143	1.90	5	5	32.0	KX085016474__M0JP
	680000	76x143	2.50	4	4	32.5	KX085016684__M0JP
	1000000	76x143	2.50	3	3	34.5	KX085016105__M0JP
	1500000	90x222	3.00	3	3	48.7	KX085016155__M0LS
25V	10000	35x60	0.25	27	21	5.9	KX085025103__M0EH
	15000	35x60	0.28	16	12	9.3	KX085025153__M0EH
	22000	35x79	0.35	18	16	11.8	KX085025223__M0EJ
	33000	35x79	0.40	15	14	12.1	KX085025333__M0EJ
	33000	51x79	0.40	15	14	13.3	KX085025333__M0GJ
	47000	51x79	0.50	12	10	15.7	KX085025473__M0GJ
	68000	51x79	0.60	10	9	16.4	KX085025683__M0GJ
	68000	51x105	0.60	10	9	18.7	KX085025683__M0GL
	100000	63x105	0.70	10	9	21.5	KX085025104__M0HL
	150000	63x105	1.00	9	9	22.0	KX085025154__M0HL
	150000	76x105	1.00	9	9	23.5	KX085025154__M0JL
	220000	76x105	1.50	9	9	24.2	KX085025224__M0JL
	220000	76x143	1.50	9	9	28.5	KX085025224__M0JP
	330000	76x143	2.00	6	6	30.5	KX085025334__M0JP
	470000	76x222	2.00	5	5	35.6	KX085025474__M0JS
40V	10000	35x60	0.20	18	12	6.5	KX085040103__M0EH
	15000	35x60	0.25	13	10	7.4	KX085040153__M0EH
	15000	35x79	0.25	13	10	8.6	KX085040153__M0EJ
	22000	35x79	0.30	16	14	8.9	KX085040223__M0EJ
	22000	51x79	0.30	16	14	10.4	KX085040223__M0GJ
	33000	51x79	0.35	15	13	13.5	KX085040333__M0GJ
	47000	51x79	0.40	10	9	14.2	KX085040473__M0GJ
	47000	51x105	0.40	10	9	15.1	KX085040473__M0GL
	47000	63x105	0.40	10	9	17.6	KX085040473__M0HL
	68000	51x105	0.50	10	8	18.2	KX085040683__M0GL
	68000	63x105	0.50	10	8	19.5	KX085040683__M0HL
	100000	63x105	0.60	9	8	21.2	KX085040104__M0HL
	150000	76x105	0.90	9	8	25.7	KX085040154__M0JL
	220000	76x143	1.00	6	6	31.5	KX085040224__M0JP
	330000	76x222	1.20	5	5	38.5	KX085040334__M0JS

KX085 TYPE STANDARD RATINGS

RATED VOLTAGE V DC	CAPACITANCE µF	Ø x L mm	Tan δ MAX 100 Hz 20°C	ESR TYP m Ω 100 Hz 20°C	Z TYP m ΩA 10 kHz 20°C	Ir a.c. max 100 Hz 85°C	PART NUMBER stud and insert style excluded
50V	4700	35x60	0.20	33	30	5.6	KX085050472__M0EH
	6800	35x60	0.20	25	24	7.0	KX085050682__M0EH
	10000	35x60	0.20	21	20	10.0	KX085050103__M0EH
	15000	35x79	0.25	17	15	11.3	KX085050153__M0EJ
	22000	51x79	0.30	16	13	13.1	KX085050223__M0GJ
	33000	51x105	0.35	15	13	16.0	KX085050333__M0GL
	33000	63x105	0.35	15	13	17.5	KX085050333__M0HL
	47000	51x105	0.40	12	10	16.2	KX085050473__M0GL
	47000	63x105	0.40	12	10	18.3	KX085050473__M0HL
	68000	51x105	0.60	12	9	18.0	KX085050683__M0GL
	68000	76x105	0.60	12	9	22.1	KX085050683__M0JL
	100000	76x105	0.90	8	8	23.8	KX085050104__M0JL
	100000	76x143	0.90	8	8	25.8	KX085050104__M0JP
	150000	76x143	1.00	6	6	31.5	KX085050154__M0JP
63V	4700	35x60	0.15	29	25	6.2	KX085063472__M0EH
	6800	35x60	0.18	21	20	7.0	KX085063682__M0EH
	6800	35x79	0.18	21	20	8.2	KX085063682__M0EJ
	10000	35x79	0.20	21	20	8.7	KX085063103__M0EJ
	10000	51x79	0.20	18	16	10.1	KX085063103__M0GJ
	15000	51x79	0.25	15	13	11.1	KX085063153__M0GJ
	22000	51x79	0.30	13	11	12.4	KX085063223__M0GJ
	22000	51x105	0.30	13	11	14.6	KX085063223__M0GL
	33000	51x105	0.35	11	10	15.6	KX085063333__M0GL
	33000	63x105	0.35	11	10	17.9	KX085063333__M0HL
	47000	51x105	0.45	10	9	15.8	KX085063473__M0GL
	47000	63x105	0.45	11	10	18.8	KX085063473__M0HL
	68000	76x105	0.70	11	10	25.7	KX085063683__M0JL
	100000	76x105	0.70	8	8	31.5	KX085063104__M0JL
	100000	76x143	0.70	8	8	34.5	KX085063104__M0JP
	150000	76x143	0.95	6	6	36.1	KX085063154__M0JP
75V	4700	35x60	0.15	29	25	5.4	KX085075472__M0EH
	6800	35x79	0.18	20	20	8.5	KX085075682__M0EJ
	10000	51x79	0.20	18	16	11.0	KX085075103__M0GJ
	15000	51x105	0.25	15	13	12.7	KX085075153__M0GL
	22000	51x105	0.30	12	11	15.2	KX085075223__M0GL
	22000	63x105	0.30	12	11	15.2	KX085075223__M0HL
	33000	63x105	0.35	11	10	18.5	KX085075333__M0HL
	33000	76x105	0.35	11	10	18.5	KX085075333__M0JL
	47000	76x105	0.45	10	10	22.1	KX085075473__M0JL
	47000	76x143	0.45	10	10	22.1	KX085075473__M0JP
	68000	76x143	0.80	10	10	26.0	KX085075683__M0JP
	100000	76x143	0.95	8	8	34.9	KX085075104__M0JP

KX085 TYPE STANDARD RATINGS

RATED VOLTAGE V DC	CAPACITANCE µF	Ø x L mm	Tan δ MAX 100 Hz 20°C	ESR TYP m Ω 100 Hz 20°C	Z TYP m Ω 10 kHz 20°C	Ir a.c. A max 100 Hz 85°C	PART NUMBER stud and insert style excluded
100V	1500	35x60	0.15	84	65	4.0	KX085100152__M0EH
	2200	35x60	0.15	57	47	5.0	KX085100222__M0EH
	3300	35x60	0.15	48	39	5.3	KX085100332__M0EH
	3300	35x79	0.15	48	39	6.8	KX085100332__M0EJ
	4700	35x79	0.15	30	26	7.5	KX085100472__M0EJ
	4700	51x79	0.15	30	26	10.0	KX085100472__M0GJ
	6800	51x79	0.20	23	20	11.1	KX085100682__M0GJ
	10000	51x79	0.20	16	14	11.9	KX085100103__M0GJ
	10000	51x105	0.20	16	14	13.9	KX085100103__M0GL
	10000	63x105	0.20	16	14	14.5	KX085100103__M0HL
	15000	51x105	0.25	13	12	14.8	KX085100153__M0GL
	15000	63x105	0.25	13	12	17.5	KX085100153__M0HL
	22000	63x105	0.25	12	12	18.2	KX085100223__M0HL
	33000	76x105	0.25	10	10	23.1	KX085100333__M0JL
	47000	76x143	0.30	10	9	30.2	KX085100473__M0JP
	68000	76x222	0.30	8	8	36.5	KX085100683__M0JS
	100000	90x222	0.50	6	5	39.5	KX085100104__M0LS
160V	1000	35x79	0.10	98	90	4.0	KX085160102__M0EJ
	1500	51x79	0.10	62	71	5.3	KX085160152__M0GJ
	2200	51x79	0.10	50	43	7.0	KX085160222__M0GJ
	3300	51x105	0.12	35	30	8.6	KX085160332__M0GL
	4700	51x105	0.12	25	25	10.9	KX085160472__M0GL
	4700	63x105	0.12	25	25	10.9	KX085160472__M0HL
	6800	63x105	0.12	20	22	13.0	KX085160682__M0HL
	10000	76x105	0.15	13	12	17.4	KX085160103__M0JL
	10000	76x143	0.15	13	12	17.4	KX085160103__M0JP
	15000	76x143	0.15	13	12	20.9	KX085160153__M0JP
	22000	76x143	0.20	10	10	26.4	KX085160223__M0JP
	33000	76x222	0.20	8	8	34.1	KX085160333__M0JS
200V	680	35X60	0.10	124	119	3.4	KX085200681__M0EH
	1000	51x79	0.10	86	88	4.2	KX085200102__M0GJ
	1500	51x79	0.10	60	63	5.8	KX085200152__M0GJ
	2200	51x105	0.10	47	44	7.2	KX085200222__M0GL
	3300	51x105	0.12	35	33	9.0	KX085200332__M0GL
	3300	63x105	0.12	35	33	9.0	KX085200332__M0HL
	4700	51x105	0.12	30	28	11.1	KX085200472__M0GL
	4700	63x105	0.12	30	28	11.1	KX085200472__M0HL
	6800	63x105	0.12	25	20	13.9	KX085200682__M0HL
	6800	76x105	0.12	25	20	13.9	KX085200682__M0JL
	10000	76x105	0.15	13	12	15.8	KX085200103__M0JL
	10000	76x143	0.15	13	12	18.6	KX085200103__M0JP
	15000	76x143	0.18	12	12	21.4	KX085200153__M0JP
	22000	76x143	0.18	10	10	28.9	KX085200223__M0JP
	33000	76x222	0.22	8	8	36.1	KX085200333__M0JS

KX085 TYPE STANDARD RATINGS

RATED VOLTAGE V DC	CAPACITANCE µF	Ø x L mm	Tan δ MAX 100 Hz 20°C	ESR TYP m Ω 100 Hz 20°C	Z TYP m Ω 10 kHz 20°C	Ir a.c. A max 100 Hz 85°C	PART NUMBER stud and insert style excluded
250V	470	35x60	0.10	211	200	2.8	KX085250471__M0EH
	680	35x79	0.10	157	150	3.5	KX085250681__M0EJ
	1000	51x79	0.10	110	95	4.6	KX085500102__M0GJ
	1500	51x105	0.10	74	65	6.1	KX085250152__M0GL
	2200	51x105	0.10	40	36	7.5	KX085250222__M0GL
	3300	51x105	0.12	35	29	9.8	KX085250332__M0GL
	3300	63x105	0.12	35	29	9.8	KX085250332__M0HL
	4700	63x105	0.12	28	25	11.8	KX085250472__M0HL
	4700	76x105	0.12	28	25	13.2	KX085250472__M0JL
	6800	76x105	0.12	25	21	14.1	KX085250682__M0JL
	10000	76x143	0.15	20	19	19.7	KX085250103__M0JP
	15000	76x143	0.15	18	18	21.9	KX085250153__M0JP
	22000	76x222	0.20	12	11	34.2	KX085250223__M0JS
350V	470	35X60	0.10	170	136	3.3	KX085350471__M0EH
	680	35X79	0.10	108	95	4.0	KX085350681__M0EJ
	1000	51x79	0.10	79	62	5.0	KX085350102__M0GJ
	1000	51x105	0.10	79	62	5.5	KX085350102__M0GL
	1500	51x105	0.10	60	52	7.4	KX085350152__M0GL
	2200	51x105	0.10	44	40	9.0	KX085350222__M0GL
	2200	63x105	0.10	44	40	9.5	KX085350222__M0HL
	3300	63x105	0.12	35	30	10.1	KX085350332__M0HL
	3300	76x105	0.12	35	30	12.8	KX085350332__M0JL
	4700	76x105	0.12	32	25	14.5	KX085350472__M0JL
	4700	76x143	0.12	32	25	17.5	KX085350472__M0JP
	5600	76x143	0.15	25	23	18.5	KX085350562__M0JP
	6800	76x143	0.15	23	21	19.2	KX085350682__M0JP
	10000	76x143	0.15	18	18	23.0	KX085350103__M0JP
	10000	76x222	0.15	16	15	26.6	KX085350103__M0JS
	15000	76x222	0.20	12	12	31.7	KX085350153__M0JS
	22000	90x222	0.25	8	8	35.4	KX085350223__M0LS

KX085 TYPE STANDARD RATINGS

RATED VOLTAGE V DC	CAPACITANCE µF	Ø x L mm	Tan δ MAX 100 Hz 20°C	ESR TYP m Ω 100 Hz 20°C	Z TYP m Ω 10 kHz 20°C	Ir a.c. A max 100 Hz 85°C	PART NUMBER stud and insert style excluded
400V	220	35x60	0.10	455	375	2.1	KX085400221__M0EH
	330	35x60	0.10	290	273	2.8	KX085400331__M0EH
	470	35x60	0.10	160	149	3.0	KX085400471__M0EH
	470	35x79	0.10	165	155	3.5	KX085400471__M0EJ
	680	51x79	0.10	120	115	4.7	KX085400681__M0GJ
	680	51x105	0.10	124	120	5.1	KX085400681__M0GL
	1000	51x79	0.10	105	95	5.8	KX085400102__M0GJ
	1000	51x105	0.10	110	85	6.3	KX085400102__M0GL
	1500	51x105	0.10	65	55	7.0	KX085400152__M0GL
	1500	63x105	0.10	65	55	7.9	KX085400152__M0HL
	2200	51x105	0.10	50	47	8.3	KX085400222__M0GL
	2200	63x105	0.10	50	47	9.0	KX085400222__M0HL
	2200	76x105	0.10	50	47	10.7	KX085400222__M0JL
	3300	63x105	0.12	35	30	11.0	KX085400332__M0HL
	3300	76x105	0.12	35	30	13.1	KX085400332__M0JL
	3300	76x143	0.12	35	30	14.2	KX085400332__M0JP
	4700	76x105	0.15	30	29	14.9	KX085400472__M0JL
	4700	76x143	0.15	30	29	18.8	KX085400472__M0JP
	6800	76x143	0.15	23	22	19.5	KX085400682__M0JP
	10000	76x222	0.15	20	19	26.0	KX085400103__M0JS
	15000	90x222	0.20	15	12	33.5	KX085400153__M0LS
450V	220	35X60	0.10	360	300	2.0	KX085450221__M0EH
	330	35X60	0.10	240	210	2.8	KX085450331__M0EH
	470	51x79	0.10	200	179	4.0	KX085450471__M0GJ
	680	51X79	0.10	140	128	4.4	KX085450681__M0GJ
	680	51x105	0.10	140	128	5.0	KX085450681__M0GL
	1000	51x79	0.10	100	88	4.8	KX085450102__M0GJ
	1000	51x105	0.10	100	88	6.4	KX085450102__M0GL
	1500	51X105	0.10	67	55	7.1	KX085450152__M0GL
	1500	63x105	0.10	67	55	8.0	KX085450152__M0HL
	2200	63x105	0.10	60	55	9.0	KX085450222__M0HL
	2200	76x105	0.10	60	47	11.2	KX085450222__M0JL
	2200	76x143	0.10	60	47	12.5	KX085450222__M0JP
	3300	76x105	0.12	35	30	11.2	KX085450332__M0JL
	3300	76x143	0.12	35	30	12.9	KX085450332__M0JP
	4700	76x143	0.15	32	30	15.0	KX085450472__M0JP
	6800	76x143	0.15	25	22	19.2	KX085450682__M0JP
	10000	76x222	0.20	20	19	23.1	KX085450103__M0JS
	12000	76x222	0.25	15	12	29.8	KX085450123__M0JS
500V	1000	51x105	0.15	159	145	4.0	KX085500102__M0GL
	1500	63x105	0.15	122	115	5.2	KX085500152__M0HL
	2200	76x105	0.15	90	85	7.4	KX085500222__M0JL
	2200	76x143	0.15	90	85	8.2	KX085500222__M0JP
	3300	76x143	0.20	60	58	10.3	KX085500332__M0JP
	4700	76x143	0.20	40	37	11.6	KX085500472__M0JP

KX105 TYPE

- Surge-proof electrolytic capacitor in aluminium can with insulation sleeve.
- Poles brought out to heavy duty screw terminals.
- To be mounted with ring clips or with threaded stud.

Very high CV for unit volume with low ESR and impedance. High ripple current capability. Extended temperature range. High level of realiability with outstanding high frequency characteristics.

APPLICATIONS

High professional power supplies. Switch power supplies, power converters, filtering devices.

SPECIFICATIONS

GENERAL CHARACTERISTICS

Temperature Range	Operating: -40°C +105°C [Environmental classification 40/105/56 IEC-68] Storage : Preferably below +25°C, not exceeding +40°C	
Rated Voltage Range (V_r)	from 16V to 450V DC	
Surge Voltage (V_p)	$V_p = 1.15\ V_r$ ($V_r \leq 250$V DC) $V_p = 1.10\ V_r$ ($V_r > 250$V DC)	
Rated Capacitance Range	from 100 µF to 470,000 µF	
Capacitance Tolerance	±20% at 100 Hz, 20°C [M class IEC-62] on request: -10% +30% at 100 Hz, 20°C [Q class IEC-62]	
Leakage Current (I_L) *(mA, 5 min, 20°C)*	max $I_L = 0.003\ C_r\ V_r + 4$ µA At 85°C max $I_L = 0.02\ C_r\ V_r$ µA	
Ripple current (I_r)	Refer to table at 105°C and 100Hz. For different temperature and frequency multiplier must be used as follows:	

FREQUENCY	50Hz	100Hz	500 Hz	1000Hz	>10kHz
MULTIPLIER	0.8	1.0	1.2	1.3	1.5

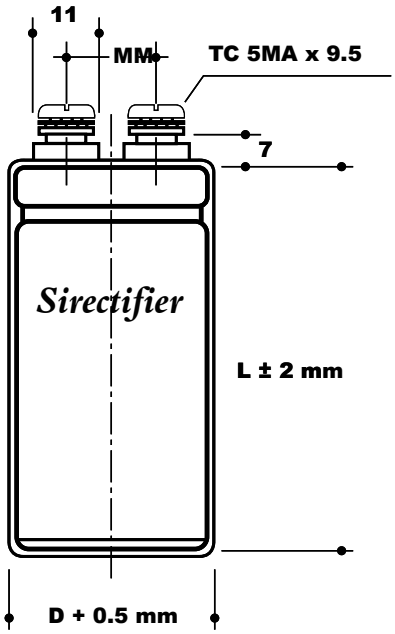
AMBIENT TEMP	35°C	45°C	55°C	65°C	75°C	85°C	95°C	105°C
MULTIPLIER	3.0	2.80	2.60	2.40	2.20	1.80	1.5	1

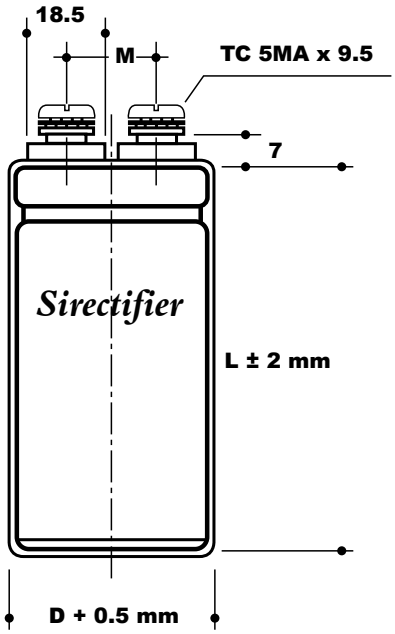
Maximum internal temperature 108°C

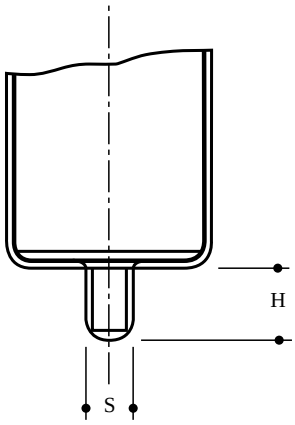
Due to the current load capability of the contact elements, the following limits must not be exceeded:

CAPACITOR DIAMETER	35mm	51mm	63mm	76mm	90mm
Maximum current	20A	30A	40A	50A	70A

Insulation Resistance	At 100V DC for 1 min is >100 MΩ across insulating sleeve and terminals.		
Vibration Resistance	Frequency range: 10 Hz to 55 Hz, amplitude 0.75 mm Capacitor length ≤ 143 : max acceleration 10g for 3x2 h Capacitor length > 143 : max acceleration 5g for 3x0.5 h		
Life test	After 2,000 hours application of rated voltage at 105°C capacitors meet characteristics aside	Cap change tan δ Leakage current (I_L) Impedance (Z)	≤ 20% ≤ 200% < initial limit ≤ 200%
Shelf life	After leaving capacitors under no load for 500 hours at 85°C, when restored at 20°C meet specifications aside	Cap change tan δ Leakage current (I_L)	≤ ±15% ≤ 150% < initial limit
Useful life	250,000 h at 40°C 15,000 h at 85°C 5,000 h at 105°C		
Failure percentage *Failure rate*	≤ 1% (during useful life) ≤ 40 fit (40 10^{-9}/h		
Self inductance	Approx. 20 nH		
Reference standards	CECC 30.300 IEC 60384-4 LONG LIFE GRADE		



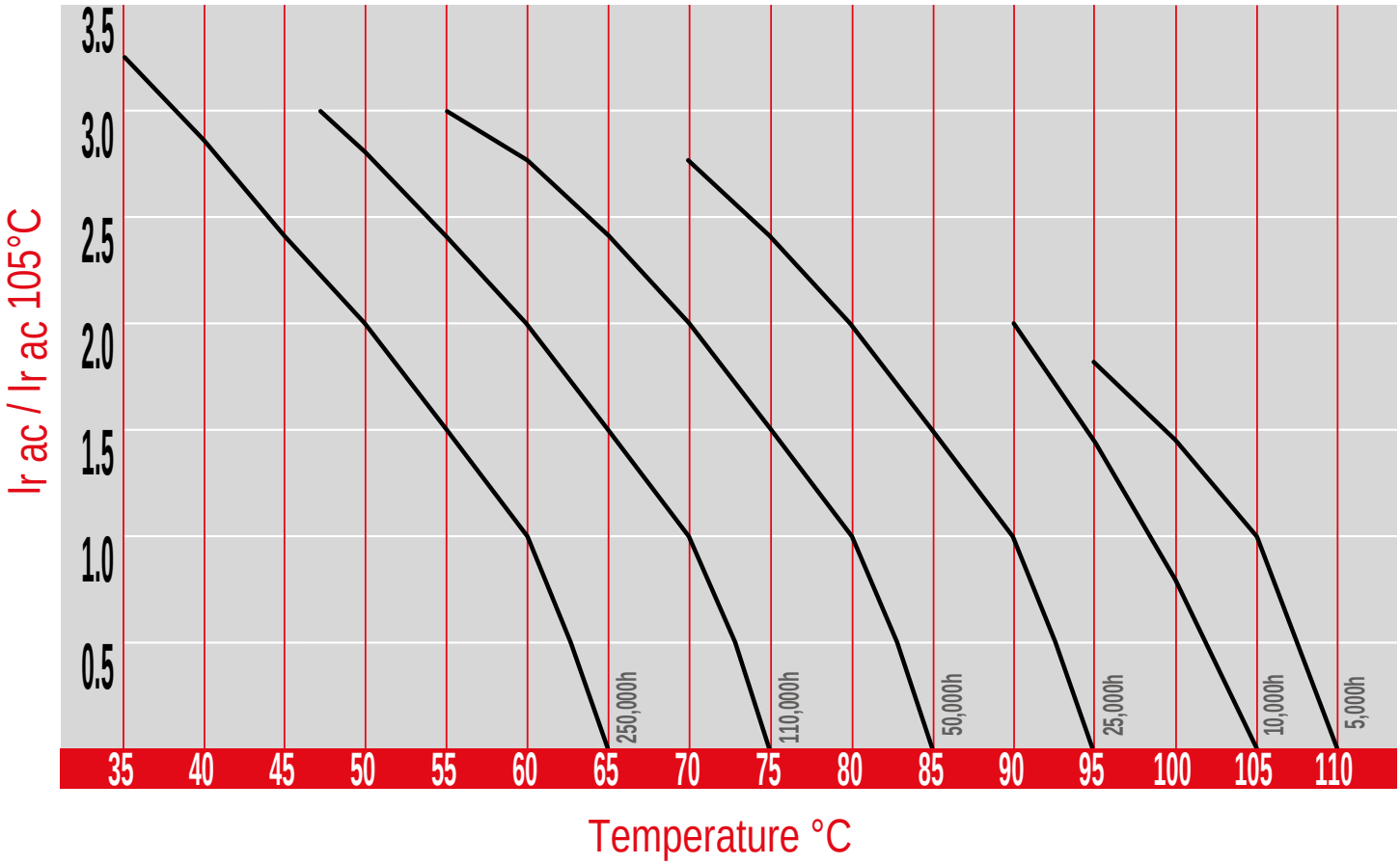




DIMENSIONS (mm)

D	L	M	S	H
35	51	12.7	M 8	12
35	60	12.7	M 8	12
35	79	12.7	M 8	12
35	105	12.7	M 8	12
51	60	22.2	M12	16
51	79	22.2	M12	16
51	105	22.2	M12	16
63	105	28.6	M12	16
76	105	31.8	M12	16
76	143	31.8	M12	16
76	222	31.8	M12	16
90	222	31.8	M12	16

USEFUL LIFE KX105



KX105 TYPE STANDARD RATINGS

RATED VOLTAGE V DC	CAPACITANCE µF	Ø x L mm	Tan δ MAX 100 Hz 20°C	ESR TYP m Ω 100 Hz 20°C	Z TYP m Ω 10 kHz 20°C	Ir a.c. A max 100 Hz 105°C	PART NUMBER stud and insert style excluded
16V	10000	35x60	0.25	25	24	3.3	KX105016103__M0EH
	15000	35x60	0.30	16	16	3.5	KX105016153__M0EH
	22000	35x60	0.35	12	12	4.4	KX105016223__M0EH
	33000	35x60	0.40	12	12	4.6	KX105016333__M0EH
	47000	35x79	0.55	9	10	7.5	KX105016473__M0EJ
	68000	51x79	0.60	8	8	11.9	KX105016683__M0GJ
	100000	51x105	0.80	8	8	12.3	KX105016104__M0GL
	150000	63x105	1.10	7	7	15.4	KX105016154__M0HL
	220000	76x105	1.50	7	7	18.8	KX105016224__M0JL
	330000	76x105	1.90	7	7	19.7	KX105016334__M0JL
	470000	76x143	2.00	6	6	22.5	KX105016474__M0JP
25V	10000	35x60	0.20	23	18	3.8	KX105025103__M0EH
	15000	35x60	0.25	16	12	4.8	KX105025153__M0EH
	22000	35x60	0.30	12	12	7.0	KX105025223__M0EH
	33000	51x79	0.35	10	10	8.9	KX105025333__M0GJ
	47000	51x79	0.40	9	9	11.6	KX105025473__M0GJ
	68000	51x105	0.50	8	8	13.0	KX105025683__M0GL
	100000	63x105	0.60	8	8	15.8	KX105025104__M0HL
	150000	76x105	0.90	7	7	18.3	KX105025154__M0JL
	220000	76x143	1.30	7	7	21.6	KX105025224__M0JP
	330000	76x143	2.00	7	7	23.8	KX105025334__M0JP
40V	4700	35x60	0.20	31	29	3.3	KX105040472__M0EH
	6800	35x60	0.20	23	20	3.9	KX105040682__M0EH
	10000	35x79	0.20	16	12	4.8	KX105040103__M0EJ
	15000	35x79	0.20	12	10	5.4	KX105040153__M0EJ
	22000	51x79	0.25	10	10	8.9	KX105040223__M0GJ
	33000	51x105	0.35	10	10	11.2	KX105040333__M0GL
	47000	51x105	0.45	9	9	13.8	KX105040473__M0GL
	47000	63x105	0.45	9	9	14.5	KX105040473__M0HL
	68000	63x105	0.60	7	7	15.0	KX105040683__M0HL
	68000	76x105	0.60	7	7	15.9	KX105040683__M0JL
	100000	76x105	0.90	7	7	19.1	KX105040104__M0JL
	100000	76x143	0.90	7	7	21.0	KX105040104__M0JP
	150000	76x143	1.30	7	7	25.9	KX105040154__M0JP

KX105 TYPE STANDARD RATINGS

RATED VOLTAGE V DC	CAPACITANCE µF	Ø x L mm	Tan δ MAX 100 Hz 20°C	ESR TYP m Ω 100 Hz 20°C	Z TYP m Ω 10 kHz 20°C	Ir a.c. A max 100 Hz 105°C	PART NUMBER stud and insert style excluded
63V	2200	35x60	0.15	72	60	2.5	KX105063222__M0EH
	3300	35x60	0.15	48	39	3.5	KX105063332__M0EH
	4700	35x60	0.15	33	28	4.2	KX105063472__M0EH
	6800	35x79	0.18	18	13	6.3	KX105063682__M0EJ
	10000	51x79	0.20	15	11	8.2	KX105063103__M0GJ
	15000	51x79	0.25	15	13	8.9	KX105063153__M0GJ
	15000	51x105	0.25	13	10	18.0	KX105063153__M0GL
	22000	51x105	0.30	11	10	11.8	KX105063223__M0GL
	22000	63x105	0.30	11	10	13.5	KX105063223__M0HL
	33000	63x105	0.35	11	10	14.8	KX105063333__M0HL
	33000	76x105	0.35	11	8	16.6	KX105063333__M0JL
	47000	76x105	0.45	9	8	17.7	KX105063473__M0JL
	47000	76x143	0.45	9	8	19.0	KX105063473__M0JP
	68000	76x105	0.45	8	8	20.1	KX105063683__M0JL
	68000	76x143	0.70	8	8	22.8	KX105063683__M0JP
	100000	76x143	0.70	8	8	24.1	KX105063104__M0JP
100V	1000	35x60	0.15	110	100	2.9	KX105100102__M0EH
	1500	35x60	0.15	80	73	3.2	KX105100152__M0EH
	2200	35x60	0.15	59	53	4.4	KX105100222__M0EH
	3300	35x79	0.15	33	31	5.8	KX105100332__M0EJ
	4700	51x79	0.15	25	22	7.2	KX105100472__M0GJ
	6800	51x105	0.15	19	17	8.9	KX105100682__M0GL
	10000	51x105	0.15	17	15	11.0	KX105100103__M0GL
	10000	63x105	0.15	17	15	12.5	KX105100103__M0HL
	15000	63x105	0.15	12	12	15.1	KX105100153__M0HL
	22000	76x105	0.18	10	9	16.5	KX105100223__M0JL
	33000	76x143	0.22	8	8	20.9	KX105100333__M0JP
160V	1000	35x79	0.11	105	90	3.3	KX105160102__M0EJ
	1500	51x79	0.11	65	60	4.1	KX105160152__M0GJ
	2200	51X105	0.11	46	43	4.8	KX105160222__M0GL
	3300	63x105	0.11	32	30	6.8	KX105160332__M0HL
	4700	63x105	0.11	27	25	8.5	KX105160472__M0HL
	6800	76x105	0.13	23	20	11.3	KX105160682__M0JL
	10000	76x143	0.15	17	16	14.9	KX105160103__M0JP
	15000	76x143	0.20	16	12	17.2	KX105160153__M0JP
	22000	76X222	0.20	11	10	19.0	KX105160223__M0JS
200V	680	35X60	0.11	133	98	2.5	KX105200681__M0EH
	1000	51x79	0.11	85	64	4.6	KX105200102__M0GJ
	1500	51x105	0.11	65	58	5.1	KX105200152__M0GL
	2200	51x105	0.11	60	53	6.1	KX105200222__M0GL
	3300	63x105	0.11	40	35	7.9	KX105200332__M0HL
	4700	63x105	0.11	30	28	8.7	KX105200472__M0HL
	6800	76X105	0.11	23	12	11.8	KX105200682__M0JL
	10000	76x143	0.15	19	12	16.0	KX105200103__M0JP
	15000	76x143	0.20	19	12	17.3	KX105200153__M0JP
	22000	76x222	0.20	11	10	18.9	KX105200223__M0JS

KX105 TYPE STANDARD RATINGS

RATED VOLTAGE V DC	CAPACITANCE µF	Ø x L mm	Tan δ MAX 100 Hz 20°C	ESR TYP m Ω 100 Hz 20°C	Z TYP m Ω 10 kHz 20°C	Ir a.c. A max 100 Hz 105°C	PART NUMBER stud and insert style excluded
250V	470	35x60	0.11	211	193	2.0	KX105250471__M0EH
	680	35x79	0.11	130	98	2.2	KX105250681__M0EJ
	1000	51x79	0.11	110	85	4.1	KX105250102__M0GJ
	1500	51x105	0.11	74	65	5.4	KX105250152__M0GL
	2200	51x105	0.11	51	48	6.8	KX105250222__M0GL
	3300	63x105	0.11	35	30	8.2	KX105250332__M0HL
	4700	76x105	0.11	26	24	11.9	KX105250472__M0JL
	6800	76x143	0.15	23	21	14.3	KX105250682__M0JP
	10000	76x143	0.20	20	19	16.0	KX105250103__M0JP
	15000	76x222	0.20	18	15	17.4	KX105250153__M0JS
350V	330	35x60	0.11	255	196	1.8	KX105350331__M0EH
	470	35x79	0.11	170	141	2.1	KX105350471__M0EJ
	680	51x79	0.11	128	96	3.8	KX105350681__M0GJ
	1000	51x105	0.11	85	68	5.0	KX105350102__M0GL
	1500	63x105	0.11	59	52	6.4	KX105350152__M0HL
	2200	76x105	0.11	44	40	8.1	KX105350222__M0JL
	3300	76x105	0.11	31	27	10.2	KX105350332__M0JL
	4700	76x143	0.11	29	25	13.5	KX105350472__M0JP
	6800	76x143	0.15	23	21	15.1	KX105350682__M0JP
	10000	76x222	0.20	20	18	19.9	KX105350103__M0JS
400V	220	35x60	0.11	350	280	1.4	KX105400221__M0EH
	330	35x60	0.11	250	210	2.2	KX105400331__M0EH
	470	51x79	0.11	170	150	2.8	KX105400471__M0GJ
	680	51x79	0.11	110	100	3.2	KX105400681__M0GJ
	1000	51x105	0.11	95	82	4.1	KX105400102__M0GL
	1500	63x105	0.11	64	53	5.8	KX105400152__M0HL
	2200	63x105	0.11	45	53	6.0	KX105400222__M0HL
	2200	76x105	0.11	45	39	7.3	KX105400222__M0JL
	3300	76x143	0.11	28	25	11.1	KX105400332__M0JP
	4700	76x143	0.11	24	23	12.8	KX105400472__M0JP
	6800	76x222	0.15	19	15	15.0	KX105400682__M0JS
450V	100	35x60	0.11	800	650	1.2	KX105450101__M0EH
	150	35x60	0.11	550	490	1.6	KX105450151__M0EH
	220	35x60	0.11	370	310	1.8	KX105450221__M0EH
	330	35x79	0.11	240	210	2.4	KX105450331__M0EJ
	470	51x79	0.11	200	179	3.0	KX105450471__M0GJ
	680	51x105	0.11	140	128	4.2	KX105450681__M0GL
	1000	51x105	0.11	100	88	4.4	KX105450102__M0GL
	1000	63x105	0.11	100	88	5.3	KX105450102__M0HL
	1500	63x105	0.11	70	63	5.7	KX105450152__M0HL
	1500	76x105	0.11	70	63	6.6	KX105450152__M0JL
	2200	76x143	0.11	60	47	8.8	KX105450222__M0JP
	3300	76x143	0.15	35	30	10.4	KX105450332__M0JP
	4700	76x143	0.15	28	25	10.9	KX105450472__M0JP
	4700	76x222	0.15	28	25	12.8	KX105450472__M0JS

KX05 TYPE

- Surge-proof electrolytic capacitor in aluminium can with insulation sleeve.
- Safety vent at bottom case or aside case.
- Snap in terminals for PCB mounting.

Very high CV for unit volume with low ESR.
High ripple current, in small dimensions case size.
Extended temperature range with outstanding reliability.

APPLICATIONS

Professional switch mode power supplies. Professional power electronics.

SPECIFICATIONS

GENERAL CHARACTERISTICS

Temperature Range	Operating: -40°C +105°C [Environmental classification 40/105/56 IEC-68] Storage : Preferably below +25°C, not exceeding +40°C
Rated Voltage Range (V_r)	from 16V to 450V DC
Surge Voltage (V_p)	$V_p = 1.15\ V_r$ ($V_r \le 250$V DC) $V_p = 1.10\ V_r$ ($V_r > 250$V DC)
Rated Capacitance Range	from 68 µF to 47,000 µF
Capacitance Tolerance	±20% at 100 Hz, 20°C [M class IEC-62]
Leakage Current (I_L) *(mA, 5 min, 20°C)*	max $I_L = 0.006\ C_r\ V_r + 4$ µA Sirectifier product limit : $I_L = 0.003\ C_r\ V_r$ At 85°C max $I_L = 0.02\ C_r\ V_r$ µA
Ripple current (I_r)	Refer to table at 105°C and 100Hz. For different temperature and frequency multiplier must be used as follows:

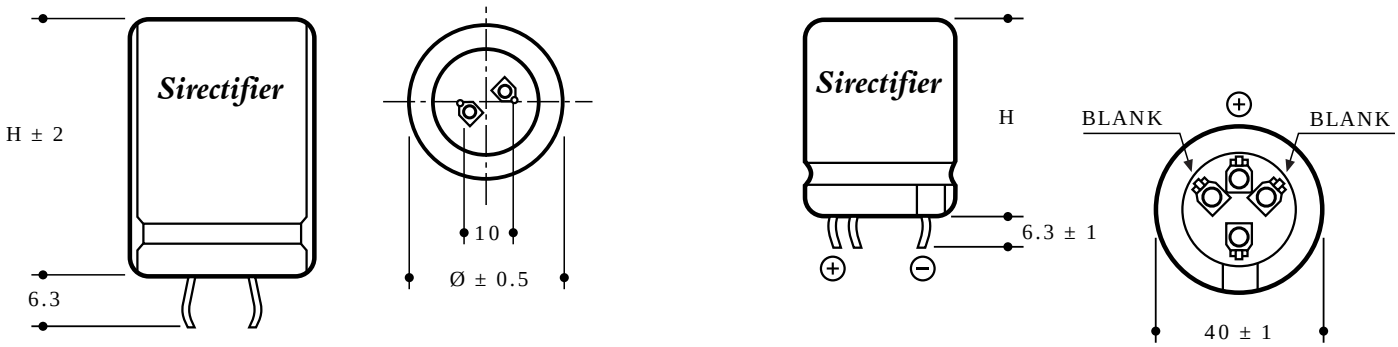
FREQUENCY	50Hz	100Hz	500 Hz	1000Hz	>10kHz
MULTIPLIER (0-25V V_r DC)	0.91	1.0	1.15	1.15	1.2
MULTIPLIER (40-100V V_r DC)	0.88	1.0	1.35	1.40	1.45
MULTIPLIER (160-450V V_r DC)	0.88	1.0	1.45	1.50	1.55

AMBIENT TEMP.	35°C	45°C	55°C	65°C	75°C	85°C	95°C	105°C
MULTIPLIER	3.0	2.80	2.60	2.40	2.20	1.80	1.50	1.0

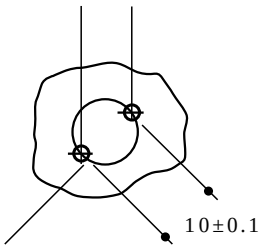
Maximum internal temperature 108°C

Insulation Resistance	At 100V DC for 1 min is >100 MΩ across insulating sleeve and terminals.		
Vibration Resistance	Frequency range: 10 Hz to 500 Hz, amplitude 0.75 mm max acceleration 10g for 3x2 h		
Life test	After 2,000 hours application of rated voltage at 105°C capacitors meet characteristics aside	Cap change tan δ Leakage current (I_L) Impedance (Z)	≤ 20% ≤ 200% < initial limit ≤ 200%
Shelf life	After leaving capacitors under no load for 500 hours at 85°C, when restored at 20°C meet specifications aside	Cap change tan δ Leakage current (I_L)	≤ ±15% ≤ 150% < initial limit
Useful life	250,000 h at 40°C 15,000 h at 85°C 5,000 h at 105°C		
Failure percentage *Failure rate*	≤ 1% (during useful life) ≤ 40 fit (40 10^{-9}/h ($V_r \le 160$V DC)		
Self inductance	Approx. 20 nH		
Reference standards	CECC 30.301 - IEC 60384-4 LONG LIFE GRADE		

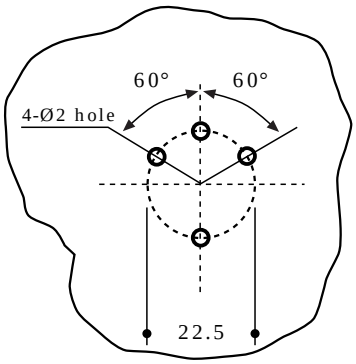
Dimensions in mm. (only Ø 40 mm.)



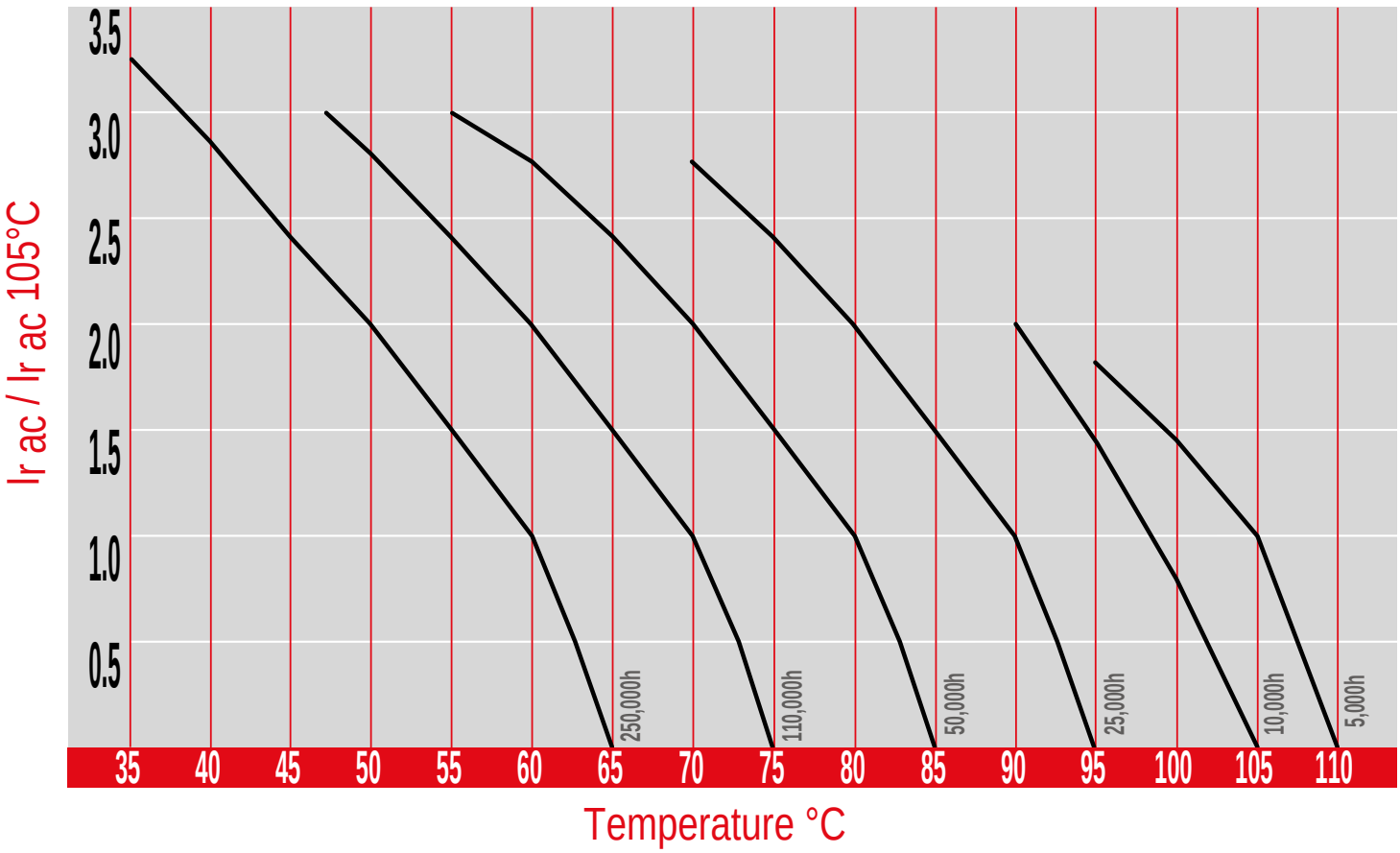
Circuit board hole dimensions



Circuit board hole dimensions



USEFUL LIFE KX05



Sirectifier® Sirectifier Electronics Technology Corporation

KX05 TYPE STANDARD RATINGS

RATED VOLTAGE V DC	CAPACITANCE µF	Ø x L mm	Tan δ MAX 100 Hz 20°C	ESR TYP m Ω 100 Hz 20°C	Z TYP m Ω 10 kHz 20°C	Ir a.c. A max 100 Hz 105°C	PART NUMBER stud and insert style excluded
16V	6800	25x30	0.30	55	40	1.9	KX05016682_PM0CB
	10000	25x40	0.40	45	35	2.0	KX05016103_PM0CD
	10000	30x30	0.40	40	35	2.0	KX05016103_PM0DB
	15000	25x40	0.45	40	35	2.6	KX05016153_PM0CD
	15000	30x40	0.45	40	35	2.8	KX05016153_PM0DD
	22000	30x40	0.60	35	24	3.1	KX05016223_PM0DD
	22000	35x40	0.60	35	24	3.3	KX05016223_PM0ED
	33000	35x50	0.70	25	20	3.6	KX05016333_PM0EF
	47000	35x50	0.90	22	20	4.9	KX05016473_PM0EF
25V	4700	25x30	0.25	53	45	1.8	KX05025472_PM0CB
	6800	25x30	0.25	50	38	2.0	KX05025682_PM0CB
	6800	30x30	0.30	50	38	2.2	KX05025682_PM0DB
	10000	25x40	0.40	40	35	2.4	KX05025103_PM0CD
	10000	30x30	0.40	40	35	2.3	KX05025103_PM0DB
	15000	30x40	0.45	39	28	2.9	KX05025153_PM0DD
	15000	35x40	0.45	39	28	3.2	KX05025153_PM0ED
	22000	35x50	0.60	30	22	3.3	KX05025223_PM0EF
	33000	35x50	0.70	22	18	4.3	KX05025333_PM0EF
40V	3300	25x30	0.20	72	58	1.5	KX05040332_PM0CB
	4700	25x30	0.20	50	38	1.8	KX05040472_PM0CB
	4700	30x25	0.20	50	38	1.8	KX05040472_PM0DA
	6800	25x40	0.30	48	33	2.3	KX05040682_PM0CD
	6800	30x30	0.30	48	33	2.4	KX05040682_PM0DB
	10000	30x40	0.40	39	28	2.8	KX05040103_PM0DD
	10000	35x30	0.40	39	28	2.9	KX05040103_PM0EB
	15000	30x40	0.45	32	22	2.8	KX05040153_PM0DD
	15000	35x40	0.45	32	22	3.7	KX05040153_PM0ED
	22000	35x50	0.55	28	20	5.4	KX05040223_PM0EF
50V	2200	25x30	0.20	72	58	1.5	KX05050222_PM0CB
	3300	25x30	0.20	48	38	1.6	KX05050332_PM0CB
	4700	25x30	0.20	50	35	2.0	KX05050472_PM0CB
	4700	30x25	0.20	50	35	2.0	KX05050472_PM0DA
	4700	30x30	0.20	50	35	2.4	KX05050472_PMODB
	6800	30x30	0.30	46	28	2.9	KX05050682_PM0DB
	6800	30x40	0.30	46	28	3.2	KX05050682_PM0DD
	10000	30x40	0.35	31	22	3.4	KX05050103_PM0DD
	10000	35x40	0.35	31	22	3.6	KX05050103_PM0ED
	15000	35x50	0.45	26	18	4.7	KX05050153_PM0EF
	22000	40x50	0.50	25	18	5.5	KX05050223_PM0FF

KX05 TYPE STANDARD RATINGS

RATED VOLTAGE V DC	CAPACITANCE µF	Ø x L mm	Tan δ MAX 100 Hz 20°C	ESR TYP m Ω 100 Hz 20°C	Z TYP m Ω 10 kHz 20°C	Ir a.c. A max 100 Hz 105°C	PART NUMBER stud and insert style excluded
63V	2200	25x30	0.15	79	60	1.5	KX05063222_PM0CB
	3300	25x40	0.15	50	40	2.3	KX05063332_PM0CD
	3300	30x30	0.15	50	40	2.1	KX05063332_PM0DB
	4700	30x30	0.20	40	29	2.4	KX05063472_PM0DB
	4700	30x40	0.20	40	29	2.8	KX05063472_PM0DD
	6800	30x40	0.30	35	25	3.0	KX05063682_PM0DD
	6800	35x40	0.30	35	25	4.4	KX05063682_PM0ED
	10000	35x50	0.35	30	23	5.3	KX05063103_PM0EF
100V	1000	25x30	0.10	127	100	1.7	KX05100102_PM0CB
	1000	30x25	0.10	127	100	1.7	KX05100102_PM0DA
	1500	25x40	0.12	105	82	2.0	KX05100152_PM0CD
	1500	30x30	0.12	105	82	1.8	KX05100152_PM0DB
	2200	30x40	0.15	71	60	2.7	KX05100222_PM0DD
	3300	30x50	0.15	48	39	3.0	KX05100332_PM0DF
	3300	35x40	0.15	48	39	3.3	KX05100332_PM0ED
	4700	35x50	0.20	33	26	4.4	KX05100472_PM0EF
	5600	40x50	0.20	33	24	4.8	KX05100562_PM0FF
	6800	40x50	0.20	33	24	4.9	KX05100682_PM0FF
200V	220	22x30	0.10	440	340	0.9	KX05200221_PM0BB
	220	25x30	0.10	440	340	1.1	KX05200221_PM0CB
	330	22x30	0.10	240	133	1.1	KX05200331_PM0BB
	330	25x30	0.10	240	133	1.2	KX05200331_PM0CB
	470	25x30	0.10	169	98	3.0	KX05200471_PM0CB
	470	30x30	0.10	169	98	1.6	KX05200471_PM0DB
	680	25x40	0.10	145	87	1.7	KX05200681_PM0CD
	680	30x40	0.10	145	87	2.0	KX05200681_PM0DD
	1000	30x40	0.10	95	63	2.1	KX05200102_PM0DD
	1000	35x40	0.10	95	63	2.4	KX05200102_PM0ED
	1500	30x50	0.10	70	41	2.4	KX05200152_PM0DF
	1500	35x50	0.10	70	41	2.6	KX05200152_PM0EF
	2200	35x50	0.12	45	33	2.8	KX05200222_PM0EF
250V	100	25x30	0.10	950	730	0.7	KX05250101_PM0CB
	150	25x30	0.10	530	290	0.7	KX05250151_PM0CB
	220	25x30	0.10	370	240	0.9	KX05250221_PM0CB
	330	30x30	0.10	260	153	1.2	KX05250331_PM0DB
	470	25x40	0.10	180	110	1.5	KX05250471_PM0CD
	470	30x30	0.10	180	110	1.5	KX05250471_PM0DB
	680	35x40	0.10	145	95	1.8	KX05250681_PM0ED
	1000	35x50	0.10	98	65	2.6	KX05250102_PM0EF
	1500	35x50	0.12	75	43	2.8	KX05250152_PM0EF

KX05 TYPE STANDARD RATINGS

RATED VOLTAGE V DC	CAPACITANCE µF	Ø x L mm	Tan δ MAX 100 Hz 20°C	ESR TYP m Ω 100 Hz 20°C	Z TYP m Ω 10 kHz 20°C	Ir a.c. A max 100 Hz 105°C	PART NUMBER stud and insert style excluded
400V	68	25x30	0.10	1405	1050	0.5	KX05400680_PM0CB
	100	25x30	0.10	796	550	0.5	KX05400101_PM0CB
	150	25x30	0.10	530	380	0.6	KX05400151_PM0CB
	150	30x30	0.10	530	380	0.8	KX05400151_PM0DB
	220	25x40	0.10	360	250	1.0	KX05400221_PM0CD
	220	30x30	0.10	360	250	1.1	KX05400221_PM0DD
	330	30x40	0.10	240	170	1.4	KX05400331_PM0DD
	330	35x30	0.10	240	170	1.4	KX05400331_PM0EB
	330	35x40	0.10	240	170	1.6	KX05400331_PM0ED
	470	35x40	0.10	170	125	1.6	KX05400471_PM0ED
	470	35x50	0.10	170	125	1.8	KX05400471_PM0EF
	680	35x50	0.10	158	110	1.9	KX05400681_PM0EF
	680	40x50	0.10	158	110	2.2	KX05400681_PM0FF
	820	35x60	0.10	110	95	2.5	KX05400821_PM0EH
	1000	40x60	0.10	95	70	3.1	KX05400102_PM0FH
450V	68	25x30	0.10	1405	1050	0.5	KX05450680_PM0CB
	100	25x30	0.10	796	710	0.5	KX05450101_PM0CB
	100	30x25	0.10	796	550	0.7	KX05450101_PM0DA
	100	30x30	0.10	796	550	0.8	KX05450101_PM0DB
	150	30x30	0.10	530	380	0.8	KX05450151_PM0DB
	150	30x40	0.10	530	380	1.0	KX05450151_PM0DD
	220	30x40	0.10	360	250	1.1	KX05450221_PM0DD
	220	35x30	0.10	360	250	1.1	KX05450221_PM0EB
	330	30x50	0.10	240	170	1.4	KX05450331_PM0DF
	330	35x40	0.10	240	170	1.4	KX05450331_PM0ED
	330	35x50	0.10	240	170	1.8	KX05450331_PM0EF
	470	35x50	0.10	170	125	1.8	KX05450471_PM0EF
	680	35x60	0.12	158	110	2.2	KX05450681_PM0EH
	1000	40x79	0.15	120	100	3.1	KX05450102_PM0FJ

KX06 TYPE

- Surge-proof electrolytic capacitor in aluminium can with insulation sleeve.
- Safety vent at bottom case or aside case.
- Snap in terminals for PCB mounting.

Very high CV for unit volume with low ESR.
High ripple current in small dimensions case size.
Operation up to 105°C permissible.

APPLICATIONS

Professional switch mode power supplies. Professional power electronics.

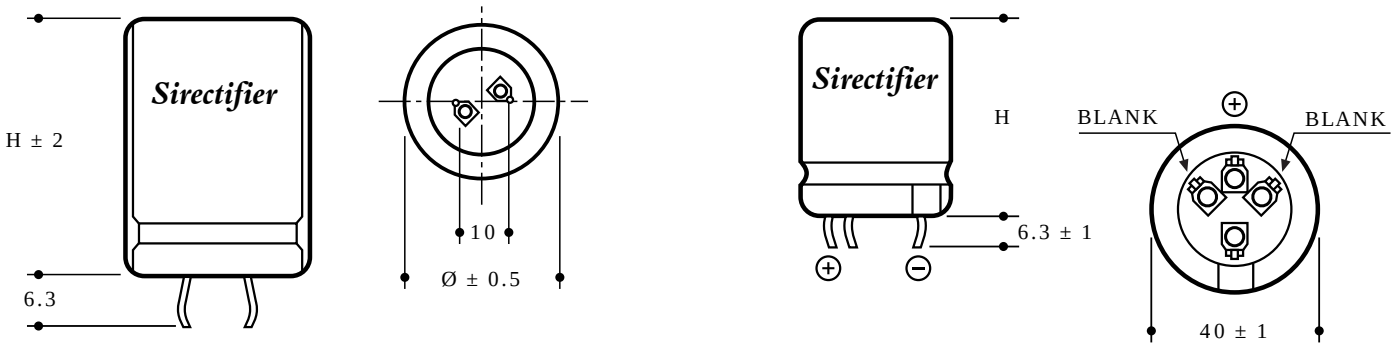
SPECIFICATIONS

GENERAL CHARACTERISTICS

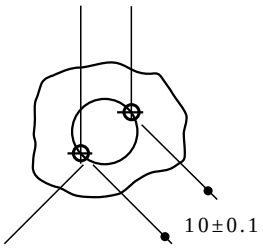
Temperature Range	Operating: -40°C +85°C [Environmental classification 40/85/56 IEC-68] Storage : Preferably below +25°C, not exceeding +40°C	
Rated Voltage Range (V_r)	from 16V to 400V DC	
Surge Voltage (V_p)	$V_p = 1.15\ V_r$ ($V_r \le 250$V DC) $V_p = 1.10\ V_r$ ($V_r > 250$V DC)	
Rated Capacitance Range	from 68 µF to 33,000 µF	
Capacitance Tolerance	±20% at 100 Hz, 20°C [M class IEC-62]	
Leakage Current (I_L) *(mA, 5 min, 20°C)*	max $I_L = 0.006\ C_r\ V_r + 4$ µA Sirectifier product limit : $I_L = 0.003\ C_r\ V_r$ At 85°C max $I_L = 0.04\ C_r\ V_r$ µA	
Ripple current (I_r)	Refer to table at 85°C and 100Hz For different temperature and frequency multiplier must be used as follows:	
Insulation Resistance	At 100V DC for 1 min is >100 MΩ across insulating sleeve and terminals.	
Vibration Resistance	Frequency range: 10 Hz to 500 Hz, amplitude 0.75 mm max acceleration 10g for 3x2 h	
Life test	After 2,000 hours application of rated voltage at 85°C capacitors meet characteristics aside	Cap change ≤ 20% tan δ ≤ 200% Leakage current (I_L) < initial limit Impedance (Z) ≤ 200%
Shelf life	After leaving capacitors under no load for 500 hours at 85°C, when restored at 20°C meet specifications aside	Cap change ≤ ±15% tan δ ≤ 150% Leakage current (I_L) < initial limit
Useful life	> 200,000 h at 40°C > 5,000 h at 85°C	
Failure percentage *Failure rate*	≤ 1% (during useful life) ≤ 40 fit (40 10^{-9}/h ($V_r \le 160$V DC) ≤ 70 fit (70 10^{-9}/h ($V_r > 160$V DC)	
Self inductance	Approx. 20 nH	
Reference standards	CECC 30.301 - IEC 60384-4 LONG LIFE GRADE	

FREQUENCY	50Hz	100Hz	500 Hz	1000Hz	>10kHz	
MULTIPLIER (0-25V V_r DC)	0.91	1.0	1.15	1.15	1.2	
MULTIPLIER (40-100V V_r DC)	0.88	1.0	1.35	1.40	1.45	
MULTIPLIER (160-450V V_r DC)	0.88	1.0	1.45	1.50	1.55	
AMBIENT TEMP.	35°C	45°C	55°C	65°C	75°C	85°C
MULTIPLIER	2.2	2.1	1.8	1.6	1.4	1.0
Maximum internal temperature	98°C					

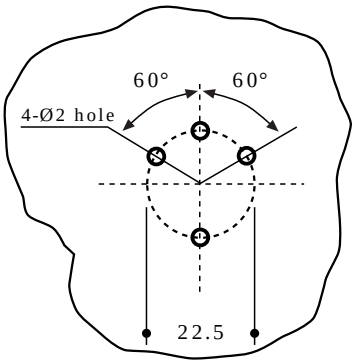
Dimensions in mm. (only Ø 40 mm.)



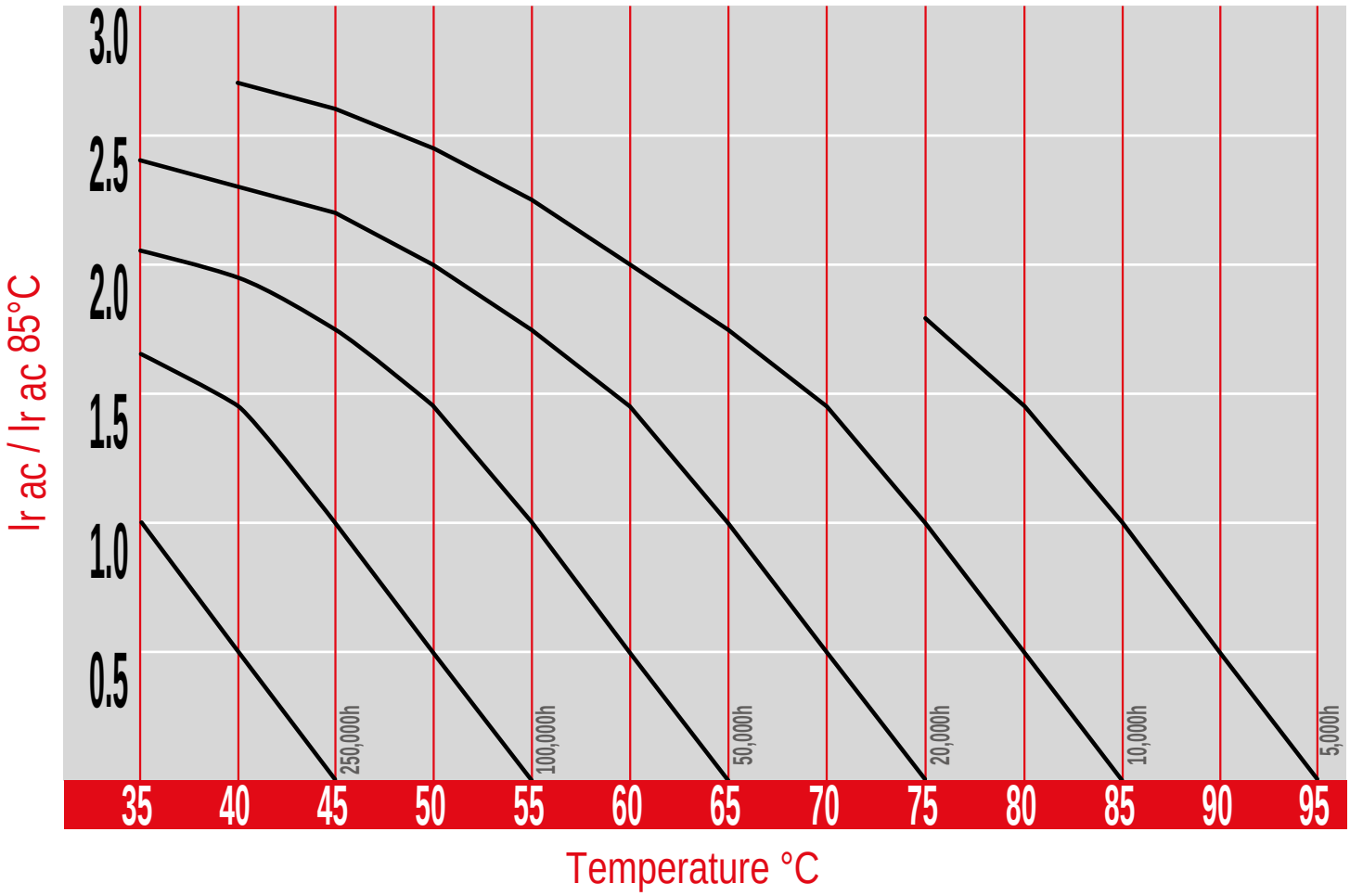
Circuit board hole dimensions



Circuit board hole dimensions



USEFUL LIFE KX06



KX06 TYPE STANDARD RATINGS

RATED VOLTAGE V DC	CAPACITANCE µF	Ø x L mm	Tan δ MAX 100 Hz 20°C	ESR TYP m Ω 100 Hz 20°C	Z TYP m Ω 10 kHz 20°C	Ir a.c. A max 100 Hz 85°C	PART NUMBER stud and insert style excluded
16V	4700	22x30	0.30	55	40	1.5	KX06016472_PM0BB
	6800	22x30	0.30	45	38	1.8	KX06016682_PM0BB
	10000	25x30	0.40	40	35	2.4	KX06016103_PM0CB
	15000	30x30	0.45	33	25	2.6	KX06016153_PM0DB
	22000	30x40	0.60	27	22	3.5	KX06016223_PM0DD
	22000	35x30	0.60	27	22	3.5	KX06016223_PM0EB
	22000	35x40	0.60	27	22	3.5	KX06016223_PM0ED
	33000	35x50	0.70	25	20	4.8	KX06016333_PM0EF
	47000	35x50	0.90	22	20	5.8	KX06016473_PM0EF
25V	4700	22x30	0.20	53	45	1.8	KX06025472_PM0BB
	6800	25x30	0.25	50	38	2.7	KX06025682_PM0CB
	10000	25x40	0.40	40	35	3.3	KX06025103_PM0CD
	10000	30x30	0.40	40	35	3.3	KX06025103_PM0DB
	15000	30x40	0.45	39	28	4.1	KX06025153_PM0DD
	15000	35x30	0.45	39	28	4.1	KX06025153_PM0EB
	22000	35x40	0.60	30	22	5.0	KX06025223_PM0ED
	33000	35x50	0.70	22	18	6.1	KX06025333_PM0EF
40V	3300	22x30	0.15	72	58	2.1	KX06040332_PM0BB
	4700	25x30	0.20	50	38	2.8	KX06040472_PM0CB
	6800	25x40	0.30	48	33	3.4	KX06040682_PM0CD
	6800	30x30	0.30	48	33	3.4	KX06040682_PM0DB
	10000	25x40	0.40	38	28	3.8	KX06040103_PM0CD
	10000	30x40	0.40	39	28	4.3	KX06040103_PM0DD
	10000	35x30	0.40	39	28	4.3	KX06040103_PM0EB
	15000	30x40	0.45	32	22	4.0	KX06040153_PM0DD
	15000	35x40	0.45	32	22	4.8	KX06040153_PM0ED
	22000	35x50	0.60	28	20	5.4	KX06040223_PM0EF
50V	2200	22x30	0.20	72	58	1.9	KX06050222_PMBB
	3300	25x30	0.20	48	38	2.5	KX06050332_PMCB
	4700	25x30	0.20	50	35	2.8	KX06050472_PMCB
	6800	25x40	0.30	48	28	3.2	KX06050682_PMCD
	6800	30x30	0.30	48	28	3.2	KX06050682_PMDB
	10000	30x40	0.35	31	22	3.8	KX06050103_PMDD
	10000	35x30	0.35	31	28	3.8	KX06050103_PMEB
	10000		0.35	31	28	4.1	KX06050103_PMED
	15000	35x50	0.45	26	18	4.9	KX06050153_PMEF
	22000	40x50	0.50	25	18	7.3	KX06050223_PMFF

KX06 TYPE STANDARD RATINGS

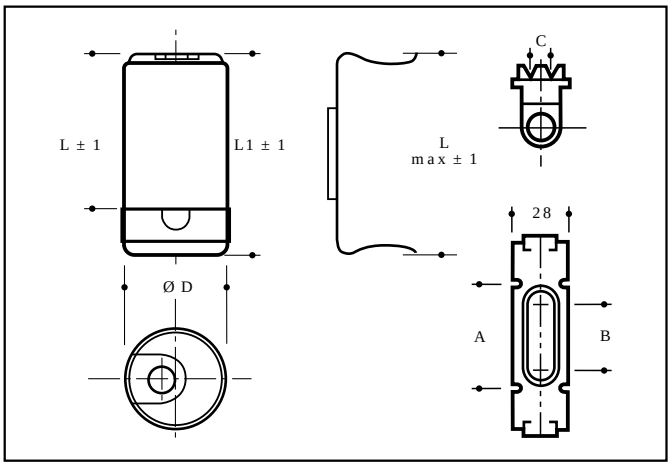
RATED VOLTAGE V DC	CAPACITANCE µF	Ø x L mm	Tan δ MAX 100 Hz 20°C	ESR TYP m Ω 100 Hz 20°C	Z TYP m Ω 10 kHz 20°C	Ir a.c. A max 100 Hz 85°C	PART NUMBER stud and insert style excluded
63V	2200	25x30	0.20	79	58	2.2	KX06063222_PM0CB
	3300	25x40	0.20	50	38	2.6	KX06063332_PM0CD
	3300	30x30	0.20	50	38	2.6	KX06063332_PM0DB
	4700	25x40	0.20	41	29	2.8	KX06063472_PM0CD
	4700	30x40	0.20	41	29	3.5	KX06063472_PM0DD
	4700	35x30	0.20	41	29	3.5	KX06063472_PM0EB
	6800	30x40	0.30	35	25	3.6	KX06063682_PM0DD
	6800	35x40	0.30	35	25	4.0	KX06063682_PM0ED
	10000	35x50	0.35	32	23	5.8	KX06063103_PM0EF
	15000	40x50	0.45	30	20	6.8	KX06063153_PM0FF
100V	1000	22x30	0.12	150	100	1.3	KX06100102_PM0BB
	1000	25x30	0.12	150	100	1.6	KX06100102_PM0CB
	1000	30x25	0.12	150	100	1.6	KX06100102_PM0DA
	1500	30x30	0.12	105	82	2.1	KX06100152_PM0DB
	2200	30x30	0.15	71	60	2.4	KX06100222_PM0DB
	2200	30x40	0.15	71	60	3.1	KX06100222_PM0DD
	2200	35x30	0.15	71	60	2.4	KX06100222_PM0EB
	3300	30x50	0.20	48	39	4.0	KX06100332_PM0DF
	3300	35x40	0.20	48	39	4.0	KX06100332_PM0ED
	4700	35x50	0.20	33	26	5.6	KX06100472_PM0EF
	6800	35x50	0.25	33	25	5.8	KX06100682_PM0EF
200V	220	22x30	0.10	440	340	0.9	KX06200221_PM0BB
	330	22x30	0.10	240	133	1.3	KX06200331_PM0BB
	470	25x30	0.10	169	98	1.5	KX06200471_PM0CB
	680	25x40	0.10	145	87	2.0	KX06200681_PM0CD
	680	30x30	0.10	145	87	2.0	KX06200681_PM0DB
	680	35x30	0.10	145	87	2.0	KX06200681_PM0EB
	1000	30x40	0.10	95	63	2.6	KX06200102_PM0DD
	1000	35x40	0.10	95	63	2.8	KX06200102_PM0ED
	1500	35x40	0.10	70	41	2.9	KX06200152_PM0ED
	1500	35x50	0.10	70	41	3.7	KX06200152_PM0EF
	2200	35x50	0.10	45	33	3.90	KX06200222_PM0EF
250V	150	22x30	0.12	530	290	0.9	KX06250151_PM0BB
	220	25x30	0.12	370	240	1.3	KX06250221_PM0CB
	330	25x40	0.12	260	153	1.4	KX06250331_PM0CD
	330	30x30	0.12	260	153	1.4	KX06250331_PM0DB
	470	25x40	0.12	180	110	1.6	KX06250471_PM0CD
	470	30x30	0.12	180	110	1.6	KX06250471_PM0DB
	680	30x40	0.12	145	95	1.9	KX06250681_PM0DD
	680	35x40	0.12	145	95	2.2	KX06250681_PM0ED
	1000	35x40	0.12	98	65	2.6	KX06250102_PM0ED
	1000	35x50	0.12	98	65	3.20	KX06250102_PM0EF
	1500	35x50	0.15	75	43	4.00	KX06250152_PM0EF
	2200	40x50	0.15	50	35	5.20	KX06250222_PM0FF

KX06 TYPE STANDARD RATINGS

RATED VOLTAGE V DC	CAPACITANCE µF	Ø x L mm	Tan δ MAX 100 Hz 20°C	ESR TYP m Ω 100 Hz 20°C	Z TYP m Ω 10 kHz 20°C	Ir a.c. A max 100 Hz 85°C	PART NUMBER stud and insert style excluded
400V	68	22x25	0.10	1405	1050	0.6	KX06400680_PM0BA
	68	22x30	0.10	1405	1050	0.6	KX06400680_PM0BB
	100	22x30	0.10	796	550	0.7	KX06400101_PM0BB
	100	25x25	0.10	796	550	0.7	KX06400101_PM0CA
	100	25x30	0.10	796	550	1.0	KX06400101_PM0CB
	150	25x30	0.10	530	380	1.0	KX06400151_PM0CB
	150	30x25	0.10	530	380	1.0	KX06400151_PM0DA
	220	25x40	0.10	360	250	1.2	KX06400221_PM0CD
	220	30x30	0.10	360	250	1.2	KX06400221_PM0DB
	330	30x40	0.10	240	170	1.7	KX06400331_PM0DD
	330	35x30	0.10	240	170	1.7	KX06400331_PM0EB
	470	35x40	0.10	170	125	2.2	KX06400471_PM0ED
	470	35x50	0.10	170	125	2.60	KX06400471_PM0EF
	560	35x50	0.10	165	122	2.60	KX06400561_PM0EF
	680	35x50	0.10	158	110	2.80	KX06400681_PM0EF
	680	40x50	0.10	158	110	3.20	KX06400681_PM0FF
	820	35x60	0.10	110	95	3.50	KX06400821_PM0EH
	1000	40x60	0.10	95	70	4.40	KX06400102_PM0FH
	1500	40x105	0.10	65	50	5.70	KX06400152_PM0FL
450V	68	22x25	0.12	1405	1050	0.6	KX06450680_PM0BA
	68	22x30	0.12	1405	1050	0.6	KX06450680_PM0BB
	100	25x30	0.12	800	560	0.7	KX06450101_PM0CB
	100	30x25	0.12	800	560	0.7	KX06450101_PM0DA
	150	30x25	0.12	550	400	1.1	KX06450151_PM0DA
	150	30x30	0.12	550	400	1.1	KX06450151_PM0DB
	220	30x40	0.12	380	265	1.3	KX06450221_PM0DD
	220	35x30	0.12	380	265	1.3	KX06450221_PM0EB
	330	30x50	0.12	255	175	1.7	KX06450331_PM0DF
	330	35x40	0.12	255	175	1.7	KX06450331_PM0ED
	470	35x50	0.12	175	125	2.40	KX06450471_PM0EF
	560	35x50	0.12	165	122	2.50	KX06450561_PM0EF
	680	35x50	0.12	158	110	2.60	KX06450681_PM0EF
	680	40x50	0.12	158	110	3.10	KX06450681_PM0FF
	820	40x60	0.12	110	95	4.00	KX06450821_PM0FH
	1000	40x79	0.12	110	95	4.90	KX06450102_PM0FJ
	1500	40x105	0.12	110	95	5.50	KX06450152_PM0FL
500V	68	25x30	0.15	1870	1380	0.6	KX06500680_PM0CB
	100	30x30	0.15	1050	790	0.7	KX06500101_PM0DB
	150	30x40	0.15	750	580	1.1	KX06500151_PM0DD
	220	30x50	0.15	579	440	1.4	KX06500221_PM0DF
	220	35x40	0.15	579	440	1.4	KX06500221_PM0ED
	330	35x50	0.15	386	290	2.1	KX06500331_PM0EF
	470	40x50	0.15	271	200	2.50	KX06500471_PM0FF
	560	40x60	0.15	230	190	3.00	KX06500561_PM0FH
	680	40x79	0.15	205	155	3.50	KX06500681_PM0FJ
	820	40x105	0.15	190	139	4.50	KX06500821_PM0FL

KX13 TYPE

- Surge-proof electrolytic capacitor in plastic case.
- Poles brought out to single or double fast-on terminals
- Normally supplied with end cup.
- On request: bipolar cable, discharge resistance, metal mounting bracket, with or without cover.



APPLICATIONS

Non polarized capacitor especially designed for intermittent A.C. voltage applications at 50-60 Hz for single phase motor starting.

SPECIFICATIONS

GENERAL CHARACTERISTICS

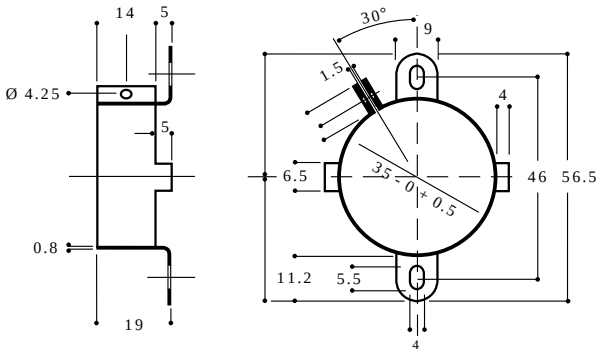
Operating Temperature Range	(Operating) -25°C +75°C (Storage) -40°C +85°C
Working Voltage Range	from 125V AC to 320V AC
Capacitance Range	from 25 µF to 800 µF
Capacitance Tolerance	-0% +25% or ±10%
Tan δ (Dissipation loss angle)	Measurement frequency; 100 Hz, temperature 20°C Value shall not exceed 0.10 and shall be calculated as follows: tan δ = W / (V x I) = (true watts / apparent watts)
Capacitance Measurement	Capacitance shall be determined by measuring the current (after 2÷3 seconds of energising) through the capacitors at rated voltage and frequency. The capacitance is defined from the following formula: $C = (I \times 10^6) / 2 p \pi x f V$ C = capacitance in µF I = current in Amperes π = 3.14 constant f = frequency in Hz V = applied AC voltage in Volt
Working condition	The standard time rating defined of the IEC 252 is 1.67% or 1/60th full time and corresponds to a duty cycle of 3 seconds on and 177 seconds off. Alternative customer duty is available on request.
Endurance test	500 hours
Reference standards	VDE 560 - 8 IEC 252

	Case			Bracket		
	Ø est. mm.	L mm.	L1 mm.	Lmax mm.	A mm.	B x C mm.
A1	36.5	69.8	82.5	89	38	22.5 x 5.1
A2	36.5	85.7	98.4	104	53	37 x 6.1
A3	46	85.7	98.4	104	53	37 x 6.1

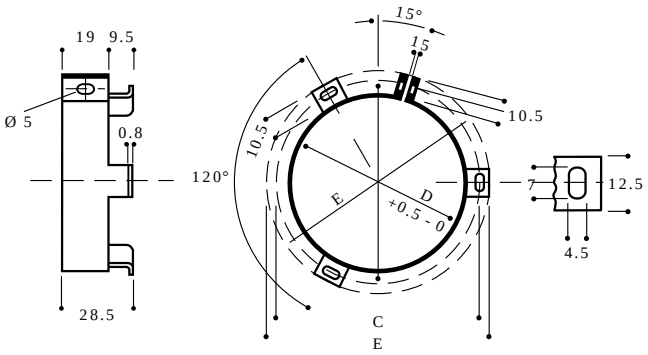
CAPACITANCE [µF]	125 VAC	250VAC	320VAC
25 - 31		✓	✓
31 - 40		✓	✓
40 - 50		✓	✓
50 - 63		✓	✓
63 - 80		✓	✓
80 - 100		✓	✓
100 - 125	✓	✓	✓
125 - 160	✓	✓	✓
160 - 200	✓	✓	✓
200 - 250	✓	✓	✓
250 - 315	✓	✓	✓
315 - 400	✓	✓	
320		✓	
500		✓	
600	✓		
800	✓		

RINGS CLIPS, HEX NUTS, WASHERS

ORDERING CODE 1635000
STANDARD



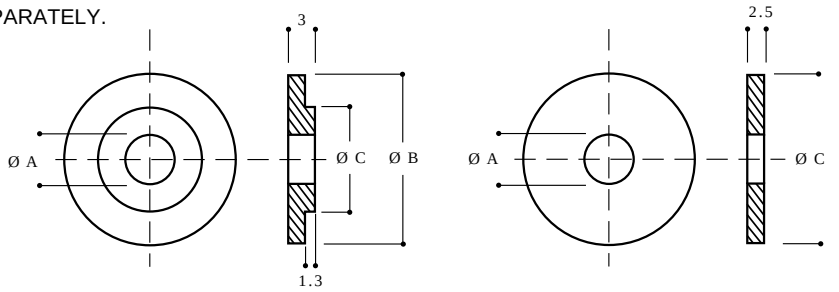
STANDARD D	C	E	ORDERING CODE
50.8	63.5	73.4	1650000
63.5	76.0	86.1	1664000
76.0	89.0	98.6	1676000



INSULATED MOUNTING WITH HEX NUT

HEX NUTS AND SPRING WASHERS ARE DELIVERED LOOSELY WITH THE CAPACITOR.
INSULATION WASHERS SHALL BE ORDERED SEPARATELY.

M	A	B	C	ORDERING CODE
8	8.4	25	18.5	130001
12	12.5	35	18.5	130002



CASE SIZE TABLE WITH DIMENSIONS CODE

		A	B	C	D	E	F	G	H	J	L	M	N	P	R	S	X
length (mm)		25	30	35	40	45	50	51	60	79	105	120	130	143	150	222	custom
diameter Ø (mm)																	
A	20	AA															
B	22	BA	BB		BD												
C	25	CA	CB		CD		CF										
D	30	DA	DB		DD		DF		DH								
E	35	EA	EB	EC	ED		EF	EG	EH	EJ	EL						
F	40			FC			FF		FH	FJ	FL						
G	51								GH	GJ	GL			GP			
H	63								HH	HJ	HL		HN	HP			
J	76									JJ	JL	JM	JN	JP	JR	JS	
L	90									LJ						LS	

Sirectifier®
Sirectifier Electronics Technology Corporation

MOUNTING HARDWARE

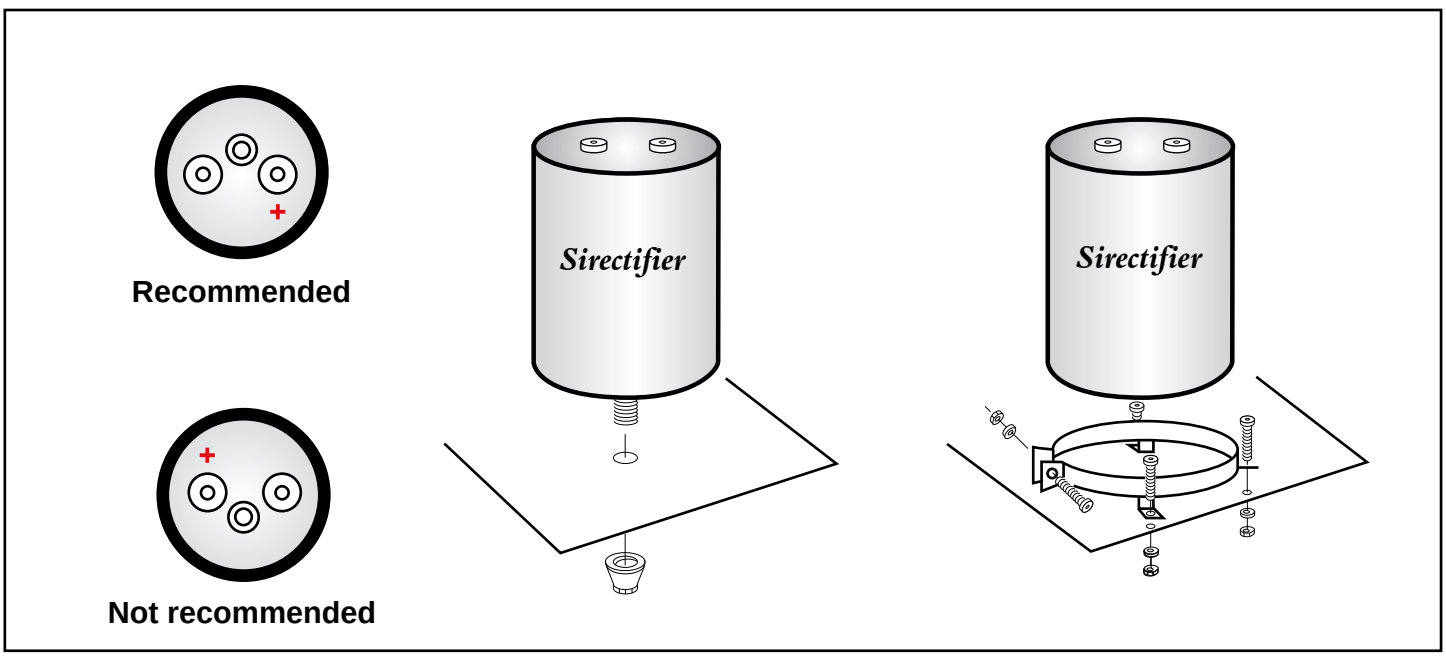
During normal operation electrolytic capacitors are subjected to an internal generation of gas due to heating combined with the inside pressure. Therefore a safety vent is provided to prevent catastrophic failures.

Sirectifier aluminium electrolytic capacitors screw terminals type KX085 and KX105 *have been provided with a safety vent plug on the deck, a tiny rubber capsule designed to support a critical bursting pressure up to 8 bar. To fix these capacitors use the appropriate mounting clamps furnished in different diameter sizes.*

Sirectifier aluminium electrolytic capacitors snap in terminals type KX05 and KX06 do have a kind of vent, realized as a weakened area in the base of the alum can, sometimes also by side, that will release the possible growth of excess pressure. Usually board mounted type are easily fixed by their own terminals, and so no special mounting hardware is then required.

When mounting the capacitor, it should be borne in mind that in the event of the vent being blown under failure conditions, a small quantity of hot conductive electrolyte and vapours can, in some cases, flow out from the vent, so the position is important and the can should be carefully located. If possible, we recommend that capacitors are mounted with the safety vent uppermost.
In any case, screws terminal capacitors can be mounted in any position so long as the vent is free to operate. The overall characteristic parameters such as capacitance, ESR, currents, etc. remain the same whatever is the orientation, but once the vent has been blown, an eventual overflow of electrolyte could damage importants parts of the circuit.

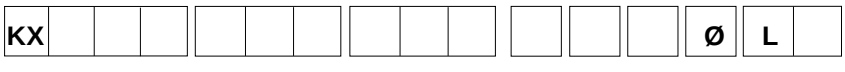
Lastly, a good cooling system must be designed. Consideration must be given as to where to place the circuits especially when dealing with high ripple currents; the area around electrolytic capacitors should be well aired with enough distance between the radiant elements, both for maintenance and for security reasons.



PART NUMBER SYSTEM

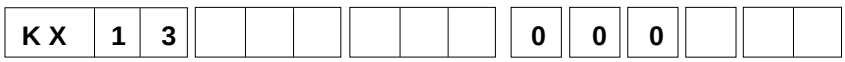
New PART-NUMBER CODE in use since Feb 2002. Total length is 15 digits.
Please see examples below and have a reference code from the standard ratings capacitors pages.

SCREW AND SNAP IN CAPACITORS



CASE SIZE	see table for dimensions codes of case size
RESERVED	0 = standard ratings
TOLERANCE	tolerance range as IEC62 M= ±20%, Q= -10% +30%, X= custom
INSERT STYLE	insert type on decks 0= STD, H= High ripple (screw type) P (pin type)
TERMINATION	terminal as follows: 0= no stud. M= M8 stud, S= M12 stud (screw type) o= std, 4= 4 pins (snap in type)
CAPACITANCE	[µF] - 2 significant digits plus multiplying factor 1= x10, 2= x100, 3x1000, 4x10000
VOLTAGE	DC rated voltage [V]
SERIES TYPE	Aluminium Electrolytic type KX085, KX105, KX05, KX06

MOTORSTART LUG CAPACITORS



CASE SIZE	A1 = 36.5 x 82.5 A2 = 36.5 x 98.4 B2 = 46.0 x 98.4
FEATURE	0 = NO CP (no cover) 1 = CP (cover) 2 = CP ST (cover + brascket)
TOLERANCE	-25% +75% (STD)
CAPACITANCE	[µF] see standard rating in section
VOLTAGE	AC rated voltage [V] see section (ex.: 125VAC)

CAPACITORS WEIGHT TABLE

KX085
KX105
SCREW TYPE

SIZE ØxL [mm]	CASE CODE	APPROX UNIT WEIGHT grams	QTY / BOX nr	BOX DIMENSIONS cm
35x51	EG	80	60	36 x 25 x 6
35x60	EH	70	60	36 x 25 x 8
35x79	EJ	110	60	36 x 25 x 8
51x60	GH	110	42	38.5 x 38.5 x 14
51x79	GJ	200	42	38.5 x 38.5 x 14
51x105	GL	260	42	38.5 x 38.5 x 14
51x143	GP	370	42	38.5 x 38.5 x 18
63x60	HH	240	25	38.5 x 38.5 x 14
63x79	HJ	280	25	38.5 x 38.5 x 14
63x105	HL	420	25	38.5 x 38.5 x 14
63x143	HP	540	25	38.5 x 38.5 x 18
76x79	JJ	450	16	38.5 x 38.5 x 14
76x105	JL	520	16	38.5 x 38.5 x 14
76x120	JM	790	16	38.5 x 38.5 x 18
76x130	JN	850	16	38.5 x 38.5 x 18
76x143	JP	940	16	38.5 x 38.5 x 18
76x220	JS	1540	16	38.5 x 38.5 x 25
90x79	LJ	510	9	38.5 x 38.5 x 14
90x220	LS	1880	9	38.5 x 38.5 x 25

KX05-KX06
SNAP-IN TYPE

22x25	BA	15	160	36 x 25 x 6
22x30	BB	19	160	36 x 25 x 6
22x40	BD	24	160	36 x 25 x 6
25x25	CA	16	126	36 x 25 x 6
25x30	CB	21	126	36 x 25 x 6
25x40	CD	30	126	36 x 25 x 6
25x50	CF	38	126	36 x 25 x 6
30x25	DA	24	77	36 x 25 x 6
30x30	DB	27	77	36 x 25 x 6
30x40	DD	38	77	36 x 25 x 6
30x50	DF	55	77	36 x 25 x 6
35x25	EA	42	60	36 x 25 x 6
35x30	EB	45	60	36 x 25 x 6
35x35	EC	50	60	36 x 25 x 6
35x40	ED	62	60	36 x 25 x 6
35x50	EF	78	60	36 x 25 x 6
35x60	EH	88	60	36 x 25 x 8
40x50	FF	98	45	36 x 25 x 6
40x60	FH	117	45	36 x 25 x 8
40x79	FJ	138	45	36 x 25 x 8
40x105	FL	181	12	36 x 25 x 6

GENERAL WARNING

Information and data contained in the section "Technical Information" must be considered as a completing part of each family type of capacitor.
Before using a Sirectifier capacitor in any application, please read carefully the related specifications included in the catalogue.
An improper installation or not respecting parameters limits might cause damage to the components, their characteristics modification and a decrease of their reliability and useful life.
Products manufactured by Sirectifier are made with maximum care, in order to result free of defects in design, materials and workmanship, according with adequate specifications and international standard requirements.

DISCLAIMER

Cooperation between Customers and Sirectifier is basically precious in order to solve problems or when a failure occurs. In case of complaint you might have, please forward the following information along with an immediate communication of the failure.
Only upon previous agreement with Sirectifier, you could send a detailed description of failure, indicating operative condition and type of application, number of defective pieces, eventually expressed in percent on whole quantity used. It is mandatory to know the original batch of goods as printed on the capacitor sleeve or labeled on the box, also let us know the delivery date and others relevant data from the billing documents. Samples of defective products should be sent to Sirectifier for analysis, packed in order to prevent additional damages different from the ones detected.
Data sheets specifications are referred to a fairly large number of components and do not constitute a guarantee of characteristics or properties in the legal sense.
However, agreement on these specifications does not mean that the Customer may not claim for replacement of individual defective capacitors within the terms of delivery; Sirectifier will not assume any further liability beyond the replacement of defective capacitors.This applies in particular to any further consequences of component failure as better specified further in this section.
A single failure among a delivered batch of capacitors should not be meaningful of poor reliability of the whole production batch, but should be understood to have reached incidentally the end of life within the failure rate defined for each series type.

NO LIABILITY FOR CONSEQUENTIAL DAMAGES

Sirectifier liability shall be limited to only replacement of repairing of goods, free of charge, after aknowledge of received notification by customer.
Sirectifier is not responsible for any possible damage to persons or things, of any kind, derived from improper installation, use of application of its products.
Also, the producer shall not be liable for any defect due to accident, fair wear and tear, negligent use, tampering, improper handling and shipment, operation and storage or any other default on the parts of any person other then Sirectifier.
To the maximum extent permitted by above statements, in no event shall Sirectifier or its referred dealers be liable for any damages whatsoever (including without limitation, special, incidental, consequential, or indirect damages for personal injury, loss of business profits, business interruption or any pecuniary loss) arising out of the use or inability to use Sirectifier products.
In the case of any product liability claim from third parties against Sirectifier, not falling within Sirectifier liability, Customer or Buyer should hold Sirectifier harmless.