Institute of Environmental Sciences and Technology

IEST-RP-CC052

Contamination Control Division
Recommended Practice 052

Understanding, Identifying, and Controlling Electrostatic Charge in Cleanrooms and Other Controlled Environments

827 Walden Office Square, Suite 400
Schaumburg, IL 60173
Phone: (847) 981-0100 • Fax: (847) 981-4130
E-mail: information@iest.org • Web: www.iest.org

Justification for RP-CC052: Understanding, Identifying and Controlling Electrostatic Charge in Cleanrooms and Other Controlled Environments

Electrostatic charge is a contaminant of energy that is rarely understood by those responsible for and working in cleanrooms. Typically referred to as ESD in most lab and manufacturing environments, it can be controlled through grounding of all conducting objects in the cleanroom including personnel, by eliminating insulators where possible, and by use of ionizers to avoid damage to products as workers sit and work at assembly or test benches.

However, in cleanrooms where people and product typically move around while working and the very nature of cleanroom materials, airflow and low relative humidity in the clean environment generates a myriad of electrostatic phenomena. The results caused by these phenomena can include electrostatic discharge (ESD) that damages product but also can manifest in other more subtle ways that also can modify the environment causing spurious particle events, interfere with processing equipment, and other problems that can hinder productivity or plague equipment maintenance efforts.

Since it is impossible to see electrostatic charge and its associated manifestations, one must be knowledgeable in the science that creates it and be able to analyze the environment to discover weakness that allows the electrostatic event to develop and play out.

IEST-RP-CC022: *Electrostatic Charge in Cleanrooms and Other Controlled Environments* was written over 20 years ago to address this topic. The overview provided some instruction for describing electrostatic risks and testing developed by the ESD Association. In a sense, it was a lite version of the ESDA formulas for addressing static charge. Unfortunately, both the ESDA documents and RP-CC022 both have little applicability to the needs of cleanroom operators and managers. Most people responsible for cleanroom operations do not have enough technical background in physics to understand how these charges are generated in the dynamic working environment of the cleanroom. As expected, this RP found little usefulness to cleanroom professionals. Several attempts were made in the past to consider revising the RP but its existing form, the Title and Scope would need to be substantially altered and results might not be well received.

A different approach was taken to provide cleanroom personnel with the background necessary to understand the science of electrostatic charge phenomena and thus understand the basis for charge control protocols. It is hoped that the information provided will lead the user to be able to apply the fundamentals they learn in the RP to recognize deficiencies in their own environment and lead them to choose appropriate remedies to avoid potential product losses, equipment failures or spurious particle events. The focus and scope of this RP is much different and more comprehensive than RP-C022, which should be sunset when the new RP is issued. IEST-RP-CC052: *Understanding, Identifying and Controlling Electrostatic Charge in Cleanrooms and Other Controlled Environments* is a comprehensive document that will be of great use to managers and operators of all cleanrooms.

This Recommended Practice was prepared by and is under the jurisdiction of Working Group 052 of the IEST Contamination Control Division (WG-CC052). The following WG voting members contributed to the development of this edition of this Recommended Practice.

Larry B. Levit, LBL Scientific
WG-CC052 Chair

Roger B. Diener, RBD Associates
WG-CC052 Co-Chair

Major Contributors
Taguhi Arakelian , Jet Propulsion Laboratory
Jan Eudy, Jan Eudy Consulting
Robert Giroux, Certifab
Pedro Godoy, Teilch
Christopher Long, IBM
Alan McCall, Intel Corporation
Julian Montoya, Intel Corporation
Mike Rataj, ARAMARK Corp
David Swinehart, Clean Environments Consultancy
Yitzak Vanek, Persys
Bill Wilson, Raytheon
Tom Watkins, Transforming Technologies
Craig Zander, Transforming Technologies

Other Contributors
Greg Heiland, Valutech
Morgan Polen, Micronize, Inc
CS. Tay, Suzhou TA&A Ultra Clean Tech Co
Nathaniel Terry, Burlington Industries
Peter Travis, Alpha Advanced
Greg Winn, White Knight Engineered Products
Keith Worthington, Varex Imaging

The Working Group also wishes to acknowledge the contributions of members who prefer to remain anonymous.

First printing, August 2021

ISBN: 978-1-937280-46-8

ISBN: 978-1-937280-45-1

PROPOSAL FOR IMPROVEMENT: The Working Groups of the Institute of Environmental Sciences and Technology are continually working on improvements to their Recommended Practices and Reference Documents. Suggestions from users of these documents are welcome. If you have a suggestion regarding this document, please use the online Proposal for Improvement form found on the IEST website at www.iest.org.

Institute of Environmental Sciences and Technology
1827 Walden Office Square, Suite 400
Schaumburg, IL 60173
Phone: (847) 981-0100 • Fax: (847) 981-4130
E-mail: information@iest.org • Web: www.iest.org

NOTICE AND DISCLAIMER: This Recommended Practice is published by the Institute of Environmental Sciences and Technology (IEST) to advance the technical and engineering sciences. Use of this document is entirely voluntary, and determination of its applicability and suitability for any particular use is solely the responsibility of the user. Use of this Recommended Practice does not imply any warranty or endorsement by IEST.

The information in this publication was considered technically sound by the consensus of persons engaged in the development and approval of the document at the time it was developed. Consensus does not necessarily mean that there is unanimous agreement among all persons participating in the development of this document.

IEST standards, recommended practices, and guideline publications, of which the document contained herein is one, are developed through a voluntary consensus standards development process. This process brings together volunteers and seeks out the views of persons who have an interest in the topic covered by this publication. While IEST administers the process to promote fairness in the development of consensus, the organization does not write the document and does not independently test, evaluate, or verify the accuracy or completeness of any information or the soundness of any judgments contained in IEST standards, recommended practices, and guideline publications.

IEST disclaims liability for any personal injury, property, or other damages of any nature whatsoever, whether special, indirect, consequential, or compensatory, directly or indirectly resulting from the publication, use of, application, or reliance on this document. IEST disclaims and makes no guaranty or warranty, express or implied, as to the accuracy or completeness of any information published herein, and disclaims and makes no warranty that the information in this document will fulfill any of the particular purposes or needs of users of the document. IEST does not guarantee the performance of any individual manufacturer or seller's products or services by virtue of this standard or guide.

In publishing and making this document available, IEST is not undertaking to render professional or other services for or on behalf of any person or entity, nor is IEST undertaking to perform any duty owed by any person or entity to someone else. Anyone using this document should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances. Information and other standards on the topic covered by this publication may be available from other sources, which the user may wish to consult for additional views or information not covered by this publication.

IEST has no power, nor does it undertake to police or enforce compliance with the contents of this document. IEST does not certify, test, or inspect products, designs, or installations for safety or health purposes. Any certification or other statement of compliance with any health or safety-related information in this document shall not be attributable to IEST and is solely the responsibility of the certifier or maker of the statement.

Understanding, Identifying, and Controlling Electrostatic Charge in Cleanrooms and Other Controlled Environments

IEST-RP-CC052.1

CONTENTS

SECTION **PAGE**

APPENDIX

Institute of Environmental Sciences and Technology
Contamination Control Division
Recommended Practice 052.1

Understanding, Identifying, and Controlling Electrostatic Charge in Cleanrooms and Other Controlled Environments

IEST-RP-CC052.1

1 SCOPE AND LIMITATIONS

1.1 Scope

This Recommended Practice (RP) provides a basis for understanding how electrostatic charge occurs. This RP discusses problems caused by electrostatic charge in cleanrooms, as related to particle management, physical damage from discharge and process interruptions from transient electromagnetic interference (EMI). This RP also provides suggestions for identifying and resolving such risks by means such as dissipation of charge from conductors and process-essential insulators that have an opportunity to interact with ESD sensitive (ESDS) items. Such conductors include personnel, conductive components in production equipment and associated fixtures.

This RP discusses sources of electrostatic charge generation in cleanrooms and other controlled environments and how the environment, products and equipment will be affected when such charges are uncontrolled. Methods for monitoring the risk of electrostatic charge issues, minimizing generation, and selection of equipment for the remediation of charges will also be discussed.

The user is referred to step by step procedures for measurement of electrostatic issues in standards and recommended practice documents by the ESD Association. This RP provides supplemental information which is required to understand and execute the prescribed measurements.

1.2 Limitations

This RP excludes specific evaluation and qualification related to the protection of ordnance, flammable materials, and explosives. This RP does not prescribe design or control limits; quality acceptance standards; process issues; or health, safety, and environmental issues and practices outside of contamination control issues. Users should establish their own quality standards.

Whereas there is a summary of tests of electrostatic control parameters shown in Appendix B, the main emphasis of this document remains on understanding how to deal with static charge rather than quantifying the appliances of charge mitigation.\

This RP does not purport to address safety problems associated with its use. It is the responsibility of the user to consult and establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to use of this RP.