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Draft Indian Standard

PLASTICS — METHODS OF TESTING
PART 5 MECHANICAL PROPERTIES
SECTION 14 DETERMINATION OF INDENTATION HARDNESS OF RIGID PLASTIC BY MEANS OF
BARCOL IMPRESSER

(*First Revision of IS 13360 (Part 5/ Sec 14)*)

(ICS 55.120)

Methods of Sampling and Test for
Plastics Sectional Committee, PCD 27

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FOREWORD

(*Formal clauses to be added later*)

This Indian Standard was originally published in 2001. In this revision, the modifications are as follows:

- Clauses 2 (Summary of test method) and 9 (Number of readings) have been modified; and
- Editorial corrections have been done.

The Barcol Impressor is portable and therefore suitable for testing the hardness of fabricated parts and individual test specimens for production control purposes.

For many materials, there may be a specification that requires the use of the test method prescribed in this standard, but with some procedural modifications that take precedence when adhering to the specification. Therefore, it is advisable to refer to that material specification before using this test method.

While preparing this standard, assistance has been derived from ASTM D2583 'Standard test method for indentation hardness of rigid plastics by means of a Barcol Impressor' issued by American Society for Testing and Materials (ASTM), USA.

In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'.

1 SCOPE

This standard (Part 5/Sec 14) prescribes a method for the determination of indentation hardness of both reinforced and non-reinforced rigid plastics using a Barcol Impressor, Model No. 934-1 and Model No. 935.

2 SUMMARY OF TEST METHOD

Model No. 934-1 is used for measuring harder materials and Model No. 935 is used for measuring softer materials within the range of hardness measured by these impressors.

3 APPARATUS

3.1 Indentor

The indentor shall consist of a hardened steel truncated cone having an angle of 26° with a flat tip of 0.157 mm in diameter. It shall fit into a hollow spindle and be held down by a spring-loaded plunger. (*see* Fig. 1).

3.2 Indicating Device

The indicating dial shall have 100 divisions, each representing a depth of 0.0076 mm penetration. Higher the reading, harder the material.

3.3 Calibration Standards

'Hard' and 'soft' aluminium alloy disks supplied by the manufacturer of the instrument shall be used. Other disks shall not be used, even if they are of the same alloy and temper as the manufacturer's disks, as the hardness of aluminium may vary within any given alloy-temper parameter.

3.4 A smooth glass plate is also needed.

4 TEST SPECIMENS

4.1 The testing area shall be smooth and free from mechanical damage.

4.2 Dimensions

Test specimens shall at least have 1.5 mm thickness and large enough to ensure a distance of 3 mm (*Min*) in any direction from the indentor point to the edge of the specimen.

5 PREPARATION AND OPERATION OF APPARATUS

5.1 The preparation and operation of Models 934-1 and 935 are identical. Place the impresser and the material to be tested (or the calibration disk) on a solidly supported, flat, hard, firm surface such as stone, metal, or ceramic. Softer supporting surfaces may result in falsely low instrument reading.

5.2 Set the point sleeve on the surface to be tested. Set the legs on the same surface or on solid material of the same thickness, so that the indentor is perpendicular to the surface being tested. Grasp the instrument firmly between the legs and point sleeve. Apply quickly, by hand, uniformly increasing force on the case until the dial indication reaches a maximum (*see* Note 2). Take care to avoid sliding or scraping while the indentor is in contact with the surface being tested.

NOTES

1. It is recommended that measurements be made with Model 934-1 when values above 90 are obtained with Model 935 and that measurements be made with Model 935 when values less than 20 are obtained with Model No. 934-1. Values below 10 using Model 935 are inexact and shall not be reported.
2. Drift in readings from the maximum may occur in some materials and can be nonlinear with time.

6 CALIBRATION

With the plunger upper guide backed out until it just engages the spring, place the impresser on a glass surface and press down until the point is forced all the way back into the lower plunger guide. The indicator shall now read 100. If it does not, loosen the lock-nut and turn the lower plunger guide in or out to obtain a 100 reading. Next, read the 'hard' aluminium alloy disk supplied by the manufacturer of the impresser and, if necessary, adjust so that the reading is within the range marked on the disk. Then do the same with the 'soft' disk. If these readings cannot be obtained, subsequent measurements are not valid.

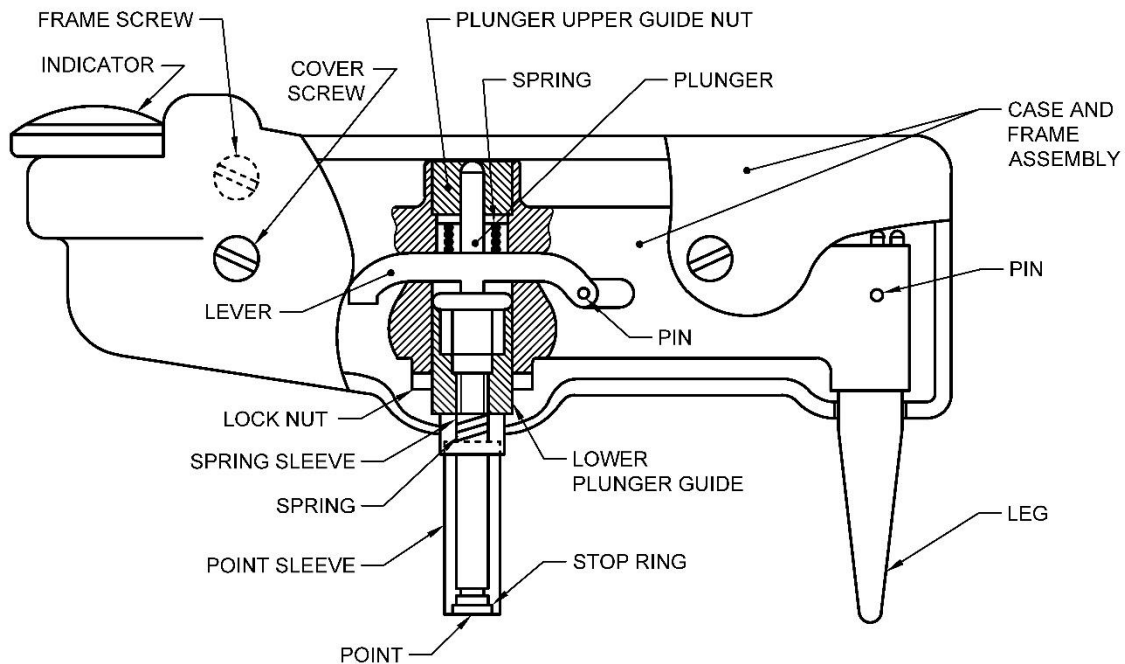


FIG 1 DIAGRAM OF BARCOL IMPRESSOR

7 CONDITIONING

7.1 Conditioning

Condition the test specimens at $27 \text{ }^\circ\text{C} \pm 2 \text{ }^\circ\text{C}$ and 65 ± 5 percent relative humidity for not less than 40 h prior to test, for those tests where conditioning is required. In cases of disagreement, the tolerances shall be $\pm 1 \text{ }^\circ\text{C}$ and ± 2 percent relative humidity.

7.2 Test Conditions

Conduct tests in the standard laboratory atmosphere of $27 \pm 2 \text{ }^\circ\text{C}$ and 65 ± 5 percent relative humidity, unless otherwise specified in the test methods or in this test method. In cases of disagreement, the tolerances shall be $\pm 1 \text{ }^\circ\text{C}$ and ± 2 percent relative humidity.

8 PROCEDURE

Observing the precautions of 5, make measurements on the specimens to be tested (*see Note*). Indentations shall not be made within 3 mm of the edge of the specimen or of other impressions.

NOTE — Curved surfaces may be more difficult to support. When the load is applied bending and spring action in the specimen should be avoided.

9 NUMBER OF READINGS

9.1 Make a minimum of ten determinations of hardness at different positions on the specimen, spaced according to 8.

NOTE — Application of the barcol impressor to reinforced plastics (nonhomogeneous) materials will produce greater variation in hardness readings than on non-reinforced (homogeneous) materials. This greater variation may be caused mainly by the difference in hardness between resin and filler materials in contact with the small diameter indenter.

10 REPORT

10.1 Report the following information

- a) Identification of material tested
- b) Conditioning of specimen
- c) Model number of impresser
- d) Number of readings taken
- e) Average of hardness values rounded to the nearest whole scale reading; and
- f) Date of test