SLOVENSKI STANDARD
SIST EN 16603-35-02:2014

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Vesoljska tehnika - Trdna pogonska goriva za vesoljska plovila in lansirnike

Space engineering - Solid propulsion for spacecrafts and launchers

Raumfahrttechnik - Feststoffantriebe für Raumfahrzeuge und Trägerraketen

Ingénierie spatiale - Propulsion solide pour satellites et lanceurs

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49.140	Vesoljski sistemi in operacije	Space systems and operations

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English version

Space engineering - Solid propulsion for spacecrafts and launchers

Ingénierie spatiale - Propulsion solide pour satellites et lanceurs

Raumfahrttechnik - Feststoffantriebe für Raumfahrzeuge und Trägerraketen

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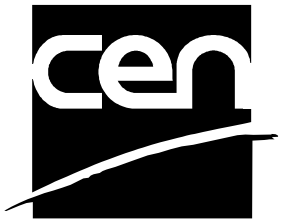

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Table of contents

Tables

Foreword

This document (EN 16603-35-02:2014) has been prepared by Technical Committee CEN/CLC/TC 5 “Space”, the secretariat of which is held by DIN.

This standard (EN 16603-35-02:2014) originates from ECSS-E-ST-35-02C.

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of an identical text or by endorsement, at the latest by March 2015, and conflicting national standards shall be withdrawn at the latest by March 2015.

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

The requirements in this Standard ECSS-E-ST-35-02C (and in the 3 other space propulsion standards ECSS-E-ST-35, ECSS-E-ST-35-01 and ECSS-E-ST-35-03) are organized with a typical structure as follows:

- functional;
- constraints;
- development;
- interfaces;
- design;
- GSE;
- materials;
- verification;
- production and manufacturing;
- in-service (operation and disposal);
- deliverables.

This standard forms parts of ECSS-E-ST-35 series which has the following structure;

- ECSS-E-ST-35 Propulsion general requirements
- ECSS-E-ST-35-01 Liquid and electric propulsion for spacecraft
- ECSS-E-ST-35-02 Solid propulsion for spacecraft and launchers
- ECSS-E-ST-35-03 Liquid propulsion for launchers
- ECSS-E-ST-35-06 Cleanliness requirements for spacecrafts propulsion hardware
- ECSS-E-ST-35-10 Compatibility testing for liquid propulsion components, subsystems, and systems

ECSS-E-ST-35 contains all the normative references, terms, definitions, abbreviated terms, symbols and DRD that are applicable for ECSS-E-ST-35, ECSS-E-ST-35-01, ECSS-E-ST-35-02 and ECSS-E-ST-35-03.

1
Scope

General requirements applying to all type of Propulsion Systems Engineering are defined in ECSS-E-ST-35. For solid propulsion activities within a space project the standards ECSS-E-ST-35 and ECSS-E-ST-35-02 are applied together.

This Standard defines the regulatory aspects that apply to the elements and processes of solid propulsion for launch vehicles and spacecraft. It specifies the activities to be performed in the engineering of these propulsion systems and their applicability. It defines the requirements for the engineering aspects such as functional, physical, environmental, quality factors, operational, and verification.

NOTE 1 Some solid propulsion systems use hot gas valves, for thrust or pressure modulation. The requirements applicable to these systems are not covered by the present document.

NOTE 2 For SRM with TVC, only moveable nozzle with flexseal are addressed.

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

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 16603-20	ECSS-E-ST-20	Space engineering - Electrical and electronic
EN 16603-20-07	ECSS-E-ST-20-07	Space engineering - Electromagnetic compatibility
EN 16603-32	ECSS-E-ST-32	Space engineering - Structural general requirements
EN 16603-32-08	ECSS-E-ST-32-08	Space engineering - Materials
EN 16603-32-10	ECSS-E-ST-32-10	Space engineering - Structural factors of safety for spaceflight hardware
EN 16603-33-11	ECSS-E-ST-33-11	Space engineering - Explosive systems and devices
EN 16603-35	ECSS-E-ST-35	Space engineering - Propulsion general requirements
EN 16602-20	ECSS-Q-ST-20	Space product assurance – Quality assurance
EN 16602-40	ECSS-Q-ST-40	Space product assurance - Safety
EN 16602-70	ECSS-Q-ST-70	Space product assurance - Materials, mechanical parts and processes

3
Terms, definition and abbreviated terms

3.1 Terms from other standards

For the purpose of this Standard, the terms and definitions from ECSS-S-ST-00-01, ECSS-E-ST-35, ECSS-E-ST-32, and ECSS-E-ST-32-10 apply, in particular for the following terms:

ECSS-E-ST-32

maximum design pressure (MDP)

maximum expected operating pressure (MEOP)

test factors (KA and KQ)

ECSS-E-ST-35

ablated thickness (ea)

burning time

charred thickness (ec)

corridor

hump effect

ignition time (t_{ign})

insulation thickness (ei)

non affected thickness(es)

pre-heating time

solid rocket motor

thrust centroid time

3.2 Abbreviated terms

For the purpose of this Standard, the abbreviated terms from ECSS-S-ST-00-01 and the following apply:

Abbreviation	Meaning
AIV	assembly, integration and verification
COG	centre of gravity
COM	centre of mass
DLAT	destructive lot acceptance test
EMC	electromagnetic compatibility
EMI	electromagnetic interference
ESD	electrostatic discharge
GSE	ground support equipment
HCl	chloride acid
MCI	mass, centre of mass, inertia
MDP	maximum design pressure
MEOP	maximum expected operating pressure
NDI	non-destructive inspection
OBDH	on-board data handling
SRM	solid rocket motor
TBPM	to be provided by manufacturer
TBPU	to be provided by user
TM/TC	telemetry/telecommand
TVC	thrust vector control

4
Solid propulsion engineering activities

4.1 Overview

A solid propulsion system comprises the following main subsystems:

- The gas generating system consisting of a solid propellant contained in a thermally protected case.
- A nozzle with or without TVC.
- An ignition system to ignite the solid propellant.

This document applies to large and small systems; the latter usually have some different requirements to the large systems.

Solid propulsion systems can either deliver a velocity increment in a fixed direction (with respect to the launcher or spacecraft) or in a variable direction, depending on whether TVC is present or not. Most solid propulsion systems use a single nozzle and roll control is usually provided by a separate system. Solid propulsion systems are "one-shot" systems and do not need a lot of preparation before use. Because a solid propellant motor is a 'one shot' item, an acceptance firing test cannot be performed with the actual flight motor.

4.2 Functional

4.2.1 Mission

a. ECSS-E-ST-35 clause 4.2 'mission' shall apply.

4.2.2 Functions

4.2.2.1 Steady state

a. The propulsion system shall:

1. conform to the interfaces (see "interfaces" clause 4.4),
2. provide the specified total impulse, a thrust profile (nominal and dispersion) versus time.