SLOVENSKI STANDARD
SIST EN 16602-70-54:2019

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Zagotavljanje kakovosti proizvodov v vesoljski tehniki - Ultra čiščenje letalske strojne opreme

Space product assurance - Ultracleaning of flight hardware

Raumfahrtproduktsicherung - Ultra-Reinigung von Flug-Hardware

Assurance produit des projets spatiaux - Ultra nettoyage des matériels de vol

Ta slovenski standard je istoveten z: **EN 16602-70-54:2019**

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49.140	Vesoljski sistemi in operacije	Space systems and operations

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English version

Space product assurance - Ultracleaning of flight hardware

Assurance produit des projets spatiaux - Ultranettoyage des matériels de vol

Raumfahrtproduktsicherung - Ultra-Reinigung von Flug-Hardware

This European Standard was approved by CEN on 9 November 2018.

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European Foreword

This document (EN16602-70-54:2019) has been prepared by Technical Committee CEN-CENELEC/TC 5 “Space”, the secretariat of which is held by DIN.

This standard (EN16602-70-54:2019) originates from ECSS-Q-ST-70-54C.

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of an identical text or by endorsement, at the latest by September 2019, and conflicting national standards shall be withdrawn at the latest by September 2019.

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 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

This ECSS Standard describes the procedures to be used to clean to a level of cleanliness beyond the scope of the ECSS-Q-ST-70-01, and to control the cleanliness level of flight hardware prior to and following a posteriori to the application of the ultracleaning process. The intended objective of the ultracleaning process is to remove all surface contamination (particulates, biologic material cell debris and chemical molecular contamination) on flight hardware, with no specific limit in geometric dimension or contamination levels. This includes removal of biological material for avoidance of false positive results during investigation of extra-terrestrial samples or environments.

1
Scope

This standard addresses process descriptions, process validation, cleanliness control and monitoring, recontamination prevention, quality assurance as follows:

PROCESSES DESCRIPTIONS, including

- Detergent cleaning
- Alcohol cleaning
- Ultrapure water cleaning
- Liquid boundary layer disruption cleaning
- Multiple solvent cleaning (JPL procedure)
- Vacuum bakeout
- Supercritical fluids cleaning
- Carbon dioxide snow cleaning
- Plasma cleaning
- Pyrolysis
- Criteria for selecting other/novel processes

PROCESS VALIDATION

- Test material selection
- Preparation of test materials for process application
- Deposition of contaminants
- Description of test conditions
- Verification of cleanliness level

CLEANLINESS CONTROL AND MONITORING, including

- Micro/nano imaging techniques
- Spectrometry techniques
- Spectroscopy techniques
- Chromatography techniques

RECONTAMINATION PREVENTION

- Packaging systems
- Protective covers
- Storage

QUALITY ASSURANCE

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 16602-10-09	ECSS-Q-ST-10-09	Space product assurance - Nonconformance control system
EN 16602-20-08	ECSS-Q-ST-20-08	Space product assurance - Storage, handling and transportation of spacecraft hardware
EN 16602-70	ECSS-Q-ST-70	Space product assurance - Materials, mechanical parts and processes
EN 16602-70-01	ECSS-Q-ST-70-01	Space product assurance - Cleanliness and contamination control
	ISO 14644-9: 2012	Cleanrooms and associated controlled environments - Part 9: Classification of surface cleanliness by particle concentration
	ISO 14644-10: 2013	Cleanrooms and associated controlled environments - Part 10: Classification of surface cleanliness by chemical concentration

3
Terms, definitions and abbreviated terms

3.1 Terms from other standards

a. For the purpose of this Standard, the terms and definitions from ECSS-S-ST-00-01 apply, in particular for the following terms:

1. cleanliness
2. qualification
3. test
4. validation
5. verification

b. For the purpose of this Standard, the terms and definitions from ECSS-Q-ST-70-01 apply, in particular for the following terms:

1. cleanroom
2. off-gassing

3.2 Terms specific to the present standard

3.2.1 bioaerosol

dispersed biological agents in a gaseous environment

[ISO 14698-1:2003]

3.2.2 biological contamination

contamination of materials, devices, individuals, surfaces, liquids, gases or air with viable particles.

NOTE 1 Depending on the context, biological contamination can be considered as organic or as particulate contamination. A bacterial cell has about 1E-13 g (organic content of one cell is below the detection limit of most chemical methods).

NOTE 2 Problem is that, apart from growing, cells and spores often have

extracellular material that can be more mass than the cell itself.

3.2.3 cleanliness (of a solid surface)

condition of a solid surface where the amount of contamination is controlled to a specific level

NOTE Example of amount of contamination include particle, chemical molecular or viable

3.2.4 contaminant

any particulate, chemical molecular, non-particulate and biological entity that can adversely affect the product or process

3.2.5 decontamination

reduction of unwanted matter to a defined level

3.2.6 direct measurement method (DMM)

measurement method where the contamination that is to be determined is being assessed without any intermediate steps

[adapted from ISO 14644-9:2012]

3.2.7 indirect measurement method (IMM)

measurement method where the contamination that is to be determined is being assessed with intermediate steps

[adapted from ISO 14644-9:2012]

3.2.8 surface cleanliness of chemicals (SCC)

presence on the surface of a product or instrument of molecular, chemical, non-particulate, species in the adsorbed or deposited state which can have a deleterious effect on the product, process or equipment in the cleanroom or controlled environment

[adapted from ISO 14644-10:2013]

3.2.9 surface cleanliness of particles (SCP)

class of surface particle cleanliness is a grading number stating the maximum allowable surface concentration, in particles per m^2, for a considered size of particles, SPC Classes 1 to 8

[adapted from ISO 14644-9:2012]

3.2.10 surface cleanliness particles (SCP) classification

level (or the process of specifying or determining the level) that represents maximum allowable surface concentrations, in particles per square metre, for considered sizes of particles, expressed in terms of an ISO SCP Class N

[ISO 14644-9:2012]

3.2.11 surface particle concentration

number of individual particles per unit of surface area under consideration

[ISO 14644-9:2012]

3.2.12 thin film contamination

layers of critical contaminants that range from the nanometre scale to the micrometre scale

3.2.13 viable particle

particle that consists of, or supports, one or more live microorganisms

3.2.14 cleaning efficacy

removal of specific contaminants from a surface by a cleaning process, determined by the final accomplished surface cleanliness, in respect to the initial surface cleanliness

NOTE 1 Cleaning efficacy can be expressed in absolute (surface concentration) or relative (percentage) terms.

NOTE 2 In general, repetitive application of the same cleaning process results in consecutive decreasing efficacy.

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
DRD	document requirements definition
ppm	parts per million (10^{-6})

3.4 Nomenclature

The following nomenclature applies throughout this document:

a. The word “shall” is used in this Standard to express requirements. All the requirements are expressed with the word “shall”.

b. The word “should” is used in this Standard to express recommendations. All the recommendations are expressed with the word “should”.

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

c. The words “may” and “need not” are used in this Standard to express positive and negative permissions, respectively. All the positive