

# SLOVENSKI STANDARD

## SIST EN 16602-70-36:2015

01-januar-2015

Nadomešča:  
SIST EN 14101:2004

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**Zagotavljanje varnih proizvodov v vesoljski tehniki - Merila za izbiro materialov za izogibanje stresnim korozijskim razpokam**

Space product assurance - Material selection for controlling stress-corrosion cracking

Raumfahrtproduktsicherung - Kriterien für die Werkstoffwahl zur Vermeidung von Spannungsrisskorrosion

Assurance produit des projets spatiaux - Sélection des matériaux en vue d'éviter leur fissuration par corrosion sous contrainte

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**Ta slovenski standard je istoveten z: EN 16602-70-36:2014**

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**EN 16602-70-36**

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**Space product assurance - Material selection for controlling  
stress-corrosion cracking**

Assurance produit des projets spatiaux - Sélection des  
matériaux en vue d'éviter leur fissuration par corrosion sous  
contrainte

Raumfahrtproduktsicherung - Kriterien für die  
Werkstoffwahl zur Vermeidung von  
Spannungsrissskorrosion

This European Standard was approved by CEN on 11 April 2014.

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**CEN-CENELEC Management Centre:  
Avenue Marnix 17, B-1000 Brussels**

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## Foreword

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This document (EN 16602-70-36:2014) has been prepared by Technical Committee CEN/CLC/TC 5 "Space", the secretariat of which is held by DIN.

This standard (EN 16602-70-36:2014) originates from ECSS-Q-ST-70-36C.

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of an identical text or by endorsement, at the latest by April 2015, and conflicting national standards shall be withdrawn at the latest by April 2015.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 14101:2001.

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 covers the following processes of the general materials, mechanicals parts and processes (MMPP) flow of ECSS-Q-ST-70:

- The selection of metal alloys for which preference is given to approved data sources (Table 5-1 to Table 5-3)
- The criticality analysis to determine if a stress corrosion cracking (SCC) evaluation is necessary

This Standard sets forth the criteria to be used in the selection of materials for spacecraft and associated equipment and facilities so that failure resulting from stress-corrosion is prevented.

It is intended to provide general criteria to be used in stress-corrosion cracking control, which begins during design thanks to a methodological material selection.

This document does not intend to include all factors and criteria necessary for the total control of stress-corrosion cracking in all alloys.

The criteria established in this Standard are only applicable to designs for service involving exposure conditions similar to testing conditions

As regards weldments, this Standard is applicable to aluminium alloys, selected stainless steels in the 300 series and alloys listed in Table 5-1.

This Standard is not applicable to listed materials whose behaviour differs at elevated temperature and in specific chemical.

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



## 2

## Normative references

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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 16602-70	ECSS-Q-ST-70	Space product assurance - Materials, mechanical parts and processes.
EN 16602-70-37	ECSS-Q-ST-70-37	Space product assurance - Determination of the susceptibility of metals to stress-corrosion cracking.
	NASA-MSFC-SPEC 522B (July 1987)	Design criteria for controlling stress-corrosion cracking

## 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-ST-00-01 and ECSS-Q-ST-70 apply.

### 3.2 Terms specific to the present standard

#### 3.2.1 stress-corrosion

combined action of sustained tensile stress and corrosion that can lead to the premature failure of materials

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### 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
SCC	stress-corrosion cracking
SCEF	stress-corrosion evaluation form

## 4 Principles

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### 4.1 Stress corrosion

Certain materials are more susceptible to stress corrosion cracking (SCC) than others. If a susceptible material is placed in service in a corrosive environment under tension of sufficient magnitude, and the duration of service is sufficient to permit the initiation and growth of cracks, failure occurs at a stress lower than that which the material is normally be expected to withstand. The corrosive environment need not be severe in terms of general corrosive attack.

NOTE Service failures due to stress-corrosion are frequently encountered in cases where the surfaces of the failed parts are not visibly corroded in a general sense.

Moreover, stresses are additive and threshold stresses for susceptibility are often low. There have been a number of stress-corrosion failures for which design stresses were intermittent and of short duration, and only of minor significance in contributing to failure. Stress-corrosion cracking in those cases occurred because of a combination of residual and assembly stresses not anticipated in design.

### 4.2 Evaluation of metal alloys

Resistance to stress- corrosion cracking of metal alloys depends mainly on factors:

- Grain orientation (see Annex D)
- Susceptibility to SCC (see Annex E)

# 5

## Requirements

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### 5.1 Stress corrosion cracking resistance evaluation of metal alloys

#### 5.1.1 Overview

Clause 5.1.2 lists the requirements applicable for applications involving and identified as case 1:

- unlisted materials (i.e. materials not listed in tables 1, 2 or 3), or
- combinations of materials and environments outside the scope of this Standard

Clause 5.1.3 lists the requirements applicable for application involving listed materials with

- moderate SCC resistance,
- low SCC resistance, or
- moderate or low SCC resistance and coated or plated with materials with a high SCC resistance.

and identified as case 2.

NOTE The classes for high, moderated and low resistance to SCC are defined in ECSS-Q-ST-70-37.

#### 5.1.2 Requirements for case 1

- A request for evaluation shall be established in conformance with the DRD in Annex A.
- As a reply to the customer request for SCC evaluation, the supplier shall provide a work proposal (including test specifications and procedures) in conformance with the DRD in Annex B.

NOTE An example of approved test specifications and procedures is ECSS-Q-ST-70-37.

- The supplier shall perform a detailed evaluation of susceptibility according to test specifications and procedures approved by the customer

NOTE This is often the case for many applications involving unfamiliar materials, or unusual combinations of materials and environments.

- d. The results of stress corrosion cracking resistance evaluation shall be reported in conformance with DRD in Annex A of ECSS-Q-ST-70-37.
- e. The SCC test report shall be submitted for customer's approval before the material under evaluation is used or incorporated in a design.

### 5.1.3 Requirements for Case 2

- a. The supplier shall provide the SCEF in conformance with the DRD in Annex C.

## 5.2 Materials selection criteria

### 5.2.1 General

- a. The supplier shall use in preference high SCC resistance alloys listed in Table 5-1.

NOTE Selecting an alloy from this table avoid the need to perform a stress corrosion evaluation

### 5.2.2 High SCC resistance alloys

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#### 5.2.2.1 Surface treated materials

- a. Alloys which are surface treated shall be evaluated according to 5.1.3a.

NOTE 1 For example:

- Metals having been treated with surface treatments such as nitriding and carburising.
- A low-strength plain carbon steel, carburised on the surface to a hardness corresponding to a tensile strength above 1 370 MPa (200 ksi).

NOTE 2 Surface treatment such as nitriding and carburising can make a stress-corrosion evaluation necessary for a material not normally considered susceptible.