

Australian Standard<sup>®</sup>

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**MACROSCOPIC ASSESSMENT**

**OF THE NON-METALLIC INCLUSION  
CONTENT IN WROUGHT STEEL**

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The following scientific, industrial and governmental organizations and departments were officially represented on the committee entrusted with the preparation of this standard:

Associated Chambers of Manufacturers of Australia  
Bureau of Steel Manufacturers of Australia  
Commonwealth Aircraft Corporation  
Department of Defence  
Federated Chamber of Automotive Industries  
Institute of Steel Service Centres of Australia  
Metal Trades Industry Association of Australia  
Railways of Australia Committee  
Society of Automotive Engineers - Australasia  
Telecom Australia  
University of New South Wales (School of Metallurgy)

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## PREFACE

This standard was prepared by the Association's Committee on Metallography. It describes three macroscopic methods for the assessment of the non-metallic inclusion content in wrought steel, each method having a specific application. It is one of two standard methods for the assessment of the non-metallic inclusion content in steel, the other covering micrographic methods.

During the preparation of this standard, the committee considered the following overseas standards and draft International standard:

- ASTM E45 Recommended Practice for Determining the Inclusion Content of Steel
- JIS-G-0556 Method of Macro Streak Flaw Test for Steel
- ISO/DIS 3763 Wrought Steels, Macroscopic Methods for Assessing Content of Non-Metallic Inclusions.

The standard is in general agreement with ISO/DIS 3763, the only significant difference being a departure from the procedure for the sampling of bars and billets in the quarter position, and the deletion of standard diagrams for reference purposes in the oxidation-fracture test.

This standard requires reference to the following Australian standards:

- AS 1171 Methods for the Magnetic Particle Testing of Ferromagnetic Products and Components
- AS 1733 Methods for the Determination of Grain Size in Metals
- AS 2085 Magnetic Particle Testing Media

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## STANDARDS ASSOCIATION OF AUSTRALIA

## Australian Standard

**METHODS FOR THE MACROSCOPIC ASSESSMENT  
OF THE NON-METALLIC INCLUSION CONTENT  
IN WROUGHT STEEL**

**1 SCOPE.** This standard describes macroscopic methods for the assessment of the non-metallic inclusion content in wrought steel products.

**2 LIMITATIONS.** The methods in this standard are—

- (a) limited to the examination of wrought steel in which the non-metallic inclusions are of sufficient size to permit assessment by the naked eye or with the aid of magnification not exceeding 10×;
- (b) not suitable for the detection of small globular inclusions, or of chains of fine elongated inclusions in wrought steel;
- (c) not suitable for distinguishing between different types of inclusions such as sulphides, silicates and oxides in wrought steel.

**3 DEFINITIONS.** For the purpose of this standard the following definitions apply:

**3.1 Non-metallic inclusion**—non-metallic compounds and mixtures in steel resulting from entrapment of deoxidation products or exogenous materials, such as refractories or hot topping compounds during solidification.

NOTE: Inclusion type, shape, size and distribution will vary greatly depending on the grade of steel, method of deoxidation, size and shape of ingot, amount of reduction received, and the position of the test piece relative to the ingot.

**3.2 Test sample**—a portion of material or a group selected from a batch by a sampling procedure.

**3.3 Test specimen**—a portion of material or a single item taken from the test sample for the purpose of applying a particular test.

**3.4 Test piece**—a prepared piece for testing, made from a test specimen by some mechanical operation.

**4 TESTS.****4.1 Oxidation-fracture Test.**

**4.1.1 Application.** The oxidation-fracture test is suitable for the assessment of all wrought steel products that can be hardened by heat treatment to approximately HRC 60, and have a grain size of 7 or finer.\*

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\* See AS 1733, Methods for the Determination of the Grain Size in Metals.