



# SLOVENSKI STANDARD

## SIST EN 16602-70-21:2015

01-januar-2015

Nadomešča:  
SIST EN 14090:2004

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### Zagotavljanje varnih proizvodov v vesoljski tehniki - Preskušanje vnetljivosti za izbiro vesoljskih materialov

Space product assurance - Flammability testing for the screening of space materials

Raumfahrtproduktsicherung - Brennverhaltenstest für die Auswahl von Raumfahrtmaterialien

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Assurance produit des projets spatiaux - Essai de flammabilité pour la sélection des matériaux d'un projet spatial

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**Ta slovenski standard je istoveten z: EN 16602-70-21:2014**

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#### **ICS:**

13.220.40	Sposobnost vžiga in obnašanje materialov in proizvodov pri gorenju	Ignitability and burning behaviour of materials and products
49.025.01	Materiali za letalsko in vesoljsko gradnjo na splošno	Materials for aerospace construction in general
49.140	Vesoljski sistemi in operacije	Space systems and operations

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EUROPEAN STANDARD

EN 16602-70-21

NORME EUROPÉENNE

EUROPÄISCHE NORM

October 2014

ICS 13.220.40; 49.025.01; 49.140

Supersedes EN 14090:2002

English version

## Space product assurance - Flammability testing for the screening of space materials

Assurance produit des projets spatiaux - Essai de flammabilité pour la sélection des matériaux d'un projet spatial

Raumfahrtproduktsicherung - Brennverhaltenstest für die Auswahl von Raumfahrtmaterialien

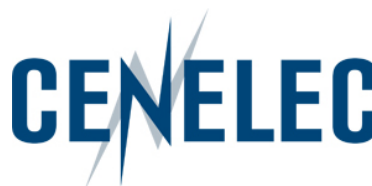
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## Foreword

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This document (EN 16602-70-21:2014) has been prepared by Technical Committee CEN/CLC/TC 5 "Space", the secretariat of which is held by DIN.

This standard (EN 16602-70-21:2014) originates from ECSS-Q-ST-70-21C.

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of an identical text or by endorsement, at the latest by April 2015, and conflicting national standards shall be withdrawn at the latest by April 2015.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 supersedes EN 14090:2002.

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.

# 1

## Scope

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This Standard defines a multi-test procedure for the determination of the flammability characteristics of non-metallic materials under a set of closely controlled conditions. The test procedure covers both individual materials and materials used in configuration. This Standard describes a series of tests to provide data for aid in the evaluation of the suitability of materials for use in a space vehicle crew compartment. The data obtained are in respect to the ease of ignition and the flame propagation characteristics of materials.

All non-metallic materials are inherently flammable, the degree to which this is true is dependant on the chemical nature of the material itself and the environment to which the material is exposed. In the closed environment of a manned spacecraft this can lead to a potentially dangerous situation and close control is therefore required.

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

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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 16602-10-09	ECSS-Q-ST-10-09	Space product assurance - Nonconformance control system
EN 16602-70	ECSS-Q-ST-70	Space product assurance - Materials, mechanical parts and processes
	DIN 50050-1:1986	Testing of materials; burning behaviour of materials; small burning cabinet
	ISO 6941:1984	Textile fabrics - Burning behaviour - Measurement of flame spread properties of vertically oriented specimens



## Terms, definitions and abbreviated terms

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### 3.1 Terms from other standards

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

**flammability**

For the purpose of this Standard, the terms and definitions from ECSS-Q-ST-70 apply.

### 3.2 Terms specific to the present standard

#### 3.2.1 oxygen concentration limit during the combustion of polymeric materials

minimum volumetric amount of oxygen contained in the nitrogen-oxygen mixture, in the presence of which the material can still combust after ignition from the bottom

NOTE 1 It is expressed as a percentage and determined using the equation:

$$C_{\text{lim}} = \frac{\sum_{i=1}^n C_{\text{lim},i}}{n} \quad [3-1]$$

NOTE 2 i.e. the arithmetic average of the concentration limit calculated as a function of the results of unit measurements of  $(C_{\text{lim},i})$ .

### 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
$C_{\text{lim}}$	minimum volumetric concentration of oxygen contained in an oxygen-nitrogen mixture, in the presence of which a material can still combust after ignition from the bottom.
HMT	hexamethylenetetramine

# 4

## Principles

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### 4.1 Test methods

Four test methods are included within this Standard. They can be divided into two different categories:

- Screening tests (see clause 4.2), and
- Configuration tests (see clause 4.3).

### 4.2 Screening tests

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#### 4.2.1 (Overview) [standards.iteh.ai](https://standards.iteh.ai/catalog/standards/sist/ced9b746-18a6-4012-94cb-0d8daefab655/sist-en-16602-70-21-2015)

These are the prime tests to be performed on a material to assess its basic acceptability or otherwise with respect to flammability. They are designed to test the material under worst case test conditions, with respect to, for instance, environment, use, or thickness.

The following two tests form the basis for acceptance or otherwise of most non-metallic materials but are very different in the data generated:

- a. Test 1: Upward propagation test
- b. Test 2: Standard test method for the determination of the oxygen concentration limit during the combustion of polymer materials

The choice of which test method is used is dependant on the project concerned and is specified within the business agreement.

Test 3 “Electrical wire insulation flammability test method” is related specifically to wire insulation materials.

Materials which meet the requirements of these tests can be considered for general application, within the constraints of the test conditions used.

#### 4.2.2 Screening Test 1: Upward propagation test

The purpose of this test is to determine the flammability characteristics of candidate materials supplied to a standard format when exposed to an ignition source applied at the bottom edge. This test in general is applicable to NASA payloads (e.g. Space Station, STS). See also NASA STD 6001 Test 1.

### 4.2.3 Screening Test 2: Standard test method for the determination of the oxygen concentration limit during the combustion of polymer materials

The oxygen concentration limit provides a comparative evaluation of the tendency of polymeric materials to burn and to assess the fire resistance of these materials.

The oxygen concentration limit during the combustion of polymer materials is considered as one of the main indices characterizing the risk of fire which materials present before being considered for use in environments containing various oxygen levels.

### 4.2.4 Screening Test 3: Electrical wire insulation flammability test method

This test is designed to screen wire insulation for flammability characteristics.

## 4.3 Configuration test

This test is designed to determine the flammability characteristics of materials configured in the same manner as that in qualification and subsequent spacecraft models. It is intended to determine whether a flammability hazard exists when a material, which fails the basic screening test, is desired to be used.

Materials which are shown to be acceptable in this manner can be accepted for restricted application, within the constraints of the test conditions used. Materials which fail this test are subject to a deviation request. Examples are:

- a. flammable adhesives where the use is to bond two non-flammable substrates together, or
- b. flammable conformal coatings applied thinly to a non-flammable printed circuit board.

## 4.4 Additional tests

These tests can be proposed related to the determination of such properties as flash and fire point, or heat of combustion.

# 5 Requirements

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## 5.1 Test procedure

### 5.1.1 Preparatory conditions

#### 5.1.1.1 Hazards, health and safety precautions

- a. The supplier shall isolate hazardous substances, items and operations from other activities.
- b. The supplier shall locate items and controls so that personnel are not exposed to hazards.

NOTE Hazards can be chemical burns, electric shock, cutting edges, sharp points or toxic atmospheres

- c. The supplier shall provide warning and caution notes in operations, storage, transport, testing, assembly, maintenance and repair instructions.
- d. The supplier shall place distinctive markings on hazardous items, equipment or facilities.

NOTE This marking is for personnel protection.

#### 5.1.1.2 Preparation of samples

##### 5.1.1.2.1 Cleaning

- a. The supplier shall perform on the samples the same cleaning and other treatment as those performed on the materials to be incorporated into the spacecraft.
- b. The supplier should not carry out further cleaning or treatment.

##### 5.1.1.2.2 Handling, storage and environmental conditions

- a. The supplier shall avoid contamination of the sample during handling.

NOTE This can be achieved by the use of, for instance, suitable protective gloves.

- b. In addition, the supplier shall store and handle samples in a cleanliness-controlled area with an ambient temperature of  $(22 \pm 3) ^\circ\text{C}$  and relative humidity of  $(55 \pm 10) \%$ .

NOTE 1 This can be achieved either in a conditioning room, or by the use of desiccators filled with silica gel or a saturated salt solution.

NOTE 2 A saturated salt solution of calcium nitrate gives approximately 51 % humidity at the testing temperature.

- c. The supplier shall shield coated surfaces from contact by using polyethylene or polypropylene bags or sheets.
- d. The supplier shall avoid mechanical damage in the standard way by packing the polyethylene- or polypropylene-wrapped test pieces in clean, dust- and lint-free material.
- e. The supplier shall label limited-life material with its relative shelf-life and date of manufacture, or date of delivery if date of manufacture is not known.

#### 5.1.1.2.3 Identification

- a. For materials submitted for testing, the supplier shall provide a description of at least the name and nature of the material or processing.

#### 5.1.1.3 Facilities

##### 5.1.1.3.1 Cleanliness

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- a. The work area shall be clean and free of dust.
- b. The supplier shall filter the air used for ventilation to prevent contamination of the workpieces by moisture, oil or dust.

##### 5.1.1.3.2 Special utilities

- a. The supplier shall use oxygen and nitrogen supplies with minimum purity of 99,9 %.

### 5.1.2 Test methods

#### 5.1.2.1 Categories

- a. The customer shall specify the choice of the screening test method within the business agreement.
- b. Materials failing to meet the requirements of the applicable screening test shall be subject to testing in configuration.
- c. Materials which fail the testing in configuration shall be subject to a deviation request.
- d. The supplier shall obtain customer approval on a case by case basis where additional tests are identified.