Lightning and Surge Protection for Wind Power Systems
Strikesorb® Provides Unparalleled Lightning and Surge Protection for Wind Turbine Systems

As more wind farms are built, turbine manufacturers and wind farm operators are becoming increasingly aware of the operational threat posed by lightning strikes.

Lightning: A real challenge for turbine electrical systems

In the landscape surrounding a wind farm, wind turbines are typically the tallest structures. Given their height and exposure to the elements it’s expected that they will experience extremely harsh weather conditions, including direct lightning strikes, multiple times during their operating life. Lightning surges produce an intense electromagnetic field that creates transient overvoltages which are passed throughout the electrical system of the turbine. These powerful surges propagate through the wind turbine’s sensitive electrical equipment, causing severe and latent damage. Power components such as generators, transformers, and power converters; as well as control electronics, communication and SCADA systems are all at risk. These damages are not always immediately noticeable after a lightning event, they may occur at any time due to the cumulative effect of repetitive exposure to surges.

Replacement of the key power components in a wind turbine is expensive and in many cases lightning induced failures may not be covered by manufacturers’ warranties. When a wind turbine is disabled, the costs of service teams, transportation and replacement components are all absorbed by the wind farm operator or the turbine manufacturer. Lead-time for replacement parts can be significant and access to wind farm sites offshore or in remote areas may be restricted for weeks due to weather conditions. All of this adds up to significant revenue losses caused by lightning.
For many years the only surge protection technology available to wind turbine manufacturers were conventional Metal Oxide Varistors (MOVs) in a DIN rail housing. Originally developed for residential and light industrial use, the application of these conventional surge protective devices (SPD) was not sufficient to protect critical wind turbine systems against damage caused by direct or indirect lightning currents. Even routine power and control system failures, which in turn create critical alarms that stop the operation of the turbine, require service crew visits to the site to restore its operation.

Solution

Reinforcing the surge protection systems inside modern wind turbines has become an imperative. Raycap’s state-of-the-art product, Strikesorb® is a superior industrial grade surge protection technology engineered to provide high reliability and safe maintenance-free operation.
Raycap’s Strikesorb modules are based on cutting-edge design parameters that eliminate common failures associated with conventional SPD technology. Strikesorb modules incorporate a more robust industrial grade MOV in a distinctive cylindrical aluminum housing. This design offers lifetime protection against surges as it resolves ageing issues that seriously impact the performance of traditional DIN rail mounted SPD technologies. Strikesorb SPDs can sustain multiple and successive lightning strikes and power surges without requiring maintenance. They are classified as Class I and Class II SPDs according to the international IEC 61643-11 standard for surge

protection devices, and are fully compliant to the UL 1449 3rd Edition Safety Standard. In addition to Strikesorb’s ability to absorb and efficiently dissipate intense power surges, it has been tested for safe operation to high levels of short circuit currents. This, in combination with the fact that it does not rely on the use of internal fuses or thermal disconnects, provides great flexibility for installation.

Strikesorb modules can be combined in different configurations. They can be installed in front of sensitive electronic subsystems or power components (generator, transformer) to prevent damages that significantly impact the turbine operation. In space-limited applications where the use of an enclosure is not an option, Strikesorb modules can be integrated on the transformer LV taps, or inside the various electrical panels of the turbine.

Wind farm operators can also upgrade the lightning/surge protection levels of their turbines currently in operation. Upgrade kits can be custom designed to meet the specific requirements of a particular wind turbine and are easy to install during planned periods of maintenance.
Field Experience

Strikesorb is a mature and field proven technology with hundreds of thousands of installations worldwide. Many of the world’s largest manufacturers of wind turbines already turn to Strikesorb to protect the critical electrical systems inside their equipment. Strikesorb technology is also widely used in the protection of Remote Radio Heads and other electronics equipment at next generation wireless sites, inside of industrial plants, in the protection of defense systems such as radar, at airport facilities to protect air traffic control towers, on board ships, in oil and gas fields, and in many other applications worldwide.

For additional information on Strikesorb protection technology visit us at: www.raycapsurgeprotection.com

---

Strikesorb Modules

### Stripesorb Electrical Specifications*

<table>
<thead>
<tr>
<th>Stripesorb Modules</th>
<th>40-V1</th>
<th>40-A</th>
<th>40-B</th>
<th>40-C</th>
<th>40-D</th>
<th>40-E</th>
<th>40-F</th>
<th>40-G</th>
<th>80-A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surge Protective Device (SPD) Type</td>
<td>per UL 1449 3rd Edition</td>
<td>Type 2 Component Assembly</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class per IEC 61643-11</td>
<td>Class I</td>
<td>Class I</td>
<td>Class I</td>
<td>Class I</td>
<td>Class I</td>
<td>Class I</td>
<td>Class I</td>
<td>Class I</td>
<td>Class I</td>
</tr>
<tr>
<td>Nominal Operating AC Voltage [U_n]</td>
<td>60V</td>
<td>120V</td>
<td>240V</td>
<td>277V</td>
<td>400V</td>
<td>480V</td>
<td>600V</td>
<td>1000V</td>
<td>120V</td>
</tr>
<tr>
<td>Maximum Continuous Operating AC Voltage [U_n]</td>
<td>75V</td>
<td>150V</td>
<td>300V</td>
<td>350V</td>
<td>480V</td>
<td>600V</td>
<td>750V</td>
<td>1200V</td>
<td>150V</td>
</tr>
<tr>
<td>Nominal Discharge Current [I_n]</td>
<td>per UL 1449 3rd Edition</td>
<td>20 kA 8/20 µs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Surge Current Capacity [I_{imp}]</td>
<td>per NEMA LS-1</td>
<td>140 kA 8/20 µs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Impulse Current [I_{imp}]</td>
<td>per IEC 61643-11</td>
<td>12.5kA 10/350 µs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage Protection Rating (VPR)</td>
<td>per UL 1449 3rd Edition</td>
<td>400V</td>
<td>600V</td>
<td>1200V</td>
<td>1200V</td>
<td>1800V</td>
<td>2000V</td>
<td>2500V</td>
<td>4000V</td>
</tr>
<tr>
<td>Voltage Protection Level [U_{p}]</td>
<td>per IEC 61643-11</td>
<td>300V</td>
<td>700V</td>
<td>1200V</td>
<td>1300V</td>
<td>1800V</td>
<td>2200V</td>
<td>2800V</td>
<td>4300V</td>
</tr>
</tbody>
</table>

*Information in this chart is subject to change at any time without notice.
**Strikesorb Benefits**

- **Maintenance Free**
  Maintenance free and require no replacement parts.

- **High Surge Current Capability**
  Provides protection against lightning strikes ranging from 60 kA to 200 kA (8/20 µs) and 5 kA to 25 kA (10/350 µs).

- **Low Let-Through Voltage & Optimum Protection Level**
  Strikesorb SPDs have low let-through voltage and optimum protection levels which keep sensitive equipment safe.

- **High Short-Circuit Rating**
  Enabling flexible integration and installation.

- **Fuseless**
  Strikesorb SPDs do not require an internal fuse to operate safely. The advantages are lower clamping voltages, elimination of voltage surge when a fuse opens, low maintenance and no replacement parts.

- **In-Line Connection**
  Strikesorb SPDs can be installed “in-line,” eliminating the cable length and resulting in the lowest clamping voltage possible.

- **Safe, Won’t Burn or Smoke**
  Strikesorb’s design eliminates the use of any material that could burn or smoke. The aluminum casing and internal components incorporated into the design of Strikesorb manage the heat generated within the device when a surge occurs.

- **Distribution Grade MOV**
  Strikesorb technology traces its origins to the electrical transmission and distribution industry. It incorporates large diameter distribution grade MOVs that can handle much larger surges without affecting performance.

- **UL-Listed**
  Strikesorb modules are fully UL-recognized as either Type 2 or Type 4 devices, according to the UL 1449 3rd Edition Safety Standard.

- **IEC-Compliant**
  Strikesorb modules have been certified by VDE as Class I and Class II SPD products, according to IEC 61643-11:2011.

- **Tested Performance**
  Performance specifications are based on actual test results conducted at internationally recognized independent laboratories.

- **10-Year Module Warranty**
  Strikesorb modules carry a 10-year warranty.

---

<table>
<thead>
<tr>
<th>80-B</th>
<th>80-C</th>
<th>80-D</th>
<th>80-E</th>
<th>80-F</th>
</tr>
</thead>
<tbody>
<tr>
<td>80-V1</td>
<td>80-A</td>
<td>80-B</td>
<td>80-C</td>
<td>80-D</td>
</tr>
<tr>
<td>Type 2 Component Assembly</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class I</td>
<td>Class I</td>
<td>Class I</td>
<td>Class I</td>
<td>Class I</td>
</tr>
<tr>
<td>240V</td>
<td>277V</td>
<td>400V</td>
<td>480V</td>
<td>600V</td>
</tr>
<tr>
<td>300V</td>
<td>350V</td>
<td>480V</td>
<td>600V</td>
<td>750V</td>
</tr>
<tr>
<td>20 kA 8/20 µs</td>
<td>200 kA 8/20 µs</td>
<td>25 kA 10/350 µs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>900V</td>
<td>1200V</td>
<td>1500V</td>
<td>1800V</td>
<td>2000V</td>
</tr>
<tr>
<td>1200V</td>
<td>1400V</td>
<td>1600V</td>
<td>2000V</td>
<td>2500V</td>
</tr>
<tr>
<td>30-V1</td>
<td>30-A</td>
<td>30-B</td>
<td>30-C</td>
<td>30-D</td>
</tr>
<tr>
<td>Type 2 Component Assembly</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class I</td>
<td>Class I</td>
<td>Class I</td>
<td>Class I</td>
<td>Class I</td>
</tr>
<tr>
<td>60V</td>
<td>120V</td>
<td>240V</td>
<td>277V</td>
<td>400V</td>
</tr>
<tr>
<td>75V</td>
<td>150V</td>
<td>275V</td>
<td>350V</td>
<td>480V</td>
</tr>
<tr>
<td>20 kA 8/20 µs</td>
<td>60 kA 8/20 µs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>200V</td>
<td>700V</td>
<td>1200V</td>
<td>1500V</td>
<td>1800V</td>
</tr>
<tr>
<td>400V</td>
<td>700V</td>
<td>1200V</td>
<td>1600V</td>
<td>2200V</td>
</tr>
<tr>
<td>330V</td>
<td>600V</td>
<td>1000V</td>
<td>1500V</td>
<td>1800V</td>
</tr>
<tr>
<td>500V</td>
<td>750V</td>
<td>1300V</td>
<td>1700</td>
<td>2300V</td>
</tr>
</tbody>
</table>
Raycap Worldwide Locations

**Offices**

**Headquarters**
Raycap GmbH
Parkring 11,
85748 Garching
Munich Germany
Phone: +49 89 360 8958 00
Fax: +49 89 360 8958 29
E-mail: info@raycap.com
Telou & Petroutsou 14
15124 Maroussi Athens
Greece

806 South Clearwater Loop
Post Falls, ID 83854
United States of America

800 Freeport Parkway
Suite 150
Coppell, TX 75019
United States of America

**Manufacturing**

Parkring 11,
85748 Garching
Munich Germany

806 South Clearwater Loop
Post Falls, ID 83854
United States of America

800 Freeport Parkway
Suite 150
Coppell, TX 75019
United States of America

Industrial Area of Drama
66100 Drama
Greece

Soseaua de Centura 27-28
077040 Chiajna Ilfov
Romania