Photovoltaic Modules: TÜV Rheinland and DB Schenker Develop New Logistics System for Greater Transparency and Safety in Global Transport

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Systematic reduction in the amount of damage to modules / Comprehensive qualification of global logistics for photovoltaic modules / Reliable performance measurements and continuous transport monitoring beginning at the factory / Certification of packaging and the entire transport process by TÜV Rheinland

Cologne/Berlin, February 27, 2014. DB Schenker, the global logistics service provider, and TÜV Rheinland, the leading testing company in the solar industry, have together developed a new system for preventing and discovering transport damage as well as monitoring transport and validating the performance of photovoltaic modules. The aim of the new, comprehensive monitoring and control system is to systematically increase transparency, data validity and safety along the solar modules’ global transport route, from the outgoing inspection at the manufacturer’s plant to delivery to the construction site, as well as to identify risks for the modules. The project's development and test phase took more than one year to complete.

“We have developed a procedure that helps to establish a reliable outgoing goods system based on valid measurements as well as to identify transport damage before the performance of a solar power plant or solar system is impaired. Thanks to continuous measurements, we can determine whether the transport loads may have caused damage to the modules,” says Willi Vaassen, who has 30 years of experience as an expert in the industry and is Head of Solar Energy at TÜV Rheinland. Vaassen explains it is also important that the inspections require hardly any additional time and that project efficiency is significantly increased because revenue losses, costs and delays caused by damage are avoided.

“With the collaboration between TÜV Rheinland and DB Schenker, two leading service providers for the solar industry have recognized the signs of the times and developed a new quality assurance standard for the solar industry. Sophisticated sensors from DB Schenker perform an alarm function during transport and notify the parties concerned if an abnormal load arises during sea or road transport,” says Joachim Marxer, an expert in the solar industry and currently Global Vice President Vertical Market Semicon / Solar at DB Schenker.

Until now, there has been no transparency regarding damage to photovoltaic modules that may have been caused by transport and the long-term effects this damage has on the energy yield of these products. However, industry experts estimate that transport has an unnecessary and detrimental effect on between 5 % and 10 % of all modules and that it impairs their performance. Vaassen: “Damage to modules often remains undetected if it is not apparent at first glance or it cannot be traced back to its origin later on when it is discovered. That is something we want to change.”

Comprehensive monitoring system comprising three phases

The newly developed monitoring system primarily serves to ensure quality in major projects or for regular flows of goods and to reveal damage caused by rough handling or environmental influences arising during transport. The system comprises three key steps: First, the transport packaging and quality processes in production are tested. Certification of the shipping unit at this point helps to prevent damage caused by insufficient packaging. Second, the procedures for taking outgoing measurements and the equipment used to assess the performance and the quality of the products upon leaving the factory are optimized and inspected. Third, transport is continuously monitored and a technical inspection is conducted – including representative spot check measurements – on the delivered products in DB Schenker’s receiving warehouse upon market entry into the European Union or other global target markets.

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Testing of the transport packaging

The tests of the transport packaging provided by the manufacturer are performed in specialized laboratories in accordance with the draft standard IEC 62759-1 which was developed with TÜV Rheinland strong participation and have three focal points: As a first step, the actual transport routes are recorded, which enables the influences during sea and land transport to be determined for the purpose of verifying standard loads. This is followed by the second and third steps, which comprise transport simulation with loading of the modules in the packaging unit provided and environmental simulation for individual modules in the laboratory.

The load tests comprise, for example, transport simulations with oscillations between 5 Hz and 200 Hz at an acceleration of 0.49 gRMS. This is followed by tests including a horizontal impact test, a tilt and fall test, one hundred shock tests at an acceleration of 10 g and horizontal braking deceleration at 1 g. “The particular expertise of both of our companies meshes together brilliantly here,” says Joachim Marxer. “If packaging provided by the module manufacturer does not fulfill TÜV Rheinland’s requirements, we can call on the support of our colleagues at DB SCHENKEReuropac, who are established and experienced experts in packaging solutions for the solar industry.”

Following these tests, performance measurements are taken and further ageing and load tests simulating the long-term effect of the damage and micro-cracks caused by the transport load are performed. These include a wind load simulation using test instructions in accordance with DIN EN 12211 and IEC 62787 as well as various tensile and pressure tests, thermal cycling tests and humidity tests in the environmental chamber in accordance with the design qualification standard IEC 61215.

Outgoing inspection at the manufacturer’s plant and monitoring during transport

The second step of the quality program concerns in particular the final inspections of the product at the module manufacturer’s plant. During the inspections, the experts from TÜV Rheinland qualify the flashers as well as the manufacturer’s performance measurement system, thereby ensuring the validity of the data collected. A similar procedure is applied when documenting the micro-cracks. All measurement data and other necessary pieces of information are stored in sufficient resolution in a database that is accessible to the delivery recipient. This is followed by continuous monitoring during transport. Marxer: “This sees all of DB Schenker’s containers fitted with specialized shock and vibration sensors that have been audited by our partner. At the same time, information about the current location of the delivery is provided via GPS. The data continuously collected during transport can then be used to determine whether the stress level previously identified and tested during inspection of the packaging has had an impact on a transport unit or not.” If the load level was exceeded, the affected goods are subject to a performance measurement and damage analysis immediately following arrival at the European DB Schenker receiving warehouse, for example.

Inspections in the receiving warehouse and certification

In addition, a statistically calculated representative spot check of the delivered modules is conducted in DB Schenker’s receiving warehouse. There, TÜV Rheinland collaborates with the logistics service provider to operate a measuring station in which insulation tests, flasher measurements and electroluminescence analyses are also conducted following the visual inspection. The spot checks are organized within the normal work process, which prevents unnecessary transport and handling. Like the results of the outgoing goods inspection at the manufacturer’s plant, the created and interpreted test images are also entered into the database, where they are accessible to the delivery recipient.

These measures serve to either confirm the condition of the modules when leaving the factory for delivery or to document mechanical damage. Once the comprehensive analyses are complete, TÜV Rheinland independently certifies the logistics processes at each manufacturer’s plant.
With DB Schenker and TÜV Rheinland, two leading companies in their industry have developed an efficient solution for the reliable verification of the photovoltaic modules' delivery condition in terms of their performance and micro-crack damage as well as for the problem of undetected transport damage. DB Schenker represents the transport and logistics activities of German rail service Deutsche Bahn and holds a leading position among the world’s largest transport and logistics service providers. With the Vertical Market Semicon / Solar division, the company specializes in the transport and storage of photovoltaic modules as well and has many years of experience in the industry. TÜV Rheinland is an internationally leading testing service provider for the solar industry. The company first started laboratory-scale technical testing of solar components back in 1985. TÜV Rheinland’s network of experts for the solar industry now comprises well over 200 specialists in laboratories worldwide. Well over 500 manufacturers of photovoltaic products are among the customers of the independent testing service provider, TÜV Rheinland.

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