PRODUCT APPLICATION NOTE

Battery Energy Storage Systems (BESS)

Protection Against Surges and Overvoltages In BESS

Four scenarios can cause an overvoltage event at a BESS installation. They are: A direct strike to the lightning protection system; a strike near the structure; a strike to the service lines connected to the structure; and a strike near the electrical lines entering the structure which will induce voltage onto those lines, and other power/data lines.

A Battery Energy Storage System (BESS) contains AC/DC converters and a bank of batteries which are stored either in concrete structures or metallic containers. If an electrical arc (due to lightning or a power surge) was to occur, the sensitive electronic components in the converters could be damaged (potentially beyond repair) while the high-capacity, low dielectric strength batteries could explode. For these reasons, it is important for engineers to perform a risk assessment of the BESS (as outlined in the IEC 62305-2 standard) to determine the type of surge protection devices (SPD) required, and if an external lightning protection system (LPS) is necessary.

The Challenge

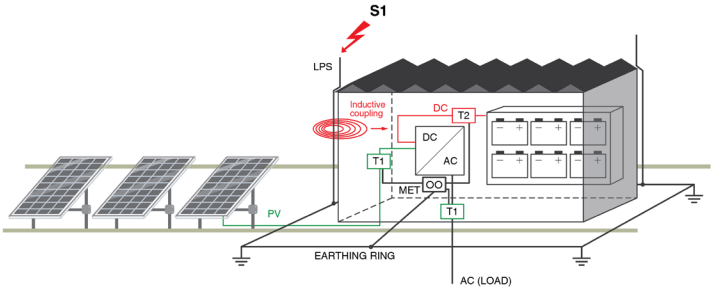
While IEC 61643-32 describes the rules for the selection and installation of DC SPDs for PV applications, the use of DC SPDs for BESS applications is relatively new, and a dedicated standard is currently not available. This presents a major challenge for BESS system designers trying to decide on the appropriate level of surge protection to use.

Use of SPDs

One way to address this challenge is to follow relevant recommendations contained in the IEC 62305-4 standard. This helps to determine the type of DC SPDs under three possible scenarios if a lightning event occurs:

Scenario 1: The BESS uses the same concrete structure to house the AC/DC converter and the batteries, with an appropriate separation distance between the LPS and the BESS equipment. Here, one T2 DC SPD is required to protect against inductive coupling caused by an S1 event (a direct strike on the LPS). However, if a metal structure is used, the effect of inductive coupling is lessened so a DC SPD is not necessary.

Scenario 2: The BESS uses separate, but adjacent, concrete structures to house the AC/DC converter and the batteries (with each structure having an appropriate separation distance between its LPS and the BESS equipment). Common grounding is provided using a DC cable which is routed underground through a protected area. Here T2 DC SPDs are required (although T1 SPDs are



Scenario 1: The BESS uses the same concrete structure to house the AC/DC converter and the batteries, with an appropriate separation distance between the LPS and the BESS equipment. Here, one T2 DC SPD is required to protect against inductive coupling caused by an S1 event (a direct strike on the LPS). However, if a metal structure is used, the effect of inductive coupling is lessened so a DC SPD is not necessary.

recommended). If the DC cable length is less than 10 meters, only one DC SPD (located at either the inverter or the battery) is required. The same approach should be followed if metal structures are used instead of concrete.

Scenario 3: Like scenario 2 the BESS uses separate, but adjacent, concrete structures to house the AC/DC converter and batteries (each structure maintains an appropriate separation distance between its LPS and the BESS equipment). The difference here, however, is that a common DC grounding cable is routed above (or below) ground via a cable trench. This scenario requires the use of T1 DC SPDs. The same approach should be followed if metal structures are used instead of concrete.

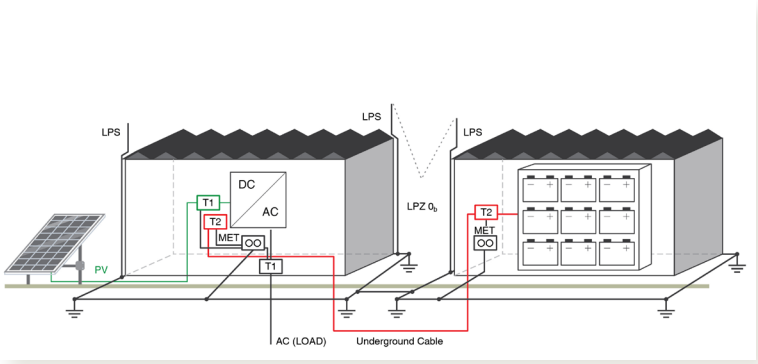
The IEC 61643-11 and IEC 61643-31 standards cover the requirements for selecting SPDs for use in AC and PV applications. However, there are currently no dedicated standards that address the selection and testing of SPDs for use in BESS applications. This can lead to the incorrect choice of SPDs for BESS.

Solutions

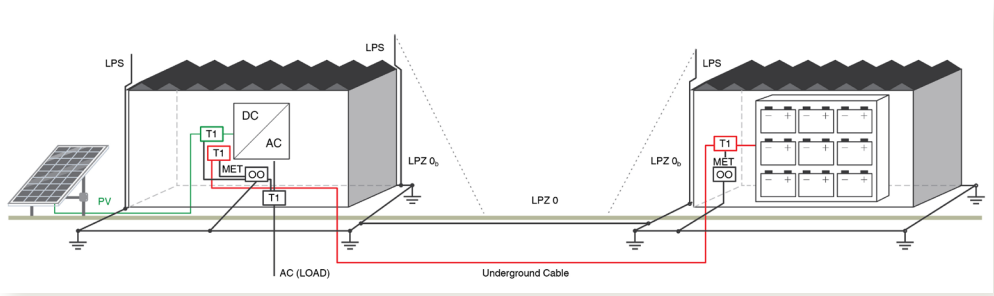
BESS System designers who want to be certain that their equipment is adequately pro-tected should be aware that Raycap's DC SPDs are tested according to IEC 61643-31 and have been optimized and field-tested for use in BESS DC applications. The Strikesorb 35, ProBlocB DC and SafeTec T2-1000DC products are all relevant for use in and are complementary to BESS installations.

Product Benefits

The Strikesorb 35 Series is designed for BESS systems up to 1500 VDC, is certified to UL1449 (5th edition) under the new supplement SB category covering DC SPDs, and can be installed without the requirement for a dedicated backup fuse (in most cases). The ProBloc B 1000 DC and SafeTec T2-1000 are DIN rail mountable SPDs which are suitable for use in DC applications. mountable SPDs that are also tested as suitable for use in DC applications.



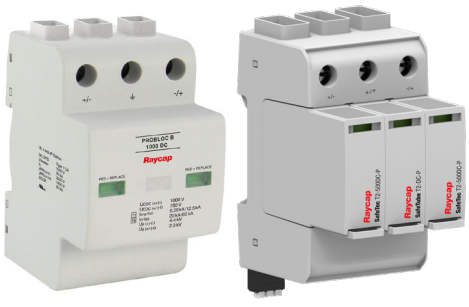
Scenario 2: Common grounding is provided using a DC cable which is routed underground through a protected area. Here T2 DC SPDs are required (although T1 SPDs are recommended). If the DC cable length is less than 10 meters, only one DC SPD (located at either the inverter or the battery) is required. The same approach should be followed if metal structures are used instead of concrete.



Scenario 3: The difference in this scenario, is that a common DC grounding cable is routed above (or below) ground via a cable trench. This scenario requires the use of T1 DC SPDs. The same approach should be followed if metal structures are used instead of concrete.

Strikesorb 35 Features

- Category IEC/EN Class I and Class II per UL 1449 5th Edition
- Suitable for DC power installations for example such as photovoltaic power semiconductor, and others
- Maximum Continuous Operating DC Voltage [U_{CPV}] up to 1500 V
- Nominal Discharge Current [I_n] per UL 1449 5th Edition 20 kA (8/20 µs) (except for 35-D-HV-M)
- Impulse Discharge Current [I_{imp}] per IEC 61643-31 12.5 kA (10/350 µs)



ProBloc B, SafeTec DC

Raycap is a trusted partner, providing maintenance-free electrical protection solutions for mission-critical applications in hundreds of thousands of installations worldwide.

For a detailed presentation on how Raycap's solutions can protect your BESS operations, contact us today!

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