



SLOVENSKI STANDARD
SIST EN 16602-60-13:2023

01-september-2023

Zagotavljanje varnih proizvodov v vesoljski tehniki - Električne, elektronske in elektromehanske komercialne komponente (EEE)

Space product assurance - Commercial electrical, electronic and electromechanical (EEE) components

Raumfahrtproduktsicherung - Kommerzielle Elektrische, elektronische und elektromechanische (EEE) Bauteile

Assurance produit des projets spatiaux - Composants électriques, électroniques et électromécaniques (EEE) commerciaux

Ta slovenski standard je istoveten z: EN 16602-60-13:2023

ICS:

49.140 Vesoljski sistemi in operacije Space systems and operations

SIST EN 16602-60-13:2023

en,fr,de

EUROPEAN STANDARD

EN 16602-60-13

NORME EUROPÉENNE

EUROPÄISCHE NORM

June 2023

ICS 49.140

Supersedes EN 16602-60-13:2015

English version

Space product assurance - Commercial electrical, electronic and electromechanical (EEE) components

Assurance produit des projets spatiaux - Composants
électriques, électroniques et électromécaniques (EEE)
commerciaux

Raumfahrtproduktsicherung - Kommerzielle
Elektrische, elektronische und elektromechanische
(EEE) Bauteile

This European Standard was approved by CEN on 30 January 2023.

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

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



**CEN-CENELEC Management Centre:
Rue de la Science 23, B-1040 Brussels**

Table of contents

European Foreword	5
Introduction	6
1 Scope	8
2 Normative references	9
3 Terms, definitions and abbreviated terms	11
3.1 Terms from other standards.....	11
3.2 Terms specific to the present standard	11
3.3 Abbreviated terms.....	12
3.4 Conventions.....	13
3.5 Nomenclature	14
3.6 Convention for the Applicability Matrix	15
4 Requirements for class 1 components	16
5 Requirements for class 2 components	28
6 Requirements for class 3 components	39
7 Quality levels	50
8 Evaluation, screening and LAT tests	51
9 Pure tin lead finish – risk analysis	93
Annex A (normative) Component control plan (CCP) - DRD	94
Annex B (normative) Declared components list (DCL) - DRD	95
Annex C (normative) Internal Supplier’s specification - DRD	96
Annex D (normative) Parts approval document - DRD	97
Annex E (informative) EEE documents delivery per review	98
Annex F (normative) Justification document - DRD	99
Annex G <<deleted>>	102

Annex H (informative) Flow chart for construction analysis	103
---	------------

Bibliography.....	106
--------------------------	------------

Figures

Figure 4-1: <<deleted>>	20
Figure 4-2: <<deleted>>	23
Figure 5-1: <<deleted>>	32
Figure 5-2: <<deleted>>	35
Figure 6-1: <<deleted>>	45
Figure 8-1: <<deleted>>	51
Figure 8-2: <<deleted>>	51
Figure 8-3: <<deleted>>	51
Figure 8-4: <<deleted>>	51
Figure 8-5: <<deleted>>	51
Figure 8-6: <<deleted>>	51

Tables

Table 4-1: <<deleted and moved as legacy test files as Table 8-9>>	20
Table 4-2: <<deleted and moved as legacy test files as Table 8-10>>	23
Table 4-3: <<deleted and moved as legacy test files as Table 8-11>>	23
Table 4-4: Documentation for Class 1 components	27
Table 5-1: <<deleted and moved as Legacy test files as Table 8-12>>	32
Table 5-2: <<deleted and moved as Legacy test files as Table 8-13>>	34
Table 5-3: <<deleted and moved to Legacy test files as Table 8-14>>	35
Table 5-4: Documentation for Class 2 components	38
Table 6-1: <<deleted>>	42
Table 6-2: <<deleted>>	44
Table 6-3: <<deleted and moved as Legacy test files Table 8-15>>	45
Table 6-4: Documentation for Class 3 components	48
Table 8-1: Procurement test table for ceramic capacitors chips	54
Table 8-2: Procurement test table for solid electrolyte tantalum capacitors chips.....	56
Table 8-3: Procurement test table for discrete parts (diodes, transistors, optocouplers)	58
Table 8-4: Procurement test table for fuses	60
Table 8-5: Procurement test table for magnetics.....	63
Table 8-6: Procurement test table for microcircuits	66
Table 8-7: Procurement test table for resistor chips.....	68

EN 16602-60-13:2023 (E)

Table 8–8: Procurement test table for Thermistors	71
Table 8–9: Legacy test files - Evaluation tests for Class 1 components - Active parts .	74
Table 8–10: Legacy test files - Screening tests for Class 1 components - Active parts	77
Table 8–11: Legacy test files - Lot acceptance tests for Class 1 components - Active parts.....	79
Table 8–12: Legacy test files - Evaluation tests - Class 2 components - Active parts ..	82
Table 8–13: Legacy test files - Screening tests - Class 2 components - Active parts...	85
Table 8–14: Legacy test files - Lot acceptance tests - Class 2 components – Active parts	87
Table 8–15: Legacy test files - LAT tests - Class 3 components - Active parts	90
Table H-1 : <<deleted>>.....	103
Table H-2 : Construction analysis sequence.....	104

iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN 16602-60-13:2023](https://standards.iteh.ai/catalog/standards/sist/5a8b8d74-773b-403e-bfc4-d4359017164b/sist-en-16602-60-13-2023)

<https://standards.iteh.ai/catalog/standards/sist/5a8b8d74-773b-403e-bfc4-d4359017164b/sist-en-16602-60-13-2023>

European Foreword

This document (EN 16602-60-13:2023) has been prepared by Technical Committee CEN-CENELEC/TC 5 “Space”, the secretariat of which is held by DIN.

This standard (EN 16602-60-13:2023) originates from ECSS-Q-ST-60-13C Rev.1.

This document will supersede EN 16602-60-13:2015.

The main changes with respect to EN 16602-60-13:2015 are listed below:

- Implementation of Change Requests
- Definition of “traceability information (trace code)” updated”
- Alignment with updated version of ECSS-Q-ST-60

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).

[SIST EN 16602-60-13:2023](https://standards.iteh.ai/catalog/standards/sist/5a8b8d74-773b-403e-bfc4-d4359017164b/sist-en-16602-60-13-2023)

<https://standards.iteh.ai/catalog/standards/sist/5a8b8d74-773b-403e-bfc4-d4359017164b/sist-en-16602-60-13-2023>

Introduction

This standard is based on and complementary to ECSS-Q-ST-60C. It defines the applicability and tailoring of the requirements of ECSS-Q-ST-60C for COTS EEE. This standard can only be used in conjunction with ECSS-Q-ST-60C in its current revision. This standard applies only to commercial components - as defined in its scope - which meet defined technical parameters that are on the system application level demonstrated to be unachievable with existing space components or only achievable with qualitative and quantitative penalties. The standard requires that qualitative and quantitative penalties are specified, as applicable, as a minimum in terms of quantifiable parameters such as: functional capability, parts count, power dissipation, frequency of operation, data/signal processing efficiency, interconnect complexity, mass, volume, ...

For traceability to ECSS-Q-ST-60, the modifications or additions are marked in blue. Text in black colour is unmodified text.

For easy tailoring and implementation of the requirements into a Requirement Management Tool, and for direct traceability to ECSS-Q-ST-60, requirements in this standards have been written in the way of a ECSS Applicability Requirement Matrix (EARM), as defined in Annex A of ECSS-S-ST-00 "ECSS system – Description, implementation and general requirements".

In line with ECSS-Q-ST-60, this standard differentiates between three classes of components through three different sets of standardization requirements (clauses) to be met.

The three classes provide for three levels of trade-off between assurance and risk. The highest assurance and lowest risk is provided by class 1 and the lowest assurance and highest risk by class 3. Procurement costs are typically highest for class 1 and lowest for class 3. Mitigation and other engineering measures can decrease the total cost of ownership differences between the three classes. The project objectives, definition and constraints determine which class or classes of components are appropriate to be utilised within the system and subsystems.

- a. Class 1 components are described in Clause 4
- b. Class 2 components are described in Clause 5
- c. Class 3 components are described in Clause 6

The objective of the EEE component selection, control, procurement and use requirements is to ensure that EEE components used in a space project enables the project to meet its mission requirements.

Important elements of EEE component requirements include:

- a. component programme management,
- b. component selection, evaluation and approval,
- c. procurement,
- d. handling and storage,
- e. component quality assurance,

- f. specific components, and
- g. documentation.

The main tools which can be used to reach the objective are:

- a. concurrent engineering,
- b. standardization of component types,
- c. characterization of components,
- d. assessment of component manufacturers including declared competencies and processes,
- e. testing, screening, lot acceptance and periodic testing,
- f. procurement specifications,
- g. control and inspection,
- h. control of nonconforming materials,
- i. assessment and use of existing component data,
- j. application of specific control to mitigate risk for components with limited data or confidence, and
- k. information management.

The basic approach is as follows:

- The customer of a given space project defines the EEE component requirements within the boundaries of this standard. They appear in the appropriate clauses of the project requirements as defined in ECSS-M-ST-10.
- The supplier defines a component control plan to implement those requirements into a system which enables, for instance, to control the selection, approval, procurement, handling in a schedule compatible with his requirements, and in a cost-efficient way.
- The supplier ensures that the applicable parts requirements are passed down to lower level suppliers and ensure that they are compliant to these parts requirements.

1

Scope

This standard defines the requirements for selection, control, procurement and usage of EEE commercial components for space projects.

This standard is applicable to commercial parts from the following families:

- Ceramic capacitors chips
- Solid electrolyte tantalum capacitors chips
- Discrete parts (transistors, diodes, optocouplers)
- Fuses
- Magnetic parts
- Microcircuits
- Resistors chips
- Thermistors

In addition for families of EEE components not addressed by the present ECSS standard, it can be used as guideline on case by case basis.

The requirements of this document are applicable to all parties involved at all levels in the integration of EEE commercial components into space segment hardware and launchers.

This standard may be tailored for the specific characteristics and constrains of a space project in conformance with ECSS-S-ST-00.23

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 16602-60-14	ECSS-Q-ST-60-14	Space product assurance - Relifing procedure - EEE components
EN 16602-60-15	ECSS-Q-ST-60-15	Space product assurance - Radiation hardness assurance - EEE components
	ESCC 20600	Preservation packaging and despatch of SCC components
	ESCC 21004	Guidelines for incoming inspection of EEE components (ESCC Basic Specification No. 21004)
	ESCC 21300	Terms, definitions, abbreviations, symbols and units
	ESCC 22500	Guidelines for displacement damage irradiation testing
	ESCC 24900	Minimum requirements for controlling environmental contamination of components
	ESCC 25100	Single Event Effects Test Method and Guidelines
	ESCC 25500	Methodology for the detection of pure tin in the external surface finish of case and leads of EEE components
	GEIA-STD-005-2	Standard for Mitigating the Effects of Tin Whiskers in Aerospace and High Performance Electronic Systems.
	JESD22-A101	Steady state temperature humidity bias life test
	JESD22-A110	Highly accelerated temperature and humidity stress test
	JESD22-A113	Preconditioning of plastic surface mount devices prior to reliability testing

EN 16602-60-13:2023 (E)

EN reference	Reference in text	Title
	JESD22-A121	Test Method for Measuring Whisker Growth on Tin and Tin Alloy Surface Finishes
	JESD22-B106	Resistance to soldering temperature for through hole mounted devices
	JESD-201	Environmental Acceptance Requirements for Tin Whisker Susceptibility of Tin and Tin Alloy Surface Finishes
	J-STD-020	Moisture/Reflow sensitivity classification for nonhermetic solid state surface mount devices
	J-STD-033	Handling, packing, shipping and use of moisture/reflow sensitive surface mount devices
	MIL-STD-750	Test methods for semiconductor devices
	MIL-STD-883	Test method standard microcircuits
	AEC-Q100	Failure mechanism based stress test qualification for integrated circuits
	AEC_Q101	Stress test qualification for automotive grade discrete semiconductors
	AEC-Q200	Stress test qualification for passive components

(standards.iteh.ai)

SIST EN 16602-60-13:2023

<https://standards.iteh.ai/catalog/standards/sist/5a8b8d74-773b-403e-bfc4-d4359017164b/sist-en-16602-60-13-2023>

Terms, definitions and abbreviated terms

3.1 Terms from other standards

- a. For the purpose of this standard, the terms and definitions from ECSS-S-ST-00-01 apply.
- b. For the purpose of this standard, the following terms and definitions from ECSS-Q-ST-60 apply:
 1. agent
 2. characterization
 3. commercial component
 4. concurrent engineering
 5. franchised distributor
 6. parts engineer
 7. parts procurer
 8. qualified parts
 9. screening
 10. space qualified parts

iTeh STANDARD PREVIEW
(standards.iteh.ai)

<https://standards.iteh.ai/catalog/standards/sist/5a8b8d74-773b-403e-bfc4-d4359017164b/sist-en-16602-60-13-2023>

3.2 Terms specific to the present standard

3.2.1 traceability information (trace code)

unique identifier used by manufacturers to label and trace a quantity of components with at least a common assembly history

NOTE 1 The notion of "lot of EEE parts" used for lot acceptance tests, except for radiation, is defined by the same trace code.

NOTE 2 The notion of "lot of EEE parts" used for the radiation is defined by the same diffusion lot.

NOTE 3 Several trace codes can be part of a same delivery from the manufacturer or the distributor.

NOTE 4 It is possible to have several diffusion lots and wafer fabs (as per ESCC 21300) in the same trace code.

3.3 Abbreviated terms

For the purpose of this Standard, the abbreviated terms from ECSS-S-ST-00-01 and the following apply:

Abbreviation	Meaning
AOQ	average outgoing quality
ASIC	application specific integrated circuit
BGA	ball grid array
CA	construction analysis
CCD	charge coupled device
CCP	component control plan
CN	change notice
CoC	certificate of conformance
CDR	critical design review
CR	change request
DCL	declared components list
DPA	destructive physical analysis
DRD	document requirement definition
DSM	deep Sub-Micron
Ea	activation energy
ECSS	European Coordination for Space Standardization
EEE	electrical, electronic, electromechanical
EFR	early failure rate
ESCC	European space components coordination
GSE	ground support equipment
HAST	highly accelerated stress test
HTOL	high temperature operating life
HTRB	high temperature reverse bias
JD	justification document
LAT	lot acceptance test
LED	light emitting diode
LVT	lot validation testing
MMIC	microwave monolithic integrated circuit
PAD	parts approval document
PCB	parts control board
PCN	process change notice
PDA	percent defective allowable
PED	plastic encapsulated device
PIND	particle impact noise detection
QBSD	full quadrant back scatter electron detector

Abbreviation	Meaning
QCI	quality conformance inspection
RFD	request for deviation
RH	relative humidity
RoHs	restriction of the use of certain hazardous substances
RVT	radiation verification testing
SCSB	Space Components Steering Board
SAM	scanning acoustic microscopy
SEM	scanning electron microscope
SMD	surface mount device
TCI	technology conformance inspection
T _g	Glass Transition Temperature
THB	temperature humidity bias
T _j	junction temperature
T/C	thermal cycling
TM	Test Method

iTeh STANDARD PREVIEW
(standards.iteh.ai)

3.4 Conventions

- a. The term “EEE component” is synonymous with the terms “EEE Part”, “Component” or just “Part”.
- b. The term “for approval” means that a decision of the approval authority is necessary for continuing the process.
- c. The term “for review” means that raised reviewers comments are considered and dispositioned.
- d. The term “for information” means that no comments are expected about the delivered item.
- e. For the purpose of clear understanding of this document, hereunder is a listing of component categories which are covered by the term EEE component, encapsulated or non-encapsulated, irrespective of the quality level:
 1. Capacitors
 2. Connectors
 3. Crystals
 4. Discrete semiconductors (including diodes, transistors)
 5. Filters
 6. Fuses
 7. Magnetic components (e.g. inductors, transformers, including in-house products)