ESD Standards: An Annual Progress Report

by EOS/ESD Association, Inc.

Industry standards play a major role in providing meaningful metrics and common procedures that allow various manufacturers, customers, and suppliers to communicate from facility to facility around the world. Standards are increasingly important in our global economy. In manufacturing, uniform quality requirements and testing procedures are necessary to make sure that all involved parties are speaking the same language. In electrostatic discharge (ESD) device protection, standard methods have been developed for component ESD stress models to measure a component's sensitivity to electrostatic discharge from various sources. In ESD control programs, standard test methods for product qualification and periodic evaluation of wrist straps, garments, ionizers, worksurfaces, grounding, flooring, shoes, static dissipative planar materials, shielding bags, packaging, electrical soldering/desoldering hand tools, and flooring/footwear systems have been developed to ensure uniformity around the world.

EOS/ESD Association, Inc. (ESDA) is dedicated to advancing the theory and practice of ESD protection and avoidance. ESDA is an American National Standards Institute (ANSI) accredited standards developer. The Association's consensus body is called the standards committee (STDCOM), which has responsibility for the overall development of documents. Volunteers from the industry participate in working groups to develop new and to update current ESDA documents.

ESDA's standards business unit is charged with keeping pace with the industry demands for increased device and product performance and more effective control programs. The existing standards, standard test methods, standard practices, and technical reports assist in the design and monitoring of the electrostatic protected area (EPA), and also assist in the stress testing of ESD sensitive electronic components. Many of the existing documents relate to controlling electrostatic charge on personnel and stationary work areas. However, with the ever increasing emphasis on automated handling, the need to evaluate and monitor what is occurring inside of process equipment is growing daily. Since automation has become more dominant, the charged device model (CDM) has become the primary cause of ESD failures and, thus, the more urgent concern. Together, the human body model (HBM) and CDM cover the vast majority of ESD events that might occur in a typical factory.

ESDA's document categories are:

- **Standard (S):** A precise statement of a set of requirements to be satisfied by a material, product, system or process that also specifies the procedures for determining whether each of the requirements is satisfied.
- **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 yield a reproducible test result.
- **Standard Practice (SP):** A procedure for performing one or more operations or functions that may or may not yield a test result. Note: if a test result is obtained it may not be reproducible.
- **Technical Report (TR):** A collection of technical data or test results published as an informational reference on a specific material, product, system or process.

ESDA's technology roadmap is compiled by industry experts in IC protection design and test to provide a look into future ESD design and manufacturing challenges. Earlier roadmaps had pointed out that numerous mainstream electronic parts and components would reach assembly factories with a lower level of ESD protection than could have been expected just a few years earlier. Those predictions have proven to be rather accurate. As with any roadmap, the view of the future is constantly changing and requires updating on the basis of technology trend updates, market forces, supply chain evolution, and field return data. An updated roadmap will be published in 2016 looking out to the year 2020. A key prediction from this new roadmap is that while the ESD protection level *range* may not change dramatically, the

distribution of products within this range may change with a change in the mix of companies remaining on today's traditional technologies while other companies continue to push for technology advancements through the need for higher performance devices.

EOS is an area that has long been overlooked by the industry, not because of any limited importance but rather because of its complex definition and multiple root causes. Indeed, it has proven difficult to find complete agreement among experts on even the fundamental definitions. Thus the language of EOS, EOS threats, and responsibility remains open for discussion. However, a working group is currently completing a TR that focuses on "best practices", outlining ways to mitigate EOS threats in manufacturing, with an anticipated release in early 2017.

An area of concern that has been growing is the need to define upgraded control processes and tighter limits for high-reliability parts as well as devices that have ESD withstand voltages lower than those specified in the scope of ANSI/ESD S20.20. WG 19 initially was targeting process controls for aerospace only but this has been redirected to consider all high-reliability ESD process control. A document development effort has been initiated to specify "best practices" for high-reliability ESD control processes.

ESDA's standards committee is continuing several joint document development activities with the JEDEC Solid State Technology Association. Under the memorandum of understanding agreement, the ESDA and JEDEC formed a joint working group for the standardization work in which volunteers from the ESDA and JEDEC member companies can participate. This collaboration between the two organizations has paved the way for the development of harmonized device test methods for both HBM and CDM ESD, which will ultimately reduce uncertainty about test standards among manufacturers and suppliers in the solid state industry. ANSI/ESDA/JEDEC JS-001-2014, a fourth revision of the joint HBM document, was published in September 2014. An update to ANSI/ESDA/JEDEC JS-001-2014 is currently in the works with an anticipated release in late 2016. This new release will introduce a new 50 volt classification level. A second joint working group has completed a joint charged device model (CDM) document. ANSI/ESDA/JEDEC JS-002-2014, the first revision of the joint CDM document, was approved and published in early 2015. These efforts assist manufacturers of devices by providing one test method and specification for each model. These joint documents are aligning the entire ESD community on standardized test methods. In addition, a new joint WG has been formed with a focus on aligning ANSI/ESD S20.20 and JEDEC JESD625B. While in this case not focusing on creating a single joint document, the intent will be to create technically equivalent documents for industry use.

ESDA is also working in the area of process assessment. ESD TR17.0-01-14 was published in 2016. The TR is a compilation of recent publications by members of the WG. The TR gives the reader examples of "best practices" of process assessment methodologies and test methods. The WG is currently working on a Standard Practice on "Process Assessment Techniques". The goal of the SP is to provide a set of methodologies, techniques, and tools that can be used by experienced users to characterize the ability of a process to safely handle ESD sensitive items with a given ESD robustness.

The ESDA standard covering the requirements for creating and managing an ESD control program is ANSI/ESD S20.20 "ESD Association Standard for the Development of an Electrostatic Discharge Control Program for – Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)". ANSI/ESD S20.20 is a commercial update of and replacement for MIL-STD-1686 and has been adopted by the United States Department of Defense. In addition, the 2016 update of IEC 61340-5-1 edition 1.0 "Electrostatics - Part 5-1: Protection of Electronic Devices from Electrostatic Phenomena General Requirements" is technically equivalent to ANSI/ESD S20.20.

The 2014 updates to ANSI/ESD S20.20 include changes in scope to address CDM and isolated conductors, changes to the qualification of footwear/flooring systems, process required insulators within 1 inch of ESD sensitive devices and requirements on isolated conductors. A section was added on product qualification for clarification. In table 3, there were updates to ionization and the inclusion of wrist strap

ground connection requirements and the addition of soldering irons. Formatting of table 3 was updated for clarity. For more information, please go to https://www.esda.org/standards/factory/esd-control-program/.

An update to ESD TR20.20 has been completed and was published in April 2016. ESD TR20.20 is a handbook providing significant detailed guidance that can be used for developing, implementing, and monitoring an electrostatic discharge control program in accordance with ANSI/ESD S20.20. Additionally, ESD TR53, Compliance Verification, was updated and published in spring 2015. ESD TR53 provides compliance verification test procedures and troubleshooting guidance for ESD protective equipment and materials. Test results may be used for the Compliance Verification Plan Requirements of ANSI/ESD S20.20 or those of the user if more restrictive. Changes to ESD TR53 reflect updates made to the compliance verification plan requirements of ANSI/ESD S20.20-2014.

To better serve the industry world-wide, the ESDA has begun the process of translating documents into other languages, including Simplified Chinese, Traditional Chinese, Korean, Thai, Polish, French, Spanish, and Japanese. ANSI/ESD S20.20-2014 is currently available in all eight languages. Other documents have also been translated or are in various stages of translation. The ESDA has formed a relationship with the China National Institute of Standardization (CNIS) for the translation and marketing of all of the ESDA documents in China. A Memorandum of Understanding has been signed between the two organizations and CNIS is currently working on translation.

In order to meet the global need in the electronics industry for technically sound ESD control programs, the ESDA has established an independent third party certification program. The program is administered by EOS/ESD Association, Inc. through country-accredited ISO9000 certification bodies that have met the requirements of this program. The facility certification program evaluates a facility's ESD program to ensure that the basic requirements from industry standards ANSI/ESD S20.20 or IEC 61340-5-1 are being followed. More than 777 facilities have been certified worldwide since inception of the program. The factory certification bodies report strong interest in certification to ANSI/ESD S20.20, and consultants in this area report that inquiries for assistance remain at a very high level. Individual education also seems of interest once again as 95 professionals have obtained certified ESD program manager status and many more are attempting to qualify for this certification. A large percentage of the certification program requirements are based on standards and the other related documents produced by the ESD Association standards committee.

Current ESD Association Standards Committee Documents

Charged Device Model (CDM)

ANSI/ESDA/JEDEC JS-002 – ESDA/JEDEC Joint Standard for Electrostatic Discharge Sensitivity Testing - Charged Device Model (CDM) - Component Level
Establishes the procedure for testing, evaluating, and classifying the ESD sensitivity of components to the defined CDM.

Cleanrooms

ESD TR55.0-01-04 – Electrostatic Guidelines and Considerations for Cleanrooms and Clean Manufacturing
Identifies considerations and provides guidelines for the selection and implementation of materials and processes for electrostatic control in cleanroom and clean manufacturing environments.

Compliance Verification

ESD TR53-01-15 – Compliance Verification of ESD Protective Equipment and Materials
Describes the test methods and instrumentation that can be used to periodically verify the performance of ESD protective equipment and materials.

Electronic Design Automation (EDA)

ESD TR18.0.01-14 – ESD Electronic Design Automation Checks
Provides guidance for both the EDA industry and the ESD design community for establishing a comprehensive ESD electronic design automation (EDA) verification flow satisfying the ESD design challenges of modern ICs.

ESD Control Program

ANSI/ESD S20.20 – Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)
This standard provides administrative and technical requirements for establishing, implementing, and maintaining an ESD Control Program to protect electrical or electronic parts, assemblies, and equipment susceptible to damage by electrostatic discharges greater than or equal to 100 volts HBM, 200 volts CDM, and 35 volts on isolated conductors.

ESD TR20.20 – ESD Handbook (Companion to ANSI/ESD S20.20)
Produced specifically to support ANSI/ESD S20.20 ESD Control Program standard. The document focuses on providing guidance that can be used for developing, implementing, and monitoring an ESD control program in accordance with the S20.20 standard.

ESD Foundry Parameters

ESD TR22.0.01-14 – Relevant ESD Foundry Parameters for Seamless ESD Design and Verification Flow
In this report the essential requirements on ESD-related technology data will be described which need to be delivered to design customers by a foundry vendor. Design customers can be design houses, IDMs following a foundry strategy or IP vendors. The purpose is to ensure seamless design integration and ESD EDA verification of IC level ESD concepts.

Flooring

ANSI/ESD STM7.1 – Resistive Characterization of Materials – Floor Materials
Covers measurement of the electrical resistance of various floor materials, such as floor coverings, mats, and floor finishes. It provides test methods for qualifying floor materials before installation or application, and for evaluating and monitoring materials after installation or application.

ESD TR7.0-01-11 – Static Protective Floor Materials
This technical report reviews the use of floor materials to dissipate electrostatic charge. It provides an overview on floor coverings, floor finishes, topical antistats, floor mats, paints and coatings. It also covers a variety of other issues related to floor material selection, installation and maintenance.

Flooring and Footwear Systems

ANSI/ESD STM97.1 – Floor Materials and Footwear – Resistance Measurement in Combination with a Person
Provides test methods for measuring the electrical system resistance of floor materials in combination with person wearing static control footwear.

ANSI/ESD STM97.2 – Floor Materials and Footwear – Voltage Measurement in Combination with a Person
Provides for measuring the electrostatic voltage on a person in combination with floor materials and footwear, as a system.

Footwear

ANSI/ESD STM9.1 – Footwear – Resistive Characterization
Defines a test method for measuring the electrical resistance of shoes used for ESD control in the electronics environment (not to include heel straps and toe grounders).

ESD SP9.2 – Footwear – Foot Grounders Resistive Characterization
Provides test methods for evaluating foot grounders and foot grounder systems used to electrically bond or ground personnel as part of an ESD Control Program. Static Control Shoes are tested using ANSI/ESD STM9.1.

Garments

ANSI/ESD STM2.1 – Garments - Resistive Characterization
Provides test methods for measuring the electrical resistance of garments. It covers procedures for measuring sleeve-to-sleeve resistance and point-to-point resistance.

ESD TR2.0-01-00 – Consideration for Developing ESD Garment Specifications
Addresses concerns about effective ESD garments by starting with an understanding of electrostatic measurements and how they relate to ESD protection.

ESD TR2.0-02-00 – Static Electricity Hazards of Triboelectrically Charged Garments
Intended to provide some insight to the electrostatic hazards present when a garment is worn in a flammable or explosive environment.

Glossary

ESD ADV1.0 – Glossary of Terms
Definitions and explanations of various terms used in Association Standards and documents are covered in this advisory. It also includes other terms commonly used in the electronics industry.

Gloves and Finger Cots

ANSI/ESD SP15.1 – In-Use Resistance Testing of Gloves and Finger Cots
Provides test procedures for measuring the intrinsic electrical resistance of gloves and finger cots.

ESD TR15.0-01-99 – ESD Glove and Finger Cots
Reviews the existing known industry test methods for the qualification of ESD protective gloves and finger cots. (Formerly TR03-99)

Grounding

ANSI/ESD S6.1 – Grounding
Specifies the parameters, materials, equipment, and test procedures necessary to choose, establish, vary, and maintain an Electrostatic Discharge Control grounding system for use within an ESD Protected Area for protection of ESD susceptible items, and specifies the criteria for establishing ESD Bonding.

Handlers

ANSI/ESD SP10.1 – Automated Handling Equipment (AHE)
Provides procedures for evaluating the electrostatic environment associated with automated handling equipment.

ESD TR10.0-01-02 – Measurement and ESD Control Issues for Automated Equipment Handling of ESD Sensitive Devices below 100 Volts
Provides guidance and considerations that an equipment manufacturer should use when designing automated handling equipment for these low voltage sensitive devices. (Formerly TR14-02)

Hand Tools

ANSI/ESD S13.1 – Electrical Soldering/Desoldering Hand Tools
Provides electric soldering/desoldering hand tool test methods for measuring the electrical leakage and tip to ground reference point resistance, and provides parameters for EOS safe soldering operation.

ESD TR13.0-01-99 – EOS Safe Soldering Iron Requirements
Discusses soldering iron requirements that must be based on the sensitivity of the most susceptible devices that are to be soldered. (Formerly TR04-99)

Human Body Model (HBM)

ANSI/ESDA/JEDEC JS-001 – ESDA/JEDEC Joint Standard for Electrostatic Discharge Sensitivity Testing – Human Body Model (HBM) – Component Level
Establishes the procedure for testing, evaluating, and classifying the electrostatic discharge sensitivity of components to the defined human body model (HBM).

ESD JTR001-01-12 – ESD Association Technical Report User Guide of ANSI/ESDA/JEDEC JS-001 Human Body Model Testing of Integrated Circuits
Describes the technical changes made in ANSI/ESDA/JEDEC JS-001 and explains how to use those changes apply human body model tests to IC components.

Human Metal Model (HMM)

ANSI/ESD SP5.6 – Electrostatic Discharge Sensitivity Testing - Human Metal Model (HMM) - Component Level
Establishes the procedure for testing, evaluating, and classifying the ESD sensitivity of components to the defined HMM.

ESD TR5.6-01-09 – Human Metal Model (HMM)
Addresses the need for a standard method of applying the IEC contact discharge waveform to devices and components.

Ionization

ANSI/ESD STM3.1 – Ionization
Test methods and procedures for evaluating and selecting air ionization equipment and systems are covered in this standard test method. The document establishes measurement techniques to determine ion balance and charge neutralization time for ionizers.

ANSI/ESD SP3.3 – Periodic Verification of Air Ionizers
Provides test methods and procedures for periodic verification of the performance of air ionization equipment and systems (ionizers).

ANSI/ESD SP3.4 – Periodic Verification of Air Ionizer Performance Using a Small Test Fixture
Provides a test fixture example and procedures for performance verification of air ionization used in confined spaces where it may not be possible to use the test fixtures defined in ANSI/ESD STM3.1 or ANSI/ESD SP3.3.

ESD TR3.0-01-02 – Alternate Techniques for Measuring Ionizer Offset Voltage and Discharge Time
Investigates measurement techniques to determine ion balance and charge neutralization time for ionizers.

ESD TR3.0-02-05 – Selection and Acceptance of Air Ionizers
Reviews and provides a guideline for creating a performance specification for the four ionizer types contained in ANSI/ESD STM3.1: room (systems), laminar flow hood, worksurface (e.g., blowers), and compressed gas (nozzles & guns).

Machine Model (MM)

ANSI/ESD STM5.2 – Electrostatic Discharge Sensitivity Testing - Machine Model (MM) - Component Level
Establishes the procedure for testing and evaluating the ESD sensitivity of components to the defined machine model.

ANSI/ESD SP5.2.1 – Machine Model (MM) Alternative Test Method: Supply Pin Ganging – Component Level
Defines an alternative test method to perform Machine Model component level ESD tests when the component or device pin count exceeds the number of ESD simulator tester channels.

ANSI/ESD SP5.2.2 – Machine Model (MM) Alternative Test Method: Split Signal Pin - Component Level
Defines an alternative test method to perform Machine Model component level ESD tests when the component or device pin count exceeds the number of ESD simulator tester channels.

ESD TR5.2-01-01 – Machine Model (MM) Electrostatic Discharge (ESD) Investigation - Reduction in Pulse Number and Delay Time
Provides the procedures, results, and conclusions of evaluating a proposed change from 3 pulses (present requirement) to 1 pulse while using a delay time of both 1 second (present requirement) and 0.5 second.

Ohmmeters

ESD TR50.0-02-99 – High Resistance Ohmmeters--Voltage Measurements
Discusses a number of parameters that can cause different readings from high resistance meters when improper instrumentation and techniques are used and the techniques and precautions to be used in order to ensure the measurement will be as accurate and repeatable as possible for high resistance measurement of materials.

Packaging

ANSI/ESD STM11.11 – Surface Resistance Measurement of Static Dissipative Planar Materials
Defines a direct current test method for measuring electrical resistance, replacing ASTM D257-78. This test method is designed specifically for static dissipative planar materials used in packaging of ESD sensitive devices and components.

ANSI/ESD STM11.12 – Volume Resistance Measurement of Static Dissipative Planar Materials
Provides test methods for measuring the volume resistance of static dissipative planar materials used in the packaging of ESD sensitive devices and components.

ANSI/ESD STM11.13 – Two-Point Resistance Measurement
Measures the resistance between two points on a material's surface without consideration of the material's means of achieving conductivity. This test method was established for measuring resistance where the concentric ring electrodes of ANSI/ESD STM11.11 cannot be used.

ANSI/ESD STM11.31 – Bags
Provides a method for testing and determining the shielding capabilities of electrostatic shielding bags.

ANSI/ESD S11.4 – Static Control Bags

Establishes performance limits for bags that are intended to protect electronic parts and products from damage due to static electricity and moisture during common electronic manufacturing industry transport and storage applications.

ANSI/ESD S541 – Packaging Materials for ESD Sensitive Items
Describes the packaging material properties needed to protect electrostatic discharge (ESD) sensitive electronic items, and references the testing methods for evaluating packaging and packaging materials for those properties. Where possible, performance limits are provided. Guidance for selecting the types of packaging with protective properties appropriate for specific applications is provided. Other considerations for protective packaging are also provided.

ESD ADV11.2 – Triboelectric Charge Accumulation Testing
Provides guidance in understanding the triboelectric phenomenon and relates current information and experience regarding tribocharge testing as used in static control for electronics.

Process Assessment

ESD TR17.0-01-15 – ESD Process Assessment Methodologies in Electronic Production Lines – Best Practices used in Industry

Gives the reader examples of “best practices” of process assessment methodologies and test methods.

Seating

ANSI/ESD STM12.1 – Seating – Resistive Measurement
Provides test methods for measuring the electrical resistance of seating used for the control of electrostatic charge or discharge. It contains test methods for the qualification of seating prior to installation or application, as well as test methods for evaluating and monitoring seating after installation or application.

Socketed Device Model (SDM)

ANSI/ESD SP5.3.2 – Electrostatic Discharge Sensitivity Testing – Socketed Device (SDM) – Component Level
Provides a test method for generating a Socketed Device Model (SDM) test on a component integrated circuit (IC) device.

ESD TR5.3.2-01-00 – Socket Device Model (SDM) Tester
Helps the user understand how existing SDM testers function, offers help with the interpretation of ESD data generated by SDM test systems, and defines the important properties of an “ideal” socketed-CDM test system.

Static Electricity

ESD TR50.0-01-99 – Can Static Electricity Be Measured?
Gives an overview of fundamental electrostatic concepts, electrostatic effects, and most importantly of electrostatic metrology, especially what can and what cannot be measured.

Susceptible Device Concepts

ESD TR50.0-03-03 – Voltage and Energy Susceptible Device Concepts, Including Latency Considerations

Contains information to promote an understanding of the differences between energy and voltage susceptible types of devices and their sensitivity levels.

Symbols

ANSI/ESD S8.1 – Symbols – ESD Awareness

Three types of ESD awareness symbols are established by this document. The first one is to be used on a device or assembly to indicate that it is susceptible to electrostatic charge. The second is to be used on items and materials intended to provide electrostatic protection. The third symbol indicates the common point ground.

System Level ESD

ESD TR14.0-01-00 – Calculation of Uncertainty Associated with Measurement of Electrostatic Discharge (ESD) Current

Provides guidance on measuring uncertainty based on an uncertainty budget.

ESD TR14.0-02-13 – System Level Electrostatic Discharge (ESD) Simulator Verification

Developed to provide guidance to designers, manufacturers, and calibration facilities for verification and specification of the systems and fixtures used to measure simulator discharge currents.

ANSI/ESD SP14.5 – Electrostatic Discharge Sensitivity Testing – Near Field Immunity Scanning - Component/Module/PCB Level

Establishes a test method for immunity scanning of ICs, modules and PCB's. Results from scanning relate to the system level performance but cannot be used to predict system level performance using the IEC 61000-4-2 test method.

Transient Latch-up

ESD TR5.4-01-00 – Transient Induced Latch-Up (TLU)

Provides a brief background on early latch-up work, reviews the issues surrounding the power supply response requirements, and discusses the efforts on RLC TLU testing, transmission line pulse (TLP) stressing, and the bi-polar stress TLU methodology.

ESD TR5.4-02-08 – Determination of CMOS Latch-up Susceptibility - Transient Latch-up

Intended to provide background information pertaining to the development of the transient latch-up standard practice originally published in 2004 and additional data presented to the group since publication.

ESD TR5.4-03-11 – Latch-up Sensitivity Testing of CMOS/Bi CMOS Integrated Circuits – Transient Latch-up Testing – Component Level Supply Transient Stimulation

Developed to instruct the reader on the methods and materials needed to perform transient latch-up Testing.

ESD TR5.4-04-13 – Transient Latch-up Testing

Defines transient latch-up (TLU) as a state in which a low-impedance path, resulting from a transient overstress that triggers a parasitic thyristor structure or bipolar structure or combinations of both, persists at least temporarily after removal or cessation of the triggering condition. The rise time of the transient overstress causing TLU is shorter than five µs. TLU as defined in this document does not cover changes of functional states, even if those changes would result in a low-impedance path and increased power supply consumption.

Transmission Line Pulse

ANSI/ESD STM5.5.1 – Electrostatic Discharge Sensitivity Testing – Transmission Line Pulse (TLP) – Component Level

Pertains to Transmission Line Pulse (TLP) testing techniques of semiconductor components. The purpose of this document is to establish a methodology for both testing and reporting information associated with TLP testing.

ANSI/ESD SP5.5.2 – Electrostatic Discharge Sensitivity Testing - Very Fast Transmission Line Pulse (VF-TLP) - Component Level

Pertains to very fast transmission line pulse (VF-TLP) testing techniques of semiconductor components. It establishes guidelines and standard practices presently used by development, research, and reliability engineers in both universities and industry for VF-TLP testing.

ESD TR5.5-01-08 – Transmission Line Pulse (TLP)

A compilation of the information gathered during the writing of ANSI/ESD SP5.5.1 and the information gathered in support of moving the standard practice toward re-designation as a standard test method.

ESD TR5.5-02-08 – Transmission Line Pulse Round Robin

Intended to provide data on the repeatability and reproducibility limits of the methods of ANSI/ESD STM5.5.1.

ESD TR5.5-03-14 – Very-Fast Transmission Line Pulse Round Robin

Reviews the RR measurements and analysis used to support the re-designation of the VF-TLP document from SP to STM. It also discusses some of the lessons learned about VF-TLP and the performing of a RR experiment.

Workstations

ESD ADV53.1 – ESD Protective Workstations

Defines the minimum requirements for a basic ESD protective workstation used in ESD sensitive areas. It provides a test method for evaluating and monitoring workstations. It defines workstations as having the following components: support structure, static dissipative worksurface, a means of grounding personnel, and any attached shelving or drawers.

Worksurfaces

ANSI/ESD S4.1 – Worksurface - Resistance Measurements

Provides test methods for evaluating and selecting worksurface materials, testing of new worksurface installations, and the testing of previously installed worksurfaces.

ANSI/ESD STM4.2 – ESD Protective Worksurfaces - Charge Dissipation Characteristics

Aids in determining the ability of ESD protective worksurfaces to dissipate charge from a conductive test object placed on them.

ESD TR4.0-01-02 – Survey of Worksurfaces and Grounding Mechanisms

Provides guidance for understanding the attributes of worksurface materials and their grounding mechanisms.

Wrist Straps

ANSI/ESD S1.1 – Wrist Straps

Establishes test methods for evaluating the electrical and mechanical characteristics of wrist straps. It includes improved test methods and performance limits for evaluation, acceptance, and functional testing of wrist straps.

ESD TR1.0-01-01 – Survey of Constant (Continuous) Monitors for Wrist Straps
Provides guidance to ensure that wrist straps are functional and are connected to people and ground.

About the EOS/ESD Association, Inc.

Founded in 1982, the EOS/ESD Association, Inc. is a professional voluntary association dedicated to advancing the theory and practice of electrostatic discharge (ESD) avoidance. From fewer than 100 members, the Association has grown to more than 2,000 throughout the world. From an initial emphasis on the effects of ESD on electronic components, the Association has broadened its horizons to include areas such as textiles, plastics, web processing, cleanrooms, and graphic arts. To meet the needs of a continually changing environment, the Association is chartered to expand ESD awareness through standards development, educational programs, local chapters, publications, tutorials, certification, and symposia.