SLOVENSKI STANDARD
SIST EN ISO 7539-1:2014

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Korozija kovin in zlitin - Ugotavljanje pokanja zaradi napetostne korozije - 1. del: Splošna navodila za postopke preskušanja (ISO 7539-1:2012)

Corrosion of metals and alloys - Stress corrosion testing - Part 1: General guidance on testing procedures (ISO 7539-1:2012)

Korrosion der Metalle und Legierungen - Prüfung der Spannungsrisskorrosion - Teil 1: Allgemeiner Leitfaden für Prüfverfahren (ISO 7539-1:2012)

Corrosion des métaux et alliages - Essais de corrosion sous contrainte - Partie 1: Lignes directrices générales relatives aux méthodes d'essai (ISO 7539-1:2012)

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English Version

Corrosion of metals and alloys - Stress corrosion testing - Part 1: General guidance on testing procedures (ISO 7539-1:2012)

Corrosion des métaux et alliages - Essais de corrosion sous contrainte - Partie 1: Lignes directrices générales relatives aux méthodes d'essai (ISO 7539-1:2012)

Korrosion der Metalle und Legierungen - Prüfung der Spannungsrisskorrosion - Teil 1: Allgemeiner Leitfaden für Prüfverfahren (ISO/FDIS 7539-1:2012)

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Foreword

This document (EN ISO 7539-1:2012) 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of an identical text or by endorsement, at the latest by June 2013, and conflicting national standards shall be withdrawn at the latest by June 2013.

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The text of ISO 7539-1:2012 has been approved by CEN as a EN ISO 7539-1:2012 without any modification.

INTERNATIONAL STANDARD

ISO 7539-1

Second edition
2012-12-15

Corrosion of metals and alloys — Stress corrosion testing —

Part 1: General guidance on testing procedures

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

Partie 1: Lignes directrices générales relatives aux méthodes d'essai

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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.

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ISO 7539-1 was prepared by Technical Committee ISO/TC 156, *Corrosion of metals and alloys*.

This second edition cancels and replaces the first edition (ISO 7539-1:1987), which has 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: Method for 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*

— *Part 10: Reverse U-bend method*

— *Part 11: Guidelines for testing the resistance of metals and alloys to hydrogen embrittlement and hydrogen-assisted cracking*

Corrosion of metals and alloys — Stress corrosion testing —

Part 1: General guidance on testing procedures

1 Scope

1.1 This part of ISO 7539 describes the general considerations that apply when designing and conducting tests to assess susceptibility of metals to stress corrosion.

1.2 This part of ISO 7539 also gives some general guidance on the selection of test methods.

NOTE 1 Particular methods of test are not treated in detail in this part of ISO 7539. These are described in the additional parts of ISO 7539.

NOTE 2 This part of ISO 7539 is applicable to cathodic protection conditions.

2 Terms and definitions

2.1
stress corrosion
process involving conjoint corrosion and straining of the metal due to applied or residual stress

2.2
threshold stress
⟨stress corrosion⟩ stress above which stress corrosion cracks initiate and grow, for the specified test conditions

2.3
threshold stress intensity factor
K_{ISCC}
⟨stress corrosion cracking⟩ stress intensity factor above which stress corrosion crack propagation is sustained

Note 1 to entry: The threshold stress intensity factor is a concept of linear elastic fracture mechanics (LEFM) and is applicable when the plastic zone size is large compared with the microstructure and a high constraint to plastic deformation prevails; i.e. under plain strain-predominant conditions. For growing stress corrosion cracks, LEFM is not necessarily applicable in detail but is adopted as a pragmatic tool that is commonly used.

Note 2 to entry: Stress corrosion cracks may initiate at a surface or a surface defect and grow in the "short crack" regime at stress levels below the apparent threshold stress intensity factor. However, LEFM is not applicable in the short crack regime and sustained propagation of these cracks requires that the threshold stress intensity factor be exceeded.

2.4
test environment
either a service environment, or an environment produced in the laboratory, to which the test specimen is exposed and which is maintained constant or varied in an agreed manner

Note 1 to entry: In the case of stress corrosion, the environment is often quite specific (see Clause 6).

2.5
start of test
time when the stress is applied or when the specimen is exposed to the test environment, whichever occurs later

2.6
crack initiation time
period from the start of a test to the time when a crack is detectable by the means employed

2.7
time to failure
period elapsing between the start of a test and the occurrence of failure, the criterion of failure being the first appearance of cracking or the total separation of the test piece, or some agreed intermediate condition

2.8
slow strain rate test
test for evaluating the susceptibility of a metal to stress corrosion cracking that most commonly involves pulling a tensile specimen to failure in a representative environment at a constant displacement rate, the displacement rate being chosen to generate nominal strain rates usually in the range 10^{-5} s^{-1} to 10^{-8} s^{-1}

Note 1 to entry: Slow strain rate testing may also be applied to specimens in bend.

2.9
strain to failure
strain at which failure occurs in a slow strain rate test expressed usually as the plastic strain to failure See ISO 7539-7.

2.10
average crack velocity
maximum depth of crack(s) due to stress corrosion, divided by the test time

2.11
orientation
direction of applied tensile stress of a test specimen with respect to some specified direction in the product from which it was prepared, e.g. the rolling direction in the plate

3 Background

3.1 Although it is generally agreed that cracking is the usual result of stress corrosion, other manifestations such as intergranular corrosion or elongated fissures, which are enhanced by the presence of stress, have also to be recognized.

As far as this part of ISO 7539 is concerned, all phenomena involving metal dissolution or the action of hydrogen introduced into the metal as the result of simultaneous effects of a corrosive environment and a tensile stress are included, except for embrittlement by liquid metal and exfoliation corrosion.

3.2 There exists a wide diversity of methods used for assessing the stress corrosion properties of metals. Each has its own particular advantage in certain situations.

3.3 Stress corrosion cracking depends on both the exposure conditions and the mechanical and microstructural characteristics of the material and susceptibility or resistance to stress corrosion can only be defined in that context. Thus, for example, there is no intrinsic threshold stress intensity factor for a material.

3.4 Ideally, in order to establish the risk of stress corrosion in a given application, it is necessary to carry out simulation testing under all likely service exposure conditions. In practice, this is difficult, if not impossible, and rarely achieved, but a number of “standard tests” have been found as a result of experience to provide reasonable guidance on likely service behaviour for given specific applications. However, these laboratory “standard tests” are only appropriate to service conditions where experience