

BS ISO 5603:2011



BSI Standards Publication

Rubber, vulcanized — Determination of adhesion to wire cord

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National foreword

This British Standard is the UK implementation of ISO 5603:2011. It supersedes BS ISO 5603:2007 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PRI/22, Physical testing of rubber.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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Rubber, vulcanized — Determination of adhesion to wire cord

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métallique*



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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 5603 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 2, *Testing and analysis*.

This third edition cancels and replaces the second edition (ISO 5603:2007), of which it constitutes a minor revision designed to add a calibration schedule (see Annex A).

Rubber, vulcanized — Determination of adhesion to wire cord

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.

IMPORTANT — Certain procedures specified in this International Standard may 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 International Standard specifies two methods for determining the adhesion strength of vulcanized rubber to wire cord which is embedded in the rubber.

The two methods do not necessarily give the same results.

They are applicable primarily to test pieces prepared in the laboratory under standard conditions and used for the development and control of materials and processes utilized in the manufacture of products reinforced with wire cord.

NOTE The methods can also be used for single wire, for example bead wire.

Method 1 reduces the dependence of the measured adhesion on the modulus and strength properties of the rubber.

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 2393, *Rubber test mixes — Preparation, mixing and vulcanization — Equipment and procedures*

ISO 5893:2002, *Rubber and plastics test equipment — Tensile, flexural and compression types (constant rate of traverse) — Specification*

ISO 18899:2004, *Rubber — Guide to the calibration of test equipment*

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

3 Principle

The adhesion strength is determined by measuring the force required to pull out a single cord from the surrounding rubber of a prepared test piece. The force is directed along the axis of the cord, using a test jig containing a suitably chosen circular- or square-shaped hole to ensure uniformity of stress.

Test pieces of cord and rubber are prepared together by vulcanizing them under pressure.

In method 1, the exterior surface of the rubber is suitably reinforced.

In method 2, such reinforcement is not employed.

4 Materials

4.1 Wire cord, conforming to the specification of the bonding system to be investigated. If no specification is given, brass-plated steel cord of construction $(1 \times 3 \times 0,15) \text{ mm} + (6 \times 0,27) \text{ mm}$ or of construction $(7 \times 4 \times 0,22) \text{ mm}$ shall be used.

NOTE The sizes of the cords are defined here in terms of their diameter and the number of component wires, starting from the centre core of the cord.

For quality control of cord, it shall be tested in the condition received, i.e. neither cleaned nor dried.

It is essential that the wire cord be stored in a dry atmosphere to prevent any surface deterioration. Storage can conveniently be carried out in an airtight container which also contains a desiccating material (for example silica, SiO_2). The container shall only be opened when removing wire cord and shall then be closed immediately. It is also essential that the cord not be contaminated with dust from the desiccating material.

4.2 Unvulcanized rubber compound, conforming to the specification of the bonding system to be investigated. Whenever possible, the rubber shall be freshly milled. If for any reason the rubber cannot be remilled, the surface shall be freshened by wiping with a solvent and allowed to dry. The preferred solvent is heptane, but a suitable alternative could be a petroleum solvent with a distillation range of about 65°C to 125°C ; these solvents shall possess a maximum residue on evaporation of 3 mg per 100 cm^3 of solvent. The compound shall be stored at a standard laboratory temperature of $(23 \pm 2)^\circ\text{C}$ or $(27 \pm 2)^\circ\text{C}$ prior to use. It can be in the form of calendered sheet of suitable thickness and shall be protected by a dark-coloured polyethylene film.

4.3 Reinforcement material, to stiffen the rubber block. This applies only to method 1. The reinforcement can either be a sheet metal strip treated with adhesive promoter (when the thickness t is at least 0,5 mm) or a strip of rigid rubberized steel cord fabric. A suitable fabric is one containing steel cords of high bending stiffness, for example one of construction $(1 \times 3 \times 0,30) \text{ mm} + (6 \times 0,38) \text{ mm}$ [when the thickness t is $(2,5 \pm 0,1) \text{ mm}$ maximum].

5 Apparatus

5.1 Mould, capable of producing a test piece in which a multiplicity of cords is embedded equally spaced along its length. Different moulds are employed for the two methods.

a) Method 1

The mould is of a semi-follow-on type to obtain maximum consolidation of rubber around the cord during the pressing stage, but thereafter becomes a fixed-cavity mould.

One suitable mould designed to accommodate steel cord fabric reinforcement is shown in Figure 1. This mould produces test pieces of length 310 mm containing 21 cords, but similar moulds employing other numbers of cords greater than nine are acceptable. The mould dimension x will depend on the embedded length of test piece required (which is governed by the diameter of wire cord used, see 7.2). The mould shall be provided with pairs of inserts or spacers to obtain the different lengths of cord embedment. Dimension y is sufficiently great to allow the incorporation of excess rubber during moulding (see 7.3.1).