

# SVENSK STANDARD

## SS-EN 16602-60:2015



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### **Rymdproduktförsäkring – Elektriska, elektroniska och elektromekaniska (EEE) komponenter**

### **Space product assurance – Electrical, electronic and electromechanical (EEE) components**



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EUROPEAN STANDARD

**EN 16602-60**

NORME EUROPÉENNE

EUROPÄISCHE NORM

August 2015

ICS 49.140

English version

**Space product assurance - Electrical, electronic and electromechanical (EEE) components**

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

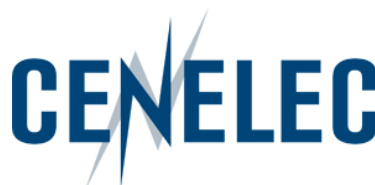
Raumfahrtproduktsicherung - Elektrische, elektronische und elektromechanische (EEE) Bauteile

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## European foreword

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This document (EN 16602-60:2015) has been prepared by Technical Committee CEN/CLC/TC 5 "Space", the secretariat of which is held by DIN.

This standard (EN 16602-60:2015) originates from ECSS-Q-ST-60C 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of an identical text or by endorsement, at the latest by February 2016, and conflicting national standards shall be withdrawn at the latest by February 2016.

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

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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

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

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 may 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 requirements of this document apply to all parties involved at all levels in the integration of EEE components into space segment hardware and launchers.

This standard may be tailored for the specific characteristics 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 16601-10	ECSS-M-ST-10	Space project management – Project planning and implementation
EN 16602-10-09	ECSS-Q-ST-10-09	Space product assurance – Nonconformance control system
EN 16602-20	ECSS-Q-ST-20	Space product assurance – Quality assurance
EN 16602-30-11	ECSS-Q-ST-30-11	Space product assurance – Derating – EEE components
EN 16602-60-02	ECSS-Q-ST-60-02	Space product assurance – ASIC and FPGA development
EN 16602-60-05	ECSS-Q-ST-60-05	Space product assurance – Generic procurement requirements for hybrid microcircuits
EN 16602-60-12	ECSS-Q-ST-60-12	Space product assurance – Design, selection, procurement and use of die form monolithic microwave integrated circuits (MMICs)
EN 16602-60-13	ECSS-Q-ST-60-13	Commercial 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	Radiation hardness assurance – EEE components
EN 16602-70	ECSS-Q-ST-70	Space product assurance – Materials, mechanical parts and processes
	ESCC 20200	ESCC: Component Manufacturer Evaluation
	ESCC 22800	ESCC: ESA/SCC Non conformance Control System
	ESCC 22900	ESCC Basic Specification: Total Dose Steady-State

EN reference	Reference in text	Title
		Irradiation Test Method
	ESCC 24900	Minimum requirements for controlling environmental contamination of components
	ESCC 25500	Methodology for the detection of pure tin in the external surface finish of case and leads of EEE components
	ESCC QPL	ESCC qualified part list ( <a href="https://escies.org">https://escies.org</a> )
	ESCC EPPL	ESCC European preferred parts list ( <a href="https://escies.org">https://escies.org</a> )
	ESCC QML	ESCC qualified manufacturers list ( <a href="https://escies.org">https://escies.org</a> )
	MIL QPLs	MIL qualified parts lists
	MIL QMLs	MIL qualified manufacturers lists
	NPSL	NASA Parts Selection List
	JAXA QPL	JAXA qualified parts list
	ESCC, MIL & JAXA specifications and standards called in the document	

# Terms, definitions and abbreviated terms

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## 3.1 Terms from other standards

For the purpose of this Standard, the terms and definitions from ECSS-S-ST-00-01 apply.

## 3.2 Terms specific to the present standard

### 3.2.1 agent

organization contracted to perform the procurement of EEE components including related engineering and quality assurance tasks

### 3.2.2 characterization

determination of the attributes of an EEE component, in sufficient detail to allow assessment of its suitability for a particular use or application

### 3.2.3 commercial component

part neither designed, nor manufactured with reference to military or space standards

### 3.2.4 concurrent engineering

engineering activity taking place in the context of simultaneous design of the product, the production process and all associated product usages, in an integrated, multifunctional team, with external organizational constraints minimized

### 3.2.5 destructive physical analysis

series of inspections, tests and analyses performed on a sample of components to verify that the material, design and workmanship used for its construction, as well as the construction itself, meet the requirements of the relevant specification and are suitable for the intended application

### 3.2.6 franchised distributor

distributor officially and contractually authorised by the manufacturer

### 3.2.7 parts engineer

professional engineer with demonstratable specialisation in EEE components



**3.2.8 parts procurer**

supplier who procures components by himself or a parts procurement agent who procures parts for the supplier

**3.2.9 qualified parts**

parts belonging to QPLs or QMLs from the following normative systems: ESCC, MIL, JAXA, CECC

**3.2.10 screening**

tests, inspections or combination thereof, imposed on 100% of parts, to remove unsatisfactory items or those likely to exhibit early failures

**3.2.11 space qualified parts**

parts belonging to QPLs or QMLs from the following normative systems (ESCC, MIL) according to quality levels listed in Table 7-1

NOTE 1 Space qualified parts are a subset of the qualified parts defined in clause 3.2.9.

NOTE 2 Parts belonging to JAXA QPL are considered as space qualified provided the equivalence of the generic JAXA specification with the ESCC or MIL generic specifications has been established.

**3.3 Abbreviated terms**

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

<b>Abbreviation</b>	<b>Meaning</b>
ASIC	Application specific integrated circuit
CCD	charge coupled device
CCP	Component control plan
CDR	critical design review
CECC	CENELEC electronic components committee
CENELEC	Comité Européen de Normalisation Electrotechnique
CI	conformance inspection
CN	change notice
CoC	certificate of conformance
CPPA	centralized parts procurement agent
CR	change request
CSI	customer source inspection
CSV	comma-separated values
DCL	declared components list
DPA	destructive physical analysis
DRD	document requirement definition
EEE	electrical, electronic, electromechanical

<b>EFR</b>	established failure rate
<b>EPPL</b>	European preferred parts list
<b>ESCC</b>	European space components coordination
<b>ESR</b>	equivalent serial resistance
<b>FPGA</b>	field programmable gate arrays
<b>GSE</b>	ground support equipment
<b>GSFC</b>	Goddard space flight center
<b>JAXA</b>	Japanese aerospace exploration agency
<b>JD</b>	justification document
<b>LAT</b>	lot acceptance test
<b>LED</b>	light emitting diode
<b>LVT</b>	lot validation testing
<b>MMIC</b>	microwave monolithic integrated circuit
<b>NASA</b>	national aeronautics and space administration
<b>NCR</b>	nonconformance report
<b>NPSL</b>	NASA parts selection list
<b>PA</b>	product assurance
<b>PAD</b>	part approval document
<b>PCB</b>	parts control board
<b>PCN</b>	process change notice
<b>PDR</b>	preliminary design review
<b>PIND</b>	particle impact noise detection
<b>QCI</b>	quality conformance inspection
<b>QML</b>	qualified manufacturers list
<b>QPL</b>	qualified parts list
<b>RFD</b>	request for deviation
<b>RFW</b>	request for waiver
<b>RVT</b>	radiation verification testing
<b>SCSB</b>	Space Components Steering Board
<b>SEB</b>	single event burn-out
<b>SEE</b>	single event effect
<b>SEFI</b>	single event functional interrupt
<b>SEGR</b>	single event gate rupture
<b>SEL</b>	single event latch-up
<b>SET</b>	single event transient
<b>SEU</b>	single event upset
<b>TCI</b>	technology conformance inspection
<b>TRR</b>	test readiness review
<b>WFR</b>	Weibull failure rate

## 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)
  8. Monolithic Microcircuits (including MMICs)
  9. Hybrid circuits
  10. Relays
  11. Resistors, heaters
  12. Surface acoustic wave devices
  13. Switches (including mechanical, thermal)
  14. Thermistors
  15. Wires and Cables
  16. Optoelectronic Devices (including opto-couplers, LED, CCDs, displays, sensors)
  17. Passive Microwave Devices (including, for instance, mixers, couplers, isolators and switches)

NOTE Microwave switches consisting of multiple EEE components are considered as equipment. The requirements of this standard are applicable to the EEE parts they incorporate and to microwave switches having a simple design (single EEE part).