
**Rubber, vulcanized or
thermoplastic — Determination of
tension set under constant elongation,
and of tension set, elongation and
creep under constant tensile load**

*Caoutchouc vulcanisé ou thermoplastique — Détermination de
la déformation rémanente sous allongement constant et de la
déformation rémanente, de l'allongement et du fluage sous charge
constante de traction*

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Contents

Page

Foreword.....	iv
1 Scope.....	1
2 Normative references.....	1
3 Terms and definitions.....	2
4 Apparatus.....	2
4.1 Constant-elongation measurements.....	2
4.2 Constant-load measurements.....	3
5 Calibration.....	4
6 Test pieces.....	4
6.1 Preparation.....	4
6.2 Test pieces for testing under constant elongation.....	4
6.2.1 Strip test pieces.....	4
6.2.2 Strip test pieces with enlarged ends.....	4
6.2.3 Ring test pieces.....	5
6.3 Test pieces for testing under constant load.....	5
6.4 Marking.....	5
6.4.1 General.....	5
6.4.2 Tests at constant elongation.....	5
6.4.3 Tests at constant load.....	6
6.5 Number of test pieces.....	6
6.6 Time interval between forming and testing.....	6
6.7 Conditioning.....	6
7 Procedure.....	6
7.1 Testing under constant elongation.....	6
7.1.1 Measurement of the test pieces.....	6
7.1.2 Stretching the test pieces.....	6
7.1.3 Exposure at the test temperature.....	6
7.1.4 Test conditions.....	7
7.2 Testing under constant load.....	8
7.2.1 General.....	8
7.2.2 Elongation.....	8
7.2.3 Creep.....	8
7.2.4 Tension set.....	8
8 Expression of results.....	8
8.1 General.....	8
8.2 Constant elongation.....	9
8.3 Constant load.....	9
9 Test report.....	9
Annex A (normative) Calibration schedule.....	11
Bibliography.....	13

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 eighth edition cancels and replaces the seventh edition (ISO 2285:2013), of which it constitutes a minor revision. A few editorial changes have been made including updating the publication dates of normative references in [Clause 2](#).

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, vulcanized or thermoplastic — Determination of tension set under constant elongation, and of tension set, elongation and creep under constant tensile load

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 the 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 number of methods of determining the dimensional changes in test pieces of vulcanized or thermoplastic rubber during and after tensile loading for relatively short periods under constant elongation or constant loading.

The constant-elongation test is intended to measure the ability of rubbers to retain their elastic properties after extension, at a standard laboratory temperature, to a specified strain which is maintained for a specified time at the same or at a specified higher temperature and then released at the test temperature or at the standard laboratory temperature.

The constant-load test specifies a method for the determination of elongation, creep and tension set of rubbers subjected to a constant load at standard laboratory temperature.

The test methods are intended to measure the elastic properties of rubber in the hardness range 20 IRHD to 94 IRHD.

The creep measurement is not intended for product design or the evaluation of low-creep materials. For these, ISO 8013 applies, and there is no agreement between the results of this test and those of ISO 8013.

NOTE The constant-load test is primarily intended for the measurement of state of cure and the quality control of thin-walled products. An increase in the state of cure or degree of crosslinking is usually reflected in a decrease in set, creep or elongation.

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 188, *Rubber, vulcanized or thermoplastic — Accelerated ageing and heat resistance tests*

ISO 8013, *Rubber, vulcanized — Determination of creep in compression or shear*

ISO 18899:2013, *Rubber — Guide to the calibration of test equipment*

ISO 23529:2016, *Rubber — General procedures for preparing and conditioning test pieces for physical test methods*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8013 and the following apply.

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

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

3.1

tension set at constant load

elongation remaining in a test piece in the unloaded condition after it has been subjected to a constant load during a specified time, expressed as a percentage of the original length in the unloaded condition

3.2

tension set at constant elongation

elongation remaining in a test piece in the relaxed condition after it has been subjected to a constant elongation during a specified time, expressed as a percentage of the elongation

3.3

creep

increase in elongation of a test piece at constant load during a specified time, expressed as a percentage of the elongation at the beginning of that time

4 Apparatus

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4.1 Constant-elongation measurements

4.1.1 Straining device, consisting of a metal rod or other suitable guide fitted with pairs of holders, one fixed and one moveable, for the ends of the test piece. The holders shall be in the form of self-tightening clamps for strip test pieces, in the form of jaws to hold tab (enlarged) ends, and in the form of flat pulleys of about 5 mm width and 10 mm diameter for ring test pieces.

If so desired, a means of operating the moving holder other than by hand may be provided, for example a threaded rod. Suitable stops or graduations may also be provided to avoid over-extension in the initial straining of the test piece.

The straining device shall be so designed that, when used at high temperatures in an oven, it can be placed with the reference length of the test piece perpendicular to the direction of the air flow. It shall also be of minimum mass in order to avoid excessive lag in the attainment of temperature equilibrium after its introduction into the oven.

A multiple-unit straining device may be used, provided that the foregoing requirements are met.

4.1.2 Oven, conforming to the requirements of ISO 188 (if the test is to be carried out at a temperature above the standard laboratory temperature). For short heating times, controlled air flow is not necessary.

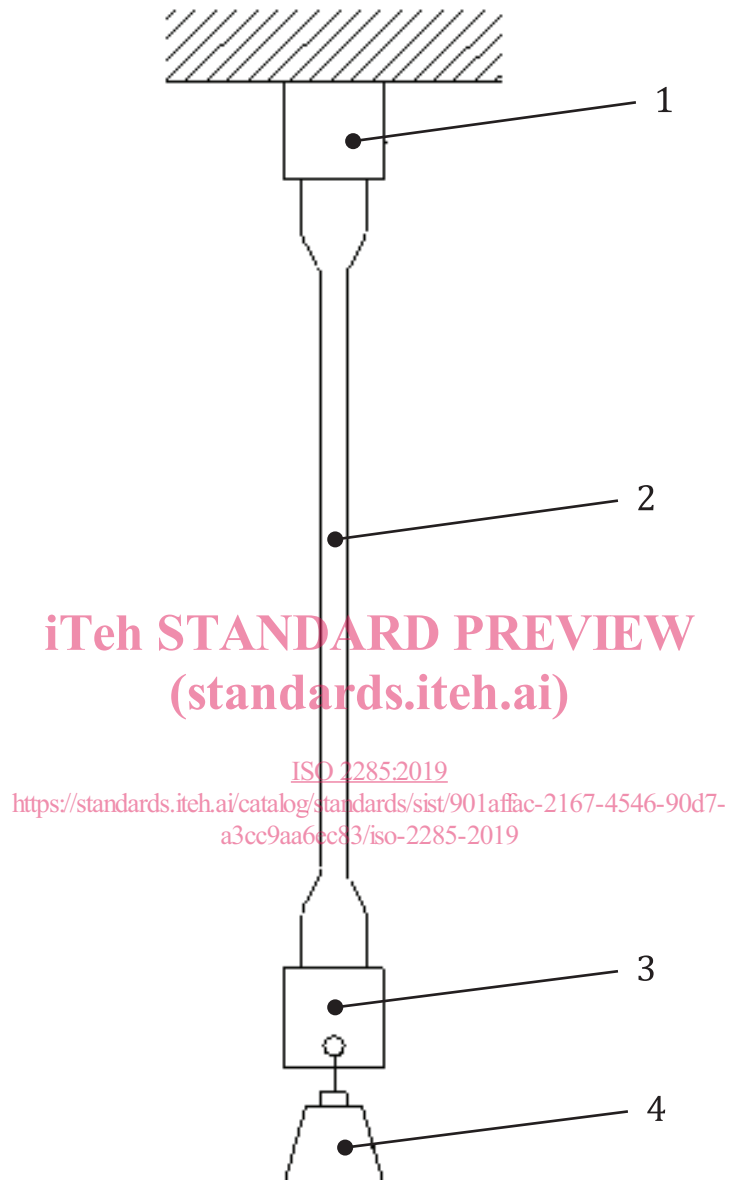
4.1.3 Length-measuring device, capable of measuring the reference length of the test piece to the nearest 0,1 mm.

For strip test pieces, a marker shall be provided to mark the length used as the reference length.

For ring test pieces, the reference length may be the inner diameter of the ring, in which case a graduated cone allowing measurements to be made to the nearest 0,1 mm shall be used. Alternatively, if measurements are to be made on a straight reference length, a rigid channel, 3,5 mm deep and 20 mm wide for large ring test pieces and 1,75 mm deep and 10 mm wide for small ring test pieces, shall be provided for straightening portions of such test pieces during marking and measuring of the reference length.

4.2 Constant-load measurements

4.2.1 **Straining device**, comprising clamps and weights, or equivalent, for loading the test pieces (see [Figure 1](#)).



Key

- 1 fixed clamp
- 2 test piece
- 3 clamp for holding weight
- 4 weight

Figure 1 — Straining device

4.2.2 **Thickness- and width-measuring device**, comprising a gauge for measuring the thickness and, where appropriate, the width of the test piece in accordance with ISO 23529:2016, method A.

The width of die-cut test pieces shall be taken as the distance between the cutting edges of the die in the narrow part, in which case a device capable of measuring the width to the nearest 0,05 mm in accordance with ISO 23529 shall be provided.

4.2.3 **Length-measuring device**, capable of measuring the reference length to the nearest 0,1 mm.

5 Calibration

The test apparatus shall be calibrated in accordance with the schedule given in [Annex A](#).

6 Test pieces

6.1 Preparation

Test pieces shall be prepared in accordance with ISO 23529. They shall be cut from flat sheet 2 mm ± 0,2 mm thick (except large ring test pieces, which shall be cut from sheet 4 mm ± 0,2 mm thick) prepared by moulding or slitting and buffing in accordance with ISO 23529.

Strip test pieces and strip test pieces with enlarged ends shall be cut using a sharp die with a cutter as specified in ISO 23529.

Ring test pieces shall be cut from sheet by means of a pair of concentric circular dies or rotating cutters. The separation of the two cutting edges shall not differ from the average value by more than 0,05 mm.

6.2 Test pieces for testing under constant elongation

6.2.1 Strip test pieces

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Strip test pieces shall be between 2 mm and 10 mm wide. A width of 6 mm is preferred.

The length of any given strip depends on the selected reference length and the type of straining device.

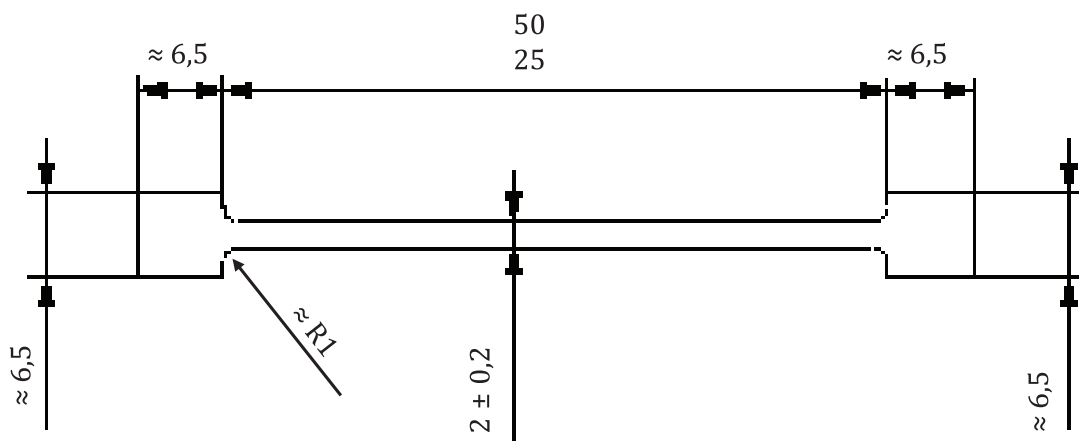
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6.2.2 Strip test pieces with enlarged ends

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Test pieces with enlarged ends shall be as shown in [Figure 2](#), with a narrow section of length between 25 mm and 50 mm which shall be used as the reference length.

Dimensions in millimetres



Thickness 2 mm ± 0,2 mm

Figure 2 — Test piece with enlarged ends

6.2.3 Ring test pieces

Ring test pieces shall be of one of the following sizes:

Large ring test piece:

- thickness: $4 \text{ mm} \pm 0,2 \text{ mm}$;
- outer diameter: $52,6 \text{ mm} \pm 0,2 \text{ mm}$;
- inner diameter: $44,6 \text{ mm} \pm 0,2 \text{ mm}$.

Small ring test piece:

- thickness: $2 \text{ mm} \pm 0,2 \text{ mm}$;
- outer diameter: $33,5 \text{ mm} \pm 0,2 \text{ mm}$;
- inner diameter: $29,5 \text{ mm} \pm 0,2 \text{ mm}$.

6.3 Test pieces for testing under constant load

Test pieces shall have the shape and dimensions shown in [Figure 3](#).

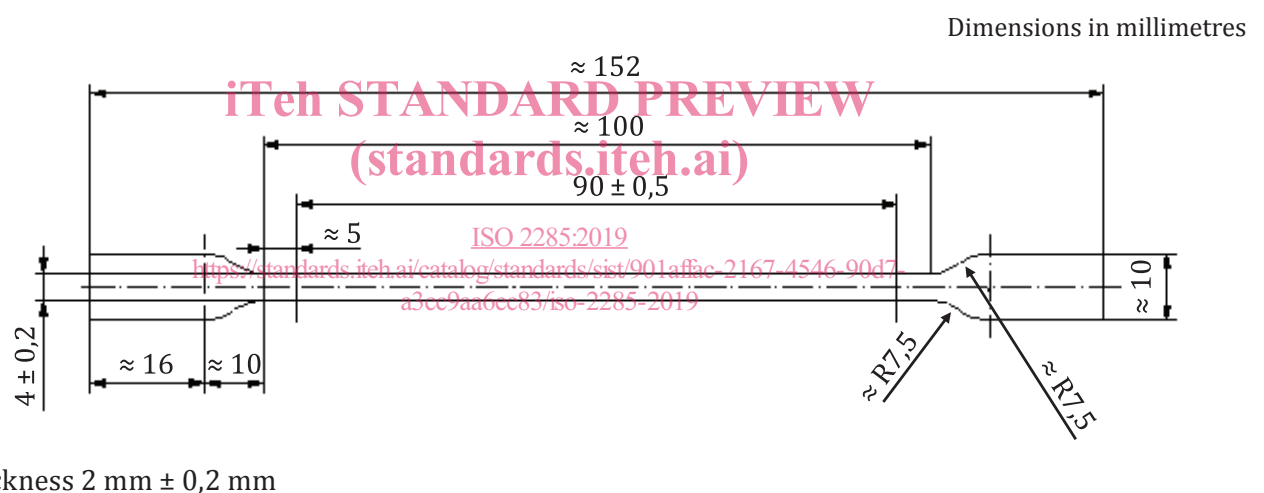


Figure 3 — Test piece for constant loading

6.4 Marking

6.4.1 General

Reference marks shall be marked on the test pieces, using a suitable marker and an ink which does not affect the material and withstands the temperature of test.

6.4.2 Tests at constant elongation

The reference length shall be between 25 mm and 50 mm, measured between the inner sides of the marks. For strip test pieces, the preferred length is 50 mm. Ring test pieces shall be straightened by means of a rigid channel (see [4.1.3](#)) and the reference length, preferably 40 mm for large ring test pieces and 25 mm for small ring test pieces, shall be marked on one of the straightened sides.