



Standard Practice for Instrumented Indentation Testing¹

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1. Scope*

1.1 This practice defines the basic steps of Instrumented Indentation Testing (IIT) and establishes the requirements, accuracies, and capabilities needed by an instrument to successfully perform the test and produce the data that can be used for the determination of indentation hardness and other material characteristics. IIT is a mechanical test that measures the response of a material to the imposed stress and strain of a shaped indenter by forcing the indenter into a material and monitoring the force on, and displacement of, the indenter as a function of time during the full loading-unloading test cycle.

1.2 The operational features of an IIT instrument, as well as requirements for Instrument Verification (**Annex A1**), Standardized Reference Blocks (**Annex A2**) and Indenter Requirements (**Annex A3**) are defined. This practice is not intended to be a complete purchase specification for an IIT instrument.

1.3 With the exception of the non-mandatory **Appendix X4**, this practice does not define the analysis necessary to determine material properties. That analysis is left for other test methods. **Appendix X4** includes some basic analysis techniques to allow for the indirect performance verification of an IIT instrument by using test blocks.

1.4 Zero point determination, instrument compliance determination and the indirect determination of an indenter's area function are important parts of the IIT process. The practice defines the requirements for these items and includes non-mandatory appendixes to help the user define them.

1.5 The use of deliberate lateral displacements is not included in this practice (that is, scratch testing).

1.6 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.7 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate*

safety and health practices and determine the applicability of regulatory limitations prior to use.

2. Referenced Documents

2.1 ASTM Standards:²

E3 Guide for Preparation of Metallographic Specimens

E74 Practice of Calibration of Force-Measuring Instruments for Verifying the Force Indication of Testing Machines

E92 Test Method for Vickers Hardness of Metallic Materials (Withdrawn 2010)³

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E384 Test Method for Knoop and Vickers Hardness of Materials

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

E1875 Test Method for Dynamic Young's Modulus, Shear Modulus, and Poisson's Ratio by Sonic Resonance

E1876 Test Method for Dynamic Young's Modulus, Shear Modulus, and Poisson's Ratio by Impulse Excitation of Vibration

2.2 American Bearing Manufacturers Association Standard:

ABMA/ISO 3290-1 Rolling Bearings- Balls-Part 1: Steel Metal Balls⁴

2.3 ISO Standards:

ISO 14577-1, -2, -3, -4 Metallic Materials—Instrumented Indentation Tests for Hardness and Material Properties⁵

ISO 376 Metallic Materials—Calibration of Force-Proving Instruments for the Verification of Uniaxial Testing Machines⁵

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ The last approved version of this historical standard is referenced on www.astm.org.

⁴ Available from American Bearing Manufacturers Association (ABMA), 2025 M Street, NW Suite 800 Washington, DC 20036, <http://www.americanbearings.org>.

⁵ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

¹ This practice is under the jurisdiction of ASTM Committee E28 on Mechanical Testing and is the direct responsibility of Subcommittee E28.06 on Indentation Hardness Testing.

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