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Interested committees:

Title: BS EN 16602-60-13 Space product assurance - Commercial electrical, electronic and electromechanical (EEE) components

Please notify the secretary if you are aware of any keywords that might assist in classifying or identifying the standard or if the content of this standard

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
- All comments should be submitted online at <https://standardsdevelopment.bsigroup.com/>. You will need to register in order to comment.

Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

October 2021

ICS 49.140

Will supersede EN 16602-60-13:2015

English version

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

Assurance produit des projets spatiaux - Exigences
pour l'utilisation de composants commerciaux sur
étagère

Raumfahrtproduktsicherung - Anforderungen für die
Nutzung von COTS-Komponenten

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/CLC/JTC 5.

If this draft becomes a European Standard, 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.

This draft European Standard was established by CEN and CENELEC 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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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation. Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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European Foreword

This document (prEN 16602-60-13:2021) has been prepared by Technical Committee CEN/CLC/TC 5 "Space", the secretariat of which is held by DIN (Germany).

This document (prEN 16602-60-13:2021) originates from ECSS-Q-ST-60-13C Rev.1 DIR1.

This document is currently submitted to the ENQUIRY.

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

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

- to be completed (currently the changes are identified with revision tracking).

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

Introduction

This standard is based on and complementary to ECSS-Q-ST-60C (with upward revisions). 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.

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
- Discretes parts (transistors, diodes, optocouplers)
- Fuses
- Magnetic parts
- Microcircuits
- Resistors
- Thermistors

Other families of EEE components are not addressed by the present ECSS standard doesn't mean that they are forbidden in commercial grade.

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 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.

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".

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

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 - Relieving procedure - EEE components
EN 16602-60-15	ECSS-Q-ST-60-15	Space product assurance – Radiation hardness assurance – EEE components
	ESCC 21300	Terms, definitions, abbreviations, symbols and units
	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
	MIL-STD-750	Test methods for semiconductor devices
	MIL-STD-883	Test method standard microcircuits
	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
	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
	GEIA-STD-005-2	Standard for Mitigating the Effects of Tin Whiskers in Aerospace and High Performance Electronic Systems.
	ESCC 21004	GUIDELINES FOR INCOMING INSPECTION OF EEE COMPONENTS (ESCC Basic Specification No. 21004)
	ESCC25100	Single Event Effects Test Method and Guidelines
	ESCC22500	GUIDELINES FOR DISPLACEMENT DAMAGE IRRADIATION TESTING
	ESCC20600	Preservation Packaging and Despatch of SCC Components

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.

For the purpose of this standard, the following terms and definitions from ECSS-Q-ST-60 apply:

agent
 characterization
 commercial component
 concurrent engineering
 franchised distributor
 parts engineer
 parts procurer
 qualified parts
 screening
 space qualified parts

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 a common manufacturing history and thereby common characteristics.

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

NOTE 2 Several trace codes can be part of a same delivery from the manufacturer or the distributor.

NOTE 3 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

Abbreviation	Meaning
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
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
QCI	quality conformance inspection
RFD	request for deviation
RH	relative humidity
RoHs	restriction of the use of certain hazardous substances

Abbreviation	Meaning
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	glassivation temperature
THB	temperature humidity bias
T _j	junction temperature
T/C	thermal cycling

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).

3.5 Nomenclature

The following nomenclature applies throughout this document:

- a. The word “shall” is used in this Standard to express requirements. All the requirements are expressed with the word “shall”.
- b. The word “should” is used in this Standard to express recommendations. All the recommendations are expressed with the word “should”.

NOTE It is expected that, during tailoring, recommendations in this document are either converted into requirements or tailored out.

- c. The words “may” and “need not” are used in this Standard to express positive and negative permissions, respectively. All the positive permissions are expressed with the word “may”. All the negative permissions are expressed with the words “need not”.
- d. The word “can” is used in this Standard to express capabilities or possibilities, and therefore, if not accompanied by one of the previous words, it implies descriptive text.

NOTE In ECSS “may” and “can” have completely different meanings: “may” is normative (permission), and “can” is descriptive.

- e. The present and past tenses are used in this Standard to express statements of fact, and therefore they imply descriptive text.

Requirements for class 1 components

Identifier	Requirement	Applicability
4.1 Component programme management		
4.1.1 General		
4.1.1a	~~The supplier shall establish and implement throughout the duration of the business agreement a component programme which ensures that the requirements of the project as defined by the customer and the supplier in the related business agreement are in compliance with this standard.~~	N/A
4.1.2 Components control programme		
4.1.2.1 Organization		
4.1.2.1a		Applicable
4.1.2.1b	~~The supplier's organization shall comply with all the requirements of ECSS M-ST-10.~~	N/A
4.1.2.2 Component control plan		
4.1.2.2a		Applicable
4.1.2.2b		Applicable
4.1.2.2c		Applicable
4.1.3 Parts control board		
4.1.3a		Applicable
4.1.3b		Applicable
4.1.3c		Applicable
4.1.3d		Applicable
4.1.4 Declared component list		
4.1.4a	For each equipment, its supplier shall issue a DCL in an editable and sortable electronic format such as .xls or .xlsx or .csv, ~~as a minimum compatible with CSV, identifying all component types needed.~~ ~~NOTE CSV is a common file format that can be used to transfer data between database or spreadsheet tables (a spreadsheet program is for example Excel®)~~	Applicable
4.1.4b		Applicable
4.1.4c		Applicable
4.1.4d	After equipment CDR, all modifications affecting the PAD and JD information shall be implemented, in the "as design" DCL, through	Applicable

	~~the CN / CR process~~ and submitted to the customer for approval, before mounting. ~~NOTE — For JD generation, see 4.2.4.d.~~	
4.1.4e		Applicable
4.1.4f		Applicable
4.1.4g		Applicable
4.1.4h		Applicable
4.1.4i	The supplier shall establish and update a consolidated “as design” DCL at its level and deliver it to the customer	Applicable
4.1.5 Electrical and mechanical GSE		
4.1.5a		Applicable
4.1.5b		Applicable
4.1.6 EQM components		
4.1.6a	EEE components used in Engineering Qualification Model (EQM) shall be fit, form and function representative of the flight components and from the same manufacturers.	Applicable
4.1.6b	If thermal vacuum tests are performed on the EQM, the EEE parts shall be material representative of the FM parts.	Applicable
4.2 Component selection, evaluation and approval		
4.2.1 General		
4.2.1a		Applicable
4.2.1b		Applicable
4.2.2 Manufacturer and component selection		
4.2.2.1 General rules		
4.2.2.1a		Applicable
4.2.2.1b		Applicable
4.2.2.1c	~~<<deleted and moved to 4.2.2.3d.>>Preference shall be given to components which necessitate the least evaluation or qualification effort.~~	N/A
4.2.2.1d	~~<<deleted and moved to 4.2.2.3e.>>Starting with the design phase of the project the supplier shall ensure maximum use of preferred (see 4.2.2.3) and qualified components to achieve an effective component reduction and standardization.~~	N/A
4.2.2.1e	~~<<deleted and moved to 4.2.2.3f.>>When selecting items, the supplier shall check the current data, applicability of the basis of qualification, problem notifications and alerts, and adequacy of specifications.~~	N/A
4.2.2.1f	~~<<deleted and moved to 4.2.2.3g.>>The supplier shall implement a type reduction activity.~~	N/A

4.2.2.1g	For the assessment of commercial components, the supplier shall collect the available data on the manufacturer and the component in the JD specified in the requirement 4.2.4d. NOTE It is important to check the exhaustiveness of the manufacturer documentation & data sheet with respect to e.g. the following items: • component marking, • mechanical description, • electrical and thermal description.	New
~~4.2.2.1h~~	~~<<deleted>>For Deep Sub-Micron Technologies (<90nm), the detailed test definition shall identify the technology through the construction analysis and the application.~~ ~~NOTE 1 It is important to ensure that the test conditions remain as close as possible to application.~~ ~~NOTE 2 This requirement is important due to the specificities of Deep Sub-Micron Technologies (<90nm).~~	Deleted
4.2.2.2 Parts and material restriction		
4.2.2.2a		Applicable
4.2.2.2b		Applicable
4.2.2.2c	With respect to health and safety, beryllium oxide, lithium (except if identified in the procurement specification), cadmium, ~~lithium~~, magnesium, mercury, zinc, radioactive material and all material which can cause safety hazard shall not be used.	Applicable
4.2.2.2d	For limited life duration, known instability, safety hazards or reliability risk reasons, EEE components listed below shall not be used: ~~<<deleted>>EEE components with pure tin (less than 3% Pb in case of SnPb alloy) used as a finish on the leads, terminations and external surfaces of components and packages.~~ ~~NOTE For EEE components with pure tin, see also requirements 4.2.2.2h and 4.2.2.2i.~~ - Hollow core resistors - Potentiometers (except for mechanism position monitoring) - Non-metallurgically bonded diodes - Semiconductor dice with unglassivated active area - Wet slug tantalum capacitors other than capacitor construction using double seals and a tantalum case	Applicable

	7. Any component whose internal construction uses metallurgic bonding with a melting temperature not compatible with the end-application mounting conditions 8. <<deleted>>~~Wire link fuses <5A~~ 9. TO5 relays without double welding of the mechanism to the header or with any type of integrated diodes inside 10. Aluminium liquid electrolytic capacitors 11. Tin coated wires and cables 12. PVC insulated wires and cables 13. Electromechanical parts in commercial grade 14. Feedthrough filter in commercial grade	
4.2.2.2e	For limited life duration, known instability, safety hazards or reliability risk reasons, EEE components listed below shall not be used for new designs: 1. RNC90 > 100 kOhm~~kΩ~~, 2. TO3 and DO4/DO5 packages. 3. Wire link fuses	Applicable
4.2.2.2f		Applicable
4.2.2.2g		Applicable
4.2.2.2h	The use of pure tin (inside or outside the part) shall be declared in the PAD or in the JD.	Applicable
4.2.2.2i	The customer shall specify either requirement 4.2.2.2j or requirements 4.2.2.2k and 4.2.2.2l to handle risks linked with pure tin terminations. ~~To assess Pb free with tin finish whisker risk, the following actions shall be performed by the supplier:~~ ~~1. In order to verify information from manufacturer (included in the JD), as part of the incoming inspection, check the lead finish of all procured lots as per ESCC 25500 basic specification.~~ ~~2. When confirmed during incoming, assess individually each use of pure tin termination through a RFD.~~ ~~3. Submit each lot confirmed with pure tin terminations to solder dip with an SnPb solder.~~ ~~NOTE — Solder dip for tin whisker mitigation differs from solder dip for solderability in that for tin whisker mitigation it is required that the termination is coated over its entire length, right up to the package surface (no stand off).~~ ~~4. Perform the retinning operation before screening and before the lot acceptance test.~~	Applicable

	~~5. Before reflowing of flight parts, document the hot solder dip process by a procedure to be submitted to customer for approval.~~ ~~6. Perform the evaluation of reflowed components in conformance with Figure 8-1 from the requirement 8.1a.~~ ~~7. Perform the lot acceptance of reflowed components in conformance with Figure 8-2 from the requirement 8.1a.~~	
4.2.2.2.j	The following actions shall be performed by the supplier to control the pure-tin risk: 1. Collect and synthesize all information participating to the risk analysis in conformance with Clause 8, 2. Based on the risk analysis, elaborate a mitigation plan. 3. Include in the JD the risk analysis and mitigation plan for customer approval. 4. In case of reflowing of flight parts, document the hot solder dip process by a procedure to be submitted to customer for approval. 5. Perform evaluation tests, lot acceptance tests and screening tests of reflowed components after the reflowing process NOTE 1 The mitigation plan can include one or a combination of the following solutions: • Tin whisker sensitivity evaluation • Reflowing of terminations with complementary evaluation. NOTE 2 Solder dip for tin whisker mitigation differs from solder dip for solderability in that for tin whisker mitigation, the termination is coated over its entire length, right up to the package surface (no stand off). This process is critical and needs to be evaluated and well controlled. • Conformal coating. • Design modification.	Applicable
4.2.2.2k	All the following conditions shall be fulfilled to use Parts with matte pure tin finish, >97% tin: 1. they pass the JESD-201 class 2 requirements or meet the GEIA-STD-0005-2/Class 2B requirements, 2. they are not used in power function, Voltage>15V and Current>2A. 3. they are not mechanically torqued on board or equipment.	Applicable

4.2.2.2l	If one of the three conditions specified in requirement 4.2.2.2.k is not met, a mitigation plan shall be submitted to the customer for approval, through the JD approval process. NOTE This mitigation plan can include, as an example, one of the following solutions: - Conformal coating - Design analysis and risk assessment versus a possible short circuit	Applicable
4.2.2.3 Preferred sources		
4.2.2.3a		Not applicable
4.2.2.3b		Not applicable
4.2.2.3c		Applicable
4.2.2.3d	Preference shall be given to components which necessitate the least evaluation or qualification effort.	Not applicable
4.2.2.3e	Starting with the design phase of the project the supplier shall ensure maximum use of preferred and qualified components to achieve component reduction and standardization.	Applicable
4.2.2.3f	When selecting items, the supplier shall check the current data, applicability of the basis of qualification, problem notifications and alerts, and adequacy of specifications.	Applicable
4.2.2.3g	The supplier shall implement a type reduction activity.	Applicable
4.2.2.4 Radiation hardness		
4.2.2.4a		Applicable
4.2.2.4b		Applicable
4.2.2.4c		Applicable
4.2.2.4d		Applicable
4.2.2.4e		Applicable
4.2.2.4f		Applicable
4.2.2.4g		Applicable
4.2.2.4h		Applicable
4.2.2.4i		Applicable
4.2.2.5 Derating		
4.2.2.5a		Applicable
4.2.2.5b	For wire link fuses, the current derating factor shall be 50 % with an additional derating of 0,2 %/°C for an increase in the temperature of fuse body above 25 °C.	N/A
4.2.2.6 Temperature range		
4.2.2.6a	Commercial parts shall be selected in the highest available temperature range.	New

4.2.2.6b	A minimum 10 °C margin shall be used between the maximum manufacturer temperature range and the application temperature range (including worst cases).	New
4.2.2.6c	~~<<deleted>>In case of (manufacturer max temperature range — used max temp) < -10 °C, an electrical characterisation shall be performed at used temperature with an additional margin of 10 °C during the evaluation step.~~ ~~NOTE 1 Example: for a manufacturer -40°C/+85°C temperature range with an application up to +80°C, then an electrical characterisation is performed at +90°C.~~ ~~NOTE 2 Example for a manufacturer -40°C/+85°C temperature range with an application down to -35°C, then an electrical characterisation is performed at -45°C.~~	Deleted New
4.2.2.6d	Operating temperature range of all commercial parts shall be greater or equal to (-40 / 85) °C.	New
4.2.2.6e	Temperature range of commercial ceramic capacitors shall be greater or equal to (-40 / 125) °C	New
4.2.3 Component evaluation		
4.2.3.1 General		
4.2.3.1a		Applicable
4.2.3.1b	~~The supplier shall plan and carry out the evaluation.~~	N/A
4.2.3.1c		Applicable
4.2.3.1d		Applicable
4.2.3.1e	In the definition of the evaluation programme any information including pertinent reliability, analysis and test data from the manufacturer of the component and previous use in comparable applications shall be considered and their relevance justified.	Applicable
4.2.3.1f		Applicable
4.2.3.1g		Applicable
4.2.3.1h		Applicable
4.2.3.1i	The supplier shall review the evaluation results to determine their impact on the content of the screening and lot acceptance tests.	Modified
4.2.3.1j		Applicable
4.2.3.1k	The supplier shall prepare a preliminary internal supplier's specification for electrical testing during evaluation tests. NOTE This specification can be part of the Test Plan.	New
4.2.3.1l	The supplier specification specified in 4.2.3.1k shall as minimum include tested parameters, test conditions, acceptance criteria, drift limits.	New

4.2.3.1m	The supplier shall update the internal supplier's specification used for screening and lot acceptance in accordance with the results of evaluation testing.	New
4.2.3.1n	The preliminary and the final internal supplier's specification as specified in Annex C shall be submitted to the customer for approval.	New
4.2.3.2 Component manufacturer assessment		
4.2.3.2.1		Not applicable See 4.2.2.1.g
4.2.3.2.2a		Not applicable See 4.2.2.1.g
4.2.3.2.2b		Not applicable See 4.2.2.1.g
4.2.3.3. Construction analysis		
4.2.3.3a		Applicable
4.2.3.3b	The Construction analysis shall be documented by a procedure to be submitted on request sent to the customer for approval. NOTE Annex H provides guidelines for microcircuits, diodes, transistors and optocouplers such procedure.	Modified
4.2.3.3c		Applicable
4.2.3.4 Evaluation testing		
4.2.3.4a		Applicable
4.2.3.4b		Applicable
4.2.3.4c	Evaluation tests shall be performed as specified in ~~Figure 4-1 and Table 4-1~~ : 1. Table 8-1 for ceramic capacitors chips, 2. Table 8-2 for solid electrolyte tantalum capacitors chips 3. Table 8-3 for discrete parts (diodes, transistors, optocouplers) 4 Table 8-4 for fuses 5. Table 8-5 for magnetic parts 6. Table 8-6 for microcircuits 7. Table 8-7 for resistors 8. Table 8-8 for thermistors	New
4.2.3.4d	Omission of any of the elements of tests specified in Table 8-1, Table 8-2, Table 8-3, Table 8-4, Table 8-5, Table 8-6, Table 8-7, Table 8-8 ~~Figure 4-1 and Table 4-1~~ , or the introduction of alternative activities, shall be justified in the JD.	New

	NOTE — ~~For mounting process (including baking for PED), see ECSS-Q-ST-70-38 and ECSS-Q-ST-70-08.~~	
4.2.3.4e	<<deleted>> ~~Evaluation of retinned components shall be performed as specified in Figure 8-1 from the requirement 8.1a.~~	Deleted

Figure 4-1: <<deleted>>

Table 4–1: <<deleted and moved as legacy test files as Table 8–9>>

4.2.4 Parts approval		
4.2.4a	All components shall be reviewed and approved by the customer through the PCB. ~~The supplier shall document the procedure for approval of each component type intended for use in flight products.~~	Applicable
4.2.4b	~~The approval of components shall be based on consideration of all pertinent data including both the electrical and environmental performance as well as the established quality and the dependability assurance requirements.~~	N/A
4.2.4c		Applicable
4.2.4d	The approval process by the customer depends on the part qualification status and shall be organized as follows: ~~Prior to procurement of components (or before equipment CDR, at the latest), the approval process by the customer shall be organized as follows:~~	Applicable Modified
	1. Space qualified parts : Space qualified parts listed in the DCL are approved through the DCL review except in the following cases where a PAD in conformance with ECSS-Q-ST-60 Annex D is delivered for customer's approval: (a) additional controls are required (e.g. precap, buy-off, LAT or LVT, RVT, DPA), (b) used outside the specified limits, (c) specific tests are required during procurement as per Table 7-1, (d) pure tin is used inside or outside the part.	Not applicable
	2. Other Hirel parts : A PAD in accordance with Q-ST-60 Annex D is delivered to customer for customer's approval.	Not applicable
	3. Commercial parts: A Justification Document ~~is required in accordance with ECSS-Q-ST-60-13 Annex F~~ is delivered to customer for customer's approval.	Applicable
	4. <<deleted>> ~~For any commercial part, a Justification Document, as per ECSS-Q-ST-60-13 (clause 4.2.4), is required, instead of a PAD.~~	Deleted
4.2.4e	In case the evaluation results are changing the testing conditions documented in the JD, a new revision of JD shall be submitted to the customer for approval.	Modified
4.2.4f	The parts approval process, including PAD and JD approval, shall be completed prior to CDR, or MRR for recurring units if there is no CDR.	Applicable
4.3 Component procurement		
4.3.1 General		
4.3.1a		Applicable

4.3.1b		Not applicable
4.3.1c		Not applicable
4.3.1d		Applicable
4.3.1e	The supplier shall ensure the compatibility of the change with its application and update all the related documentation. NOTE e.g RFD, PAD, JD, evaluation.	Applicable
4.3.1f	The change shall be submitted to the customer for approval. ~~For non-qualified parts, a change of products as defined in 4.3.1d shall be reflected in an updated PAD or JD.~~	Applicable
4.3.1g		Applicable
4.3.1h		Applicable
4.3.1i	Each procured EEE part shall be traceable to a manufacturer assigned trace code. NOTE The procurement of a single trace code per delivery lot should be preferred and encouraged.	New
4.3.1j	Each trace code shall be maintained as is through the entire supply chain including distributor. NOTE As far as possible, commercial parts should be ordered in the manufacturer's standard packing quantities or multiples thereof to avoid distributor re-packing and handling and to preserve the traceability information usually included on the original manufacturer packaging.	New
4.3.1k	The supplier shall ensure that the elements of the JD in accordance with Annex F, including any action plan, are applicable to flight parts.	New
4.3.2. Procurement specification		
4.3.2a	The supplier shall procure EEE components according to controlled specifications. NOTE It can be procurer's in-house specification, a manufacturer's drawing or a datasheet as a minimum.	Modified
4.3.2b		Not applicable
4.3.2c		Not applicable
4.3.2d		Not applicable
4.3.2e		Applicable
4.3.2f		Applicable
4.3.2g		Applicable

4.3.2h	If additional requirements to the manufacturer are identified by the supplier, they shall be specified in the procurement specification, in conformance with DRD from Annex C.	New
4.3.3. Screening requirements		
4.3.3a		Applicable
4.3.3b		Applicable
4.3.3c		Applicable
4.3.3d	For commercial parts, screening tests shall be performed in accordance with ~~Table 4-2~~ : 1. Table 8-1 for ceramic capacitors chips, 2. Table 8-2 for solid electrolyte tantalum capacitors chips 3. Table 8-3 for discrete parts (diodes, transistors, optocouplers) 4. Table 8-4 for fuses 5. Table 8-5 for magnetic parts 6. Table 8-6 for microcircuits 7. Table 8-7 for resistors 8. Table 8-8 for thermistors	Modified
4.3.3e	~~For active parts (transistors, diodes) packaged in TO3, DO4 or DO5, the PIND test method shall be submitted to the customer's approval.~~	N/A
4.3.3f		Applicable
4.3.3g	~~In case a component is not available in a qualified version according to quality level specified in Table 7-1, the screening of the component shall meet the screening flow defined by the generic specifications listed in Table 7-1.~~	N/A Applicable
4.3.3h	In case of X-rays or CT scan inspection, the total dose deposited and exposure time shall not deteriorate part performance or reliability ~~shall be less than 1/10 of the product acceptable dose.~~	Applicable

Table 4-2: <<deleted and moved as legacy test files as Table 8-10>>

4.3.4 Initial customer source inspection (precap)		
4.3.4a		Not applicable
4.3.4b		Not applicable
4.3.4c		Not applicable
4.3.5 Lot acceptance		
4.3.5a	The supplier shall ensure that any lot/date ~~each trace code~~ of EEE parts is submitted to a lot acceptance procedure specified, in line with	Applicable Modified

	applied normative systems, ~~in Figure 4-2 and Table 4-3~~ according to the following rules:	
	1.	Not applicable
	2.	Not applicable
	3. Commercial components: (a) The content of the lot acceptance is defined according to information provided by the justification document according to ECSS-Q-ST-60-13 Annex F ~~Each trace code is submitted to lot acceptance as specified in Table 4-3.~~ (b) The proposed lot acceptance is approved through the approval process in accordance with the clause 4.2.4. ~~(c) Omission of any of these elements, or the introduction of alternative tests, is justified in the JD.~~ ~~(d) If evaluation test is performed directly on flight lot (and if in conformance with lot acceptance and screening requirements), evaluation data can be used as lot acceptance.~~ ~~(e) The lot acceptance report is sent to the customer, on request, for information.~~	Applicable Modified
4.3.5b		Not applicable
4.3.5c	Lot acceptance tests ~~of retinned components~~ shall be performed in accordance with: ~~as specified in Figure 8-2, from the requirement 8.1a.~~ 1. Table 8-1 for ceramic capacitors chips, 2. Table 8-2 for solid electrolyte tantalum capacitors chips 3. Table 8-3 for discrete parts (diodes, transistors, optocouplers) 4. Table 8-4 for fuses 5. Table 8-5 for magnetic parts 6. Table 8-6 for microcircuits 7. Table 8-7 for resistors 8. Table 8-8 for thermistors	New

Figure 4-2: <<deleted>>

Table 4-3: <<deleted and moved as legacy test files as Table 8-11>>

4.3.6 Final customer source inspection (buy-off)

4.3.6a		Not applicable
4.3.6b		Not applicable
4.3.6c	For commercial parts, the buy off shall be replaced by an incoming inspection at the procurement entity's facility reported in the JD in accordance with clause 4.3.7.	Modified
4.3.6d		Not applicable
4.3.7 Incoming inspection		
4.3.7a		Applicable
4.3.7b	The incoming inspection shall include the following items: - For any part: the minimum inspections required in ESCC 21004. - For the non-space qualified parts, when the final customer source inspection has not been performed, the following additional items shall be done: - External visual inspection by sampling (AQL 0,65% level II or 20 parts min) - Electrical measurements at room temperature on 20 parts or 100 % (if lot size < 20 parts), or a datapackage review.	Applicable
4.3.7c		Applicable
4.3.7d		Not applicable
4.3.7e		Applicable
4.3.8 Radiation verification testing		
4.3.8a		Applicable
4.3.8b	RVT shall be performed in accordance with internationally recognized standards, such as ESCC Basic Specifications No. 22900, 25100 and 22500.	Applicable
4.3.8c		Not applicable
4.3.8d		Applicable
4.3.8e		Applicable
4.3.8f	Parts submitted to RVT total dose test shall be first screened as specified in the clause 4.3.3 to be fully representative of flight parts.	New
4.3.9 Destructive physical analysis		
4.3.9a	The DPA shall be performed according to the procurement Tables Table 8-1, Table 8-2, Table 8-3, Table 8-4, Table 8-5, Table 8-6, Table 8-7, Table 8-8 of Clause 8 ~~on 3 samples per lot of commercial parts during evaluation after lifetest as specified in the clause 4.2.3.4 and after reliving as specified in the clause 4.3.10.~~ ~~NOTE — Annex H provides guidelines for the construction analysis and descriptive physical analysis.~~	Modified

4.3.9b		Not applicable
4.3.9c		Not applicable
4.3.9d		Not applicable
4.3.9e	The DPA process shall be documented by a procedure to be submitted ~~sent~~, on request, to the customer for review. NOTE For guidance refer to the basic specification ESSC 20600 and for active parts ECSS-Q-ST-60-13 Annex H ~~provides guidelines for the construction analysis and destructive physical analysis.~~	Applicable
4.3.9f		Applicable
4.3.9g	~~Independent laboratories may perform DPA when approved by the customer.~~	N/A
4.3.9h		Not applicable
4.3.9i		Applicable
4.3.9j		Applicable
4.3.9k	~~<<deleted>>A DPA shall be conducted during relifing in accordance with clause 4.3.10.~~	Deleted New
4.3.10 Relifing		
4.3.10a		Applicable
4.3.10b	For components meeting the criteria specified in the requirement 4.3.10a, and which have a lot / date code exceeding the period defined in ECSS-Q-ST-60-14 clause 57 ~~years~~ , the relifing procedure ECSS-Q-ST-60-14 shall apply ~~to the lot~~ .	Applicable Modified
4.3.10c	~~<<deleted>>Humidity test and lifestest shall be performed in accordance with the clause 4.3.5 in case these tests have not been performed on the lot during the evaluation or the procurement phase.~~ NOTE ~~Humidity test includes HAST or THB.~~	Deleted New
4.3.10d	~~<<deleted>>As part of the relifing process, a DPA on 3 pieces shall be performed on each lot in accordance with the clause 4.3.9.~~	Deleted New
4.3.11 Manufacturer's data documentation deliveries		
4.3.11a	The manufacturer's ~~or the franchised distributor's~~ CoC shall be delivered to the parts procurer.	Modified
4.3.11b	Any other data, defined in the procurement documents, shall be delivered to the parts' procurer in line with the purchase order.	Modified
4.3.11c	For non qualified parts, the parts procurer shall store the documentation for a minimum of 15 ~~10~~ years after reception of the components.	Applicable Modified
4.4 Handling and storage		

4.4a	The supplier shall establish and implement procedures for handling and storage of components in order to prevent possible degradation. NOTE For guidance, refer to the basic specification ESCC 20600.	Applicable
4.4b		Applicable
4.4c		Applicable
4.4d		Applicable
4.4e	Plastic encapsulated devices shall be stored in one of the following conditions: 1. Dry Nitrogen 2. Dry and ionised air, with RH in a range of 15% to 20% 3. Dry packs as specified in J-STD-033 for dry pack inspection and control	New
4.5 Components quality assurance		
4.5.1 General		
4.5.1a		Applicable
4.5.2 Nonconformances or failures		
4.5.2a		Applicable
4.5.2b		Applicable
4.5.2c		Applicable
4.5.2d		Applicable
4.5.3 Alerts		
4.5.3a	The supplier shall take into account all received alerts, errata sheets, from international alert systems, from manufacturers or sent by the customer and shall validate that there are no alerts related to the intended application and the recommendations of alerts have been taken into account ~~on the proposed parts with respect to the batch information (including date code).~~	Applicable
4.5.3b		Applicable
4.5.3c		Applicable
4.5.4 Traceability		
4.5.4a	~~The traceability of individual components during manufacturing and testing shall be maintained as required by the procurement specifications.~~	N/A Applicable
4.5.4b	The traceability shall be maintained through incoming, storage, and installation at the procurer and user of the component ~~in accordance with programme PA requirements.~~	Applicable
4.5.4c		Applicable

4.5.4d	The traceability of EEE parts during installation in equipment, shall be ensured by the supplier through maintaining the traceability to the manufacturer's trace code number of the EEE parts actually mounted.	Modified
4.5.4e	If the as built DCL has not yet been delivered, the supplier shall be able to provide this information (part type actually installed with its relevant trace code number) within one week.	Modified
4.5.5 Lot homogeneity for sampling test		
4.5.5a	If tests are performed by sampling, the sampled parts shall be selected so that they are representative of the trace code distribution.	Modified
4.5.5b		Applicable
4.6 Specific components		
4.6.1 General		
4.6.1a	<<deleted>>	Deleted
4.6.2 ASICs		
4.6.2a		Applicable
4.6.3 Hybrids		
4.6.3a		Not applicable
4.6.3b		Not applicable
4.6.3c		Not applicable
4.6.4 One time programmable devices		
4.6.4a		Applicable
4.6.4b	The JD shall allow traceability to the information related to the procurement of blank parts, the programming process and the acceptance of the programmed parts. NOTE The programming process and the acceptance of the programmed parts may be part of PCB, for customer approval, if not indicated in the JD.	Modified
4.6.4c	<<deleted>>	Deleted
4.6.4d		Applicable
4.6.4e	For One-time programmable FPGA and PROM ~~types~~ without a clear and defined heritage, a post-programming burn-in shall be applied, in conformance with ESCC9000 subclause 8.16-~~8.21~~, for a minimum duration of 160 h. NOTE FPGA and PROM ~~types~~ with defined heritage are documented in these reports: ESCC REP 010 and ESCC REP011, available on https://escies.org.	Applicable
4.6.4f	The supplier shall prepare a post-programming procedure for customer's approval, depending on part types, including post and port burin-in electrical tests, burn-in conditions ~~including when~~	Applicable

	~~necessary electrical tests, programming conditions and equipment, programming software version qualified by the supplier, burn-in conditions, additional screening tests and specific marking after programming) as applicable per 4.6.4d.~~ NOTE: This includes, when necessary: - electrical test conditions, - programming conditions and equipment, - programming software version qualified by the supplier, - burn-in conditions, - additional screening tests, and - specific marking after programming	
4.6.4g		Applicable
4.6.4h		Applicable
4.6.5 Microwave monolithic integrated circuits		
4.6.5a		Not applicable
4.6.6 Connectors		
4.6.6a	For connectors with removable contacts, contacts shall be procured from the same manufacturer as the connector in which they are mounted.	Applicable
4.7 Documentation		
4.7a	Any result from inspection or control shall be documented (including lot acceptance, incoming, reliving and complementary tests).	Modified

Table 4-4: Documentation for Class 1 components

Document	Clause	Customer	Comments
~~New : RFD~~	~~4.2.2.2~~	~~Approval~~	~~For pure tin termination~~
New : Procedure for hot solder dip process	4.2.2.2j.	Approval	For re-tinning operation
New : Internal supplier's specification	4.2.3.1k.i	Approval	Applicable to the preliminary and final internal supplier's specification
<i>PAD : not applicable</i>	4.2.4	-	-
New : Justification Document	4.2.4	Approval	-
<i>Procedure for customer pre-cap : not applicable</i>	4.3.4	-	-
New : Procedure for construction analysis	4.2.3.3	~~Approval~~ Information (on request)	-
New : ~~Lot acceptance report~~ Evaluation and LAT report	~~4.3.5~~ 4.2.4d.	Information (on request)	-

Requirements for class 2 components

5.1 Components programme management		
5.1.1. General		
5.1.1a	The supplier shall establish and implement throughout the duration of the business agreement a component programme which ensures that the requirements of the project as defined by the customer and the supplier in the related business agreement are in compliance with this standard.	N/A ~~Applicable~~
5.1.2 Components control programme		
5.1.2.1 Organization		
5.1.2.1a		Applicable
5.1.2.2 Component control plan		
5.1.2.2a		Applicable
5.1.2.2b		Applicable
5.1.3 Parts control board		
5.1.3a		Applicable
5.1.3b		Applicable
5.1.3c		Applicable
5.1.3d		Applicable
5.1.4. Declared component list		
5.1.4a	For each equipment, its supplier shall issue a DCL in an editable and sortable electronic format such as .xls or .xlsx or .csv, ~~as a minimum compatible with CSV, identifying all component types needed.~~ ~~NOTE — CSV is a common file format that can be used to transfer data between database or spreadsheet tables (a spreadsheet program is for example Excel®)~~	Applicable
5.1.4b		Applicable
5.1.4c		Applicable
5.1.4d	After equipment CDR, all modifications affecting the PAD and JD information shall be implemented, in the "as design" DCL, ~~through the CN-/CR-process~~ and submitted to the customer for approval. ~~NOTE — For JD generation, see 5.2.4.d.~~	Applicable ~~Modified~~

5.1.4e		Applicable
5.1.4f		Applicable
5.1.4g		Applicable
5.1.4h		Applicable
5.1.4i	The supplier shall establish and update a consolidated “as design” DCL at its level and deliver it to the customer.	Applicable
5.1.5. Electrical and mechanical GSE		
5.1.5a		Applicable
5.1.5b		Applicable
5.1.6 EQM components		
5.1.6a	EEE components used in Engineering Qualification Model (EQM) shall be fit, form and function representative of the flight components and from the same manufacturers.	Applicable
5.1.6b	If thermal vacuum tests are performed on the EQM, the EEE parts shall be material representative of the FM parts.	Applicable
5.2 Component selection, evaluation and approval		
5.2.1 General		
5.2.1a		Applicable
5.2.1b		Applicable
5.2.2. Manufacturer and component selection		
5.2.2.1 General rules		
5.2.2.1a		Applicable
5.2.2.1b		Applicable
5.2.2.1c	~~<<deleted and moved to 5.2.2.5b>>Preference shall be given to components which necessitate the least evaluation or qualification effort.~~	N/A Applicable
5.2.2.1d	~~<<deleted and moved to 5.2.2.5c>>When selecting items, the supplier shall check the current data, applicability of the basis of qualification, problem notifications and alerts, and adequacy of specifications.~~	N/A Applicable
5.2.2.1e	For the assessment of commercial components, the supplier shall collect the available data on the manufacturer and the component in the JD. Specified in the requirement 5.2.4.d. NOTE It is important to check the exhaustiveness of the manufacturer documentation & data sheet with respect to the following items: • component marking, • mechanical description, • electrical and thermal description	New