



SLOVENSKI STANDARD
oSIST prEN 16604-10:2023
01-julij-2023

Vesoljska vzdržljivost - Zahteve za zmanjšanje količine vesoljskih odpadkov (ISO 24113:2019, spremenjen)

Space sustainability - Space debris mitigation requirements (ISO 24113:2019, modified)

Raumfahrtssysteme - Anforderungen zur Eindämmung des Weltraummülls (ISO 24113:2019, modifiziert))

Durabilité des activités spatiales - Exigences relatives à la réduction des débris spatiaux (ISO 24113:2019, modifiée)

<https://standards.iteh.ai/catalog/standards/sist/2722abcd-1819-44b5-948a-101610161016/sist-pr-en-16604-10-2023>

Ta slovenski standard je istoveten z: prEN 16604-10

ICS:

13.030.99	Drugi standardi v zvezi z odpadki	Other standards related to wastes
49.140	Vesoljski sistemi in operacije	Space systems and operations

oSIST prEN 16604-10:2023

en,fr,de

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

DRAFT
prEN 16604-10

May 2023

ICS 49.140

Will supersede EN 16604-10:2009

English version

Space sustainability - Space debris mitigation requirements (ISO 24113:2019, modified)

Développement durable de l'espace - Exigences
relatives à la réduction des débris spatiaux (derivé de
l'ISO 24113:2019)

Nachhaltigkeit im Weltraum - Space debris mitigation
requirements (modified ISO 24113:2019)

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/CLC/JTC 5.

If this draft becomes a European Standard, 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.

This draft European Standard was established by CEN and CENELEC in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN and CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN and CENELEC members are the national standards bodies and national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and United Kingdom.

Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation. Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Warning : This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.



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

Contents	Page
European foreword	3
Introduction	5
1 Scope.....	7
2 Normative references.....	7
3 Terms and definitions	7
4 Symbols and abbreviated terms.....	11
4.1 Symbols	11
4.2 Abbreviated terms.....	11
5 Protected regions.....	12
5.1 General.....	12
5.2 LEO protected region.....	12
5.3 GEO protected region	12
6 Technical requirements	13
6.1 Avoiding the intentional release of space debris into Earth orbit during normal operations	13
6.1.1 General.....	13
6.1.2 Space debris from pyrotechnics and solid rocket motors	13
6.2 Avoiding break-ups in Earth orbit.....	13
6.2.1 Intentional break-up	13
6.2.2 Accidental break-up caused by an on-board source of energy	13
6.2.3 Accidental break-up caused by a collision.....	14
6.3 Disposal of a spacecraft or launch vehicle orbital stage after the end of mission so as to minimize interference with the protected regions	14
6.3.1 Provisions for successful disposal	14
6.3.2 Disposal to minimize interference with the GEO protected region.....	15
6.3.3 Disposal to minimize interference with the LEO protected region	15
6.3.4 Re-entry.....	16
7 Planning requirements.....	16
7.1 General.....	16
7.2 Space debris mitigation plan	16
Annex A (informative) Post-launch life cycle phases of a launch vehicle or spacecraft.....	18
Bibliography	20

European foreword

This document (prEN 16604-10:2023) has been prepared by Technical Committee CEN/CLC/JTC 5 “Space”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 16604-10:2019.

The main changes with respect to EN 16604-10:2019 are:

Adoption of ISO 24113, Space systems — Space debris mitigation requirements, Third edition 2019-07 (referred to as ISO 24113:2019) with following additional changes from ECSS:

- Addition of “Context information” w.r.t. ECSS
- Update of “Scope” with ECSS related information
- Update of Note to definition 3.8 “Earth orbit” and definition 3.20 “probability of successful disposal”
- Addition of Note 1 to requirement 7.2.2

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

Context information

This document outlines the clauses and the requirements of the standard ISO 24113, Space systems — Space debris mitigation requirements, Third edition 2019-07 (referred to as ISO 24113:2019) with modifications, additions, notes and clarifications implemented for application in ECSS.

The standard ISO 24113, Space systems — Space debris mitigation requirements has been developed by ISO TC20/SC14. The key space debris mitigation requirements have been thoroughly discussed at international level, agreed by the ISO members and published as standard ISO 24113.

Aiming at the development of world wide implementation standards dealing with space debris mitigation, ECSS has proactively contributed to the preparation of ISO 24113.

ECSS decided to adopt and apply ISO 24133 with a minimum set of modifications, identified in the present document, to account for the reference and applicable space debris mitigation documents existing in Europe and of the needs of the ECSS members.

In 2012, ECSS adopted ISO 24113:2011 with a minimum set of modifications (as per ECSS-U-AS-10C), which have been mostly incorporated in ISO 24113:2019. Moreover, ISO 24113:2019 represents a significant improvement with respect to the previous ISO 24113:2011. Therefore, ECSS decided to adopt and apply ISO 24113:2019 as it is, without any modifications of the requirements. However, in the present document a few clarifications with respect to ISO 24113:2019 and its application are provided to account for the needs of the ECSS members.

prEN 16604-10:2023 (E)

A major clarification addressed in the present document is to stress that space debris mitigation requirements apply to space objects in any bounded Earth orbit and apply also to space objects in unbounded Earth orbits in case there is a risk for interference with the LEO and GEO protected regions. Moreover, the present document provides clarifications about the evaluation of the probability of successful disposal based on reliability analyses and about verification methods to be agreed with the approving agents, accounting for existing ECSS implementation practices.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[oSIST prEN 16604-10:2023](https://standards.iteh.ai/catalog/standards/sist/2722abcd-1819-44b5-948a-bb46bc66ab92/osist-pren-16604-10-2023)

<https://standards.iteh.ai/catalog/standards/sist/2722abcd-1819-44b5-948a-bb46bc66ab92/osist-pren-16604-10-2023>

Introduction

Space debris comprises all objects of human origin in Earth orbit or re-entering the atmosphere, including fragments and elements thereof, that no longer serve a useful purpose. The growing population of these objects poses an increasing hazard to mankind's use of space. In response to this problem, there is international consensus that space activities need to be managed to minimize collision risks among space objects and casualty risks associated with atmospheric re-entry. This consensus is embodied in space debris mitigation guidelines published by organizations such as the International Telecommunication Union (ITU) [1], the Inter-Agency Space Debris Coordination Committee (IADC) [2][3] and the United Nations (UN) [4]. The transformation of debris mitigation guidelines into engineering practice is a key purpose of this document.

The importance of this document can be seen within the context of four UN treaties [5] that were established under the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) to govern the involvement of nations in space activities. These are the *Outer Space Treaty*, the *Liability Convention*, the *Registration Convention* and the *Rescue Agreement*. Through some of these treaties, a Launching State has total liability for damage caused by its spacecraft or launch vehicle orbital stages (or any parts thereof) on the surface of the Earth or to aircraft in flight, as well as in outer space where fault can be proven.

All countries are encouraged to abide by these international agreements in order not to endanger or constrain existing and future activities in space. A Launching State can choose to appoint licensing or regulatory authorities to administer its approach for complying with the above-mentioned UN treaties. In several Launching States, these authorities have implemented national legislation to enforce the UN treaties. Such legislation can include the mitigation of space debris. Some Launching States meet their obligations by appointing non-regulatory government bodies, such as national space agencies, to provide the necessary guidelines or requirements, including those for space debris mitigation.

The general aim of space debris mitigation is to reduce the growth of space debris by ensuring that spacecraft and launch vehicle orbital stages are designed, operated and disposed of in a manner that prevents them from generating debris throughout their orbit lifetime. Another aim of space debris mitigation is to ensure that space objects re-entering the Earth's atmosphere cause no harm. These aims are achieved by the following actions:

- a) avoiding the intentional release of space debris into Earth orbit during normal operations;
- b) avoiding break-ups in Earth orbit;
- c) removing spacecraft and launch vehicle orbital stages from protected orbital regions after the end of mission;
- d) performing the necessary actions to minimize the risk of collision with other space objects;
- e) reducing the risks associated with re-entry, e.g. to people, property and the Earth's environment.

Such actions are especially important for a spacecraft or launch vehicle orbital stage that has one or more of the following characteristics:

- has a large collision cross-section;
- remains in orbit for many years;
- operates near manned mission orbital regions;
- operates in highly utilized regions, such as protected regions;

prEN 16604-10:2023 (E)

— operates in regions of high debris population.

This document transforms these objectives into a set of high-level debris mitigation requirements. Methods and processes to enable conformance with these requirements are provided in a series of lower-level implementation standards.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[oSIST prEN 16604-10:2023](https://standards.iteh.ai/catalog/standards/sist/2722abcd-1819-44b5-948a-bb46bc66ab92/osist-pren-16604-10-2023)

<https://standards.iteh.ai/catalog/standards/sist/2722abcd-1819-44b5-948a-bb46bc66ab92/osist-pren-16604-10-2023>

1 Scope

This document defines the primary space debris mitigation requirements applicable to all elements of unmanned systems launched into, or passing through, near-Earth space, including launch vehicle orbital stages, operating spacecraft and any objects released as part of normal operations.

The requirements contained in this document are intended to reduce the growth of space debris by ensuring that spacecraft and launch vehicle orbital stages are designed, operated and disposed of in a manner that prevents them from generating debris throughout their orbit lifetime. The requirements are also intended to reduce the casualty risk on ground associated with atmospheric re-entry of space objects.

This document is the top-level standard in a family of standards addressing space debris mitigation. It is the main interface for the user, bridging between the primary space debris mitigation objectives and a set of lower level standards and technical reports that support conformance. The lower level documents contain detailed requirements and implementation measures associated with the high-level requirements in this document.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1

approving agent

entity from whom approval is sought for the implementation of *space debris* (3.23) mitigation requirements with respect to the procurement of a *spacecraft* (3.25), or its launch, or its operations in outer space, or its safe *re-entry* (3.22), or a combination of those activities

EXAMPLE Regulatory or licensing authorities; national or international space agencies; other delegated organizations.

3.2

break-up

event that completely or partially destroys an object and generates *space debris* (3.23)

3.3

casualty risk

expected number of casualties

situation expressed by the probability that at least one person is killed or seriously injured as a consequence of an event

Note 1 to entry: The medical profession has defined a number of different injury scoring systems to distinguish the severity of an injury. Broadly, a serious injury is one of such severity that hospitalization is required.

Note 2 to entry: The *re-entry* (3.22) of a *spacecraft* (3.25) is an example of an event.

prEN 16604-10:2023 (E)**3.4****controlled re-entry**

type of *re-entry* (3.22) where the time of re-entry is sufficiently controlled so that the impact of any surviving debris on the surface of the Earth is confined to a designated area

Note 1 to entry: The designated area is usually an uninhabited region such as an ocean.

3.5**disposal**

actions performed by a *spacecraft* (3.25) or *launch vehicle orbital stage* (3.13) to permanently reduce its chance of accidental *break-up* (3.2) and to achieve its required long-term clearance of the *protected regions* (3.21)

Note 1 to entry: Actions can include removing stored energy and performing post-mission orbital manoeuvres.

3.6**disposal manoeuvre**

action of moving a *spacecraft* (3.25) or *launch vehicle orbital stage* (3.13) to a different orbit as part of its *disposal* (3.5)

3.7**disposal phase**

interval during which a *spacecraft* (3.25) or *launch vehicle orbital stage* (3.13) performs its *disposal* (3.5)

3.8**Earth orbit**

bounded or unbounded Keplerian orbit with Earth at a focal point, or Lagrange point orbit which includes Earth as one of the two main bodies

Note 1 to entry: The requirements in this document do not apply to *space objects* (3.24) in an unbounded Earth orbit if, for at least 100 years after the space objects enter the unbounded Earth orbit:

- the assessed risk of the space objects interference with the *LEO* and *GEO* (3.11) *protected regions* (3.21), or
- the assessed risk of the space objects *re-entry* (3.22)

is less or equal to the corresponding threshold set by the approving agent.

3.9**end of life**

instant when a *spacecraft* (3.25) or *launch vehicle orbital stage* (3.13):

- a) is permanently turned off (nominally as it completes its *disposal phase* (3.7)),
- b) re-enters the Earth's atmosphere, or
- c) can no longer be controlled by the operator

Note 1 to entry: See Annex A.

3.10**end of mission**

instant when a *spacecraft* (3.25) or *launch vehicle orbital stage* (3.13):

- a) completes the tasks or functions for which it has been designed, other than its *disposal* (3.5),
- b) becomes non-functional as a consequence of a failure, or
- c) is permanently halted through a voluntary decision

Note 1 to entry: See Annex A.

3.11**geostationary Earth orbit****GEO**

Earth orbit (3.8) having zero inclination, zero eccentricity, and an orbital period equal to the Earth's sidereal rotation period

3.12**launch vehicle****(deprecated: launcher)**

system designed to transport one or more payloads into outer space

3.13**launch vehicle orbital stage**

complete element of a *launch vehicle* (3.12) that is designed to deliver a defined thrust during a dedicated phase of the launch vehicle's operation and achieve orbit

Note 1 to entry: Non-propulsive elements of a launch vehicle, such as jettisonable tanks, multiple payload structures or dispensers, are considered to be part of a launch vehicle orbital stage while they are attached.

3.14**launching state**

state that launches or procures the launching of a *spacecraft* (3.25), or state from whose territory or facility a spacecraft is launched

Note 1 to entry: This definition is consistent with the definition in the UN Liability Convention [5] and the UN General Assembly's Resolution 59/115 on the notion of the Launching State [6].

3.15**mission**

set of tasks or functions to be accomplished by a *spacecraft* (3.25) or *launch vehicle orbital stage* (3.13), other than its *disposal* (3.5)

3.16**mission lifetime extension**

postponement of the previously defined *end of mission* (3.10)

3.17**normal operations**

execution of the planned tasks or functions for which a *spacecraft* (3.25) or *launch vehicle orbital stage* (3.13) was designed

Note 1 to entry: Normal operations include the *disposal phase* (3.7).