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INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION
R 868

PLASTICS

DETERMINATION OF INDENTATION HARDNESS OF PLASTICS BY MEANS OF A DUROMETER (SHORE HARDNESS)

1st EDITION

November 1968

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 868, *Plastics – Determination of indentation hardness of plastics by means of a durometer (Shore hardness)*, was drawn up by Technical Committee ISO/TC 61, *Plastics*, the Secretariat of which is held by the United States of America Standards Institute (USASI).

Work on this question led, in 1965, to the adoption of a Draft ISO Recommendation.

In September 1966, this Draft ISO Recommendation (No. 988) was circulated to all the ISO Member Bodies for enquiry. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

Australia	India	South Africa, Rep. of
Austria	Iran	Spain
Belgium	Ireland	Sweden
Brazil	Israel	Switzerland
Bulgaria	Italy	Thailand
Canada	Japan	Turkey
Chile	Korea, Rep. of	U.A.R.
Czechoslovakia	Netherlands	United Kingdom
Finland	Poland	U.S.A.
Germany	Portugal	U.S.S.R.
Hungary	Romania	

Two Member Bodies opposed the approval of the Draft :

France
New Zealand

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in November 1968, to accept it as an ISO RECOMMENDATION.

ISO Recommendation R 868 November 1968

PLASTICS

DETERMINATION OF INDENTATION HARDNESS OF PLASTICS BY MEANS OF A DUROMETER (SHORE HARDNESS)

1. SCOPE

1.1 This ISO Recommendation describes the procedure for determining the indentation hardness of plastics by means of durometers of two types; durometer Type A is used for softer plastics and durometer Type D for harder plastics (see Note, clause 7.2). The method permits measurement either of the initial indentation or of indentation after specified periods of time, or both.

NOTE. – The durometers and the methods described in this ISO Recommendation are referred to as Type A Shore and Type D Shore durometers and durometer methods.

1.2 These methods are empirical tests intended primarily for control purposes. No simple relationship exists between indentation hardness determined by this method and any fundamental property of the material tested. For specification purposes, it is recommended that ISO Recommendation R 48, *Determination of hardness of vulcanized natural and synthetic rubbers,* should be used for the softer materials.

2. PRINCIPLE

This method measures the penetration of a specified indenter forced into the material under specified conditions. The indentation hardness is inversely related to the penetration and is dependent on the modulus of elasticity and the viscoelastic properties of the material. The shape of the indenter and the force applied to it influence the results obtained so that there may be no simple relationship between the results obtained with one type of durometer and those obtained with either another type of durometer or another instrument for measuring hardness.

3. APPARATUS

The durometers, Types A and D, consist of the following components :

3.1 *Presser foot,* with a hole between 2.5 and 3.5 mm in diameter, centred at least 6 mm from any edge of the foot.

3.2 *Indenter,* formed from a hardened steel rod between 1.10 and 1.40 mm in diameter to the shape and dimensions shown in Figure 1, for Type A durometers, and Figure 2, for Type D durometers.

3.3 *Indicating device,* for reading the extent of protrusion of the point of the indenter beyond the face of the presser foot; this may be read directly in terms of units ranging from zero, for the full protrusion of 2.50 ± 0.04 mm, to 100, for nil protrusion obtained by placing the pressure foot and indenter in firm contact with a flat piece of glass.

3.4 *Calibrated spring,* for applying force to the indenter in accordance with one of the following equations :

(*a*) Force in grammes-force $= 56 + 7.66\,H_A$
where H_A is hardness reading on Type A durometer;

(*b*) Force in grammes-force $= 45.36\,H_D$
where H_D is hardness reading on Type D durometer.

4. TEST PIECE

4.1 For the determination of hardness by the Type A Shore durometer method, the test piece should be at least 5 mm thick, and by the Type D Shore durometer method, at least 3 mm thick. A test piece may be composed of thinner layers to obtain the necessary thickness, but determinations made on such test pieces may not agree with those made on one-piece test pieces because the surfaces between plies may not be in complete contact.

4.2 The dimensions of the test piece should be sufficient to permit measurements at least 12 mm away from any edge, unless it is known that identical results are obtained when measurements are made at a lesser distance from an edge. The surface of the test piece should be flat over an area sufficient to permit the presser foot to be in contact with the test piece over an area having a radius of at least 6 mm from the indenter point. Satisfactory durometer hardness determinations cannot be made on rounded, uneven, or rough surfaces.

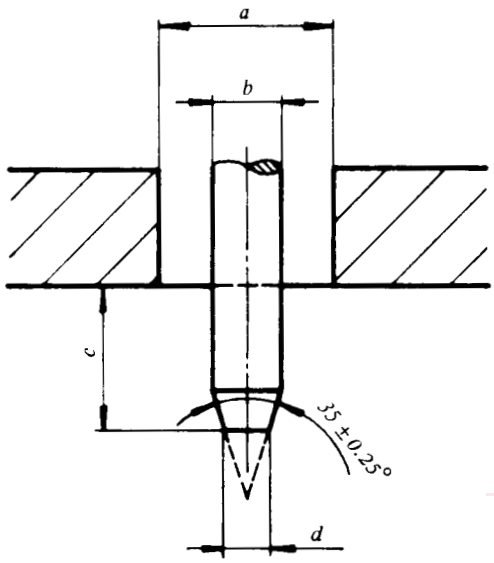

FIG. 1 – **Indenter for Type A durometer**

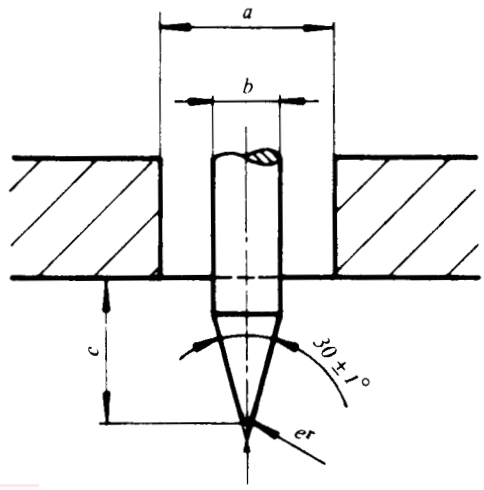

FIG. 2 – **Indenter for Type D durometer**

a	3 ± 0.5 mm
b	1.25 ± 0.15 mm
c	2.5 ± 0.04 mm
d	0.79 ± 0.03 mm
e^r	0.1 ± 0.012 mm

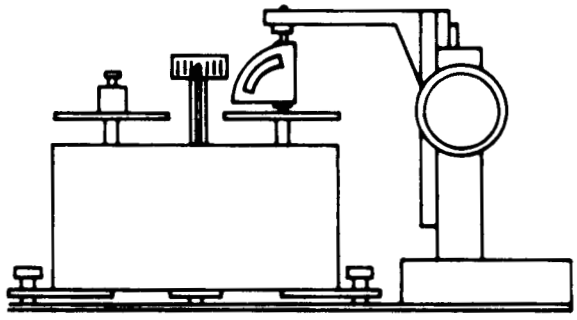

FIG. 3 – **Apparatus for calibration of durometer spring**

5. CALIBRATION

The spring of the durometer is calibrated by supporting the durometer in a vertical position and resting the point of the indenter on a small spacer at the centre of one pan of a balance, as shown in Figure 3, in order to prevent interference between the presser foot and the pan (see Note below). The spacer has a small cylindrical stem approximately 2.5 mm in height and 1.25 mm in diameter, and is slightly cupped on top to accommodate the indenter point. The mass of the spacer is balanced by a weight on the opposite pan of the balance. Weights are added to the opposite pan to balance the force on the indenter at various scale readings. The measured force should be equal to the force calculated by either equation (*a*) within ± 8 gf or equation (*b*) within ± 45 gf.

NOTE. – Instruments specifically designed for calibration of durometers may be used. Balances or instruments used for calibration should be capable of measuring or applying a force on the point of the indenter within 0.4 gf for Type A durometer, and within 2.0 gf for Type D durometer.

6. CONDITIONING

6.1 Temperature and humidity

Tests should be made in one of the standard atmospheres specified in R 291, *Standard atmospheres for conditioning and testing*, unless otherwise stated in the relevant material specification.

6.2 Conditioning

The durometer and test pieces should be conditioned at the temperature of test for at least 1 hour, before testing materials whose hardness is not dependent on the relative humidity (see Note below). For materials whose hardness is dependent on the relative humidity, the test pieces should be conditioned in accordance with ISO Recommendation R 291, or according to the applicable material specification.

NOTE. – When a durometer is moved from a location below room temperature to a location with a higher temperature, it should be placed in a suitable desiccator or airtight container immediately upon removal and allowed to remain there until the temperature of the durometer is above the dew point of the air in the new environment.

7. PROCEDURE

7.1 Place the test piece on a hard horizontal, plane surface. Hold the durometer in a vertical position with the point of the indenter at least 12 mm from any edge of the test piece. Apply the presser foot to the test piece as rapidly as possible, without shock, keeping the foot parallel to the surface of the test piece. Apply just sufficient pressure to obtain firm contact between presser foot and test piece (see Note below).

Read the scale after 15 ± 1 seconds. If an instantaneous reading is specified, read the scale within one second after the presser foot is in firm contact with the test piece.

NOTE. – Better reproducibility may be obtained by using either a durometer stand or a weight centred on the axis of the indenter, or both, to apply the presser foot to the test piece. Recommended masses are 1 kg for the Type A durometer and 5 kg for the Type D durometer.

7.2 Make five measurements of hardness at different positions on the test piece at least 6 mm apart and determine the mean value (see Note below).

NOTE. – It is recommended that measurements be made with the Type D durometer when values above 90 are obtained with the Type A durometer and that measurements be made with the Type A durometer when values less than 20 are obtained with the Type D durometer.