

**Utility-interconnected photovoltaic inverters - Test  
procedure of islanding prevention measures**

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

See Eesti standard EVS-EN 62116:2014 sisaldab Euroopa standardi EN 62116:2014 ingliskeelset teksti.	This Estonian standard EVS-EN 62116:2014 consists of the English text of the European standard EN 62116:2014.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 25.07.2014.	Date of Availability of the European standard is 25.07.2014.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile [standardiosakond@evs.ee](mailto:standardiosakond@evs.ee).

ICS 27.160

### Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega:  
Aru 10, 10317 Tallinn, Eesti; [www.evs.ee](http://www.evs.ee); telefon 605 5050; e-post [info@evs.ee](mailto:info@evs.ee)

### The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:  
Aru 10, 10317 Tallinn, Estonia; [www.evs.ee](http://www.evs.ee); phone 605 5050; e-mail [info@evs.ee](mailto:info@evs.ee)

English Version

Utility-interconnected photovoltaic inverters - Test procedure of  
islanding prevention measures  
(IEC 62116:2014)

Onduleurs photovoltaïques interconnectés au réseau public  
- Procédure d'essai des mesures de prévention contre  
l'îlotage  
(CEI 62116:2014)

Photovoltaik-Wechselrichter für den Anschluss an das  
Stromversorgungsnetz - Prüfverfahren für Maßnahmen zur  
Verhinderung der Inselbildung  
(IEC 62116:2014)

This European Standard was approved by CENELEC on 2014-04-02. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

## Foreword

The text of document 82/813/FDIS, future edition 2 of IEC 62116, prepared by IEC/TC 82 "Solar photovoltaic energy systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62116:2014.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2015-01-25
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2017-04-02

This document supersedes EN 62116:2011.

EN 62116:2014 includes the following significant technical changes with respect to EN 62116:2011:

Previous edition		Present edition
3.7	Real power	Active power
5.1		
5.4		
6.1 b)		
6.1 d)		
6.1 e)		
6.1 g)		
Table 1		
Table 6		
Table 7		
Table 9		
5.2	<p>A PV array or PV array simulator (preferred) may be used.</p> <p>If the EUT can operate in utility-interconnected mode from a storage battery, a DC power source may be used in lieu of a battery as long as the DC power source is not the limiting device as far as the maximum EUT input current is concerned.</p>	<p>A DC power source, such as a PV array simulator, a PV array, or a current and voltage limited DC power supply with series resistance may be used.</p> <p>If the EUT can operate in utility-interconnected mode from a storage battery, a DC power source may be used in lieu of a battery as long as the DC power source shall not be the limiting device as far as the maximum EUT input current is concerned.</p>

Table 5	EUT input voltage 90 %	EUT input voltage 75 %
	EUT input voltage 10 %	EUT input voltage 20 %
	EUT Trip Settings Manufacturer specified voltage and frequency trip settings	Voltage and frequency trip settings according to National standards and/or local code
Tables 6 & 7 (Heading)	Percent change in real load, reactive load from nominal	Percent change in active load, reactive load from nominal output power

Major changes with respect to the previous edition concern the DC power source and test conditions.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

### Endorsement notice

The text of the International Standard IEC 62116:2014 was approved by CENELEC as a European Standard without any modification.

## **Annex ZA**

(normative)

### **Normative references to international publications with their corresponding European publications**

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: [www.cenelec.eu](http://www.cenelec.eu).

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC/TS 61836	-	Solar photovoltaic energy systems - Terms, definitions and symbols	CLC/TS 61836	-

## CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references .....	7
3 Terms and definitions .....	7
4 Testing circuit.....	9
5 Testing equipment.....	11
5.1 Measuring instruments.....	11
5.2 DC power source .....	11
5.2.1 General .....	11
5.2.2 PV array simulator .....	12
5.2.3 Current and voltage limited DC power supply with series resistance.....	12
5.2.4 PV array .....	12
5.3 AC power source .....	13
5.4 AC loads.....	13
6 Test for single or multi-phase inverter.....	13
6.1 Test procedure.....	13
6.2 Pass/fail criteria .....	17
7 Documentation .....	17
Annex A (informative) Islanding as it applies to PV systems .....	20
A.1 General.....	20
A.2 Impact of distortion on islanding.....	21
Annex B (informative) Test for independent islanding detection device (relay) .....	22
B.1 General.....	22
B.2 Testing circuit .....	22
B.3 Testing equipment .....	22
B.3.1 General .....	22
B.3.2 AC input source .....	22
B.4 Testing procedure.....	23
B.5 Documentation.....	23
Annex C (informative) Gate blocking signal.....	24
C.1 General.....	24
C.2 Gate blocking signal used in photovoltaic systems .....	24
C.3 Monitoring the gate blocking signal .....	24
Bibliography.....	25
Figure 1 – Test circuit for islanding detection function in a power conditioner (inverter) .....	11
Figure B.1 – Test circuit for independent islanding detection device (relay) .....	22
Table 1 – Parameters to be measured in real time .....	10
Table 2 – Specification of array simulator (test conditions).....	12
Table 3 – PV array test conditions .....	13
Table 4 – AC power source requirements .....	13
Table 5 – Test conditions.....	14

Table 6 – Load imbalance (real, reactive load) for test condition A (EUT output = 100 %) .....	16
Table 7 – Load imbalance (reactive load) for test condition B (EUT output = 50 % to 66 %) and test condition C (EUT output = 25 % to 33 %) .....	16
Table 8 – Specification of the EUT provided by the manufacturer (example) .....	17
Table 9 – List of tested condition and run on time (example).....	18
Table 10 – Specification of testing equipment (example).....	19



## INTRODUCTION

Islanding is a condition in which a portion of an electric power grid, containing both load and generation, is isolated from the remainder of the electric power grid. This situation is one which electric power providers (utilities) regularly contend with. When an island is created purposely by the controlling utility – to isolate large sections of the utility grid, for example – it is called an intentional island. Conversely, an unintentional island can be created when a segment of the utility grid containing only customer-owned generation and load is isolated from the utility control.

Normally, the customer-owned generation is required to sense the absence of utility-controlled generation and cease energizing the grid. However, when the generation and load within the segment are well balanced prior to the isolation event, the utility is providing little power to the grid segment, thus making it difficult to detect when the isolation occurs. Damage can occur to customer equipment if the generation in the island, no longer under utility control, operates outside of normal voltage and frequency conditions. Customer and utility equipment can be damaged if the main grid recloses into the island out of synchronization. Energized lines within the island present a shock hazard to unsuspecting utility lineworkers who think the lines are dead.

The PV industry has pioneered the development of islanding detection and prevention measures. To satisfy the concerns of electric power providers, commercially-available utility-interconnected PV inverters have implemented a variety of islanding detection and prevention (also called anti-islanding) techniques. The industry has also developed a test procedure to demonstrate the efficacy of these anti-islanding techniques; that procedure is the subject of this document.

This standard provides a consensus test procedure to evaluate the efficacy of islanding prevention measures used by the power conditioner of utility-interconnected PV systems. Note that while this document specifically addresses inverters for photovoltaic systems, with some modifications the setup and procedure may also be used to evaluate inverters used with other generation sources or to evaluate separate anti-islanding devices intended for use in conjunction with PV inverters or other generation sources acting as or supplementing the anti-islanding feature of those sources.

Inverters and other devices meeting the requirements of this document can be considered non-islanding, meaning that under reasonable conditions, the device will detect island conditions and cease to energize the public electric power grid.