
**Rubber, vulcanized or thermoplastic —
Determination of dead-load hardness
using the very low rubber hardness
(VLRH) scale**

*Caoutchouc vulcanisé ou thermoplastique — Détermination de la dureté
sous charge constante au moyen de l'échelle de très faible dureté*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 27588 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 2, *Testing and analysis*.

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Introduction

The hardness test specified in this International Standard is intended as a more discriminating alternative to the international rubber hardness degrees scale (ISO 48) for rubbers below 35 IRHD. A durometer method for soft rubbers is described in ISO 7619-1 as the AO scale. Examples of applications are low-modulus bearings, soft roller coverings and printing rubbers.

Figure 1 shows a comparison of the ranges of the IRHD N and IRHD L methods in ISO 48 with the VLRH scale of this International Standard.

The methods differ primarily in the diameter of the indenting ball and the magnitude of the indenting force, these being chosen to suit the particular application.

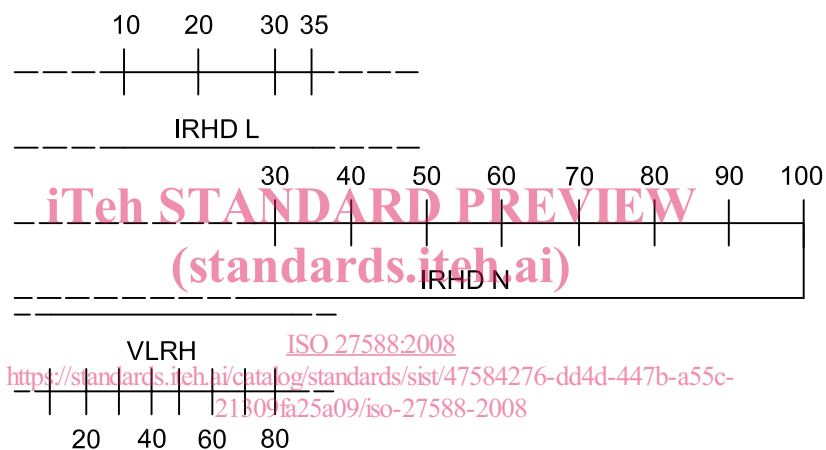


Figure 1 — Comparison of the ranges of hardness measurement methods for rubber

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WARNING — Persons using this International Standard should be familiar with normal laboratory practice. This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any national regulatory conditions.

1 Scope

This International Standard specifies a dead-load method for the determination of the hardness of very soft vulcanized or thermoplastic rubbers using the very low rubber hardness (VLRH) scale.

The relation between the depth of penetration and the VLRH scale is linear.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 23529, Rubber — *General procedures for preparing and conditioning test pieces for physical test methods*

3 Principle

The hardness test consists of measuring the difference between the depths of indentation of a ball into the rubber under a small contact force and a large total force. From this difference, the hardness in “very low rubber hardness degrees” (VLRH) is obtained using Table A.1 (see Annex A) or graphs based on this table or a scale, reading directly in very low rubber hardness degrees, calculated from the tables and fitted to the indentation-measuring instrument.

4 Apparatus

The essential parts of the apparatus are as follows, the appropriate dimensions and forces being shown in Table 1. Detailed information can be found in References [1] and [2].

4.1 Vertically guided plunger, having a ball or spherical surface on the lower end, and **means for supporting the plunger** so that the spherical tip is kept slightly above the surface of the annular foot prior to applying the contact force.

4.2 Means for applying a contact force and an additional indenting force to the plunger, making allowance for the mass of the plunger, including any fittings attached to it, and for the force of any spring acting on it, so that the forces actually transmitted through the spherical end of the plunger are as specified.

4.3 Means for measuring the increase in depth of indentation of the plunger caused by the indenting force, either in millimetres with a maximum uncertainty of 0,001 mm, or reading directly in VLRH with a resolution such that a reading to at least 0,5 VLRH is possible.

4.4 Flat annular foot, normal to the axis of the plunger and having a central hole for the passage of the plunger. The foot rests on the test piece and shall be rigidly connected to the indentation measurement device so that a measurement is made of the movement of the plunger relative to the foot (i.e. the top surface of the test piece), not relative to the surface supporting the test piece.

If it is required that measurements be made on test pieces with a curved surface, a calibration has to be carried out. Tests need to be made on test pieces of the material with both flat and curved surfaces. The hardness difference ($H_{\text{curved}} - H_{\text{flat}}$) which is found for the flat and the curved test pieces is used with opposite sign as correction of the hardness values obtained on test pieces of a similar material with a curved surface.

4.5 Measuring table, as support for the test piece. The measuring table shall be flat and normal to the axis of the plunger.

Table 1 — Nominal values and tolerances of forces and diameters

Contact mN	Force on ball		Force on foot mN
	Indenting mN	Total mN	
8,3 ± 0,5	91,7 ± 0,5	100,0 ± 1,0	235 ± 30
Ball		Diameter mm Foot	Hole
2,50 ± 0,01		6,0 ± 0,5	3,0 ± 0,1

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5 Test pieces

The test pieces shall be prepared in accordance with ISO 23529.

The test pieces shall have their upper and lower surfaces flat, smooth and parallel to one another.

The standard test piece shall be a minimum of 6 mm thick and shall be made up of one, two or three layers of rubber, the thinnest of which shall not be less than 2 mm. The lateral dimensions of the test piece shall be such that three or more measurements can be made at least 10 mm from each other and at least 3 mm from the edges of the test piece.

Test pieces of other dimensions or from finished products may be used but as a rule deliver results which differ from those obtained on standard test pieces.

6 Time interval between forming the test pieces and testing

The time interval between forming the test pieces and testing shall be in accordance with ISO 23529.

7 Conditioning

The test pieces shall be maintained at a standard laboratory temperature (see ISO 23529) for a minimum of 3 h immediately before testing.

8 Temperature of test

The test shall be carried out at the same standard laboratory temperature as was used for the conditioning.

9 Procedure

Place a test piece on the horizontal measuring table. Bring the foot into contact with the surface of the test piece. Press the plunger and indenting ball onto the rubber for 5 s, the force on the ball being the contact force.

If the gauge is graduated in VLRH degrees, adjust it to read 100 at the end of the 5 s period. Then apply the additional indenting force and maintain it for 30 s, when a direct reading of hardness in VLRH degrees is obtained.

If the gauge is graduated in millimetres, note the differential indentation of the plunger caused by the additional indenting force, applied for 30 s. Convert this to VLRH degrees by using Table A.1 or a graph constructed therefrom.

Repeat the test to obtain measurements at three different locations on the test piece, observing the requirements for separation distances given in Clause 5. Take the median of the three results as the result of the test.

10 Test report

The test report shall include the following information:

a) sample details:

- 1) a full description of the sample and its origin,
- 2) compound details and cure details, where appropriate,
- 3) the dimensions of the test piece,
- 4) the number of layers in the test piece and the thickness of the thinnest layer,
- 5) in the case of curved or irregularly shaped test pieces, a description of the test piece,
- 6) the method of preparation of the test pieces from the sample, e.g. by moulding or cutting;

b) test method:

- 1) a reference to the test method used, i.e. the number of this International Standard,
- 2) for curved test pieces, the way in which the test piece was mounted and the way the test force was applied;

c) test details:

- 1) the time and temperature of conditioning prior to the test,
- 2) the temperature of test, and the relative humidity, if necessary,
- 3) details of any procedures not specified in this International Standard;

d) test result:

- 1) the number of test pieces tested,
- 2) the individual test results,
- 3) the median result, e.g. 15 VLRH;

e) the date of the test.