INTERNATIONAL STANDARD 868

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Plastics — Determination of indentation hardness by means of a durometer (Shore hardness)

Plastiques — Détermination de la dureté par pénétration au moyen d'un duromètre (dureté Shore)

First edition — 1978-05-15

UDC 678.5/.8 : 620.178.15

Ref. No. ISO 868-1978 (E)

Descriptors : plastics, tests, hardness tests, indentation hardness tests, test equipment, hardness testers, Shore hardness.

Price based on 3 pages

FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 868 was developed by Technical Committee ISO/TC 61, *Plastics*.

It was submitted directly to the ISO Council, in accordance with clause 6.12.1 of the Directives for the technical work of ISO. It cancels and replaces ISO Recommendation R 868-1968, which had been approved by the member bodies of the following countries :

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

The member bodies of the following countries had expressed disapproval of the document on technical grounds :

France
New Zealand

Printed in Switzerland

Plastics — Determination of indentation hardness by means of a durometer (Shore hardness)

1 SCOPE AND FIELD OF APPLICATION

1.1 This International Standard specifies a method for the determination of 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 the note in 8.2). The method permits measurement either of the initial indentation or of the indentation after specified periods of time, or both.

NOTE — The durometers and the methods specified in this International Standard are referred to as type A Shore and type D Shore durometers and durometer methods respectively.

1.2 This method is an empirical test 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 48, *Vulcanized rubbers — Determination of hardness (hardness between 30 and 85 IRHD)*, should be used for the softer materials.

2 REFERENCE

ISO 291, *Plastics — Standard atmospheres for conditioning and testing.*

3 PRINCIPLE

Measurement of 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.

4 APPARATUS

Shore durometers, types A and D. The durometers consist of the following components :

4.1 Presser foot, with a hole of diameter between 2,5 and 3,5 mm, centred at least 6 mm from any edge of the foot.

4.2 Indenter, formed from a hardened steel rod of diameter between 1,10 and 1,40 mm, to the shape and dimensions shown in figure 1, for type A durometers, and figure 2, for type D durometers.

4.3 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 0, 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.

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

a) $F = 549 + 75{,}12\, H_A$

where

F is the applied force, in millinewtons;

H_A is the hardness reading on the type A durometer.

b) $F = 444{,}83\, H_D$

where

F is the applied force, in millinewtons;

H_D is the hardness reading on the type D durometer.

5 TEST PIECE

5.1 For the determination of hardness by the type A Shore durometer method, the thickness of the test piece shall be at least 5 mm, and by the type D Shore durometer method, at least 3 mm. 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 surface between plies may not be in complete contact.

5.2 The dimensions of the test piece shall 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 shall 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.

Dimensions in millimetres

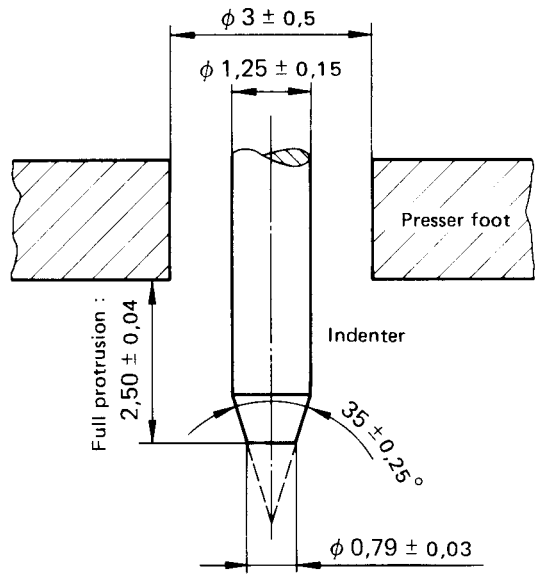

FIGURE 1 — **Indenter for type A durometer**

6 CALIBRATION

The spring of the durometer (4.4) is calibrated by supporting the durometer in a vertical position and resting the point of the indenter (4.2) 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 (4.1) and the pan (see the note). The spacer has a small cylindrical stem of height approximately 2,5 mm and diameter approximately 1,25 mm, 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 shall be equal to the force calculated by either equation 4.4 a) within ± 78 mN (± 8 gf) or equation 4.4 b) within ± 441 mN (± 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 3,9 mN (0,4 gf) for the type A durometer, and within 19,6 mN (2,0 gf) for the type D durometer.

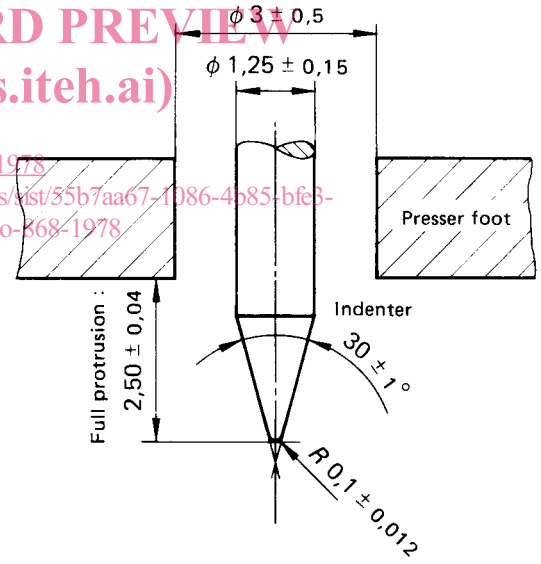

FIGURE 2 — **Indenter for type D durometer**

7 CONDITIONING AND TESTING ATMOSPHERES

7.1 For materials whose hardness is not dependent on the relative humidity (see the note), the durometer and test pieces shall be conditioned at the temperature of test (see 7.2) for at least 1 h before testing. For materials whose hardness is dependent on the relative humidity, the test pieces shall be conditioned in accordance with ISO 291, or according to the relevant 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.

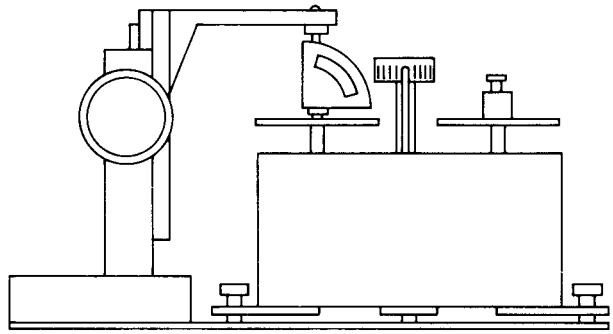

FIGURE 3 — **Apparatus for calibration of durometer spring**

7.2 Tests shall be carried out in one of the standard atmospheres specified in ISO 291, unless otherwise stated in the relevant material specification.

8 PROCEDURE

8.1 Place the test piece on a hard, horizontal, plane surface. Hold the durometer in a vertical position with the point of the indenter (4.2) at least 12 mm from any edge of the test piece. Apply the presser foot (4.1) 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 the note).

Read the scale of the indicating device (4.3) after 15 ± 1 s. If an instantaneous reading is specified, read the scale within 1 s 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.

8.2 Make five measurements of hardness at different positions on the test piece at least 6 mm apart and determine the mean value.

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.

9 TEST REPORT

The test report shall include the following particulars :

a) reference to this International Standard;

b) complete identification of the material tested;

c) description of test piece, including thickness and, in the case of a composite test piece, the number of layers;

d) temperature of test, and relative humidity when hardness of the material is dependent on humidity;

e) type of durometer (A or D);

f) time elapsed between the preparation of the test piece and the measurement of hardness;

g) individual values of indentation hardness and time-interval after which each reading was taken;

NOTE – Readings may be reported in the form A/45/15, where A is the type of durometer, 45 the reading, and 15 the time in seconds between bringing the pressure foot in firm contact with the test piece and taking the reading. Similarly, D/60/1 indicates a reading of 60 on the type D durometer obtained either within 1 s or from a maximum indication.

h) average value of indentation hardness;

j) date of test;

k) details of procedure not specified in this International Standard and any incidents likely to have had an influence on the results.