

STN	Zabezpečovanie výrobkov kozmického programu. Mechanické skúšanie kovových materiálov.	STN EN 16602-70-45 31 0542
------------	--	--

Space product assurance - Mechanical testing of metallic materials

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 03/15

Obsahuje: EN 16602-70-45:2014

120362

Úrad pre normalizáciu, metrológiu a skúšobníctvo SR, odbor SÚTN, 2015
Podľa zákona č. 264/1999 Z. z. v znení neskorších predpisov sa môžu slovenské technické normy rozmnožovať a rozširovať iba so súhlasom Úradu pre normalizáciu, metrológiu a skúšobníctvo SR.

ICS 49.025.01; 49.140

English version

Space product assurance - Mechanical testing of metallic materials

Assurance produit des projets spatiaux - Essais
mécaniques des matériaux métalliques

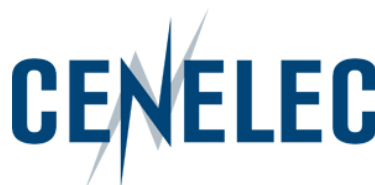
Raumfahrtproduktsicherung - Mechanische Tests von
metallinem Material

This European Standard was approved by CEN on 18 October 2014.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN and CENELEC member.

This European Standard exists 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, 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 United Kingdom.



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

Table of contents

Foreword	5
1 Scope.....	6
2 Normative references	7
3 Terms, definitions and abbreviated terms.....	9
3.1 Terms defined in other standards	9
3.2 Terms specific to the present standard	9
3.3 Abbreviated terms.....	10
3.4 Symbols.....	11
4 Principles	12
4.1 Overview	12
4.2 Tensile test	12
4.3 Fracture toughness test	12
4.3.1 Overview.....	12
4.3.2 Determination of fracture toughness using the K_{Ic} test method.....	12
4.3.3 Determination of fracture toughness using the J_{Ic} test method	13
4.3.4 Characterization of fracture toughness using the R-curve test method	13
4.3.5 Characterization of fracture toughness using the CTOD test method	13
4.4 Fatigue test.....	14
4.4.1 General	14
4.4.2 Force controlled constant amplitude axial fatigue test	14
4.4.3 Strain-controlled fatigue test.....	14
4.5 Fatigue crack propagation test.....	14
4.5.1 Stable crack growth rate.....	14
4.5.2 Crack propagation threshold	15
4.6 Fracture and fatigue test in special environment.....	15
4.7 Stress corrosion cracking test.....	15
4.7.1 Overview.....	15
4.7.2 Stress corrosion cracking test using smooth specimens	15
4.7.3 Stress corrosion cracking test using pre-cracked specimens	16

4.8	Creep test.....	16
4.9	Test results presentation.....	16
5	Requirements.....	17
5.1	Customer agreement.....	17
5.2	Tensile testing	17
5.2.1	General.....	17
5.2.2	Tensile testing of weldments.....	17
5.3	Fracture toughness test.....	18
5.3.1	K_{Ic} test method.....	18
5.3.2	J_{Ic} test method.....	18
5.3.3	R-curve test method.....	18
5.3.4	CTOD test method	18
5.4	Fatigue test.....	19
5.4.1	Force controlled constant amplitude axial fatigue test	19
5.4.2	Strain-controlled fatigue test.....	19
5.5	Fatigue crack propagation test.....	20
5.5.1	Determination of fatigue crack growth rate	20
5.5.2	Determination of a fatigue crack propagation threshold.....	20
5.6	Fracture and fatigue tests in special environments	21
5.7	Stress corrosion cracking test.....	21
5.7.1	Stress corrosion cracking test using smooth specimens	21
5.7.2	Stress corrosion cracking test using pre-cracked specimens	21
5.8	Creep test.....	21
5.9	Evaluation of test results.....	21
5.10	Storage.....	22
5.11	Reporting.....	22
5.12	Quality assurance.....	22
5.12.1	General	22
5.12.2	Calibration.....	22
5.12.3	Quality control of raw materials	23
5.12.4	Nonconformance.....	23
5.12.5	Traceability and records.....	23
	Annex A (normative) Request for mechanical testing of materials – DRD.....	24
	Annex B (normative) Proposal for mechanical testing of materials – DRD.....	26
	Annex C (normative) Report of mechanical testing of materials – DRD.....	28

Annex D (informative) References	31
Bibliography.....	32

Foreword

This document (EN 16602-70-45:2014) has been prepared by Technical Committee CEN/CLC/TC 5 "Space", the secretariat of which is held by DIN.

This standard (EN 16602-70-45:2014) originates from ECSS-Q-ST-70-45C.

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 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

This Standard specifies requirements for mechanical testing of metallic materials to be used in the fabrication of spacecraft hardware.

This Standard establishes the requirements for most relevant test methods carried out to assess the tensile, fatigue and fracture properties of metallic materials. It does not give a complete review of all the existing test methods for the evaluation of mechanical properties of metallic materials.

Furthermore, this Standard specifies requirements for the evaluation, presentation and reporting of test results.

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

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
EN 16602-70-37	ECSS-Q-ST-70-37	Space product assurance — Determination of the susceptibility of metals to stress-corrosion cracking
EN 16602-70-46	ECSS-Q-ST-70-46	Space product assurance — Requirements for manufacturing and procurement of threaded fasteners
	ASTM E 139	Standard test methods for conducting creep, creep-rupture, and stress-rupture tests of metallic materials
	ASTM E 399	Standard test method for plane-strain fracture toughness of metallic materials
	ASTM E 466	Standard practice for conducting force controlled constant amplitude axial fatigue tests of metallic materials
	ASTM E 561	Standard practice for R-curve determination
	ASTM E 606	Standard practice for strain-controlled fatigue testing
	ASTM E 647	Standard test method for measurement of fatigue crack growth rates
	ASTM E 739	Standard practice for statistical analysis of linear or linearized stress-life (S-N) and strain-life (e-N) fatigue

		data
	ASTM E 1290	Standard test method for crack-tip opening displacement (CTOD) fracture toughness measurement
	ASTM E 1820	Standard test method for measurement of fracture toughness
	EN 10002-1	Metallic materials — Tensile testing — Part 1: Method of test at ambient temperature
	EN 10002-2	Metallic materials — Tensile testing — Part 2: Verification of the force measuring system of the tensile testing machines
	EN 10002-4	Metallic materials — Tensile testing — Part 4: Verification of the extensometers used in uniaxial testing
	ESDU 96013:1996	Fracture toughness (K_{Ic}) values of some aluminium alloys
	ISO 7539-6:2003	Corrosion of metals and alloys — Stress corrosion testing — Part 6: Preparation and use of pre-cracked specimens for tests under constant load or constant displacement

koniec náhľadu – text ďalej pokračuje v platenej verzii STN