solis seminars

Episode 30

The influence of salt spray and high humidity environments on solar PV systems

Background

The working environment of a PV plant is relatively complex, and extreme environments such as high/low temperature, humidity, salt spray, heavy sand and other harsh environments, can test the reliability and environmental adaptability of the PV system. More and more PV plants are being built on water, desert, and in coastal areas.

2-3 years after a power station is built and commissioned, extreme environments can have serious consequences on equipment within the system; such as the distribution box, mounting, and inverters.

In this issue of Solis Seminar we've analyzed the impact of salt spray and high humidity environments on the operation of solar plants and highlight some solutions.

The impact of salt spray and high humidity environment

Salt spray contains a large amount of chloride ions, which can easily penetrate the protective layer of a metal surface and cause an electrochemical reaction with the contact metal causing a product to fail. Solar power stations built along the coast are susceptible to the effects of high salinity and humid air. The external salt spray particles and humid air will affect the components, cables (especially grounding cables), metal brackets, inverters, and distribution boxes.

In addition, high temperature and high humidity environments will also affect the PV system, such as:

1. In environments with large temperature differences, such as beaches, mountains and other areas, water vapor evaporates and condenses.

2. In places with high environmental humidity, such as lake areas, coastal areas, etc., the surrounding air is humid, and it is easy to cause condensation inside the equipment. This causes internal moisture and can lead to flashover accidents.

3. Exposed conductors are easily corroded in a high salt spray and high humidity environment, which increases impedance and leads to poor contact.

If salt mist and water vapor are sucked into the distribution box, terminal or inverter, the long-term accumulation will corrode the internal structure of the equipment and cause damage to the equipment.

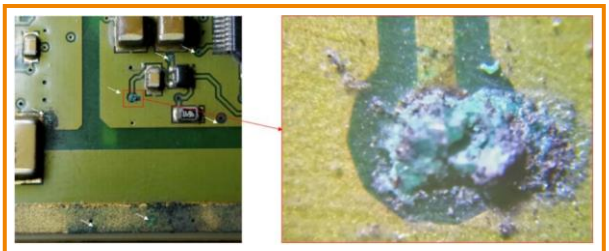


Figure 1: Corroded PCB boards and components inside the inverter

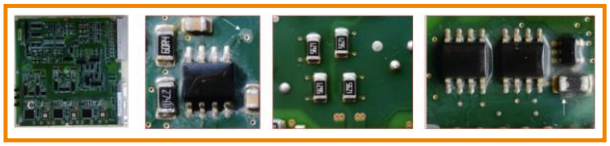
Figure 2: Corroded PE cable and grid box interior

Prevention

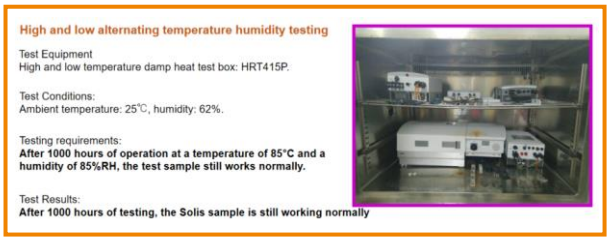
1. Equipment selection needs to consider to its protective ability

The equipment chosen needs to have strict anti-corrosion and protection levels. Equipment such as inverters and distribution boxes used in areas with high salt spray or high humidity need to have higher protection levels and anti-corrosion designs than in other areas. It is recommended to use products with IP65 protection or higher for the inverter and the distribution box needs to be galvanized and sprayed with anti-corrosion paint, and be 100% air tight. For inverters with IP65 protection, it can effectively prevent external moisture from entering the inside of the machine.

In addition, the inverter PCB and electronic components need to have film coating, glue or protective paint to protect the circuit board from moisture, salt spray and mildew;



The inverter needs to pass temperature and humidity tests and corrosion resistance tests. Look out for the relevant certification on this in your area.



We also need to pay attention to products such as cables, metal brackets and combiner boxes. Such as:

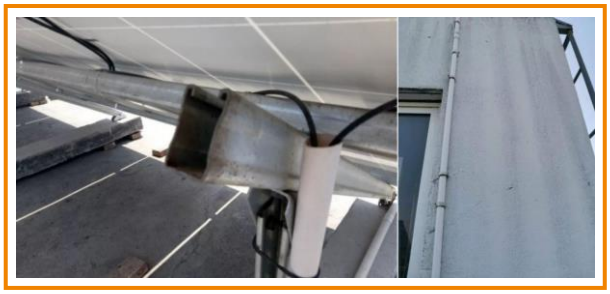
1) Choose PV products, and metal mounting equipment which is treated with anti-corrosion products.

2) At the same time, the metal parts of the AC/DC/PE cables must not be exposed to the air.

3) The wiring terminals should be shielded and fitted to avoid contact with the metal surface.

Protective treatment during installation and construction

PV, PE and AC cables need to be placed in PVC pipes or buried in the ground for protection to prevent the effects of abrasion and salt spray;



The metal bracket and grounding grid metal need to be painted with anti-corrosion paint or galvanized and inspected and repaired at regular intervals to prevent later corrosion.

Special attention should be paid to the use of "Al/Zn Bolt" to connect stainless plates when selecting screw materials to prevent electrochemical corrosion caused by contact between different metals.

Plastic gaskets can be added to isolate the two metals and prevent "contact corrosion".

	Stainless Bolt	Al/Zn Bolt	Suggest
Stainless Plate	Yes	No	Al/Zn Bolt and Stainless Plate can not be connected, easy to produce contact corrosion
Al/Zn Bolt Plate	Yes	Yes	Stainless Bolt and Al/Zn Bolt plates can be used in most cases

For the combiner box or grid box, we need to use fire-resistant mud at its inlet and outlet to improve its protection and prevent water vapor from entering.

Summary

Salt fog and high humidity environments can cause huge issues from corrosion of solar plant facilities and will seriously affect the safety, reliability, and long-term operation of the power station. Therefore, in these environments, particular attention should be paid to ; equipment selection, construction and operation and maintenance to improve the operational stability of the PV plant and reduce system errors.