ECSS–Q–60A
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Space Product Assurance

Electrical, Electronic and Electromechanical (EEE) Components

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Foreword

This standard is one of the series of ECSS Standards intended to be applied together for the management, engineering and product assurance in space projects and applications. ECSS is a cooperative effort of the European Space Agency, National Space Agencies and European industry associations for the purpose of developing and maintaining common standards.

Requirements in this standard are defined in terms of what must be accomplished, rather than in terms of how to organise and perform the necessary work. This allows existing organisational structures and methods to be applied where they are effective, and for the structures and methods to evolve as necessary without rewriting the standards.

The formulation of this standard takes into account the existing ISO 9000 family of documents.

This standard has been prepared by the ECSS Product Assurance Working Group, reviewed by the ECSS Technical Panel and approved by the ECSS Steering Board.

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General

1.1 Scope

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

1.2 Objectives

The objective of the EEE component selection, control and procurement requirements is to ensure that the EEE components used in space projects will allow the project as a whole to meet its requirements in terms of functionality, quality, reliability, schedule, and cost.

Important elements are:

- Components programme management
- Components engineering
- Components Quality Assurance

The main tools to be used to reach the objectives are:

- standardization of types
- definition of quality and testing levels
- qualification of components and manufacturers
- testing / screening / lot acceptance and periodic tests
- procurement specifications
- control and inspection
- control of non–standard components
- documentation and data definition

1.3 Basic Approach

For space projects the EEE component requirements will be defined in line with this standard by the customer and will appear in the appropriate clauses of the Project Requirements Document (PRD).

The supplier will make a EEE components apportionment of requirements to lower levels.

The supplier will define EEE component requirements within the boundaries of this standard based on the requirements of the system and its elements, and takes

into consideration the operational and environmental requirements of the programme.

The supplier will then define a component control plan to implement those requirements into a system which enables to control the selection, approval, procurements, handling, etc. in a schedule compatible with his requirements, and in a cost–efficient way.

1.4 Applicability

The provisions of this document apply to all actors involved in all levels in the realisation of space segment hardware and its interfaces.

1.5 Normative References

This ECSS standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these apply to this ECSS standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

ECSS–P–001	ECSS Glossary of Terms
ECSS–Q–00	Product Assurance
ECSS–Q–20	Quality Assurance
ECSS–Q–20–xa	Alert Systems – Implementation Procedures
ECSS–Q–20–xb	Nonconformance Control System – Implementation Procedure
ECSS–Q–30–xx	Derating Requirements
ECSS–Q–60–01	EEE Component Screening Compatibility Matrix
ECSS–Q–60–xx	European Preferred Parts List
ECSS–Q–70	Materials, Mechanical Parts & Processes
ECSS–M–20	Project Organisation
ECSS–M–40	Configuration Management
ESA/SCC QPL	ESA Qualified Parts List
SCC/REF 001	Requirements for component specification format

1.6 Definitions and Abbreviations

1.6.1 Definitions

For the purposes of this standard, the definitions given in ECSS–P–001 Issue 1 apply. In particular, it should be noted that the following terms have a specific definition for use in ECSS standards.

Customer

Supplier

System

The following terms and definitions are specific to this standard and shall be applied.

“agent:

In the sense of procurement agent: an organisation performing procurement of EEE components including related engineering and quality assurance tasks under contract for third parties (component users).”

“part approval document:

Format for collecting component data as a basis for approval of a component for a project. Such data include the information about the component and the manufacturer, as well as back–up alternatives, eventual requirements, and procurement and acceptance requirements. Its approval forms the formal acceptance of the procurement of such components.”

“screening: The sum of Final Product Test, Burn–in and Electrical testing.”

1.6.2 Abbreviations

The following abbreviations are defined and used within this standard.

Abbreviation	Meaning
CDR:	Critical Design Review
CECC	CENELEC Electronic Components Committee
CENELEC	Comité Européen de Normalisation Electrotechnique
DPA	Destructive Physical Analysis
ECSS	European Cooperation for Space Standardization
EEE:	Electric, Electronic, Electromechanical
ESA	European Space Agency
ESA/SCC	European Space Agency Space Components Coordination
LAT	Lot Acceptance Test
MRB	Material Review Board
NASA	National Aeronautics and Space Administration
NCR	Nonconformance Report
PA	Product Assurance
PAD	Part Approval Document
PDR	Preliminary Design Review
PPL	Preferred Parts List
QCI	Quality Conformance Inspection
RVT	Radiation Verification Testing

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Components Programme Management

2.1 General

The supplier shall establish and implement throughout the duration of the contract a component programme which ensures full compliance with the requirements of the project as defined by his customer in line with this standard.

2.2 Planning

The supplier shall ensure that the component programme is thoroughly planned, documented and implemented in a timely manner and that back–up plans are initiated whenever there is evidence of possible schedule or technical problems.

2.3 Component Control Programme

2.3.1 Organisation

a. The supplier shall establish and maintain an organisation responsible for the management of the component programme.

b. This organisation shall comply in all respects with the requirements of ECSS–Q–00.

2.3.2 Component Control Plan

a. The supplier shall prepare a Component Control Plan which describes in detail the proposed approach, methods, procedures and organisation he will adopt.

b. Specifically, this plan shall include, but not be limited to, a detailed description of the following items:

1. Organisational structure, responsibility descriptions and management approach,
2. Major tasks and methods of implementation,
3. Programme for standardization and control of component selection,
4. Component Evaluation and related testing approach,
5. Component testing level and lot acceptance testing level,
6. Component quality assurance activities,
7. Requirements on, and system for the control of, lower level suppliers, procurement agents (if any) and manufacturers,

8. Radiation control programme (if required),
9. Procurement system, including rationale for its selection,
10. Programme planning with schedule of tasks linked to programme milestones,
11. Reporting and deliverables,
12. Compliance matrix to the clauses of this standard taking into account applicable tailoring as defined in the contract.

2.3.3 Component Advisory Board

a. The first–level supplier shall establish a Component Advisory Board at programme level.
b. The Component Advisory Board is composed of representatives of:
   1. customer of the first–level supplier, if so required by the contract
   2. first–level supplier
   3. procurement agent, if any
   4. component user, when requested by first–level supplier
   5. component manufacturer, when needed
c. The main objectives of the Component Advisory Board shall be to achieve:
   1. Component types reduction and standardization.
   2. Identification of tasks to be performed, such as:
      (a) Component Evaluation
      (b) Specification writing
      (c) Manufacturer Evaluation
   3. Assessment of problem notifications and alerts.

2.4 Declared Component List

2.4.1

The supplier shall issue a Declared Component List identifying all component types needed and this list shall be kept under configuration control.

2.4.2

The Declared Component List shall be issued as a minimum at PDR and CDR (as designed) as well as at flight hardware delivery (as built).

2.4.3

The following information shall be included as a minimum.

a. Generic designation
b. Component type, package, and value range (including voltage, tolerance, etc.)
c. Manufacturer (name, plant)
d. Specification reference (generic / detail, including issue)
e. Equipment name(s)
f. Procurement: Self–procured(S), In–house–manufactured(I), Agent(A)
g. PPL reference
h. PAD sheet references

3

Component Engineering

3.1 General

The supplier of each product shall be responsible for the selection and procurement of components that will enable the performance, lifetime, environmental, material, safety, quality and reliability requirements of the product of which it forms a part, to be satisfied in all respects.

3.2 Component Selection

3.2.1 General Rules

a. The supplier shall establish and maintain in his own facility, and assure that his suppliers also establish and maintain, internal procedures for selecting and approving all components intended for use in deliverable products.

b. Components shall be selected on the basis of proven qualification and/or flight experience from manufacturers or sources employing effective Product Assurance Programmes in manufacturing and test.

c. When selecting items, particular attention shall be paid to the current data, applicability of the basis of qualification, and adequacy of specifications.

d. Evidence of compliance with the requirements specified herein shall be demonstrated for each procurement.

3.2.2 Components requiring specific authorisation

Use of components with the following characteristics shall be prohibited except where specifically agreed on case–by–case basis:

a. Limited life

b. Known instability

c. May cause a safety hazard

d. May create a reliability risk

EXAMPLE

- Plastic encapsulated semiconductors
- Components containing the following materials:
  - Beryllium oxide (except if the health and safety hazards are identified in the specification)
  - Cadmium
  - Lithium
  - Magnesium
  - Mercury
  - Radioactive material
  - Pure tin (electroplated or fused)
- Hollow core resistors
- Potentiometers
- Non–metallurgically bonded diodes
- Non–solid tantalum capacitors with silver case
- Dice with no glassivation
- Unpassivated power transistors
- Wet slug tantalum capacitors (except for CLR79 construction using double seals and a tantalum case)
- Any component whose internal construction uses metallurgic bonding with a melting temperature not compatible with the end–application mounting conditions
- Wire link fuses

3.2.3 Type Reduction and Standardization

a. The supplier shall establish and implement a programme for the control of the selection of components.

b. This programme shall ensure maximum use of preferred and qualified components and shall restrict the number of component types to a minimum.

c. Such a programme shall be planned and enforced in the design phase, so as to permit effective component standardization.

3.2.4 Radiation Sensitive Components

a. Single event as well as total–dose effects shall be assessed for the selection and application of components exposed to a radiation environment.

b. The required radiation tolerance, including types and levels of radiation, shall be specified by the organisation responsible for the design of the product into which each component is to be embodied.

c. Specific information as to the radiation control programme, including test facility, test method, planning and control, shall be included in the Component Control Plan or issued as a separate document.

3.2.5 Material Requirements for EEE Components

The supplier shall ensure that non–hermetically sealed materials of components meet the requirements of ECSS–Q–70 regarding outgassing, flammability, toxicity and/or other criteria required for the intended use.

3.2.6 Component Derating

a. When components are selected, derating shall be taken into account.

b. All components shall be derated in the manner outlined in ECSS–Q–30–xx.

c. Project–specific stresses, such as temperature, radiation, etc., shall be reviewed as a means of assessing whether to apply additional derating.

3.2.7 Availability of EEE Components

a. When components are selected for project application, their availability throughout the project life–time shall be assessed.

b. Back–up solutions shall be identified when an availability risk is expected.

3.2.8 Component Selection Criteria

a. The ECSS Preferred Parts List (ECSS–Q–60–XX) shall be used as the primary basis for component selection, provided that the requirements for the particular application are met.

b. The selection of components not listed in the PPL shall be based on knowledge regarding technical performance, qualification status or qualifiability, and history of previous use in similar applications.

c. Preference shall be given to components from sources that will necessitate the least evaluation/qualification effort.

d. In these circumstances preference shall be given to the following components in the order shown:

   1. Components qualified by ESA/SCC (see ESA/SCC Qualified Parts List);
   2. Components approved for European space programmes;
   3. Components which have met qualification requirements of non–European standards for space–flight use.

3.3 Component Approval

3.3.1 General

a. All components shall be approved through PAD sheets prior to procurement, as specified below.

b. The first–level supplier shall assure that the PAD sheets are issued by the responsible procurement agent, either the component user for in–house– or self–procured components, or the agent for agent–procured components.

c. Justification shall be given for the use of all components not classified as standard components.

3.3.2 Approval

Information supporting the request for approval to use components shall be provided as follows:

a. Standard:

   1. For components contained in any Qualified Components List and in the PPL, PAD page 1 shall be provided to the first–level supplier for information only.
   2. For components selected from the PPL which are not qualified, the PAD page 1 shall be provided to the first–level supplier for approval.

b. Non–standard:

   1. For components contained in any Qualified Components List which are not contained in the PPL, the PAD page 1 shall be provided to the first–level supplier for approval.

2. For components not contained in the PPL for which there is a history of use in space projects, the PAD page 1 and the Evaluation Report (see also sub–clause 4.2.6) shall be provided to the first–level supplier and, if required, to the customer for approval.

c. All other cases:

1. The PAD page 2 shall be provided to the first–level supplier and, if required, to the customer for approval.
2. After evaluation and prior to procurement, the PAD page 1 shall be provided to the first–level supplier and, if required, to the customer for approval.

3.4 Procurement Requirements

3.4.1 Procurement Specifications

a. All components intended for use in deliverable products shall be procured according to controlled specifications.

b. The maximum use practicable shall be made of existing European component specification systems, either CECC or ESA/SCC as appropriate.

c. Whenever a new procurement specification is established, it shall, to the greatest extent practicable, specify the manufacturer's standard product, without special requirements.

d. All new specifications shall be designed to be totally compliant with one of the existing European standardization systems.

e. New specifications shall include the following as a minimum:

1. Relevant electrical and mechanical parameters
2. Screening, burn–in, and acceptance requirements
3. Documentation/data requirements
4. Delta limits when applicable
5. Criteria for percent defective allowable
6. Lot Acceptance Tests / Quality Conformance Inspections
7. Marking
8. Storage requirements
9. Requirements for lot homogeneity
10. Serialisation (when applicable)
11. Protective packaging and handling requirements
12. Radiation Verification Testing requirements, when applicable

f. Specifications shall include configuration control requirements that ensure that any change of the product that refers to the qualification or that may affect performance, quality, reliability, and interchangeability is identified by the manufacturers.

3.4.2 Screening Requirements

a. All components to be incorporated into flight–standard hardware shall be subjected to screening testing.

b. The screening–test requirements shall be so designed that accumulated stress will not jeopardise component reliability.

c. The customer shall define in the requirements, the ESA/SCC testing level according to the following categories:

1. testing level 1: applicable for critical flight–standard hardware
2. testing level 2: applicable for maintainable, non–critical flight hardware of single experiments

d. For components not procured to ESA/SCC specifications, screening shall be compatible with above levels.

e. Project testing levels and compatibility to ESA/SCC shall be as defined in ECSS–Q–60–01.

f. All screening tests shall be performed at the component manufacturer's premises or at a source approved by the PAD approval authority, for the performance of screening.

3.4.3 Lot Acceptance Testing (LAT) or Quality Conformance Inspection (QCI)

a. It shall be ensured that all components shall be subjected to Lot Acceptance Testing (LAT) as defined in the ESA/SCC specifications, or QCI (Quality Conformance Inspection) as defined in the United States Military specifications.

b. The levels shall be as defined below:

1. Level LAT1 or QCI compatible: the component is neither ESA/SCC nor United States Military qualified at the time of the procurement and level LAT2 is not applicable.
2. Level LAT2 or QCI compatible: the component is not space qualified but has successfully supported other long life and/or high reliability space programmes and the reliability/evaluation data are still valid for the current design.
3. Level LAT3 or QCI compatible: all cases not included in level LAT1 or LAT2. Level LAT3 tests may be replaced by incoming inspection. Level LAT3 tests may be omitted for qualified ranges of components (e.g. 54HC, ...).

3.4.4 Radiation Verification Testing (RVT)

When the component radiation sensitivity, as calculated either from radiation characterisation test or from existing radiation resistance data, is suspected to be inadequate (as defined by project requirements) with respect to the component anticipated dose, samples from the lot or wafer under procurement shall be subjected to RVT.

3.4.5 Components from stock

a. Components from stock that have a lot/date code which indicates that less than 5 years will have elapsed from date of manufacture to date of intended installation in equipment shall meet the following requirements:

1. quality requirements specified herein and verified by data review shall be met;
2. Destructive Physical Analysis (DPA) shall be performed in cases where:
   (a) DPA would normally be required, and no available DPA report covers the lot; or
   (b) degradation of the components during storage may have occurred.
   (c) Any such DPA shall be defined on an individual PAD including the lot sample basis.

b. For components from stock that have a lot/date code which indicates that more than 5 years will have elapsed from date of manufacture to date of intended installation in equipment the following shall be performed:

1. 100% electrical testing of ageing–sensitive parameters on a sample basis (Acceptable Quality Level = 0,65, level II);
2. visual inspection on a sample basis (Acceptable Quality Level = 0,65, level II);

3. additional hermeticity test, when applicable, on a sample basis (Acceptable Quality Level = 0,65, level II);
4. DPA shall be performed in cases where:
   (a) DPA would normally be required, and no available DPA report covers the lot; or
   (b) degradation of the components during storage may have occurred.
   (c) Any such DPA shall be defined on an individual PAD including the lot sample basis.

3.5 Specific Components

For specific component types, dedicated requirements in addition to the requirements in this document shall apply.

3.5.1 Application Specific Integrated Components

The specific requirements detailed in ECSS–Q–60–xx shall apply, covering development, prototype manufacturing, testing, validation and quality assurance.

3.5.2 Hybrids

The specific requirements detailed in ECSS–Q–60–xx shall apply, covering the evaluation, qualification, procurement and add–on components.

3.5.3 User–programmable Devices

The specific requirements detailed in ECSS–Q–60–xx shall apply, covering post–programming screening and testing.

3.5.4 Electro–optical Devices

The specific requirements detailed in ECSS–Q–60–xx shall apply for components not covered by a generic specification.

3.5.5 Electro–magnetic Devices

The specific requirements detailed in ECSS–Q–60–xx shall apply, covering design, manufacturing and quality control of custom–made electromagnetic devices such as coils and transformers.

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Components Quality Assurance

4.1 General

The supplier shall establish and implement all of the requirements of this document including methods, organisations and documents used to control the selection and procurement of components in accordance with the requirements of ECSS–Q–20.

4.2 Manufacturer and Component Evaluations

a. The supplier shall assure that the selected manufacturer complies with the requirements defined in this document.

b. He shall also ensure that the components are actually procured from these manufacturers.

c. Traceability data shall be available to show that the flight components have been made according to the same technology and manufacturing processes as the evaluated components.

d. If valid and acceptable qualification of a component type cannot be demonstrated, a component evaluation and approval testing programme, as defined below, shall be implemented.

e. The content and extent of such a programme shall be approved by the customer before its implementation.

4.2.1 General

a. The evaluation programme shall cover the following elements :

1. Design and application assessment
2. Constructional analysis
3. Manufacturer assessment
4. Evaluation testing.

b. Reduction or complete omission of any element of the evaluation requirements shall be approved by the customer on the basis of documentary evidence provided to substantiate the reduction or omission.

c. The supplier shall:
   1. ensure that sufficient data are made available to the customer;
   2. demonstrate that all aspects of the application and the mission operational life requirements have been fully considered, and
   3. propose inspections and/or tests to be included within an evaluation and qualification testing programme to address any concerns or doubts.

4.2.2 Design and Application Assessment

a. A Design and Application Assessment shall be performed to:
   1. Identify those electrical parameters essential for the intended application.
      (a) This assessment shall be supported by the practical results obtained from evaluation samples to demonstrate that the component type is suitable for the application.
      (b) These tests shall take into account the applicable derating requirements and any special electrical, mechanical, or environmental conditions not normally tested or checked but that are necessary for the intended application (such as temperature, radiation effect, etc.).
   2. Justify why a fully qualified component cannot be used, including a comparison also to other partially or non qualified alternatives and the reasons for the selection of this particular component type.

b. The Design and Application Assessment Report shall be included in Evaluation Report.

4.2.3 Constructional Analysis

a. Constructional analysis shall be carried out on representative components. The primary aim of constructional analysis is to provide an early indication of a component's probability of meeting the evaluation requirements and the operational goals of the concerned programme.

b. This analysis shall demonstrate that:
   1. The standard of fabrication and assembly is fully assessed to identify any area where modifications are required or where specific tests or inspection points should be identified in the procurement specification or during procurement.
   2. All potential failure modes are identified in order to assess the need for additional tests
   3. Assurance is obtained that no materials or processes have been employed that are likely to deteriorate over time and that may result in a malfunction.

c. The findings of the analysis shall be contained within a Constructional Analysis Report and shall be included in the Evaluation Report.

4.2.4 Manufacturer Assessment

The purpose of the evaluation of a manufacturer is to assess his capability, to ensure the adequacy of his organisation plant and facilities, and to ascertain his fitness to supply components to the appropriate specifications for space application.

a. This evaluation shall be performed against the appropriate ESA/SCC checklist and shall include, but not necessarily be limited to, a survey of:
   1. The overall manufacturing facility and its organisation and management
   2. The manufacturer's system for inspection and manufacturing control including all relevant specifications, procedures, and internal documents.
   3. The production line used for the component.

b. The complete manufacturer evaluation shall be included in the Evaluation Report.

4.2.5 Evaluation Testing

a. On completion of the design assessment, constructional analysis, and manufacturer evaluation of the submission of documentary evidence for substitution of any of these evaluation requirements, evaluation testing shall be carried out.

b. This assessment shall determine which inspections or tests are required to provide the confidence that the component type under evaluation will, when assembled and tested in accordance with the procurement specification, successfully meet the mission requirements.

c. Sufficient data shall be available on completion of the evaluation programme to demonstrate component stability.

d. In addition, evaluation testing shall be required where any of the previous stages have identified any anomaly reflecting a design, material, or process weakness that could shorten the active life of the concerned component and that could not be identified during the final production testing or screening tests included in the procurement specifications. Because of the wide range of possible anomalies or weaknesses that would require evaluation testing, it is not possible to define the precise test programme to be followed; however, the types of testing to be considered should include:

   - Electrical stress, such as accelerated life testing, high temperature reverse bias, or endurance testing, normally used to assess stability
   - Mechanical stress, including shock, vibration, and centrifuge, to evaluate the robustness of the assembly
   - Environmental stress, such as thermal shock or cycling, high– or low–temperature storage, and seal tests, etc., to evaluate package integrity or a particular facet of the design expected to be susceptible to temperature extremes
   - Assembly capability testing.
   - Radiation testing, for total dose and single event effects sensitivity.

e. For evaluation testing the supplier shall document in the PAD for that component:

   1. the test programme
   2. the test methods
   3. the sample size.

f. This shall be approved by the customer prior to test implementation.

g. After completion of the evaluation testing, a final review of the proposed procurement specification shall be carried out to determine if the obtained results will have an impact on the content of the procurement specification.

4.2.6 Evaluation Report

The full details of the evaluation testing, the results achieved, and an overall assessment of the complete evaluation programme shall be included within the Evaluation Report, which, once complete, shall be submitted to the customer for approval.

4.3 Procurement Control

4.3.1 General

a. The supplier shall be responsible for manufacturer surveillance and control throughout the procurement programme.

b. The requirements defined within the present document shall be met, through any surveillance or control measures considered necessary to ensure that the

manufacturer meets the obligations of the purchase order and procurement specification(s).

c. All major inspection points shall be identified within the PAD.

d. These Customer Support Inspections, including precap and test witnessing, shall be carried out by the supplier inspectors or their approved representatives.

4.3.2 Traceability

a. Traceability during components manufacturing and testing shall be covered by the procurement specifications.

b. This traceability shall be maintained through incoming and installation in accordance with programme PA Requirements.

4.4 Incoming Inspection

4.4.1 General

a. Incoming inspection shall be performed on all components to verify compliance with the purchase order requirements.

b. This inspection shall include:

1. Review of the manufacturer–delivered documentation.
2. External visual inspection.

This inspection may include, based on the type of component, criticality and experience with the manufacturer:

- Electrical measurement of critical parameters on sampling basis if final source inspection has not been performed. (Final source inspection means witnessing of electrical measurements on sample basis including a verification of the documentation.)
- Destructive Physical Analysis as defined below.
- Solderability test as far as necessary.
- RVT results against needs, if RVT is performed.

c. The results of the incoming inspection and any additional performed test shall be documented and held on file for a duration determined by the contract.

4.4.2 Destructive Physical Analysis (DPA)

DPA comprises a 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.

a. DPA shall be performed on three samples from each date code (exception when reduction is applicable) of the component types listed below:

NOTE The DPA sample size may be reduced, but such reduction shall be subject to customer approval via the PAD

1. discrete semiconductors
2. integrated circuits
3. filters
4. variable resistors
5. variable capacitors
6. ceramic capacitors
7. tantalum capacitors
8. relays

9. crystals
10. hybrids
11. switches
12. high–voltage components
13. high–frequency components
14. opto–electronic components

DPA may be carried out on representative samples of the component family.

b. This shall be identified in the PAD.

DPA tests may be omitted for ESA/SCC (or equivalent, see ECSS–Q–60–01) qualified components.

c. This shall be identified in the PAD.

d. DPA shall be performed and completed before the installation of components into flight hardware by the procuring authority in accordance with approved DPA procedures.

e. These procedures shall:

1. define methods and accept/reject criteria for inspecting component:
   (a) materials
   (b) design
   (c) construction
   (d) workmanship
2. be approved by the customer.

Independent laboratories may perform DPA when approved by the customer.

DPA may be performed by the manufacturer if witnessed by the supplier (or approved representative).

4.5 Handling and Storage

a. Procedure for handling and storage of components in order to prevent possible degradation shall be established and implemented.

b. As a minimum, the following areas shall be covered:

1. Control of environment such as temperature and humidity and cleanliness.
2. Appropriate measures and facilities to segregate and protect components during receiving inspection, storage, and delivery to manufacturing.
3. Control measures to ensure that electrostatic discharge susceptible components are identified and handled only by properly trained personnel using anti static packaging and tools.
4. Traceability.

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Nonconformances or Failures

a. The supplier shall establish and maintain a closed loop nonconformance control system in accordance with the general requirements in ECSS–Q–20.

b. Any observed deviation of EEE components from requirements as laid down in applicable specifications, procedures and drawings shall be controlled by the non conformance control system. This includes failures, malfunctions, deficiencies and defects.

c. The nonconformance control system shall handle all nonconformances occurring on EEE components during:

   1. manufacture (if available), screening and acceptance tests,
   2. incoming inspection, or
   3. integration and test of equipment, or
   4. storage and handling

d. shall be handled using the .

e. Nonconformances shall be classified as major or minor in accordance with the ECSS–Q–20–xb depending on the nature and effect of the deviation.

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6

Alerts

a. The supplier shall participate in an alert system established by the customer in accordance with the general requirements in ECSS–Q–20, and the implementation requirements in ECSS–Q–20–xa.

b. The supplier shall appoint an individual as Alert Co–ordinator, who shall be in charge of:

   1. Investigating and screening for technical validity, co–ordinating and maintaining a permanent record of all Alert Reports
   2. Transmission of preliminary alerts to the designated Alert Co–ordinator and the involved manufacturer.
   3. Disseminating information within his organisation on impending alerts.
   4. Updating the original Alert Report to reflect relevant comment from the involved manufacturer or others.

c. The ESA Alert Co–ordinator shall maintain a list on Alert Co–ordinators and duly distribute Alert Reports.

d. This alert system shall also handle all alerts provided by other systems (e.g. Government–Industry Data Exchange Program – GIDEP, NASA, Military Parts Control Advisory Groups – MPCAG, etc.) of which the supplier becomes aware.

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Documentation

The following documents shall be prepared and maintained for a period of time specified by the programme requirements.

a. Component Control Plan (see clause 2.3.2)

b. Declared Components List (see clause 2.4)

c. PAD sheets (see clause 3.3, annex A)

d. Evaluation report (see clause 4.2.6)

e. Manufacturer documents (see clause 4.3):

NOTE 1 The originals of the following documentation shall be stored at the facilities of the manufacturer or the procurement responsible.

NOTE 2 The customer shall have access to the originals on request.

1. recorded values of measured parameters and calculated deltas related to serial numbers (if applicable),
2. copies of radiographic films and scanning electron microscope photos related to serial numbers (if applicable),
3. detailed results of lot acceptance test or equivalent. If none need be performed, the manufacturer shall make available for review a copy of the latest environmental and life test results, for example, summary of Group B and Group C test results for United States Military–specification components,
4. internal screening reports
5. precap (Customer Source Inspection) reports

f. Manufacturer–delivered documents (see clause 4.4.1):

NOTE The documentation, as required from the manufacturer as a minimum for each delivery lot.

1. Certificate of Conformance verifying that all requirements of the applicable specifications are met,
2. List of tests or measurements with the quantity of components tested and the quantity of components failed,
3. Failure Analysis Reports (if applicable),
4. Radiation Verification Testing (RVT) results (if applicable)

g. DPA reports (see clause 4.4.2)
h. Nonconformance Reports and MRB reports (see ECSS–Q–20)
i. Component experience (part of Lessons Learnt Report) (see ECSS–M–20)

Annex A (normative)

PAD format

PROJECT:	Sheet 1 of [ ]	Doc No:	
		Issue:	Date:
Approval requested by:			
Family:	Fcode [ ]	Group:	Gcode [ ]
Component Number:		Similar to style:	
Technology/Characteristics (range, case, tolerance, voltage, etc)			
Generic specification:		Issue:	Rev.:
Detail specification:		Issue:	Rev.:
Specification amendment:		Issue:	Rev.:
Testing level:		Procured by:	
Manufacturer/Country:		Man/C [ ]	
Backup Manufacturer:		BMan/C [ ]	
APPROVAL STATUS			
SCC qualified (Y/N) [ ]		Certificate number:	Valid until:
Other approvals/former usage			
Appears in ESA PPL /Y/N) [ ]		Project PPL	
Further evaluation necessary (Y/N) [ ]			
PROCUREMENT INSPECTIONS			
SEM [ ] Precap [ ] Batch acceptance [ ]		Other inspection	
DPA [ ] Sample size		Customer sample size	
LAT/QCI: level [ ]			
Remarks:			
RADIATION HARDNESS DATA			
Insensitive [ ]	Sensitive [ ]	Data available [ ]	
Data reference			
Acceptance test per lot is required (Y/N) [ ]			
Total dose OK [ ]	SEU OK [ ]	SEL OK [ ]	
Specification [			
Equipment [			
Methods [			
Other [			
Approval customer		Date	
Approval first–level supplier		Date	

PROJECT:	Sheet 2 of [ ]	Doc No: Issue:	Date:
Approval requested by: Family:	Fcode [ ]	Group:	Gcode [ ]
Component Number: Testing level:		Similar to style:	
DETAILS OF SPECIFICATION MODIFICATIONS PENDING			
DETAILS OF EVALUATION PROGRAMME PLANNING Evaluation programme under: Design assessment (Y/N) [ ]		Manufacturer audit (Y/N) [ ]	
Constructional analysis (Y/N) [ ] If [N] entered above, provide rationale:		Sample size	
Radiation testing (Y/N) [ ]			
Evaluation testing (Y/N) [ ] If [N] entered above, provide rationale for evaluation acceptance:		Sample size	
TYPE APPROVAL TESTING SCC LAT 1 [ ]	Other [ ] (Give details below)		
Approval customer		Date	
Approval first–level supplier		Date	

NOTE 1 Abbreviations used are:

DPA:	Destructive Physical Analysis
ESA:	European Space Agency
LAT:	Lot Acceptance Test
PPL:	Preferred Parts List
QCI:	Quality Conformance Inspection
SCC:	Space Components Coordination
SEL:	Single Event Latchup
SEM:	Scanning Electron Microscope
SEU:	Single Event Upset

NOTE 2 The layout adopted in the PAD forms is informative only.

GUIDANCE NOTE FOR COMPLETION OF PART APPROVAL DOCUMENT

One PAD shall be completed per component type, specification, variant, testing level and procurement occasion. A range of values and more than one tolerance or voltage (for passive components) may be entered on one PAD.

Doc No:	Unique sequential number
Issue:	Issue of document
Date:	Date of issue
Project:	Name of project using the component
Approval requested by:	Name of the company submitting the PAD
Family:	Capacitor, resistor, etc. (see ESA database)
Group:	Ceramic, tantalum, etc. (see ESA database)
Component number:	In accordance with procurement spec.
Similar to style:	Commercial or military equivalent
Technology/Characteristics:	Describing the components covered by the PAD
Generic specification:	Relevant specifications with issue and revisions
Detail specification:	Relevant specification with issue and revisions
Testing level:	Testing level/quality level/class/failure rate according to spec.
Procured by:	Name of procuring company or agent
Manufacturer/Country:	Manufacturer code (for ESA/SCC qualified component ref. to QPL may be entered) (see ESA database)
Approval status:	Information about known approvals (SCC, used in other projects, etc.)
Further evaluation:	Y/N as applicable
Procurement inspections:	Y/N as applicable
DPA sample size:	Number (normally 3)
Customer samples:	Agreed number (if not otherwise agreed, 3 pcs.)
LAT/QCI:	Identify level
Radiation hardness data:	
Insensitive Sensitive Data available	Tick as applicable
Radiation acceptance test:	Y/N as applicable
Specification etc.	Relevant information about test methods, sample sizes, etc. (or reference to relevant documents)
Approval customer:	Signature signifies acceptance
Approval first–level supplier:	Signature signifies acceptance
Details of specification modifications pending:	Self explanatory
Details of evaluation programme planning:	Self explanatory
Type approval testing:	Self explanatory
Approval customer:	Signature signifies acceptance
Approval first–level supplier:	Signature signifies acceptance

NOTE Abbreviations used are:

DPA:	Destructive Physical Analysis
ESA:	European Space Agency
LAT:	Lot Acceptance Test
QCI:	Quality Conformance Inspection
QPL:	Qualified Parts List
SCC:	Space Components Coordination

Annex B (informative)

Level 3 standards

Proposed level 3 standard		Suitable existing standards		Reusability cat.*	Comments
Discipline	**Title proposed**	**Ident. (No., Issue)**	**Title**		**Major changes**
Dependability	Derating requirements	PSS–01–301	Parts Derating Requirements	2	New part types Several comments
Q–60–01	EEE Component Screening Compatibility Matrix			4	Draft 1 exists
Q–60–xx	ECSS Preferred Parts List	ESA/SCC QPL	ESA Qualified Parts List	1	
Q–60–xx	Requirements for ASICs	QC/172/RdM	ESA ASIC Design and Assurance Requirements	3	
Q–60–xx	Requirements for hybrids	PSS–01–605	The Capability Approval Programme for Hermetic Thin Film Hybrid Microcircuits	3	
Q–60–xx	Requirements for hybrids	PSS–01–606	The Capability Approval Programme for Hermetic Thick Film Hybrid	3	
Q–60–xx	Requirements for hybrids	PSS–01–608	Generic specification for hybrid microcircuits	3	
Q–60–xx	Requirements for user–programmable devices			4	
Q–60–xx	Requirements for electro–optical devices			4	
Q–60–xx	Requirements for electro–magnetic devices	MIL–STD–981	Design, Manufacturing and Quality Standards for Custom Electromagnetic Devices for Space Application	3	
Q–20–xx	Nonconformance control				see Note 2
Q–20–xx	Alert processing				see Note 2

NOTE 1 Reusability categories:

1. Use as is with editorial changes only
2. Major changes in some areas
3. Content to be assessed after consolidation of level 2 standard
4. New standard to be created

NOTE 2 For both ECSS–Q–20 level 3 standards, drafts have been established as part of an ESA study considering ISO 9001 as input. This study has been commonly performed by DASA–RI, Aérospatiale/Cannes, Alcatel Espace and Alenia Spazio in 1992/93. These level 3 standards could well be used as starting point for ECSS level 3 standards.