INTERNATIONAL STANDARD

IEC 904-7

First edition
1995-09

Photovoltaic devices –

Part 7:
Computation of spectral mismatch error introduced in the testing of a photovoltaic device

Dispositifs photovoltaïques –

Partie 7: Calcul de l'erreur de désadaptation des réponses spectrales dans les essais d'un dispositif photovoltaïque

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– la CEI 617 *Symboles graphiques pour schémas;*

et pour les appareils électromédicaux,

– la CEI 878 *Symboles graphiques pour équipements électriques en pratique médicale*

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– IEC 27 *Letter symbols to be used in electrical technology*,

– IEC 417 *Graphical symbols for use on equipment Index, survey and compilation of the single sheets;*

– IEC 617 *Graphical symbols for diagrams*,

and for medical electrical equipment,

– IEC 878 *Graphical symbols for electromedical equipment in medical practice*

The symbols and signs contained in the present publication have either been taken from IEC 27, IEC 417, IEC 617 and/or IEC 878, or have been specifically approved for the purpose of this publication.

IEC publications prepared by the same technical committee

The attention of readers is drawn to the end pages of this publication which list the IEC publications issued by the technical committee which has prepared the present publication.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

PHOTOVOLTAIC DEVICES –

Part 7: Computation of spectral mismatch error introduced in the testing of a photovoltaic device

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international cooperation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

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3) They have the form of recommendations for international use published in the form of standards, technical reports or guides and they are accepted by the National Committees in that sense.

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International Standard IEC 904-7 has been prepared by IEC technical committee 82: Solar photovoltaic energy systems.

The text of this standard is based on the following documents:

DIS	Report on voting
82(CO)12	82(CO)20

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

PHOTOVOLTAIC DEVICES –

Part 7: Computation of spectral mismatch error introduced in the testing of a photovoltaic device

1 Scope

This part of IEC 904 describes the procedure for determining the error introduced in the testing of a photovoltaic device caused by the interaction of the mismatch between the spectral responses of the test specimen and the reference device, and the mismatch between the test spectrum and the reference spectrum. The procedure applies only to linear photovoltaic devices.

2 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this part of IEC 904. At the time of publication, the edition indicated was valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 904 are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 904-3: 1989, *Photovoltaic devices – Part 3: Measurement principles for terrestrial photovoltaic (PV) solar devices with reference spectral irradiance data*

3 Description of method

The error is computed from the integrated products of the relative spectral responses of the reference device and the test specimen and the relative spectral irradiances of the simulator and the reference solar spectral irradiance distribution as defined in IEC 904-3. Thus, if

J_1 is the short-circuit current density of the reference cell in solar radiation having an irradiance of 1 000 W m^{-2} and the reference spectral distribution [A m^{-2}];

J_2 is the short-circuit current density of the reference cell as measured in natural or simulated solar radiation [A m^{-2}];

$s_{1\lambda}$ is the absolute spectral response of the reference cell at wavelength λ [A W^{-1}];

$k_1 \cdot s_{1\lambda}$ is the relative spectral response of the reference cell at wavelength λ;

J_3 is the short-circuit current density of the test specimen (in solar radiation) having an irradiance of 1 000 W · m^{-2} and the reference spectral irradiance distribution [A m^{-2}];

J_4 is the short-circuit density of the test specimen as measured in the natural or simulated solar radiation [A m^{-2}];

$s_{2\lambda}$ is the absolute spectral response of the test specimen at wavelength λ [A W^{-1}];

$k_2 \cdot s_{2\lambda}$ is the relative spectral response of the test specimen at wavelength λ;

$G_{s\lambda}$ is the absolute spectral irradiance at wavelength λ of the reference spectral irradiance distribution [W $m^{-2} \cdot \mu m^{-1}$];

$k_3 \cdot G_{s\lambda}$ is the relative spectral irradiance at wavelength λ of the reference spectral irradiance distribution;

$G_{t\lambda}$ is the absolute spectral irradiance at wavelength λ of the natural or simulated solar radiation [W $m^{-2} \cdot \mu m^{-1}$];

$k_4 \cdot G_{t\lambda}$ is the relative spectral irradiance at wavelength λ of the natural or simulated solar radiation;

then:

$$J_1 = \int s_{1\lambda} \cdot G_{s\lambda} \cdot d(\lambda)$$

$$J_2 = \int s_{1\lambda} \cdot G_{t\lambda} \cdot d(\lambda)$$

$$J_3 = \int s_{2\lambda} \cdot G_{s\lambda} \cdot d(\lambda)$$

$$J_4 = \int s_{2\lambda} \cdot G_{t\lambda} \cdot d(\lambda)$$

Integration of the products of the measured relative spectral response and the relative spectral irradiance yields the following parameters:

$$A_1 = \int k_1 \; s_{1\lambda} \cdot k_3 \; G_{s\lambda} \cdot d(\lambda) = k_1 \cdot k_3 \cdot J_1$$

$$A_2 = \int k_1 \; s_{1\lambda} \; k_4 \cdot G_{t\lambda} \; d(\lambda) = k_1 \; k_4 \cdot J_2$$

$$A_3 = \int k_2 \; s_{2\lambda} \; k_3 \; G_{s\lambda} \; d(\lambda) = k_2 \cdot k_3 \; J_3$$

$$A_4 = \int k_2 \; s_{2\lambda} \; k_4 \cdot G_{t\lambda} \; d(\lambda) = k_2 \cdot k_4 \; J_4$$

The error in measuring the short-circuit current density of the test specimen is then given by:

$$\text{Spectral mismatch error (\%)} = \left[\frac{(J_4 - J_3)}{J_3}\right] \times 100 = \left[\frac{(A_1 - A_4)}{(A_2 - A_3)}\left(\frac{J_2}{J_1}\right) - 1\right] \times 100$$