



SLOVENSKI STANDARD

SIST EN 16812:2016

01-julij-2016

Tekstilije in tekstilni izdelki - Tekstilije, ki prevajajo elektriko - Ugotavljanje linearne električne upornosti prevodnih prog

Textiles and textile products - Electrically conductive textiles - Determination of the linear electrical resistance of conductive tracks

Textilien und textile Erzeugnisse - Elektrisch leitfähige Textilien - Bestimmung des elektrischen Widerstands von textilbasierenden Strukturen

Textiles et produits textiles - Textiles électriquement conducteurs - Détermination de la résistance électrique linéaire des pistes conductrices

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ICS:

59.080.01 Tekstilije na splošno Textiles in general

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EUROPEAN STANDARD

EN 16812

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April 2016

ICS 59.080.01

English Version

Textiles and textile products - Electrically conductive textiles - Determination of the linear electrical resistance of conductive tracks

Textiles et produits textiles - Textiles électriquement
conducteurs - Détermination de la résistance
électrique linéaire des pistes conductrices

Textilien und textile Erzeugnisse - Elektrisch leitfähige
Textilien - Bestimmung des linearen elektrischen
Widerstands von Leiterbahnen

This European Standard was approved by CEN on 13 February 2016.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents	Page
European foreword.....	3
1 Scope	4
2 Normative references	4
3 Terms and definitions	4
4 Principle of test	5
5 Test equipment	5
6 Test specimens	6
6.1 Number of test specimens	6
6.2 Dimensions of specimens	6
6.3 Conditioning	6
6.4 Relaxation	6
7 Test set-up	6
7.1 General	6
7.2 Test set-up for a “four electrode - four wire method”	6
7.3 Test set-up for a “two electrode - four wire method”	7
8 Test procedure	8
8.1 General	8
8.2 Preparation of conductive track contact points	8
8.3 Tensioning	9
8.3.1 General	9
8.3.2 Yarns	9
8.3.3 Fabrics	9
8.4 Contacting/ clamping of the specimen	9
8.5 Modus operandi and calculation of results	10
8.5.1 “Four electrode - four wire method”	10
8.5.2 “Two electrode - four wire measurement”	10
9 Test report	11
Annex A (informative) Four point (wire) Kelvin method	13
A.1 “Four electrode - four wire method”	13
A.2 “Two electrode - four wire method”	14
Bibliography	15

European foreword

This document (EN 16812:2016) has been prepared by Technical Committee CEN/TC 248 "Textiles and textile products", the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2016, and conflicting national standards shall be withdrawn at the latest by October 2016.

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EN 16812:2016 (E)

1 Scope

This European Standard describes a test method for the determination of the linear electric resistance of conductive tracks for textile structures or intended for application in/ to textiles, e.g. yarns, printed or coated tracks, ropes, ribbons and webbing.

This European Standard is designed for materials showing ohmic behaviour.

This European Standard is designed for conductive tracks where electrical contact between the measurement electrodes and the conductive track is possible.

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.

EN 12127, *Textiles — Fabrics — Determination of mass per unit area using small samples*

EN ISO 139, *Textiles — Standard atmospheres for conditioning and testing (ISO 139)*

3 Terms and definitions

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

3.1

textile-based electrically conductive track

electrically conductive part of the textile having a length to width ratio of minimum 10 to 1

Note 1 to entry: Examples for textile based electrically conductive tracks and how to determine their length (L) and width (w) are given in Figure 1

3.2

Ohmic behaviour

conductor's behaviour following Ohm's law

Note 1 to entry: Ohm's law is a fundamental law of electricity, stating that the voltage at the terminals of an ideal resistor is proportional to the current in the resistor (voltage U across the terminals equals resistance R times current I) [www.electropedia.org IEV ref 131-15-08].

Note 2 to entry: In this standard 'U' is used for the measured voltage, according to the IEC electropedia (www.electropedia.org).

3.3

linear electrical resistance R_l

electrical resistance per unit length of a track, as determined in this standard (expressed in ohm/m)

3.4

wire

lead or measurement point used in the four point Kelvin method

3.5

electrode

contact between the measurement wire and the sample

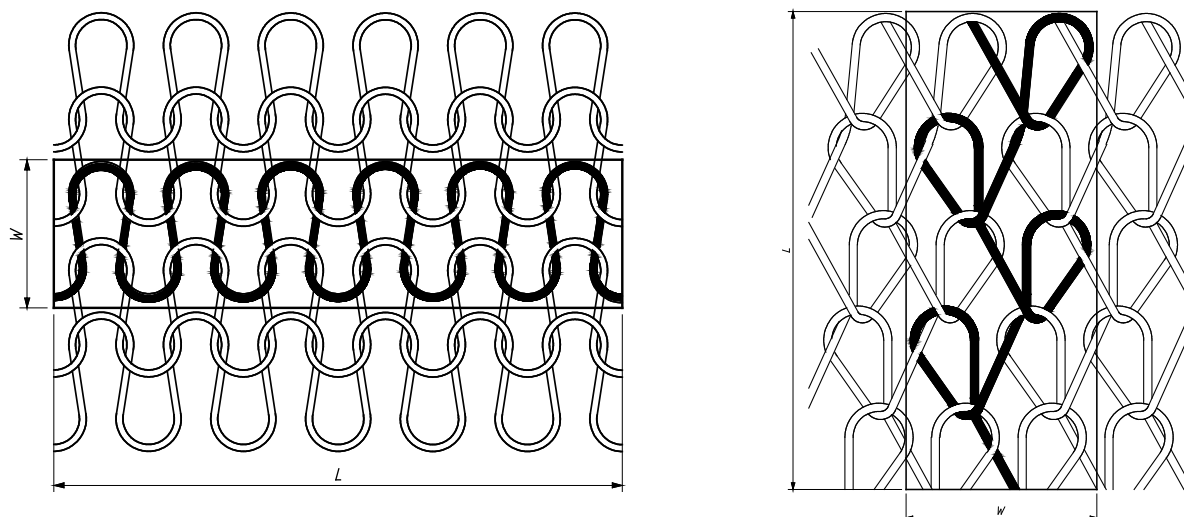


Figure 1 — Different types of conductive tracks, with indication on how to determine the width (W) and the length (L) of the track. Images adapted from EN ISO 8388

4 Principle of test

This test describes a procedure to measure the linear electrical resistance of textile based electrically conductive tracks using the measurement principle of the four wire (four point) Kelvin method and a DC current source.

This test method can be performed as “four electrode - four wire method” or “two electrode - four wire method”.

By using four electrodes the contact resistances between the electrodes and the sample are compensated. As a result this method requires less measurements and calculations as compared to the “two electrode - four wire method”. This is why the “four electrode - four wire method” is preferred.

In cases where it is not feasible to prepare the necessary four contacts for the electrodes, “the two electrode - four wire method” can be used.

5 Test equipment

The test equipment shall consist of:

- an electrical current source able to deliver a stable DC current in the range necessary for the measurement;
- a volt-meter capable of measuring voltages in the range necessary for the measurement.

NOTE An Ohm meter in accordance with EN 60051-6, suitable for four wire measurements, can also be used.

- Contacting electrodes, which shall be clean, oxide free and undamaged, and suitable for low-resistance measurements e.g. made of chrome or gold finished copper. The electrodes shall be suitable for soft materials e.g. have a flat contact surface.
- A calibrated ruler to measure the distance between the voltage electrodes (edge to edge), with the resolution of at least 3 significant digits in relation to the sample length. The ruler should preferably be integrated in the clamping device.

EN 16812:2016 (E)

- An insulating surface on which the specimen is placed. An insulating surface has a surface resistance of $> 10^9 \Omega$ reduced to a square, also commonly expressed as Ω / \square or Ω/sq . Alternatively the specimen can also be suspended in air.

6 Test specimens**6.1 Number of test specimens**

Five representative specimens per sample shall be tested.

NOTE Resistance may depend on the orientation of the sample taken out of the textile structure.

Additional specimens may be required as discussed in 8.5.

6.2 Dimensions of specimens

The specimen length shall be chosen such that:

- the distance d between the voltage electrodes is at least 10 times the width w of the conductive track; a recommended distance d is 50 cm, taking into account the requirements mentioned below.
- the part between the voltage electrodes represents the full structure of the conductive track
- the specimen fits into the measurement set-up, including clamping device and current electrodes.

6.3 Conditioning

Test specimens shall be stored for at least 24 h in standard atmosphere conditions (20 °C and 65 % RH in accordance with EN ISO 139).

6.4 Relaxation

Relaxation of the fabrics shall be performed according to EN 12127.

It is important to ensure that the fabrics are in the relaxed state prior to testing. The fabrics shall be kept in a flat tension free state for at least 24h, during conditioning. Knitted fabrics may require a longer relaxation treatment, as agreed upon between the interested parties.

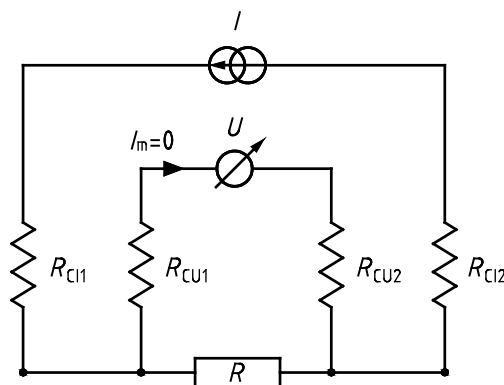
7 Test set-up**7.1 General**

In the following the test set-up is described with the level of detail needed for implementing this standard. A more detailed description of the test set-up can be found in Annex A.

7.2 Test set-up for a “four electrode – four wire method”

This set-up is the preferred set-up, as discussed in Clause 4.

The electrodes shall be arranged as shown in Figure 2 and shall cover the whole width of the conductive track.

**Key**

I the applied current, in amperes

U the measured voltage, in volts

I_m the current in the voltage measurement circuit (equivalent to zero)

R_{C11}, R_{C12} the contact resistances in the current circuit, in ohms

R_{CU1}, R_{CU2} the contact resistances in the voltage circuit, in ohms

R the resistance of the sample in ohms, identical to the measured resistance: $R = U/I$

Figure 2 — Schematic test set-up for a four electrode - four wire measurement

7.3 Test set-up for a “two electrode - four wire method”

This set-up shall be used for tracks where the application of the “four electrode - four wire method” is not possible.

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