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# INTERNATIONAL STANDARD



# 2039

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## Plastics and ebonite — Determination of hardness by the ball indentation method

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## 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 2039 was drawn up by Technical Committee ISO/TC 61, *Plastics*, and circulated to the Member Bodies in December 1970.

It has been approved by the Member Bodies of the following countries :

|                     |                |                       |
|---------------------|----------------|-----------------------|
| Austria             | India          | South Africa, Rep. of |
| Belgium             | Israel         | Spain                 |
| Canada              | Japan          | Sweden                |
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| Egypt, Arab Rep. of | Netherlands    | Turkey                |
| France              | Poland         | U.S.A.                |
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The Member Bodies of the following countries expressed disapproval of the document on technical grounds :

Australia  
Italy  
New Zealand  
United Kingdom

# Plastics and ebonite — Determination of hardness by the ball indentation method

## 1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies a method for determining the hardness of plastics by means of a loaded ball indenter. The method may also be used for the testing of hard rubber — ebonite.

## 2 REFERENCE

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

## 3 DEFINITION

For the purpose of this International Standard the ball-indentation hardness is defined as the quotient of the load on the ball indenter by the surface area of the impression caused by the ball indenter after a specified time of load application. It is expressed in decanewtons per square millimetre.

## 4 SIGNIFICANCE OF THE TEST

The ball indentation hardness determined by this method may provide data for research and development, quality control and acceptance or rejection under specifications.

## 5 PRINCIPLE OF THE METHOD

The method consists of forcing a ball under a specified load into the surface of the test specimen. The depth of impression is measured under load. The surface area of the impression is computed from its depth. The ball-indentation hardness is then calculated from the following relationship :

$$\text{Ball-indentation hardness} = \frac{\text{Applied load}}{\text{Surface area of impression}}$$

There are two methods, designated A and B.

Method A is particularly useful for evaluating the hardness of superficial layers (penetration being limited to small depths : 100  $\mu\text{m}$ ). It requires the more precise apparatus.

Method B is used more for measuring the hardness of thicker layers (depth of penetration 350  $\mu\text{m}$ ). The apparatus may therefore be less precise (see 6.5).

## 6 APPARATUS

**6.1** The apparatus shall consist essentially of a frame with an adjustable platform fitted with a plate to support the test specimen, an indenter with its associated fittings and a device for applying the load without impact.

The apparatus shall be equipped with a device to measure the depth of penetration of the indenter with the accuracy indicated in 6.5.

The frame shall not be deformed under the maximum load by more than 0,03 mm for method A or 0,05 mm for method B, the deformation being measured along the main axis of the applied force.

**6.2** The indenter shall be made from hardened steel of Vickers hardness 800 daN/mm<sup>2</sup> and shall be polished. The ball shall not show any deformation or damage after the test.

Diameter of the ball :

### Method A

The reference ball is the 5 mm diameter ball. If, with any of the loads given in 6.4, the 5 mm ball does not permit the requirements given in 6.5 to be respected, it is possible to use, in order of preference, the 10 mm, 7,5 mm or 2,5 mm ball.

### Method B

5,0 mm.

The diameter of the ball shall be within  $\pm 1\%$  of the nominal diameter.

**6.3** The initial load (tolerance  $\pm 1\%$ ) shall be as follows :

### Method A

0,245 daN for a test load up to and including 9,8 daN.

0,98 daN for a test load greater than 9,8 daN.

### Method B

0,98 daN.