BS EN 62759-1:2015

BSI Standards Publication

Photovoltaic (PV) modules — Transportation testing

Part 1: Transportation and shipping of module package units

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National foreword

This British Standard is the UK implementation of EN 62759-1:2015. It is identical to IEC 62759-1:2015.

The UK participation in its preparation was entrusted to Technical Committee GEL/82, Photovoltaic Energy Systems.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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English Version

Photovoltaic (PV) modules - Transportation testing - Part 1: Transportation and shipping of module package units (IEC 62759-1:2015)

Modules photovoltaïques (PV) - Essais de transport - Partie 1: Transport et expédition d'unités d'emballage de modules (IEC 62759-1:2015)

Transportprüfung von Photovoltaik(PV)-Modulen - Teil 1: Transport und Versand von PV-Modulpaketen (IEC 62759-1:2015)

This European Standard was approved by CENELEC on 2015-07-31. 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.

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

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European foreword

The text of document 82/962/FDIS, future edition 1 of IEC 62759-1, prepared by IEC/TC 82 "Solar photovoltaic energy systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62759-1:2015.

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) 2016-05-01
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2018-07-31

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 62759-1:2015 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.

Publication	Year	Title	EN/HD	Year
IEC 60068-2-27	2008	Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock	EN 60068-2-27	2009
IEC 60068-2-64	-	Environmental testing - Part 2-64: Tests - Test Fh: Vibration, broadband random and guidance	EN 60068-2-64	-
IEC 61215	2005	Crystalline silicon terrestrial photovoltaic (PV) modules - Design qualification and type approval	EN 61215	2005
IEC 61646	2008	Thin-film terrestrial photovoltaic (PV) modules - Design qualification and type approval	EN 61646	2008
IEC 61730-2 (mod)	2004	Photovoltaic (PV) module safety qualification - Part 2: Requirements for testing	EN 61730-2	2007
IEC/TS 61836	-	Solar photovoltaic energy systems - Terms, definitions and symbols	CLC/TS 61836	-
IEC 62108	2007	Concentrator Photovoltaic (CPV) modules and assemblies - Design qualification and type approval	EN 62108	2008
IEC/TS 62782	- [1)]	Dynamic mechanical load testing for photovoltaic (PV) modules	-	-
ISO 13355	-	Packaging - Complete, filled transport packages and unit loads - Vertical random vibration test	EN ISO 13355	-

1) To be published.

Publication	Year	Title	EN/HD	Year
ASTM D 880-92	2008	Standard Test Method for Impact Testing for Shipping Containers and Systems	-	-
ASTM D 4169	2008	Standard Practice for Performance Testing of Shipping Containers and Systems	-	-
ASTM D 4728	2006	Standard Test Method for Random Vibration Testing of Shipping Containers	-	-
ASTM D 5277	1992	Standard Test Method for Performing Programmed Horizontal Impacts Using an Inclined Impact Tester	-	-
MIL-STD-810G	-	Test Method Standard: Environmental Engineering Considerations and Laboratory Tests	-	-

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

PHOTOVOLTAIC (PV) MODULES – TRANSPORTATION TESTING –

Part 1: Transportation and shipping of module package units

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). 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. 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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International Standard IEC 62759-1 has been prepared by IEC technical committee 82: Solar photovoltaic energy systems.

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

FDIS	Report on voting
82/962/FDIS	82/982/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of IEC 62759 series, under the general title *Photovoltaic (PV) modules – Transportation testing*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

PHOTOVOLTAIC (PV) MODULES – TRANSPORTATION TESTING –

Part 1: Transportation and shipping of module package units

1 Scope and object

Photovoltaic (PV) modules are electrical devices intended for continuous outdoor exposure during their lifetime. Existing type approval standards do not consider mechanical stresses that may occur during transportation to the PV installation destination.

This part of IEC 62759 describes methods for the simulation of transportation of complete package units of modules and combined subsequent environmental impacts, it does however not include pass/fail criteria.

This standard is designed so that its test sequence can co-ordinate with those of IEC 61215 or IEC 61646, so that a single set of samples may be used to perform both the transportation simulation and performance evaluation of a photovoltaic module design. This standard applies to flat plate photovoltaic modules, but may also be used as a basis for testing of CPV modules and assemblies.

2 Normative references

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.

IEC 60068-2-27:2008, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60068-2-64, *Environmental testing – Part 2-64: Tests – Test Fh: Vibration, broadband random and guidance*

IEC 61215:2005, *Crystalline silicon terrestrial photovoltaic (PV) modules – Design qualification and type approval*

IEC 61646:2008, *Thin-film terrestrial photovoltaic (PV) modules – Design qualification and type approval*

IEC 61730-2:2004*, Photovoltaic (PV) module safety qualification – Part 2: Requirements for testing*

IEC TS 61836, *Solar photovoltaic energy systems – Terms, definitions and symbols*

IEC 62108:2007, *Concentrator photovoltaic (CPV) modules and assemblies – Design qualification and type approval*

IEC 62782, *Dynamic mechanical load testing for photovoltaic (PV) modules* (to be published)

ISO 13355, *Packaging – Complete, filled transport packages and unit loads – Vertical random vibration test*

ASTM D880-92:2008, *Standard Test Method for Impact Testing for Shipping Containers and Systems*

ASTM D4169:2008, *Standard Practice for Performance Testing of Shipping Containers and Systems*

ASTM D4728:2006, *Standard Test Method for Random Vibration Testing of Shipping Containers*

ASTM D5277:1992, *Test method for performing programmed horizontal impact using an incline impact tester*

ISTA 3E:2009, *Unitized Loads of Same Product*

MIL STD 810G, *Test Method Standard for Environmental Engineering Considerations and Laboratory Tests*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC TS 61836:1999 and the following apply.

3.1
bandwidth
difference in Hz between the upper and lower limits of a frequency band. For the purposes of the described test method, the bandwidth may be considered equivalent to the frequency resolution of a spectrum analysis

3.2
overall g_{RMS}
square root of the integral of power spectral density over the total frequency range. It describes the severity or harshness of the testing grade

3.3
root mean square
r.m.s.
square root of the mean square value. In the exclusive case of a sine wave, the r.m.s. value is 0,707 times peak value

3.4
random vibration
oscillation whose instantaneous amplitude is not prescribed for any given instant in time. The instantaneous amplitudes of a random vibration are prescribed by a probability distribution function, the integral of which, over a given amplitude range, will give the probable percentage of time that the amplitude will fall within that range. Random vibration contains no periodic or quasi-periodic components

3.5
packaging
material and technology used to protect goods from transportation stresses and separate individual units from each other

3.6
power spectral density
PSD
expression of random vibration in terms of mean-square acceleration per unit of frequency. The units are g^2/Hz (g^2/cycles/s). Power spectral density is the limit of the mean square

amplitude in a given rectangular waveband divided by the bandwidth, as the bandwidth approaches zero

3.7
grade A PV modules
100 % functional modules without any visual or functional defects

3.8
grade B or lower PV modules
grade B or lower modules may have visual or functional defects. The modules should be equivalent to grade A modules regarding their mass, size and mechanical behavior.

4 Sampling

As test samples for the basic transportation and shock test methods, a shipping unit of PV modules shall be taken at random from a production batch or batches. The shipping unit shall contain the usual amount of PV modules. This test procedure is however designed for shipping units containing at least 10 modules. For further testing (path A and B for PV modules) at least six grade A modules are needed from the shipping unit.

Further three grade A modules are to be taken from a separate shipping unit not undergoing any transportation simulation.

Grade B or lower modules can be used to fill up the shipping system (uniform distribution) of samples, completing it to a regular shipping unit. Each individual substitute shall cover the same mass, size and bending stiffness as the modules to be tested in the subsequent environmental impact tests.

The shipping unit shall contain at least 25 % grade A modules. If the shipping unit contains less than 24 modules at least six grade A modules shall be provided.

In case of horizontal shipping the bottom and the top of the shipping unit shall be made up with grade A modules and in case of vertical shipping the outer modules of the shipping unit shall be made up with grade A modules.

Use the regular shipment packaging materials with the modules, as marketed and designed by the manufacturer.

The modules shall have been manufactured from specified materials and components in accordance with the relevant drawings and process sheets and shall have been subjected to the manufacturer's normal inspection, quality control and production acceptance procedures. The modules shall be complete in every detail, including a type label and shall be accompanied by the manufacturer's handling, mounting, shipping/packaging and installation instructions, including the information of the maximum permissible system voltage.

The shipping unit of test specimen shall be in accordance with the standard procedures used to ship modules to customers.

NOTE For CPV modules the sample numbers may vary, as shipping units may be much larger.

5 Handling

The test samples shall be handled with suitable care prior to the application of the tests described in this standard. It shall be ensured that the test samples are not exposed to additional mechanical impacts in form of shocks, rough handling, dropping, etc.

For the transportation from the manufacturer to the test laboratory special care should be taken to avoid any kind of damage. A special packaging concept may be considered for this particular shipping route (manufacturer – test site). Testing shall be carried out without additional packaging.

6 Testing procedures

6.1 General

Performance measurements, insulation and wet leakage current testing shall be performed in accordance with IEC 61215:2005 respectively IEC 61646:2008, 10.2, 10.3 and 10.15 as relative initial and control measurements. Electroluminescence or thermal images can be used to support the evaluation of the samples initial and intermediate status (e. g. micro cracks, defects, etc.).

The initial and visual inspection in accordance with IEC 61215:2005, 10.1 or IEC 61646:2008, 10.1 for PV modules and IEC 62108:2007, 10.1 for CPV modules shall also be part of the assessment.

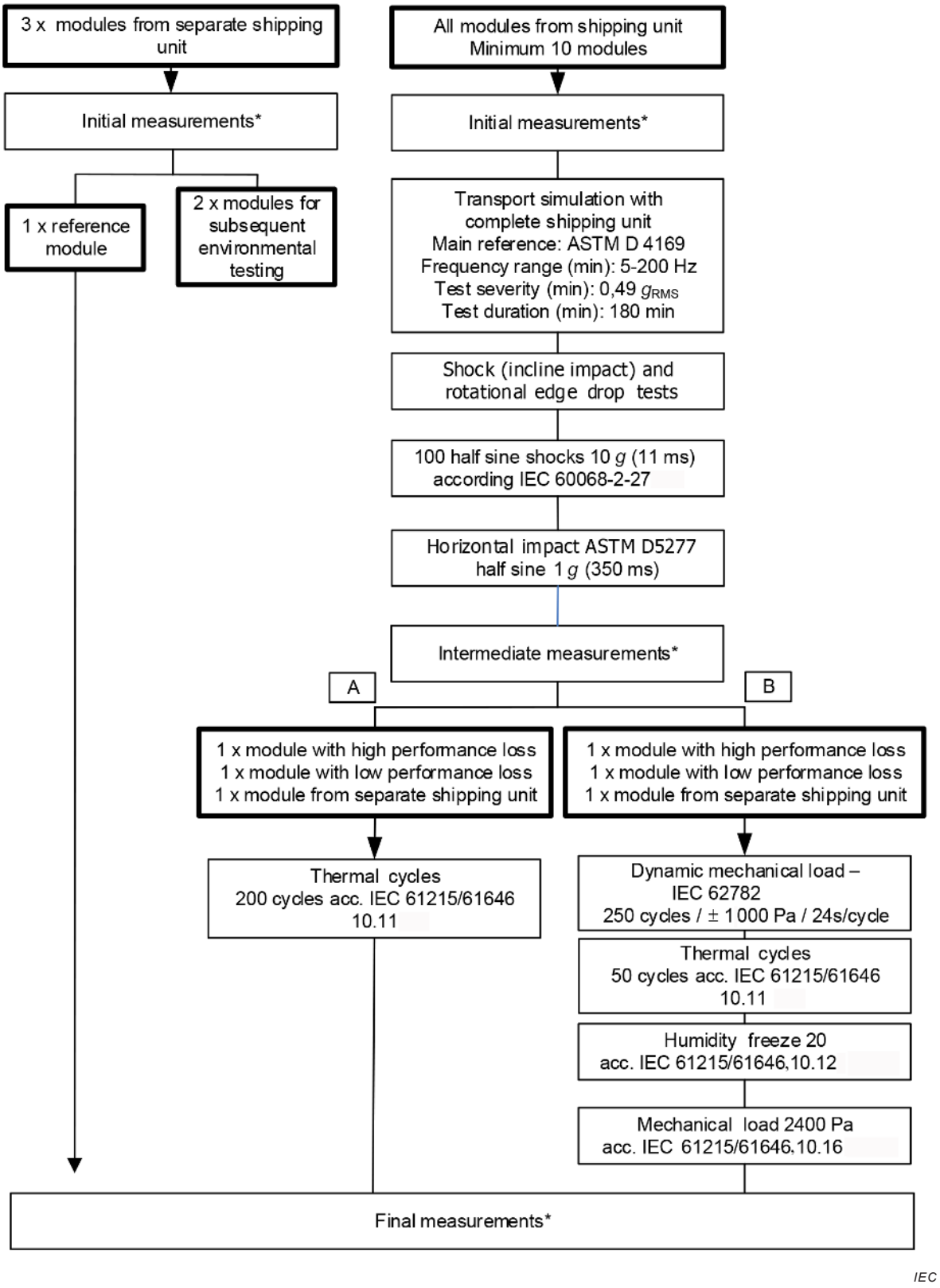
The actual transportation test is shown in Figure 1 for PV modules; Figure 2 shows a possible test sequence for CPV modules. The sequences of combined transportation stress testing and the possible effects of these impacts on the PV modules shall detect early failures in regards to future life-time stresses.

If a manufacturer wishes to combine the testing to this standard with type approval testing, sequence A of Figure 1 can also be used in conjunction with IEC 61215 respectively IEC 61646 testing. Combined testing will increase the risk of failure in type approval testing, as the transportation testing will pose additional stress to the samples.

Sequence B of Figure 1 could be extended with the UV preconditioning test and then also be coordinated with IEC 61215 respectively IEC 61646.

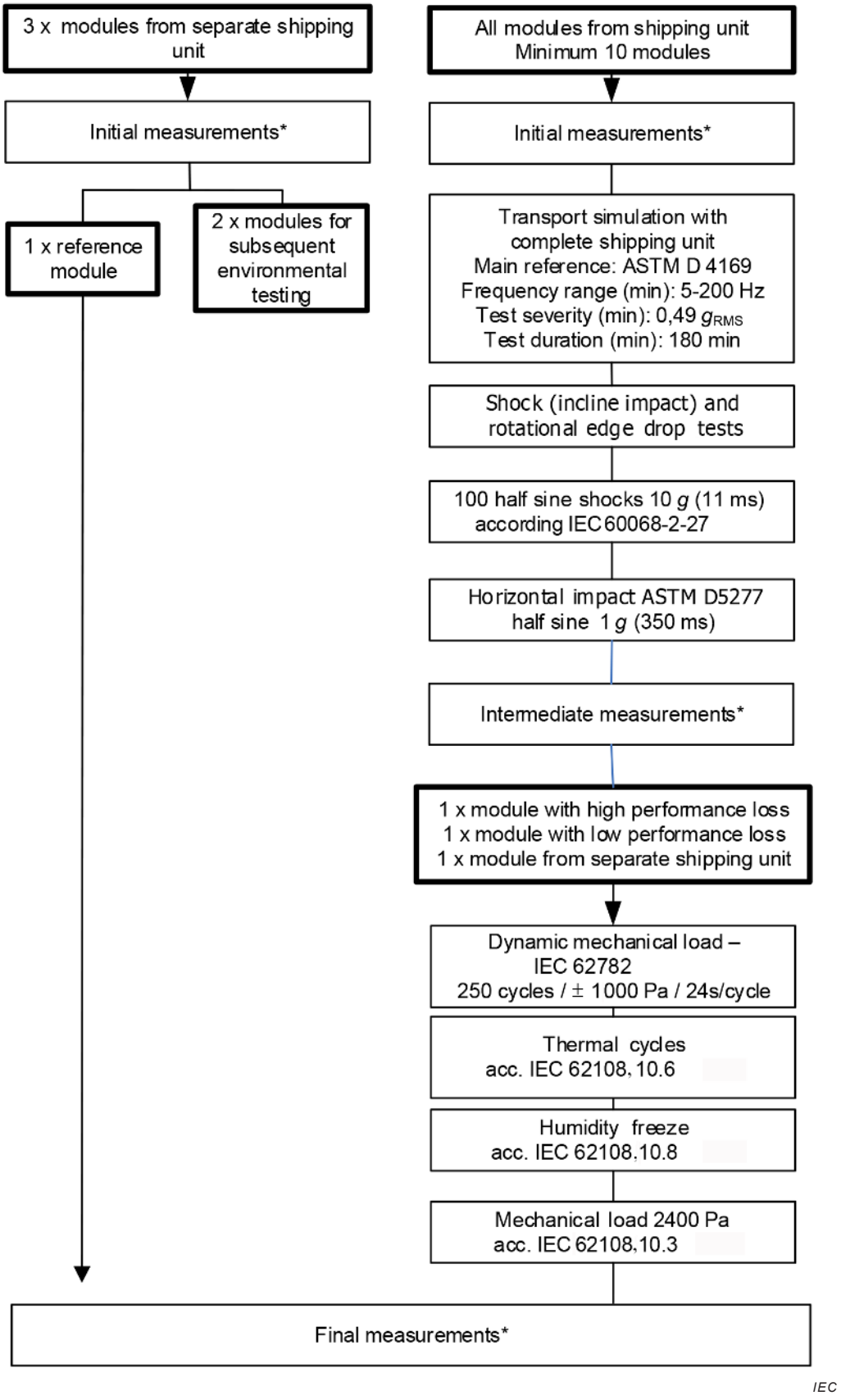
The proposed test sequence in Figure 2 for CPV modules can also be adjusted to coordinate with IEC 62108. The sequence shall be adjusted depending on whether receivers or modules are tested. For receivers, instead of the pre-thermal cycling and humidity freeze test, the thermal cycling test according to IEC 62108:2007, 10.8 may be performed.

Separate modules, that have not undergone any transportation testing, are also subjected to the stress tests in sequences A and B. Failures induced by the transportation simulation and potentially worsen defects due to the environmental stress tests shall be identified in comparison to the modules tested without any transportation pre-damages.



* See 6.2 for details on measurements.

Figure 1 – Test sequences for PV modules



* See 6.2 for details on measurements.

Figure 2 – Test sequences for CPV modules

6.2 Measurements

Each initial, intermediate and final measurement shall characterize the electrical performance of the PV modules and document the influence of the stress tests. The initial, intermediate and final measurements are:

- Visual inspection according to IEC 61215:2005, IEC 61646:2008, respectively IEC 62108:2007, 10.1
- Maximum power determination according to IEC 61215:2005, IEC 61646:2008, respectively IEC 62108:2007, 10.2
- Insulation test according to IEC 61215:2005, IEC 61646:2008, 10.3 respectively IEC 62108:2007, 10.4
- Ground continuity test according to IEC 61730-2:2004,10.4 respectively IEC 62108, 10.3
- Wet leakage current test according to IEC 61215:2005, IEC 61646:2008, 10.15 respectively IEC 62108, 10.5
- Optionally electroluminescence (only for PV modules) or infrared imaging can be used for analysing modules for cracked or broken solar cells, etc.

While the maximum power determination is only a relative measurement, some PV technologies may require preconditioning according to their respective type approval standard to arrive at meaningful data.

6.3 Transportation testing

6.3.1 General

Performing tests of random vibration and various shock tests on the complete package system of modules simulates road transportation and the related mechanical impacts on shipping units and the (C)PV modules that are contained within.

NOTE Sequence B of Figure 1 can be extended by the UV preconditioning test to be able to coordinate with IEC 61215 or IEC 61646 if desired.

While the (C)PV modules are carefully unpacked, the modules shall be marked: the original packaging situation and the module position within the package shall be adequately documented.

After the initial measurements described in 6.2, the modules shall be restored to their original packaged condition in order to perform the tests described under 6.3.2 and 6.3.3.

6.3.2 Random vibration testing

6.3.2.1 Purpose

Transportation simulation is achieved through a random vibration test. Truck transportation is considered to be the most severe method of long distance transportation for shipping goods. The truck transportation test therefore covers most other means of transportation.

6.3.2.2 Apparatus

Test equipment as described in ASTM D4728:2006, section 5 – Apparatus, shall be used.

6.3.2.3 Procedure

The transportation simulation shall be performed in accordance with ASTM D4169 with one complete stack of modules:

The applied test profile shall meet the following requirements:

a) A frequency range of within 5 Hz to 200 Hz.

b) A test severity not below 0,49 g_{RMS} as described in Annex A.

c) The test duration shall last at least 180 min.

d) Excitation axis: vertical.

Following the random vibration test, a series of shock tests shall be carried out on the shipping unit.

6.3.3 Shock testing

6.3.3.1 Vertical shock test

6.3.3.1.1 Purpose

A shock test according to IEC 60068-2-27 shall be performed. This test procedure simulates stresses as may be caused by potholes or sidewalk edges which are not covered by the random vibration test.

6.3.3.1.2 Apparatus

Test equipment as described in IEC 60068-2-27:2008, Clause 4 shall be used.

The following deviations will be tolerated, if the applied variations are explained and clearly documented in the report:

- Extension of the mounting table in order to fit larger package units in an appropriate way.

6.3.3.1.3 Procedure

100 half sinusoidal shocks with duration of 11 ms shall be applied vertically (z direction).

6.3.3.2 Incline impact test

6.3.3.2.1 Purpose

The incline impact test shall be performed to simulate stress potentially caused by forklift transportation.

6.3.3.2.2 Apparatus

Test equipment as described in ASTM D880 shall be used.

6.3.3.2.3 Procedure

The procedure as described in ISTA 3E, Test Block, 2 shall be followed.

6.3.3.3 Horizontal impact test

6.3.3.3.1 Purpose

For testing the integrity of the shipping unit regarding internal displacements or displacements of the shipping goods against the palette, an incline impact test shall be performed in accordance with ASTM D5277. This test simulates sudden deceleration and sideward acceleration in curves during truck transportation.

6.3.3.3.2 Apparatus

Test equipment as described in ASTM D5277 shall be used.

6.3.3.3.3 Procedure

A test according to ASTM D5277 – “test method for performing programmed horizontal impact using an incline impact tester” shall be performed. The difference to the incline impact test is that the shipping unit is decelerated on the transport sledge / transport vehicle.

The characteristic of this impact shall be half sinusoidal shock like. The half sine shock shall have a deceleration of 1 *g* and a length of 350 ms and shall be applied on each horizontal side.

It is common to start with an initial value of 0,3 *g* and increase the deceleration stepwise till the integrity of the shipping unit is damaged or the end value of 1 *g* is reached.

6.3.3.4 Rotational edge drop test

6.3.3.4.1 Purpose

A rotational edge drop test shall be performed to test the integrity of the shipping supporting units pallet.

6.3.3.4.2 Apparatus

Test equipment as described in ISTA 3E, Test Block 3, shall be used.

6.3.3.4.3 Procedure

The procedure as described in ISTA 3E, Test Block 3, shall be followed.

6.4 Environmental stress tests

6.4.1 PV modules

6.4.1.1 Path A

The transportation test is followed by a thermal cycling test in accordance with IEC 61215:2005 respectively IEC 61646:2008, 10.11 for 200 cycles. During this thermal cycle test no current flow is required unless this test protocol is combined with an IEC 61215 respectively IEC 61646 type approval. Continuity of the circuit through the module shall still be measured using a current flow of less than 0,5 % of short circuit current of the module under test.

Sample allocation for path A:

a) 1 × module (highest power loss relative to initial measurement after transport simulation);

b) 1 × module (lowest power loss relative to initial measurement after transport simulation);

c) 1 × module from separate shipping unit.

NOTE The thermal cycling test represents the worst case variability of temperature in temperate climates. In general, PV modules are multilayer products. Each material (layer) has a different thermal expansion. This causes stress between the layers while thermal cycling. The cells, the joints and cell/string connectors may be especially prone to strains.

6.4.1.2 Path B

The transportation test is followed by a dynamic mechanical load test according to IEC 62782, a thermal cycling test according to IEC 61215 respectively IEC 61646, 10.11 with 50 cycles and a humidity freeze test according to IEC 61215 respectively IEC 61646, 10.12. The sequence concludes with a mechanical load test according to IEC 61215 respectively IEC 61646, 10.16.

The dynamic mechanical load test for photovoltaic modules is described in IEC 62782. The module shall be installed according to the installation manual of the manufacturer. If different mounting techniques are possible, the worst case mounting situation shall be applied.

Sample allocation for path B:

a) 1 × module (highest power loss relative to initial measurement after transport simulation);

b) 1 × module (lowest power loss relative to initial measurement after transport simulation);

c) 1 × module from separate shipping unit.

6.4.2 CPV modules and receivers

The transportation test is followed by a dynamic mechanical load test acc. to IEC 62782, a pre-thermal cycle test and a humidity freeze test according to IEC 62108:2007, 10.8. The sequence concludes with a mechanical load test according to IEC 62108:2007, 10.13.

The dynamic mechanical load test for photovoltaic modules is described in IEC 62782. The CPV module shall be installed according to the installation manual of the manufacturer. If different mounting techniques are possible, the worst case mounting situation shall be applied.

Sample allocation for CPV modules and receivers

a) 1 × module (highest power loss relative to initial measurement after transport simulation);

b) 1 × module (lowest power loss relative to initial measurement after transport simulation);

c) 1 × modules from separate shipping unit.

7 Reporting

Each test report shall include at least the following information:

a) a title;

b) name and address of the test laboratory and location where the tests were carried out;

c) unique identification of the report and of each page;

d) name and address of client, where appropriate;

e) description and identification of the item tested;

f) characterization and condition of the test item;

g) date of receipt of test item and date(s) of test, where appropriate;

h) identification of test method used;

i) reference to sampling procedure, where relevant;

j) the applied standard for transportation testing and the used test profile. Any deviations from, additions to or exclusions from the test method, and any other information relevant to a specific tests, such as environmental conditions;

k) measurements, examinations and derived results supported by tables, graphs, sketches and photographs respectively electroluminescence or thermal images. Of particular importance are results indicating power loss or damages caused by the testing;

l) camera properties of electroluminescence and thermal imaging devices as well as the used current on the PV module and the exposure time;

m) a statement of the estimated uncertainty of the test results (where relevant);

n) a signature and title, or equivalent identification of the person(s) accepting responsibility for the content of the certificate or report, and the date of issue;

o) where relevant, a statement to the effect that the results relate only to the items tested;

p) a statement that the report shall not be reproduced except in full, without the written approval of the laboratory.

A copy of this report shall be kept by the manufacturer for reference purposes.

Annex A
(normative)

Test profiles

A.1 Overview

For informative purposes, the following PSD test profiles are shown and analyzed according to the criteria defined in Clause 6.The main reference for transport testing is the PSD profile out of the standard ASTM D4169. Other PSD profiles also fulfill the transportation testing requirements. The relevant frequency range for examination is between 5 Hz and 200 Hz. The result of the analysis is shown in Table A.1. The listed test profiles fulfill the requirements which are defined in Clause 6. The listed test profiles pass the requirements which are defined in Clause 6.

Table A.1 – Severity of common transport test profiles: complete and in range (5 Hz – 200 Hz)

Name of test profile	g_{RMS} (5 Hz – 200 Hz)	g_{RMS} complete profile
Main reference: ASTM D4169 (truck medium)	0,499	0,520
ISTA 3 E	0,504	0,540
MIL STD 810G / IEC 60064-2-64	0,950	1,040
ISO 13355	0,583	0,590

The resonance of PV modules depends on the construction: including mass, size and stiffness. Tests have shown that the slowest fundamental resonance of a PV module is ~5 Hz. Most transportation test profiles have the majority of the energy between the frequencies of 5 Hz and 200 Hz. A reasonable benchmark for different transportation test profiles for PV modules should therefore only include vibrations between 5 Hz and 200 Hz.

A.2 Data points of appropriate PSD test profiles

The following Tables A.2 to A.5 identify the profile boundaries of the PSD excitation profiles analysed and shown in Table A.1 and Figure A.1.

Table A.2 – Main reference ASTM D4169 (truck medium)

Frequency Hz	g^2/Hz
1	0,00005
4	0,01
16	0,01
40	0,001
80	0,001
200	0,00001
	0,520 g_{RMS}

Table A.3 – Grid points ISO 13355

Frequency Hz	g^2/Hz
3	0,0005
6	0,012
18	0,012
40	0,001
200	0,0005
	0,590 g_{RMS}

Table A.4 – IEC 60068-2-64 / MIL STD 810G

Frequency Hz	g^2/Hz
5	0,015
40	0,015
500	0,00015
	1,040 g_{RMS}

Table A.5 – ISTA 3E

Frequency Hz	g^2/Hz
1	0,0072
3	0,018
4	0,0018
6	0,00072
12	0,00072
16	0,0036
25	0,0036
30	0,00072
40	0,0036
80	0,0036
100	0,00036
200	0,000018
	0,540 g_{RMS}

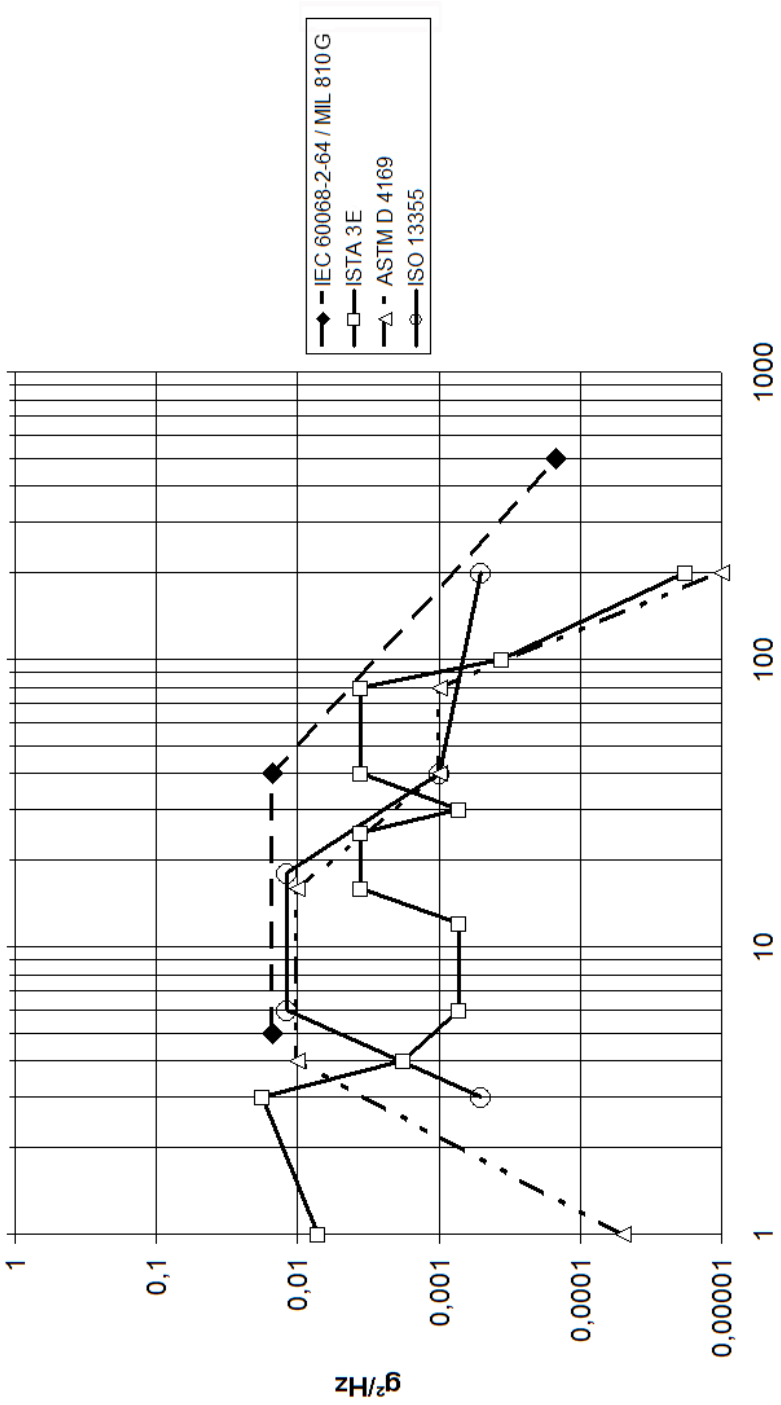


Figure A.1 – Appropriate PSD test profile

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BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

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