PV inverter performance in desert-like locations

Unique desert challenges addressed through rigorous testing

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Extreme climate conditions like those found in desert-like regions make for high demands on solar technologies. Outdoor installed inverters are subjected to extreme temperature fluctuations and problematic sand and dust in the air.

SMA Solar Technology AG, the world leader in solar inverter technology and manufacturing, knows open-air equipment in particular, like SMA's Sunny Central CP series, has to withstand these conditions, reliably performing for the operational life of the PV plant, which often exceeds 20 years. All components of an inverter, and especially its interior, need to be securely sealed to protect against the damaging effects brought on from desert storms and enormous temperature swings.

The stress imposed by sandstorms can be especially severe, as the very fine dust can penetrate even the smallest openings, potentially causing problems within the interior of the inverter, the key component in any PV system. This fine sand and dust settling on an inverter's sensitive electronics represents an enormous potential risk to the operation and longevity of the entire PV plant.

The Sunny Central CP integrated OptiCool™ system eliminates this problem, as proven by SMA's sand and dust tests. SMA subjected the Sunny Central CP to intensive testing in order to demonstrate that Sunny Central CP inverters are engineered for outdoor use in conditions where dust and sand is prevalent in the ambient air.

Methodology

An independent facility subjects a Sunny Central CP to intensive dust and sand testing.

A Sunny Central CP unit was recently sent to an independent testing facility and subjected over the course of several days to fine dust particles. The tests were conducted in the environmental simulation laboratory at RUAG Land Systems AG, an accredited testing laboratory according to ISO/IEC 17025. The sand and dust testing was conducted in accordance with IEC 68-2-68/EN 60068-2-68, according to test method Lc1, in a circulating chamber for dust testing at a RUAG facility in Thun, Switzerland. The facility used pulverized roof tiles whose composition was found to be similar to the sand found in the Arizona desert. The dust particle concentrations used in the testing exceed the limits established under the classification of ambient conditions according to IEC 60721-3-4, category 4S2, by several times. Materials utilized included brick powder with a diameter of 7-20 microns and quartz sand with diameter between 0.1 and 0.6 millimeters.

The test objective was to determine any possible harmful effects on electrotechnical products from particles entrained in an air stream.

Dust and sand were blown horizontally directly at the unit during testing. This four-step test process began with a dust test, followed by a sand test. A second sand test came after a rain and sprinkler test. During the experiment the ventilation system took in and circulated air, as is normal with the OptiCool system.

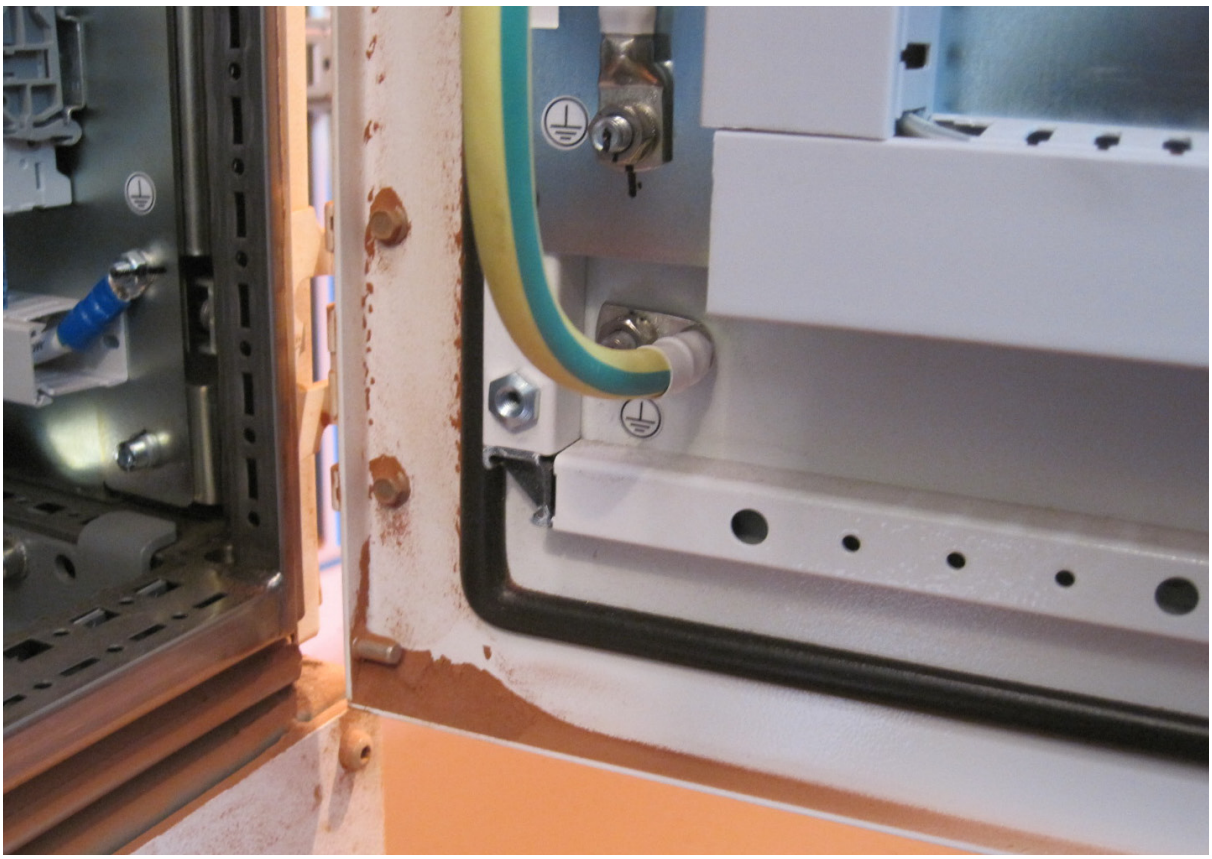
Results

The inverter's seals protected it from harmful dust deposits.

The testing resulted in several findings, including:

- Stack heat sink after testing: There was no deposition of dust particles in the stack heat sinks.
- Stack fan after testing: There was no appreciable deposition of dust particles on the fan blower.
- Inverter after testing/seals: Dust deposits were present outside the seals but there was no dust penetration into the interior of the inverter.
- Inertial separator in the inverter roof: As expected, the deposited dust and sand particles accumulate in the inertial separator, behind the insect screen in the roof prior to entering the heat exchangers. This dust is easily removed through normal service and maintenance.

The thorough testing showed that although the exterior of the unit and its seals were covered in dust, none had found its way into the interior. The same was true for the fans which, when taken out, were free of harmful dust accumulation. OptiCool's encapsulated design securely protected the units and their electronic components.



Lab tested and field proven

A Sunny Central CP inverter is shown in the dust chamber.

This testing further demonstrates that Sunny Central CP inverters offer unmatched performance for utility-scale PV under conditions where windblown dirt and dust is present. This is a significant advantage when it comes to the investment security, life expectancy and durability of PV plants located in desert-like regions.

In addition to withstanding the damaging effects of sand and dust, these inverters also perform well in hot environments due to their intelligent power management, which allows operation at full nominal power at ambient temperatures up to 50 °C (122 °F).

Through rigorous testing, SMA has developed technology capable of withstanding challenging environments and, through its field-proven experience, application engineering to optimize plant production, providing developers, EPCs and utilities with the most experienced and reliable partner for PV power plants.

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