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

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

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Contents

	Page
Foreword.....	iv
1 Scope.....	1
2 Normative references.....	1
3 Terms and definitions.....	1
4 Principle.....	1
5 Apparatus.....	2
6 Test piece.....	5
7 Calibration.....	5
8 Temperature of test.....	5
9 Procedure.....	5
10 Expression of results.....	6
11 Test report.....	6
Bibliography.....	7

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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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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), 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.

5 Apparatus

5.1 Parallel-plate plastimeter, consisting of the following elements:

5.1.1 Two parallel, circular platens, having smooth, flat surfaces, movable in relation to each other, both provided with suitable means of heating, and **a jacket** so that the material being tested and the area surrounding it can be maintained at the specified test temperature.

One of the two platens shall be a right cylinder of stainless steel and shall have one of the following diameters: 7,30 mm, 10,00 mm or 14,00 mm (tolerance $\pm 0,02$ mm), its effective depth shall be $4,50 \text{ mm} \pm 0,15 \text{ mm}$ and care shall be taken to ensure that the edge of the working face is neither worn nor damaged. The diameter shall be selected so that the measured plasticity (see [Clause 10](#)) lies between 20 and 85. The other platen can be of chromium-plated brass or stainless steel and shall be of a larger diameter than the first platen. Its effective depth of inclusion within any heating jacket shall be $3,50 \text{ mm} \pm 0,25 \text{ mm}$. Figure 1 is a schematic diagram of the platens.

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Dimensions in millimetres

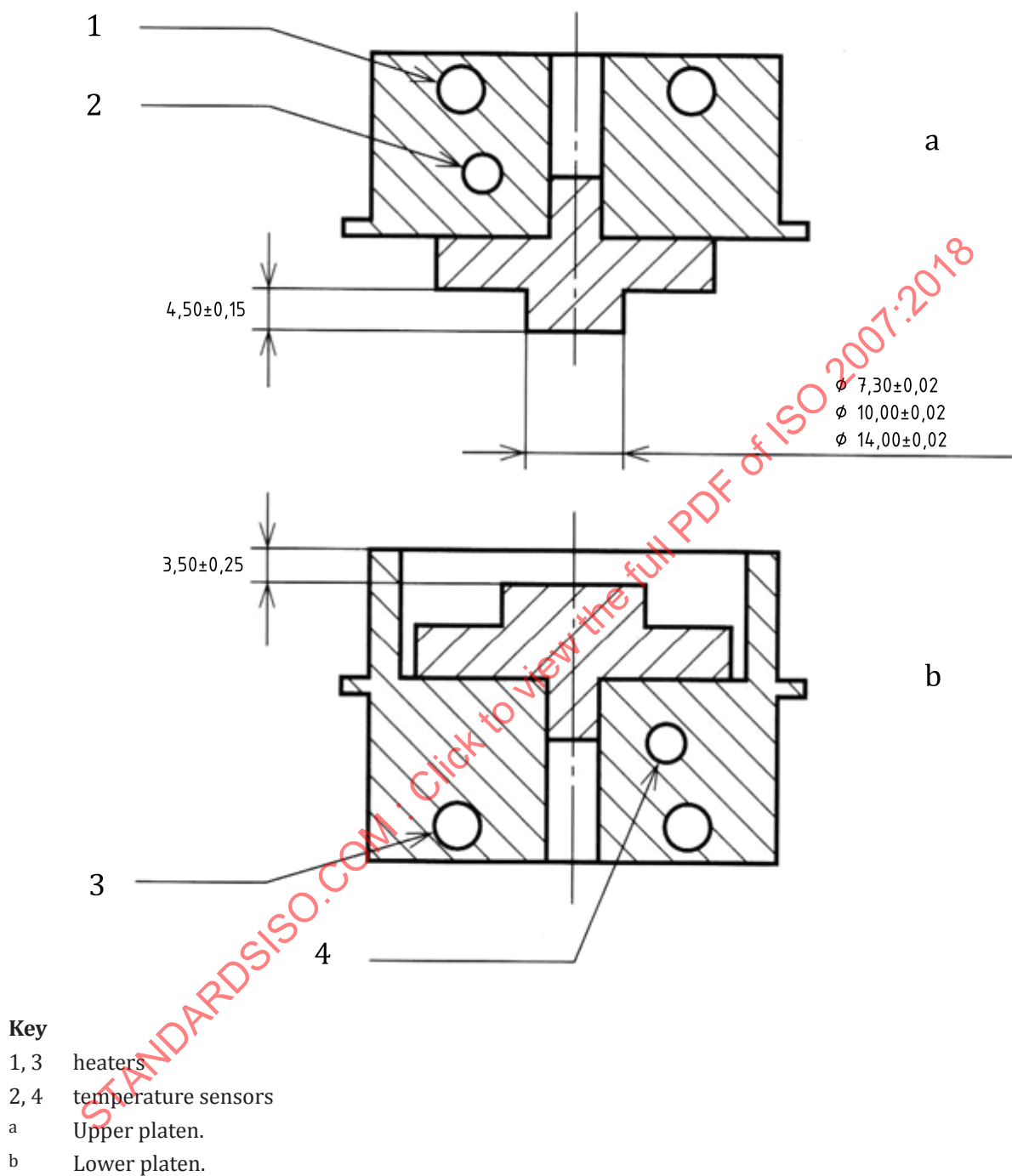


Figure 1 — Schematic diagram of parallel-plate plastimeter

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.

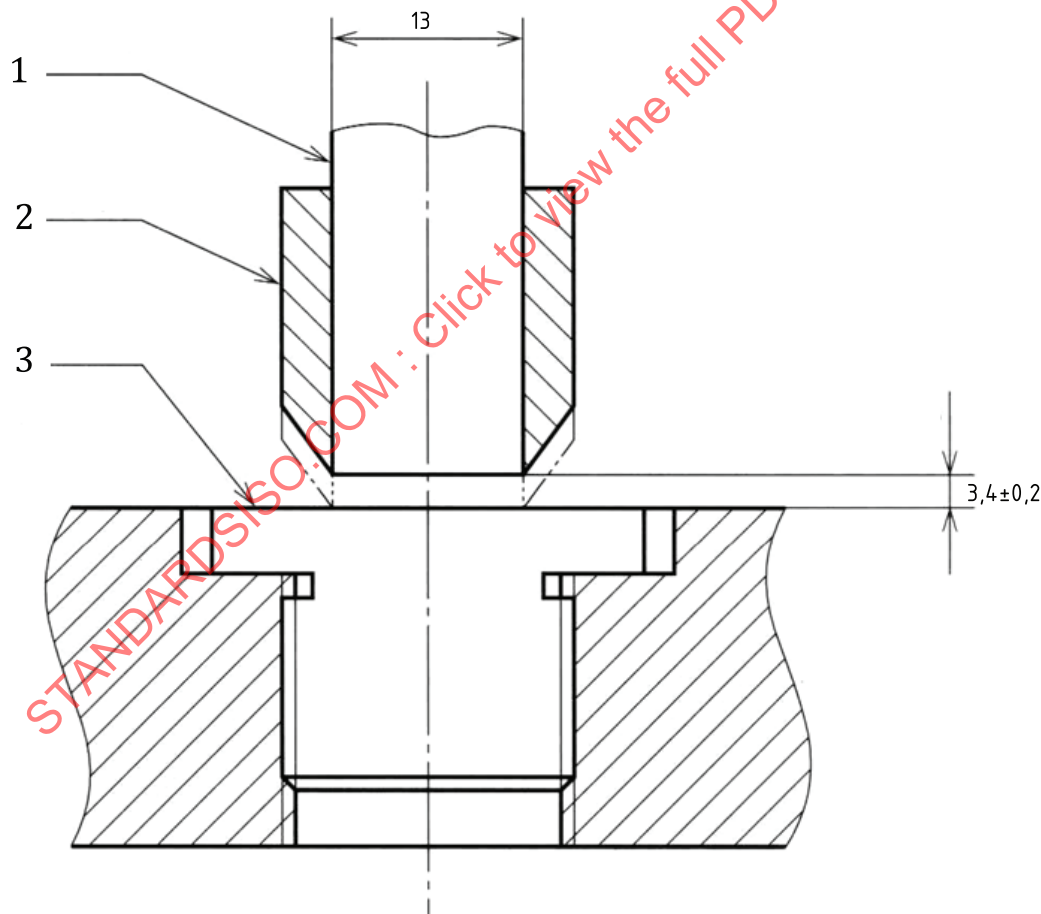
5.1.4 Means for indicating the thickness of the test piece to the nearest $0,01\text{ mm}$ when it is between the platens.

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.