



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).

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

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

2. Referenced Documents

2.1 ASTM Standards:

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method²

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 tungsten carbide ball 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 carbide ball 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. Significance and Use

4.1 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 material being tested. The results obtained are indicative of the strength and dependent on the heat treatment of the material tested.

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

A. GENERAL DESCRIPTION OF INSTRUMENTS AND TEST PROCEDURE FOR LEEB HARDNESS TEST

5. Apparatus

5.1 The instrument used for Leeb hardness testing consists of (1) an impact device that is equipped with a tungsten carbide ball or synthetic diamond tipped impact body, an induction coil velocity measuring assembly, and a support ring, and (2) an electronic digital display hardness indicating device.

5.2 *Impact Devices*—There are six types of impact devices used in Leeb hardness testing. These are the *D*, *DC*, *D+15*, *G*, *C*, and the *E* impact units. Brief descriptions of the types of devices and their common applications are given in Appendix X1.

5.3 *Summary of Test Method*—During a hardness test, an impact body with a spherically shaped tungsten carbide or diamond tip impacts under spring force, the test surface from which it rebounds. The impact and rebound velocities are

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 *Annual Book of ASTM Standards*, Vol 14.02.