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ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION

R 80

ROCKWELL HARDNESS TEST (B AND C SCALES) FOR STEEL

ISO 6508

1st EDITION

February 1959

For each individual country the only valid standard is the national standard of that country.

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BRIEF HISTORY

The ISO Recommendation R 80, *Rockwell Hardness Test (B and C Scales) for Steel*, was drawn up by Technical Committee ISO/TC 17, *Steel*, the Secretariat of which is held by the British Standards Institution (B.S.I.).

At the first meeting of ISO/TC 17, held in London, in June 1950, the Secretariat submitted a first draft proposal for the Rockwell hardness test, based on a document which had been drawn up by the former International Federation of the National Standardizing Associations (ISA). The Technical Committee instructed its Working Group No. 1, *Methods of Mechanical Testing for Steel*, to examine this draft proposal and to prepare a new version of it, taking into account certain observations put forward by Member Bodies.

In February 1952, the Working Group submitted a second draft proposal, which was discussed at the second plenary meeting of ISO/TC 17, held in New York, in June 1952, and which was passed back to the Working Group so that it might include therein data on tolerances.

The third draft proposal, submitted by the Working Group in August 1953, was studied by the Technical Committee during its third plenary meeting, held in London, in December 1953, along with the comments of the Member Bodies. The ISO/TC 17 Secretariat was then assigned to draw up a fourth draft proposal incorporating the changes voted during the meeting, and this was circulated in April 1954.

The comments of the Member Bodies on this fourth draft proposal were discussed at the fourth plenary meeting, held in Stockholm, in June 1955, and the Technical Committee decided to adopt it, subject to a few amendments, as a Draft ISO Recommendation.

On 28 September 1956, this Draft ISO Recommendation (No. 119) was distributed to all the ISO Member Bodies and was approved, subject to a few modifications of details, by the following Member Bodies:

*Australia	France	Pakistan
Belgium	*Greece	Poland
Bulgaria	Hungary	Portugal
*Canada	*Ireland	Spain
Chile	Italy	Sweden
Czechoslovakia	Japan	Switzerland
Denmark	Netherlands	U.S.S.R.
Finland	Norway	Yugoslavia

One Member Body opposed the approval of the Draft: Austria.

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in February 1959, to accept it as an ISO RECOMMENDATION.

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* These Member Bodies stated that they had no objection to the Draft being approved.

ISO Recommendation R 80 February 1959

ROCKWELL HARDNESS TEST (B AND C SCALES) FOR STEEL

1. PRINCIPLE OF TEST

The test consists in forcing a penetrator of standard type (cone or ball) into the surface of a test piece in two operations and measuring the permanent increase e of the depth of indentation of this penetrator under conditions defined later.

The unit of measurement for e is 0.002 mm, from which a number, known as the Rockwell hardness, is deduced.

2. SYMBOLS AND DESIGNATIONS

TABLE 1. — **Test with diamond cone (Rockwell C)**

Number	Symbol	Designation
1	—	Angle at the tip of the diamond cone (120°)
2	—	Radius of curvature at the tip of the cone (0.20 mm)
3	F_o	Preliminary load = 10 kgf
4	F_1	Additional load = 140 kgf
5	F	Total load = $F_o + F_1 = 10 + 140 = 150$ kgf
6	—	Depth of indentation under preliminary load before application of additional load
7	—	Increase in depth of indentation under additional load
8	e	Permanent increase of depth of indentation under preliminary load after removal of additional load, the increase being expressed in units of 0.002 mm
9	HRC	Rockwell hardness C = 100 − e

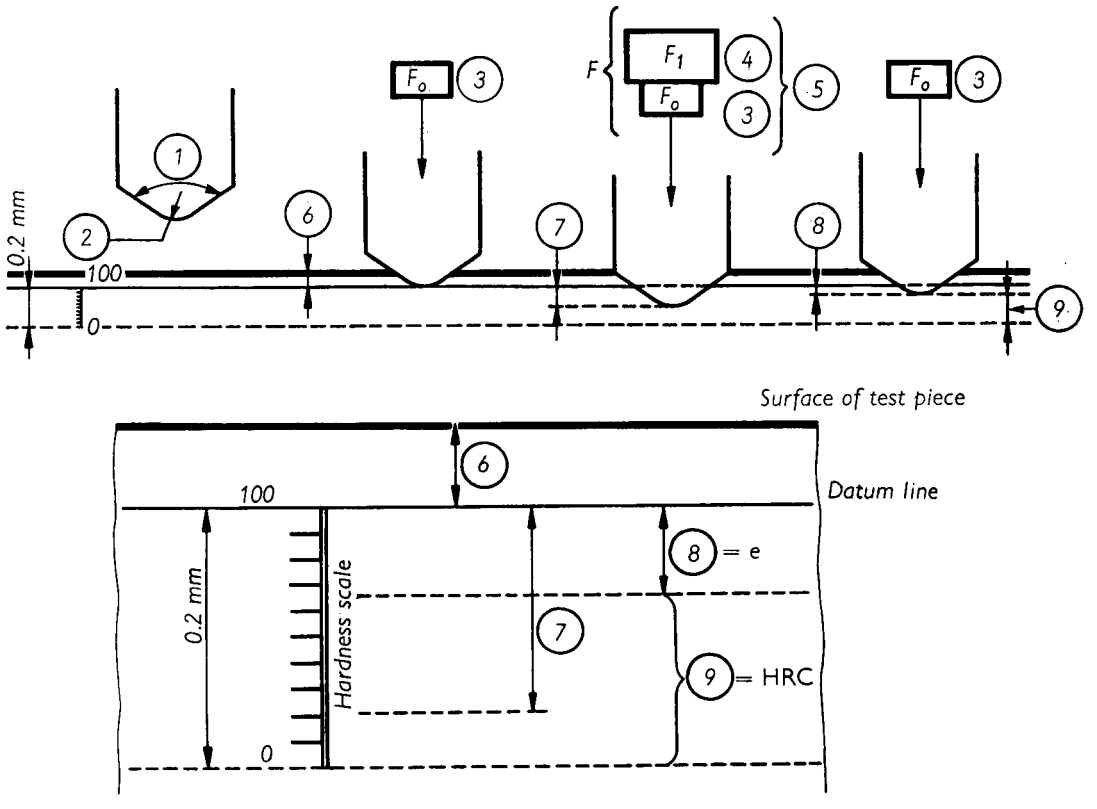

FIG. 1

TABLE 2. — **Test with steel ball (Rockwell B)**

Number	Symbol	Designation
1	D	Diameter of ball (1.587 5 mm or 1/16 in)
3	F_o	Preliminary load = 10 kgf
4	F_1	Additional load = 90 kgf
5	F	Total load = $F_o + F_1$ = 10 + 90 = 100 kgf
6	—	Depth of indentation under preliminary load before application of additional load
7	—	Increase in depth of indentation under additional load
8	e	Permanent increase of depth of indentation under preliminary load after removal of additional load, the increase being expressed in units of 0.002 mm
9	HRB	Rockwell hardness B = 130 − e

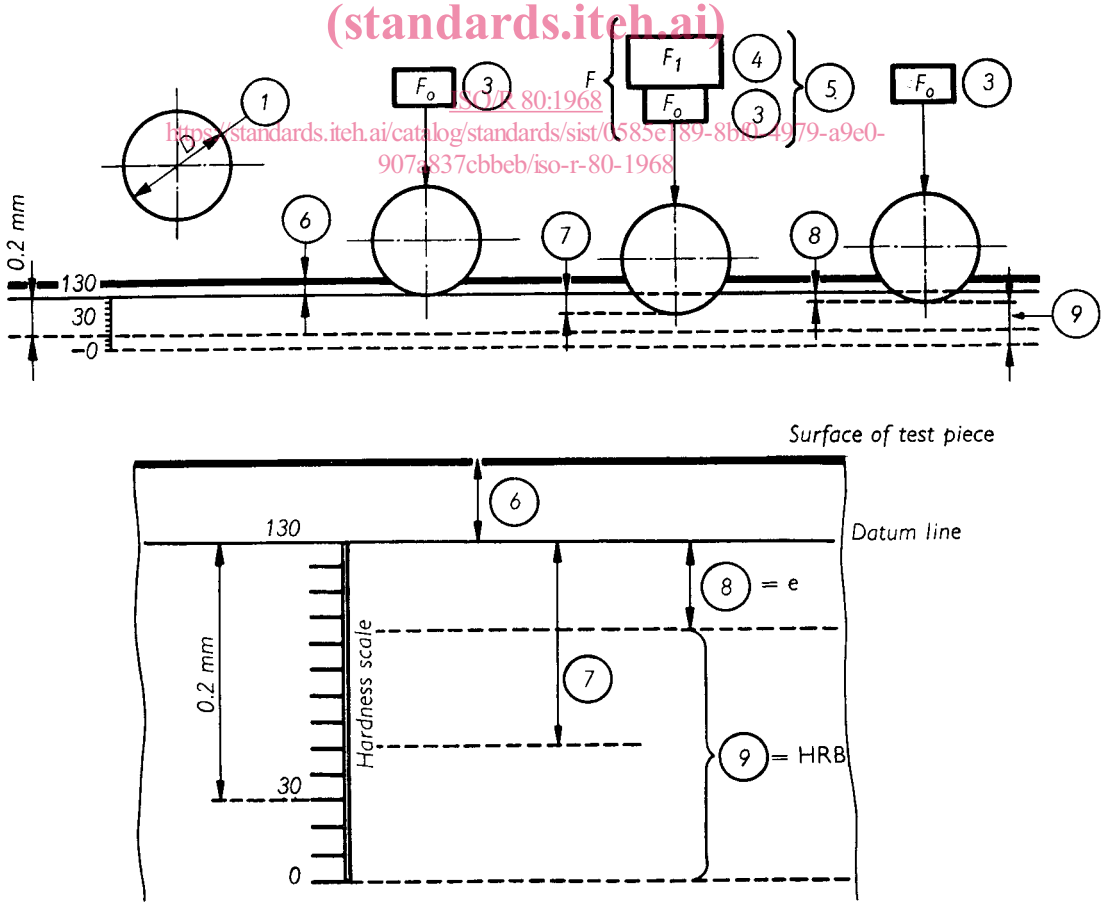

FIG. 2

3. TESTING EQUIPMENT

3.1 The conical penetrator is a diamond in the form of a right circular cone with a rounded tip. The diamond cone has an included angle of 120° ± 0.5° and its axis is in line with the axis of the penetrator within a tolerance of 0.5°. The tip of the cone is rounded to a radius of 0.20 mm and the contour of the tip of the cone should not depart from the nominal contour by more than 0.002 mm. The surface of the cone blends in a truly tangential manner with the surface of the sphere (see Note 2, page 7).

3.1.1 The penetrator should be free from cracks or other surface defects.

3.2 The ball penetrator is a hardened and polished steel ball having a diameter of 1.587 5 mm (1/16 in). No diameter of the ball should differ from the nominal diameter by more than ± 0.003 5 mm.*

3.2.1 The ball is of hardened steel with a hardness of at least 850 HV (taking into account the curvature of the ball, when testing); it should be polished and free from surface defects. Any ball showing any deformation after the test greater than the tolerance specified under clause 3.2 above or any surface defect should be rejected and the corresponding test discarded.

4. TEST REQUIREMENTS

4.1 The test is carried out at ambient temperature, unless otherwise specified.

4.2 The penetrator, when normal to, and in contact with the surface to be tested, is put, without sudden shock, under preliminary load:

$$F_o = 10 \text{ kgf} \pm 0.2 \text{ kgf}$$

Care should be taken that this load is not exceeded.

4.3 The dial of the indicator (depth gauge) is set at the initial position and the load increased, without sudden shock, within three to six seconds, by the value of the additional load:

$$F_1 = \begin{matrix} 140 \text{ kgf} \pm 0.7 \text{ kgf (cone)}, \\ 90 \text{ kgf} \pm 0.45 \text{ kgf (ball) (see Note 3, page 7)}, \end{matrix}$$

thus obtaining a total load:

$$F = F_o + F_1 = \begin{matrix} 150 \text{ kgf} \pm 0.9 \text{ kgf (cone)}, \\ 100 \text{ kgf} \pm 0.65 \text{ kgf (ball)}. \end{matrix}$$

4.4 When the needle of the indicator (depth gauge) is steady, the additional load F_1 is removed so as to bring the load back to the preliminary load F_o.

4.5 The permanent increase of depth of indentation e is read off from the dial and the Rockwell hardness number deduced. The indicator (depth gauge) should be accurate to ± 0.5 of a scale unit, i.e. to ± 0.001 mm.

4.5.1 Most dial scales give a direct reading of the Rockwell hardness number.

* These tolerances correspond to Grade 6 of the ISA System (ISA Bulletin 25).

4.6 The test should be carried out on a surface which is smooth and even, and free from oxide scale and foreign matter. Care should be taken in preparing the surface to avoid any change in condition, e.g. due to heating or cold working.

4.7 The radius of curvature of curved surfaces to be tested should be not less than 2.5 mm. The testing of curved surfaces with smaller radii should be the subject of special agreement.

4.8 The test piece should be placed on a rigid support. The contact surfaces should be clean and free from foreign matter (scale, oil, dirt, etc.). It is important that the test piece lies firmly on the support so that displacement cannot occur during the test.

4.8.1 After each change or removal and replacement of the penetrator or the support, it should be ascertained that the new penetrator (or the new support) is correctly mounted in its housing.

4.9 The thickness of the test piece or of the layer under test should be at least 8 times the permanent increase of depth e. No deformation should be visible at the back of the test piece after the test.

4.10 The distance between the centres of two adjacent indentations or from the centre of any indentation to the edge of the test piece should be at least 3 mm, unless otherwise agreed.

4.11 Throughout the test the apparatus should be protected from shock or vibration.

NOTES

1. There is no general process for converting accurately Rockwell hardness into other scales of hardness or tensile strength. These conversions therefore should be avoided, except for special cases where a reliable basis for the conversion has been obtained by comparison tests.

2. The form of the point and the size of the radius of the penetrator have an important effect on the Rockwell hardness number obtained. The anisotropy of diamonds makes difficult the machining of the penetrator to a precise symmetrical form.

3. Measurements made in accordance with this ISO Recommendation will probably be within ± 1 unit at 60 HRC; if results within $\pm 1\frac{1}{2}$ units are acceptable, the tolerance on the additional load F_1 may be increased to ± 1 per cent.

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