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Measurement NOCT of PV Module Using Several Methods According to the IEC61215

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ABSTRACT

International Standard IEC 61215 is very important in testing the quality of photovoltaic (PV), and one of the most important tests is of nominal operating cell temperature (NOCT) in the part (Crystalline silicon terrestrial photovotaic modules – Design qualification and type approval), So we can see in the operating mode part in the point C ; Reject ambient temperatures outside the range 20°C ± 15°C or varying by more than 5°C from the maximum value to the minimum value recorded during the recording of a data set, This condition can change with changes in the region and climate differences and this condition forces us to extract three methods for calculating NOCT the first method reject ambient temperatures outside the range (min T) + 5°C, the second method reject ambient temperatures outside the range (max T) - 5°C and the third method reject ambient temperatures outside the range (between min T and max T is 5°C). In this paper we calculating the NOCT of two different technology of PV modules (glass to glass (PV1) and backsheet to glass(PV2)) by this three methods according to the standard IEC 61215 and conclude which is better.

Keywords: IEC 61215, NOCT, PV Module, Temperature.

1. Introduction

International Standard IEC 61215-2 has been prepared by IEC technical committee 82: Solar photovoltaic energy systems. Whereas Part 1 of this standard series describes requirements (both in general and specific with respect to device technology), the sub-parts of Part 1 define technology variations and Part 2 defines a set of test procedures necessary for design qualification and type approval. The test procedures described in Part 2 are valid for all device technologies. The power of PV-modules depends on the cell temperature. The cell temperature is primarily affected by the ambient temperature, the solar irradiance, and the wind speed [1].

NMOT is defined as the equilibrium mean solar cell junction temperature within an open-rack mounted module operating near peak power in the following standard reference environment (SRE): Tilt angle: (37 ± 5) °, Total irradiance: 800 W/m², Ambient temperature: 20 °C, Wind speed: 1 m/s, Electrical load: A resistive load sized such that the module will operate near its maximum power point at STC or an electronic maximum power point tracker (MPPT) [1]. NMOT is similar to the former NOCT except that it is measured with the module under maximum power rather than in open circuit. Under maximum power conditions (electric) energy is withdrawn from the module, therefore less thermal energy is dissipated throughout the module than under open-circuit conditions. Therefore, NMOT is typically a few degrees lower than the former NOCT. NMOT can be used by the system designer as a guide to the temperature at which a module will operate in the field, and it is therefore a useful parameter when comparing the performance of different module designs. However, the actual operating temperature at any particular time is affected by the mounting structure, distance from ground, irradiance, wind speed, ambient temperature, sky temperature and reflections and emissions from the ground and nearby objects. For accurate performance predictions, these factors shall be taken into account.

In the case of modules not designed for open-rack mounting, the method may be used to determine the equilibrium mean solar cell junction temperature in the SRE, with the module mounted as recommended by the manufacturer [1]. There is a lot of new research regarding NOCT, Ref [2] a new method for calculating the NOCT of PVT modules with water as the working fluid is presented. Four unglazed identical PVT modules in series were tested outdoors with various mass flow rates.

2. Experimental

This method is based on gathering actual measured module temperature data under a range of environmental conditions including the SRE. The data are presented in a way that allows accurate and repeatable interpolation of the NMOT. The temperature of the solar cell junction (TJ) is primarily a function of the ambient temperature (Tamb), the average wind speed (v) and the total solar irradiance (G) incident

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on the active surface of the module. The temperature difference (TJ – Tamb) is largely independent of the ambient temperature and is essentially linearly proportional to the irradiance at levels above 400 W/m².
The module temperature is modelled by:

$$TJ - Tamb = \frac{G}{(u0 - u1v)} \quad (1)$$

The coefficient u0 describes the influence of the irradiance and u1 the wind impact.
The NMOT value for TJ is then determined from the model formula above by using Tamb = 20 °C, irradiance G of 800 W/m² and a wind speed v of 1 m/s.

3. Results and Discussion

Figure 1 Shows one of nine outcomes of the results obtained the table 1 shows all results.

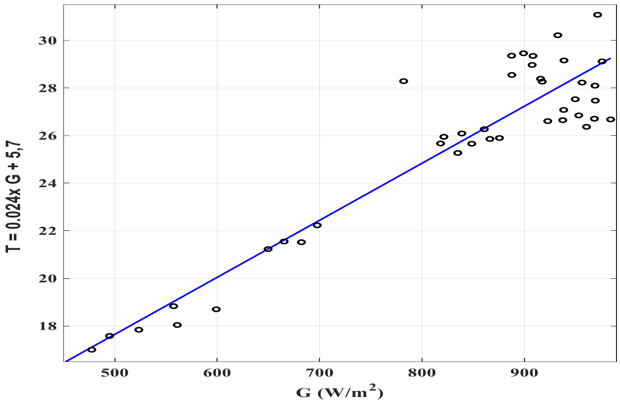

Figure 1 : G (W/m²) Vs T (C°)

	Method1	Method2	Method3	IEC61215
	NOCT			
PV1	45°C ± 1°C	45°C ± 1°C	45°C ± 1°C	45°C ± 1°C
PV2	47°C ± 3°C	47°C ± 3°C	47°C ± 3°C	47°C ± 2°C

4. Conclusions

The results obtained are acceptable and compatible with international standard IEC 61215 for technology glass to glass but in the technology backsheet to glass We note that the results were not consistent with the international standard where we found them 47°C ± 3°C but with IEC 61215 must be 47°C ± 2 °C .

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