



**SLOVENSKI STANDARD**  
**SIST EN 16602-20-08:2016**

**01-november-2016**

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**Zagotavljanje varnih proizvodov v vesoljski tehniki - Skladiščenje, ravnanje in transport strojne opreme vesoljskih plovil**

Space product assurance - Storage, handling and transportation of spacecraft hardware

Raumfahrtproduktsicherung - Lagerung, Handhabung und Transport von Raumfahrzeug-Hardware

Assurance produit des projets spatiaux - Stockage, manipulation et transport du matériel d'un véhicule spatial

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## Space product assurance - Storage, handling and transportation of spacecraft hardware

Assurance produit des projets spatiaux - Stockage, manipulation et transport du matériel d'un véhicule spatial

Raumfahrtproduktsicherung - Lagerung, Handhabung und Transport von Raumfahrzeug-Hardware

This European Standard was approved by CEN on 22 May 2016.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN and CENELEC member.

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**CEN-CENELEC Management Centre:  
Avenue Marnix 17, B-1000 Brussels**

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## European Foreword

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This document (EN 16602-20-08:2016) has been prepared by Technical Committee CEN-CENELEC/TC 5 "Space", the secretariat of which is held by DIN.

This standard (EN 16602-20-08:2016) originates from ECSS-Q-ST-20-08C.

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of an identical text or by endorsement, at the latest by February 2017, and conflicting national standards shall be withdrawn at the latest by February 2017.

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 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, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

## Introduction

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This standard focuses on requirements for preservation of space segments and associated hardware.

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# 1 Scope

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The standard specifies requirements to ensure safe handling, storage, transportation of space segment hardware, including associated items to avoid degradation from integration up to launch.

The standard is applicable to: Space systems, Space segments, Assembled Spacecraft, Space segment elements, Spacecraft Modules, space segment subsystems, space segment equipment, partly manufactured space segment equipment. Intended programs are all space programs and target users all space hardware suppliers and customers.

The standard does not cover obsolescence management issues.

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

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NOTE This standard is applicable to GSE, when mentioned in the different clauses of this standard.

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## 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	ECSS-E-ST-10	Space engineering - System engineering general requirements
EN 16603-10-03	ECSS-E-ST-10-03	Space engineering - Testing
EN 16601-40	ECSS-M-ST-40	Space project management - Configuration and information management
EN 16601-80	ECSS-M-ST-80	Space project management - Risk management
EN 16602-10	ECSS-Q-ST-10	Space product assurance - Product assurance management
EN 16602-10-04	ECSS-Q-ST-10-04	Space product assurance - Critical item control
EN 16602-10-09	ECSS-Q-ST-10-09	Space product assurance - Nonconformance control system
EN 16602-20	ECSS-Q-ST-20	Space product assurance - Quality assurance
EN 16602-30-02	ECSS-Q-ST-30-02	Space product assurance - Failure modes effects (and criticality) analysis
EN 16602-40	ECSS-Q-ST-40	Space product assurance - Safety

## 3

## Terms, definitions and abbreviated terms

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### 3.1 Terms from other standards

- a. For the purpose of this standard, the terms and definitions from ECSS-ST-00-01 apply, in particular for the following terms:
1. cleanliness
  2. contamination
  3. space segment
  4. space segment subsystem
  5. space segment element
  6. cleanliness
  7. safety

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### 3.2 Terms specific to the present standard

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#### 3.2.1 handling

movement, lifting, tilting, rotation, on-site transports, of space hardware

NOTE On-site transport is a transport between buildings, without any use of public infrastructures.

#### 3.2.2 storage

non-operating phase between two phases of manufacturing, assembly and testing or launch campaign of a space hardware lifetime agreed between a customer and a supplier

#### 3.2.3 transport

movement of hardware between two places, using public infrastructure

### 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
ABCL	as built configuration list
AIT	assembly, integration and test
AR	acceptance review
BOM	bill of materials
CIL	critical items list
CTT	consent to transport
DRB	delivery review board
DRD	document requirements definition
EIDP	end item data package
ESD	electrostatic discharge
FMEA	failures modes and effect analysis
HW	hardware
ITT	invitation to tender
MGSE	mechanical ground support equipment
N/A	not applicable
NCR	nonconformance report
PSR	pre-storage review
QA	quality assurance
RFD	request for deviation
RFW	request for waiver
TOL	transport operations leader
TRR	test readiness review

### 3.4 Nomenclature

#### 3.4.1 Formal verbs

The following nomenclature apply throughout this document:

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

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

- The words “may” and “need not” are used in this document 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”.
- The word “can” is used in this document 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 a complete different meaning: “may” is normative (permission) and “can” is descriptive.

- The present and past tense are used in this document to express statement of fact, and therefore they imply descriptive text.

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## General requirements for storage, handling and transportation

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### 4.1 Project phasing

- a. The overall activities for handling, storage and transportation shall be planned as part of the normal engineering activities at each project phase in conformance with requirement 5.4.1.1b from ECSS-E-ST-10,
- b. Handling, storage and transportation documentation shall be phased with design documents and issued at various reviews.

NOTE Guidelines for deliverables per review list are provided in the Annex E.

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### 4.2 Design considerations

- a. In line with requirement 5.4.1.1b from ECSS-E-ST-10, the design shall not prevent to meet the handling, storage and transportation constraints, as specified in Design Definition File in conformance with DRD from Annex G of ECSS-E-ST-10.
- b. The flight hardware shall be designed for an lifetime extending from the equipment Delivery Review Board to satellite end of operation lifetime, including specified storage at any level from unit to space segment element level.
- c. The satellite design should provide the capability of performing periodic inspection, maintenance and local testing during AIT and on-ground storage without the need to remove equipment or activate the complete satellite.

NOTE Example of this maintenance is exercising of mechanisms to allow lubricant redistribution.

- d. Coherent with specific storage duration of minimum 6 months, the design shall ensure that there is no need for inspection, testing or maintenance during 6 months.
- e. The need for maintenance and refurbishment shall be derived from the design.

- f. The design of the flight object shall provide direct access to connectors, test ports and fixation points for AIT operation, handling or transportation.
- g. Test or stimulus points shall be accessible without the need to disconnect or deroute flight harness of an item of equipment.
- h. It shall be ensured that the environment seen by the flight hardware during transportation is not exceeding the acceptance level.
- i. The non-flight and protection hardware shall be designed and compatible of transportation constraints and requirements.

### 4.3 Nonconformance management

- a. Nonconformance procedure for handling, storage, and transportation activities shall be performed in compliance with requirements from clause 5 to clause 6 of ECSS-Q-ST-10-09.

### 4.4 Safety

- a. Safety conditions for transport, storage and handling shall be defined prior to transport, storage and handling and documented in the project product assurance plan in conformance with the DRDs of Annex A and D of the ECSS-Q-ST-10 and in the safety plan in conformance with the DRD in the Annex B of the ECSS-Q-ST-40.

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### 4.5 Environmental conditions

- a. The constraints for the environmental conditions, or the environmental conditions themselves shall be specified by the customer in the ITT.
- b. The supplier shall assess the applicable environmental conditions and provide this assessment to the customer, to allow the customer to confirm them at the SRR.
- c. The supplier shall record the environmental conditions into the Storage Plan in conformance with DRD from Annex A.

### 4.6 Packaging and protection material

- a. Material selected for packaging and protection shall:
  1. not contain risk of contamination degradation or loss of protection by itself,
  2. provide the expected protection w.r.t. to the environmental or technical specification of the item to be protected,
  3. ensure protection for ESD.