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Method of test for determination of fracture toughness in metallic materials using single edge notched tension (SENT) specimens

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Contents

Summary of pages

This document comprises a front cover, an inside front cover, pages i to ii, pages 1 to 22, an inside back cover and a back cover.

Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 1 December 2014. It was prepared by Subcommittee ISE/101/4, *Toughness testing*, under the authority of Technical Committee ISE/101, *Test methods for metals*. A list of organizations represented on these committees can be obtained on request to their secretary.

Information about this document

This standard has been developed primarily to meet the needs of the steel pipeline industry where this method has been used to determine the fracture toughness of girth welds experiencing plastic straining during installation.

Hazard warnings

WARNING. This British Standard calls for the use of substances and/or procedures that can be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Use of this document

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its methods are expressed as a set of instructions, a description, or in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

1 Scope

This British Standard gives methods for determining fracture toughness in metallic materials in terms of δ (crack tip opening displacement, CTOD) and J (experimental equivalent of the J-integral) using single edge notched tension (SENT) specimens.

This British Standard gives a method for determining fracture toughness as a resistance to ductile crack extension (R-curve). A method for single point determination of fracture toughness is also given. The method uses specimens which have been notched and fatigue pre-cracked into parent metal, weld metal or heat affected zone (HAZ). The specimens are loaded in tension, and the force and crack mouth opening displacement are recorded.

NOTE Methods to evaluate the suitability of a weld for notch placement within the target area and, where appropriate, to evaluate the effectiveness of the fatigue crack in sampling these areas are given in BS EN ISO 15653.

2 Normative references

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

BS EN ISO 15653:2010, *Metallic materials – Method of test for the determination of quasistatic fracture toughness of welds*

ISO 12135:2002, *Metallic materials – Unified method of test for the determination of quasistatic fracture toughness*

3 Terms, definitions and symbols

For the purposes of this British Standard, the following terms, definitions and symbols apply.

3.1 Terms and definitions

3.1.1 blunting
apparent crack extension not associated with the creation of new fracture surface prior to the onset of unstable crack extension, pop-in or slow stable crack extension and occurring within the same plane as the fatigue pre-crack

3.1.2 target area
intended fatigue pre-crack tip position within the parent metal, weld metal or heat affected zone (HAZ)

3.1.3 pop-in
abrupt discontinuity in the force versus displacement record, indicated by a sudden increase in displacement and, generally, a sudden decrease in force, subsequent to which displacement and force increase to above their previous values

3.1.4 sample
un-notched blank cut from the source material

3.1.5 specimen
machined and notched sample ready for testing