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Space engineering - Testing guidelines

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European Foreword

This document (CEN/CLC/TR 17603-10-03:2022) has been prepared by Technical Committee CEN/CLC/JTC 5 “Space”, the secretariat of which is held by DIN.

It is highlighted that this technical report does not contain any requirement but only collection of data or descriptions and guidelines about how to organize and perform the work in support of EN 16603-10-03.

This Technical report (TR 17603-10-03:2022) originates from ECSS-E-HB-10-03A.

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

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

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

Introduction

Testing is an important part of a Space Project, because of its impact on cost and because is the most effective way to demonstrate a product functionalities and performances.

As such, this Handbook is of outmost importance in defining how the requirements can be implemented into the verification approach and in providing "real life" experience and examples in order to have an effective application into the test execution.

In order to meet this objective, the WG have tried, in preparing this Handbook, to be as exhaustive as possible in providing methods and techniques, as well as examples, in a punctual one-to-one requirement versus guideline approach.

The WG also recognized that this approach, even if punctually exhaustive, provided in most cases an unstructured definition of the tests as a whole giving a leopard spots information which may not be useful in preparing and conducting a test.

As a consequence, the WG have decided to complement the main body of the Handbook with Annexes where a structured and comprehensive test organization has been defined and described.

In those cases, testing people can find how a test is prepared, applied and executed in terms, for example, of test setup, test configuration, used instrumentation and test facilities/equipment, test preparation suggestions, safety rules to be considered, data acquisition and reporting content, together with pictures, tables and sketches of real cases,

This approach has allowed, in particular for Mechanical, Microvibration and Integrity Tests as well as for Alignment and PIM tests, to have in one shot a complete and structured set of guidelines easing the implementation of the requirements of such tests.

It is to be underlined that some of this material comes from the ECSS-E-HB-32-26 "Spacecraft mechanical load analysis handbook", which contained a lot of information about mechanical testing.

It is worthy to pay attention that the Annexes of this Testing Guidelines do not correspond to the Annexes of the Testing Standard.

Moreover, this handbook only applies for the Revised version of the ECSS-E-ST-10-03 Standard (ECSS-E-ST-10-03C Rev.1, 31 May 2022).

1 Scope

This handbook provides additional information for the application of the testing standard ECSS-E-ST-10-03 to a space system product.

This handbook does not contain requirements and therefore cannot be made applicable. In case of conflict between the standard and this handbook, the standard prevails.

This handbook is relevant for both the customer and the supplier of the product during all project phases.

To facilitate the cross-reference, this handbook follows as much as practical, the structure of the standard even if, as written in the Introduction, some tests are described in the Annexes to allow a better comprehensive view.

Where test material is already covered in other ECSS handbook, this document refers to them instead of duplicating the information, this is the case of ECSS-E-HB-32-25 “Mechanical shock design and verification handbook” and the various parts of ECSS-E-HB-31-01 “Thermal design handbook”.

As the Standard applies to different products at different product levels of the space segment, the space segment equipment and the space segment elements. In the testing standard the requirements applicable to each level are addressed in different chapters clearly identified. The standard clearly states that it is not applicable to other segment (launch and ground) as well as software; as a consequence, no pre-tailoring matrix is needed.

Moreover, as per testing standard, this handbook does not contain guidelines for constellation programmes.

Testing aspects are derived from the verification approach covered in the ECSS-E-ST-10-02 and in its corresponding handbook ECSS-E-HB-10-02.

The application of the requirements of the standard to a particular project is intended to result in effective product verification and consequently to a high confidence in achieving successful product operations for the intended use, in this respect this handbook has the goal to help reaching these objectives.

2 References

EN Reference	Reference in text	Title
EN 16601-00-01	ECSS-S-ST-00-01	ECSS – Glossary of terms
EN 16603-10-02	ECSS-E-ST-10-02	Space engineering - Verification
EN 16603-10-03	ECSS-E-ST-10-03	Space engineering - Testing
EN 16603-31	ECSS-E-ST-31	Space engineering - Thermal control general requirements
EN 16603-31-02	ECSS-E-ST-31-02	Space engineering – Two-phase heat transport equipment
EN 16603-32-02	ECSS-E-ST-32-02	Space engineering – Structural design and verification of pressurized hardware
EN 16603-33-11	ECSS-E-ST-33-11	Space engineering - Explosive subsystems and devices
EN 16603-35-02	ECSS-E-ST-35-02	Space engineering - Solid propulsion for spacecrafts and launchers
EN 16603-ST-40	ECSS-E-ST-40	Space engineering - Software
TR 17603-10-02	ECSS-E-HB-10-02	Space engineering - Verification guidelines
TR 17603-20-01	ECSS-E-HB-20-01	Space engineering - Multipactor handbook
TR 17603-20-07	ECSS-E-HB-20-07	Space engineering - Electromagnetic compatibility handbook
TR 17603-31-01 to TR 17603-31-16	ECSS-E-HB-31-01 (all parts)	Space engineering – Thermal design handbook
TR 17603-32-25	ECSS-E-HB-32-25	Space engineering - Mechanical shock design and verification handbook
TR 17603-32-26	ECSS-E-HB-32-26	Space engineering - Spacecraft mechanical loads analysis handbook
EN 16602-10-09	ECSS-Q-ST-10-09	Space product assurance – Nonconformance control system
EN 16602-70-01	ECSS-Q-ST-70-01	Space product assurance – Cleanliness and contamination control
EN 16602-70-05	ECSS-Q-ST-70-05	Space product assurance – Non-destructive testing
EN 16602-80	ECSS-Q-ST-80	Space product assurance – Software product assurance
	NASA-STD-7012	Leak test requirement
	ATS paper_MATED Improvement (October 2018)	MATED (Model And Test Effectiveness Database) Improvement and Added Value on Industry

	MTF.AIDT.TN.2168, Issue 1, Rev.1 (3 March 2020)	Dynamited Final Report
	ECSSMET 2016 (article)	DYNAMIC TESTS, WHAT'S BEHIND THE CURVES ?
	MSG-NNT-SE-TN-0742 (28 October 1996)	Notching guidelines for mechanical test
	TASI-ASE-ORP-0006_Iss.01 (20 October 2014)	Analysis of Spacecraft qualification Sequence & Environmental Testing (ASSET)
	TASI-ASE-ORP-0009_01 (3 October 2016)	Analysis of Spacecraft qualification Sequence & Environmental Testing (ASSET+)