INTERNATIONAL STANDARD

ISO 4646

Third edition
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Rubber- or plastics-coated fabrics — Low-temperature impact test

Supports textiles revêtus de caoutchouc ou de plastique — Essai de choc à basse température

Reference number
ISO 4646:2022(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 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 4, *Products (other than hoses)*.

This third edition cancels and replaces the second edition (ISO 4646:1989), which has been technically revised.

The main changes are as follows:

— Clause 3, "Terms and definitions", has been added, and the subsequent clauses have been renumbered;

— in 4.1, another type of impact tester which is generally used in the industries has been added in Figure 1 as b);

— in 4.3, Dichlorodifuloromethane has been replaced with methylcyclohexane due to its toxicity, and other heat-transfer mediums have also been updated.

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- or plastics-coated fabrics — Low-temperature impact test

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 ensure compliance with any national regulatory conditions.

1 Scope

This document specifies a procedure for determining the lowest temperature at which rubber- or plastics-coated fabrics will not exhibit fractures or coating cracks when subjected to specific impact conditions.

Rubber-or plastics-coated fabrics are used in many applications involving low-temperature flexing with or without impact. Data obtained by this method can be used to predict the behaviour of these coated fabrics at low temperatures only in the applications in which the conditions of deformation are similar to those specified in the method.

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 2231, *Rubber- or plastics-coated fabrics — Standard atmospheres for conditioning and testing*

ISO 2286-3, *Rubber- or plastics-coated fabrics — Determination of roll characteristics — Part 3: Method for determination of thickness*

3 Terms and definitions

No terms and definitions are listed in this document.

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

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

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

4 Apparatus and materials

Typical two types of impact testers which are generally used in the industries are shown in Figure 1 a) and b). Some other testers can be commercially available, however, the apparatus used shall meet the requirements specified below for certain components.

4.1 Test piece clamps and striking arm, it shall be designed to hold the test piece(s) as cantilever beam(s). Each individual test piece shall be held firmly and securely in the clamp without causing distortion to the test piece.

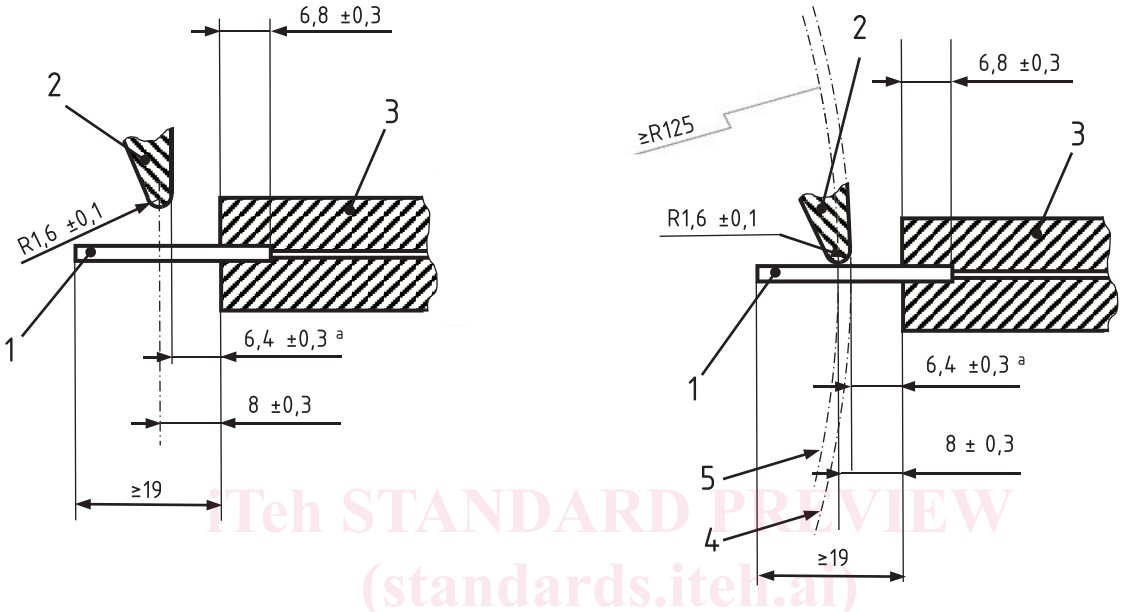
The striking edge shall move relative to the test piece(s) along a trajectory normal to the upper surface of the test piece(s) at a linear testing speed of 1,8 m/s to 2,1 m/s at impact and during at least the following 6 mm of travel after impact. In order to maintain this velocity consistently within the heat-

transfer medium (4.3), the striking arm shall be positively driven. It may be necessary in some cases to reduce the number of test pieces tested at one time.

The striking edge shall have a radius of 1,6 mm ± 0,1 mm;

The striking arm and the test piece clamps shall have a clearance at and immediately following impact in accordance with the dimensions listed in Table 1.

Dimensions in millimetres



a) Straight-line motion **b) Rotational motion**

Key

1 test piece
2 striker
3 test piece clamp
4 locus described by point on striker closest to test piece clamp
5 locus described by impact point on striker
[a] See Table 1.

Figure 1 — Test piece clamps and striking arm

4.2 Insulated tank

4.3 Heat-transfer medium, liquid or gaseous, which remains fluid at the test temperature and which does not appreciably affect the material being tested shall be used.

CAUTION — Where a flammable or toxic solvent is used as the heat-transfer medium, the customary precautions in handling such a material shall be exercised.

a) for temperatures down to −60 °C, silicone fluids are usually suitable owing to their chemical inertness towards rubbers, their non-flammability and their non-toxicity;

NOTE A kinematic viscosity of about 5 mm^2/s at ambient temperature has been found suitable.

b) for temperatures down to −73 °C, ethanol;

c) for temperatures down to −120 °C, methylcyclohexane cooled by liquid nitrogen (found to be satisfactory with the use of suitable apparatus).

4.4 Stirrer, to provide thorough circulation of the heat-transfer medium.

4.5 Temperature control, automatic or manual, for controlling the temperature of the heat-transfer medium to within ±0,5 °C of the desired temperature.

Powdered solid carbon dioxide (dry ice), liquid nitrogen or liquid carbon dioxide are recommended for lowering the temperature. An electric immersion heater is required for raising the temperature.

4.6 Thermocouple, with associated temperature indicator graduated in 1 °C divisions and having a range suitable for the temperature at which the tests are to be made.

The thermocouple shall be constructed of copper-constantan wire between 0,2 mm and 0,5 mm in diameter and shall be fusion-bonded at the junction. It shall be located as near the test piece as possible.

NOTE A thermometer can be used if it is shown to be in agreement with the specified thermocouple.

5 Test pieces

5.1 Test pieces shall be die-punched. Each shall be 6,4 mm ± 0,5 mm wide. Test pieces shall be cut with the longer dimensions parallel to the lengthwise and traverse direction of the coated fabrics across the full usable width of the coated fabric unless otherwise specified.

Dimensions in millimetres

Table 1 — Clearance of striking arm and test piece clamps

Thickness of test piece	Required clearance
1,65 to 2,15	6,4 ± 0,3
1,05 to 1,64	5,7 ± 0,3
0,55 to 1,04	5,2 ± 0,3
0,10 to 0,54	4,8 ± 0,3
The thickness of the test piece shall be determined in accordance with ISO 2286-3. The required clearance may be obtained by fabricating an adjustment plate of individual plates to fit the test piece clamps illustrated in Figure 1. Apparatus for this test may be powered in any way, provided that it meets the dimensional and velocity requirements given above and Clause 4. If the striker is electrically driven, a means of controlling and regulating the voltage is needed to control the speed when testing light gauge material.	

5.2 A minimum of 6 mm of the test pieces shall be held in the clamp, and the length extending from the clamp shall be 25 mm ± 5 mm.

Sharp dies shall be used in the preparation of test pieces for this test if reliable results are to be obtained. Light honing of the cutting edges with a jeweller's honing stone should be carried out daily.

6 Time – interval between manufacturing and testing

6.1 For all test purposes, the minimum time between manufacturing and testing shall be 16 h.

6.2 For non-product test, the maximum time between manufacturing and testing shall be 4 weeks and, for evaluations intended for purposes, all tests should, as far as possible, be carried out after the same time-interval.

6.3 For product tests, wherever possible, the time between manufacturing and testing should not exceed 3 months. In other cases, tests shall be made 2 months of the date of receipt by the customer.

7 Conditioning of test pieces

Condition the test piece in accordance with method 1 of ISO 2231.

NOTE In ISO 2231, three standard atmospheres are defined for method 1 namely:

— temperature 20 °C ± 2 °C, relative humidity 65 % ± 5 % R.H.;

or

— temperature 23 °C ± 2 °C, relative humidity 50 % ± 5 % R.H.;

— for tropical countries only, temperature 27 °C ± 2 °C, relative humidity 65 % ± 5 % R.H.

8 Procedure

8.1 Prepare the insulated tank (4.2) and bring the apparatus to the desired temperature. This may be accomplished by placing a suitable amount of solid carbon dioxide (dry ice) in the tank and slowly adding the heat-transfer medium (4.3) until the tank is filled to within 50 mm of the top. During the test, the temperature of the bath shall be maintained constant by judicious addition of small quantities of dry ice.

NOTE The desired temperature can also be obtained by filling the tank with the heat-transfer medium and lowering the temperature by the addition of liquid carbon dioxide, controlled by a solenoid-actuated valve with an associated temperature control unit. Where temperatures below that obtainable with dry ice or liquid carbon dioxide are required, liquid nitrogen can be used.

8.2 Determine the thickness of the test pieces in accordance with the method described in ISO 2286-3.

8.3 Mount the test pieces in the clamps and immerse them for 3,0 min ± 0,5 min at the desired temperature. The side to be evaluated shall face toward the striking arm unless otherwise specified.

8.4 After immersion for the specified time at the test temperature, record the temperature and deliver a single impact.

8.5 For each test, check the speed of the striker, which shall be between 1,8 m/s and 2,1 m/s (see Annex A).

8.6 After removing the test pieces from the tank, examine each test piece to determine whether or not it has failed. Failure is defined as any fracture or crack viable in the coating when examined under a x 5 magnifier, bend each test piece to an angle of 180° around a 6 mm diameter mandrel in the same direction as the bond caused by the impact prior to examining it under the x 5 magnifier.

8.7 Use new test pieces for each temperature.

For routine testing, subject five test pieces to the impact test for each face, at the temperature specified in the relevant material specification.

9 Test report

The test report shall include the following particulars:

a) a reference to this document including its year of publication, i.e. ISO 4646:2022;

b) all details necessary for the identification of the sample;

c) the temperature at which the test pieces were tested;

d) the type of test apparatus used;

e) the conditioning temperature, humidity and period;

f) the length of time the test pieces were immersed, if different from that specified in 8.3;

g) the number of test pieces tested;

h) the speed of the striker at impact;

i) the behaviour of each individual test piece;

j) the thickness of the coated fabric;

k) which face or side of the coated fabric was tested;

l) details of the heat-transfer medium used;

m) the date of the test.

Annex A
(informative)

Speed calibration of a solenoid-actuated low-temperature impact tester[1)]

A.1 Speed calibration prior to testing

A.1.1 Principle

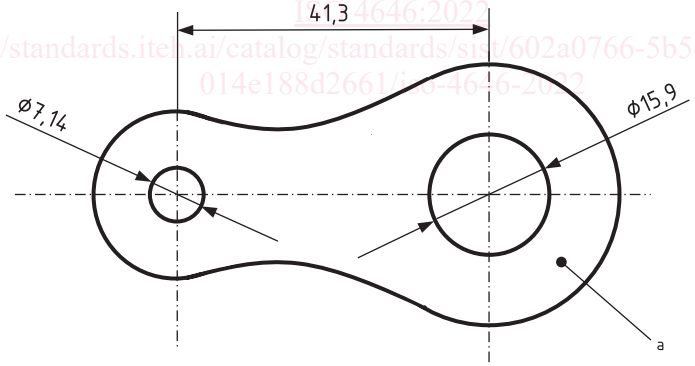
The height, *h*, to which a steel ball, suspended on the striker mechanism of the tester, rises after the striker has had its upward motion halted by contact with a mechanical stop is measured. The ball decelerates in such a manner that the law governing a body moving freely under the influence of gravity applies.

A.1.2 Procedure

A.1.2.1 Securing ball support

Remove either one of the nuts that fasten the striking bar guide rods to the solenoid armature yoke. Place the small hole in the ball support (see Figure A.1) over the guide rod and replace and secure the nut.

Dimensions in millimetres



[a] Thickness = 3,2 mm.

Figure A.1 — Ball support

A.1.2.2 Adjusting stroke or striker

Remove the metal guard from around the solenoid. Spread open the rubber bumper (see Figure A.2) and insert it around the armature. Replace the solenoid guard. Insert a typical test piece into the specimen holder of the tester. Raise the striking mechanism by hand until the end of the stroke is reached. It is essential that, with the striking mechanism raised to its maximum height, the striker bar of the tester is in contact with the test piece but that the bar is not in the plane of the test piece. If the striker bar is not in contact with the test piece, the rubber bumper should be removed and replaced by a thinner bumper.

1) Users should note that this annex applies only to certain types of impact tester.