INTERNATIONAL STANDARD

ISO 18080-1

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2015-12-15

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

Part 1:
Test method using corona charging

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

Partie 1: Méthode d'essai de charge Corona

Reference number
ISO 18080-1:2015(E)

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) are worldwide federations of national standards bodies (ISO member bodies and IEC national committees). The work of preparing International Standards is normally carried out through ISO and IEC 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 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 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. Definitive performance requirements are not given, but guidance on the interpretation of results is given in informative Annex A. The qualitative interpretation scheme is based on anecdotal experience in industry in controlling clinging, uncomfortable shocks and attraction of particulate contaminants. Nevertheless, it is provided for guidance only and users of this International Standard are advised to check its validity for their own applications.

NOTE IEC 61340-2-1 describes an alternative test method that can be used to determine electrostatic propensity of fabrics and garments using corona charging.

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

Part 1:
Test method using corona charging

1 Scope

This part of ISO 18080 specifies a test method using corona charging with measurement of the impressed peak voltage and charge decay time on specimens of fabric or all types of composition and construction.

The test methods 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 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
decay time
time for the impressed voltage to decay to a percentage of the peak voltage

3.3
half decay time
HDT
time for the impressed voltage to decay to half of the peak voltage

3.4
corona discharge
electric discharge with slight luminosity produced around a current conductor, without greatly heating it, and limited to the region surrounding the conductor in which the electric field exceeds a certain value

3.5
corona charging
charging of test specimens by means of corona discharge created by a sharply pointed electrode

3.6
conductive
providing a sufficiently high conductivity so that potential differences over any parts of a material or object are not sufficiently large as to be of practical significance

Note 1 to entry: In general, a conductive material has a resistance below about 10^5 Ω but different standards may define different resistance ranges for this term.

3.7
conductive fibre
fibre in which conductive components are included

Note 1 to entry: If conductive components are exposed at the surface, the fibre is called surface conductive fibre. If the conductive components are completely embedded in non-conductive polymer, the fibre is called core conductive fibre.

4 Principle

A fabric specimen is charged by corona charging and the peak value of the impressed voltage is obtained immediately after the application of high voltage is stopped. The impressed voltage on the specimen decays towards zero, but not necessarily down to zero. The electrostatic propensity of the test specimen is quantified by determining the peak voltage value and the half decay time, or decay time to some other percentage.

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 The measurements of temperature and humidity are specified in ISO 139.

6 Apparatus

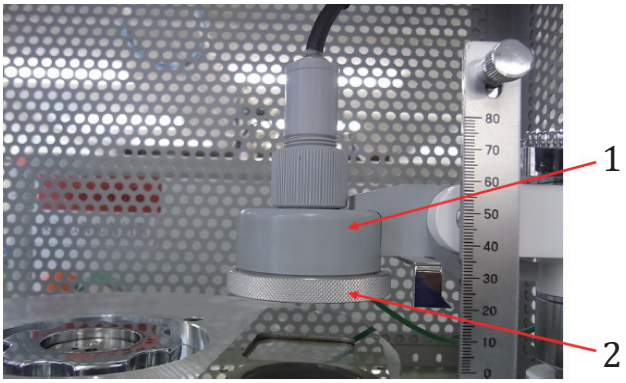
6.1 General

One possible test apparatus is shown below as an example. Other apparatus capable of measuring impressed peak voltage and charge decay time from corona charged specimens may also be used after appropriate validation.

6.2 Test apparatus

The apparatus is composed of the following parts.

— **Emitter**, shown in Figure 1 and Figure 2, a needle type, applied voltage of (−10 ± 1) kV, negative polarity. When the high voltage is applied to this electrode, corona discharge occurs; this is used to charge the test specimen.



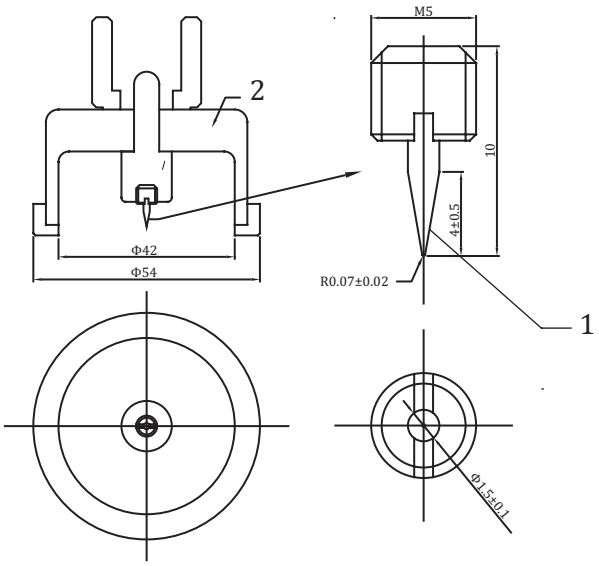
Key

1 exterior cladding (Polyvinyl chloride)

2 exterior cladding (aluminium)

Figure 1 — Appearance of emitter

Dimensions in millimetres



Key

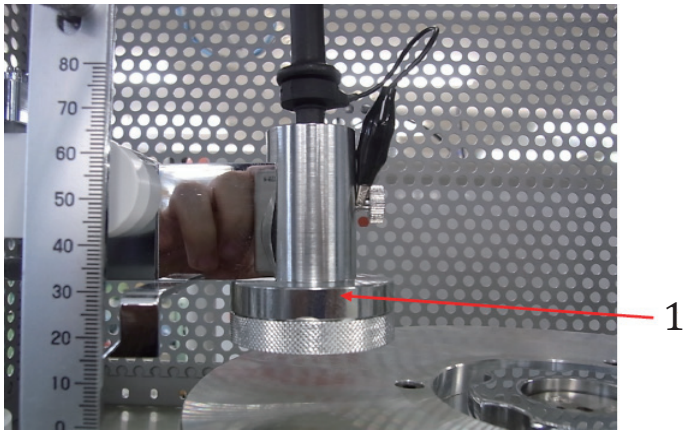
1 discharging electrode

2 insulator (PVC)

NOTE All dimensions have a tolerance of ±0,5 mm, except where stated.

Figure 2 — Dimension of emitter

— **Detective electrode**, a plate type field sensor shown in Figure 3 and Figure 4 with a plate diameter of 28 mm ± 0,5 mm, measurement range from 0 kV to –10 kV with an accuracy of ±5 %, and response time less than 4 ms.

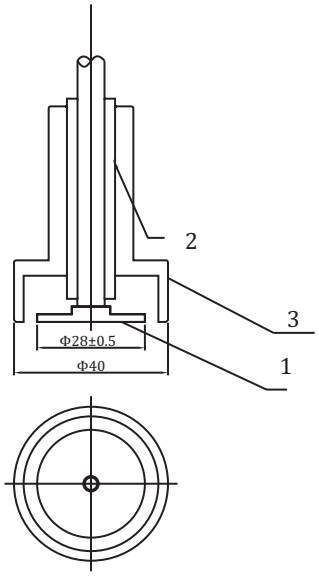


Key

1 exterior cladding (metal)

Figure 3 — Appearance of detective electrode

Dimensions in millimetres



Key

1 detectiveelectrode

2 insulator (PVC)

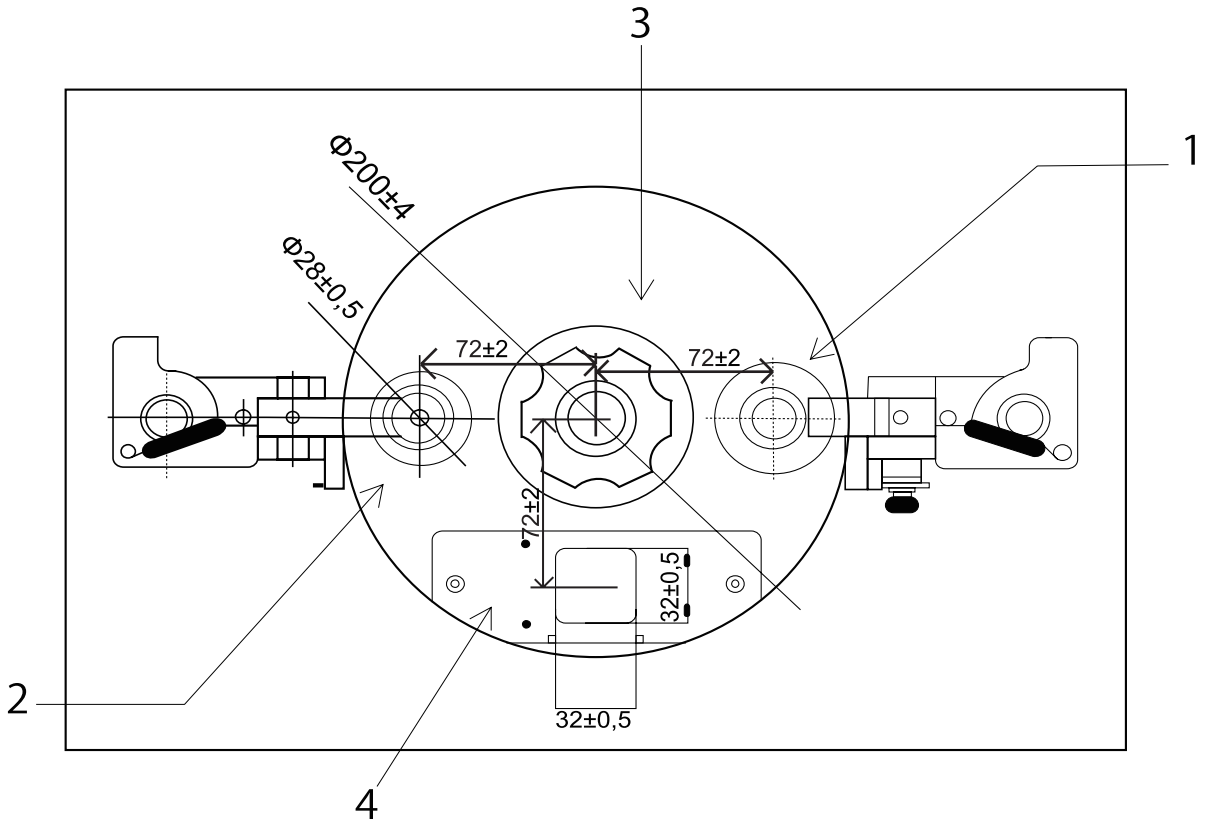
3 cladding

NOTE All dimensions have a tolerance of ±0,5 mm.

Figure 4 — Dimension of detective electrode

— **Turntable**, Figure 5 and Figure 6, solid plain metal with a diameter of 200 mm ± 4 mm, and with a rotation of at least 1 000 r/min.

Dimensions in millimetres

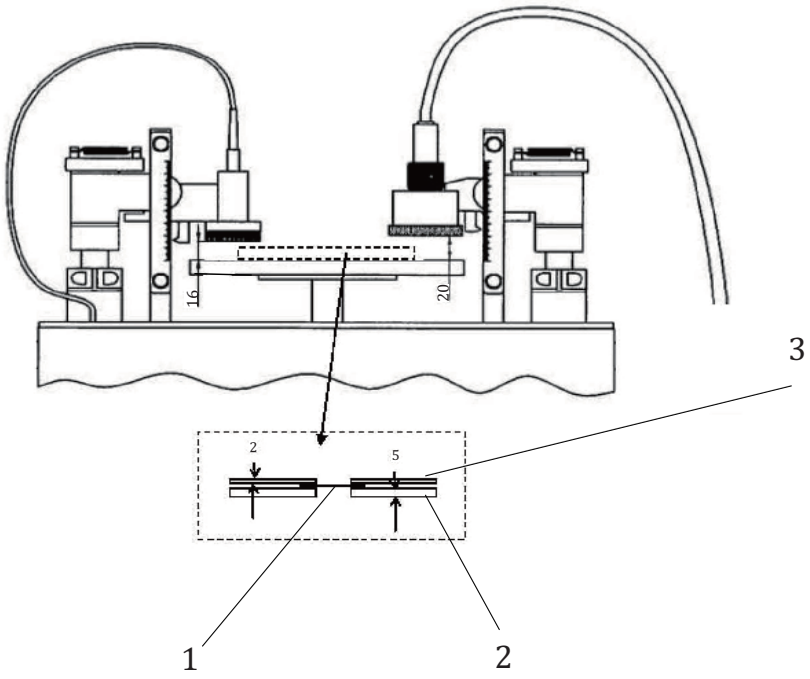


Key

1 emitter
2 detective electrode
3 turntable
4 specimen cover

Figure 5 — Top view of turntable

Dimensions in millimetres



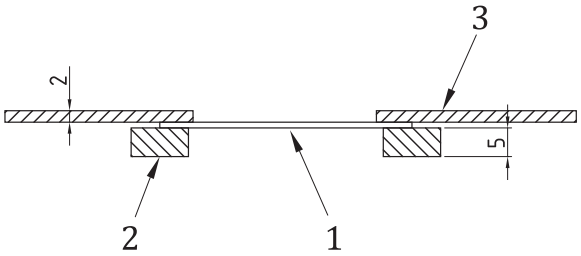
Key

1 specimen
2 spacer (SUS304)
3 specimen cover

NOTE All dimensions have a tolerance of ±0,1 mm.

Figure 6 — Side view of turntable

Dimensions in millimetres



Key

1 specimen
2 spacer (SUS304)
3 specimen cover

NOTE All dimensions have a tolerance of ±0,1 mm.

Figure 7 — Magnified spacer, cover and specimen

The turntable dimensions are shown in Figure 5. The distance from the centre of the turntable to the centre of the specimen and electrodes is 72 mm ± 2 mm. The material used for the table is a metal with a good grounding from the shaft, using a conductive carbon brush.

— **Spacer**, to make a cavity under specimen, shown in Figure 6, Figure 7, and Figure 8, made of aluminium with a thickness of 5 mm ± 1 mm, and with an open space of the same dimensions as the specimen cover.

Dimensions in millimetres

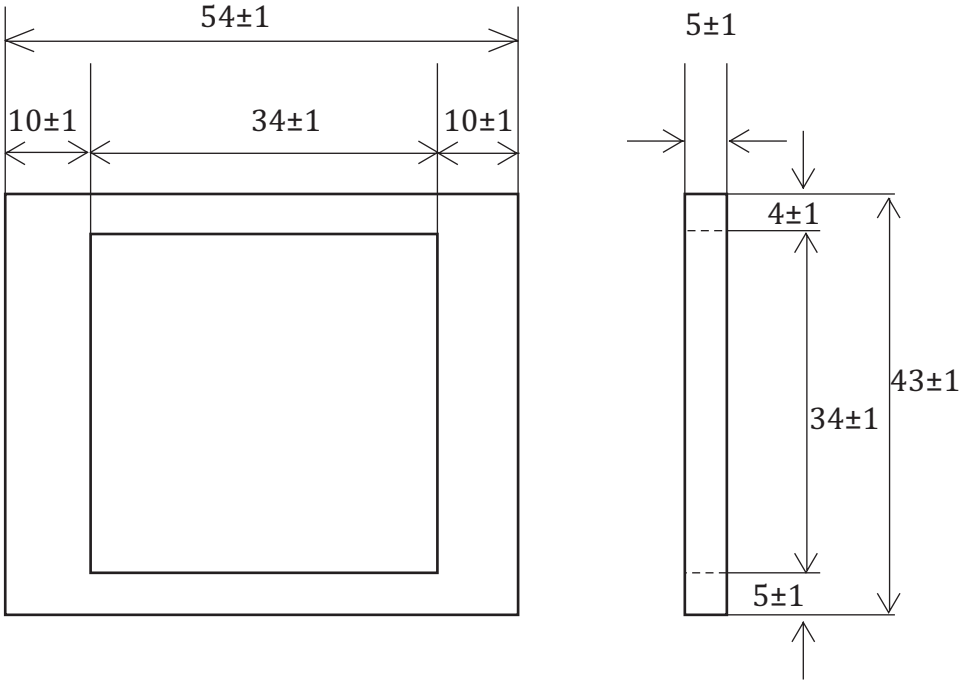


Figure 8 — Dimension of spacer

— **Specimen cover**, shown in Figure 5, Figure 6, and Figure 7. The inner dimension of the cover is 32 mm ± 0,5 mm by 32 mm ± 0,5 mm. The cover is made of metal with a thickness of 2 mm ± 0,1 mm.

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

6.3 Recording device, recorder or data acquisition system capable of capturing the impressed voltage values with respect to time.

6.4 Electro static neutralization apparatus, self-discharge type or superimposed voltage type.

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

7 Preparation of specimen

7.1 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.

7.2 Cleansing of sample

7.2.1 General

In case cleansing of the 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.

7.2.2 Wash by water

Wash the samples through 3 cycles according to ISO 6330 Procedure 4N or 4M at 40 °C water temperature, using a 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.

7.2.3 Dry cleaning

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

7.3 Conditioning of sample

Condition samples as follows:

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

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

8 Preparation of the test apparatus

8.1 Adjust the distance between the tip of the needle electrode and the surface of the specimen cover to 18 mm ± 0,1 mm, and the distance between the detective electrode and the surface of the specimen cover to 13 mm ± 0,1 mm.

NOTE The thickness of the specimen cover is 2 mm ± 0,1 mm, so the distance from the needle electrode to the surface of specimen is 20 mm ± 0,1 mm and from the detective electrode to the surface of specimen is 15 mm ± 0,1 mm.

8.2 Connect the test apparatus to the recording device.

8.3 Set the voltage to be applied to −10 kV.

9 Test method

9.1 After conditioning as specified in 7.3, cut 5 square test specimens, 45 mm ± 1 mm by 45 mm ± 1 mm, from the sample.

9.2 Eliminate static electricity from the specimen by using an electro static neutralization apparatus (6.4)

9.3 Mount the test specimen on the spacer (Figure 8) and slide it under the specimen frame (Figure 6 and Figure 7).

9.4 Start the turntable rotating and allow it to reach a steady rotation speed.

9.5 Apply the voltage of −10 kV for 30 s while the turntable is rotating.

9.6 Stop applying voltage while the turntable is continuously rotating.

9.7 Measure the impressed peak voltage and the decay of the voltage against time.

If the half decay time is not obtained within 120 s, stop the measurement and record the half decay time as over 120 s.

9.8 Remove the specimen from the specimen frame.

9.9 Repeat the test procedure from 9.2 to 9.8 for the other 4 test specimens.

Test results shall be expressed as the arithmetic mean value of the impressed peak voltages and the arithmetic mean value of the half decay times for the five specimens tested. Round results off to two significant figures.

10 Test report

Test report shall include the following information:

a) reference to this part of ISO 18080, i.e. ISO 18080-1;

b) identification of test fabrics;

c) atmosphere for conditioning and testing if there is deviation from this International Standard;

d) cleansing method, if used;

e) test result for the impressed peak voltage and half decay time or any other decay time obtained;

f) any deviation from this part of ISO 18080.

Annex A
(informative)

Interpretation of the test result

A.1 General

The interpretation of test results in relation to the fitness of the fabrics tested for a specific application is a decision to be made between the parties concerned. An example of a scheme for making such interpretation based on test results from this part of ISO 18080 is given in this Annex.

A.2 Interpretation based only on this part of ISO 18080 test results

Qualitative interpretation of the electrostatic propensity of fabrics based only on this part of ISO 18080 test results can be made as shown in Table A.1.

Table A.1 — Interpretation based only on this part of ISO 18080 test results

ISO 18080-1	**Half decay time (HDT) (s)**			
	HDT ≤ 10	**10 < HDT ≤ 30**	**30 < HDT ≤ 60**	**60 < HDT**
Interpretation of anti-static properties	Excellent	Better	Good	Poor

Annex B
(informative)

Round robin test results

B.1 Test sample

Three samples were prepared for this test:

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

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

— polyester 100 % woven fabric with conductive fibres in stripe: designated as C.

B.2 Round robin test condition

B.2.1 Participants

Testing houses from Japan: designated as Ta, Tb, Tc and Td.

B.2.2 Used equipment: Made by SHISHIDO ELECTROSTATIC. LTD,

Type: STATIC HONESTMETER H-0110-S4

B.2.3 Testing condition

B.2.3.1 Temperature and relative humidity used are 20 °C and 40 %.

B.2.3.2 Cleansing method used is ISO 6330, 4 M, 3 cycles and then washing by 40 °C water for 10 min in 3 cycles, then, natural drying.

B.2.4 Test result

The test results for the half decay time (s) and the impressed peak voltage are shown in Table B.1 and Table B.2 respectively.

The summary of the test result is as follows

Sample	**Charged voltage** (kV)	**Half decay time** (s)
A	1,68	>120
B	1,51	45,3
C	1,69	4,5

Table B.1 — Test result for half decay time (s)

Sample		A[a]				B				C			
Testing house (TH)		Ta	Tb	Tc	Td	Ta	Tb	Tc	Td	Ta	Tb	Tc	Td
Test data:	1	120	120	120	120	62,4	36,4	50,5	36,1	3,2	1,8	3,0	5,3
Half decay time (s)	2	120	120	120	120	90,2	39,7	47,6	35,3	3,5	2,1	2,0	6,5
	3	120	120	120	120	44,4	35,2	56,9	36,7	9,0	1,8	3,2	8,4
	4	120	120	120	120	43,6	35,7	53,9	33,7	5,8	2,0	3,4	8,7
	5	120	120	120	120	41,8	33,6	55,9	35,5	7,2	2,4	3,1	7,0
Average for TH		120	120	120	120	56,5	36,1	53	35,5	5,7	2	2,9	7,2
STD for TH		0	0	0	0	20,6	2,3	3,9	1,1	2,5	0,2	0,5	1,4
Average for all the TH		120				45,3				4,5			
STD for all the TH		0				11,0				2,4			
CV% for all the TH		0				24,4				53,7			
[a] 120 s means over a time limit of 120 s.													

Table B.2 — Test result for the impressed peak voltage (kV)

Sample		A				B				C			
Testing house (TH)		Ta	Tb	Tc	Td	Ta	Tb	Tc	Td	Ta	Tb	Tc	Td
Test data: Impressed peak voltage (kV)	1		1,87	1,57	1,56	1,55	1,62	1,57	1,42	1,68	1,8	1,58	1,72
	2		1,89	1,59	1,57	1,57	1,63	1,47	1,43	1,64	1,8	1,61	1,7
	3		1,84	1,59	1,56	1,49	1,67	1,43	1,42	1,76	1,67	1,6	1,64
	4		1,85	1,63	1,62	1,5	1,61	1,35	1,41	1,73	1,75	1,65	1,63
	5		1,87	1,65	1,55	1,51	1,57	1,53	1,42	1,73	1,81	1,63	1,72
Average for TH			1,86	1,61	1,57	1,52	1,62	1,47	1,42	1,71	1,77	1,61	1,68
STD for TH			0,02	0,03	0,03	0,03	0,04	0,09	0,01	0,05	0,06	0,03	0,04
Average for all the TH		1,68				1,51				1,69			
STD for all the TH		0,01				0,03				0,01			
CV% for all the TH		0,40				2,18				0,77			

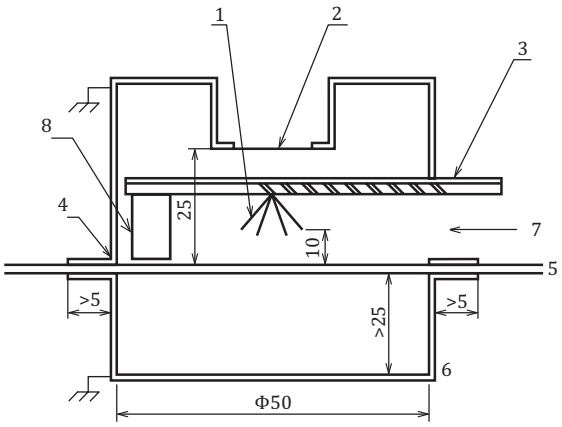
Annex C
(informative)

Comparison between IEC 61340-2-1 and this part of ISO 18080

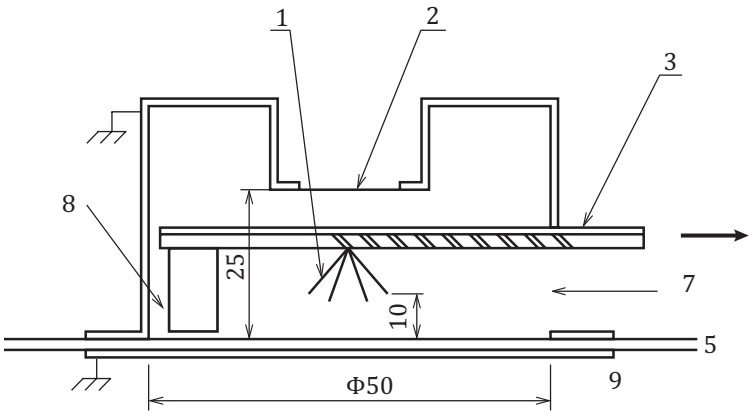
	IEC 61340–2-1	ISO 18080-1
Title	Electrostatics — Part 2–1: Measurement methods — Ability of materials and products to dissipate static electric charge	Textiles — Test methods for evaluating the electrostatic propensity of fabrics — Part 1: Test method using corona charging
Origin	BS 7506–2	JIS L 1094
Principle of method	Instrument is placed on the sample. The instrument has a removable corona array which is momentarily energised to deposit charge on the sample surface. The corona array is quickly removed leaving the sample surface exposed to a fieldmeter, which is used to monitor the surface potential and its decay. See Figure 1.	A cut specimen is placed on a turntable. As the turntable is rotated, the specimen is exposed to a corona array to deposit charge on the specimen surface. A fieldmeter is used to monitor the surface potential and its decay. See Figure 2.
Test area	50 mm diameter	32 mm × 32 mm
Sampling	— Cut specimens — Uncut fabric — Garments and other finished items — Rigid materials — Powders (with suitable sample holder) — Liquids (with suitable sample holder) — No thickness restrictions	Thin, cut specimens only
Possible uses	— Production quality control — Material qualification — Finished product qualification — Inwards goods inspection — Compliance verification of products during use life, including re-testing of products after washing/cleaning	— Production quality control — Material qualification — Finished product qualification (but product would be damaged by cutting specimens)
Portability	Existing commercial equipment is self-contained and easily portable. Suitable for laboratory and factory measurements.	Existing commercial equipment is not portable. Suitable for laboratory measurements only.
Validation	Extensive research work has been conducted by the developer of the test method and published in learned journals and at relevant conferences (see http://www.infostatic.co.uk/papers.html). Published work includes comparison with realistic charging mechanisms (tribocharging), and relevance to specific applications including cleanrooms, electronics, ignition risks, garment clinging, etc.	Japan Foundation of Textile Testing published the [Textile products quality standard] in which the standard value are specified for synthetic textiles, liner clothes, etc. measured by using this International Standard as shown in JWG 26 in Tokyo.

	IEC 61340–2-1	ISO 18080-1
Apparatus	See Figure C.1	See Figure 5 and Figure 6

Dimensions in millimetres



a)



b)

Key

1	array of corona points, the tips of which form a circle (10 ± 1) mm in diameter	5	sample
2	fieldmeter sensing aperture	6	open-shielded backing
3	movable plate:	7	grounded backing
	— insulating plate to mount corona points (resistance to ground > 10^{14} Ω)	8	air dam
	— grounded top surface to shield fieldmeter	9	grounded backing
4	grounded casing		

NOTE All dimensions have a tolerance of ±1 mm.

Figure C.1 — Test apparatus of IEC 61340-2-1

Bibliography

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

[2] ISO 18080-2, *Textiles — Test methods for evaluating the electrostatic propensity of fabrics: Part 2: Test method using rotary mechanical friction*

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[5] IEC 61340-2-3, *Electrostatics — Part 2-3: Methods of test for determining the resistance and resistivity of solid planar materials used to avoid electrostatic charge*

[6] Japan Foundation of Textile Testing. *Textile products quality standard*. 2007

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