भारतीय मानक
Indian Standard

IS 3400 (Part 5) : 2022
ISO 36 : 2020

रबड़, वल्कनीकृत या थर्मोंप्लास्टिक के परीक्षण की पद्धतियाँ

भाग 5 वस्त्रादि के साथ रबड़ का आसंजन

(चौथा पुनरीक्षण)

Methods of Test For Rubber, Vulcanized or Thermoplastic

Part 5 Adhesion of Rubbers to Textile Fabrics

(Fourth Revision)

ICS 83.060; 59.080.40

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NATIONAL FOREWORD

This Indian Standard (Part 5) (Fourth Revision) which is identical with ISO 36 : 2020 'Rubber, vulcanized or thermoplastic — Determination of adhesion to textile fabrics' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on recommendation(s) of the Methods of Test for Rubber and Rubber Products Sectional Committee and approval of the Petroleum, Coal and Related Products Division Council.

This Indian Standard was originally published in 1965 and subsequently revised in 1983 and 1986. First revision was carried out to align it with ISO/R 36-1969 ' Determination of the adhesion strength of vulcanized rubbers to textile fabrics', issued by the International Organization for Standardization. In the first revision, two methods were prescribed, namely, Method A, Machine method, based on ISO/R 36-1969 and Method B based on BS 903 (Part A-12)-1959. Lately British Standards Institution (BSI) has revised the above standard and have retained the 'machine method' deleting the static mass method.

Accordingly, in the second revision 'Static mass method ' which is also not internationally approved, has been deleted for obvious reasons like lack of precision and in accurate results. 'Machine method ' which was based on ISO/DIS 36 Rubber Vulcanized — Determination of adhesion to textile fabric has been retained. This method covers procedure for measuring the force required to separate, by stripping two plies of fabrics bonded with rubber or a rubber layer bonded with fabric ply. Further by using this method variation in adhesion strength over the test piece may also be determined. Apart from this all other changes considered necessary to align this standard with International standards or the National standards of other countries have also been included.

The third revision of this standard was undertaken to align it with latest version of ISO 36 : 2017.

The fourth revision of this standard has been carried out to align it with latest version of ISO 36 : 2020 under dual numbering system. The main change compared to the previous edition is that another method, using film, has been added to prepare test pieces (**7.2**). The Committee also decided to modify the common title of all the Indian Standards under IS 3400 series as 'Methods of test for rubber, vulcanized or thermoplastics' for the uniformity in the title in line with the ISO Standards. Accordingly, title of the standard has been modified.

The method covered in this standard is not applicable to proofed fabrics for which a separate method has been prescribed in IS 7016.

The text of ISO Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain terminologies and conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.
b) Comma (,) has been used as a decimal marker, while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this adopted standard reference appear to the following International Standard for which Indian Standard also exists. The corresponding Indian Standard, which is to be substituted in its place, is listed below along with its degree of equivalence for the edition indicated

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
ISO 23529 Rubber — General procedures for preparing and conditioning test pieces for physical test methods	IS 13867 : 2021/ISO 23529 : 2016 Rubber — General procedures for preparing and conditioning test pieces for physical test methods (*first revision*)	Identical with ISO 23529 : 2016

The technical committee has reviewed the provisions of the following International Standards referred in this adopted standard and has decided that they are acceptable for use in conjunction with this standard:

(*Continued on third cover*)

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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 seventh edition cancels and replaces the sixth edition (ISO 36:2017), which has been technically revised.

The main change compared to the previous edition is that another method, using film, has been added to prepare test pieces (7.2).

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.

Indian Standard

METHODS OF TEST FOR RUBBER, VULCANIZED OR THERMOPLASTIC

PART 5 ADHESION OF RUBBERS TO TEXTILE FABRICS

(Fourth Revision)

WARNING — 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 national regulatory conditions.

1 Scope

This document specifies a method of test for measuring the force required to separate, by stripping, two plies of fabric bonded with rubber, or a rubber layer and a fabric ply bonded together.

The method is applicable when the ply surfaces are approximately plane or when they are in the form of a cylinder having an internal diameter greater than approximately 50 mm. The method is not applicable when the ply surfaces contain sharp bends, angles or other gross irregularities which cannot be excluded when cutting out test pieces.

This document does not apply to coated fabrics, which are tested in accordance with ISO 2411, or textile conveyor belts, which are tested in accordance with ISO 252.

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 5893:2019, *Rubber and plastics test equipment — Tensile, flexural and compression types (constant rate of traverse) — Specification*

ISO 6133:2015, *Rubber and plastics — Analysis of multi-peak traces obtained in determinations of tear strength and adhesion strength*

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

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

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:

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

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

3.1
adhesion strength
force per unit width required to cause a separation at the interface between the assembled components

Note 1 to entry: Any separation occurring at any other point, for example inside either component under test, is a failure of the component material, and does not indicate an adhesion strength. In such cases, the adhesion strength is greater than the strength of the weakest component involved.

4 Principle

The stripping force required to separate two plies of fabric bonded with rubber, or a rubber layer and a fabric ply bonded together, is measured under specified conditions using test pieces of standard dimensions in the form of a flat strip.

5 Apparatus

5.1 Test machine, power-driven and equipped with a suitable dynamometer; it shall be capable of maintaining a substantially constant rate of traverse of the moving head during the test and shall be linked to an autographic recorder or a computer with graphic capabilities for data acquisition and processing. A dynamometer without inertia (e.g. of the electronic or optical type) should preferably be used.

The machine shall comply with the requirements of ISO 5893, be capable of measuring force with an accuracy corresponding to class 1 as defined in ISO 5893:2019, and have a rate of traverse of the moving grip of 50 mm/min ± 5 mm/min.

The machine shall be fitted with grips capable of holding the test piece and the ply to be separated without slipping during the test.

5.2 Autographic recorder, with a scale sufficiently large to permit easy interpretation of the trace, or computer with graphic capabilities and software enabling it to be in accordance with the procedure for data processing described in ISO 6133.

6 Calibration

The test apparatus shall be calibrated in accordance with the schedule given in Annex A.

7 Test piece

7.1 Test piece cut from a product

The test piece shall have a width of 25 mm ± 0,5 mm and shall be of sufficient length to permit ply separation during measurement over a length of at least 100 mm. The minimum thickness of the constituent components, or of one of them, shall be such that the weakest component can transmit the force necessary for separation without breaking.

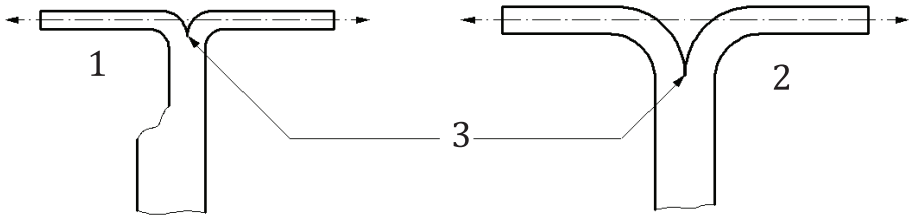
The test piece shall be cut in a plane parallel to the warp in the length direction and parallel to the weft in the width direction.

If required, also cut test pieces in a plane parallel to the weft in the length direction and parallel to the warp in the width direction.

If there is a danger of bits of fabric being removed from the test piece due to irregularity of fabric alignment, make the test pieces slightly wider, but at least the ply to be stripped shall be cut to the width of 25 mm.

The thickness shall be suitably reduced in accordance with ISO 23529, if necessary, in order to ensure that the line of separation of the plies during the test lies as close as possible to the plane of the strips of test piece held in the grips (see Figure 1). For tests intended to be comparable, the test pieces shall have the same dimensions.

Whenever possible, the standard test piece shall be cut from the article and prepared in accordance with the relevant product standard, if one exists.



Key

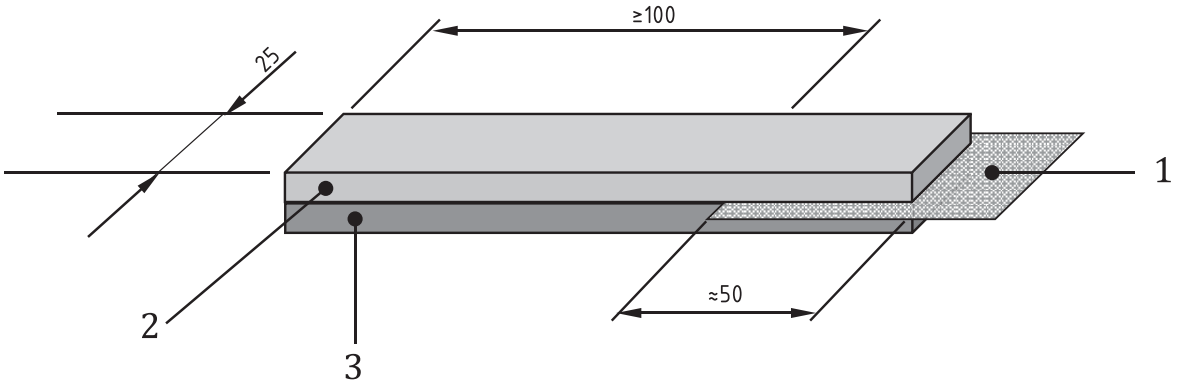
1 ideal
2 undesirable
3 line of separation

Figure 1 — Position of line of separation of plies

7.2 Test piece prepared in laboratory

Test pieces with dimensions as described in 7.1 shall be prepared masking one end for a distance of approximately 50 mm with pressure sensitive tape or a plastic film, in order to leave the edge of the test sample adhesion free, so that the separated ends can be fixed/attached to the test machine grips (see Figure 2).

Dimensions in millimetre



Key

1 pressure sensitive tape or plastic film
2 rubber
3 fabric

Figure 2 — Test piece prepared in Laboratory

8 Number of test pieces

Unless otherwise specified, three test pieces shall be tested for each direction of test.

9 Time-interval between vulcanization and testing

Unless otherwise specified for technical reasons, the following requirements for time-intervals shall be observed:

a) For all test purposes, the minimum time between vulcanization and testing shall be 16 h.

b) For non-product tests, the maximum time between vulcanization and test shall be four weeks, and for evaluations intended to be comparable the tests shall be carried out, as far as possible, after the same time-interval.

c) For product tests, whenever possible, the time between vulcanization and testing shall not exceed three months. In other cases, tests shall be made within two months of the date of receipt of the product by the customer.

10 Conditioning of test pieces and temperature of test

Condition all test pieces in accordance with ISO 23529. If the preparation of test pieces involves buffing, the interval between buffing and testing shall be not less than 16 h and not greater than 72 h.

For tests at a standard laboratory temperature (see ISO 23529), test pieces that do not require further preparation may be tested immediately, if cut from conditioned test samples. Where additional preparation is involved, a minimum conditioning period of 3 h at a standard laboratory temperature shall be allowed.

For tests at temperatures other than a standard laboratory temperature, condition the test pieces at the temperature at which the test is to be conducted for a period sufficient to enable the test pieces to attain substantial equilibrium in accordance with ISO 23529.

11 Procedure

Take the test piece as described in 7.1 or 7.2. For test pieces taken from a product, separate a ply of fabric or a rubber layer by hand for a distance of approximately 50 mm. The use of a scalpel or similar implement might be necessary to initiate the separation.

Fix the separated ends of the test piece in the grips of the test machine (5.1) and adjust so that the tension is distributed uniformly and so that no twisting of the test piece will occur during the test. Place the body of the test piece in the non-driven grip and the ply to be separated in the power-driven grip so that the angle of separation is approximately 180°. It is important to ensure that the strips of test piece held in the grips lie in the same plane.

Start the machine and continue the ply separation while recording on the chart recorder or in the memory of the computer (see 5.2) the force values over a length separation of at least 100 mm. The rate of travel of the power-driven grip shall be 50 mm/min ± 5 mm/min.

Examine the separated pieces for separation or failure.

12 Expression of results

12.1 Calculate the adhesion strength of the test piece by dividing the separation force, determined in accordance with ISO 6133:2015 using method A, B, C, D or E, as appropriate to the trace, by the width of the test piece. Report the result as the median of the individual values obtained for the three test pieces, expressed in newtons per millimetre.

12.2 Describe the type of failure or separation using the following terminology:

R indicates that the failure is in the rubber layer;

RA indicates that the separation is between the rubber layer and the adhesive;

AT indicates that the separation is between the adhesive and the fabric;

RB indicates that the failure is in the rubber bond between two fabric plies;

T indicates that the failure is in the fabric;

RT indicates that the separation is between the rubber and the fabric when no adhesive is present.

13 Test report

The test report shall include the following information:

a) sample details:

   1) a full description of the sample and its origin,

   2) the method of preparation of the test pieces from the sample, for example moulded or cut,

   3) whether the test pieces were cut with their length in a plane parallel or perpendicular to the warp direction;

b) a reference to the test method used, i.e. the number of this document (ISO 36:2020);

c) test details:

   1) the standard laboratory temperature used,

   2) the time and temperature of conditioning prior to the test,

   3) the temperature of test, if other than a standard laboratory temperature, and the relative humidity, if necessary,

   4) the number of test pieces tested (if not three),

   5) details of any procedures not specified in this document;

d) test results:

   1) the individual test results,

   2) the median value of the individual results,

   3) the method of calculation used, i.e. A, B, C, D or E (see 12.1),

   4) the type of failure or separation (see 12.2);

e) the date of the test.

Annex A
(normative)

Calibration schedule

A.1 Inspection

Before any calibration is undertaken, the condition of the items to be calibrated shall be ascertained by inspection and recorded in any calibration report or certificate. It shall be reported whether calibration is carried out in the "as-received" condition or after rectification of any abnormality or fault.

It shall be ascertained that the apparatus is generally fit for the intended purpose, including any parameters specified as approximate and for which the apparatus does not therefore need to be formally calibrated. If such parameters are liable to change, then the need for periodic checks shall be written into the detailed calibration procedures.

A.2 Schedule

Verification/calibration of the test apparatus is a mandatory part of this document. However, the frequency of calibration and the procedures used are, unless otherwise stated, at the discretion of the individual laboratory, using ISO 18899 for guidance.

The calibration schedule given in Table A.1 has been compiled by listing all of the parameters specified in the test method, together with the specified requirement. A parameter and requirement can relate to the main test apparatus, to part of that apparatus or to an ancillary apparatus necessary for the test.

For each parameter, a calibration procedure is indicated by reference to ISO 18899, to another publication or to a procedure particular to the test method which is detailed (whenever a calibration procedure which is more specific or detailed than that in ISO 18899 is available, it shall be used in preference).

The verification frequency for each parameter is given by a code-letter. The code-letters used in the calibration schedule are:

C requirement to be confirmed, but no measurement;

S standard interval selected as described in ISO 18899;

U in use.

Table A.1 — Calibration frequency schedule

Parameter	Requirement	Subclause of ISO 18899:2013	Verification frequency guide	Notes
Test machine	In accordance with ISO 5893			
Force measurement accuracy	Class 1	21.1	S	
Rate of traverse of moving grip	(50 ± 5) mm/min	23.4	S	
Grips	No slippage	C	U	
Autographic recorder	With a sufficiently large scale (see 5.2)	C	S	To permit easy interpretation

In addition to the items listed in Table A.1, use of the following is implied, all of which shall be calibrated in accordance with ISO 18899:

— a thermometer for monitoring the conditioning and test temperatures;

— instruments for determining dimensions of the test pieces.

Bibliography

[1] ISO 252, *Conveyor belts — Adhesion between constitutive elements — Test methods*

[2] ISO 2411, *Rubber- or plastics-coated fabrics — Determination of coating adhesion*

(*Continued from second cover*)

International Standard	*Title*
ISO 5893 : 2019	Rubber and plastics test equipment — Tensile, flexural and compression types (constant rate of traverse) — Specification
ISO 6133 : 2015	Rubber and plastics — Analysis of multi-peak traces obtained in determinations of tear strength and adhesion strength
ISO 18899 : 2013	Rubber — Guide to the calibration of test equipment

In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the website-www.bis.gov.in or www.standardsbis.in.

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Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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