

Photovoltaic systems — Power conditioners — Procedure for measuring efficiency

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British Standard

ICS 27.160

National foreword

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Summary of pages

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Procedure for measuring efficiency
(IEC 61683:1999)**

Systèmes photovoltaïques
Conditionneurs de puissance
Procédure de mesure du rendement
(CEI 61683:1999)

Photovoltaische Systeme
Stromrichter - Verfahren zu Messung
des Wirkungsgrades
(IEC 61683:1999)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
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Foreword

The text of document 82/229/FDIS, future edition 1 of IEC 61683, prepared by IEC TC 82, Solar photovoltaic energy systems, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61683 on 2000-01-01.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2000-10-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2003-01-01

Annexes designated "normative" are part of the body of the standard.

Annexes designated "informative" are given for information only.

In this standard, annex ZA is normative and annexes A, B, C and D are informative.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61683:1999 was approved by CENELEC as a European Standard without any modification.

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INTRODUCTION

Among the principal characteristics of power conditioners, efficiency is considered as an important factor. A standardized procedure for measuring the efficiency of power conditioners is necessary for their widespread use in photovoltaic systems by increasing the reliability of their claimed efficiency.

Generally speaking, power conditioner efficiency is affected by the following parameters:

- power level;
- input voltage;
- output voltage;
- power factor;
- harmonic content;
- load non-linearity;
- temperature.

These parameters are considered to be included in the test condition of this standard explicitly or implicitly.

The purpose of this standard is to provide the means to evaluate the intrinsic efficiency of power conditioners by a direct measurement of input and output power in the factory. Therefore, indirect items such as maximum power-point tracking accuracy are outside the scope of this document. It is expected that those will be dealt with in future relevant IEC standard(s).

PHOTOVOLTAIC SYSTEMS – POWER CONDITIONERS – PROCEDURE FOR MEASURING EFFICIENCY

1 Scope

This standard describes guidelines for measuring the efficiency of power conditioners used in stand-alone and utility-interactive photovoltaic systems, where the output of the power conditioner is a stable a.c. voltage of constant frequency or a stable d.c. voltage. The efficiency is calculated from a direct measurement of input and output power in the factory. An isolation transformer is included where it is applicable.

2 Normative reference

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60146-1-1:1991, *Semiconductor convertors – General requirements and line commutated convertors – Part 1-1: Specifications of basic requirements*

3 Definitions

For the purposes of this standard, the following definitions apply. All efficiency definitions are applied to electric power conversion alone and do not consider any heat production. The above normative references contain other definitions.

In annex A, the definition of power conditioner is given. Power efficiency and conversion factor are explained in annex B.

3.1

rated output efficiency

ratio of output power to input power when the power conditioner is operating at its rated output

3.2

partial output efficiency

ratio of output power to input power when the power conditioner is operating below its rated output

3.3

energy efficiency

ratio of output energy to input energy during an identified period

3.4

efficiency tolerance

permissible tolerance between the manufacturer's specified efficiency and the measured efficiency

3.5

PV array simulator

simulator which has I-V characteristics equivalent to a PV array

3.6

no-load loss

input power of the power conditioner when its load is disconnected or its output power is zero

3.7

standby loss

for a utility interactive power conditioner, power drawn from the utility grid when the power conditioner is in standby mode. For a stand-alone power conditioner, d.c. input power when the power conditioner is in standby mode

3.8

maximum power point tracking (MPPT)

control strategy whereby the power conditioner input voltage is always at or near the maximum power point of the PV array

4 Efficiency measurement conditions

Efficiency shall be measured under the matrix of conditions as described in the following clauses and table 1. Specific conditions may be excluded by mutual agreement when those conditions are outside the manufacturer's allowable operating range. The resulting data shall be presented in tabular form and may also be presented graphically.

NOTE For example, stand-alone power conditioners are typically designed to handle short-term overload significantly above the rated power. The test at 120 % of rated capacity is included to give an indication of the performance of the power conditioner under these conditions. Some power conditioners are not designed to provide more than their rated output and might be damaged if operated at 120 % of rated capacity. In such cases, test documentation shall note that the test was excluded due to limitation in the power conditioner.

4.1 DC power source for testing

For power conditioners operating with fixed input voltage, the d.c. power source shall be a storage battery or constant voltage power source to maintain the input voltage.

For power conditioners that employ maximum power point tracking (MPPT) and shunt-type power conditioners, either a photovoltaic array or a photovoltaic array simulator shall be utilized.

4.2 Temperature

All measurements are to be made at an ambient temperature of $25\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$. Other ambient temperatures may be allowed by mutual agreement. However, the temperature used must be clearly stated in all documentation.

4.3 Output voltage and frequency

The output voltage and frequency shall be maintained at the manufacturer's stated nominal values.