Product Brief

IXYS UK WESTCODE

Capacitors for power electronics

December 2012 Issue 1

IXYS UK can offer a range of power electronics capacitors to suit almost any application from filtering and smoothing DC voltages to GTO/IGBT snubber circuits and medium frequency applications.

Power electronics capacitors can be used for a wide variety of applications, even where extremely non-sinusoidal voltages and pulsed currents are present. Both AC and DC capacitors are available. AC capacitors are periodically recharged during operation; DC capacitors are periodically charged and discharged without recharge.

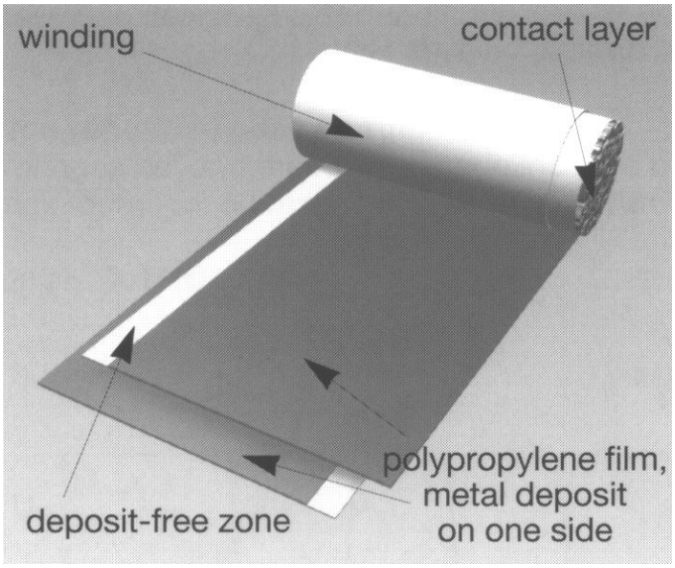
This booklet contains brief details of all of the capacitor types we can offer. For more detailed information please consult the Chippenham factory

Applications and uses

- Filters
- GTO and IGBT snubbers
- Smoothing
- Commutation
- Medium frequency applications
- Induction heating processes

Internal construction

The MKP-type capacitors consist of a low-loss dielectric formed by pure polypropylene film. A thin self-healing mixture of zinc and aluminium is metallized directly on one side of the PP-film under vacuum. In some cases, additional unmetallized layers are added between the metallized ones. The plastic film is wound into stable cylindrical windings on the most modern automated equipment. The ends of the capacitor windings are contacted by spraying with a metal contact layer facilitating a high current load and ensuring a low-inductance connection between the terminals and windings.
Our long-term experience as well as on-going research and improvements in this technology ensure the excellent self-healing characteristics of the dielectric and a long operating life of all our capacitors.
The link between PP-film and zinc contact layer is highly stressed during high surge or rms current and therefore considered very critical for operating life and reliability of the capacitor. By cutting the film for selected types in a wave-like manner, we increase the contact surface between film and zinc layer which substantially reduces this strain.



Impregnants

The use of filling materials in capacitors is necessary in order to insulate the capacitor electrodes from oxygen, humidity and other environmental interference. Without such insulation, the metal coating would corrode, an increasing number of partial discharges would occur, the capacitor would lose more and more of its capacitance and suffer increased dielectric losses, and a reduced operating life.
Therefore, an elaborate vacuum drying procedure is initiated immediately after insertion of the capacitor elements into the aluminium case and biologically degradable plant oil or solidifying PUR resin is introduced. Both protect the winding from environmental influence and provide an extended life-expectancy and stable capacitance.

Nomenclature

All parts are numbered using the following system

Example – E63.S32-105C2W

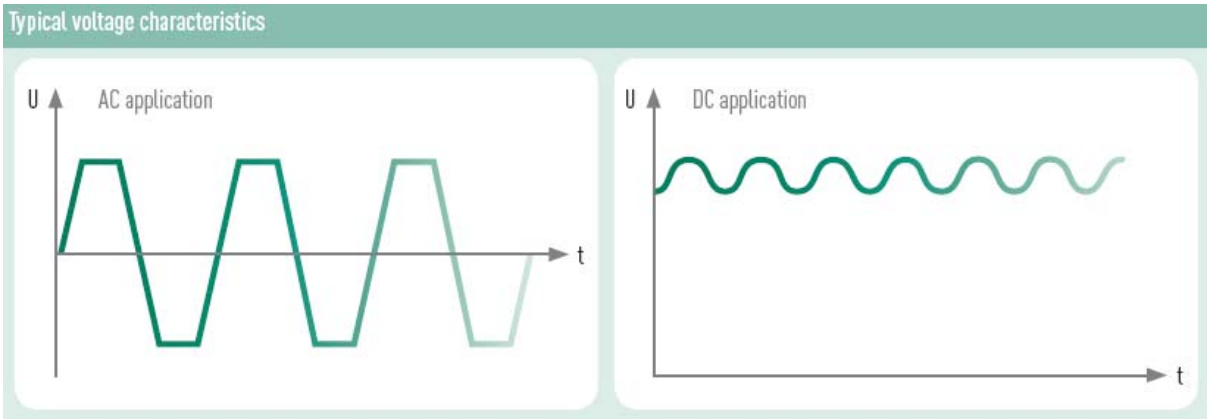
E63 – Capacitor type
S – Diameter (See table below)
32 – length
105 – Capacitance
C2 – mounting/termination arrangement
W – Fixed code

Diameter code table

Code	Diameter (mm)	Code	Diameter (mm)
C	30	**M**	75
D	35	**N**	85
E	40	**P**	95
F	45	**Q**	100
G	50	**R**	116
H	55	**S**	136
K	60	**T**	142
L	65	**U**	172

Capacitor types

- AC/DC capacitors for general use
- Axial low inductance AC/DC capacitors
- Radial low inductance AC/DC capacitors
- GTO Snubber axial low inductance capacitors
- PK-16 low inductance DC capacitors
- SR17TM DC capacitors for traction
- DC capacitors for general use
- 3-phase AC filter capacitors



Damping or Snubber Capacitors (AC) are usually connected in series with a resistor, and are designed for the damping of undesirable voltage spikes caused by the so-called carrier storage effect during the switching of power semiconductors.

Commutation Capacitors (AC) are switched in parallel to a thyristor and designed to quench its conductive state. Since commutating capacitors are periodically and abruptly recharged, the peak current may substantially exceed the rms value. AC capacitors are used in low-detuned or close-tuned filter circuits for filtering or absorbing harmonics. As Pulse Discharge capacitors they are useful in applications with reversing voltages, e.g. in magnetising equipment.

The scope of application for DC capacitors is similarly diverse:

Smoothing Capacitors (DC) serve for the reduction of the AC component of fluctuating DC voltage in, for example;
- power supplies in radio and television technology (transmitters),
- high-voltage testing equipment,
- DC controllers,
- measurement and control technology, and
- cascaded circuits for generation of high DC voltage a.m.o.

Supporting Capacitors, DC-Filter or Buffer Circuit Capacitors (DC) are used for energy storage in intermediate DC circuits, e.g. in frequency converters for poly-phase drives, transistor and thyristor converters. They must be able to absorb and release very high currents within short periods, the peak value of the current being substantially greater than the rms value.

Surge (Pulse) Discharge Capacitors (DC) are capable of supplying or absorbing extreme short-time current surges. They are usually operated in discharge applications with non-reversing voltages, and at low repetition frequencies, e.g. in laser technology and lightning generators.

AC/DC capacitors for general use

E62.XXX 420 – 5000V AC / 700 - 5000V DC

Thanks to their high AC voltage load capacity and outstanding suitability for high rms and surge currents, E62 capacitors are widely used in power electronics applications, e.g. as commutation, supporting, smoothing and surge discharge capacitors. Further in AC filters a.m.o. Filled with liquid resin, these capacitors have a high specific ratio of capacitance to volume. Very good self-healing characteristics and the integrated overpressure protection (break-action mechanism) ensure safe operation and controlled disconnection in the event of overload or failure at the end of operating life.

Capacitance	1µF to 2000µF
Standards	IEC 61071 (optional IEC 61881)
Can	Aluminium. 30mm to 136mm Diameter
Mounting Position	terminals pointing upwards
Filling Material	Liquid, based on vegetable oil, non-PCB
Internal Protection	Break-action mechanism
Fire Load	40 MJ/kg
C_N Tolerance	±10% (optional ±5%)
Insulation Strength	C x R_{is} 5000 s
tanδ_0	2 x 10^{-4}
Operating Temperatures	Θ_{min} to Θ_{min} -25°C to +85°C
	$\Theta_{HOTSPOT} \leq 85°C$
Storing Temperature	-40°C to +85°C
Reference Service Life	100,000 Hours at $\Theta_{HOTSPOT} \leq 70°C$

B2

C6

CD

CR

E1

G1

D1

E2

K1

D2

E4

M1/L1

Axial low inductance DC capacitors

E51.XXX **2300 – 5000V DC**

This series of capacitors is primarily suitable for use in low–inductance buffer circuits with higher voltages as well as in discharge circuits, and they are suitable for use in power electronics in general. Despite the high voltage rating, they are manufactured in dry technology and without expensive bushings. Inside the can made of self-extinguishing plastic, the capacitor element is enclosed in solid resin (PUR). Connection is made through robust terminals with internal thread. Along with their very good ratio of capacitance to volume, these capacitors do also have high pulse strength and very good self-healing characteristics without loss of capacitance.

Capacitance	0.5µF to 667µF
Standards	IEC 61071 (optional IEC 61881)
Can	Plastic (UL94:V0). 90mm to 140mm diameter
Mounting Position	Optional
Filling Material	Solid, based on vegetable oil, non-PCB
Internal Protection	None
Fire Load	40 MJ/kg
C_N Tolerance	±10% (optional ±5%)
Insulation Strength	C x R_{is} 5000 s
$\tan\delta_0$	2 x 10^{-4}
Operating Temperatures	Θ_{min} to Θ_{min} -25°C to +70°C $\Theta_{HOTSPOT} \leq$ 70°C
Storing Temperature	-40°C to +85°C
Reference Service Life	100,000 Hours at $\Theta_{HOTSPOT} \leq$ 70°C

R

Radial low inductance DC capacitors

E53.XXX H 500 – 1600V DC

E53 capacitors have a particularly low series resistance and high pulse strength; they are especially suited for low-inductance buffer circuits with high rms currents. Along with their very good ratio of capacitance to volume, these capacitors do also have very good self-healing characteristics without loss of capacitance. Connection is made through robust studs with M8 thread. Two brackets at the base of the can make for convenient mounting.

Capacitance	30µF to 400µF
Standards	IEC 61071 (optional IEC 61881)
Can	Plastic (UL94:V0). 55mm to 115mm diameter
Mounting Position	Optional
Filling Material	Solid, based on vegetable oil, non-PCB
Internal Protection	None
Fire Load	40 MJ/kg
C_N Tolerance	±10% (optional ±5%)
Insulation Strength	C x R_{is} 5000 s
tanδ_0	2 x 10^{-4}
Operating Temperatures	Θ_{min} to Θ_{min} -25°C to +70°C $\Theta_{HOTSPOT} \leq$ 70°C
Storing Temperature	-40°C to +85°C
Reference Service Life	100,000 Hours at $\Theta_{HOTSPOT} \leq$ 70°C

H1

T1

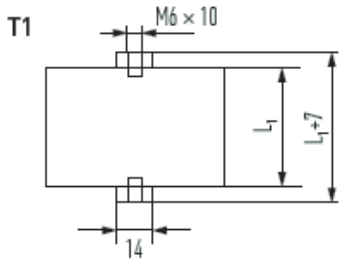
GTO Snubber axial low inductance capacitors

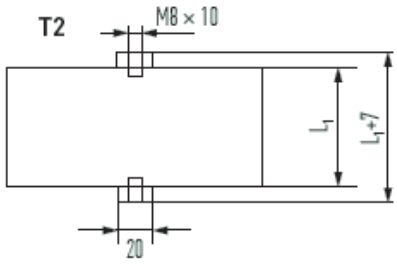
E51.XXX **2300 – 5000V DC**

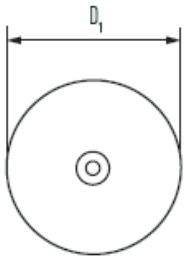
IXYS UK supplies a broad range of capacitors suitable for GTO snubber circuits. These capacitors have a low series resistance and high pulse strength; they also have very good self-healing characteristics without loss of capacitance.
These capacitors consist of a flame retardant plastic can filled with solid resin to ensure reliable operation even under the most extreme environmental conditions.

Capacitance	1µF to 250µF
Standards	IEC 61071 (optional IEC 61881)
Can	Plastic (UL94:V0). 90mm to 140mm diameter
Mounting Position	Optional
Filling Material	Solid, based on vegetable oil, non-PCB
Internal Protection	None
Fire Load	40 MJ/kg
C_N Tolerance	±10% (optional ±5%)
Insulation Strength	C x R_{is} 5000 s
tanδ_0	2 x 10^{-4}
Operating Temperatures	Θ_{min} to Θ_{min} -25°C to +70°C $\Theta_{HOTSPOT} \leq$ 70°C
Storing Temperature	-40°C to +85°C
Reference Service Life	100,000 Hours at $\Theta_{HOTSPOT} \leq$ 70°C

T1/T2







PK16 – Low inductance DC capacitors

E50.XXX PK16 600-2600V

The modular PK16 Capacitor can be universally used for the assembly of low-inductance DC buffer circuits and DC filters; with its high energy density it can replace banks of series-connected electrolytic capacitors as well as large film capacitors in rectangular cases. Thanks to its compact cylindrical aluminium (N1/N5) or plastic (N4) can design this capacitor is ideal for both the electrical and mechanical requirements of high-speed IGBT converters. Its robust terminals and the robust fixing stud allow for very simple and reliable mounting that unites lowest inductance and highest current strength. The particularly large clearance and creepage distances make this design suitable for a wide range of operating voltages. As a result existing standard converter concepts can easily be adapted to new applications without having to change the principal construction and to re-approve the entire system.

Capacitance	60µF to 3600µF
Standards	IEC 61071 (optional IEC 61881)
Can	Aluminium/plastic aluminium (UL94:V0). 85mm to 136mm diameter
Mounting Position	Optional
Filling Material	Solid, based on vegetable oil, non-PCB
Internal Protection	None
Fire Load	40 MJ/kg
C_N Tolerance	±10% (optional ±5%)
Insulation Strength	C x R_{is} 5000 s
tanδ_0	2 x 10^{-4}
Operating Temperatures	Θ_{min} to Θ_{min} -25°C to +85°C
	$\Theta_{HOTSPOT} \leq 85°C$
Storing Temperature	-40°C to +85°C
Reference Service Life	100,000 Hours at $\Theta_{HOTSPOT} \leq 70°C$

N4

NZ

NT - 85ø

NT - 116ø

NT - 136ø

SR17™ – DC capacitors for traction

E50.UXX SR17™ 1800-2650V DC

The capacitors of our SR17™ series were developed especially for the maintenance of older traction converters. As a result of on-going development of existing, well proven MKP technologies, engineers have managed to place self-healing DC Capacitors, with very high density and stability of capacitance, into a can with dimensions identical to those of traditionally used metallized paper capacitors (MP). Moreover, the low-loss polypropylene dielectric permits a far higher AC ripple load than with conventional MP capacitors.

As opposed to the oil filled MP models, the new SR17™ are filled with an eco-friendly solid resin, which not only makes them safe against liquid leakage but also insensitive to shocks and vibrations. The same applies to their robust plastic insulators.

Other ratings and designs are available upon request.

Capacitance	280µF to 1300µF
Standards	IEC 61071 (optional IEC 61881)
Can	Stainless Steel. 142mm to 172mm diameter
Mounting Position	Optional
Filling Material	Solid, no liquids (PUR, non-PCB)
Internal Protection	None
Fire Load	35 MJ/kg
C_N Tolerance	±10% (optional ±5%)
$\tan\delta_0$	2×10^{-4}
Operating Temperatures	Θ_{min} to Θ_{min} -40°C to +70°C (Short term load: 85°C) $\Theta_{HOTSPOT} \leq 70°C$
Storing Temperature	-40°C to +85°C
Reference Service Life	100,000 Hours at $\Theta_{HOTSPOT} \leq 70°C$

F

DC capacitors for general use

E63.XXX **800 – 6300V DC**

The special kind of films and coatings used in our E63 capacitors make them interesting particularly for applications with high rms currents, e.g. as smoothing or supporting capacitors in buffer storage circuits. Filled with liquid resin, these capacitors have a high specific ratio of capacitance to volume. At the same time, they are extremely overvoltage proof. Very good self-healing characteristics and the integrated overpressure protection (break-action mechanism) ensure safe operation and controlled disconnection in the event of overload or failure at the end of operating life.

Capacitance	6.3µF to 500µF
Standards	IEC 61071 (optional IEC 61881)
Can	Aluminium. 50mm to 136mm diameter
Mounting Position	Terminals pointing upwards
Filling Material	Liquid, based on vegetable oil, non-PCB
Internal Protection	Break-action Mechanism
Fire Load	40 MJ/kg
C_N Tolerance	±10% (optional ±5%)
Insulation Strength	C x R_{is} 5000 s
tanδ_0	2 x 10^{-4}
Operating Temperatures	Θ_{min} to Θ_{min} -25°C to +70°C $\Theta_{HOTSPOT} \leq$ 70°C
Storing Temperature	-40°C to +85°C
Reference Service Life	100,000 Hours at $\Theta_{HOTSPOT} \leq$ 70°C

CR

D1

G1

3-phase AC filter capacitors

E62.XXX **640 – 1700V AC**

These capacitors, which have been designed especially for harmonic filtering in three-phase mains, stand out by their high AC voltage load capacity and suitability for high rms and surge currents. Thanks to their construction they have a very low series resistance and a small self-inductance. The three capacitor elements are connected in delta internally; liquid resin filling services for improved head dissipation. The finger-proof screw terminals of designs L and M (rated IP20) make for simpler connections. Very good self-healing characteristics and the integrated overpressure protection (break-action mechanism) ensure safe operation and controlled disconnection in the event of overload or failure at the end of operating life. The standard design has a capacitance tolerance of ± 5%. Tighter tolerances are available on request.

Capacitance	3x4µF to 3x200µF
Standards	IEC 61071 (optional IEC 61881, IEC 60831)
Can	Aluminium. 50mm to 136mm diameter
Mounting Position	Terminals pointing upwards
Filling Material	Liquid, based on vegetable oil, non-PCB
Internal Protection	Break-action Mechanism (BAM)
Fire Load	40 MJ/kg
C_N Tolerance	±5%
Insulation Strength	C x R_{is} 5000 s
tanδ_0	2 x 10^{-4}
Operating Temperatures	Θ_{min} to Θ_{min} -40°C to +85°C $\Theta_{HOTSPOT} \leq$ 85°C
Storing Temperature	-40°C to +85°C
Reference Service Life	100,000 Hours at $\Theta_{HOTSPOT} \leq$ 70°C

D3

L3/M3

Customer specific large capacitance AC and DC capacitors

In our E59 customer specific range, we can realize voltages up to 10kV AC and 25kV DC; the exact capacitance rating depends on the user's specific requirements.

Instead of flat pack windings, our capacitance is formed by homogenous cylindrical windings, avoiding the mechanical stress and instabilities at the edges of flat packs. The capacitors are housed in aluminium or steel cases and filled with solid resin which makes them absolutely dry and leakage proof. Their shape and size, as well as terminals and fixing can be adapted to the individual requirements of the customer.

Special terminals allow for substantial reduction of the self-inductance which can be further minimized by construction adjustments if required. At the same time, they are extremely overvoltage proof. They are especially suited for DC link circuits of converters, tuned filter circuits and such like.

Even at high temperatures, and after numerous self-healing dielectric breakdowns, the capacitance remains stable.

An irreversible pressure switch can be used for external monitoring of the internal pressure. It signals 0.5 atmospheres of pressure rise by closing (or optionally: opening) the contact, allowing for safe external disconnection in the event of overload or failure at the end of operating life.

Our highly skilled and experienced technical team are on hand to assist in designing a capacitor to suit your requirements

Maximum electrical ratings

Rated voltage:	**25kV DC/10kV AC**
Insulation level:	**28/75kV**
RMS current:	**950A**
Surge current	**700kA**

Capacitor E59.A66-10501W
1000µF, 3kV DC
Custom designed for use in IGBT switching circuit

Certificate FM26085

IXYS UK Westcode Ltd's BS EN ISO9001 quality system is registered by BSI

IXYS UK WESTCODE
Langley Park Way
Chippenham, SN15 1GE
United Kingdom
Tel: +44 (0)1249 444524
Fax: +44 (0)1249 659448
E-mail: sales@ixysuk.net

IXYS
Edisonstr. 15
D-68623 Lampertheim
Germany
Tel: +49 (0) 6206 503-0
Fax: +44 (0) 6206 503627
E-mail: marcom@ixys.de

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