



BSI Standards Publication

**Rubber, unvulcanized — Determination of
plasticity — Rapid-plastimeter method**

National foreword

This British Standard is the UK implementation of ISO 2007:2018. It supersedes BS ISO 2007:2007, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PRI/22, Testing and analysis of rubber.

A list of organizations represented on this committee can be obtained on request to its secretary.

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**Rubber, unvulcanized —
Determination of plasticity — Rapid-
plastimeter method**

*Caoutchouc non vulcanisé — Détermination de la plasticité —
Méthode au plastomètre rapide*



Reference number
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Tel. +41 22 749 01 11
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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

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

This fifth edition cancels and replaces the fourth edition ([ISO 2007:2007](http://www.iso.org/iso/2007:2007)), which has been technically revised.

The main changes compared to the previous edition are as follows:

- inclusion of the schematic diagram for the parallel-plate plastimeter and punch in [5.1](#) and [5.2](#);
- inclusion of heating device and temperature control system in [Clause 5](#);
- inclusion of cigarette paper in [Clause 5](#);
- change of test piece thickness in [Clause 6](#);
- change of calibration requirement in [Clause 7](#).

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Rubber, unvulcanized — Determination of plasticity — Rapid-plastimeter method

WARNING 1 — Persons using this document should be familiar with normal laboratory practice. This document 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 determine applicability of any other restrictions.

WARNING 2 — Certain procedures specified in this document might involve the use or generation of substances, or the generation of waste, that could constitute a local environmental hazard. Reference should be made to appropriate documentation on safe handling and disposal after use.

1 Scope

This document specifies a method for the rapid determination of the plasticity of raw rubber and unvulcanized compounded rubber. It is applicable to the determination of the plasticity retention index (PRI) as specified in [ISO 2930](#).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 1795](#), *Rubber, raw natural and raw synthetic — Sampling and further preparative procedures*

[ISO 18899](#), *Rubber — Guide to the calibration of test equipment*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp/>

3.1

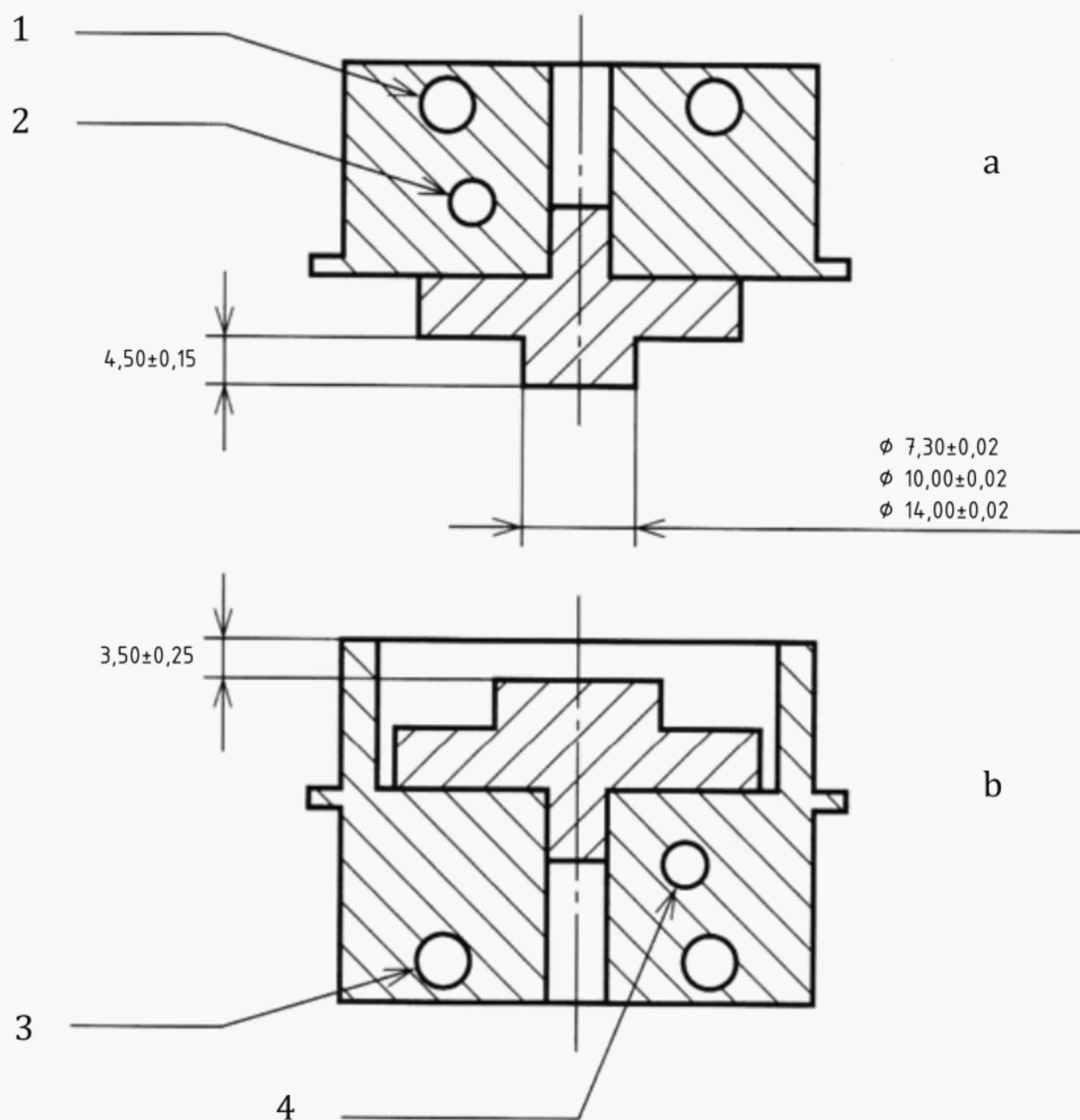
plasticity number

measure of plasticity, based upon the height of a test piece after being subjected to deformation under specified conditions of compressive force, time and temperature

4 Principle

A disc-shaped test piece is compressed rapidly between small parallel platens to a fixed thickness of 1 mm. The test piece is maintained at this compression for 15 s to enable it to reach approximate temperature equilibrium with the platens. After this period, the test piece is subjected to a constant compressive force of $100\text{ N} \pm 1\text{ N}$ for 15 s. Its thickness at the end of this period is taken as the measure of plasticity.

Dimensions in millimetres



Key

- 1, 3 heaters
- 2, 4 temperature sensors
- a Upper platen.
- b Lower platen.

Figure 1 — Schematic diagram of parallel-plate plastimeter

5.1.2 Means for moving one or other of the two platens normal to its surface, to compress the test piece to a thickness of $1,00 \text{ mm} \pm 0,01 \text{ mm}$. The mode of movement of the platen and the forces applied in this operation shall be such that, with or without the test piece in place, the movement is always completed within a period of 2 s. A force of at least 300 N is required and can be conveniently provided by springs.

5.1.3 Means of applying to one or other platen a test force of $100\text{ N} \pm 1\text{ N}$ normal to its surface to compress the test piece.

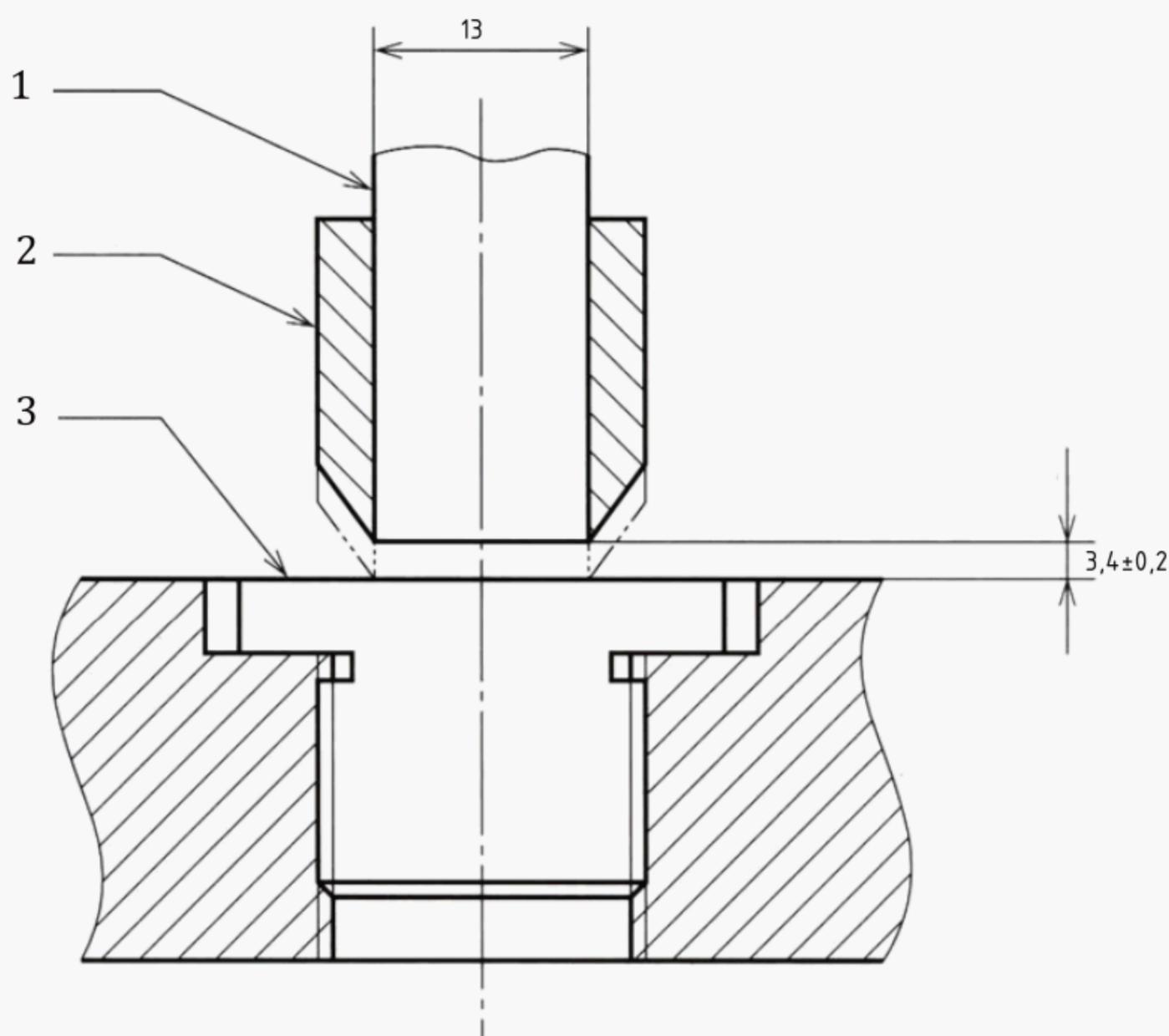
5.1.4 Means for indicating the thickness of the test piece to the nearest $0,01\text{ mm}$ when it is between the platens.

5.1.5 Timing device, so that the test can be timed in seconds to an accuracy of $0,2\text{ s}$.

5.1.6 Heating device and temperature control system, capable of maintaining the temperature of the upper and lower platens and that of the platens to within $\pm 1\text{ }^\circ\text{C}$ of the test temperature.

5.2 Punch, capable of producing test pieces of approximately constant volume quickly and without difficulty. The punch shall consist of a flat-ended cylindrical anvil and a coaxial tubular knife, moving independently of one another. A single action of the handle shall compress a portion of the material to a thickness of $3,4\text{ mm} \pm 0,2\text{ mm}$ and shall cut out a disc of approximately 13 mm diameter. Figure 2 is a schematic diagram of a punch.

Dimensions in millimetres



Key

- 1 cylindrical plunger
- 2 circular cutter
- 3 base

Figure 2 — Schematic diagram of a punch

5.3 Bleached, unglazed, acid-free tissue paper, of approximately 17 g/m² or **cigarette paper** of about 22 g/m² to 26 g/m², cut into two equal pieces.

Both papers shall use the dimension of 30 mm × 45 mm.

For interlaboratory testing, paper from the same source shall be used.

6 Test piece

Raw rubber shall be homogenized when comparative tests are carried out. The preparation and homogenization of the sample shall be carried out in accordance with the provisions of [ISO 1795](#).

The test piece shall be a disc of rubber approximately 13 mm in diameter and with a thickness of 3,4 mm ± 0,2 mm.

If the specified thickness is attained by compressing an initially thicker sheet, the latter shall be not more than 3,6 mm thick.

Prepare three test pieces for the determination of plasticity number.

The sample shall be conditioned at 25 °C ± 5 °C, for a minimum of 1 h before testing. The test pieces cut from conditioned test samples may be tested immediately. The conditioning in a standard laboratory temperature is strongly recommended.

7 Calibration

The settings of the rapid plastimeter shall be checked against the manufacturer's instructions. In the absence of this, the loading spring (100 N ± 1 N) and the timing unit (pre-heating time 15⁺¹₀ s and test period 15 s ± 0,2 s) shall be calibrated in accordance with [ISO 18899](#). The position of the top platen shall be checked before each test.

A sample of standard butyl or Constant Viscosity natural rubber can be used to check whether the machine is in working order. The test pieces shall in this case be prepared from a sheet of 3,4 mm ± 0,2 mm thick, cut from the standard butyl or Constant Viscosity natural rubber.

Alternatively, test piece NBS-388 of National Institute of Standard and Technology (NIST) can be used as a standard material for calibration.

8 Temperature of test

Unless otherwise stated, the test shall be carried out at 100 °C ± 1 °C.

9 Procedure

Place two pieces of tissue paper or cigarette paper ([5.3](#)), between the heated platens ([5.1.1](#)) and set the thickness-measuring device ([5.1.4](#)) to zero when the platens are closed. Insert the test piece centrally between the two pieces of tissue paper or cigarette paper, and place the whole between the heated platens. Compress the test piece to a thickness of 1,00 mm ± 0,01 mm with the platen-moving device ([5.1.2](#)), and hold it in the compressed state for a pre-heating period of 15⁺¹₀ s.

On completion of the pre-heating period, apply a test force of 100 N ± 1 N to the movable platen for a period of 15 s ± 0,2 s with the force-application device ([5.1.3](#)). At the end of this time, measure the thickness of the test piece. Take the reading of thickness at the moment the 15 s test period is completed. On models with electronic digital read-out, the measurement shall be held until the instrument is reset. On instruments with dial gauge read-out, the reading shall be taken immediately before any drop-back occurs, and before the locking mechanism operates.

10 Expression of results

The median value of the thickness of three test pieces at the end of the 15 s compression period, expressed in hundredths of a millimetre, shall be taken as the plasticity number.

11 Test report

The test report shall include the following information:

- a) sample details:
 - 1) a full description and identification of the sample tested and its origin,
 - 2) details of test piece preparation, for example the milling procedure used (see [ISO 1795](#)),
 - 3) details of compounded rubbers, if applicable;
- b) test method:
 - 1) a reference to this document, i.e. ISO 2007,
 - 2) any special data concerning the apparatus;
- c) test details:
 - 1) the size of platen used (as given in [5.1.1](#)),
 - 2) the temperature of test;
- d) the test result, i.e. the plasticity number, expressed as specified in [Clause 10](#);
- e) the date of the test.

Bibliography

- [1] [ISO 2930](#), *Rubber, raw natural — Determination of plasticity retention index (PRI)*

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BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK