ANSI/ESD STM2.1-2013
Revision of ESD STM2.1-1997

ESD Association Standard Test Method

ANSI/ESD STM2.1-2013

For the Protection of Electrostatic Discharge Susceptible Items

Garments - Resistive Characterization

Electrostatic Discharge Association
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ESD Association Standard Test Method for the Protection of Electrostatic Discharge Susceptible Items -

Garments - Resistive Characterization

Approved February 19, 2013
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FOREWORD

This standard test method[1] (STM) provides test methods for evaluating the electrical resistance of garments that contain surface conductive or dissipative components or materials used in the electronics industry for the control of electrostatic discharge. This document defines procedures for measuring electrical resistance, including a system resistance test for garments that provide a ground path for personnel.

Clothing made from synthetic fibers is a common source of electrostatic charge. Wearing an appropriate static control garment over personal clothing can minimize the effect of this charge. To effectively control electrostatic charges, the static control garment must be grounded.

Three categories of garments are considered in this document.

- ESD Category 1 garment; a **static control garment** may suppress or otherwise affect an electric field from clothing worn underneath the garment without being attached to ground. However, without grounding, a charge may accumulate on conductive or dissipative elements of a garment, if present, resulting in a charged source.
- ESD Category 2 garment; a **groundable static control garment,** when connected to ground, provides a higher level of suppression of the affects of an electric field from clothing worn underneath the garment.
- ESD Category 3 garment; a **groundable static control garment system** provides a ground path for a person that suppresses the electrical field from clothing worn underneath the garment and also bonds the skin of the test subject to an identified ground path. Groundable static control garment systems may also be used in conjunction with a continuous or constant monitoring system in a manner similar to those used in continuous monitoring of wrist straps in an ESD protected area (EPA).

Resistive characterization is only one aspect to consider in evaluating garments for any specific application. To fully characterize a garment, electrical field attenuation, static charge decay, peak voltage, residual voltage and triboelectric charging may need to be considered. Other attributes related to applications and environments, such as cleanroom compatibility, chemical and fire resistance, etc., should be evaluated in the garment selection process but are beyond the scope of this document.

Garments constructed from fabrics made with fibers that are not surface conductive but may have other related properties that impart some level of electrostatic charge dissipation or suppression when connected to ground, are not specifically measured by the methods provided in this STM.

Some garment fabrics and construction may allow for surface voltage accumulation and charge transfer to occur, which may be detrimental to electronic items.

This document was originally designated ANSI/ESD STM2.1-1997 and approved on September 20, 1997. On September 7, 2011, ANSI administratively withdrew ANSI/ESD STM2.1-1997 and the document was redesignated ESD STM2.1-1997. ANSI/ESD STM2.1-2013 is a revision of ESD STM2.1-1997 and was approved on February 10, 2013.

[1] **ESD Association Standard Test Method (STM):** A definitive procedure for the identification, measurement and evaluation of one or more qualities, characteristics or properties of a material, product, system or process that yields a reproducible test result.

At the time ANSI/ESD STM2.1-2013 was prepared, the 2.0 Garments Subcommittee had the following members:

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1.0 PURPOSE, SCOPE, AND APPLICATION

1.1 Purpose

This document provides test methods for evaluating the electrical resistance of static control garments that contain surface conductive or dissipative components or materials.

1.2 Scope

This document applies to outer garments that utilize surface conductive or dissipative components or materials, used for static control applications.

NOTE: The test methods defined in this document are not intended to measure materials with buried conductive layers.

1.3 Application

The test methods defined in this document utilize standard instruments to measure the electrical resistance of static control garments that are constructed with surface conductive or dissipative components or materials.

1.3.1 The resistance point-to-point test method (Figures 3a, 3b, 3c, 4, 5a, 5b, and 5c) tests the electrical resistance between the two sleeves, any two panels, or any two or more electrically interconnected components of the static control garment, including the electrical resistance across the seams and body contact point (BCP) of the garment as applicable.

1.3.1.1 An alternate sleeve-to-sleeve test method is provided in Section 6.5.2. It uses clamp/electrodes to hang the garment during the measurement, as shown in Figure 10.

1.3.2 Static control garments that electrically bond to the test subject and provide a path to ground for the test subject (Category 3) shall be evaluated by all three methods:

- the resistance point-to-point test method (Fig 5a, 5b and 5c);
- the resistance point to groundable point test method (Figures 4, 6a, 6b and 7); and
- the system test to determine the resistance from the person, through the garment groundable point of the garment to the groundable point, including the ground cord (Figures 8a and 8b).

1.3.3 The BCP measurement test method is provided in Section 6.3.3.3 for garments so equipped. The cuff test fixture shown in Figure 2 and applied in Figure 7 is required for these measurements. This cuff test fixture is also described in ANSI/ESD S1.1 - Wrist Straps.