Irish Standard
I.S. EN 16603-20-06:2020&LC:2020

Space engineering - Spacecraft charging

I.S. EN 16603-20-06:2020&LC:2020

Incorporating amendments/corrigenda/National Annexes issued since publication:

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This document is based on: *Published:*

This document was published under the authority of the NSAI and comes into effect on:

2020-11-18

ICS number:

49.140

NOTE: If blank see CEN/CENELEC cover page

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National Foreword

I.S. EN 16603-20-06:2020&LC:2020 is the adopted Irish version of the European Document EN 16603-20-06:2020, Space engineering - Spacecraft charging

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Correction Notice

Reference: EN 16603-20-06:2020

Title: Space engineering - Spacecraft charging

Work Item: JT005159

Brussels, 2020-10-14

Please include the following minor editorial correction(s) in the document related to:

the following language version(s) :
- ☒ English
- ☐ French
- ☐ German

for the following procedure :
- ☐ PQ/UQ
- ☐ Enquiry
- ☐ 2nd Enquiry
- ☐ Parallel Enquiry
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- ☐ 2nd Parallel Formal Vote
- ☐ UAP
- ☐ TC Approval
- ☐ 2nd TC Approval
- ☒ Publication
- ☐ Parallel Publication

It has been brought to our attention that this document, issued on 2020-09-09, requires modification.

Superseding information was incorrect in the Foreword: it was twice referred to the 2004 version, instead of 2014.

Foreword has been updated accordingly for English version.

We apologise for any inconvenience this may cause.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 16603-20-06

September 2020

ICS 49.140

Supersedes EN 16603-20-06:2014

English version

Space engineering - Spacecraft charging

Ingéniérie spatiale - Charges électrostatiques des engins spatiaux

Raumfahrttechnik - Aufladung von Raumfahrzeugen

This European Standard was approved by CEN on 3 May 2020.

This European Standard was corrected and reissued by the CEN-CENELEC Management Centre on 14 October 2020.

CEN-CENELEC Management Centre:
Rue de la Science 23, B-1040 Brussels

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European foreword

This document (EN 16603-20-06:2020) has been prepared by Technical Committee CEN-CENELEC/TC 5 “Space”, the secretariat of which is held by DIN.

This document (EN 16603-20-06:2020) originates from ECSS-E-ST-20-06C 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 March 2021, and conflicting national standards shall be withdrawn at the latest by March 2021.

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 16603-20-06:2014.

The main changes with respect to 16603-20-06:2014 are listed below:

- Addition of definition for the term "flashover current"
- Addition of abbreviated terms "RIC" and "SPIS"
- Addition of the “Nomenclature” in clause 3.4
- Addition of informative text in 6.1.3 about neutralizers after deletion of requirement 6.7e
- Changes to maximum permitted voltages and acceptance of higher voltages if the effect of worst-case ESD would be acceptable
- Simplification of the grounding requirements for surface materials
- Change in the permitted ESD energy where surface ESD cannot be excluded
- Change to explicitly allow surface charging analysis to justify acceptance
- For surface charging analysis , removal of acceptance by similarity and statement of the need for material testing
- For internal charging, completely embedded floating metals may be accepted under specified conditions

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, Turkey and the United Kingdom..

Introduction

The subject of spacecraft plasma interactions has been part of the spacecraft design process since spacecraft surface charging was first encountered as a problem in the earliest geostationary spacecraft. However, spacecraft surface charging is only one of the ways in which the space environment can adversely affect the electrical state of spacecraft and satellite technology has evolved over the years.

A need was identified for a standard that is up to date and comprehensive in its treatment of all the main environment-induced plasma and charging processes that can affect the performance of satellites in geostationary and medium and low Earth orbits. This standard is intended to be used by a number of users, with their own design rules, and therefore it has been done to be compatible with different alternative approaches.

This document aims to satisfy these needs and provides a consistent standard that can be used in design specifications. The requirements are based on the best current understanding of the processes involved and are not radical, building on existing de-facto standards in many cases.

As well as providing requirements, it aims to provide a straightforward brief explanation of the main effects so that interested parties at all stages of the design chain can have a common understanding of the problems faced and the meaning of the terms used. Guide for tailoring of the provisions for specific mission types are described in Annex B. Further description of the main processes are given in Annex C. Some techniques of simulation, testing and measurement are described in Annex D and Annex E.

Electrical interactions between the space environment and a spacecraft can arise from a number of external sources including the ambient plasma, radiation, electrical and magnetic fields and sunlight. The nature of these interactions and the environment itself can be modified by emissions from the spacecraft itself, e.g. electric propulsion, plasma contactors, secondary emission and photoemission. The consequences, in terms of hazards to spacecraft systems depend strongly on the sensitivity of electronic systems and the potential for coupling between sources of electrical transients and fields and electronic components.

Proper assessment of the effects of these processes is part of the system engineering process as defined in ECSS-E-ST-20. General assessments are performed in the early phases of a mission when consideration is given to e.g. orbit selection, mass budget, thermal protection, and materials and component selection policy. Further into the design of a spacecraft, careful consideration is given to material selection, coatings, radiation shielding and electronics protection.

This standard begins with an overview of the electrical effects occurring in space (Clause 4). The requirements, in terms of spacecraft testing, analysis and design that arise from these processes (Clause 5 to Clause 11) form the core of this document. Annex B holds a discussion of types of orbits and how to tailor the requirements according to the mission. Annex C discusses the quantitative assessment of the physical processes behind these main effects. Annex D describes computer simulations and Annex E describes testing and measurement.

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Scope

This standard is a standard within the ECSS hierarchy. It forms part of the electrical and electronic engineering discipline (ECSS-E-ST-20) of the engineering branch of the ECSS system (ECSS-E). It provides clear and consistent provisions to the application of measures to assess, in order to avoid and minimize hazardous effects arising from spacecraft charging and other environmental effects on a spacecraft's electrical behaviour.

This standard is applicable to any type of spacecraft including launchers, when above the atmosphere.

Although spacecraft systems are clearly subject to electrical interactions while still on Earth (e.g. lightning and static electricity from handling), these aspects are not covered, since they are common to terrestrial systems and covered elsewhere. Instead this standard covers electrical effects occurring in space (i.e. from the ionosphere upwards).

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