CAPACITORS FOR INVERTERS
What is an inverter

- An electronic device or circuitry that changes direct current (DC) to alternating current (AC)
  - Applications where DC is converted to AC
    - Solar
      - DC from solar panels converted to AC
    - Uninterruptible Power Supplies (UPS)
      - DC from storage batteries
  - Applications where AC is first converted to DC then back to AC
    - Wind turbine
    - Variable Frequency Drive (VFD)
      - Motor speed control
    - Induction heating
    - HVDC power transmission
SOLAR INVERTER

DC Vin → INPUT FILTER → DC TO DC BOOST → DC LINK → DC TO AC CONVERSION → L/C OUTPUT HARMONIC FILTER → LOAD

DC

BATTERIES / SUPERCAPS

CONTROL CIRCUIT

DC Ac

CHARGE

SCREW TERMINAL, POWER FILM, & PLUG IN

SNUBBER

SF, PC, PFCH, & ACF

CDE

CORNEILL DUBLIER

ENERGIZING IDEAS
Solar Inverter technologies

- **String inverter**
  - PV panels provide DC to inverter
  - Inverter centrally located
  - $$

- **Micro inverter**
  - Converts DC to AC at the PV panel
  - $$$

- **Power optimizer**
  - PV panels provide “conditioned” DC power to inverter
  - $$

energysage.com/solar
Guts of a Sunny Boy 3000 inverter

- DC link
- Input filter
- Output filter
- Input DC
- Output AC
Inside a large solar grid tie inverter

AC Filter bank

DC Bus Filter bank
UNINTERRUPTIBLE POWER SUPPLY - UPS

INPUT FILTER

AC TO DC RECTIFIER

DC LINK

DC TO AC CONVERSION

L/C OUTPUT HARMONIC FILTER

LINE

∽

AC

∽

LOAD

∽

AC

BATTERIES / SUPERCAPS

CONTROL CIRCUIT

SF, PC, PFCH, & ACF

SNUBBER

SF, PC, PFCH, & ACF

SCREW TERMINAL, POWER FILM, & PLUG IN
UNINTERRUPTIBLE POWER SUPPLY – UPS

- Types
  - Offline / Standby
  - Line interactive
  - Standby

- Power source
  - Batteries
  - Rotary (flywheel)
Inside a large UPS system

- DC link
- Control circuit
- Input filter caps
- Harmonic filter caps
VARIABLE FREQUENCY DRIVE - VFD

INVERTER CONTROL CIRCUIT
SPEED CONTROL CIRCUIT

LINE
~

INPUT FILTER

AC TO DC RECTIFIER

DC LINK

DC TO AC CONVERSION

L/C OUTPUT HARMONIC FILTER

MOTOR
~

MOTOR SPEED CONTROLLED BY VARYING FREQUENCY

AC

INVERTER CONTROL CIRCUIT
SPEED CONTROL CIRCUIT

SF, PC, PFCH, & ACF

SCREW TERMINAL, POWER FILM, & PLUG IN

SF, PC, PFCH, & ACF

SNUBBER
CAPACITORS FOR INVERTERS

**Power Film DC Link**
CDE offers the most advanced metallized film technology for long life and high reliability in DC link applications. Available in a variety of package styles, our technology combines high capacitance and very high ripple current capability needed for today's inverter designs for wind, solar, fuel cells, UPS systems, medical power and more.

**Screw Terminal and Snap-in Capacitors**
CDE is the industry's leading manufacturer of screw terminals aluminum electrolytic capacitors for inverter applications. We excel at designing high ripple current screw terminal and snap-in capacitors for critical power electronics applications.

**IGBT Snubber Modules**
Low inductance snubbers protect IGBT modules from overvoltage transients. Choose from our board-mount or direct-mount styles for maximum protection.

**AC Harmonic Filter Capacitors**
Choose from single phase (Type PC) and 3-Phase (Type PFCH) fluid filled AC capacitors designed for filtering harmonics at the input or inverter output. Oil filled types contain an environmentally friendly fluid and their built in safety pressure interrupter ensures open circuit failure mode at end of life. Use axial type ACF for the same high performance filtering where dry construction is preferred.
PRODUCTS FOR THE INVERTER

DC Link Capacitors:
Used for bulk storage and ripple filtering

Aluminum Electrolytic

OR

Power Film
INVERTER DC LINK APPLICATION

- 60 Hz AC is rectified to “lumpy” DC (120 Hz)
- A smoothing - DC Link capacitor is placed between the rectifier and the inverter switch to smooth the voltage
- DC Link decouples the input from the output
- DC Link must also handle high frequency ripple resulting from inverter switching
## DC LINK CAPACITORS: Film Versus Aluminum

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>ALUMINUM</th>
<th>FILM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacitance</td>
<td>High (3X Film)</td>
<td>Medium</td>
</tr>
<tr>
<td>ESR</td>
<td>30 mΩ Typical</td>
<td>2.0 mΩ Typical</td>
</tr>
<tr>
<td>Operating Temp Rating (with full ripple)</td>
<td>105°C Max</td>
<td>85°C Max</td>
</tr>
<tr>
<td>Ripple Current (1000 µF, 500 Vdc) @ 85°C</td>
<td>6.3 A</td>
<td>3X-4X aluminum</td>
</tr>
<tr>
<td>Voltage</td>
<td>600 Vdc</td>
<td>High Voltage. Eliminates the need for capacitors in series and balancing resistors.</td>
</tr>
<tr>
<td>Resistance to Overvoltage</td>
<td>50 V surge</td>
<td>1.5 X rated for 10 s</td>
</tr>
<tr>
<td>Failure Mode</td>
<td>rupture</td>
<td>fail open mode</td>
</tr>
<tr>
<td>Construction</td>
<td>Liquid Electrolyte</td>
<td>Dry, no liquid electrolyte</td>
</tr>
<tr>
<td>Polarity</td>
<td>Must observe polarity</td>
<td>Non Polar</td>
</tr>
</tbody>
</table>
ALUMINUM ELECTROLYTIC CAPACITORS

More Capacitance for the Buck
ALUMINUM ELECTROLYTIC ADVANTAGE

• The high value capacitor choice
• Typically last more than 10 years
• Lowest cost dielectric for high capacitance and energy storage
• 4 to 10 times the capacitance per dollar of film capacitors
• Great for power electronics bus capacitors up to 550 Vdc
TYPICAL HIGH- RIPPLE LIFETIMES

4700 μF 450 V Comparison
60 °C, 12 A @ 120 Hz, 400 V

<table>
<thead>
<tr>
<th>Type</th>
<th>Case Size (in)</th>
<th>Life (years)</th>
<th>Price (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCMC</td>
<td>3x5 1/8</td>
<td>4.6</td>
<td>100</td>
</tr>
<tr>
<td>500C</td>
<td>3x5 5/8</td>
<td>9.5</td>
<td>110</td>
</tr>
<tr>
<td>520C</td>
<td>3x5 5/8</td>
<td>23.7</td>
<td>130</td>
</tr>
<tr>
<td>550C</td>
<td>3 1/2x5 5/8</td>
<td>48.8</td>
<td>142</td>
</tr>
</tbody>
</table>
CDE SCREW TERMINAL COMPETITIVE STRENGTHS

• Extended cathode for cooler operation
• Life and Temperature calculators available at: http://www.cde.com/STapplet/CDE_Applet_Intro.html
• Application engineers, FAEs available to assist with optimal capacitor selection
• Custom designs to achieve desired performance (life and reliability)
• Thermocouples can be provided to allow for heat rise measurements
SNAP-IN CAPACITORS, HIGH RIPPLE, LONG-LIFE

Broad, power-focused selection including:

- High voltage: up to 600 Vdc
- Long life: 8,000 hrs
- High ripple current: Up to 20 Arms
CDE Snap-In Competitive Advantages

• Offering focused on high performance, high ripple current, long life
• Life and Temperature calculators available at: http://www.cde.com/Snapplet/Snapplet_CDE_Applet_Intro.html
• Application engineers, FAEs available to assist with optimal capacitor selection
POWER ALUMINUM ELECTROLYTIC COMPETITORS
POWER FILM: DC LINK CAPACITORS

More Ripple Current for the Buck
POWER DC FILM ADVANTAGE

- The high ripple current capacitor choice
- Higher voltage than aluminum electrolytics - up to 100,000 Vdc
- No need to place capacitors in series
  - Eliminates need for balancing resistors
- Dry construction – no electrolyte
- Non-polar
- Self healing – open circuit failure mode
FILM CAPACITORS
FOR DC LINK, TYPE 947D

High Current, High Capacitance for Inverter Applications

Type 947D series uses the most advanced metallized film technology for long life and high reliability in DC Link applications. This series combines high capacitance and very high ripple current capability needed for today’s inverter designs for wind, solar, fuel cells, UPS systems and more.

Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacitance Range</td>
<td>130 to 1500 µF</td>
</tr>
<tr>
<td>Capacitance Tolerance</td>
<td>±10% standard</td>
</tr>
<tr>
<td>Rated Voltage</td>
<td>900 to 1300 Vdc</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>-45 °C to 85 °C (ambient)</td>
</tr>
<tr>
<td>Maximum rms Current</td>
<td>see data tables</td>
</tr>
<tr>
<td>Maximum rms Voltage</td>
<td>230 Vac</td>
</tr>
<tr>
<td>Test Voltage between Terminals @ 25 °C</td>
<td>150% rated DC voltage for 10 s</td>
</tr>
<tr>
<td>Test Voltage between Terminals and Case @ 25 °C</td>
<td>4 kVac @ 50/60 Hz for 10 s</td>
</tr>
<tr>
<td>Life Test</td>
<td>7000 h @ 85 °C, rated voltage</td>
</tr>
<tr>
<td>Life Expectancy</td>
<td>350,000 h @ 60 °C Core, rated voltage</td>
</tr>
<tr>
<td>RoHS Compliant</td>
<td></td>
</tr>
</tbody>
</table>
FILM CAPACITORS FOR DC LINK, TYPE 944U
“Hockey Puck” Style

High Current, Low Profile for Inverter Applications

Type 944U is specifically designed for use in high power DC filtering applications. The low inductance internal construction utilizes low loss metallized polypropylene for high ripple current capability. Male or female terminal options offer design flexibility in a rugged UL 94VO rated flame retardant plastic case and resin fill. High current ratings and robust mounting flanges make the 944U suited for inverter applications in electric vehicle power inverters, wind power inverters and motor drives.

Highlights
- Low Inductance
- Low Profile
- Low ESR
- High Ripple Current
- High Voltage Ratings

Specifications

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacitance Range</td>
<td>33 to 220 µF</td>
</tr>
<tr>
<td>Capacitance Tolerance</td>
<td>±10% standard</td>
</tr>
<tr>
<td>Rated Voltage</td>
<td>800 to 1400 Vdc</td>
</tr>
<tr>
<td>Operating Temperature Range with Ripple</td>
<td>-40 °C to 85 °C</td>
</tr>
<tr>
<td>Maximum rms Current</td>
<td>74A @ 55 °C</td>
</tr>
<tr>
<td>Maximum rms Voltage</td>
<td>230 Vac</td>
</tr>
<tr>
<td>Test Voltage between Terminal @ 25°C</td>
<td>150% rated DC voltage for 10 s</td>
</tr>
<tr>
<td>Test Voltage between Terminals &amp; Case @ 25°C</td>
<td>4 kVac @ 50/60 Hz for 60 s</td>
</tr>
<tr>
<td>Life Test</td>
<td>5000 h @ 85 °C, rated voltage</td>
</tr>
</tbody>
</table>

RoHS Compliant
FILM CAPACITORS
FOR DC LINK, TYPE UNL
Board Mount DC Link

High Capacitance, High Current, Board Mount

constructed using a low-loss polypropylene film, the UNL series offers high ripple current capabilities and high capacitance values making them ideal for electrolytic bank replacement and high ripple current applications.

Highlights

Advantages over Electrolytics
- Exceptionally low ESR
- Up to 10 times the ripple current
- Non-polar
- Higher voltage ratings
- Dry construction - no electrolyte
- Improved reliability

Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacitance Range</td>
<td>4.7 to 100 μF</td>
</tr>
<tr>
<td>Capacitance Tolerance</td>
<td>±10% (K) standard, ±5% (J) optional</td>
</tr>
<tr>
<td>Rated Voltage</td>
<td>400 to 1500 Vdc</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>-55 ºC to 105 ºC*</td>
</tr>
<tr>
<td></td>
<td>*Full rated voltage at 85 ºC - derate linearly to 50% rated at 105 ºC</td>
</tr>
<tr>
<td>Maximum rms Current</td>
<td>Check tables for values</td>
</tr>
<tr>
<td>Test Voltage between Terminals @ 25 ºC</td>
<td>125% rated DC voltage for 60 s</td>
</tr>
<tr>
<td>Test Voltage between Terminals &amp; Case @ 25 ºC</td>
<td>3 kVac @ 50/60 Hz for 60 s</td>
</tr>
<tr>
<td>Life Test</td>
<td>2,000 h @ 85 ºC, 125% rated voltage</td>
</tr>
<tr>
<td>Life Expectancy</td>
<td>60,000 h @ 70 ºC, rated voltage</td>
</tr>
</tbody>
</table>

RoHS Compliant
FILM CAPACITORS
FOR DC LINK, TYPE BLH

Board Mount DC Link for Harsh Environments

85 °C / 85% RH, 1500h @ Vr, AEC-Q200 Qualified

Type BLH DC Link capacitors use the most advanced construction and technology to meet the challenges of harsh environments. Tested for 1,500-hour at 85 °C / 85% relative humidity with rated voltage applied (50% greater than competitive THB test life). The series is qualified to automotive-grade electrical and mechanical testing per standard AEC-Q200.

Specifications

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacitance Range</td>
<td>1 to 170 µF</td>
</tr>
<tr>
<td>Capacitance Tolerance</td>
<td>±10% standard, ±5% optional</td>
</tr>
<tr>
<td>Rated Voltage</td>
<td>450 to 1200 Vdc</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>-40 °C to 105 °C (&gt;85 °C derate voltage 1.35% per °C)</td>
</tr>
<tr>
<td>Maximum rms Current</td>
<td>see data tables</td>
</tr>
<tr>
<td>Maximum rms Voltage</td>
<td>230 Vac</td>
</tr>
<tr>
<td>Test Voltage between Terminals @ 25 °C</td>
<td>150% rated DC voltage for 10 s</td>
</tr>
<tr>
<td>Test Voltage between Terminals and Case @ 25°C</td>
<td>3 kVac @ 50/60 Hz for 10 s</td>
</tr>
<tr>
<td>Insulation Resistance</td>
<td>≥30,000 MΩxµF @ 100 Vdc 25 °C after 1 minute</td>
</tr>
<tr>
<td>Life Expectancy</td>
<td>100,000 h @ 70°C hot spot, rated voltage</td>
</tr>
<tr>
<td>THB Rating</td>
<td>85 °C / 85% RH - rated voltage - 1500 h</td>
</tr>
<tr>
<td>Reference Standards</td>
<td>IEC 61071, AEC-Q200 qualified (as noted)</td>
</tr>
</tbody>
</table>
Custom DC Link, Large Case

Highlighted Capabilities

- Capacitance: up to 50,000 uF
- Voltage (DC): up to 100,000 VDC
- Current (Peak): up to 100,000 amp
- Inductance (nH): As low as 25nH
- Energy Density: Up to 3 J/cc
- Metal cases or isolated plastic cases available
- Water-cooled construction available
- Wide variety of terminations available
CDE DC LINK COMPETITIVE ADVANTAGES

- Application engineers, FAEs available to assist with optimal capacitor selection/design
- Extensive custom design and manufacturing capability to optimize performance, fit, reduce size and cost.
- Thermocouples can be provided to allow for heat rise measurements
IGBT SNUBBERS
WHAT’S AN IGBT

- IGBT – Insulated Gate Bipolar Transistor
- Power switch of choice for most inverter applications
The word *snub* means to rebuff, spurn, repulse, give someone the cold shoulder, shortened at the end.

**IGBT Snubber:** A device used to protect IGBT switches from overvoltage during turnoff.

During turn off, a voltage transient appears across the IGBT that may exceed its voltage rating. The voltage transient is proportional to the amount of stray inductance (L) and the rate in change in current with time.

\[ V_{\text{transient}} = -L \frac{di}{dt} \]
WHAT’S AN IGBT SNUBBER

IGBT snubbers are designed to protect IGBTs by reducing the voltage spike across the IGBT during turn-off.

A conservative rule of thumb is to use 1µF of capacitance for every 100A of IGBT.
IGBT SNUBBERS

**Discrete Axial Leaded Snubbers**
- High dV/dt – 940C, 941C PPA, PPS
- Very High dV/dt: 942C, 943C

**Radial Leaded Box Snubbers**
- High dV/dt: PSB

**Direct Mount Snubbers**
- Capacitor Type: SCD, PMB, PMC
- Clamp Type w diode: SCM
- Dual Clamp Type: SCC
CDE’S IGBT SNUBBER COMPETITIVE ADVANTAGE

• Broadest standard offering to accommodate most IGBT manufacturers’ lead spacing
• Application engineers available to assist with optimal capacitor selection and design
• Custom designs to optimize performance
DC POWER FILM COMPETITORS
AC HARMONIC FILTERING

Where/Why are AC capacitors used

11/18/2014
WHY IS HARMONIC FILTERING NECESSARY

• Clean power required for electrical equipment to function properly
• Inverter switching schemes cause harmonic distortion of the input / output power
• Filters required to “clean” the power
Inverter IGBT switching result in harmonics that are odd numbered multiples of the fundamental switching frequency ($3^{\text{rd}}$, $5^{\text{th}}$, $7^{\text{th}}$, etc.). These harmonics combine with the fundamental frequency and cause distortion of the waveform.
HOW DO AC OUTPUT FILTERS WORK

Block diagram of the DC link and filter components

Grid tie inverters require filter components in two key areas: The DC bus and AC output.

The AC output filter is a low pass filter (LPF) that blocks high frequency PWM currents generated by the inverter. Three phase inductors and capacitors form the low pass filters. Resonant filters are specifically designed (inductance and capacitance) to “tune” out the harmonic frequencies.
Type PFCH, 3-Phase AC Power Harmonic Filter Capacitors

Type PFCH 3-phase series capacitors are designed to filter undesirable harmonics at the AC output of large inverter systems. Each PFCH capacitor is made with three self-healing metallized polypropylene windings, connected in delta, enclosed in a cylindrical aluminum case and filled with an environmentally friendly fluid. Typical applications include wind turbine PFC controllers, solar inverter output filters, and power line conditioning.

**Highlights**
- For 3-phase AC power harmonic filtering
- Delta connected
- Discharge resistors included
- UL810 approved internal pressure interrupter

**Specifications**

<table>
<thead>
<tr>
<th>Capacitance Tolerance</th>
<th>0 to +10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Frequency (f_r)</td>
<td>50 Hz and 60 Hz</td>
</tr>
<tr>
<td>Rated AC Voltages (V_n)</td>
<td>240 Vac, 480 Vac, 600 Vac</td>
</tr>
<tr>
<td>Operating Temperature Range with Ripple</td>
<td>-40 °C to +55 °C</td>
</tr>
<tr>
<td>kvar Range</td>
<td>0.5 kvar to 30.2 kvar</td>
</tr>
<tr>
<td>Maximum Permissible Voltage (V_{max})</td>
<td>110% of rated rms voltage</td>
</tr>
<tr>
<td></td>
<td>120% of rated peak voltage ((1.2 \times 2\times V_{rms}))</td>
</tr>
<tr>
<td>Internal Connection</td>
<td>Delta (Δ)</td>
</tr>
<tr>
<td>Maximum Permissible Current (I_{max})</td>
<td>135% of nominal rms current based on rated kvar and rated voltage - (up to 150% of (I_r) including combined effects of harmonics, over voltages and capacitances, tolerance)</td>
</tr>
<tr>
<td>Life</td>
<td>60,000 h w/94% survival rate</td>
</tr>
<tr>
<td>FIT (Failure In Time)</td>
<td>(\leq 300 \times 10^6) component h</td>
</tr>
<tr>
<td>Maximum Short Circuit Current</td>
<td>10 kA (according to UL 810)</td>
</tr>
<tr>
<td>Mechanical and Electrical Safety</td>
<td>Pressure Interrupter (PI) disengages all 3 phases in the event of capacitor end of life or overload</td>
</tr>
<tr>
<td>Discharge Resistor Time</td>
<td>(\leq 60) seconds (\leq 50) V for 600 V or less; over 600 V (\leq 5) minutes</td>
</tr>
</tbody>
</table>
Type PC Power Conversion Capacitors

Type PC capacitors are designed to meet the demands of filter applications rich in system total harmonic distortion (THD). This series has a dual protection system utilizing self healing metallized polypropylene and a mechanical pressure interrupter to ensure a safe open circuit mode in the event of overload or end of life. (*)

**Highlights**
- Uninterruptable power supplies (UPS)
- AC Tuned filters (harmonic reduction)
- AC Input filtering
- Line conditioning
- Noise suppression
- Variable speed drives
- Wind turbine motoring

**Specifications**

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacitance Range</td>
<td>20 µF to 125 µF</td>
</tr>
<tr>
<td>Capacitance Tolerance</td>
<td>±5% Standard, ±10%, ±6 and ±3% available</td>
</tr>
<tr>
<td>Rated Voltage</td>
<td>300 Vac, 500 Vac, 700 Vac</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>−40 °C to +70 °C</td>
</tr>
</tbody>
</table>
| Maximum Permissible Voltage (Vmax)    | 110% of rated rms voltage
                                             120% of rated peak voltage (1.2 x \( \sqrt{2} \) x Vrms)               |
| Maximum Permissible Current (Imax)    | 135% of nominal rms current based on the combined effects of harmonics, over voltages capacitances and tolerances |
| Terminations                          | M6x1 Threaded tinplated brass terminals standard, other sizes available |
| Maximum Rated Current (Irms)          | 70A (Limited by the terminals)                                         |
| Service Life Objective                | 60,000 h w/94% survival rate                                           |
| FIT (Failure In Time)                 | ≤300 x 10^9 component h                                                |
| Maximum Short Circuit Current (available fault current) | 10 kA (according to UL 810)                                           |
| Notes                                 | Additional ratings, size and terminals are available upon request.      |
Custom, AC Harmonic Filter Capacitors, Large Welded Case

Highlighted Capabilities

- KVAR up to 15,000
- Vrms up to 8,500
- Irms up to 5,000
- Frequency up to 500 KHz
- Available in drawn or custom welded metal cases
- Water-cooled construction available
- Wide variety of terminations available
CDE’s AC HARMONIC FILTER COMPETITIVE ADVANTAGE

• We offer both oil-filled and dry capacitor solutions.
• Application engineers available to assist with optimal capacitor selection and design
• Extensive custom design and manufacturing capability to optimize performance, fit, reduce size and cost.
AC HARMONIC FILTER COMPETITORS

ASC Capacitors
Electronic Concepts
Electronicon
always in charge
TDK EPCOS
Vishay
AVX
A Kyocera Group Company
CDE Cornell Dubilier
INVERTER AT A GLANCE

CDE at a Glance
Capacitors for Inverter Applications

Cornell Dubilier Electronics excels with leading edge aluminum electrolytic and film dielectric capacitors designed to solve the unique demands presented within each of the electronic stages of power inverters. Among CDE’s 35,000 worldwide customers are leading manufacturers of welders, UPS systems, motor drives, medical imaging, medical lasers, semiconductor processing, and inverters for distributed/renewable power.

Power Film DC Link
Screw Terminal and Snap-In Capacitors
IGBT Snubber Modules
AC Harmonic Filter Capacitors

CDE offers the most advanced metalized film technology for long life and high reliability in DC link applications. Available in a variety of package styles, our technology combines high capacitance and very high ripple current capability needed for today’s inverter designs for wind, solar, fuel cells, UPS systems, medical power and more.

Low inductance snubbers protect IGBT modules from overvoltage transients. Choose from our board-mount or direct-mount styles for maximum protection.

Choose from single phase (Type PFCI) and 3-Phase (Type PFCII) fluid filled AC capacitors designed for filtering harmonics at the input or inverter output. Oil filled types contain an environmentally friendly fluid and their built in safety pressure interrupter ensures open circuit failure mode at end of life. Use axial type AC for the same high performance filtering where dry construction is preferred.

Contact us for your next design:
Aluminum Electrolytics - 140 Technology Place, Liberty, SC 29657
703-308-3000, Fax (703) 308-3001
Email: cde@cornell.com

Contact us for your next design:
Film & Mica - 1605 E. Rodney French Blvd., New Bedford, MA 02744
(508) 996-8561, Fax (508) 996-8390
Email: cdlib@cd.com

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Thank You!