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Research Report

Rable substructure guidance

Client	Rable
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Content

Research

Reason

Rable is a manufacturer of a substructure for solar panels on flat roofs. Since the publication of NEN1010:2015, the substructure of PV systems is more often equalized by the installer. Rable wants to know if the product offers sufficient conductivity so that it can inform installers about equalizing Rable substructures.
Rable commissioned Omega Energy Engineering to investigate the system's internal conductivity.

Approach

Starting point

The premise of this study was that there is no standard that specifies requirements for internal resistance of substructure.
Given that the question from Rable arose due to a change in NEN1010, therefore, in this study we are working as much as possible in accordance with requirements from NEN1010:2015 + C1:2015. At the time of the study, this is the version of NEN1010 designated via the Buildings Decree and Government Gazette.
The substructure will be considered as part of the potential equalization. In accordance with requirements in chapter 61 of NEN1010:2015, a resistance is established with measurements. This is the way in which in an installation the uninterrupted being of protective conductors should be determined.
During this study, the installation tester Nieaf Smitt Installtest XE with serial number 19280841 was used for the measurements, all performed on April 20-2023. This tester was last calibrated on 12-01-2023.

Sub-studies

This study consists of two sub-studies. These consist measurements on two different setups, namely:

- Indoor trial with new materials
- An existing outdoor system (>1 year old)

In the test setup, the resistances of all individual connections are measured separately from each other. This is to determine if there are any connections that do not conduct. Then in two separate systems in operation, some resistances are randomly measured, as is common in an inspection in accordance with standards such as:

- NEN1010:2015 + C1:2016,
- NEN-EN-IEC 62446:2016 en
- NEN 3140:2019.

Research results

Sample

Description

The test rig consists of several parts connected together, with two or more parts of the substructure linked in accordance with the manual. The whole is pulled tight with steel cables which provides the load-bearing capacity and rigidity. In this way, all connections can be measured separately from each other.

Fig. 1 Indoor test setup

Measurement results

The resistance of the connections to the substructure is 0.07Ω. This is sufficiently low. The

resistance of the connection carrier-steel cable is 0.27Ω. This is also sufficiently low.

NOTE. A low-impedance connection between PV modules and carrier cannot be guaranteed in the long term due to external influences and therefore does not give a representative picture.

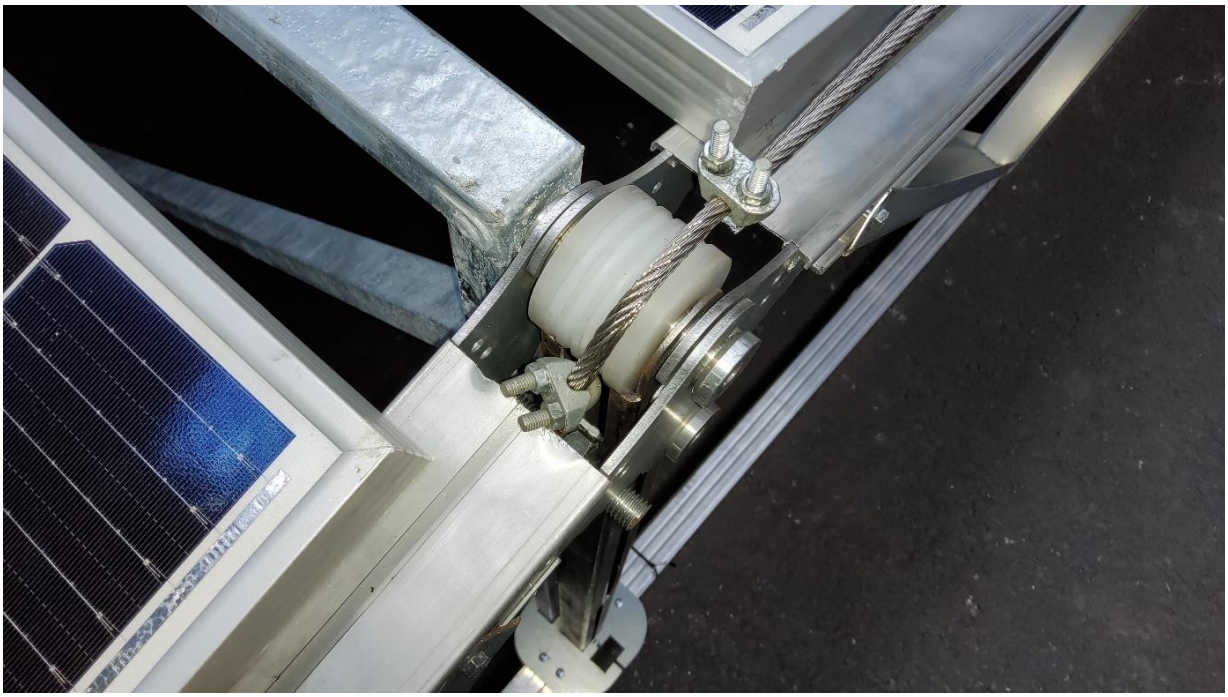

Fig. 2 Sample wire rope connection.

The resistance of all other connections is at most 0.17Ω, again the lower limit of the installation tester's measurement range. The resistance on these connections is sufficiently low.

System (indoor and outdoor setup)

Description

In this system, the panels are oriented like the indoor system in an east-west configuration. The system has a roof shape. Each "roof segment" counts 2x 8 panels and can be expanded and connected as desired.
The system is approximately one year old, assembled in accordance with installation instructions and is optically free of defects.

Fig. 3 arrangement steel cable Fig

. 4 arrangement roller guides Fig

. 5 arrangement underside

Measurement results

Sample resistance between two points on the substructure was measured. The sample also includes measurements between the joints of the far corners of the field. A total of fourteen resistance measurements were taken. The lowest value measured is 0.01Ω, the lower limit of the measurement range of the installation tester used. The highest value measured is 0.03Ω. The resistance on the substructure and equalization line is sufficiently low.

Conclusion

When installed correctly in accordance with the installation instructions, the Rable substructure has a sufficiently low internal resistance to be included in the equalization of the PV system. As far as can be assessed, time and weather conditions seem to have little or no influence on the internal resistance of Rable substructure.