INTERNATIONAL STANDARD

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Metallic materials — Method of constraint loss correction of CTOD fracture toughness for fracture assessment of steel components

Matériaux métalliques — Méthode de correction de perte de contrainte du CTOD de la ténacité à la rupture pour l'évaluation de la rupture des composants en acier

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 164 *Mechanical Testing of Metals,* Subcommittee SC 4, *Toughness testing — Fracture (F), Pendulum (P), Tear (T).*

This second edition cancels and replaces the first edition (ISO 27306:2009), which has been technically revised.

Metallic materials — Method of constraint loss correction of CTOD fracture toughness for fracture assessment of steel components

1 Scope

In fracture assessments of steel structures containing cracks, it has generally been assumed that the fracture resistance of fracture toughness specimens is equal to the fracture resistance of structural components. However, such an assumption often leads to excessively conservative fracture assessments. This is due to a loss of plastic constraint in structural components, which are subjected mainly to tensile loading. By contrast, fracture toughness specimens hold a constrained stress state near the crack-tip due to bending mode. The loss of constraint is significant for high strength steels with high yield-to-tensile ratios (= yield stress/tensile strength) which have been extensively developed and widely applied to structures in recent years.

This International Standard specifies a method for converting the CTOD (crack-tip opening displacement) fracture toughness obtained from laboratory specimens to an equivalent CTOD for structural components, taking constraint loss into account. This method can also apply to fracture assessment using the stress intensity factor or the *J*-integral concept (see Clause 9).

This International Standard deals with the unstable fracture that occurs from a crack-like defect or fatigue crack in ferritic structural steels. Unstable fracture accompanied by a significant amount of ductile crack extension and ductile fractures are not included in the scope hereof.

The CTOD fracture toughness of structural steels is measured in accordance with the established test methods, ISO 12135[1)] or BS 7448-1. The fracture assessment of a cracked component is done using an established method such as FAD (Failure Assessment Diagram) in the organization concerned, and reference is not made to the details thereof in this International Standard.

This International Standard can be used for eliminating the excessive conservatism frequently associated with the conventional fracture mechanics methods and accurately assessing the unstable fracture initiation limit of structural components from the fracture toughness of the structural steel. This is also used for rationally determining the fracture toughness of materials to meet the design requirements of performance of structural components.

2 Normative references

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

ISO 12135, *Metallic materials — Unified method of test for the determination of quasistatic fracture toughness*

BS 7448-1, *Fracture mechanics toughness tests —Part 1: Method for determination of* K_{Ic}, critical CTOD and critical J values of metallic materials

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12135 and the following apply.

1) To be published.