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Space engineering - Testing

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 12/22

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 16603-10-03

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Supersedes EN 16603-10-03:2014

English version

Space engineering - Testing

Ingénierie spatiale - Vérification par essai

Raumfahrttechnik - Tests

This European Standard was approved by CEN on 29 May 2022.

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European Foreword

This document (EN 16603-10-03:2022) has been prepared by Technical Committee CEN/CLC/JTC 5 “Space”, the secretariat of which is held by DIN.

This standard (EN 16603-10-03:2022) originates from ECSS-E-ST-10-03C Rev.1.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2023, and conflicting national standards shall be withdrawn at the latest by April 2023.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 16603-10-03:2014.

The main changes with respect to EN 16603-10-03:2014 are listed below:

- Scope: Clarification on applicability perimeter, including not covering space vehicle constellation
- Thermal Tests:
  - o New and more clear definitions, (thermal vacuum test, thermal test at room pressure and thermal test at mission pressure, they are no more in the Glossary),
  - o Thermal Ambient Test not used and substituted by Thermal Test at mission pressure,
  - o Alternative methods are addressed as reference to the Handbook
  - o “thermal” word in thermal parameters (cycles, levels, gradient and so on) changed as “temperature”,
  - o Test for switch on capability at equipment level was updated to cover test at maximum and minimum temperature,
  - o New requirement on power status during thermal tests at equipment level and parameter monitoring.
- Test on solar arrays and panel:
  - o overall align of the Testing Standard with the new version of ECSS-E-ST-20-08,
  - o new requirements for solar array performance tests in addition to flasher test,
  - o additional requirement for after storage phase,
  - o functional tests requirements at equipment level during thermal tests for solar arrays are now expanded.
- Pressure test:
  - o Overall alignment with new version of ECSS-E-ST-32-02,

- o requirements on proof pressure test rephrased to enlarge the objective of the test.

- Input test Tolerance and measurement uncertainties:

  - o "tolerance" definition was substituted by "test input tolerance" whereas "accuracy of measurement" was deleted and substituted by "measurement uncertainty" to be in accordance with actual International Standards,

  - o some requirements rephrased to avoid confusion between "uncertainty" (quantitative evaluation) and "error" (quantitative, but unknown),

  - o Table 4-2 now addresses typical values for test centres and no more requirements.

- Sine burst test replaced Transient test at space segment equipment level, because rarely used, and it is merged with Transient at space segment element level.

- Microvibration and Audible noise:

  - o new requirements for microvibration in particular to cover signal measurement and background noise measurement and background noise mitigation actions,

  - o requirements on Audible noise were changed, and some deleted, at equipment level to account for the tight dependence on the mounting structure.

- Polarity test: new requirement for polarity test of non-critical modes.

This document has been prepared under a standardization request given to CEN by the European Commission and the European Free Trade Association.

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

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

Introduction

The requirements on the systems engineering process are gathered in ECSS-E-ST-10; while specific aspects are further elaborated in dedicated standards, in particular: ECSS-E-ST-10-06, ECSS-E-ST-10-02 and the present standard (ECSS-E-ST-10-03)

In the System Engineering branch (ECSS-E-10) this standard aims at a consistent application of on ground testing requirements to allow proper qualification and acceptance of space products

Experience has demonstrated that incomplete or improper on ground testing approach significantly increase project risks leading to late discovery of design or workmanship problem(s) or in-orbit failure(s).

Testing is part of the system engineering process as defined in ECSS-E-ST-10. This starts at the early phase of the mission when defining verification process in terms of the model philosophy and sequences of tests and ends at the last testing phase prior launch.

In the level of decomposition of a space system, this standard addresses the requirements for space segment element and space segment equipment.

The document is organised such that:

- clause 4 provides requirements for overall test programme, test management test conditions, test input tolerances and measurement uncertainties;
- clause 5 provides requirements for Space segment equipment;
- clause 6 provides requirements for Space segment element;
- clause 7 provides requirements for Pre-launch testing.

Clauses 5 and 6 are organised as follows:

- general requirements for the products under test applicable to all models (clause 5.1 or 6.1);
- requirements applicable to qualification model (clause 5.2 or 6.2);
- requirements applicable to acceptance model (clause 5.3 or 6.3);
- requirements applicable to protoflight model (clause 5.4 or 6.4);
- detailed implementation requirements (clause 5.5 or 6.5);

In the clause providing requirements for each model (i.e. clauses 5.2, 5.3, 5.4, 6.2, 6.3 and 6.4), the first table of the clause:

- lists all types of test and defines their applicability and conditions;
- links to the second table of the clause that defines tests level and duration;

- provides reference to the clause defining the detailed implementation requirements for the given test (clause 5.5 or 6.5).

For space segment equipment, the required sequence of tests, for each model, is defined by tailoring the two tables in clause 5.2, 5.3 or 5.4.

Since testing activities are part of the overall verification activities, test documentation to be produced (DRD's) are either specified in the ECSS-E-ST-10-02 (case of the test report) or in this document.

Annex D gives guidelines for performing the tailoring of this standard as well as the generation of the compliance and verification matrices.

1 Scope

This standard addresses the requirements for performing verification by testing of space segment elements and space segment equipment on ground prior to launch. The document is applicable for tests performed on qualification models, flight models (tested at acceptance level) and protoflight models.

The standard provides:

- Requirements for test programme and test management,
- Requirements for retesting,
- Requirements for redundancy testing,
- Requirements for environmental tests,
- General requirements for functional and performance tests,

  NOTE 1 Specific requirements for functional and performance tests are not part of this standard since they are defined in the specific project documentation.
- Requirements for qualification, acceptance, and protoflight testing including qualification, acceptance, and proto-fight models' test margins and duration,
- Requirements for test factors, test condition, test input tolerances, and measurement uncertainties,
- General requirements for development tests pertinent to the start of the qualification test programme,

  NOTE 2 Development tests are specific and are addressed in various engineering discipline standards.
- Content of the necessary documentation for testing activities (e.g. DRD).

Due to the specific aspects of the following types of test, this Standard does not address:

- Space system testing (i.e. testing above space segment element), in particular the system validation test,
- Testing peculiarities of space vehicles constellations,
- In-orbit testing,
- Testing of space segment subsystems,

  NOTE 3 Tests of space segment subsystems are often limited to functional tests that, in some case, are run on dedicated models. If relevant,

qualification tests for space segment subsystems are assumed to be covered in the relevant discipline standards.

- Testing of hardware below space segment equipment levels (including assembly, parts, and components),
- Testing of stand-alone software,

  NOTE 4 For verification of flight or ground software, ECSS-E-ST-40 and ECSS-Q-ST-80 apply.

- Testing of two-phase heat transport equipment,

  NOTE 5 For acceptance and qualification testing of two-phase heat transport equipment, ECSS-E-ST-31-02 applies.

- Tests of launcher segment, subsystem and equipment, and launch facilities,
- Tests of facilities and ground support equipment,
- Tests of ground segment.

This standard may be tailored for the specific characteristic and constrains of a space project in conformance with ECSS-S-ST-00. Annex D gives guidelines for performing this tailoring.

2
Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this ECSS Standard. For dated references, subsequent amendments to, or revision of any of these publications do not apply. However, parties to agreements based on this ECSS Standard are encouraged to investigate the possibility of applying the more recent editions of the normative documents indicated below. For undated references, the latest edition of the publication referred to applies.

EN reference	Reference in text	Title
EN 16601-00-01	ECSS-S-ST-00-01	ECSS system - Glossary of terms
EN 16603-10-02	ECSS-E-ST-10-02	Space engineering - Verification
EN 16603-20	ECSS-E-ST-20	Space engineering - Electrical and electronic
EN 16603-20-01	ECSS-E-ST-20-01	Space engineering - Multipactor design and test
EN 16603-20-06	ECSS-E-ST-20-06	Space engineering - Spacecraft charging
EN 16603-20-07	ECSS-E-ST-20-07	Space engineering - Electromagnetic compatibility
EN 16603-20-08	ECSS-E-ST-20-08	Space engineering - Photovoltaic assemblies and components
EN 16603-31	ECSS-E-ST-31	Space engineering - Thermal control general requirements
EN 16603-32	ECSS-E-ST-32	Space engineering - Structural general requirements
EN 16603-32-02	ECSS-E-ST-32-02	Space engineering - Structural design and verification of pressurized hardware
EN 16603-32-10	ECSS-E-ST-32-10	Space engineering - Structural factors of safety for spaceflight hardware
EN 16603-32-11	ECSS-E-ST-32-11	Space engineering - Modal survey assessment
EN 16603-33-01	ECSS-E-ST-33-01	Space engineering - Mechanisms
EN 16601-40	ECSS-M-ST-40	Space project management - Configuration and information management
EN 16602-10-09	ECSS-Q-ST-10-09	Space product assurance - Nonconformance control system
EN 16602-20-07	ECSS-Q-ST-20-07	Space product assurance - Quality assurance for test centres
EN 16602-40	ECSS-Q-ST-40	Space product assurance - Safety
EN 16602-70-01	ECSS-Q-ST-70-01	Space product assurance - Cleanliness and contamination control
	ISO 3740:2019	Acoustics - Determination of sound power levels of noise sources - Guidelines for the use of basic standards

koniec náhľadu – text ďalej pokračuje v platenej verzii STN