SLOVENSKI STANDARD
SIST EN ISO 7539-6:2003

01-december-2003

Nadomeğļ a:

SIST EN ISO 7539-6:1999

Korozija kovin in zlitin - Preskušanje napetostne korozije - 6. del: Priprava in uporaba preskušancev z umetno razpoko za preskuse pri konstantni obremenitvi ali konstantni deformaciji (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 (ISO 7539-6:2003)

Korrosion der Metalle und Legierungen - Prüfung der Spannungsrisskorrosion - Teil 6: Vorbereitung und Anwendung von angerissenen Proben für die Prüfung unter konstanter Kraft oder konstanter Verformung (ISO 7539-6:2003)

Corrosion des métaux et alliages - Essais de corrosion sous contrainte - Partie 6: Préparation et utilisation des éprouvettes préfissurées pour essais sous charge constante ou sous déplacement constant (ISO 7539-6:2003)

Ta slovenski standard je istoveten z: **EN ISO 7539-6:2003**

ICS:

77.060	Korozija kovin	Corrosion of metals

SIST EN ISO 7539-6:2003 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 7539-6

February 2003

ICS 77.060

Supersedes EN ISO 7539-6:1995

English version

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 (ISO 7539-6:2003)

Corrosion des métaux et alliages - Essais de corrosion sous contrainte - Partie 6: Préparation et utilisation des éprouvettes préfissurées pour essais sous charge constante ou sous déplacement constant (ISO 7539-6:2003)

Korrosion der Metalle und Legierungen - Prüfung der Spannungsrisskorrosion - Teil 6: Vorbereitung und Anwendung von angerissenen Proben für die Prüfung unter konstanter Kraft oder konstanter Verformung (ISO 7539-6:2003)

This European Standard was approved by CEN on 7 February 2003.

CEN 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 Management Centre or to any CEN 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 member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovak Republic, Spain, Sweden, Switzerland and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Ref. No. EN ISO 7539-6:2003 E

CORRECTED 2003-03-12

Foreword

This document (EN ISO 7539-6:2003) has been prepared by Technical Committee ISO/TC 156 "Corrosion of metals and alloys" in collaboration with Technical Committee CEN/TC 262 "Metallic and other inorganic coatings", the secretariat of which is held by BSI.

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 August 2003, and conflicting national standards shall be withdrawn at the latest by August 2003.

This document supersedes EN ISO 7539-6:1995.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovak Republic, Spain, Sweden, Switzerland and the United Kingdom.

Endorsement notice

The text of ISO 7539-6:2003 has been approved by CEN as EN ISO 7539-6:2003 without any modifications.

NOTE Normative references to International Standards are listed in Annex ZA (normative).

Annex ZA
(normative)

Normative references to international publications with their relevant European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE Where an International Publication has been modified by common modifications, indicated by (mod.), the relevant EN/HD applies.

Publication	Year	Title	EN	Year
ISO 7539-1	1987	Corrosion of metals and alloys - Stress corrosion testing - Part 1: General guidance on testing procedures	EN ISO 7539-1	1995

INTERNATIONAL STANDARD

ISO 7539-6

Second edition
2003-02-15

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

Corrosion des métaux et alliages — Essais de corrosion sous contrainte —

Partie 6: Préparation et utilisation des éprouvettes préfissurées pour essais sous charge constante ou sous déplacement constant

Reference number
ISO 7539-6:2003(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 7539-6 was prepared by Technical Committee ISO/TC 156, *Corrosion of metals and alloys*, in collaboration with the National Physical Laboratory (United Kingdom).

This second edition cancels and replaces the first edition (ISO 7539-6:1989), Clauses 1, 2, 3, 4 and 7; subclause 5.2.5 d); Figures 1, 2 d), 5 b), 8, 9, and 10; Annexs A and B of which have been technically revised.

ISO 7539 consists of the following parts, under the general title *Corrosion of metals and alloys — Stress corrosion testing*:

— *Part 1: General guidance on testing procedures*

— *Part 2: Preparation and use of bent-beam specimens*

— *Part 3: Preparation and use of U-bend specimens*

— *Part 4: Preparation and use of uniaxially loaded tension specimens*

— *Part 5: Preparation and use of C-ring specimens*

— *Part 6: Preparation and use of pre-cracked specimens for tests under constant load or constant displacement*

— *Part 7: Slow strain rate testing*

— *Part 8: Preparation and use of specimens to evaluate weldments*

— *Part 9: Preparation and use of pre-cracked specimens for tests under rising load or rising displacement*

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

1 Scope

1.1 This part of ISO 7539 covers procedures for designing, preparing and using pre-cracked specimens for investigating susceptibility to stress corrosion. It gives recommendations for the design, preparation and use of pre-cracked specimens for investigating susceptibility to stress corrosion. Recommendations concerning notched specimens are given in Annex A.

The term "metal" as used in this part of ISO 7539 includes alloys.

1.2 Because of the need to confine plasticity at the crack tip, pre-cracked specimens are not suitable for the evaluation of thin products such as sheet or wire and are generally used for thicker products including plate bar and forgings. They can also be used for parts joined by welding.

1.3 Pre-cracked specimens may be loaded with equipment for application of a constant load or can incorporate a device to produce a constant displacement at the loading points. Tests conducted under increasing displacement or increasing load are dealt with in ISO 7539-9.

1.4 A particular advantage of pre-cracked specimens is that they allow data to be acquired from which critical defect sizes, above which stress corrosion cracking may occur, can be estimated for components of known geometry subjected to known stresses. They also enable rates of stress corrosion crack propagation to be determined. The latter data may be taken into account when monitoring parts containing defects during service.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 7539-1, *Corrosion of metals and alloys — Stress corrosion testing — Part 1: General guidance on testing procedures*

ISO 11782-2, *Corrosion of metals and alloys — Corrosion fatigue testing — Part 2: Crack propagation testing using precracked specimens*

3 Terms and definitions

For the purposes of this part of ISO 7539, the definitions given in ISO 7539-1 and the following apply.

3.1
crack length
a
effective crack length measured from the crack tip to either the mouth of the notch or the loading point axis depending on the specimen geometry

3.2
specimen width
W
effective width of the specimen measured from the back face to either the face containing the notch or the loading plane depending on the specimen geometry

3.3
specimen thickness
B
side-to-side dimension of the specimen being tested

3.4
reduced thickness at side grooves
B_{n}
minimum side-to-side dimension between the notches in side-grooved specimens

3.5
specimen half-height
H
50 % of the specimen height measured parallel to the direction of load application for compact tension, double cantilever beam and modified wedge opening loaded test pieces

3.6
load
P
that load which, when applied to the specimen, is considered positive if its direction is such as to cause the crack faces to move apart

3.7
deflection at loading point axis
V_{LL}
crack opening displacement produced at the loading line during the application of load to a constant displacement specimen

3.8
deflection away from the loading line
V_0
crack opening displacement produced at a location remote from the loading plane, e.g. at knife edges located at the notch mouth, during the application of load to a constant displacement specimen

3.9
modulus of elasticity
E
elastic modulus (i.e. stress/strain) in tension

3.10
stress intensity factor
K_I
function of applied load, crack length and specimen geometry having dimensions of stress × $\sqrt{\text{length}}$ which uniquely define the elastic stress field intensification at the tip of a crack subjected to opening mode displacements (mode I)

NOTE It has been found that stress intensity factors, calculated assuming that specimens respond purely elastically, correlate the behaviour of real cracked bodies provided that the size of the zone of plasticity at the crack tip is small compared to the crack length and the length of the uncracked ligament. In this part of ISO 7539, mode I is assumed and the subscript I is implied everywhere.

3.11
initial stress intensity factor
K_{Ii}
stress intensity applied at the commencement of the stress corrosion test

3.12
plane strain fracture toughness
K_{Ic}
critical value of K_I at which the first significant environmentally independent extension of the crack occurs under the influence of rising stress intensity under conditions of high resistance to plastic deformation

3.13
provisional value of K_{Ic}, K_Q
$K_Q = K_{Ic}$ when the validity criteria for plane strain predominance are satisfied

3.14
threshold stress intensity factor for susceptibility to stress corrosion cracking
K_{ISCC}
that stress intensity factor above which stress corrosion cracking will initiate and grow for the specified test conditions under conditions of high resistance to plastic deformation, i.e. under plane strain predominant conditions

3.15
provisional value of K_{ISCC}, K_{QSCC}
$K_{QSCC} = K_{ISCC}$ when the validity criteria for plane strain predominance are satisfied

3.16
maximum stress intensity factor
K_{max} in fatigue
highest algebraic value of the stress intensity factor in a cycle, corresponding to the maximum load

3.17
0,2 % proof stress
$R_{p0,2}$
stress which must be applied to produce a plastic strain of 0,2 % during a tensile test

3.18
applied stress
σ
stress resulting from the application of load to the specimen

3.19
stress intensity factor coefficient
Y
factor derived from the stress analysis for a particular specimen geometry which relates the stress intensity factor for a given crack length to the load and specimen dimensions

3.20
load ratio
R **in fatigue loading**
algebraic ratio of minimum to maximum load in a cycle:

$$R = \frac{P_{\text{min}}}{P_{\text{max}}} = \frac{K_{\text{min}}}{K_{\text{max}}}$$

3.21
crack velocity
instantaneous rate of stress corrosion crack propagation measured by a continuous crack monitoring technique

3.22
average crack velocity
average rate of crack propagation calculated by dividing the change in crack length due to stress corrosion by the test duration

3.23
specimen orientation
fracture plane of the specimen identified in terms of firstly the direction of stressing and secondly the direction of crack growth expressed with respect to three reference axes identified by the letters X, Y and Z

where

Z is coincident with the main working force used during manufacture of the material (short-transverse axis);

X is coincident with the direction of grain flow (longitudinal axis);

Y is normal to the X and Z axes

4 Principle

4.1 The use of pre-cracked specimens acknowledges the difficulty of ensuring that crack-like defects introduced during either manufacture or subsequent service are totally absent from structures. Furthermore, the presence of such defects can cause a susceptibility to stress corrosion cracking which in some materials (e.g. titanium) may not be evident from tests under constant load on smooth specimens. The principles of linear elastic fracture mechanics can be used to quantify the stress situation existing at the crack tip in a pre-cracked specimen or structure in terms of the plane strain-stress intensity.

4.2 The test involves subjecting a specimen in which a crack has been developed by fatigue, from a machined notch, to either a constant load or displacement at the loading points during exposure to a chemically aggressive environment. The objective is to quantify the conditions under which environmentally-assisted crack extension can occur in terms of the threshold stress intensity for stress corrosion cracking, K_{ISCC}, and the kinetics of crack propagation.

4.3 The empirical data can be used for design or life prediction purposes in order to ensure either that the stresses within large structures are insufficient to promote the initiation of environmentally-assisted cracking at whatever pre-existing defects may be present or that the amount of crack growth which would occur within the design life or inspection periods can be tolerated without the risk of unstable failure.

4.4 Stress corrosion cracking is influenced by both mechanical and electrochemical driving forces. The latter can vary with crack depth, opening or shape because of variations in crack-tip chemistry and electrode potential and may not be uniquely described by the fracture mechanics stress intensity factor.

4.5 The mechanical driving force includes both applied and residual stresses. The possible influence of the latter shall be considered in both laboratory testing and the application to more complex geometries. Gradients in residual stress in a specimen may result in non-uniform crack growth along the crack front.

