ICS 49.140 SLOVENSKÁ TECHNICKÁ NORMA Január 2024

STN	**Kozmická technika** **Fotovoltické zostavy a komponenty**	**STN** **EN 16603-20-08** 31 0543

Space engineering - Photovoltaic assemblies and components

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 12/23

Obsahuje: EN 16603-20-08:2023

Oznámením tejto normy sa ruší
STN EN 16603-20-08 (31 0543) z februára 2015

obsahuje farebné strany

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 16603-20-08

September 2023

ICS 49.140

Supersedes EN 16603-20-08:2014

English version

Space engineering - Photovoltaic assemblies and components

Ingéniérie spatiale - Ensembles et composants photovoltaïques

Raumfahrttechnik - Fotovoltaische Baugruppen und Komponenten

This European Standard was approved by CEN on 23 July 2023.

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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 CEN and CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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European foreword

This document (EN 16603-20-08:2023) has been prepared by Technical Committee CEN-CENELEC/TC 5 “Space”, the secretariat of which is held by DIN.

This standard (EN 16603-20-08:2023) originates from ECSS-E-ST-20-08C Rev.2.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2024, and conflicting national standards shall be withdrawn at the latest by March 2024.

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

This document supersedes EN 16603-20-08:2014.

The main changes with respect to EN 16603-20-08:2014 are listed below:

- Implementation of change requests
- Addition of new clause 12 “Planar Blocking Diodes”
- Check and update of the use of the verb “define” in the document

This document has been prepared under a standardization request given to CEN by the European Commission and the European Free Trade Association.

This document has been developed to cover specifically space systems and has therefore precedence over any EN covering the same scope but with a wider domain of applicability (e.g. : aerospace).

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

The qualification, procurement, storage and delivery of space solar arrays are specified in the dedicated solar array specification, where requirements for the solar array electrical layout, structure and mechanism are specified.

This Standard outlines the requirements for the qualification, procurement, storage and delivery of the main assemblies and components of the space solar array electrical layout: photovoltaic assemblies, solar cell assemblies, bare solar cells, coverglass and protection diodes. This Standard does not outline the requirements for the qualification, procurement, storage and delivery of the solar array subsystem, comprising the solar panels, structural parts and mechanisms.

The general requirements are covered in the main part of this Standard (clauses 5 to 11). Annex A to Annex E specify the contents of the source control drawing of photovoltaic and solar cell assemblies, bare solar cells coverglasses and protection diodes and include the inspection data, physical and electrical characteristics, other ratings and acceptance and qualification specific requirements, which can be different for each space project.

This Standard is divided into five specific subjects, each one corresponding to each assembly or component:

- Clause 5 for photovoltaic assemblies,
- Clause 6 for solar cell assemblies,
- Clause 7 for bare solar cells,
- Clause 8 for coverglasses,
- Clause 9 for protection diodes,
- Clause 12 for planar blocking diodes.

Two additional clauses are dedicated to Sun simulators and calibration procedures (clause 10) and capacitance measurement methods (clause 11).

NOTE At the time of the publication of this Standard the handbook ECSS-E-HB-20-08A, that is called in this document, has not yet been published.

1
Scope

This Standard specifies the general requirements for the qualification, procurement, storage and delivery of photovoltaic assemblies, solar cell assemblies, bare solar cells, coverglasses, protection diodes and planar blocking diodes suitable for space applications.

This standard does not cover the particular qualification requirements for a specific mission.

This Standard is primarily applicable for qualification approval for photovoltaic assemblies, solar cell assemblies, bare solar cells, coverglasses, protection diodes and planar blocking diodes, and to the procurement of these items.

This standard is limited to crystalline Silicon and single and multi-junction GaAs solar cells with a thickness of more than 50 μm and does not include thin film solar cell technologies and poly-crystalline solar cells.

This Standard does not cover the concentration technology, and especially the requirements related to the optical components of a concentrator (e.g. reflector and lens) and their verification (e.g. collimated light source).

This Standard is not applicable for qualification of the solar array subsystem, solar panels, structure and solar array mechanisms.

This standard may be tailored for the specific characteristic and constrains of a space project in conformance with ECSS-S-ST-00.

Qualification is a process to confirm compliance with requirements that have been established with reference to foregoing characterization and engineering test programs. Guidelines for characterization and engineering tests and for relaxation of qualification tests due to similarity with earlier performed qualification are described in the handbook ECSS-E-HB-20-08. Those clauses in this standard, for which the Handbook gives additional information, will refer to the Handbook.

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Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this ECSS Standard. For dated references, subsequent amendments to, or revision of any of these publications do not apply, However, parties to agreements based on this ECSS Standard are encouraged to investigate the possibility of applying the more recent editions of the normative documents indicated below. For undated references, the latest edition of the publication referred to applies.

EN reference	Reference in text	Title
EN 16601-00-01	ECSS-S-ST-00-01	ECSS system – Glossary of terms
EN 16603-10-03	ECSS-E-ST-10-03	Space engineering – Testing
EN 16603-20	ECSS-E-ST-20	Space engineering –Electrical and electronic
EN 16603-20-06	ECSS-E-ST-20-06	Space engineering – Spacecraft charging
EN 16602-60	ECSS-Q-ST-60	Space product assurance — Electrical, electronic and electromechanical (EEE) components
EN 16602-70-01	ECSS-Q-ST-70-01	Space product assurance – Cleanliness and contamination control
EN 16602-70-06	ECSS-Q-ST-70-06	Space product assurance – Particle and UV radiation testing for space materials
EN 16602-70-09	ECSS-Q-ST-70-09	Space product assurance – Measurements of thermo-optical properties of thermal control materials
	ISO 15387	Space Systems – Single junction space solar cells – Measurement and calibration procedures
	ISO 14644-1:1999	Cleanrooms and associated controlled environments – Part 1: Classification of air cleanliness
	MIL-E-12397B	Eraser, rubber pumice for testing coated optical elements
	MIL-STD-750	Test methods for semiconductor devices
	IEC 60749-26:2006	Semiconductor devices – Mechanical and climatic test methods - Part 26: Electrostatic discharge (ESD) sensitivity testing – Human body model (HBM)
	IEC 60904-7	Photovoltaic devices – Part 7: Computation of the spectral mismatch correction for measurements of photovoltaic devices
	IEC 60904-10	Photovoltaic devices – Part 10: Methods of linearity measurement

EN reference	Reference in text	Title
	ASTM D1193-99	Standard specification for reagent water
	ESCC 23800 Issue 1	Electrostatic Discharge Sensitivity Test Method; ESCC Basic Specification
	ESCC 24900 Issue 2	Minimum Requirements for Controlling Environmental Contamination of Components; ESCC Basic Specification
	ESCC 2265000	Evaluation test programme for discrete Non-microwave semiconductors; ESCC Basic Specification
	EN 1464:2010	Adhesives - Determination of peel resistance of adhesive bonds - Floating roller method
	Gueymard, C., 2018	Gueymard, C., Revised composite extraterrestrial spectrum based on recent solar irradiance observations Solar Energy, Volume 169, 2018, Pages 434-440, ISSN 0038-092X, https://doi.org/10.1016/j.solener.2018.04.067. (https://www.sciencedirect.com/science/article/pii/S0038092X1830433X)