



Standard Test Method for Leeb Hardness Testing of Steel Products¹

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1. Scope

1.1 This test method covers the determination of the Leeb hardness of steel, cast steel, and cast iron (Part A), including the methods for the verification of Leeb hardness testing instruments (Part B), and the calibration of standardized test blocks (Part C).

NOTE 1—The original title of this standard was “Standard Test Method for Equotip Hardness Testing of Steel Products.”¹

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 *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

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

3. Terminology

3.1 *Definitions:*

3.1.1 *calibration*—determination of the values of the significant operating parameters of the instrument by comparison with values indicated by a reference instrument or by a set of reference standards.

3.1.2 *Leeb hardness number*—a number equal to the ratio of the rebound velocity to the impact velocity of a 3-mm or 5-mm (based on the type of impact device) diameter spherically

shaped tungsten carbide, silicon nitride, or diamond tipped impact body, multiplied by 1000.

$$L = \frac{\text{Rebound Velocity}}{\text{Impact Velocity}} \times 1000$$

The Leeb hardness number is followed by the symbol *HL* with one or more suffix characters representing the type of impact device.

3.1.3 *Leeb hardness test*—a dynamic hardness test method using a calibrated instrument that impacts a spherically shaped tungsten carbide, silicon nitride, or diamond tipped body with a fixed velocity (generated by a spring force) onto a surface of the material under test. The ratio of the rebound velocity to the impact velocity of the impact body is a measure of the hardness of the material under test.

3.1.4 *surface finish*—all references to surface finish in this test method are defined as surface roughness (that is, *Ra* = average roughness value, *AA* = arithmetic average).

3.1.5 *verification*—checking or testing the instrument to ensure conformance with this test method.

4. Summary of Test Method

4.1 During a hardness test, an impact body with a spherically shaped tungsten carbide, silicon nitride, or diamond tip impacts under spring force, the test surface from which it rebounds. The impact and rebound velocities are measured when the impact body is approximately 1 mm from the test surface. This is accomplished by means of a permanent magnet mounted in the impact body which, during the test, moves through a coil in the impact device and induces an electric voltage on both the impact and rebound movements. These induced voltages are proportional to the respective impact and rebound velocities. The quotient of these measured voltage values derived from the impact and rebound velocities, multiplied by the factor 1000 produces a number which constitutes the Leeb hardness value.

5. Significance and Use

5.1 Hardness of a material is a poorly defined term that may have many meanings depending on the type of test performed and the expectations of the person involved. The Leeb hardness test is of the dynamic or rebound type, which primarily depends both on the plastic and on the elastic properties of the

¹ This test method 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.

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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.