



Standard Guide for Preparing and Evaluating Specimens for Automatic Inclusion Assessment of Steel¹

This standard is issued under the fixed designation E 768; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide² covers two preparation methods for steel metallographic specimens that will be analyzed for nonmetallic inclusions with automatic image analysis (AIA) equipment. The two methods of preparation are offered as accepted methods used to retain nonmetallic inclusions in steel. This guide does not limit the user to these methods.

1.2 A procedure to test the suitability of the prepared specimen for AIA inclusion work, using differential interference contrast (DIC), is presented.

2. Referenced Documents

2.1 ASTM Standards:

E 3 Methods of Preparation of Metallographic Specimens³

E 7 Terminology Relating to Metallography³

E 45 Test Methods for Determining the Inclusion Content of Steel³

E 883 Guide for Reflected-Light Photomicrography³

E 1122 Practice for Obtaining JK Inclusion Ratings Using Automatic Image Analysis³

E 1245 Practice for Determining the Inclusion or Second-Phase Constituent Content of Metals by Automatic Image Analysis³

3. Terminology

3.1 Definitions:

3.1.1 For definitions used in this practice, refer to Terminology E 7.

3.1.2 *differential interference contrast microscopy*—a comprehensive definition appears in Guide E 883, paragraph 11.8.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *rigid grinding disk*—a non-fabric support surface, such as a composite of metal/ceramic or metal/polymer, charged with an abrasive (usually 6 to 15-μm diamond particles), and used as the fine grinding operation in a metallographic preparation procedure.

4. Significance and Use

4.1 Inclusion ratings done either manually using Test Methods E 45 or automatically using Practice E 1122 or E 1245 are influenced by the quality of specimen preparation. This guide provides examples of proven specimen preparation methods that retain inclusions in polished steel specimens.

4.2 This guide provides a procedure to determine if the prepared specimens are of suitable quality for subsequent rating of inclusions. None of these methods should be construed as defining or establishing specific procedures or limits of acceptability for any steel grade.

5. Preparation Methods

5.1 Background:

5.1.1 The inclusions in the plane of polish must be fully preserved and clearly visible. Preparation should not produce excessive relief around the perimeter of the inclusions that would exaggerate the size and number of inclusions on the plane of polish. In many cases, the preparation of specimens for inclusion rating is more readily performed after the specimens have been hardened by a suitable heat treatment procedure (austenize, quench to fully martensitic structure, temper at a relatively low temperature).

5.1.2 Cleanliness is an important consideration in all stages of specimen preparation.

5.1.2.1 Heat-treated specimens should be wire brushed or shot blasted or have the surface ground to remove adherent scale.

5.1.2.2 After completing the grinding steps and before performing the polishing steps, the specimens and specimen holders must be cleaned to prevent contamination of the next preparation step. Cleaning the specimens and specimen holders between each grinding step can eliminate contamination of coarse abrasives to the following finer preparation step.

5.1.2.3 After the preparation is complete, swab the surface carefully with cotton and a water/soap solution containing a corrosion inhibitor such as a machine coolant or ethyl alcohol solution to remove any films or other debris that would interfere with the inclusion rating.

5.1.2.4 It is advisable to perform the inclusion analysis as soon as possible after preparation to minimize staining or other problems that can affect the analysis.

¹ This test method is under the jurisdiction of ASTM Committee E-4 on Metallography and is the direct responsibility of Subcommittee E04.01 on Sampling Specimen Preparation, and Photography.

Current edition approved April 10, 1999. Published July 1999.

² Supporting data available from ASTM Headquarters. Request E04.1002.

³ *Annual Book of ASTM Standards*, Vol 03.01.