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IEC 61215-1-4

Edition 2.0 2021-02
REDLINE VERSION

INTERNATIONAL STANDARD



**Terrestrial photovoltaic (PV) modules – Design qualification and type approval –
Part 1-4: Special requirements for testing of thin-film $\text{Cu}(\text{In,Ga})(\text{S,Se})_2$ based
photovoltaic (PV) modules**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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CONTENTS

FOREWORD	4
1 Scope and object	6
2 Normative references	7
3 Terms and definitions	7
4 Test samples	7
5 Marking and documentation	7
6 Testing	7
7 Pass criteria	7
8 Major visual defects	7
9 Report	7
10 Modifications	7
11 Test flow and procedures	8
11.1 Visual inspection (MQT 01)	8
11.2 Maximum power determination (MQT 02)	8
11.3 Insulation test (MQT 03)	8
11.4 Measurement of temperature coefficients (MQT 04)	8
11.5 Measurement of nominal module operating temperature (NMOT) (MQT 05) Placeholder section, formerly NMOT	8
11.6 Performance at STC (MQT 06.1) and NMOT (MQT 06.2)	8
11.7 Performance at low irradiance (MQT 07)	8
11.8 Outdoor exposure test (MQT 08)	8
11.9 Hot-spot endurance test (MQT 09)	8
11.9.1 Purpose	8
11.9.2 Hot-spot effect	8
11.9.3 Classification of cell interconnection	9
11.9.4 Apparatus	9
11.9.5 Procedure	9
11.9.6 Final measurements	9
11.9.7 Requirements	9
11.10 UV preconditioning test (MQT 10)	9
11.11 Thermal cycling test (MQT 11)	9
11.12 Humidity-freeze test (MQT 12)	9
11.13 Damp heat test (MQT 13)	11
11.13.1 Procedure	11
11.14 Robustness of terminations test (MQT 14)	12
11.15 Wet leakage current test (MQT 15)	12
11.16 Static mechanical load test (MQT 16)	12
11.17 Hail test (MQT 17)	12
11.18 Bypass diode testing (MQT 18)	12
11.19 Stabilization (MQT 19)	12
11.19.1 Criterion definition for stabilization	12
11.19.2 Light induced stabilization procedures	12
11.19.3 Other stabilization procedures	12
11.19.4 Initial stabilization (MQT 19.1)	12
11.19.5 Final stabilization (MQT 19.2)	13

11.20 Cyclic (dynamic) mechanical load test (MQT 20).....	13
11.21 Potential induced degradation test (MQT 21)	13
11.22 Bending test (MQT 22).....	14
Figure 1 – Current flow using MQT 11 Method B	10
Figure 2 – Current flow using MQT 12 Method B	11
Figure 3 – Electrical connections for MQT 21 Method B, positive system voltage	14
Figure 4 – Electrical connections for MQT 21 Method B, negative system voltage.....	14

INTERNATIONAL ELECTROTECHNICAL COMMISSION

TERRESTRIAL PHOTOVOLTAIC (PV) MODULES – DESIGN QUALIFICATION AND TYPE APPROVAL –

Part 1-4: Special requirements for testing of thin-film Cu(In,Ga)(S,Se)₂ based photovoltaic (PV) modules

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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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 61215-1-4:2016. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

International Standard IEC 61215-1-4 has been prepared by IEC technical committee 82: Solar photovoltaic energy systems.

This second edition cancels and replaces the first edition of IEC 61215-1-4, issued in 2016, and constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) A cyclic (dynamic) mechanical load test (MQT 20) added.
- b) A test for detection of potential-induced degradation (MQT 21) added.
- c) A bending test (MQT 22) for flexible modules added.

Informative Annex A of 61215-1:2021 explains the background and reasoning behind some of the more substantial changes that were made in the IEC 61215 series in progressing from edition 1 to edition 2.

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

FDIS	Report on voting
82/1827/FDIS	82/1852/RVD

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

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

This standard is to be read in conjunction with IEC 61215-1:2021 and IEC 61215-2:2021.

A list of all parts in the IEC 61215 series, published under the general title *Terrestrial photovoltaic (PV) modules – Design qualification and type approval*, can be found on the IEC website.

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
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TERRESTRIAL PHOTOVOLTAIC (PV) MODULES – DESIGN QUALIFICATION AND TYPE APPROVAL –

Part 1-4: Special requirements for testing of thin-film Cu(In,Ga)(S,Se)₂ based photovoltaic (PV) modules

1 ~~Scope and object~~

~~This part of IEC 61215 lays down IEC requirements for the design qualification and type approval of terrestrial photovoltaic modules suitable for long-term operation in general open-air climates, as defined in IEC 60721-2-1.~~

This document lays down requirements for the design qualification of terrestrial photovoltaic modules suitable for long-term operation in open-air climates. The useful service life of modules so qualified will depend on their design, their environment and the conditions under which they are operated. Test results are not construed as a quantitative prediction of module lifetime.

In climates where 98th percentile operating temperatures exceed 70 °C, users are recommended to consider testing to higher temperature test conditions as described in IEC TS 63126. Users desiring qualification of PV products with lesser lifetime expectations are recommended to consider testing designed for PV in consumer electronics, as described in IEC 63163 (under development). Users wishing to gain confidence that the characteristics tested in IEC 61215 appear consistently in a manufactured product may wish to utilize IEC 62941 regarding quality systems in PV manufacturing.

This document is intended to apply to all thin-film Cu(In,Ga)(S,Se)₂ based terrestrial flat plate modules. As such it addresses special requirements for testing of this technology supplementing IEC 61215-1:2016/2021 and IEC 61215-2:2016/2021 requirements for testing.

This document does not apply to modules used with concentrated sunlight although it may be utilized for low concentrator modules (1 to 3 suns). For low concentration modules, all tests are performed using the irradiance, current, voltage and power levels expected at the design concentration.

~~The object of this test sequence is to determine the electrical and thermal characteristics of the module and to show, as far as possible within reasonable constraints of cost and time, that the module is capable of withstanding prolonged exposure in climates described in the scope. The actual lifetime expectancy of modules so qualified will depend on their design, their environment and the conditions under which they are operated.~~

The object of this test sequence is to determine the electrical characteristics of the module and to show, as far as possible within reasonable constraints of cost and time, that the module is capable of withstanding prolonged exposure outdoors. Accelerated test conditions are empirically based on those necessary to reproduce selected observed field failures and are applied equally across module types. Acceleration factors may vary with product design and thus not all degradation mechanisms may manifest. Further general information on accelerated test methods including definitions of terms may be found in IEC 62506.

Some long-term degradation mechanisms can only reasonably be detected via component testing, due to long times required to produce the failure and necessity of stress conditions that are expensive to produce over large areas. Component tests that have reached a sufficient level of maturity to set pass/fail criteria with high confidence are incorporated into the IEC 61215 series via addition to Table 1 in IEC 61215-1. In contrast, the tests procedures described in this series, in IEC 61215-2, are performed on modules.

This document defines PV technology dependent modifications to the testing procedures and requirements per IEC 61215-1:~~2016~~2021 and IEC 61215-2:~~2016~~2021.

2 Normative references

The normative references of IEC 61215-1:~~2016~~2021 and IEC 61215-2:~~2016~~2021 are applicable without modifications.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Terrestrial photovoltaic (PV) modules – Design qualification and type approval –
Part 1-4: Special requirements for testing of thin-film Cu(In,Ga)(S,Se)₂ based
photovoltaic (PV) modules**

**Modules photovoltaïques (PV) pour applications terrestres – Qualification de la
conception et homologation –
Partie 1-4: Exigences particulières d'essai des modules photovoltaïques (PV)
au Cu(In,Ga)(S,Se)₂ à couches minces**

CONTENTS

FOREWORD	4
1 Scope	6
2 Normative references	6
3 Terms and definitions	7
4 Test samples	7
5 Marking and documentation	7
6 Testing	7
7 Pass criteria	7
8 Major visual defects	7
9 Report	7
10 Modifications	7
11 Test flow and procedures	7
11.1 Visual inspection (MQT 01)	7
11.2 Maximum power determination (MQT 02)	7
11.3 Insulation test (MQT 03)	8
11.4 Measurement of temperature coefficients (MQT 04)	8
11.5 Placeholder section, formerly NMOT	8
11.6 Performance at STC (MQT 06.1)	8
11.7 Performance at low irradiance (MQT 07)	8
11.8 Outdoor exposure test (MQT 08)	8
11.9 Hot-spot endurance test (MQT 09)	8
11.9.1 Purpose	8
11.9.2 Hot-spot effect	8
11.9.3 Classification of cell interconnection	8
11.9.4 Apparatus	8
11.9.5 Procedure	8
11.9.6 Final measurements	9
11.9.7 Requirements	9
11.10 UV preconditioning test (MQT 10)	9
11.11 Thermal cycling test (MQT 11)	9
11.12 Humidity-freeze test (MQT 12)	10
11.13 Damp heat test (MQT 13)	11
11.13.1 Procedure	11
11.14 Robustness of terminations (MQT 14)	12
11.15 Wet leakage current test (MQT 15)	12
11.16 Static mechanical load test (MQT 16)	12
11.17 Hail test (MQT 17)	12
11.18 Bypass diode testing (MQT 18)	12
11.19 Stabilization (MQT 19)	12
11.19.1 Criterion definition for stabilization	12
11.19.2 Light induced stabilization procedures	12
11.19.3 Other stabilization procedures	12
11.19.4 Initial stabilization (MQT 19.1)	12
11.19.5 Final stabilization (MQT 19.2)	13
11.20 Cyclic (dynamic) mechanical load test (MQT 20)	13

11.21	Potential induced degradation test (MQT 21)	13
11.22	Bending test (MQT 22).....	14
Figure 1	– Current flow using MQT 11 Method B.....	10
Figure 2	– Current flow using MQT 12 Method B.....	11
Figure 3	– Electrical connections for MQT 21 Method B, positive system voltage.....	14
Figure 4	– Electrical connections for MQT 21 Method B, negative system voltage.....	14

INTERNATIONAL ELECTROTECHNICAL COMMISSION

TERRESTRIAL PHOTOVOLTAIC (PV) MODULES – DESIGN QUALIFICATION AND TYPE APPROVAL –

Part 1-4: Special requirements for testing of thin-film Cu(In,Ga)(S,Se)₂ based photovoltaic (PV) modules

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TERRESTRIAL PHOTOVOLTAIC (PV) MODULES – DESIGN QUALIFICATION AND TYPE APPROVAL –

Part 1-4: Special requirements for testing of thin-film Cu(In,Ga)(S,Se)₂ based photovoltaic (PV) modules

1 Scope

This document lays down requirements for the design qualification of terrestrial photovoltaic modules suitable for long-term operation in open-air climates. The useful service life of modules so qualified will depend on their design, their environment and the conditions under which they are operated. Test results are not construed as a quantitative prediction of module lifetime.

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2 Normative references

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SOMMAIRE

AVANT-PROPOS	18
1 Domaine d'application	20
2 Références normatives	21
3 Termes et définitions	21
4 Échantillons d'essai	21
5 Marquage et documentation	21
6 Essais	21
7 Critères d'acceptation	21
8 Défauts visuels majeurs	21
9 Rapport	21
10 Modifications	22
11 Série et procédures d'essais	22
11.1 Examen visuel (MQT 01)	22
11.2 Détermination de la puissance maximale (MQT 02)	22
11.3 Essai diélectrique (MQT 03)	22
11.4 Mesurage des coefficients de température (MQT 04)	22
11.5 Section de l'espace réservé, précédemment NMOT	22
11.6 Performances dans les STC (MQT 06.1)	22
11.7 Performances sous faible éclairage (MQT 07)	22
11.8 Essai d'exposition en site naturel (MQT 08)	22
11.9 Essai de tenue à l'échauffement localisé (MQT 09)	22
11.9.1 Objet	22
11.9.2 Effet de l'échauffement localisé	23
11.9.3 Classification des interconnexions de cellules	23
11.9.4 Appareillage	23
11.9.5 Procédure	23
11.9.6 Mesurages finaux	23
11.9.7 Exigences	23
11.10 Essai de préconditionnement aux UV (MQT 10)	23
11.11 Essai de cycle thermique (MQT 11)	23
11.12 Essai humidité-gel (MQT 12)	24
11.13 Essai de chaleur humide (MQT 13)	25
11.13.1 Procédure	25
11.14 Essai de robustesse des sorties (MQT 14)	26
11.15 Essai de courant de fuite en milieu humide (MQT 15)	26
11.16 Essai de charge mécanique statique (MQT 16)	26
11.17 Essai à la grêle (MQT 17)	26
11.18 Essai de la diode de dérivation (MQT 18)	26
11.19 Stabilisation (MQT 19)	26
11.19.1 Définition de critères pour la stabilisation	26
11.19.2 Procédures de stabilisation induite par la lumière	26
11.19.3 Autres procédures de stabilisation	26
11.19.4 Stabilisation initiale (MQT 19.1)	26
11.19.5 Stabilisation finale (MQT 19.2)	27
11.20 Essai de charge mécanique cyclique (dynamique) (MQT 20)	27

11.21	Essai de dégradation induite par le potentiel (MQT 21)	27
11.22	Essai de flexion (MQT 22).....	29
Figure 1	– Circulation de courant utilisant la méthode B de MQT 11	24
Figure 2	– Circulation de courant utilisant la méthode B de MQT 12	25
Figure 3	– Connexions électriques pour la méthode B de l’essai MQT 21, tension de réseau positive	28
Figure 4	– Connexions électriques pour la méthode B de l’essai MQT 21, tension de réseau négative	29

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

MODULES PHOTOVOLTAÏQUES (PV) POUR APPLICATIONS TERRESTRES – QUALIFICATION DE LA CONCEPTION ET HOMOLOGATION –

Partie 1-4: Exigences particulières d'essai des modules photovoltaïques (PV) au Cu(In,Ga)(S,Se)_2 à couches minces

AVANT-PROPOS

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La Norme internationale IEC 61215-1-4 a été établie par le comité d'études 82 de l'IEC: Systèmes de conversion photovoltaïque de l'énergie solaire.

Cette deuxième édition annule et remplace la première édition de l'IEC 61215-1-4, parue en 2016. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

- a) Ajout d'un essai de charge mécanique (dynamique) cyclique (MQT 20).
- b) Ajout d'un essai de dégradation induite par le potentiel (MQT 21).
- c) Ajout d'un essai de flexion (MQT 22) dédié aux modules souples.

L'Annexe informative A de l'IEC 61215-1:2021 explique le contexte et le raisonnement qui justifient certaines modifications les plus importantes apportées à la série IEC 61215 dans l'évolution de l'édition 1 à l'édition 2.

Le texte de cette norme est issu des documents suivants:

FDIS	Rapport de vote
82/1827/FDIS	82/1852/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cette Norme internationale.

La version française de la norme n'a pas été soumise au vote.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2.

La présente norme doit être utilisée conjointement avec l'IEC 61215-1:2021 et l'IEC 61215-2:2021.

Une liste de toutes les parties de la série IEC 61215, publiées sous le titre général *Modules photovoltaïques (PV) pour applications terrestres – Qualification de la conception et homologation*, peut être consultée sur le site web de l'IEC.

Le comité a décidé que le contenu de ce document ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous "http://webstore.iec.ch" dans les données relatives au document recherché. À cette date, le document sera

- reconduit,
- supprimé,
- remplacé par une édition révisée, ou
- amendé.

IMPORTANT – Le logo "colour inside" qui se trouve sur la page de couverture de ce document indique qu'elle contient des couleurs qui sont considérées comme utiles à une bonne compréhension de son contenu. Les utilisateurs devraient, par conséquent, imprimer ce document en utilisant une imprimante couleur.

MODULES PHOTOVOLTAÏQUES (PV) POUR APPLICATIONS TERRESTRES – QUALIFICATION DE LA CONCEPTION ET HOMOLOGATION –

Partie 1-4: Exigences particulières d'essai des modules photovoltaïques (PV) au $\text{Cu}(\text{In,Ga})(\text{S,Se})_2$ à couches minces

1 Domaine d'application

Le présent document établit les exigences pour la qualification de la conception des modules photovoltaïques (PV) pour applications terrestres adaptés à une utilisation de longue durée dans les climats à l'air libre. La durée de vie utile des modules ainsi qualifiés dépend de leur conception, de leur environnement et de leurs conditions de fonctionnement. Les résultats d'essai ne sont pas considérés comme une prévision quantitative de la durée de vie des modules.

Sous des climats pour lesquels les températures de fonctionnement du 98^e percentile dépassent 70 °C, il est recommandé aux utilisateurs d'envisager d'effectuer des essais dans des conditions d'essai à des températures plus élevées telles que décrites dans l'IEC TS 63126. Il est recommandé aux utilisateurs qui souhaitent qualifier des produits PV ayant une durée de vie moins longue d'envisager des essais conçus pour des produits PV utilisés dans l'électronique grand public, comme cela est spécifié dans l'IEC 63163 (en cours d'élaboration). Les utilisateurs qui souhaitent être assurés qu'un produit fabriqué présente de manière cohérente les caractéristiques soumises aux essais dans le cadre de l'IEC 61215 peuvent vouloir utiliser l'IEC 62941 relative aux systèmes de qualité pour la fabrication des modules photovoltaïques (PV).

Le présent document est destiné à s'appliquer à tous les modules à plaque plane au $\text{Cu}(\text{In,Ga})(\text{S,Se})_2$ à couches minces pour applications terrestres. À ce titre, il spécifie des exigences d'essai particulières à cette technologie en complément des exigences d'essai données dans l'IEC 61215-1:2021 et l'IEC 61215-2:2021.

Le présent document ne s'applique pas aux modules utilisés avec un ensoleillement intense, même s'il peut être utilisé pour les modules à faible concentration (ensoleillement 1 à 3). Pour les modules à faible concentration, tous les essais sont réalisés en utilisant les niveaux d'éclairement, de courant, de tension et de puissance prévus à la concentration théorique.

L'objet de cette séquence d'essais est de déterminer les caractéristiques électriques du module et de démontrer, dans toute la mesure du possible et avec des contraintes de coût et de temps raisonnables, que le module est capable de supporter une exposition prolongée en site naturel. Les conditions d'essais accélérés sont fondées de manière empirique sur les conditions nécessaires pour reproduire les défaillances sur site observées sélectionnées et sont appliquées de manière égale aux types de modules. Les facteurs d'accélération peuvent varier avec la conception du produit et ainsi les mécanismes de dégradation peuvent ne pas tous se produire. D'autres informations générales concernant les méthodes d'essais accélérés, y compris les définitions des termes, peuvent être consultées dans l'IEC 62506.

Certains mécanismes de dégradation de longue durée ne peuvent être raisonnablement détectés que par des essais de composants, en raison des longs délais exigés pour produire la défaillance et de l'existence nécessaire de conditions de contrainte dont la réalisation est coûteuse sur de grandes surfaces. Les essais de composants qui ont atteint un niveau de maturité suffisant pour établir des critères d'acceptation/refus en toute fiabilité sont intégrés dans la série IEC 61215 par le biais d'un ajout dans le Tableau 1 de l'IEC 61215-1. En

revanche, les procédures d'essai décrites dans cette série IEC 61215-2, sont réalisées sur des modules.

Le présent document définit les modifications dépendantes de la technologie photovoltaïque, apportées aux exigences et procédures d'essai de l'IEC 61215-1:2021 et de l'IEC 61215-2:2021.

2 Références normatives

Les références normatives de l'IEC 61215-1:2021 et de l'IEC 61215-2:2021 s'appliquent sans modification.