



# Standard Test Method for Vickers Hardness of Metallic Materials<sup>1</sup>

This standard is issued under the fixed designation E 92; 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 Department of Defense. Consult the DoD Index of Specifications and Standards for the specific year of issue which has been adopted by the Department of Defense.*

<sup>ε1</sup> NOTE—Section 27 was added editorially in October 1997.

## 1. Scope

1.1 This test method covers the determination of the Vickers hardness of metallic materials, using applied loads of 1 kgf to 120 kgf,<sup>2</sup> the verification of Vickers hardness testing machines (Part B), and the calibration of standardized hardness test blocks (Part C). Two general classes of standard tests are recognized:

1.1.1 *Verification, Laboratory, or Referee Tests*, where a high degree of accuracy is required.

1.1.2 *Routine Tests*, where a somewhat lower degree of accuracy is permissible.

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:*

E 4 Practices for Force Verification of Testing Machines<sup>3</sup>

E 140 Hardness Conversion Tables for Metals (Relationship Between Brinell Hardness, Vickers Hardness, Rockwell Hardness, Rockwell Superficial Hardness, Knoop Hardness, and Scleroscope Hardness)<sup>3</sup>

E 384 Test Method for Microhardness of Materials<sup>3</sup>

## 3. Terminology

3.1 *Vickers hardness number, HV*—a number related to the applied load and the surface area of the permanent impression made by a square-based pyramidal diamond indenter having included face angles of 136° (see Fig. 1 and Table 1), computed from the equation:

$$HV = 2P \sin (\alpha/2)/d^2 = 1.8544P/d^2$$

where:

$P$  = load, kgf,

$d$  = mean diagonal of impression, mm, and

$\alpha$  = face angle of diamond = 136°.

3.2 *Vickers hardness test*—an indentation hardness test

using calibrated machines to force a square-based pyramidal diamond indenter having specified face angles, under a pre-determined load, into the surface of the material under test and to measure the diagonals of the resulting impression after removal of the load.

3.2.1 Vickers hardness tests are made at test loads of 1 kgf to 120 kgf.

3.2.2 For practical purposes the Vickers hardness number is constant when a square-based diamond pyramid with a face angle of 136° is used with applied loads of 5 kgf and higher. At lower test loads the Vickers hardness may be load-dependent. In Table 2 are given the Vickers hardness numbers for a test load of 1 kgf. For obtaining hardness numbers when other test loads are used, the Vickers hardness number obtained from Table 2 is multiplied by the test load in kilograms-force (Table 3).

NOTE 1—The Vickers hardness number is followed by the symbol HV with a suffix number denoting the load and second suffix number indicating the duration of loading when the latter differs from 10 to 15 s, which is the normal loading time.

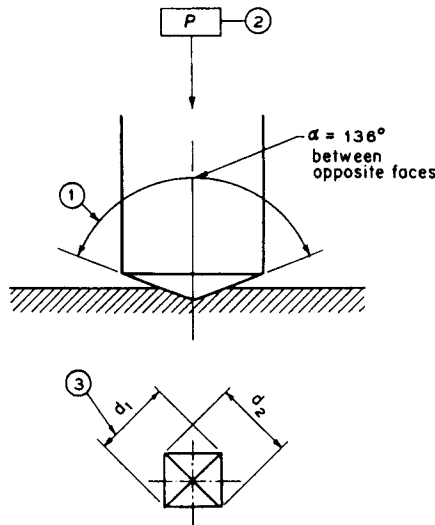


FIG. 1 Vickers Hardness Test (see Table 1)

TABLE 1 Symbols and Designations Associated with Fig. 1

| Number | Symbol | Designation                                          |
|--------|--------|------------------------------------------------------|
| 1      | ...    | Angle at the vertex of the pyramidal indenter (136°) |
| 2      | $P$    | Test load in kilograms-force                         |
| 3      | $d$    | Arithmetic mean of the two diagonals $d^1$ and $d^2$ |

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee E-28 on Mechanical Testing and is the direct responsibility of Subcommittee E28.06 on Indentation Hardness Testing.

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<sup>2</sup> A procedure covering Vickers tests using applied loads of 1 gf to 1000 gf (1 kgf) may be found in Test Method E 384, Test Method for Microhardness of Materials, appearing in the *Annual Book of ASTM Standards*, Vol 03.01.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 03.01.