INTERNATIONAL STANDARD

ISO 23529

Third edition
2016-11-01

Rubber — General procedures for preparing and conditioning test pieces for physical test methods

Caoutchouc — Procédures générales pour la préparation et le conditionnement des éprouvettes pour les méthodes d'essais physiques

Reference number
ISO 23529:2016(E)

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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 on 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 the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 2, *Testing and analysis*.

This third edition cancels and replaces the second edition (ISO 23529:2010), which has been technically revised as follows.

— Clause 2 and Clause 3 have been added.

— Rubber solvent has been added as a textile-removing liquid (7.2.2.1).

— Description on preparation of unvulcanized test pieces has been added (7.6).

— 7.3.1 and 7.3.2 have been modified.

— Information on suitable callipers has been added (Note to 9.2).

— The format of Table A.1, Table A.2 and Table A.3 has been improved.

Rubber — General procedures for preparing and conditioning test pieces for physical test methods

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 ensure compliance with any national regulatory conditions.

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 general procedures for the preparation, measurement, marking, storage, and conditioning of rubber test pieces for use in physical tests specified in other International Standards, and the preferred conditions to be used during the tests. Special conditions, applicable to a particular test or material or simulating a particular climatic environment, are not included, nor are special requirements for testing whole products.

This document also specifies the requirements for the time interval to be observed between forming and testing of rubber test pieces and products. Such requirements are necessary to obtain reproducible test results and to minimize disagreements between customer and supplier.

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*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1382 apply.

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

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

4 Identification and record keeping

Records shall be kept of the identity of each test piece so that it is identifiable with the sample supplied and such that all the relevant details of preparation, storage, conditioning and measurement are traceable to each individual test piece.

Each sample or test piece shall be individually identifiable by marking or segregation at each stage of its preparation and testing. Where marking is used as the method of identification, the markings shall be sufficiently durable to ensure that the test piece or sample remains identifiable until discarded. Where grain effects can be significant, the direction of the grain shall be identified on each sample or test piece.

The method of marking shall not affect the properties of the sample or test piece and shall avoid significant surfaces, i.e. surfaces which are to be directly tested (e.g. in abrasion tests) or surfaces at which a fracture terminates in the test (e.g. tear or tensile tests).

5 Standard laboratory conditions

5.1 Standard laboratory temperature

The standard laboratory temperature shall be either (23 ± 2) °C or (27 ± 2) °C in accordance with national practice. If a closer tolerance is required, it shall be ±1 °C.

NOTE The temperature 23 °C is normally the standard laboratory temperature in temperate countries and 27 °C is normally the standard laboratory temperature in tropical and subtropical countries.

5.2 Standard laboratory humidity

If control of both temperature and humidity is necessary, they shall be selected from Table 1.

Table 1 — Preferred relative humidity

Temperature °C	Relative humidity %	Tolerance on humidity %
23	50	±10[a]
27	65	

[a] If a tighter tolerance is needed, ±5 % can be specified.

5.3 Other conditions

When control of temperature and humidity is not necessary, the prevailing ambient temperature and humidity can be used. The latter conditions shall be used where standard laboratory conditions cannot easily be achieved.

6 Storage of samples and test pieces

6.1 Samples awaiting the preparation of test pieces and test pieces prior to conditioning shall be stored under conditions which minimize the possibility of degradation by ambient conditions, such as heat or light, or of contamination, e.g. cross-contamination from other samples.

6.2 For all tests, the minimum time between forming the material and testing shall be 16 h. When test pieces are cut from a product or where a whole product, e.g. bridge bearings, is tested, considerably more time than 16 h between forming the material and testing can be necessary. In these cases, the minimum time shall be as given in the product specification or relevant test method.

6.3 For non-product tests, the maximum time between forming the material and testing shall be 4 weeks and, for evaluations intended to be comparable, the tests shall be carried out, as far as possible, after the same time interval.

6.4 For product tests, whenever possible, the time between forming the product and testing shall not exceed 3 months. In other cases, tests shall be made within 2 months of the date of receipt of the product by the customer.

6.5 These requirements relate only to initial rubber material tests and to product tests at both the initial and delivery stage. Special tests for other purposes can be carried out at any time, e.g. for the

purposes of process control or to evaluate the influence of abnormal storage conditions on a product. Such reasons shall be clearly stated in the test report.

6.6 In the case of unvulcanized compound, batches shall be conditioned for between 2 h and 24 h at one of the standard laboratory temperatures specified in 5.1, preferably in a closed container to prevent absorption of moisture from the air, or in a room in which the relative humidity is controlled at (50 ± 5) %.

7 Preparation of test pieces

7.1 Test piece thickness

The test piece thickness shall be as specified in the relevant test method. However, the test piece thicknesses other than those in Table 2 may be specified where it is necessary to retain the original surface of the sample.

Table 2 — Preferred test piece thicknesses

Test piece thickness mm	Tolerance mm
1,0	±0,1
2,0	±0,2
4,0	±0,2
6,3	±0,3
12,5	±0,5

7.2 Thickness adjustment

7.2.1 General

When material, particularly from products, requires testing, but is not available in a thickness recommended in Table 2, procedures are required to adjust the thickness to within the prescribed limits. Recommended procedures are given in 7.2.2. In most cases, thickness adjustments shall be made on the material before the cutting of the test pieces.

For most rubbers, splitting or buffing modifies the surface. Hence, when a surface-dependent property is being measured, thicknesses other than those in Table 2 might need to be specified in order to retain the original surface.

7.2.2 Techniques

7.2.2.1 Removal of textiles combined with the rubber

The separation shall preferably avoid the use of a liquid, which causes swelling. If this is not possible, a nontoxic liquid of low boiling point, such as isooctane (2,2,4-trimethylpentane) or rubber solvent (gasoline), can be used to wet the contacting surfaces. Care shall be taken to avoid excessive stretching of the rubber by separating a little at a time while the rubber is gripped near the point of separation. If a liquid is used, the rubber shall be placed so as to permit free evaporation of the liquid, and time shall be allowed for the complete evaporation of the liquid, preferably at least 16 h, before the test pieces are cut and tested.

7.2.2.2 Cutting techniques

When it is necessary to remove a considerable thickness of rubber or to produce a number of slices from a thick piece of rubber, cutting equipment such as that specified in 7.2.3.1 and 7.2.3.2 shall be used.

7.2.2.3 Abrading techniques

When it is necessary to remove surface unevenness, such as fabric impressions or corrugations caused by contact with fabric components or with cloth wrappings used for vulcanization, or unevenness caused by cutting, this shall be done using the equipment specified in 7.2.3.3 or 7.2.3.4.

7.2.3 Equipment for test piece preparation

7.2.3.1 Rotating-blade equipment

This equipment is based on commercial slicing machines. The machine consists of a motor- or hand-driven disc cutter of suitable diameter with a movable cutting table which transports the sample to the cutting edge.

An adjustable slow-feed mechanism fitted to the cutting table feeds the rubber forward to the line of cut, and controls the thickness of the slice. Clamping devices shall be available to secure the rubber. The blade shall preferably be lubricated with a dilute aqueous detergent solution to ease the cutting operation.

7.2.3.2 Skiving machines

This equipment is based on commercial leather-slitting machinery, and convenient types are available for cutting strips about 50 mm wide with thicknesses up to about 12 mm. Adjustment shall be possible to vary the thickness of cut, and feed rollers shall be provided to transport the material past the knife. Provision shall be made for maintaining the cutting edge in a sharp condition. Attachments are available for splitting and cutting sections from cable sheathing.

7.2.3.3 Abrasive wheels

The abrading apparatus shall consist of an abrader with a motor-driven abrasive wheel. It is important that the wheel runs true without vibration, and that the abrasive surface, of aluminium oxide or silicon carbide, is true and sharp. The abrader can be equipped with a slow-feed mechanism so that very light cuts can be made to avoid overheating of the rubber. Suitable means shall be provided for securing the rubber to prevent excessive deformation and for controlled traversing of the rubber against the abrasive wheel.

NOTE Wheels of diameter 150 mm operating at a surface speed in the range of 10 m/s to 12 m/s, designated C-30-P-4-V for roughing and designated C-60-P-4-V for finishing (see ISO 525[1]), have been found suitable.

The depth of cut produced in the first pass shall not exceed 0,2 mm. Successive cuts shall be progressively less deep to avoid overheating. Buffing shall not be carried out beyond the point where unevenness in the thickness has been eliminated. For removal of greater thicknesses of rubber, cutting equipment as specified in 7.2.3.1 or 7.2.3.2 shall be used.

7.2.3.4 Flexible abrasive belts

The apparatus shall consist of either a motor-driven drum on which a helical strip of the abrasive belt is secured, or of two pulleys, one motor-driven and the other adjustable, to tension and align the belt. The abrasive belt shall be of textile or paper or a combination of the two, with the abrasive, of aluminium oxide or silicon carbide, bonded to the surface with a resin which is unaffected by water. Equipment shall be provided for slow feeding of the material to the abrasive belt and for securing the material without excessive deformation.

NOTE A surface speed of the band of (20 ± 5) m/s has been found suitable.

With this apparatus, cuts removing several tenths of a millimetre of rubber are practicable as much less heat is produced than with the equipment specified in 7.2.3.3. Abrasion can be carried out against the drum, against one of the pulleys or against the taut belt between the pulleys.

7.3 Test piece cutters

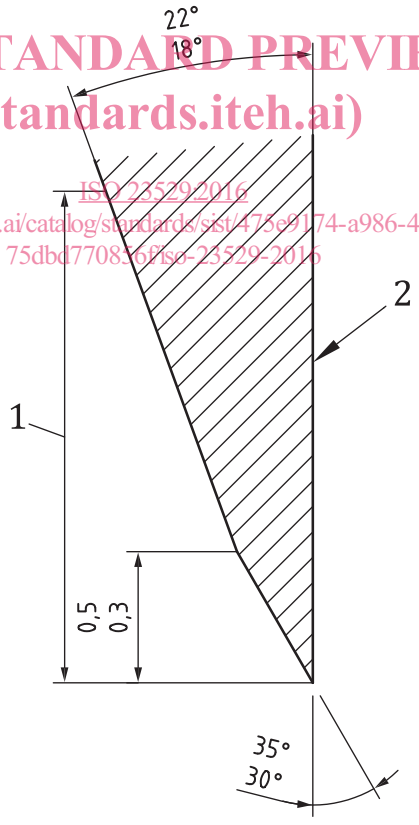
7.3.1 General

The design and type of cutter or die employed depends on the thickness and hardness of the material under test. In the case of thin materials, punching or rotary cutting techniques shall be used as specified in 7.3.2, 7.3.3 or 7.3.4. For thicker materials, usually above 4 mm, a rotary cutting technique as specified in 7.3.4 is desirable to reduce the degree of dishing of the cut edge resulting from compression of the rubber during cutting.

7.3.2 Fixed-blade cutters

For cutters which do not have replaceable blades, an example of a suitable cutting edge is shown in Figure 1. These shall be made from high-quality tool steel and can be of either one-piece (solid metal) or two-piece construction. They can be designed to punch out single or multiple test pieces. It is essential that the design ensures sufficient rigidity to prevent distortion of the cutting shape, and the cutter shall preferably be fitted with an ejection system to release the test piece. If fitted, such a system shall be designed to accommodate material up to the maximum thickness to be cut, normally 4,2 mm. If an ejection system is not fitted, access shall be available from the rear to permit release of the test piece by the operator without damaging the cutting edge. The cutting edge shall be kept sharp and free from nicks, as specified in 7.4, to prevent the formation of ragged edges on the test pieces.

Dimensions in millimetres



Key

1 ground area approximately 6 mm wide

2 inside surface of cutter

Figure 1 — Example of suitable cutting edge