

INTERNATIONAL STANDARD

**Electrostatics –
Part 4-9: Standard test methods for specific applications – Garments**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTROSTATICS –

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Garments

FOREWORD

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International Standard IEC 61340-4-9 has been prepared by IEC technical committee 101: Electrostatics.

The text of this standard is based on ANSI/ESD STM2.1-1997. It was submitted to the National Committees for voting under the Fast Track Procedure.

The text of this standard is based on the following documents:

FDIS	Report on voting
101/294/FDIS	101/298/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61340 series, under the general title *Electrostatics*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

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INTRODUCTION

This part of IEC 61340 provides test methods for evaluating the resistance of garments used in the electronics industry for the control of electrostatic discharge. This part is limited to defining procedures for measuring electrical resistance of garments. It does not address electrical resistance through a person or in combination with a person connected to ground. However, resistance may not fully characterize a garment's performance. Additional parts may cover procedures for evaluating these properties.

A common source of electrostatic charge is clothing made from synthetic fibres resulting in an accumulation of charge on a person's clothing. The effect of this charge can be minimized by evaluating and selecting an appropriate garment. To effectively control electrostatic charges, the garment should be grounded.

This standard may be used in part to cover specific applications. To fully characterize a garment, field attenuation and tribocharging may need to be considered, but these procedures are beyond the scope of this standard.

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ELECTROSTATICS –

Part 4-9: Standard test methods for specific applications – Garments

1 Scope

This part of IEC 61340 provides specific test methods for evaluating electrical resistance of static control garments.

This part defines the test methods for determining the electrical resistance from sleeve-to-sleeve and point-to-point of static control garments.

The test methods defined in this standard utilize standard instruments to measure the resistance of static control garments. These methods are intended as qualification test procedures. They can also be used as periodic tests to ensure ongoing electrical integrity of the garment under ambient conditions.

The sleeve-to-sleeve method (Figures 1 and 2) is intended to test the integrity of the electrical resistance across the seams of the garment.

The point-to-point test method (Figure 3) is intended to test the electrical resistance between any two points on the garment, which may include the electrical resistance across the seams of the garment.

2 Normative references

The following referenced documents are indispensable for the application 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.

ESD ADV1.0, *ESD Association glossary of terms*¹

ANSI/ESD S4.1, *ESD standard for protection of electrostatic discharge susceptible items – ESD protective worksurfaces*

ANSI/ESD STM11.11, *Surface resistance measurement of static dissipative planar materials*

ASTM F-150, *Standard test method for electrical resistance of conductive and static dissipative resilient flooring*²

National Fire Protection Association (NFPA) 99:2005, *Standard for health care facilities*

¹ ESD Association, 7900 Turin Rd, Bldg 3, Ste 2, Rome, NY 13440, 315-339-6937

² American Society for Testing and Materials (ASTM) 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, 610-832-9500

3 Terms and definitions

For the purposes of this document, the following terms, in addition to those specified in the EOS/ESD glossary of terms, shall apply.

3.1

garment system

any electrically interconnected components of static control apparel

3.2

point-to-point resistance

resistance in ohms measured from one point to another on the surface of the same panel or two different panels of a garment

3.3

sleeve-to-sleeve resistance

resistance in ohms measured from the sleeve opening of the garment to the other sleeve opening of the same garment

3.4

static control garments

personnel garments that are designed for electrostatic charge control

4 Personnel safety

4.1 The procedures and equipment described in this standard may expose personnel to hazardous electrical conditions. Users of this standard are responsible for selecting equipment that complies with applicable laws, regulatory codes and external and internal policy. Users are cautioned that this standard cannot replace or supercede any requirements for personnel safety. The ultimate responsibility for personnel safety resides with the end user of this standard.

4.2 Ground fault circuit interrupters (GFCI) and other safety protection should be considered wherever personnel might come into contact with electrical sources.

4.3 Electrical hazard reduction practices should be exercised and proper grounding instructions for the equipment must be followed when performing these tests.

5 Test methods

This clause defines the test methods for measuring the sleeve-to-sleeve and point-to-point electrical resistance of a static control garment or garment system.

5.1 Test equipment requirements

5.1.1 Resistance measuring equipment

Self-contained resistance meters (i.e. megohmmeter) or power supplies and current meters in the appropriate configuration for resistance measurement within a ± 10 % accuracy shall be utilized. The equipment shall be capable of open-circuit voltage of 100 V ± 10 V d.c. Both test leads must be isolated from ground.

5.1.2 Clamps/electrodes (sleeve-to-sleeve)

The electrodes shall consist of two flat electrically conductive plates (e.g. stainless steel) with a dimension of 50,8 mm \times 25,4 mm (2" \times 1") each as shown in Figure 1. The clamps shall be electrically conductive with sufficient pressure to suspend the garment, see Figure 2.

5.1.3 Electrodes (point-to-point)

Use electrodes in accordance with ANSI/EOS/ESD S4.1 (ie. two cylindrical 2,27 kg (5 pound) electrodes with a diameter of 63,5 mm (2,5" each having contacts of electrically conductive material with a shore-A (IRHD) durometer hardness of 50-70). The resistance between the two electrodes should be less than 100 k Ω when measured at 10 V on a metallic surface. Electrodes that meet ASTM F-150 and NFPA 99 also meet these characteristics.)

5.1.4 Environmental test chamber

A closed chamber capable of controlling relative humidity (RH) at $(12 \pm 3) \% RH$ and $(50 \pm 5) \% RH$ and a temperature of $(23 \pm 3) ^\circ C$. The humidity indicating instrumentation shall be accurate to within $\pm 3 \% RH$ in the operation range and traceable to national standards, such as the National Institute of Standards and Technology (NIST) in the United States or international standards.³

5.1.5 Support surface

The support surface shall be a smooth flat insulative surface. Surface resistance of the support surface shall be greater than $1,0 \Omega \times 10^{13} \Omega$ when tested in accordance with EOS/ESD S11.11.

5.2 Test parameters

5.2.1 Sample preparation

The test sample shall be processed through 3 cycles of the garment material manufacturer's prescribed cleaning process prior to performing the test.

5.2.1.1 Sample sketch

Testers should examine the garment's construction and make a general sketch showing separate FRONT and BACK panels used to fabricate the garment. Number the panels for measurement identification purposes from n° 1 through to n° n. Identify the sleeves as LEFT and RIGHT.

5.2.2 Humidity

The test samples shall be tested at two humidity conditions.

5.2.2.1 Low humidity

The test sample shall be preconditioned at $(12 \pm 3) \% RH$ and $(23 \pm 3) ^\circ C$ for a minimum of 48 h prior to performing the test at these environmental conditions.

5.2.2.2 Moderate humidity

The test sample shall be preconditioned at $(50 \pm 5) \% RH$ and $(23 \pm 3) ^\circ C$ for a minimum of 48 h prior to performing the test at these environmental conditions.

5.2.3 Test sample quantity

Test all samples for each style and manufacturer when using this test procedure as a qualification test.

³ National Institute of Standards and Technology, Bldg 820, NIST North, Gaithersburg, MD 20899, 301-948-1784.