



Standard Practice for Portable Hardness Testing by the Ultrasonic Contact Impedance Method¹

This standard is issued under the fixed designation A 1038; 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 practice covers the determination of comparative hardness values by applying the Ultrasonic Contact Impedance Method (UCI Method).

1.2 *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

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products

E 10 Test Method for Brinell Hardness of Metallic Materials

E 18 Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials

E 92 Test Method for Vickers Hardness of Metallic Materials

E 140 Test Method for Hardness Conversion Tables for Metals

E 384 Test Method for Microindentation Hardness of Materials

3. Terminology

3.1 *Definitions:*

3.1.1 *UCI method*—Ultrasonic Contact Impedance, a hardness testing method developed by Dr. Claus Kleesattel in 1961 based on the measurement of the frequency shift of a resonating rod caused by the essentially elastic nature of the finite area of contact between the indenter and the test piece during the penetration.

3.1.2 *UCI hardness test*—a hardness testing practice using a calibrated instrument by pressing a resonating rod with a

defined indenter, for example, a Vickers diamond, with a fixed force against the surface of the part to be tested.

3.1.3 *calibration*—determination of the specific values of the significant operating parameters of the UCI instrument by comparison with values indicated by a standardized workbench hardness tester or by a set of certified reference test pieces.

3.1.4 *verification*—checking or testing the UCI instrument to ensure conformance with this practice.

3.1.5 *surface finish*—all references to surface finish in this practice are defined as surface roughness (that is, R_a = average roughness value).

4. Significance and Use

4.1 The hardness of a material is a defined quantity having many scales and being dependent on the way the test is performed. In order to avoid the creation of a new practice involving a new hardness scale, the UCI method converts into common hardness values, for example, HV, HRC, etc.

4.2 The UCI hardness test is a superficial determination, only measuring the hardness condition of the surface contacted. The results generated at a specific location do not represent the part at any other surface location and yield no information about the material at subsurface locations.

4.3 The UCI hardness test may be used on large or small components at various locations. It can be used to make hardness measurements on positions difficult to access, such as tooth flanks or roots of gears.

A. GENERAL DESCRIPTION OF INSTRUMENTS AND TEST PROCEDURE FOR UCI HARDNESS TESTING

5. Apparatus

5.1 Instruments used for UCI hardness testing generally consist of (1) a probe containing a rod with a defined indenter, for example, a Vickers diamond, attached to the contacting end per Test Method **E 92** and Test Method **E 384**, (2) vibration generating means, (3) vibration detecting means, (4) electronic means for the numerical evaluation, and (5) a digital display, indicating the measured hardness number.

5.2 *UCI Probes*—There are different probes available for UCI hardness testing. They typically cover static loads ranging from 1 N to 98 N. See also **Appendix X1**. They come also in

¹ This practice is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.06 on Steel Forgings and Billets.

Current edition approved Jan. 1, 2005. Published February 2005.

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.