

***ESD association technical report***

***ESD TR2.0-01-00***  
*(formerly TR05-00)*

**CONSIDERATION FOR DEVELOPING  
*ESD GARMENT SPECIFICATIONS***

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# CONSIDERATIONS FOR DEVELOPING ESD GARMENT SPECIFICATIONS

## **INTRODUCTION**

### **A DISCUSSION OF ESD PROPERTIES**

- Feature 1.  
ESD Awareness
- Feature 2.  
Surface Resistance (Conduction)
- Feature 3.  
Dissipation of Charge (Static Decay)
- Feature 4.  
Shielding Types
- Feature 5.  
Induce Electrostatic Voltage Suppression
- Feature 6.  
Anti-Static (Non-Tribocharging)

### **GENERAL COMMENTS**

#### *Possible Garment Tests*

#### **I. Device Damage**

##### **Device Sensitivity Types**

- 1. Voltage Sensitive Devices
- 2. Energy Sensitive Devices

##### **Discharge & Damage sources**

#### **II. Evaluation of ESD Problems**

- 1. Determine Discharges from Clothing
- 2. Develop Standard Model for Induced Charge
- 3. Determine Amount of Field Suppression
- 4. Compare Background to Charged Garments
- 5. Determine Damage by Type and Class

#### **IV. Garment Material Tests**

- 1. Resistance Measurement
- 2. Decay test
- 3. Induced Voltage Test.
- 4. Tribocharging Tests

#### **V. Manufactured Garment Tests**

- 1. Resistance Point to Point.
- 2. Resistance to Groundable Point.
- 3. Charge Decay Test Through Groundable Point.
- 4. Tribocharge

### **SUMMARY AND CONCLUSION**

#### **APPENDIX**

- Resistance
- Ohms Law
- Resistance/Resistivity Measurements
- Tribocharging
- Discharge of Squares
- Conductive fiber - Carbon Core
- Garment Experiment
- Definitions
- Gross Resistance
- Evaluation Test
- Acceptance Test
- Periodic Test
- Avalanche (Charge)
- Sheet Material
- "Figure of Merit"
- Ideal Garment
- References

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### Introduction

Concerns about effective ESD garments are best addressed by starting with an understanding of electrostatic measurements and how they relate to ESD protection. Basic ESD measurements are simple, but for yarns, fabrics, or garments, measurements become difficult and complicated. An ESD Association Technical Report (TR), TR-1 "*CAN STATIC ELECTRICITY BE MEASURED?*" by Niels Jonassen [1] discusses ESD measurements at length and at a fairly high technical level. The principals stated in TR-1 are basic to understanding electrostatic measurements, and what measurements are, or are not, valid. From studying these basic principals, garment measurements can be understood. Only proper test methods will provide the information that can determine effective ESD protection.

There are many test methods applied to garments, some are applicable others are not. Some of the test methods being used today are valid measurement standards however, they were designed for other specific materials. Some test methods do provide useful information to assure device protection. Others use in-house test methods that may or may not be effective. So far, these test methods have not been demonstrated to be directly related to the protection of ESD sensitive devices.

After careful analysis, some presently proposed measurements may be discarded as improper, impractical, or meaningless. Still, there will be those that will argue about the validity and usefulness of a particular measurement because they believe that their measurement or test method will determine ESD protection. Disagreement is inevitable, as the variables of numerous protection configurations, device requirements, and static charge sources are open-ended. Only when scientifically valid models are proposed can people agree on the facts and calculations to show what is useful for determining ESD protection.

The device's sensitivity must be considered and related to the requirements before ESD protections can be evaluated. What must be considered is the type of sensitivity of various device technologies and the possible way that devices can be damaged by common clothing, ordinary garments, or ESD garments. Only then can the requirements be evaluated to assure ESD protection.

To start the analysis of garment requirements, a list of "features" is discussed and defined. This will prevent confusion with the actual terms used to describe garment protection attributes. Then, the measurement methods can be discussed and evaluated. Also, measurement methods that could theoretically be made are analyzed and their problems discussed.

The Appendix has helpful and supporting information. The Appendix also has a definition of an ideal garment. The definitions show the contradictions of the listed requirements that are assumed to be needed for ESD protection of devices.