INTERNATIONAL STANDARD

ISO 18080-2

First edition
2015-12-15

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

Part 2: Test method using rotary mechanical friction

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

Partie 2: Méthode d'essai de frottement mécanique rotatif

Reference number
ISO 18080-2:2015(E)

COPYRIGHT PROTECTED DOCUMENT

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

Contents

Page

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.

This test method simulates electrostatic charging typically experienced in wearing conditions. The standard rubbing cloths and mechanical conditions have been selected from long experience.

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

Part 2:
Test method using rotary mechanical friction

1 Scope

This part of ISO 18080 specifies a test method using rotary mechanical friction with measurement of the friction-charged electrostatic potential on specimens of fabric. 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 mechanical 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 5084, *Textiles — Determination of thickness of textiles and textile products*

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

3.3
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.

4 Principle

A fabric specimen is mounted on a rotary drum and mechanically rubbed against a stationary rubbing cloth as the drum rotates. The electrostatic potential caused by the friction between the specimen and the rubbing cloth is measured by a detector electrode during the rotation cycle.

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, one possible test apparatus is shown in Figures 1 to 3 as an example with further details shown below. Other apparatus may also be used after appropriate validation.

6.2 Rotary drum (Figure 1, key 5), aluminium drum with specimen mounting holders. The outside diameter of the drum is 150 mm ± 1 mm, the width is 60 mm ± 1 mm, and it is rotated at (400 ± 1) rpm by a motor.

— **Mounting pedestal for specimen** (Figure 1, key 3, and Figure 2), made from a metal frame with an insulating plastic insert such as polytetrafluoroethylene, the surface of which is level with the upper edge of the metal frame and of the same radius of curvature.

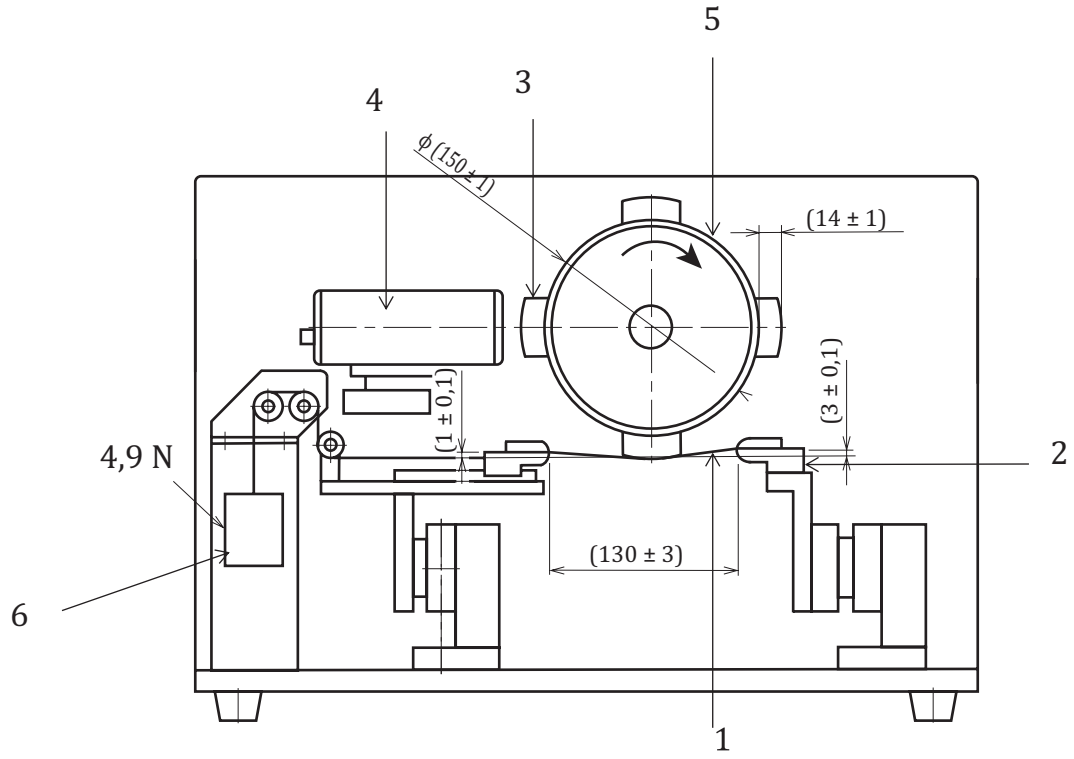
NOTE Figure 1 shows a drum fitted with four mounting pedestals. This is necessary to keep the drum in balance as it rotates. Only one pedestal is used for mounting the test specimen.

— **Specimen cover** (Figure 3), made of stainless steel with a thickness of 1 mm ± 0,1 mm.

— **Friction position** (shown in Figure 1), a rubbing cloth (key 1) of 25 mm ± 1 mm width by 150 mm ± 1mm length is held by clamps (key 2) at both ends with a distance of 130 mm ± 3 mm between the clamps and held in tension by a load of 4,9 N ± 0,1 N (key 6). The vertical distance between the rubbing cloth surface and a horizontal line tangential to the specimen pedestal surface shall be 1,0 mm ± 0,1 mm measured at the left side clamp and 3,0 mm ± 0,1 mm measured at the right side clamp.

— **Detector electrode** (Figure 1, key 4) a plate type field sensor with a plate diameter of 20 mm ± 1 mm, measurement range from 0 kV to 10 kV with an accuracy of ±5 %, and response time less than 7 ms. Other types of electrostatic fieldmeters or non-contacting voltmeters of suitable dimensions can be used.

Dimensions in millimetres

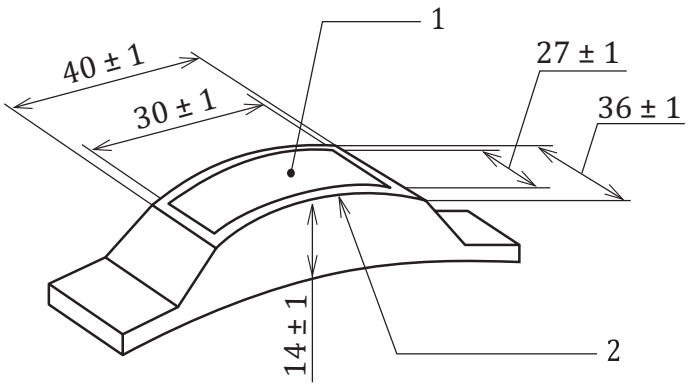


Key

1 rubbing cloth
2 clamp for rubbing cloth
3 mounting pedestal for specimen (only one pedestal is used for mounting the test specimen)
4 detector electrode
5 rotary drum
6 load (tolerance: ±0,1 N)

Figure 1 — Example of a testing apparatus

Dimensions in millimetres

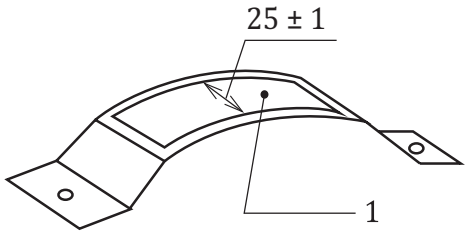


Key

1 insulating plastic pedestal
2 metal frame with a radius of curvature approximately 90 mm ± 1mm

Figure 2 — Mounting pedestal

Dimensions in millimetres



Key

1 open space (25 mm ± 1 mm width by 30 mm ± 1 mm length)

Figure 3 — Specimen cover

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.

6.3 Recording device.

6.4 Static electricity elimination equipment, self-discharge type or superimposed voltage type.

6.5 Rubbing cloth, wool and cotton standard adjacent fabrics specified in ISO 105-F01 and ISO 105-F02.

If other rubbing cloths are used, a complete description shall be included in the test report.

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

7 Preparation of specimen

7.1 Sampling

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

7.1.2 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 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 can affect test results. Careful cleaning of the washing machine before use is recommended.

7.2.3 Dry cleaning

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

7.3 Conditioning of sample

Condition samples as follows:

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

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

8 Preparation for the apparatus

8.1 Specimen thickness

Measure the thickness (t mm) of the specimen to be tested according to ISO 5084.

8.2 Adjustment of the height of detector electrode

Adjust the distance from the detector electrode to the surface of specimen cover on the mounting pedestal (Figure 1, key 4) to be 15 mm + t mm.

8.3 Adjustment of the height of rubbing cloth clamps

The standard clamp positions over horizontal tangent line are 1 mm ± 0,1 mm for left clamp and 3 mm ± 0,1 mm for right clamp. According to the thickness of specimen, adjust the height of clamps down by the amount of the specimen thickness (t).

For the left clamp position: 1 mm – t mm

For the right clamp position: 3 mm – t mm

8.4 Connection to recording device

Connect the apparatus to recording device.

9 Testing method

9.1 After conditioning as specified in 7.3, cut five test specimens from the sample of dimensions 50 mm ± 1 mm by 80 mm ± 1 mm with the longer dimension in the direction of the warp in woven fabrics, the wale in knitted fabrics, or machine direction in nonwoven fabrics. Cut a further five specimens with the longer dimension in the direction of the weft in woven fabrics, the course in knitted fabrics, and the cross direction in nonwoven fabrics.

9.2 After conditioning as specified in 7.3, cut 10 pieces of each type of rubbing cloth of dimensions 150 mm ± 1 mm by 25 mm ± 1 mm with the longer dimension in the warp direction.

9.3 Eliminate static electricity from the specimen and rubbing cloth by using static electricity elimination equipment (6.4).

9.4 Set the rubbing cloth (Figure 1, key 1) in the clamps (Figure 1, key 2) and ensure the position of the clamps is adjusted as specified in 8.3.

9.5 Mount the test specimen on the mounting pedestal (Figure 1, key 3) with its surface upward and tight the specimen cover.

9.6 Start the motor to rotate the rotary drum, thereby causing the test specimen to be rubbed against the rubbing cloth.

9.7 After 60 s, measure the generated voltage, whilst the drum is rotating, and then switch off the motor to stop the drum.

9.8 Change the specimen and rubbing cloth and repeat the measurement for the other four test specimens in same direction of fabric.

The measurement shall be done for warp and weft directions in woven fabrics, wale and course directions in knitted fabrics or machine, and cross directions in nonwoven fabrics. The overall test result shall be expressed by the average of five test results for 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 18080-2;

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 of average of each direction and total;

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 on Part 2 test results

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

Table A.1 — Interpretation based on Part 2 test results

Part 2 Friction-charged electrostatic potential (FP) (V)	FP ≤ 1 000	1 000 < FP ≤ 2 000	2 000 < FP ≤ 3 000	3 000 < FP
Interpretation of antistatic properties	Excellent	Better	Good	Poor

Annex B
(informative)

Round robin test result

B.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 with conductive fibres in stripe: designated as C.

B.2 Round robin test condition

B.2.1 Participants

Four testing houses (TH) from Japan: designated as Ta, Tb, Tc, and Td.

B.2.2 Testing condition

B.2.2.1 Temperature and relative humidity used are 20 °C and 40 %.

B.2.2.2 Cleansing method used is ISO 6330 4 M, three cycles, and then washing by 40 °C water for 10 min then natural drying.

B.3 Equipment used

Ta: DAIEI KAGAKU SEIKI MFG. CO., LTD RST 300

Tb: INTEC CO., LTD EC-3DN

Tc: DAIEI KAGAKU SEIKI MFG. CO., LTD, RST 500

Td: DAIEI KAGAKU SEIKI MFG. CO., LTD, RST 200

B.4 Test result

The summary of the test result is as the following based on Table B.1 to Table B.5.

Sample	Friction charge potential (V)
A	3 941
B	1 128
C	1 132

Table B.1 — Test result using cotton rubbing fabric and warp direction

	Rubbing fabric	Direction	No.	A				B				C			
				Ta	Tb	Tc	Td	Ta	Tb	Tc	Td	Ta	Tb	Tc	Td
Test data (V)	Cotton	Warp	1	3 824	2 815	4 939	2 901	974	298	706	812	—	—	936	1 334
			2	3 711	2 653	5 442	2 926	1 027	215	628	885	—	—	922	1 297
			3	3 777	2 286	5 337	2 993	1 199	162	485	1 010	—	—	978	1 289
			4	3 773	2 564	5 920	3 001	971	178	713	737	—	—	930	1 362
			5	3 934	2 447	5 587	2 853	1 045	281	737	715	—	—	1 028	1 244
		Average within TH		3 803,8	2 553	5 445	2 934,8	1 043,2	226,8	653,8	831,8			958,8	1 305,2
		STD within TH		83,1	200,8	358,3	62,6	92,9	60,7	102,8	120,0			44,3	45,1
		Average among TH		3 684,2				688,9				1 132,0			
		STD among TH		1 285,3				346,8				244,9			
		CV% among TH		34,9				50,3				21,6			

Table B.2 — Test result using cotton rubbing fabric and weft direction

	Rubbing fabric	Direction	No.	A				B				C			
				Ta	Tb	Tc	Td	Ta	Tb	Tc	Td	Ta	Tb	Tc	Td
Test data (V)	Cotton	Weft	1	3 665	1 738	5 458	2 807	1 987	305	1 144	1 257	848	1 556	—	950
			2	3 648	2 111	5 406	2 780	1 749	164	1 208	1 376	742	1 231	—	866
			3	3 607	2 932	5 336	2 796	1 740	310	632	1 387	791	1 492	—	896
			4	3 575	2 134	5 840	2 933	1 992	275	1 001	1 324	705	1 263	—	837
			5	3 675	2 317	5 661	2 945	1 927	243	884	1 237	655	1 291	—	894
		Average for TH		3 634	2 246,4	5 540,2	2 852,2	1 879	259,4	973,8	1 316,2	748,2	1 367		888,6
		STD for TH		42,0	437,2	206,7	79,9	125,5	59,7	228,8	67,9	74,8	147,0		41,9
		Average for all the TH		3 568,2				1 107,1				1 001,1			
		STD for all the TH		1 432,1				677,2				324,4			
		CV% for all the TH		40,1				61,2				32,4			

Table B.3 — Test result using wool rubbing fabric and warp direction

	Rubbing fabric	Direction	No.	A				B				C			
				Ta	Tb	Tc	Td	Ta	Tb	Tc	Td	Ta	Tb	Tc	Td
Test data (V)	Wool	Warp	1	3 724	3 866	5 196	2 961	601	532	956	1 166	—	—	948	661
			2	3 774	3 464	5 272	3 047	682	697	1 010	952	—	—	885	595
			3	3 787	3 899	5 675	3 057	595	509	853	968	—	—	877	646
			4	3 677	3 287	5 070	2 888	640	552	799	1 005	—	—	1 351	604
			5	3 585	3 941	5 578	2 935	643	594	923	1 049	—	—	1 039	576
		Average for TH		3 709,4	3 691,4	5 358,2	2 977,6	632,2	576,8	908,2	1 028			1 020	616,4
		STD for TH		82,1	296,3	257,6	72,9	35,4	74,1	83,4	85,7			196,1	35,7
		Average for all the TH		3 934,2				786,3				818,2			
		STD for all the TH		1 008,7				216,7				285,4			
		CV% for all the TH		25,6				27,6				34,9			

NOTE The values of this table and Table B.4 have negative polarity. To compare numbers, an absolute value has been adopted.

Table B.4 — Test result using wool rubbing fabric and weft direction

	Rubbing fabric	Direction	No,	A				B				C			
				Ta	Tb	Tc	Td	Ta	Tb	Tc	Td	Ta	Tb	Tc	Td
Test data (V)	Wool	Weft	1	3 767	3 611	5 254	2 852	1 332	619	1 710	1 221	467	703	—	575
			2	3 682	3 774	5 412	2 990	1 445	344	1 533	1 152	476	404	—	571
			3	3 663	3 827	5 373	2 860	1 453	569	1 226	1 214	482	473	—	581
			4	3 750	3 585	5 823	2 941	1 393	453	1 264	1 340	507	668	—	535
			5	3 572	3 623	5 567	2 886	1 243	551	1 145	1 343	436	486	—	583
		Average for TH		3 686,8	3 684	5 485,8	2 905,8	1 373,2	507,2	1 375,6	1 254	473,6	546,8		569
		STD for TH		77,8	108,9	219,2	58,6	87,4	109,3	237,0	84,3	25,7	131,0		19,6
		Average for all the TH		3 940,6				1 127,5				529,8			
		STD for all the TH		1 093,7				417,4				49,9			
		CV% for all the TH		27,8				37,0				9,4			
NOTE The values of this table and Table B.4 have negative polarity. To compare numbers, an absolute value has been adopted.															

Table B.5 — Summary for the maximum frictional charged voltage and deviation

Rubbing fabric	Direction	No	A				B				C			
			Ta	Tb	Tc	Td	Ta	Tb	Tc	Td	Ta	Tb	Tc	Td
Wool for A and B, Cotton for C	Weft for A and B, Warp for C	1	3 767	3 611	5 254	2 852	1 332	619	1 710	1 221	—	—	936	1 334
		2	3 682	3 774	5 412	2 990	1 445	344	1 533	1 152	—	—	922	1 297
		3	3 663	3 827	5 373	2 860	1 453	569	1 226	1 214	—	—	978	1 289
		4	3 750	3 585	5 823	2 941	1 393	453	1 264	1 340	—	—	930	1 362
		5	3 572	3 623	5 567	2 886	1 243	551	1 145	1 343	—	—	1 028	1 244
	Average for TH		3 686,8	3 684	5 485,8	2 905,8	1 373,2	507,2	1 375,6	1 254			958,8	1 305,2
	STD for TH		77,8	108,9	219,2	58,6	87,4	109,3	237	84,3			44,3	45,1
	Average for all the TH		3 940,6				1 127,5				1 132			
	STD for all the TH		1 093,7				417,4				244,9			
	CV% for all the TH		27,8				37,0				21,6			

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*

ICS 59.080.30

Price based on 14 pages