



ESD Protected Area



SIKA CONTINUING EDUCATION

THE FUNDAMENTALS OF ELECTROSTATIC CONTROL FLOORING

BUILDING TRUST



About the Author

Jim Ziegler, ESDA TR5321-104 Auditor Market Development Manager - ESD

For over 35 years, Jim Ziegler, Sika Flooring's Market Development Manager - ESD, has collaborated with architecture and design firms across every industry including life sciences, food/beverage, manufacturing, education and military government sectors.

He has held technical management positions with some of the world's most recognized resinous floor and wall manufacturers in the US and abroad. Jim is an industry expert, whose opinions are often sought after by the media for his insight on emerging trends.

He is a published author and speaker at industry forums and conferences.

Jim maintains technical accreditations with EOS, SSPC CCI, NACE, ICRI, CSI and ISPE.



UNDERSTANDING THE PRINCIPALS OF ESD FLOORING

What is ESD?

Electrostatic Discharge (ESD) is a sudden and momentary flow of electrical current between two electrically charged objects caused by contact or near contact. A buildup of static electricity can be caused by tribocharging or by electrostatic induction. Tribocharging is a contact electrification process that enables buildup of static electricity due to touching or rubbing of surfaces, contacting, and separating of two surfaces in specific combinations of two dissimilar materials. These events occur because of the energy created when people walk on surfaces, move chairs, carts, and vehicles.

A person can “feel” static discharge (as in touching a doorknob) at about 3,000 volts, and “see” it as a momentary spark at about 5,000 volts. Microelectronic parts can be damaged or destroyed by an event of less than 100 volts. With the development of faster, more powerful, and smaller electronics devices, they have become more sensitive to static discharge.

ESD has become a critical concern within the industry. As electronics become more complex their sensitivity to electrostatic instances increase. According to the ESD Association, the average product loss to static electricity is 33%! The damage is estimated in the billions of dollars annually. Many of these events occur because of the energy created during the movement of people, vehicles, chairs, carts, and containers. Protect your work environment against electrostatic discharge with Sikafloor® ESD Control Floor Systems. Sikafloor Electrostatic Control Floor Systems provide effective personnel grounding and meets or exceeds the requirements of ANSI S20.20 for electronics applications, DOD facilities, and NFPA requirements for flammable liquids, powders, and gasses.

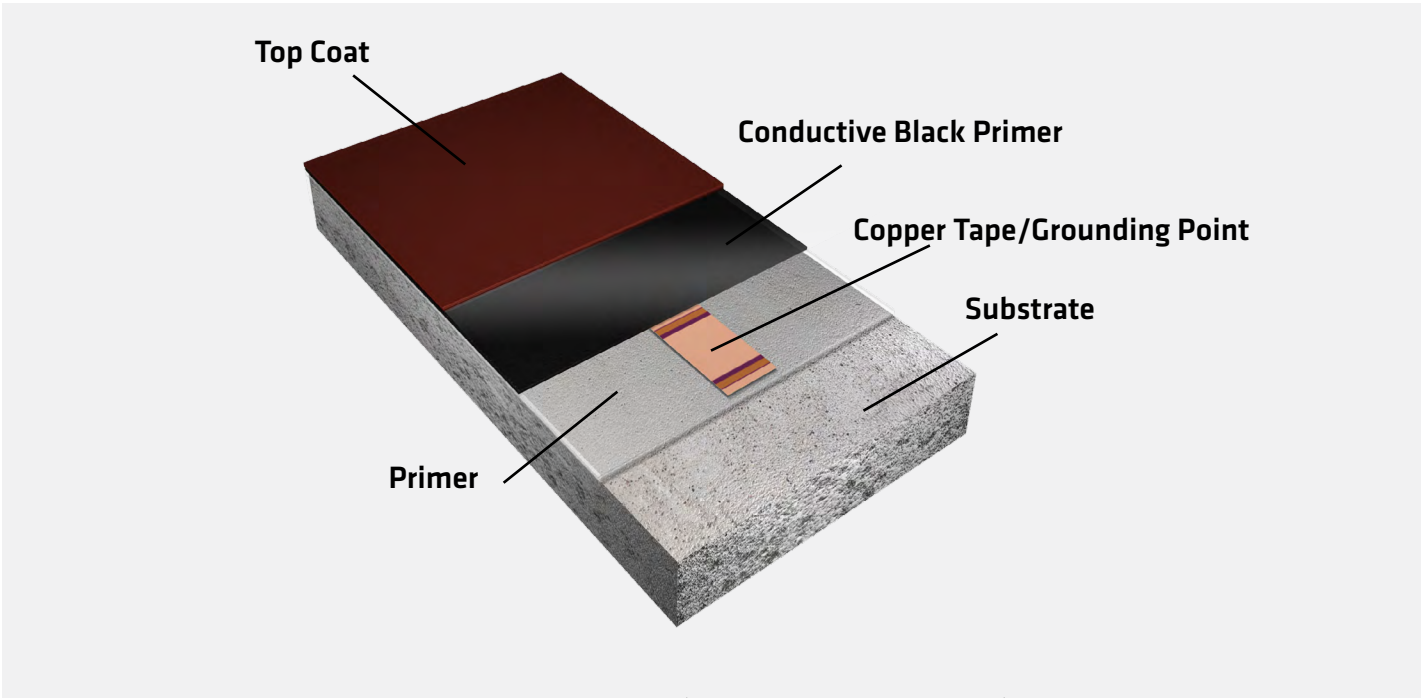
An ESD Glossary

- **BVG - Body Voltage Generation** - When people walk across a floor, the friction between the soles of their shoes and the surface of the floor generates a triboelectric—or static—charge, also called walking body voltage. The charge stays in place until the person touches someone or something, then it jumps to that person or object.
- **Conductive flooring system** - A flooring system that has a resistance to groundable point of less than 1.0×10^6 ohms.
- **Dissipative flooring** - A flooring system that has a resistance to groundable point of greater than or equal to 1.0×10^6 ohms and less than 1.0×10^9 ohms.
- **EPA** - Electrostatic Protected Area
- **ESD** - Electrostatic Discharge
- **ESDA TR53** - ESD Association Technical Report for the Protection of Electrostatic Discharge Susceptible Items - Compliance Verification of ESD Protective Equipment and Materials.
- **Tribocharging** - A contact electrification process that enables buildup of static electricity due to touching or rubbing of surfaces in specific combinations of two dissimilar materials.

What is ESD Protection?

Electrostatic Discharge (ESD) flooring protects from damage caused by static electricity, which accumulates as people walk etc. Conductive elements such as antimony tin oxide (ATO, the same element used in touch screens and phones), carbon, graphite, or metal-coated particles, distributed throughout the flooring material, give ESD floors electrical conductivity, and create an electrical pathway from the walking surface to earth ground. To make the full path to the earth ground, the flooring system must have a grounding plane.

This grounding plane is a base layer, usually in the conductive range, which is carrying a charge to from the floor to the earth ground. This coating is typically black since it uses black carbon or graphite.



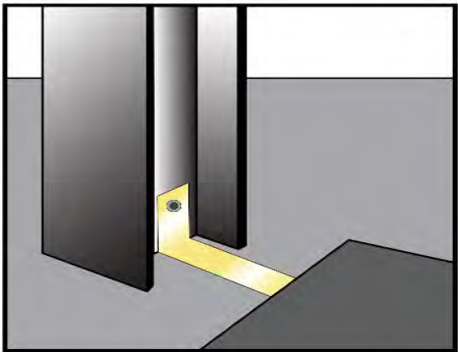
Sika ESD Flooring System showing Grounding Plane (conductive black primer)

Grounding Plane

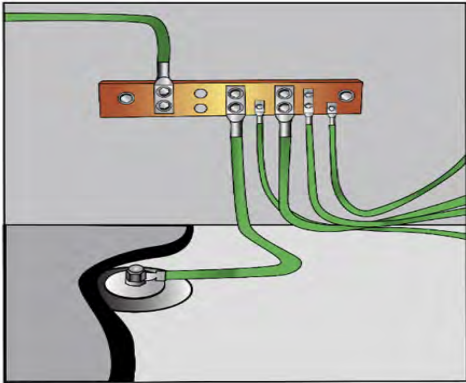
ESD floors are applied over a grounding plane. This is usually a coating with black carbon and applied on top of a copper strip or earthing strip. This very low resistant copper conductor is attached to an electrical outlet, steel column or the facilities grounding system creating a safe electrical pathway to the ground.



Ground to an ESD Electrical Outlet



Ground to a Steel Column



Ground to an Earthing Point

An electrostatic charge, which occurs during materials contact and separation, has to be discharged via an earthing point. The Sikafloor® Earthing Kit, is a unique tool box containing all of the necessary components for up to 10 earthing points.

Each earthing point is able to conduct to earth up to 3,200 ft². Ensure the longest distance between each earthing point in each room or area is a maximum of 30 ft. apart. In larger areas with longer distances, additional earthing points must be installed in accordance with the Electrical Engineer's requirements.

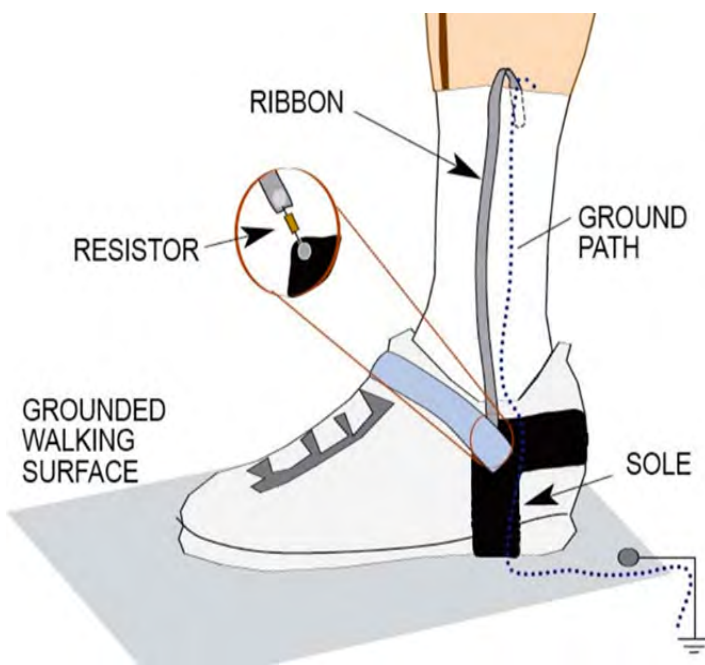
If site conditions or other constraints do not allow the positioning of any additional required earthing points, then any longer distances (>30 ft.) must be bridged by the use of additional adhesive copper tapes in accordance with the relevant specifications. All of the earthing points have to be connected to an appropriate ring-main to ground them and this work must be carried out and approved by the responsible Electrical Engineer in accordance with all relevant local regulations.

Product Qualification - Flooring

Proper footwear must also be considered in conjunction with the ESD flooring. Typical footwear manufacturing or casual footwear is made of rubber, polyvinylchloride compounds, polyurethane, and leather. These compounds are typically insulators, except for leather, with high moisture content leather can have conductive properties.

This requirement is completed before the selection of ESD Flooring System that will be used for the ESD Control Program. The product qualification requirements for each ESD Flooring/Footwear can be found in ANSI S20.20-2021, Table 2 for Personnel Grounding Requirement and Table 3 for EPA ESD Control Items used in the ESD protected area (EPA).

There are no direct requirements for humidity control in ANSI/ESD S20.20-2021. However, in Table 3 Product Qualification, Test Method ANSI/ESD STM7.1, 6.1.1 Environment, "A low humidity environment shall be an environment of 12% ± 3% relative humidity and 73° F ± 3° F. And 6.1.2 Moderate Humidity Environment shall be an environment of 50% ± 5% relative humidity and 73° F ± 3° F. Preconditioning of the specimen shall be at least 72 hours. Acceptable required limits are Point to Point and Point to Ground <1.0 X 10⁹.



Compliance Verification- Flooring

A compliance verification plan shall be established to ensure the ESD Flooring System meets the requirements identified in Table 3 of the ANSI S20.20-2021 standard. This includes the use of the test method and test limits identified in this table. The compliance verification plan shall identify the ESD Flooring System to be tested periodically.

Product Acceptance of Installed Flooring System

For newly installed flooring systems, allow proper cure time following manufacturer's instructions. Testing before resinous flooring is fully cured, resistance measurements that may differ from those measured after materials are fully cured. In accordance with ANSI/ESD STM7.1-2020, both resistance to ground and resistance point-to-point shall be measured. Perform a minimum of five tests, in various locations, per contiguous flooring system area or a minimum of five tests per 5,000 square feet, whichever is greater.

ANSI/ESD S20.20-2021 Table 2

Technical Requirement	Personal Qualification Test Methods/Required Limits		Compliance Verification Test Methods/Required Limits	
Footwear/Flooring System (Both limits must be met)	ANSI/ESD STM97.1	<1.0 x 10 ⁹ ohms	ESD TR53 Footwear Section	<1.0 x 10 ⁹ ohms
	ANSI/ESD STM 97.2 Peak	<100 volts	ESD TR53 Flooring Section	<1.0 x 10 ⁹ ohms

ANSI/ESD S20.20-2021 Table 3

Technical Requirement	ESD Control Item	Personal Qualification Test Methods/Required Limits	Compliance Verification Test Methods/Required Limits
EPA	Flooring	ANSI/ESD STM7.1	Point to Point <1.0 x 10 ⁹ ohms
			Point to Groundable Point <1.0 x 10 ⁹ ohms

Testing Equipment

Surface Resistance Meter - A portable battery-powered instrument designed to measure resistance point-to-point (RTT) and surface to ground (RTG). The meter is equipped with an automatic test voltage selector. The test voltage will switch from 10V to 100V should the measured resistance exceed 1.0 x 10⁵ ohms.

Electrodes - Two cylindrical 5 lb. electrodes shall have a diameter of 2.5 inches, each having contacts of electrically conductive material with a Shore-A (IRHD) durometer hardness of 50-70 (Test Method D2240). The electrically conductive material may be permanently attached to the electrode.



ESD Flooring Test Kit

Testing Procedure

ANSI/ESD STM71-2020 Flooring Systems Resistive Characterization

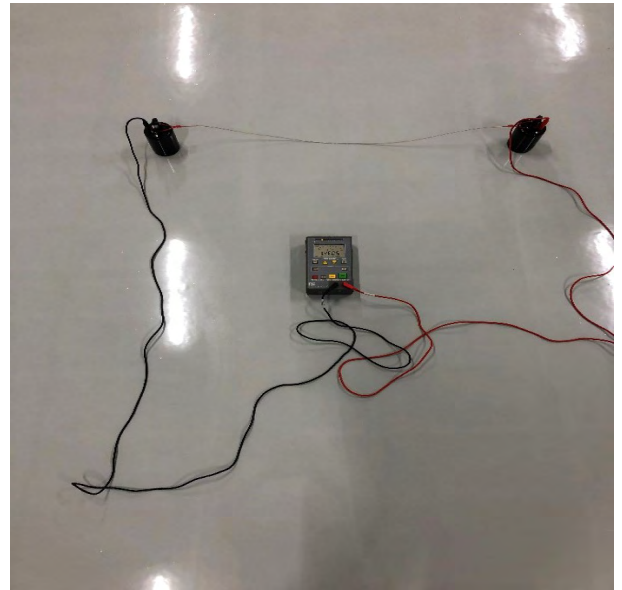
ASTM F150-06 (2018) - Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring

(Both standards are similar except ANSI/ESD STM71 requires 12% and 50% RH for qualification and ASTM F150 requires 50% RH)

Lightly wipe the area to be tested with a lint-free cloth to remove any foreign material prior to placing of the electrodes. The surfaces of the electrodes, prior to placing, should be cleaned with a minimum 70% isopropanol-water solution using a clean low linting cloth. Allow to dry.

Point-to-Point Testing

Connect the meter and the electrodes, place the electrodes on the ESD Flooring System 36 inches apart, energize the meter, set to AUTO, and press Test. Once the measurement is stable, record.



Point-to-Point Testing



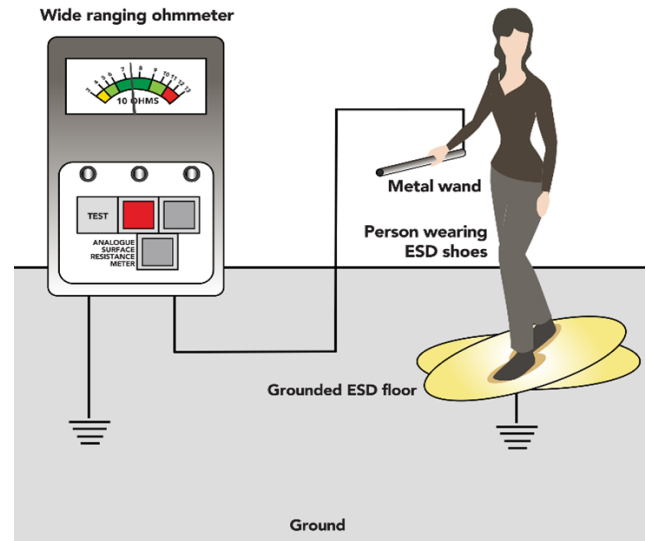
Point-to-Groundable Point

Point-to-Groundable Point Testing

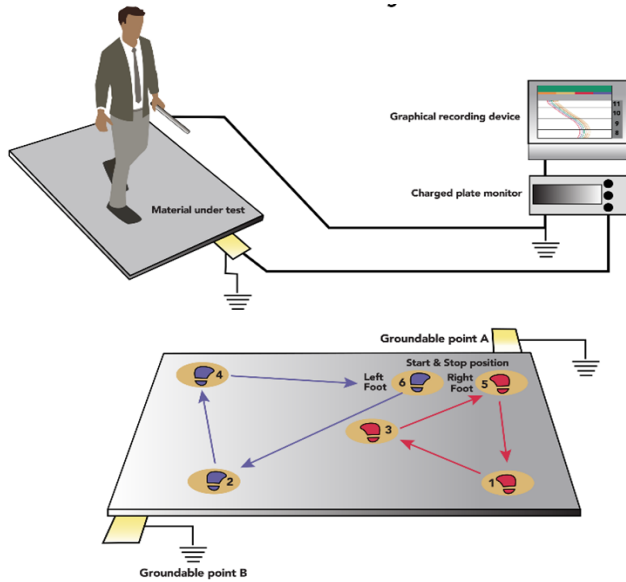
Connect one lead of the meter to ground and the other lead to the electrode, approximately 36 inches from the grounding connection, energize the meter, once the measurement is stable, record.

ANSI/ESD STM97.1-2015 Floor Materials and Footwear Resistance Measurement in Combination with a Person

System resistance measures the resistance to ground of a person standing on a floor, wearing static control footwear. System resistance measures the person, the footwear they are wearing, the contact resistance of the floor surface, and the resistance to ground of the floor covering.



ANSI/ESD STM97.1-2015



ANSI/ESD STM97.2-2016

ANSI/ESD STM97.2-2016 Standard Test Method for the Protection of Electrostatic Discharge Susceptible Items - Footwear/Flooring System - Voltage Measurement in Combination with a Person.

The purpose of the charge generation test (also known as the walking body voltage test) is to determine if a person wearing specific types of static-control footwear will maintain a static charge maximum below 100 volts when walking on a static control floor.

Reporting of Test Results

Report all values in ohms for resistance to groundable point and resistance point-to-point. Also, report location/rooms, test voltage, test date, temperature, relative humidity at the time of testing, the actual duration of conditioning, test equipment used, all components of the flooring system tested. Summarize the test data by reporting the minimum and maximum values obtained. Also include a diagram showing approximate electrode and ground connections used.

Required Limits

ANSI/ESD STM7.1 - $<1.0 \times 10^9$

ANSI/ESD STM97.1 - $<1.0 \times 10^9$

ANSI/ESD STM97.2 - <100 Volts

ASTM F150-06 (2018) - Conductive flooring- between 2.5×10^4 and 1.0×10^6

- Dissipative flooring- between 1.0×10^6 and 1.0×10^9



Sika Industrial Flooring - ESD Test Report

ANSI/ESD STM7.1-2020

Date of Testing: _____

Specimen #: _____

Temp °F: _____

Humidity % _____

Test Equipment Used: Model: _____

Manufacturer: _____

Serial or ID#: _____

Calibration Due Date: _____

Flooring System Components as Test-

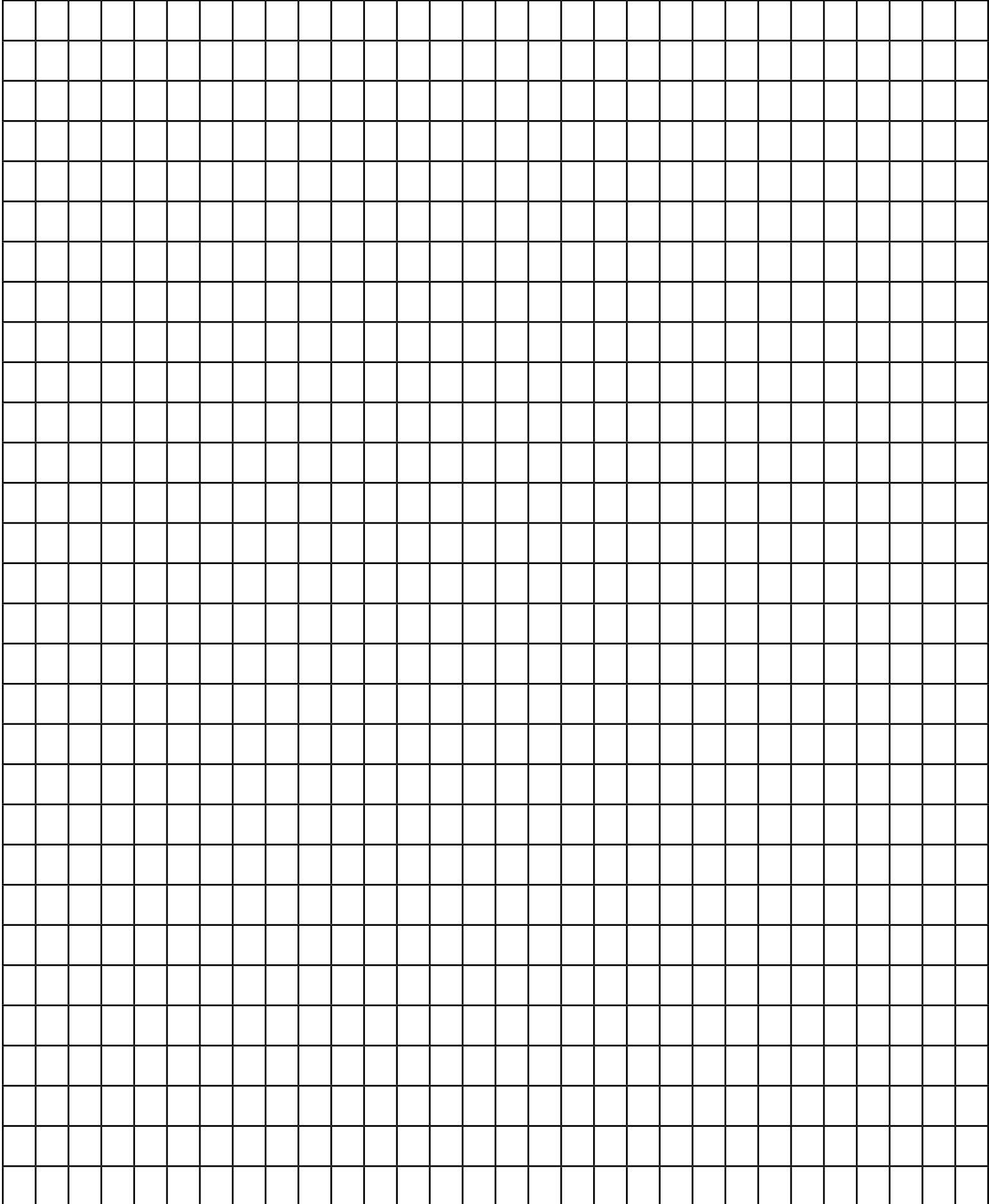
Component	Product ID	Manufacturer	Lot # (if appropriate)

Location	Point to Groundable Point	
	Resistance, ohms	Test Voltage, ohms
A-1		
A-2		
A-3		
A-4		
A-5		
A-6		
B-1		
B-2		
B-3		
B-4		
B-5		
B-6		
	Summary	
Minimum		
Maximum		

Location	Point to Groundable Point	
	Resistance, ohms	Test Voltage, ohms
A-1		
A-2		
A-3		
A-4		
A-5		
A-6		
B-1		
B-2		
B-3		
B-4		
B-5		
B-6		
	Summary	
Minimum		
Maximum		

An interactive ESD Test Report may be obtained by contacting Sikafloor Technical Support.

Notes and Maps



Sika High-Performance ESD Flooring

Our commitment to our customers includes a full understanding ESD Resinous flooring and ESD Protected areas. Sika maintains active memberships in many of the leading developmental associations in the areas of ESD, food safety, life sciences and industrial environments. Additionally, many of our employees have obtained regulatory compliance certification in these areas.

Sika's TR53 Certified Auditors have been extensively trained on how to audit your ESD controls to verify that they are functioning correctly. The training includes in depth understanding on the operation of test instrument, correct procedures for testing and trouble shooting when the measurements do not meet expectations.

Sika seamless resinous ESD flooring can provide all the benefits of polymer flooring, including:

- No waxing required.
- Excellent impact resistance
- Excellent abrasion resistance
- Excellent chemical resistance
- Non-porous, easy to clean and maintain.
- Maintains ESD throughout the entire thickness throughout the entire thickness of the system.
- Lower life cycle costs

Summary

If you are responsible for ESD Compliance, or an ESD flooring contractor, please contact a TR53 Certified ESD Technician who understands ESD phenomenon and relevance. Understand all measurement techniques for compliance verification as defined in TR53-01-18 and the correlation to an ESD control program and troubleshoot ESD protective items and corrective actions.



SIKA CORPORATION – FLOORING

201 Polito Avenue
Lyndhurst, NJ 07041
Tel (844) 529-7101
www.SikaFloorUSA.com
ziegler.jim@us.sika.com

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