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Textiles — Test methods for evaluating the electrostatic propensity of fabrics —

Part 4: Test method using horizontal mechanical friction

Textiles — Méthodes d'essai pour l'évaluation de la propension des étoffes électrostatique —

Partie 4: Méthode d'essai de friction mécanique horizontale

Reference number
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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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Foreword

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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).

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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 WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committees responsible for this document are Technical Committee ISO/TC 38, *Textiles* and IEC/TC 101 *Electrostatics* as JWG 26, *Antistatic*, in the lead of ISO/TC 38.

ISO 18080 consists of the following parts, under the general title *Textiles — Test methods for evaluating the electrostatic propensity of fabrics*:

— *Part 1: Test method using corona charging*

— *Part 2: Test method using rotary mechanical friction*

— *Part 3: Test method using manual friction*

— *Part 4: Test method using horizontal mechanical friction*

Introduction

In addition to safety hazards and damage or disruption of sensitive electronic devices and systems which are covered by other International Standards, electrostatic charging of clothing can also cause problems of clinging, uncomfortable shocks and the attraction of airborne dust and other contaminants.

Clothing designed to avoid airborne dust contamination is required in a number of expanding industries relating to precision technology, biotechnology, food, hygiene, etc. It is also generally desirable to have clothing that does not cling or cause uncomfortable shocks.

Test methods are required to evaluate the propensity of fabrics used to make clothing designed to avoid problems associated with electrostatic charging. Test methods are specified in a number of National and International Standards including those published by ISO and IEC. However, the relationship between measurable electrostatic properties and end use performance is rather complex and may require a combination of different test methods depending on application.

The test method described in this International Standard is one of a number of test methods that can be used to evaluate the electrostatic propensity of textile materials.

The test method is based on frictional charging which is one of the main charging mechanisms present in practical wearing conditions. Although the methods described in ISO 18080-2 and ISO 18080-3 also use frictional charging, the results may not be directly comparable in absolute terms because of the different ways in which friction is applied.

Textiles — Test methods for evaluating the electrostatic propensity of fabrics —

Part 4:
Test method using horizontal mechanical friction

1 Scope

This part of ISO 18080 specifies a test method using horizontal mechanical friction with measurement of friction-charged electrostatic potential on specimens of fabric and the time for that potential to decay. The test method is suitable for fabrics of all types of composition and construction that are capable of withstanding frictional charging.

Some fabrics, e.g. fabrics of low strength or loose construction, may not be physically capable of withstanding the manual friction used in this test method or may give false results. In such cases, the test method described in ISO 18080-1 can be used to evaluate electrostatic propensity.

The test method described may not be suitable for evaluating garments and garment materials in relation to safety of personnel and protection of electrostatic discharge sensitive devices.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 105-F01, *Textiles — Tests for colour fastness — Part F01: Specification for wool adjacent fabric*

ISO 105-F02, *Textiles — Tests for colour fastness — Part F02: Specification for cotton and viscose adjacent fabrics*

ISO 3175-2, *Textiles — Professional care, drycleaning and wetcleaning of fabrics and garments — Part 2: Procedure for testing performance when cleaning and finishing using tetrachloroethene*

ISO 3175-3, *Textiles — Professional care, drycleaning and wetcleaning of fabrics and garments — Part 3: Procedure for testing performance when cleaning and finishing using hydrocarbon solvents*

ISO 6330, *Textiles — Domestic washing and drying procedures for textile testing*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
antistatic
property of a material that reduces its propensity to acquire electrostatic charges or allows electrostatic charges to dissipate quickly

3.2
conductive
providing a sufficiently high conductivity so that potential differences over any parts of a material or object are not sufficiently large to be of practical significance

3.3
friction-charged electrostatic potential
potential generated on a material by friction with another or same material obtained as voltage

3.4
decay time
time for the impressed voltage to decay to a percentage of the peak voltage

3.5
half decay time
time for the impressed voltage to decay to half of the peak voltage

4 Principle

A specimen is rubbed by a rubbing fabric using a horizontal mechanical friction test apparatus. After rubbing, the specimen pedestal is moved under an electrostatic fieldmeter. Surface potential on the specimen is measured by the electrostatic fieldmeter and recorded against the elapsed time as the potential decays. The friction-charged electrostatic potential, i.e. the peak electrostatic potential, and half decay time are derived from the recorded data.

5 Conditioning and testing atmosphere

Unless otherwise agreed or specified, the atmosphere for conditioning and testing shall be a temperature of (20 ± 2) °C and a relative humidity of (40 ± 4) %. If a different temperature or humidity is used for conditioning or testing, record it in the test report.

NOTE For measurements, refer to ISO 139.

6 Apparatus

6.1 Testing apparatus, an example of apparatus is shown in Figure 1 and composed of as the following.

Test apparatus other than that described below may be used after appropriate validation and provided a full description is included in the test report.

— **Rubbing unit**, Figure 1, key 1.

— **Specimen table**, Figure 1, key 2, thickness 1,5 mm ± 0,1 mm and with a hole of 72 mm ± 1 mm diameter. After rubbing, the specimen table is moved so that the specimen is placed under the electric fieldmeter Figure 1, key 3.

— **Specimen holder**, Figure 1, key 4, thickness 1 mm ± 0,1 mm with a hole of 75 mm ± 1 mm diameter positioned so that the centre of the hole in the specimen holder is vertically aligned with the centre of the hole in the specimen table.

— **Electrostatic fieldmeter**, Figure 1, key 3, a rotating sector type with an effective diameter of 40 mm to 45 mm positioned at a distance of 50 mm ± 1 mm from the specimen used to detect the electrostatic potential generated by rubbing.

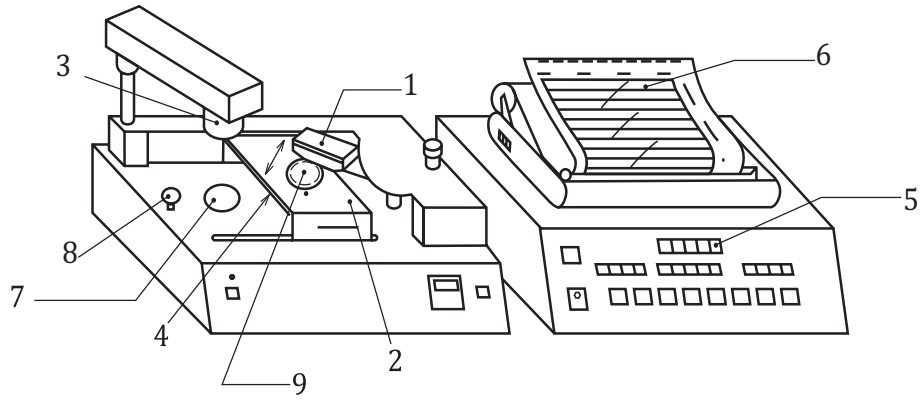
— **Controller**, Figure 1, key 5.

— **Recorder**, Figure 1, key 6.

— **Calibration electrode**, Figure 1, key 7.

— **Calibration electrode pull-up handle**, Figure 1, key 8.

Metal and other conductive components of the test apparatus shall be connected to the ground with a resistance to the ground of less than 10 Ω.

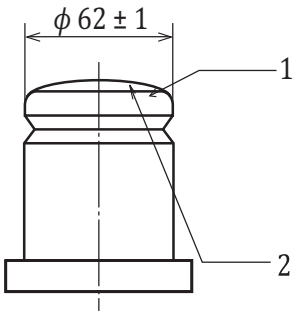


Key

1 rubbing unit
2 specimen table
3 electrostatic fieldmeter
4 specimen holder
5 controller
6 recorder
7 calibration electrode
8 calibration electrode pull-up handle
9 specimen

Figure 1 — Testing apparatus for measurement of friction charged potential and potential decay

Dimensions in millimetres



Key

1 edge curvature radius, approximately 6 mm
2 curvature radius, approximately 250 mm

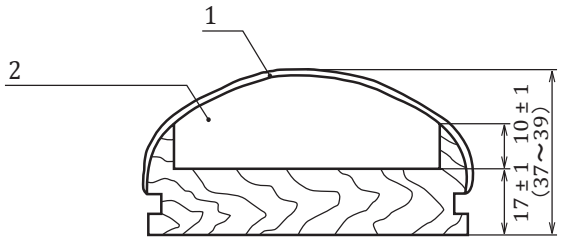
Figure 2 — Specimen supporting pedestal

6.2 Specimen supporting pedestal, Figure 2, made of wood such as magnolia or oak with a resistance to the ground when installed in the test apparatus of 10^7 Ω to 10^{10} Ω measured under the conditions specified in Clause 5. The pedestal is positioned under the specimen (Figure 1, key 9) and is used to support the specimen during rubbing. The top face of the pedestal is higher than the specimen table by approximately 1 mm, as shown in Figure 4.

6.3 Rubbing unit, Figure 3, made from wood (as in 6.2) of dimensions 130 mm ± 1 mm by 70 mm ± 1 mm, thickness 27 mm ± 1 mm with a 10 mm ± 1 mm recess stuffed with cotton batting and covered by cotton fabric. The cotton fabric is described in ISO 105-F02.

The rubbing unit is mounted on the arm frame and the position of the frame is adjusted to determine the pressure between the specimen and the rubbing unit. The pressure is set so that the distance between the specimen and rubbing unit is reduced by 3 mm ± 0,1 mm from the initial point of contact.

Dimensions in millimetres



Key

1 cotton cloth

2 cotton batting

Figure 3 — Rubbing unit

6.4 Rubbing fabric. Use wool or cotton fabric described in ISO 105-F01 or ISO 105-F02. Other rubbing fabrics may be used with the consensus of concerned parties. If other rubbing fabrics are used, their details shall be recorded in the test report.

6.5 Recorder, with a full-scale response time of 0,3 s or less.

6.6 Neutralization apparatus, self-discharge type or voltage imposing type.

6.7 Adhesive tape, double-sided or single-sided pressure-sensitive adhesive tape.

6.8 Oven, used to dry samples at (70 ± 3) °C.

7 Movement of the test apparatus

The automated movement of the test apparatus is as follows:

— the specimen table moves to position above the rubbing pedestal;

— the rubbing pedestal moves up and presses the specimen from the back side;

— the rubbing unit rubs the specimen one way, such as left to right, with a speed of two times per second;

— the rubbing unit moves up and returns to the starting position without rubbing;

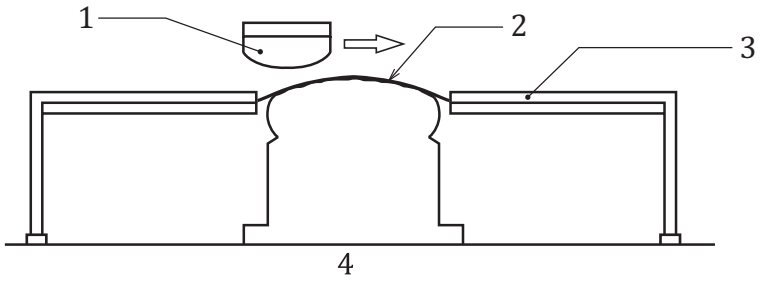
— the rubbing unit rubs the specimen one way again;

— after 10 times of rubbing, the rubbing pedestal moves down immediately;

— the specimen table moves under the fieldmeter in a time that is short compared to the shortest decay time to be measured;

— the electric potential is recorded during potential decay;

— the electrostatic potential is recorded against time.



Key

1 rubbing unit
2 specimen
3 specimen table
4 rubbing pedestal

Figure 4 — Position of specimen supporting pedestal, rubbing unit, and specimen

8 Preparation of specimen

8.1 Sampling

Prepare a sample for the test from a fabric roll or from clothing.

Careful handling and the use of clean, lint free gloves is recommended to avoid contaminating the samples.

8.2 Cleansing of sample

8.2.1 General

In case of cleansing of samples is required, use one of the following procedures.

If the procedure used for cleansing differs from those detailed below, either in the method, number of cycles, or any other condition, details of such deviations shall be included in the test report.

8.2.2 Wash by water

Wash the samples three cycles according to ISO 6330 Procedure 4 N or 4 M at 40 °C water temperature using reference detergent according to ISO 6330. Dry them by one of the natural drying procedures according to ISO 6330.

Residual detergent from previous use of the washing machine may affect test results. Careful cleaning of the washing machine before use is recommended.

8.2.3 Dry cleaning

Dry clean samples according to ISO 3175-2 or ISO 3175-3.

8.3 Conditioning of sample

Condition samples as follows:

— dry the samples for one hour at 70 °C;

— place the samples in the conditioning atmosphere specified in Clause 5 for at least 24 h.

9 Test procedure

9.1 Cut specimens from the conditioned sample with dimensions 120 mm ± 1 mm by 100 mm ± 1 mm, warp and weft directions for woven fabrics, wale and course directions for knitted fabrics or machine, and cross directions for nonwoven fabrics, three specimens for each fabric direction.

9.2 Cut one piece of each rubbing fabric from the conditioned standard fabrics with dimensions 300 mm ± 1 mm by 300 mm ± 1 mm.

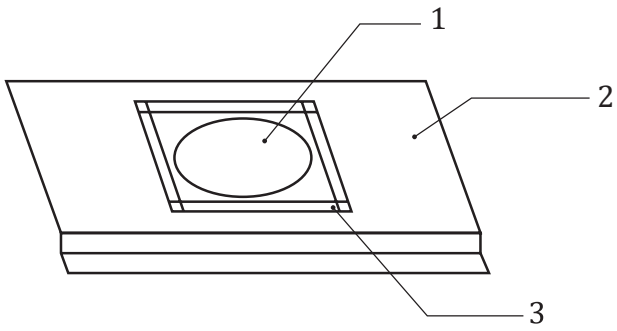
Fold a piece of rubbing fabric in half along the weft/course/cross direction and cover the face of the rubbing unit with the folded rubbing cloth using a rubber band to hold it in place.

9.3 The rubbing unit is basically used three times, then the surface was turned over the unused side.

9.4 Move the specimen table of Figure 1, key 2 under the electrostatic, Figure 1, key 3.

9.5 Make adjustments to align the centre of the circular opening of the specimen table, Figure 1, key 2, and the specimen holder, Figure 1, key 4, with the centre of the measuring aperture of the electrostatic fieldmeter, Figure 1, key 3, and adjust the height measured from the specimen table to the electrostatic fieldmeter measuring aperture to 50 mm ± 1 mm.

9.6 Mount a specimen to the specimen holder, Figure 1, key 4. Spread the specimen and attach firmly using adhesive tape as shown in Figure 5 so as not to wrinkle the specimen.



Key

1 specimen
2 specimen holder
3 adhesive tape

Figure 5 — Mounting a specimen on the specimen holder

9.7 Eliminate static electricity from the specimen and rubbing cloth by using a static electricity elimination equipment.

9.8 Activate the controller of the testing apparatus of Figure 1, key 5.

9.9 Adjust the pressure of the rubbing unit against the specimen so that the centre of the rubbing unit is depressed by approximately 3 mm when in contact with specimen.

9.10 Switch on the rubbing unit and activate the automated movement as described in Clause 7.

9.11 Record the electrostatic potential (V) and its decay curve.

9.12 From the curve, determine the maximum electrostatic potential and half decay time to a half of the maximum potential.

9.13 Change the specimen and repeat the measurement for the next two test specimens.

9.14 Change the rubbing fabric to a different type and repeat all the processes from 9.3 to 9.13.

Measurements shall be done for warp and weft directions in woven fabrics, wale and course directions in knitted fabrics, and machine and cross directions for nonwoven fabrics. The results shall be expressed as averages for three specimens in each fabric direction.

10 Test report

Test report shall include the following information:

a) a reference to this part of ISO 18080, i.e. ISO 18080-4;

b) identification of test fabrics;

c) atmosphere for conditioning and testing if there is deviation from this part of ISO 18080;

d) cleansing method, if used;

e) test result for friction-charged electrostatic potential and half decay time;

f) any deviation from this part of ISO 18080.

Annex A
(informative)

Test result

A.1 Test sample

The following are the three samples prepared for this test:

— polyester 100 % woven fabric without treatment for antistatic: designated as A;

— polyester 100 % woven fabric with treatment for antistatic: designated as B;

— polyester 100 % woven fabric including conductive yarns: designated as C.

A.2 Participant

One testing house in Japan.

A.3 Apparatus used

Tc: INTEC CO.,LTD, EST-8

A.4 Testing condition

A.4.1 Temperature and relative humidity used are 20 °C and 40 %.

A.4.2 The cleansing method used was ISO 6330 4 M, three cycles and then washing by 40 °C water for 10 min, then natural drying.

A.5 Test result

The testing result is shown in Table A.1. The following is the summary of this test.

	Friction charged potential (V)	**Half decay time** (s)
Sample A:	14 190	>60
Sample B:	709	15,4
Sample C:	493	3,4

Table A.1 — Test result for friction charged potential and half decay time

Rubbing fabric	Direction	n	Friction charged potential (V)			Half decay (s)		
			A	B	C	A[a]	B	C
Cotton	Warp	1	12 420	690	530	60,0	19,2	3,8
		2	11 300	800	450	60,0	13,2	3,4
		3	11 750	620	500	60,0	9,2	3,0
		Average	11 823	703	493	60,0	13,9	3,4
		SD	563,6	90,7	40,4	0,0	5,0	0,4
	Weft	1	14 720	750	400	60,0	14,4	3,6
		2	14 640	610	420	60,0	19,4	2,8
		3	13 210	700	370	60,0	12,4	3,4
		Average	14 190	687	397	60,0	15,4	3,3
		SD	849,6	70,9	25,2	0,0	3,6	0,4
Wool	Warp	1	13 040	350	260	60,0	11,4	3,0
		2	11 170	400	300	60,0	14,6	2,8
		3	12 660	340	220	60,0	13,2	4,0
		Average	12 290	363	260	60,0	13,1	3,3
		SD	988,4	32,1	40,0	0,0	1,6	0,6
	Weft	1	12 100	350	260	60,0	11,4	2,4
		2	13 290	280	260	60,0	7,2	3,2
		3	14 420	330	280	60,0	12,6	2,8
		Average	13 270	320	267	60,0	10,4	2,8
		SD	1 160,1	36,1	11,5	0,0	2,8	0,4

[a] Data of 60 s is over limit.

Bibliography

[1] ISO 139, *Textiles — Standard atmospheres for conditioning and testing*

[2] ISO 18080-1, *Textiles — Test methods for evaluating the electrostatic propensity of fabrics — Part 1: Test method using corona charging*

[3] IEC/TR 61340-1, *Electrostatics — Part 1: Electrostatic phenomena — Principles and measurements*

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