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Space engineering – Part 20-08: Photovoltaic assemblies and components



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EUROPEAN STANDARD

EN 16603-20-08

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Space engineering - Part 20-08: Photovoltaic assemblies and components

Ingénierie spatiale - Partie 20-08: Ensembles et composants photovoltaïque

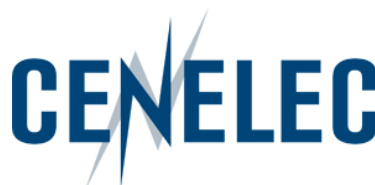
Raumfahrttechnik - Teil 20-08: Fotovoltaische Baugruppen und Komponenten

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Table of contents

Foreword	10
Introduction	11
1 Scope	12
2 Normative references	13
3 Terms, definitions and abbreviated terms	14
3.1 Terms from other standards.....	14
3.2 Terms specific to the present standard	14
3.3 Abbreviated terms.....	19
4 General	22
4.1 Overview	22
4.1.1 Objective and organization.....	22
4.1.2 Interfaces with other areas	23
4.2 Physical properties	24
4.3 Test and storage.....	25
4.3.1 Test environment	25
4.3.2 Test tolerances and accuracies	25
4.3.3 Margins	26
4.4 Critical materials	26
5 Photovoltaic assemblies	27
5.1 Overview	27
5.1.1 Description.....	27
5.1.2 Purpose and objective.....	27
5.2 Conditions and method of test	28
5.3 Photovoltaic assembly design.....	29
5.3.1 Overview.....	29
5.3.2 Parameters related to parts, materials and processes (PMP).....	29
5.3.3 Parameters related to design	30
5.4 PVA manufacturing.....	34
5.4.1 Process validation	34

5.4.2	Defect acceptability	34
5.4.3	In-process testing	34
5.4.4	Identification and traceability	35
5.4.5	Recording	36
5.5	PVA tests	36
5.5.1	Qualification tests	36
5.5.2	Acceptance tests for qualification coupons	41
5.5.3	Definition of tests and checks	42
5.6	Failure definition	53
5.6.1	Failure criteria	53
5.6.2	Failed qualification coupons	53
5.7	Data documentation	53
5.8	Delivery	54
5.9	Packaging, packing, handling and storage	54
6	Solar cell assemblies	55
6.1	General	55
6.1.1	Testing	55
6.1.2	Conditions and methods of test	55
6.1.3	Deliverable components	55
6.1.4	Identification and traceability	55
6.2	Production control (process identification document)	56
6.3	Acceptance tests	56
6.3.1	General	56
6.3.2	Test methods and conditions	56
6.3.3	Electrical performance acceptance test (EPA)	57
6.4	Qualification tests	57
6.4.1	General	57
6.4.2	Qualification	59
6.4.3	Test methods, conditions and measurements	60
6.5	Failure definition	71
6.5.1	Failure criteria	71
6.5.2	Failed SCAs	72
6.6	Data documentation	72
6.7	Delivery	72
6.8	Packing, dispatching, handling and storage	72
6.8.1	Overview	72
6.8.2	ESD Sensitivity	72

7 Bare solar cells	73
7.1 Testing, deliverable components and marking	73
7.1.1 Testing	73
7.1.2 Deliverable components.....	74
7.1.3 Marking	74
7.2 Production control (process identification document)	74
7.3 Acceptance tests	75
7.3.1 General	75
7.3.2 Test methods and conditions	76
7.3.3 Documentation.....	76
7.4 Qualification tests	77
7.4.1 General	77
7.4.2 Qualification	79
7.5 Test methods, conditions and measurements.....	80
7.5.1 Visual inspection (VI)	80
7.5.2 Dimensions and weight (DW).....	82
7.5.3 Electrical performance (EP)	82
7.5.4 Temperature coefficients (TC).....	83
7.5.5 Spectral response (SR).....	84
7.5.6 Optical properties (OP)	84
7.5.7 Humidity and temperature (HT).....	85
7.5.8 Coating adherence (CA)	86
7.5.9 Contact uniformity (CU).....	87
7.5.10 Contact thickness (CT).....	87
7.5.11 Surface finish (SF)	87
7.5.12 Pull test (PT)	88
7.5.13 Electron irradiation (EI)	88
7.5.14 Proton irradiation (PI).....	89
7.5.15 Photon irradiation and temperature annealing (PH).....	90
7.5.16 Solar cell reverse bias test (RB).....	90
7.5.17 Thermal cycling (CY).....	91
7.5.18 Active-passive interface evaluation test (IF)	91
7.5.19 Flatness test (FT).....	91
7.6 Failure definition	92
7.6.1 Failure criteria	92
7.6.2 Failed components.....	92
7.7 Data documentation.....	92

7.8	Delivery	92
7.9	Packing, dispatching, handling and storage	93
7.9.1	Overview	93
7.9.2	ESD Sensitivity	93
8	Coverglasses	94
8.1	Overview	94
8.1.1	Purpose	94
8.1.2	Description	94
8.2	Interfaces	94
8.3	Testing, deliverable components and marking	95
8.3.1	Testing	95
8.3.2	Deliverable components	95
8.3.3	Marking (coating orientation)	96
8.4	Production control (Process identification document)	96
8.5	Acceptance tests	96
8.5.1	Acceptance test samples	96
8.5.2	Acceptance test sequence	97
8.5.3	Test methods and conditions	97
8.5.4	Documentation	97
8.6	Qualification tests	98
8.6.1	General	98
8.6.2	Qualification	98
8.7	Test methods, conditions and measurements	100
8.7.1	Visual inspection (VI)	100
8.7.2	Transmission into air (TA)	101
8.7.3	Electro-optical properties (EO)	102
8.7.4	Mechanical properties	102
8.7.5	Reflectance properties (OP)	103
8.7.6	Normal emittance (e_N) (NE)	105
8.7.7	Surface resistivity	105
8.7.8	Flatness or bow (FT)	105
8.7.9	Transmission into adhesive (TH)	106
8.7.10	Boiling water test (BW)	106
8.7.11	Humidity and temperature	106
8.7.12	UV exposure (UV)	107
8.7.13	Electron irradiation (EI)	108
8.7.14	Proton irradiation (PI)	108

8.7.15	Breaking strength (BS).....	108
8.7.16	Thermal cycling (CY).....	109
8.7.17	Abrasion resistance (coated surface) (AE)	109
8.7.18	Coating adhesion (TD).....	109
8.8	Failure definition	109
8.8.1	Failure criteria	109
8.8.2	Failed components.....	110
8.9	Data documentation.....	110
8.10	Delivery	110
8.11	Packing, dispatching, handling and storage.....	110
9	Solar cell protection diodes.....	111
9.1	Overview	111
9.2	Testing, deliverable components and marking.....	111
9.2.1	Testing.....	111
9.2.2	Deliverable components.....	113
9.2.3	Marking.....	113
9.3	Production control (process identification document).....	113
9.3.1	Integral protection diodes.....	113
9.3.2	External protection diodes.....	113
9.4	Acceptance tests	114
9.4.1	General.....	114
9.4.2	Integral protection diodes.....	114
9.4.3	External protection diodes.....	114
9.4.4	External and integral diodes.....	115
9.4.5	Test methods and conditions	115
9.4.6	Documentation.....	116
9.5	Qualification tests	116
9.5.1	General.....	116
9.5.2	Integral protection diodes.....	116
9.5.3	External protection diodes.....	117
9.5.4	Integral and external protection diodes.....	118
9.6	Test methods, conditions and measurements.....	119
9.6.1	General.....	119
9.6.2	Visual inspection (VI)	119
9.6.3	Dimensions and weight (DW).....	120
9.6.4	Thermal cycling (CY).....	121
9.6.5	Burn in (BI).....	121

9.6.6	Humidity and temperature (HT).....	122
9.6.7	Contact uniformity (CU).....	122
9.6.8	Contact thickness (CT).....	123
9.6.9	Surface Finish (SF)	123
9.6.10	Contact adherence (CA)	123
9.6.11	Pull test (PT).....	124
9.6.12	Electron irradiation (EI)	124
9.6.13	Temperature annealing (TA)	125
9.6.14	Temperature behaviour (TB).....	125
9.6.15	Diode characterization (DC).....	126
9.6.16	Human body ESD (DE).....	127
9.6.17	Switching test (DS).....	128
9.6.18	Life test (DL)	130
9.7	Failure definition	132
9.7.1	Failure criteria	132
9.7.2	Failed components.....	133
9.8	Data documentation.....	133
9.9	Delivery	133
9.10	Packing, despatching, handling and storage.....	133
9.10.1	Overview.....	133
9.10.2	ESD sensitivity	133
10	Sun simulators and calibration procedures.....	134
10.1	Sun simulators.....	134
10.1.1	Spectral distribution.....	134
10.1.2	Irradiance uniformity.....	142
10.1.3	Irradiance stability	142
10.2	Standard cell and Sun simulator calibration	143
10.2.1	Primary standards.....	143
10.2.2	Secondary working standards (SWS).....	144
10.2.3	Standards cells documentation	145
10.2.4	Maintenance of standards	146
10.2.5	Recalibration and intercomparison.....	146
10.2.6	Sun simulator calibration and maintenance.....	146
11	Capacitance measurement methods	147
11.1	Single junction solar cell capacitance measurement.....	147
11.1.1	Overview.....	147
11.1.2	Signal measurement method	148

11.1.3	Measurement procedure	148
11.1.4	Measurement analysis	152
11.1.5	Measurement of the capacitance of a multi-junction cell	155
11.2	Time domain capacitance measurement	155
11.2.1	Overview.....	155
11.2.2	Measurement procedure	156
Annex A	(normative) Source control drawing for photovoltaic assembly (SCD-PVA) - DRD	158
Annex B	(normative) Source control drawing for solar cell assembly (SCD-SCA) - DRD.....	164
Annex C	(normative) Source control drawing for bare solar cell (SCD-BSC) - DRD.....	169
Annex D	(normative) Source control drawing for coverglass (SCD-CVG) - DRD	178
Annex E	(normative) Source control drawing for External Protection Diodes (SCD-EPD) - DRD	184
Annex F	(normative) Process identification document (PID) - DRD.....	188
Annex G	(normative) Data documentation package (DDP) - DRD	190
Bibliography		193
Figures		
Figure 4-1:	Specification hierarchy	23
Figure 6-1:	Definition of cell defects.....	61
Figure 6-2:	Test points for electrical performance measurement	63
Figure 7-1:	Definition of bare solar cell defects.....	81
Figure 8-1:	Methods of defining coverglass orientation.....	96
Figure 8-2:	Edge chip parameters	101
Figure 8-3:	Corner chip parameters.....	101
Figure 8-4:	Coverglass manufacturing tolerance limits	103
Figure 8-5:	Schematic for calculating surface resistivity.....	105
Figure 8-6:	Definition of coverglass flatness	106
Figure 9-1:	Diode forward and reverse test profile	129
Figure 9-2:	Diode switching test profile.....	130
Figure 11-1:	Solar cell impedance measurement equipment	149
Figure 11-2:	Channel balancing and reduction of the parasitic inductances.....	150

Figure 11-3: Measurement of the resistance value of the shunt in the measuring conditions (shunt in parallel with the input of the network analyser)..... 151

Figure 11-4: Small signal electrical schema biased with a DC voltage associated impedance 153

Figure C-1 : BSC front side 171

Figure C-2 : BSC rear side 172

Figure C-3 : BSC contact..... 172

Tables

Table 4-1: Test tolerances on temperature26

Table 5-1: Qualification test plan for PVA37

Table 5-2: Acceptance test plan42

Table 6-1: Qualification test plan for SCA.....58

Table 6-2: Maximum dimensions of corner chips, edge chips and surface nicks61

Table 7-1: Acceptance test matrix75

Table 7-2: Qualification test plan for bare solar cells78

Table 7-3: Maximum dimensions of corner chips, edge chips and surface nicks81

Table 8-1: Qualification test plan for coverglasses.....99

Table 9-1: Acceptance test matrix IPD 114

Table 9-2: Acceptance test matrix EPD 114

Table 9-3: Qualification test plan for integral protection diode..... 117

Table 9-4: Qualification test plan for external protection diodes..... 118

Table 9-5: Diode life test parameters..... 132

Table 10-1: AM0 solar spectral irradiance (WRC)..... 135

Table 10-2: Classes of single and multi-source solar simulators..... 140

Table 10-3: Classes of solar simulators with respect to nonconformity of irradiance uniformity 142

Table 10-4: Classes of solar simulators with respect to temporal instability of irradiance... 143

Table B-1 : Minimum current requirement for solar assemblies (25 °C or operating temperature) 166

Table C-1 : Electrical performance pass-fail criteria..... 174

Foreword

This document (EN 16603-20-08:2014) has been prepared by Technical Committee CEN/CLC/TC 5 "Space", the secretariat of which is held by DIN.

This standard (EN 16603-20-08:2014) originates from ECSS-E-ST-20-08C Rev.1.

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 February 2015, and conflicting national standards shall be withdrawn at the latest by February 2015.

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 has been prepared under a mandate 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, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

The qualification, procurement, storage and delivery of space solar arrays are defined 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 defines requirements for photovoltaic assemblies,
- Clause 6 for solar cell assemblies,
- Clause 7 for bare solar cells,
- Clause 8 for coverglasses,
- Clause 9 for protection diodes.

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

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 and protection diodes suitable for space applications.

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

This Standard primarily applies to qualification approval for photovoltaic assemblies, solar cell assemblies, bare solar cells, coverglasses and protection 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 does not apply to qualification of the solar array subsystem, solar panels, structure and solar array mechanisms.

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

2

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 16602-60	ECSS-Q-ST-60	Space product assurance – Electrical, electronic and electromechanical (EEE) components
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 15387:2005	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
	IEC 60749-26:2006	Semiconductor devices – Mechanical and climatic test methods - Part 26: Electrostatic discharge (ESD) sensitivity testing – Human body model (HBM)
	ASTM D1193-99	Standard specification for reagent water
	ESCC 23800 Issue 1	Electrostatic Discharge Sensitivity Test Method
	ESCC 24900 Issue 2	Minimum Requirements for Controlling Environmental Contamination of Components
	DIN 53289	Testing of adhesives for metals; floating roller peel test

Terms, definitions and abbreviated terms

3.1 Terms from other standards

For the purpose of this Standard, the terms and definitions from ECSS-S-ST-00-01 apply, in particular for the following terms:

qualification

verification

3.2 Terms specific to the present standard

3.2.1 General

3.2.1.1 blistering

forming of multiple small air bubbles inside the perimeter of a finish layer

3.2.1.2 bubbles

gaseous inclusion in the cell, coverglass or coverglass adhesive

3.2.1.3 chip

local absence of material along the edges and corners of a complete component and which extend through the thickness of the component

3.2.1.4 crack

fissure in the component with no separated portion from the remainder

NOTE Cracks can propagate from the edge of the material (edge cracks) or terminate at both ends within the material (surface cracks).

3.2.1.5 delamination

physical separation between two material layers, which are joined in design

3.2.1.6 discolouration

local variation of solar cell anti-reflection coating colour due to the influence of the structure orientation of the cell layer immediately below or the variation of the anti-reflection coating layer thickness

3.2.1.7 dig

cavities in the surface of a component caused by impact with a pointed object or by crushing a material into the surface

3.2.1.8 inclusion

volume contained within the component that is devoid of the substrate material

3.2.1.9 in-process testing

tests performed during the manufacturing of a component or assembly in order to identify, in advance, defects or low performances

3.2.1.10 nick

local absence of material on the surface of a complete component which does not extend through the thickness of the component

3.2.1.11 peeling

forming of a delamination of a finish layer at the edge of the finished area. A blister at the edge of the surface

3.2.1.12 procurement lot

set of shipment lots of solar cells assemblies, bare solar cells and coverglasses, manufactured with the same processes and materials, with identical manufacturing lines, that fill the same purchase order

3.2.1.13 scratch

linear marking of the component that represents a volume devoid of the substrate material emanating from a single face of the component and not penetrating through the whole thickness of the substrate at any point

3.2.1.14 shipment lot

solar cell assemblies, bare solar cells and coverglasses manufactured with the same processes and materials with identical manufacturing lines delivered to the customer as a part of a purchase order

3.2.1.15 spatter

small bits of solid coating material imbedded on or in the coating or substrate

3.2.1.16 voids

absence of deposited materials

NOTE Examples are absence of cell contact material or anti-reflection coating.

3.2.2 Photovoltaic assemblies**3.2.2.1 photovoltaic assembly**

power generating network comprising the interconnected solar cell assemblies (strings and sections), the shunt and blocking diodes, the busbars and wiring collection panels, the string, section and panel wiring, the wing transfer harness, connectors, bleed resistors and thermistors

3.2.2.2 qualification coupon

non-flight representative test sample of flight panels, built with flight processes and containing representative materials and components to be used in the manufacture of flight panels, formerly also called DVT coupon