



FLOORING

SIKA TECHNOLOGY AND CONCEPTS
FOR ESD AND CONDUCTIVE
FLOORING REQUIREMENTS WITH
Sikafloor®

THE IMPORTANCE OF ESD

Reduction of risk

STATIC ELECTRICITY can result in significant damage, injury and financial loss in industries where electronic components or volatile chemicals are involved. All active electronic components and equipment e.g. micro-chips, integrated circuits and machinery are sensitive to electrostatic discharges (also known as ESD events).

WHAT IS CONDUCTIVITY AND HOW DOES IT WORK?

Conductivity refers to the ability of a material to conduct an electrical charge to earth or 'ground'. In non-technical terms, this can be described as the ability of a material to carry or 'conduct' an electrical current. The electrical conductivity or the specific conductance of a flooring system is therefore also a measure of the material's ability to conduct an electric current. An electric current is a quantitative measure of the amount of charged particles passing through a medium, and in order for an electric current to be created, there needs to be an electrical potential difference between two points in a conductive medium with an energy source to drive the charge.

The electrical resistance of a material is a measure of its resistance to the flow of an electric current. An ohmmeter is a device that is used to measure this conductivity or electrical resistance. The conductivity or electrical resistance of a flooring system is therefore also measured with an ohm meter.

The ohmmeter measures the amount of electrical friction generated as the charged particles pass through an electrical conductor e.g. Sikafloor®-2350 ESD. This measured value is then expressed in units of "ohm", which are governed by "Ohm's Law". This states that "the current passing through an electrical circuit is directly proportional to the amount of voltage used to create the flow and is inversely proportional to the resistance when the temperature is constant". It can be written in three ways:

$$V = I \times R, \text{ or } I = V/R, \text{ or } R = V/I$$

Where: V = voltage in volts (V),

I = current in amps (A),

R = resistance in ohms (Ω)

Or alternatively it can be used where:

V = voltage in volts (V),

I = current in milliamps (mA),

R = resistance in kilohms ($k\Omega$).

For most electronic circuits the amp is too large and the ohm is too small, therefore it is usual to measure the current in milliamps (mA) and therefore to obtain the resistance in kilohms ($k\Omega$). 1 mA = 0.001 A and 1 $k\Omega$ = 1000 Ω .

These Ohm's Law equations work if you use V, A and Ω and also if you use V, mA and $k\Omega$, but you cannot mix these sets of units in the same equations.

WHAT IS ESD?

Controlling electrostatic discharge begins with understanding how an electrostatic charge occurs in the first place. An Electro Static Discharge (ESD) is the transfer of an electrostatic charge between two objects. This is a very rapid event that happens when two objects with different electrical potentials come into direct contact with each other. This charging results in one object gaining electrons on its surface area to become negatively charged, whilst the other object loses electrons from its surface area and therefore becomes positively charged. The creation of an electrical discharge by this contact and separation of objects is known as triboelectrical charging, which also explains the small static electric shock you may receive from touching certain objects.

Electrostatic charges are therefore commonly created by the contact and separation of two similar or dissimilar materials. For example, a person walking across the floor generates static electricity as shoe soles contact and then separate from the floor surface. A metal component or an electronic device sliding into or out of a case or against another piece of equipment also generates an electrostatic charge as multiple contacts and separations are made.





WHAT ARE THE RISKS?

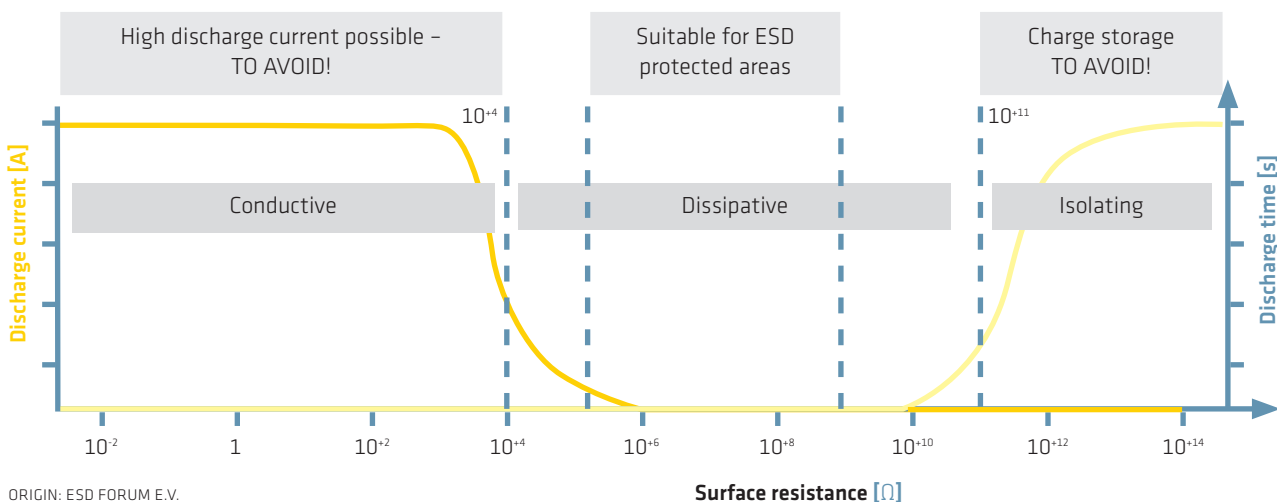
What are the risks if ESD protection and control is not taken into consideration where there are electrostatic sensitive devices? The devices could be damaged or completely destroyed.

It is this potentially unseen, unfelt or unheard 'micro lightning' spark that can occur without warning, which must be prevented or controlled.

WHERE IS AN ESD FLOOR NEEDED?

In industries where electronic components or volatile chemicals are involved, static electricity can result in significant damage, injury and financial loss. All active electronic components and equipment e.g. micro-chips, integrated circuits and machinery are sensitive to ESD events. Even when areas and people are equipped to handle such static-sensitive devices, inadvertent contact and damage can still occur. Sikafloor® ESD (Electro Static Discharge) and Sikafloor® ECF (Electrically Conductive Flooring) Systems, can safeguard your entire process. These systems can be used to design and produce a floor that is 'tailor-made' to meet your specific needs.

MATERIALS FOR ELECTROSTATIC PROTECTED AREAS

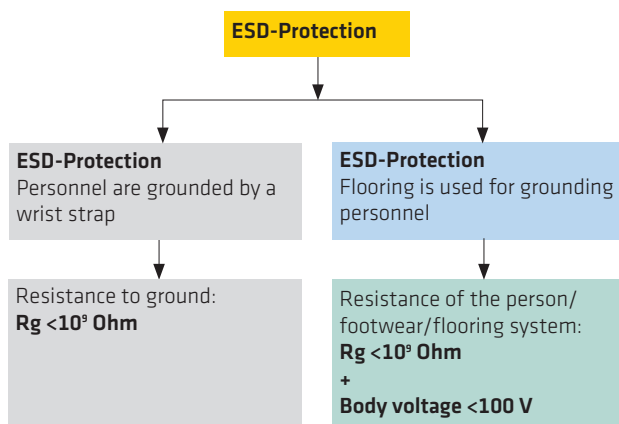


GLOBAL Sikafloor® SOLUTIONS FOR ESD PROTECTION AND ELECTRO-STATIC DISCHARGE CONTROL

EVEN WHEN AREAS AND PEOPLE are equipped to handle such static-sensitive devices, inadvertent contact and damage can occur. Sikafloor® ESD (Electro Static Discharge), DIF (Dissipative Flooring) and ECF (Electrically Conductive Flooring) systems, can safeguard your entire process. These systems can be designed to produce a floor tailored to meet your specific needs.

ESD PROTECTION WITH FLOOR COVERINGS 2016 VERSION

ESD protection with floor coverings 2025 Version requirements according IEC 61340-5-1 & ANSI/ESD S20.20-2014



Definition: Conductive/Dissipative Flooring Materials (ECF/DIF)

- Conductivity refers to the ability of a material to conduct a charge to ground. In non-absolute technical terms, this means its ability to conduct an electrical current.
- Conductive floors and electrostatic dissipative floors are classified according to their electrical resistance to ground.

Conductive Flooring Material (ECF)

(e.g. according to ASTM F150) A floor material that has a resistance to ground between 2.5×10^4 and 1.0×10^6 ohms

Dissipative Flooring Material (DIF)

(e.g. according to ASTM F150) A floor material that has a resistance to ground between 1.0×10^6 to 1.0×10^9 ohms

ANSI/ESD S 20.20

This Standard covers the requirements necessary to design, establish, implement and maintain an **E**lectro**s**tatic **D**ischarge (ESD) Control Program for activities that manufacture, process, assemble, install, package, label, service, test, inspect or otherwise handle electrical or electronic components, plus assemblies and equipment susceptible to damage by electrostatic discharges greater than, or equal to 100 volts **H**uman **B**ody **M**odel (HBM). This Standard is also harmonized with the IEC 61340-5-1.

ASTM F 150

This Standard is a test method that covers the determination of electrical conductance or resistance of resilient flooring, either in tile or sheet form, for applications such as hospitals, computer rooms, clean rooms, access flooring, munitions plants, or any other environment concerning personnel-generated static electricity.

DIN VDE 0100

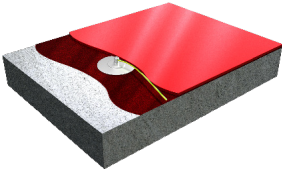
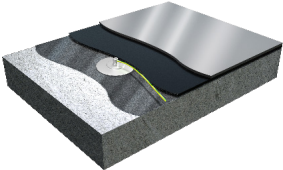
Central regulations for the German and partly European area of application can be found in the DIN VDE 0100 in which the fundamental principles, of low-voltage electrical installations are stated.

Systems:	DIN EN 1081	IEC 61340-5-1 (IEC 61340-4-5) System Test: < 10 ⁹ Ω	IEC 61340-5-1 (IEC 61340-4-5) Walking Test (BVG) < 100 Volt	IEC 61340-5-1 (IEC 61340-4-1) Resistance to Ground RG < 10 ⁹ Ω	ATEX 137 / TRGS 727 European Standard Resistance to Ground RG < 10 ⁸ Ω	DIN VDE 0100-410 (IEC 60364-4-41) Isolation Resistance > 50 kΩ
Smooth and textured, hygienic ECF floors						Any insulating self-smoothing layers e.g. Sikafloor®-264 Plus
Sikafloor®-262 AS N	▲	–	–	▲	▲	
Sikafloor®-262 AS Thixo	▲	–	–	▲	▲	
Sikafloor® BC 375 NAS	▲	–	–	▲	▲	
High chemical resistance						
Sikafloor®-381 ECF	▲	–	–	▲	▲	
Sikafloor®-392 ECF	▲	–	–	▲	▲	
Approved for clean rooms						
Sikafloor®-2355 ESD CR	▲	▲	▲	▲	▲	
ESD systems with very low body voltage generation						
Sikafloor®-2350 ESD	▲	▲	▲	▲	▲	



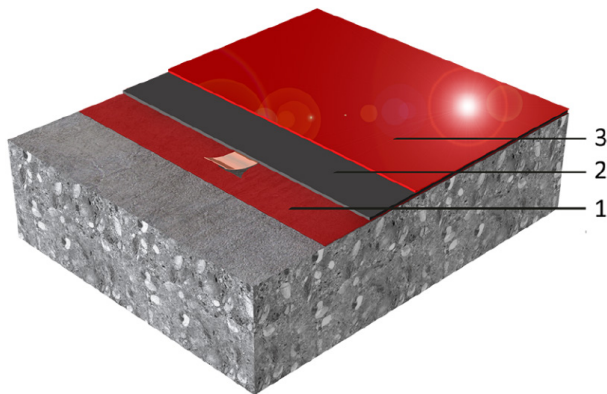
Sikafloor® ESD AND ECF FLOORING SYSTEMS



SYSTEM	Sikafloor® MultiDur ES-55 ESD	Sikafloor® MultiDur ES-56 ESD
		
DESCRIPTION	Smooth unicolor high performance electrostatic discharge (ESD) epoxy floor covering	Smooth unicolor high performance electrostatic discharge (ESD) epoxy floor covering
NOMINAL THICKNESS / LAYERS	~ 2 mm 2	~ 2 mm 3
CHARACTERISTICS	■ Good wear and abrasion resistance ■ Good chemical resistance ■ Easy to clean ■ Low emission ■ Conductive ■ Conforms to the requirements of ANSI/ESD S20.20 and IEC 61340-5-1 ■ Color options	■ Good wear and abrasion resistance ■ Good chemical resistance ■ Easy to clean ■ Low emission ■ Conductive ■ Conforms to the requirements of ANSI/ESD S20.20 and IEC 61340-5-1 ■ Low Body-Voltage-Generation (BVG) ■ Color options
SYSTEM COMPONENTS	■ Sikafloor®-150 Plus/-151/-1590 ■ Sikafloor®-2350 ESD	■ Sikafloor®-150 Plus/-151 ■ Sikafloor®-220 W Conductive ■ Sikafloor®-2350 ESD

Sika Main ESD System

Sikafloor® MultiDur ES-55 ESD



System Build Up

- 3 Sikafloor®-2350 ESD
- 2 Sikafloor®-220 W Conductive
- 1 Sikafloor®-161 HC

A two part, total solid, electrostatic dissipative, coloured epoxy binder for self-smoothing screed systems. Total layer thickness: approx. 2.0 mm.

Resistance to ground	$R_c < 10^9 \Omega$ This product fulfills the requirements of ATEX 137	(IEC 61340-4-1)
Typical average resistance to ground	$R_c < 10^9 \Omega$ to $10^7 \Omega$	(IEC 61340-4-1)
Body voltage generation	$< 100 \text{ V}$	(IEC 61340-4-1)
System Resistance (Person/ Floor/ Footwear)	$< 10^9 \Omega$	

Properties:

- Smooth ESD screed WITH SUPERIOR AESTHETIC (without fibers)
- High wear and abrasion resistance
- Good chemical resistance
- Low Odor
- BVG $< 30 \text{ V}$ (even at low Relative Humidity %)
- Colored
- Easy cleaning



FLOORING & COATING



FLOORING & COATING

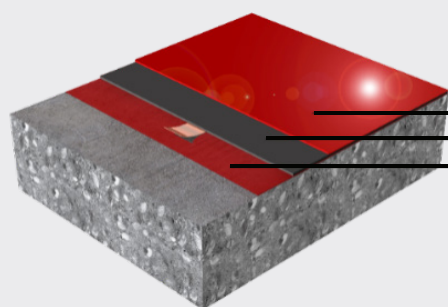
Sika Selected Systems

Sikafloor®-2350 ESD Outstanding Performances

Features:

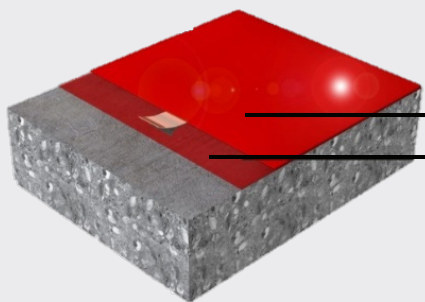
- Low odour during application
- Free of Carbon Fibres
- Free of Ionic/Antistatic Agent
- Volume Conductivity
- High Compressive Strength & Hardness
- Suitable for permanent water load
- Meets ESD-requirements also at low air humidity: BVG < 30 V
- Outstanding appearance: "Like a mirror"
- Does not contain CMR-substances
- Meets the requirements of LEED V4, French Label, AgBB, CSM.
- EPD Available.
- Sikafloor MultiDur ES-55 ESD can be used without conductive primer (depends on requirements)
- Time and money saving
- Can be recoated with itself
- Thin system available (MultiDur ES-59 ESD)

Note: Some RAL Colours are not possible.



Sikafloor®-2350 ESD
Sikafloor®-220 W Conductive + Sika® Earthing Kit
Sikafloor®-161

Sikafloor® MultiDur
ES-56 ESD



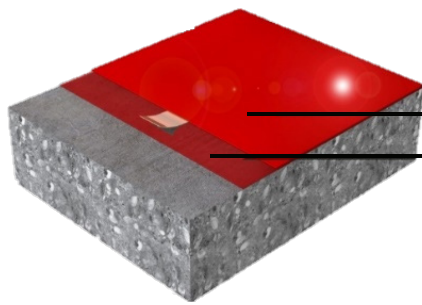
Sikafloor®-2350 ESD
Sikafloor®-161 + Sika® Earthing Kit

Sikafloor® MultiDur
ES-55 ESD

Sika Selected Systems

Sika Main ESD Smooth Systems

Based on Sikafloor®-2350 ESD

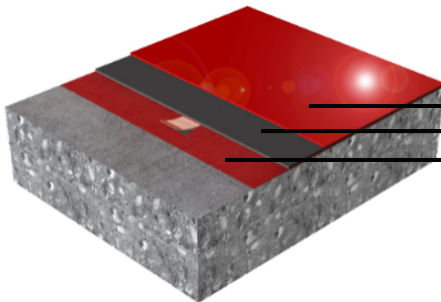


Sikafloor® MultiDur ES-55 ESD

Sikafloor®-2350 ESD

Sikafloor®-161 + Sika® Earthing Kit

With Conductive Primer



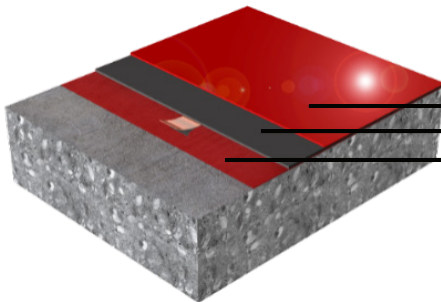
Sikafloor® MultiDur ES-56 ESD

Sikafloor®-2350 ESD

Sikafloor®-220 W Conductive + Sika® Earthing Kit

Sikafloor®-161

With Standard Conductive Primer



Sikafloor® MultiDur ES-57 ESD

Sikafloor®-2350 ESD

Sikafloor®-220 W Conductive + Sika® Earthing Kit

Sikafloor®-161

With Conductive Primer Increased Electrical Resistance

Sikafloor® MultiDur ES-55 ESD

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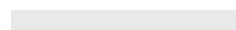
Sikafloor® MultiDur ES-57 ESD

3.8



Sikafloor® MultiDur ES-56 ESD

0.11

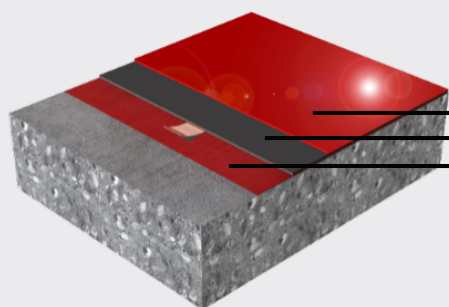


All readings in
M Ohm

Sika Selected Systems

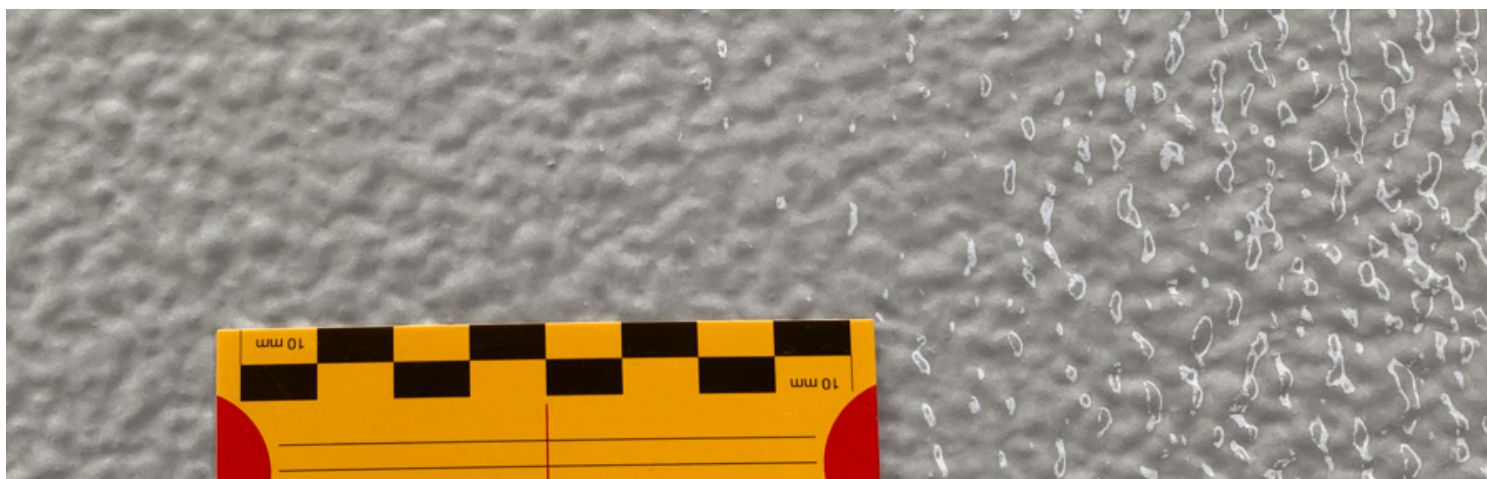
Sika Main ESD Smooth Systems

Based on Sikafloor®-2350 ESD



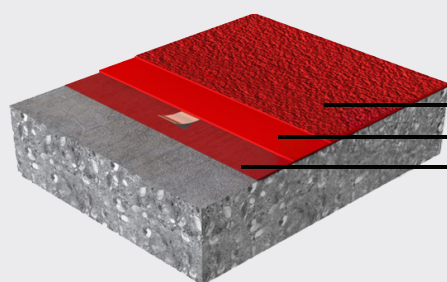
Sikafloor®-2350 ESD + 2% Extender T
Sikafloor®-220 W Conductive + Sika® Earthing Kit
Sikafloor®-161

Sikafloor® MultiDur
ET-56 ESD



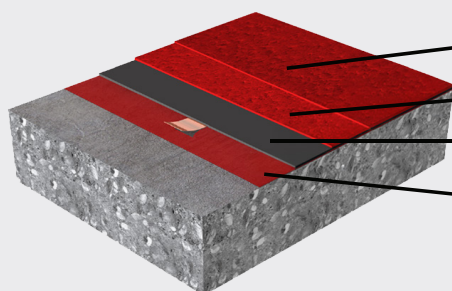
Sika Selected Systems

Sika Main Broadcast Systems Based On Sikafloor®-2350 ESD



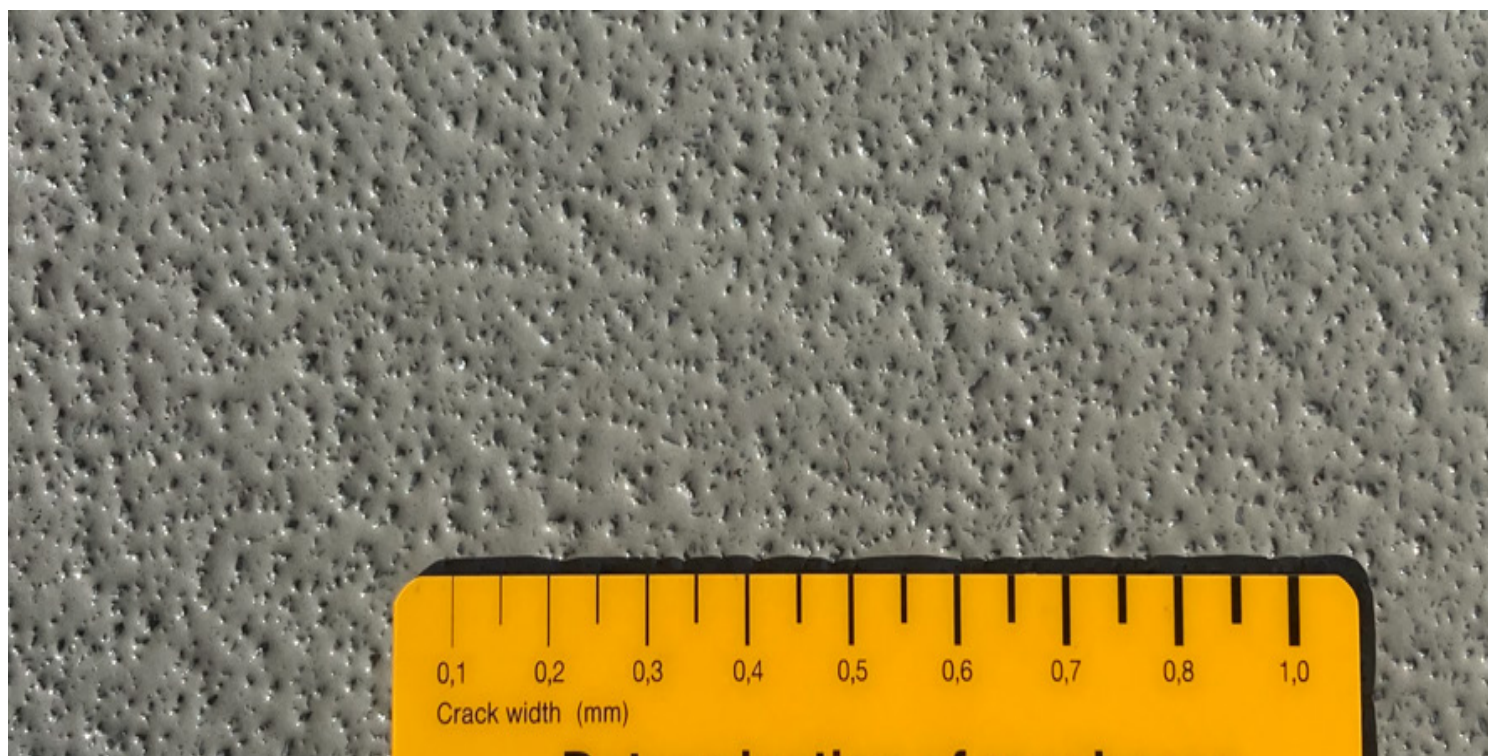
- Sikafloor®-2350 ESD
- Sikafloor®-2350 ESD (broadcast to excess with SiC)
- Sikafloor®-161+ Sika® Earthing Kit

Sikafloor® MultiDur
EB-55 ESD



- Sikafloor®-2350 ESD
- Sikafloor®-2350 ESD (broadcast to excess with SiC)
- Sikafloor®-220 W Conductive + Sika® Earthing Kit
- Sikafloor®-161

Sikafloor® MultiDur
EB-56 ESD



Sika Selected Systems

Test Certificates of Sikafloor®-2350 ESD Product/Systems

Product & Systems / Certificates	AgBB	ASTM F 150	CSM	ESQ Requirements IEC 61340-5-1	Fire Classification EN 13501-1	French VOC Label	LEED V 4.1 (EQc2, MRc2/EPD, MRc4)	Slip Resistance Pendulum acc. DIN EN 13036-4	Slip resistance DIN EN 51130	VDE 100-610	Spark proofness UFGS-09 97 23	ISEGA Foodstuff suitability
Sikafloor®-2350 ESD	▲		▲			▲	▲		▲			▲
Sikafloor MultiDur ES-55 ESD		▲		▲	▲					▲		
Sikafloor MultiDur ES-56 ESD		▲		▲	▲			▲	▲		▲	
Sikafloor MultiDur ES-57 ESD		▲		▲								
Sikafloor MultiDur EB-55 ESD		▲		▲					▲			
Sikafloor MultiDur EB-56 ESD		▲		▲				▲	▲			
Sikafloor MultiDur EB-57 ESD		▲		▲				▲	▲			
Sikafloor MultiDur ET-56 ESD		▲		▲	▲			▲	▲			
Sikafloor MultiDur ET-57 ESD		▲		▲	▲							
Sikafloor MultiDur ES-59 ESD		▲		▲	▲							

▲ External test certificate available ▲ Meet requirements, tested internally

Sika Selected Systems

Systems with Sikafloor®-235 ESD

Available Colors

Approved RAL Color Shades	Sikafloor MultiDur ES-56 ESD/ EB-56 ESD/ ET-56 ESD (with SR-220 W)	Sikafloor MultiDur ES-55 ESD/ EB-55 ESD (without cond. Primer)
1000	Yes	No
1001	Yes	No
1011	Yes	No
1014	Yes	Yes
1019	Yes	No
3012	Yes	No
5024	Yes	No
6000	Yes	Yes
6010	Yes	Yes
6020	Yes	Yes
6021	Yes	No
6027	Yes	Yes
6033	Yes	Yes
6034	Yes	Yes
7001	Yes	Yes
7004	Yes	No
7005	Yes	Yes
7011	Yes	Yes
7015	Yes	No
7016	Yes	Yes
7021	Yes	Yes
7024	Yes	No
7030	Yes	No
7032	Yes	Yes
7035	Yes	Yes
7037	Yes	No
7038	Yes	Yes
7040	Yes	Yes
7042	Yes	No
7045	Yes	Yes
7046	Yes	No
7047	Yes	Yes
9002	Yes	Yes
NCS 3500-N	Yes	No

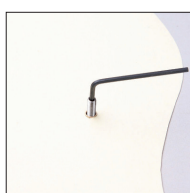
Sikafloor® EARTHING KIT



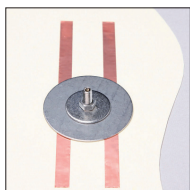
An electrostatic charge, which occurs during materials contact and separation, has to be discharged via an earthing point. Sika provides the Earthing Kit, a unique tool box containing all of the necessary components for up to 10 earthing points.

Every earthing point is able to conduct approximately 300 m² to earth. Ensure the longest distance between each earthing point in each room or area is a maximum of 10 m apart. In larger areas with longer distances, additional earthing points must be installed in accordance with the Electrical Engineer's requirements.

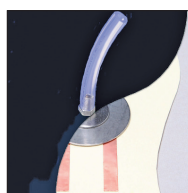
If site conditions or other constraints do not allow the positioning of any additional earthing points that are required, then any longer distances (>10 m) must be bridged by the use of additional adhesive copper tapes in accordance with the relevant specifications. All of the earthing points have to 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.



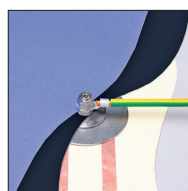
- Prepare and prime the substrate in accordance with the relevant Sikafloor® PDS.
- When primer has cured, drill a hole: diameter 8 mm, depth > 50 mm.
- Remove all dust, loose and friable material around the hole and insert a size 8 plastic plug. The plug must be flush with the floor surface.
- Screw the threaded dowel rod with a hexagonal socket into the plastic plug with an Allen key. Dowel rod must extend 16 mm above the floor.



- Fully bond the copper strips (2 × 100 mm) on both sides of the hole.
- Place large (D = 60 mm) washer followed by the smaller (D = 30 mm) washer over the threaded dowel rod and secure with the nut (M6) so the washers are pressed onto the copper strips ensuring good contact.

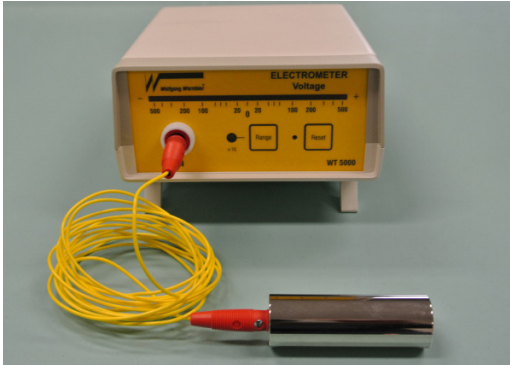


- Push the transparent plastic hose over the threaded dowel rod so the hose fits tightly.



- Apply the selected Sikafloor® conductive primer and conductive wearing finish ensuring all washers and copper tape are completely covered.
- After curing the Sikafloor® products, remove the transparent plastic hose.
- Clean the head of the threaded dowel rod. Fix the brass eyelet using the self-locking nut (M6) onto the threaded dowel rod. Connect the grounding cable with the brass eyelet.
- Connect the earthing main cable with the brass eyelet (only by a qualified Electrical Engineer).

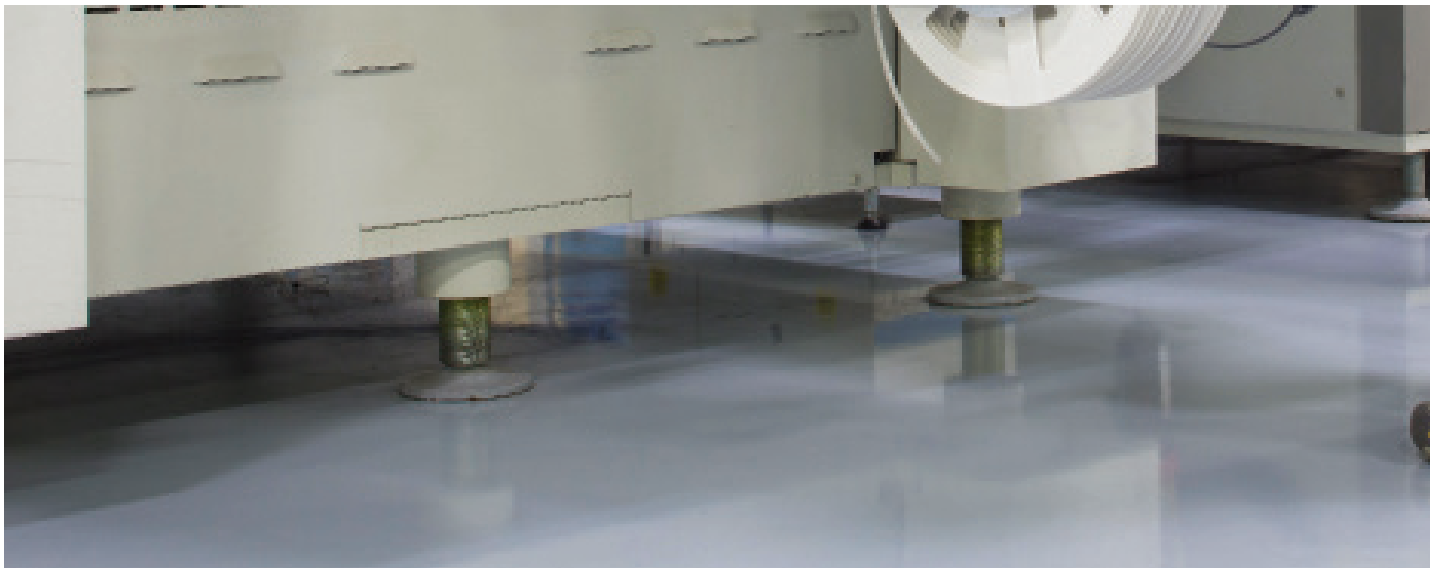
MEASUREMENT OF THE CONDUCTIVITY OR ELECTRICAL RESISTANCE OF Sikafloor® ESD AND ECF SYSTEMS



As previously indicated at the beginning of this brochure, an Ohm meter, as pictured in the left photo, is the equipment that is used for the measurement of the conductivity or electrical resistance of these flooring systems. The range of the Ohm meter must be within $1 \times 10^3 \Omega$ to $1 \times 10^{13} \Omega$.

The metering voltage required for an electrical resistance of $< 1 \times 10^6 \Omega$ is 10 V, whilst the metering voltage for an electrical resistance of $\geq 1 \times 10^6 \Omega$ is 100 V. Body Voltage Generation (BVG) is measured separately with an 'electrostatic field meter'.

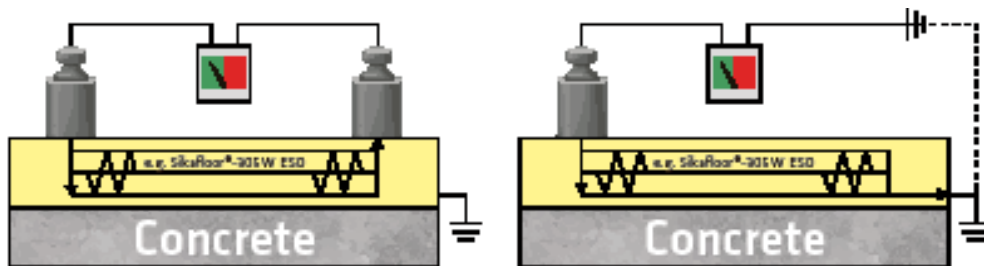
The main differences between different models and manufacturers of the measurement electrodes used for this are not their size or the weight, but the type and hardness of their contact surface. This can give misleading results and should only be carried out by suitably qualified and experienced people. Therefore Sika generally recommends for measurements according to IEC 61340, the use of metal electrodes with a contact area of $65 \pm 5 \text{ mm}$, a conductive rubber pad of Shore Hardness $A = 60 \pm 10$ and a weight of $2.5 \pm 0.25 \text{ kg}$ for hard resin floor surfaces.



DIFFERENT TYPES OF CONDUCTIVE FLOOR PERFORM DIFFERENTLY

In the example of testing for resistance below, Sika Conductive “Carbon Fibre Fillers”-Technology is compared with Sika Conductive “Pigment Fillers”-Technology

Controlled homogeneity of the floor surface using Sika Conductive “pigment fillers”-Technology

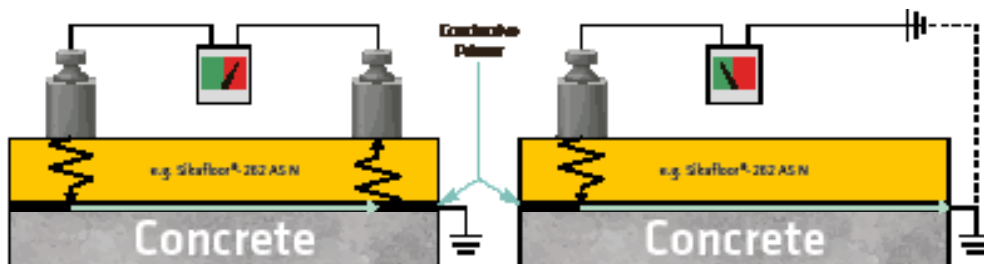


Note:

The conductive fillers are in permanent continuous contact and so there are many paths across & through the conductive system – the surface is suitable for point to point measurement.

Typically the Resistance to Ground (Rtg) with the Conductive Priming Layer is equal to or greater than the Resistance Point to Point (Rtt)

Variable Floor Surface with Sika Conductive “Carbon Fibre Fillers”-Technology



Note:

The resin around the fibres can insulate points on the surface and within the thickness of the resin. Therefore Point to Point measurement is NOT recommended on the surface of conductive flooring systems based on carbon fibre technology.

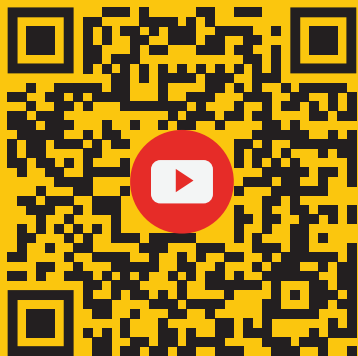
Typically the Resistance Point to Point (Rtt) is greater than the Resistance to Ground (Rtg)



These graphs show the effects of Multi-directional Conductivity and Uni-directional Conductivity obtained with the different filler types.

As an additional practical example:

It is not possible to refurbish (over-coat) existing conductive floors based on carbon fibre technology with each other, without the application of an intermediate conductive primer (such as SikaFloor®-220 W Conductive). This is because there is a minimal chance that the carbon fibres in each layer will make an adequate connection to the carbon fibres in the other. As a result any electrical charges could not be discharged to ground. However this type of refurbishment and over-coating work is perfectly possible with systems based on conductive fillers (such as SikaFloor®-305 W ESD). This is because the conductive fillers provide fully homogeneous conductivity.



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BUILDING TRUST

