Australian Standard®

REBOUND HARDNESS TESTS ON METALS

Part 1—SHORE ‘C’ METHOD

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Aluminium Development Council
Australasian Institute of Metals
Bureau of Steel Manufacturers of Australia
Commonwealth Scientific and Industrial Research Organization
Confederation of Australian Industry
Department of Defence
Federal Chamber of Automotive Industries
Metal Trades Industry Association of Australia
National Association of Testing Authorities
Railways of Australia Committee
Society of Automotive Engineers—Australasia
University of Melbourne
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Part 1—SHORE ‘C’ METHOD

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PREFACE

This standard was prepared under the direction of the Association's Committee on Mechanical Testing of Metals by its subcommittee on hardness testing as the result of a request from industry to provide a standard method for measuring hardness on such items as large castings and mill rolls. It forms Part 1 of a two-part standard dealing with rebound hardness test methods, and sets out the method for measuring the rebound hardness of large non-austenitic ferrous castings and forgings based on the principle of the Short 'C' Scleroscope. Part 2* deals with the measurement of hardness based on rebound velocity.

The method specified in this standard has been restricted to the use of 'C' type instruments, since comment received at public review stage indicated that a need did not exist in Australia for a method using 'D' type instruments. Should such a need arise, a separate standard will be prepared for 'D' type instruments.

During preparation of this standard, cognizance was taken of the following standards:

ASTM A 427 Standard Specification for Wrought Alloy Steel Rolls for Cold and Hot Reduction

ASTM E 140 Standard Hardness Conversion Tables for Metals

ASTM E 448 Standard Recommended Practice for Scleroscope Hardness Testing of Metallic Materials

JIS B 7727 Shore Hardness Testing Machines

JIS B 7731 Standard Blocks of Shore Hardness

JIS Z 2246 Method of Shore Hardness Test.

The conversion table included as Table C1 has been taken from JIS B 7731, and due acknowledgement is made to the Japanese Standards Association which gave its approval for reproduction of the table.

* In course of preparation.

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FOREWORD

Uniform hardness scales are normally maintained by reference to national scales generated by precisely constructed standardizing machines. No such machines currently exist in Australia for rebound hardness scales based on rebound height, although such a machine is maintained in Japan.* To ensure a reasonable degree of uniformity of these scales in the interval before suitable standardizing machines become available in Australia, the scales defined in this standard have been referred for standardizing purposes only to the Vickers scales by correlation. The correlation has been based on a formula published in JIS B 7731 (see Appendix C).

This correlation is intended to be applied to the calibration of hardness blocks used in the initial and periodic calibration of rebound hardness testing instruments only and should not be used for any other purpose.

The conversion tables given in ASTM E 140 differ from values given by the conversion equation published in JIS B 7731 by small amounts only.

Conversion tables given in ASTM A 427 are applicable to a modified form of the Shore Scleroscope intended for the measurement of hardness of forged steel rolls. The hardness value produced by this type of instrument is significantly different from the value obtained by the method outlined in the standard.

* National Research Laboratory of Metrology (NRLM), Japan.

METHOD

1 SCOPE. This standard sets out the method for measuring the rebound hardness of large non-austenitic ferrous castings and forgings based on the principle of the Shore 'C' Scleroscope.

The standard includes requirements for the use of the hardness test instrument and for the initial and periodic calibrations, and recommendations for the maintenance of test instruments by the user.

NOTE: This standard applies only to rebound hardness test instruments which can be mounted on fixed stands.

2 APPLICATION. Rebound hardness tests are carried out where size and the need to avoid surface damage are limiting factors in carrying out other types of hardness tests.

The test is not suitable for the testing of sheet or strip methods, or for the testing of magnetized metals.

3 REFERENCED DOCUMENTS. The following standards are referred to in this standard:

AS 1239 Steel—Schedule of Tool Steel Compositions

AS 1817 Method for Vickers Hardness Test
Part 1—Testing of Metals
Part 2—Calibration of the Testing Machine

AS 2193 Methods for Calibration and Grading of Force-measuring Systems of Testing Machines.

4 DEFINITIONS. For the purpose of this standard, the following definition applies:

Calibration—all the operations for the purpose of determining the values of the errors of a rebound hardness test instrument (and, if necessary, to determine other metrological properties).

5 PRINCIPLE OF TEST. The test involves the use of a calibrated instrument in which a hammer drops from a predetermined height onto the test surface. The height of rebound of the hammer is used as a measure of hardness.

6 HARDNESS VALUES. Shore rebound hardness numbers are measured on a uniformly divided scale which is calibrated with reference to the average height of rebound of the hammer from a standard test block.

The Shore hardness number is specified by adding HS after the hardness numeral, and 'C' to indicate the scale, e.g. 65 HSC.

NOTE: Some rebound hardness test instruments are made with a large profile hammer. The hardness scales on these instruments are calibrated with reference to standard test blocks with other hardness values and care should be taken in the interpretation of the results.

7 TEST EQUIPMENT.

7.1 General. The test instrument shall perform the test in accordance with the principle outlined in Clause 5 and shall comply with the requirements of Clauses 7.2 to 7.6.

7.2 Maintenance and calibration. The test instrument shall be maintained and calibrated in accordance with Appendices A and C.

7.3 Hammer. The hammer shall comprise a diamond with a tip in the form of a hemisphere rigidly attached concentric with a cylindrical body relieved circumferentially to reduce friction. The tip of the diamond may have a flat surface; any such surface shall be flat and square to the axis of the body (see Fig. 1). The dimensions and height of drop of the hammer shall comply with the requirements of Table 1. The diameter of any flat surface shall be adjusted to comply with the calibration requirements of Table 1 (see also Appendix C).

7.4 Glass tube. The hammer shall be guided during its fall and rebound by a glass tube the bottom of which, together with any termination device, shall form a reference surface in contact with the surface being tested. Vent holes shall be included in the bottom of the tube to allow the free escape of air while the hammer is falling.

The radial clearance between the hammer and the glass tube shall be—

(a) 0.25 ± 0.05 mm at a point corresponding to the top of the hammer when the hammer is in the latched position; and

(b) 0.025 ± 0.005 mm at the point corresponding to the lowest guide surface of the hammer when the tip of the diamond is in the plane of the instrument foot.

NOTE: Dimensions of the hammer and tube must be such that specified clearances are maintained.

7.5 Operation of the hammer. The hammer shall be actuated by a pneumatic system consisting of a rubber bulb and an activating mechanism such that the hammer can be drawn up and latched in a set position when the bulb is compressed and quickly released.

Hooks shall positively locate the hammer in the latched position and shall release the hammer cleanly when the bulb is recompressed.

A pneumatically activated cam shall rotate positively through one index position each time the bulb is compressed. The cam shall open and close a poppet valve which controls the movement of air both in and out of the tube.

TABLE 1

REQUIREMENTS FOR HAMMER FOR 'C' TYPE TEST INSTRUMENTS

Maximum dia. of any flat surface* mm	Dia. of hammer mm	Overall length of hammer mm	Mass of hammer g	Height of drop of hammer mm
0.4	5.54 to 6.2	21 ± 0.3	2.3 ± 0.5	251.2 $^{+0.1}_{-0.4}$

* Dimensions allow for adjustment to comply with calibration requirements.