Designation: E92 – 16

Standard Test Methods for Vickers Hardness and Knoop Hardness of Metallic Materials[1]

This standard is issued under the fixed designation E92; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 These test methods cover the determination of the Vickers hardness and Knoop hardness of metallic materials by the Vickers and Knoop indentation hardness principles. This standard provides the requirements for Vickers and Knoop hardness machines and the procedures for performing Vickers and Knoop hardness tests.

1.2 This standard includes additional requirements in annexes:

Verification of Vickers and Knoop Hardness Testing Machines	Annex A1
Vickers and Knoop Hardness Standardizing Machines	Annex A2
Standardization of Vickers and Knoop Indenters	Annex A3
Standardization of Vickers and Knoop Hardness Test Blocks	Annex A4
Correction Factors for Vickers Hardness Tests Made on Spherical and Cylindrical Surfaces	Annex A5

1.3 This standard includes nonmandatory information in an appendix which relates to the Vickers and Knoop hardness tests:

Examples of Procedures for Determining Vickers and Knoop Hardness Uncertainty	Appendix X1

1.4 This test method covers Vickers hardness tests made utilizing test forces ranging from 9.807×10^{-3} N to 1176.80 N (1 gf to 120 kgf), and Knoop hardness tests made utilizing test forces from 9.807×10^{-3} N to 19.613 N (1 gf to 2 kgf).

1.5 Additional information on the procedures and guidance when testing in the microindentation force range (forces ≤ 1 kgf) may be found in Test Method E384, Test Method for Microindentation Hardness of Materials.

1.6 *Units*—When the Vickers and Knoop hardness tests were developed, the force levels were specified in units of grams-force (gf) and kilograms-force (kgf). This standard specifies the units of force and length in the International System of Units (SI); that is, force in Newtons (N) and length in mm or µm. However, because of the historical precedent and continued common usage, force values in gf and kgf units are provided for information and much of the discussion in this standard as well as the method of reporting the test results refers to these units.

NOTE 1—The Vickers and Knoop hardness numbers were originally defined in terms of the test force in kilogram-force (kgf) and the surface area or projected area in millimetres squared (mm^2). Today, the hardness numbers are internationally defined in terms of SI units, that is, the test force in Newtons (N). However, in practice, the most commonly used force units are kilogram-force (kgf) and gram-force (gf). When Newton units of force are used, the force must be divided by the conversion factor 9.80665 N/kgf.

1.7 The test principles, testing procedures, and verification procedures are essentially identical for both the Vickers and Knoop hardness tests. The significant differences between the two tests are the geometries of the respective indenters, the method of calculation of the hardness numbers, and that Vickers hardness may be used at higher force levels than Knoop hardness.

NOTE 2—While Committee E28 is primarily concerned with metallic materials, the test procedures described are applicable to other materials. Other materials may require special considerations, for example see C1326 and C1327 for ceramic testing.

1.8 *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]

C1326 Test Method for Knoop Indentation Hardness of Advanced Ceramics

C1327 Test Method for Vickers Indentation Hardness of Advanced Ceramics

E3 Guide for Preparation of Metallographic Specimens

E6 Terminology Relating to Methods of Mechanical Testing

E7 Terminology Relating to Metallography

[1] These test methods are 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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[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.

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