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Space systems — Electrical, electronic and electromechanical (EEE) parts —

Part 2: Control programme requirements

Systèmes spatiaux — Composants électriques, électroniques et électromécaniques (EEE) —

Partie 2: Exigences du programme de contrôle

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 14, *Space systems and operations*.

This edition cancels and replaces the first edition (ISO 14621-2:2003), which has been technically revised. The main changes compared to the previous edition are as follows:

— Introduction and definitions have been revised,

— consistency has been checked with ISO 14621-1, and

— the document has been aligned with the ISO/IEC Directives Part 2, 2018 edition.

A list of all parts in the ISO 14621 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

ISO 14621-1 and ISO 14621-2 are designed to jointly assist the user and supplier communities in developing and executing an effective process for the design, selection and application of electrical, electronic, and electromechanical (EEE) space parts throughout the life cycle of the programme.

NOTE In both ISO 14621-1 and ISO 14621-2, the family of EEE parts includes electro-optical parts.

The strategy represented in the ISO 14621 series is:

— for ISO 14621-1 a system approach to managing risk throughout the life cycle of the programme, by developing, selecting and properly applying the right EEE part for its intended application;

— for ISO 14621-2 a framework for developing and documenting an EEE parts control programme to assure that the parts used in space flight hardware have acceptable risk, i.e. possess adequate functional, radiation and reliability characteristics to meet the system requirements.

Both ISO 14621-1 and ISO 14621-2 should be tailored to meet the specific needs of each individual programme, i.e. to address the applicable system performance requirements, risk tolerance, budget, mission duration, operating environment, and schedule. Tailoring should result in a set of planned activities that are not only capable of achieving all contractual EEE parts related requirements, but also commensurate with the space system's unit-value/mission-criticality and life cycle technical data product requirements.

NOTE This type of planning is sometimes referred to as capability-based Safety, Dependability, and Quality Assurance (SD&QA) programme tailoring; and the guidance for performing it is provided in ISO/TS 18667.

ISO 14621-1 and ISO 14621-2 are relevant to all users and customers of space systems, and the suppliers and vendors that furnish space flight hardware. However, to utilize these documents to their fullest potential, it is necessary to understand the commercial space business environment which has unique cost and schedule constraint challenges.

Space systems — Electrical, electronic and electromechanical (EEE) parts —

Part 2:
Control programme requirements

1 Scope

This document establishes technical guidelines for developing and documenting an electrical, electronic and electromechanical (EEE) parts control program, in order to assure that the parts used in the flight hardware are acceptable and possess adequate functional, radiation and reliability characteristics to meet the system requirements. The family of EEE parts includes electro-optical parts.

This document identifies a set of management guidelines for dealing with space systems engineering activities and defines the minimum existing processes on the subject.

These guidelines are tailorable to the needs of each individual programme based on the project performance criteria, risk tolerance, budget, mission duration, environment, schedule and other considerations. This document is applicable to all customers and suppliers furnishing flight hardware and is suitable for reference in proposal instructions.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 14300-1, *Space systems — Programme management — Part 1: Structuring of a project*

ISO 14300-2, *Space systems — Programme management — Part 2: Product assurance*

ISO 14621-1, *Space systems — Electrical, electronic and electromechanical (EEE) parts — Part 1: Parts management*

ISO 17666, *Space systems — Risk management*

3 Terms, definitions, and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1.1
customer
person or organization that could or does receive a product or a service that is intended for or required by this person or organization

[SOURCE: ISO 9000:2015, 3.2.4, modified — EXAMPLE and Note 1 to entry have been deleted.]

3.1.2
manufacturer
company or organization that transforms raw material into a product

3.1.3
electronic, electrical, or electromechanical part
EEE part
device that performs an electrical, electronic, or electromechanical (EEE) function, including electro-optical devices, and consists of one or more elements so joined together that they cannot normally be disassembled without destroying the functionality of the device

3.1.4
procurement responsible
party accountable for the process of procuring an *EEE part* (3.1.3)

EXAMPLE *Customer* (3.1.1), *supplier* (3.1.6), or independent procurement agent.

3.1.5
service company
organization that provides services related to *EEE parts* (3.1.3)

EXAMPLE Distributor, screening laboratories or DPA laboratories.

3.1.6
supplier
organization or person that provides a product as part of a business agreement

[SOURCE: EN 16601-00-01:2015, 2.3.209]

3.2 Abbreviated terms

CID commercial item description

DPA destructive physical analysis

EEE electrical, electronic and electromechanical

LAT lot acceptance testing

MRB material review board

PPL preferred parts list

QCI quality conformance inspection

RHA radiation hardness assurance

RVT radiation verification testing

TCI technology conformance inspection

4 Requirements

4.1 General

Technical guidelines for parts control programme tasks, applied throughout all phases of flight hardware development, manufacturing, and logistic support, are described in the following subclauses. The customer and suppliers may include additional tasks not described below and exclude tasks described herein based on other factors such as project design implementation and the project's risk tolerance, in order to institute the most effective parts control programme for the space system.

The customer should reference this document in the request for proposal or statement of work and should identify any additional tasks, deletions, or other special requirements with regard to parts. The supplier shall implement a parts control programme covering each of the subjects in 4.2 to 4.20 and any additional tasks included in the request for proposal or statement of work. If any of these tasks are excluded, they should be so identified.

4.2 Organization

The space hardware supplier shall identify the organization responsible for managing its parts control programme and describe the organization's approaches, skills, and authority to implement, manage, and control the parts control programme efficiently, including reporting, as specified in ISO 14300-1.

4.3 Parts selection and standardization

The space hardware supplier shall have an EEE parts selection and standardization process and implementation plan, which will allow it to meet the cost, schedule, operating, stability, environmental, radiation, material, safety, quality, and reliability requirements defined for the related space programme, as described in ISO 14300-1 and ISO 14300-2.

The space hardware supplier shall describe the process for selection and standardization of the parts as defined in ISO 14621-1. This includes the approach for technology insertion and the methodology and rationale for selection of parts manufacturers and service companies.

The space hardware supplier shall optimize the use of previously qualified or approved parts for equivalent applications, thereby restricting the number of different part types, encouraging standardization and reducing life cycle costs and risk of obsolescence. The supplier is recommended to have a PPL, a parts usage list or an equivalent approved parts list which includes parts suitable from the viewpoint of quality assurance, cost availability, usage history, new and current technology, and data to support their space radiation sensitivity.

4.4 Parts evaluation and characterization

The space hardware supplier shall define the process to be implemented for the evaluation and characterization of the EEE parts. Where adequate assessment data does not already exist, the space hardware supplier shall define and describe how it will verify the capability of each selected part type to meet the mission requirements, in accordance with ISO 14621-1.

The manufacturer or service company used by the space hardware supplier shall be capable of demonstrating that they meet the performance requirements and expectations of the programme. This includes a description of the configuration controls that ensure that the parts used for space hardware are equivalent in form, fit, function, and performance to the evaluated parts.

4.5 Parts requiring specific authorization

Prior to incorporating EEE parts into any space hardware, the supplier shall develop a risk management plan (see 4.18) for EEE parts requiring specific authorization or restriction for reasons such as limited-life, limited useful shelf life, instability, operation outside temperature range, or other reliability risks.

The supplier shall address the methodology used for custom and in-house developed parts. These parts shall be subjected to the same evaluation criteria as all other parts.

4.6 Radiation hardness assurance programme

The space hardware supplier shall define the development and implementation of a EEE parts RHA programme addressing all applicable phases of the programme emphasizing the early development phase, such as system design radiation impact analysis, technical parts review, RHA test programme design, radiation evaluation testing, and RHA impact reporting.

The space hardware supplier shall document how the part types shall be reviewed to establish their sensitivity to all radiation effects, the manner in which these effects are determined, whether there is a necessity for system mitigation techniques, and, if so, how they will be implemented.

4.7 Parts derating

The space hardware supplier shall document a process for derating all EEE parts, for all factors that degrade performance in order that the parts are capable of meeting probability of mission success and mission life requirements. Furthermore, the space hardware supplier shall verify derating conformance by analysis or test (parts stress analysis) in accordance with ISO 14621-1.

4.8 Parts approval process

The space hardware supplier shall document the process for approval of each part before installation into space hardware and provide access to the part selection process, including risk assessment, before design acceptance sign-off, in accordance with the delegation level defined by the customer.

4.9 Parts procurement documents

The space hardware supplier shall describe the process for originating the necessary procurement specifications and using existing specifications, such as controlled specifications, drawings, CIDs, or standard manufacturer part numbers for the procurement of parts.

4.10 Parts screening

The space hardware supplier shall describe how all parts used in space hardware are to be screened to the extent appropriate for the space programme. The screening test requirements shall be designed so that accumulated stresses do not jeopardize parts reliability.

The relevant screening process shall be defined by the supplier and shall be available as input to the reliability programme.

4.11 Lot acceptance test (LAT)/quality conformance inspection (QCI)/technology conformance inspection (TCI)

Based on the available technical performance and parts manufacturer's test data, the procurement responsible shall apply the LAT/QCI/TCI rules defined by the space hardware supplier and, when necessary, shall select the appropriate level of LAT/QCI/TCI, in accordance with the space hardware supplier's requirements, to demonstrate that each lot is in accordance with the technical and quality assurance requirements of the space hardware. Detailed procedures shall be described in the individual part procurement specifications.

4.12 Radiation verification test (RVT)

When applicable, an RVT programme shall be implemented by the procurement responsible in accordance with procedures defined by the space hardware supplier to demonstrate that the flight parts meet or exceed the RHA requirements for the space programme (see 4.6).

4.13 Compliance with purchase order requirements

The space hardware supplier shall describe how the process performed by the procurement responsible ensures that the procured EEE parts comply with the purchase order requirements.

4.14 Destructive physical analysis (DPA)

The space hardware supplier shall document the conditions under which DPA is implemented. DPA shall be performed and completed sufficiently early to allow recovery without adverse impact to the programme schedule.

4.15 Parts manufacturer and service company surveillance

The space hardware supplier shall document the policy and procedures, applicable to the procurement responsible, for surveillance and validation of parts manufacturers and service companies to ensure compliance with procurement and quality assurance requirements, through the overall life cycle of the programme, in accordance with ISO 14621-1.

This policy may accept previous certifications to avoid duplication of effort.

4.16 Non-conformance control system

The space hardware supplier shall document the process for a closed-loop, non-conformance control system and MRB, established and implemented to manage any problem notification or alert to ensure that defective parts are not selected, procured for use, or installed in space hardware, in accordance with ISO 14300-2.

4.17 Traceability

The space hardware supplier shall document the process for establishing and maintaining parts traceability through the life cycle of the space hardware.

4.18 Risk management plan

The space hardware supplier shall implement, at his/her level, a risk management plan for EEE parts as specified in ISO 17666.

The space hardware supplier shall review all EEE parts to establish their criticality level and the relevant mitigation for each of them.

4.19 Handling and storage

The space hardware supplier shall identify required precautions in the handling and storage of EEE parts and shall document the establishment and implementation of procedures for handling and storage of parts through incoming inspection, kitting of parts, and space hardware assembly operations and testing.

Procedures shall include quarantine and disposition of any non-conforming parts (see 4.16).

4.20 Documentation

The space hardware supplier shall prepare, maintain, and deliver to the customer, parts documentation as specified by the customer.