



New possibility for EPA entrance checks based on field measurement

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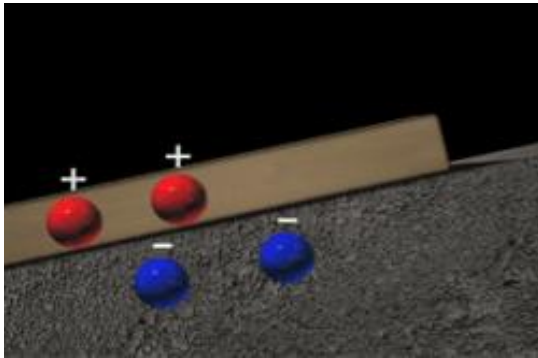
Milestones

- 2001 Foundation in 4 countries as a system supplier for ESD protection
- 2008 New building in Nußbach - Austria
- 2012 New branch in České Budějovice
- 2015 Restructure and founding of **center of competence** in Germany
- 2017 participation in standardisation commission DKE/K185 und TC101
- 2019 Certified acc. ISO 9001 and ISO 29993

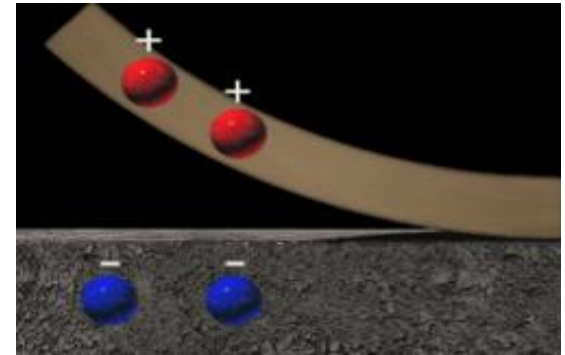




3 origins of electrostatic net charges



1. Friction



2. Contact & Separation

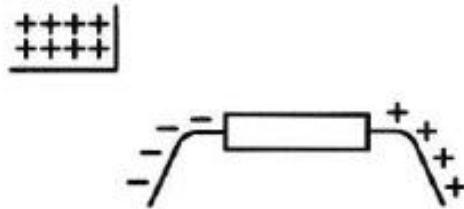




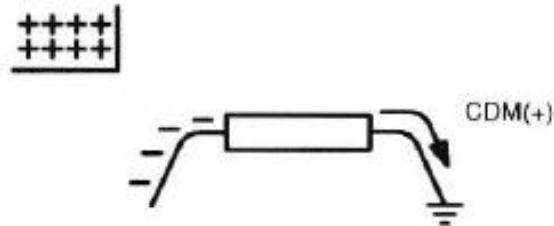
3. Charging by induction

is the separation or shifting of electrical charge through an electric field.

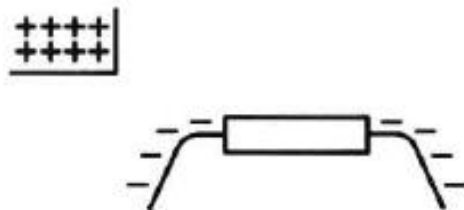
A) DEVICE IN STATIC FIELD



B) FIRST EVENT-GROUNDING IN FIELD



C) DEVICE LEFT WITH NET CHARGE



D) SECOND EVENT-GROUNDING IN LATER STEP

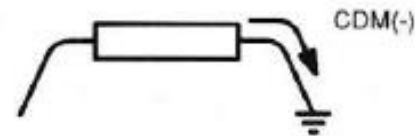


Figure 3-10. ESD by induction

Charging by Induction,, Vergl.G.T. Dangelmayer " ESD Program Management" page 47.



Problem - Field strength

- The potential on a conductive object is homogeneous.
- The potential on an insulative object is variable.
- The resulting field strength on a big or flat surface reaches out wider than from a small or uneven object (blue arrows).
- Every object which comes close will change the capacitance and will reduce the field strength.
- This field meter could be seen as a part of a capacitor when measuring the surface potential.

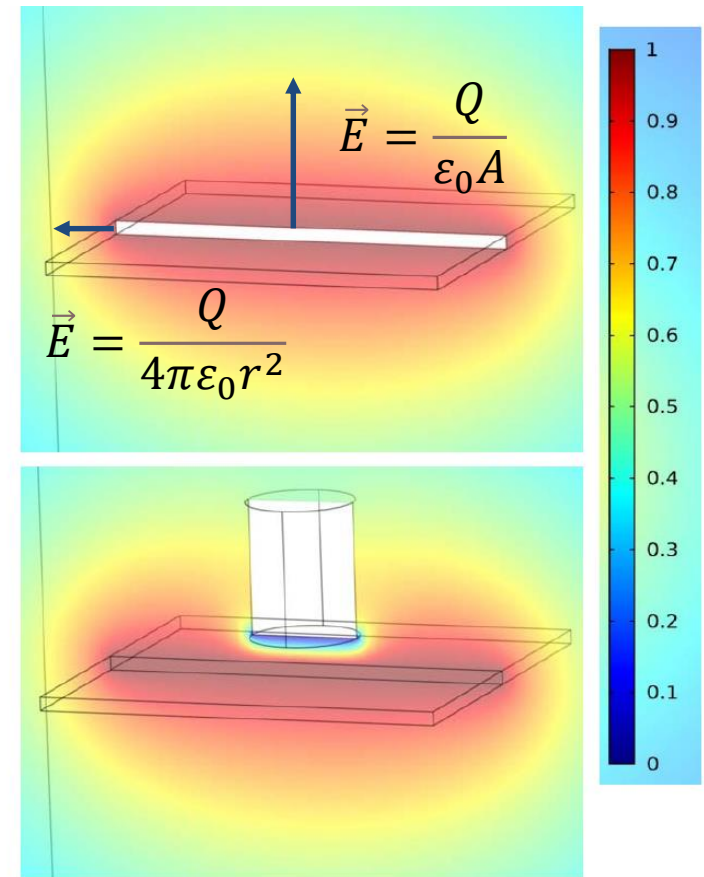


Figure 17. Space potential (voltage) around a conductor at constant voltage (above) with no other object present and (below) with an earthed field meter present



Business as usual

- Potentials and fields are usually measured by a field meter
- The standard reading of a voltage (U in V) at a distance of e.g. 20 mm ($530 \text{ V} \approx 250 \text{ V/cm}$)
- Or Field strength (E in V/m) at the point of use (25 kV/m)
- The allowed field strength acc. IEC 61340-5-1 is $5 \text{ kV/m} \approx 50 \text{ V/cm}$



Picture 1: measurement area of a field mill

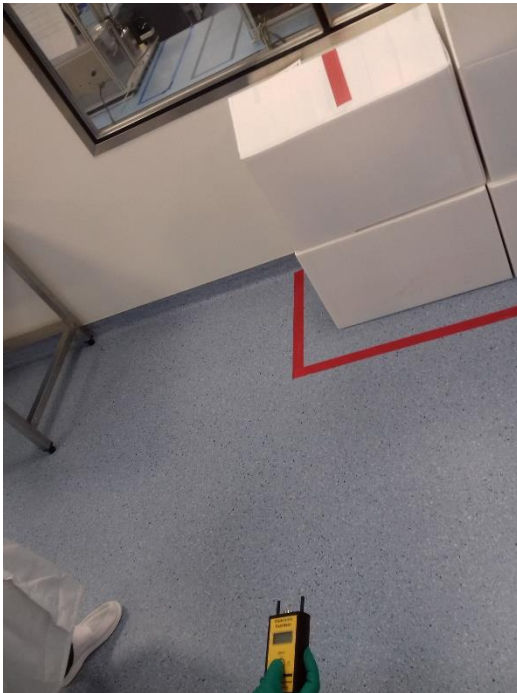
Picture 2: readings of same potential in different modes at 2 cm distance and in E-Field-Mode



Picture taken from: Vergleichende Messungen des Oberflächenpotentials von Materialien, R. Pfeffe, ESD-Forum2013 and own

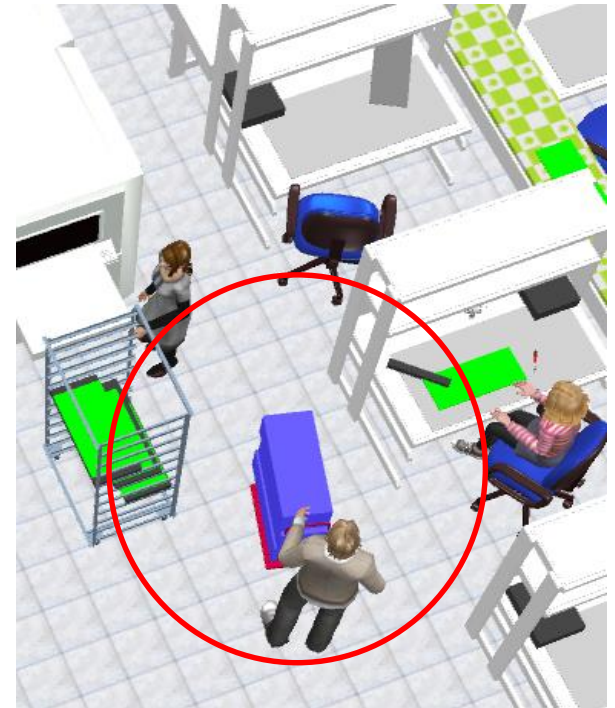


Range of fields and the arising CDM risk



Picture 1: Surface potential of 14 kV results in a field strength of 100 V/cm at a distance of 1,4 m. -> Deviation acc. IEC 61340-5-1!

Picture 2:
risk range arising
from these boxes
during internal
transport

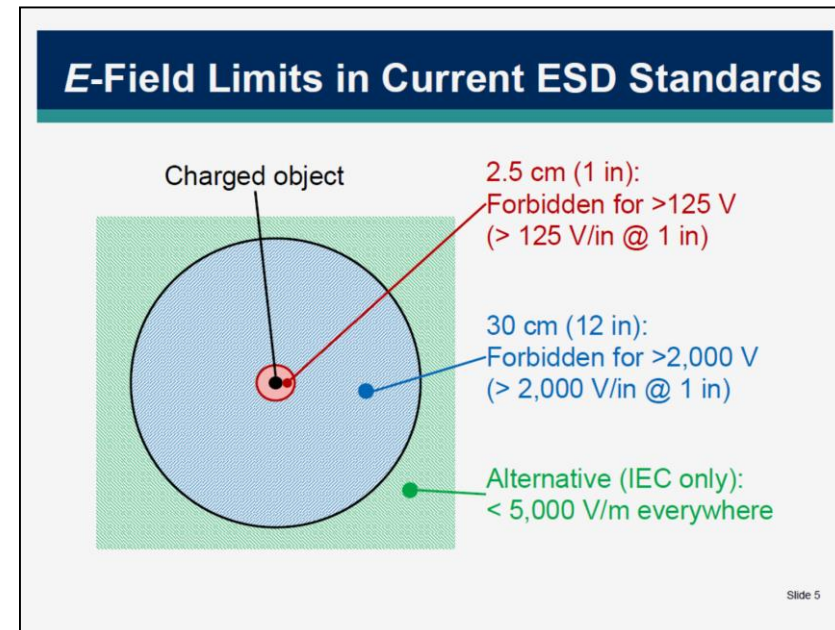


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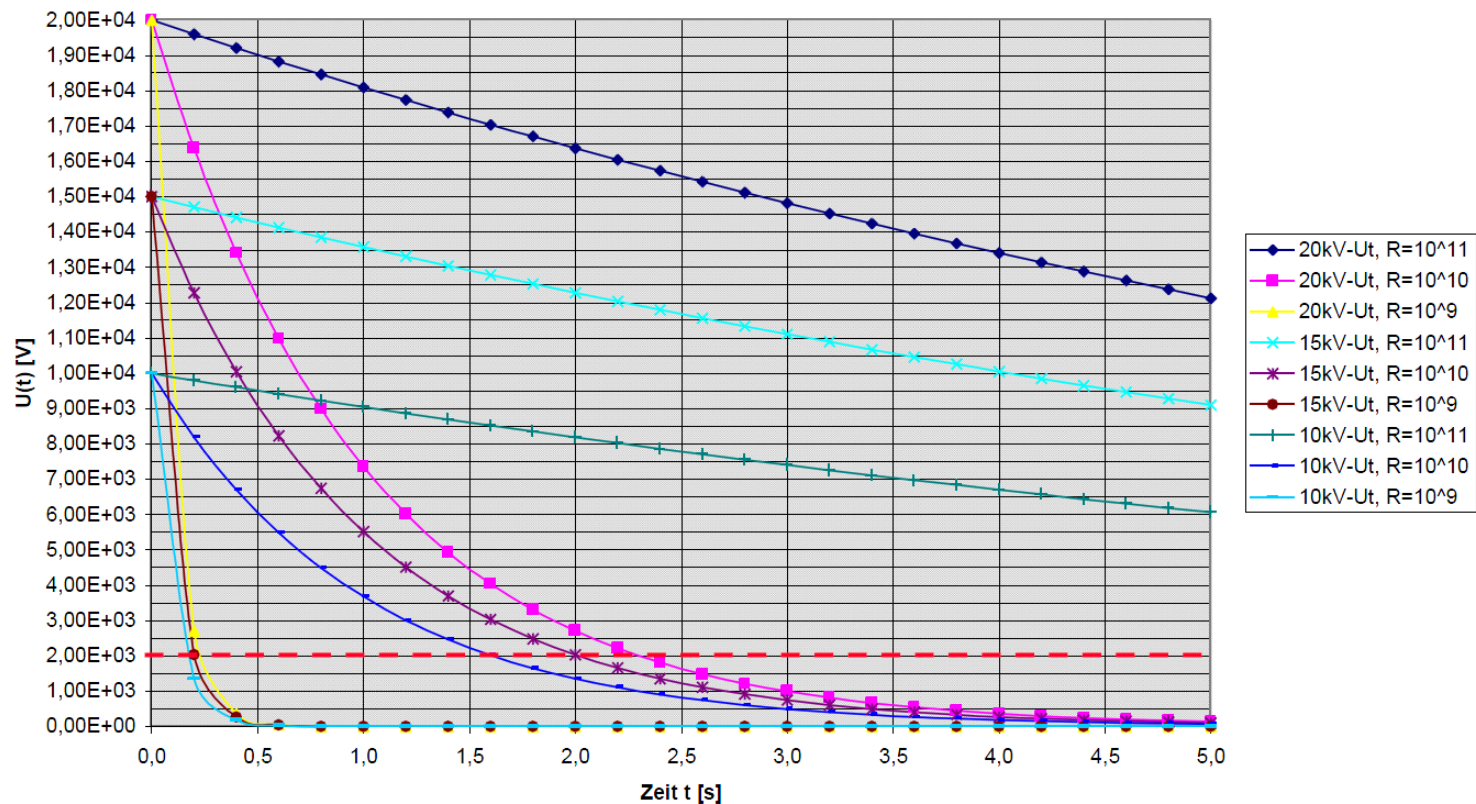
CDM – the main failure model

- Based on the experiences and numbers in the moment 95% of all ESD-failures are related to CDM!
- The root cause for these events are often potentials on objects close to the ESDS.
- What means „close to“?





Relationship between resistance and static decay



Picture taken from: Karl H. Helling, EIB, 16.10.2012 Stuttgart



Historical view - advantage by testing

- Based on this relation the most organizations using personal grounding testers for entrance checks at the EPA.
- First entrance checkers were invented late 1980th.
- **Advantage:** HBM failures were remarkable reduced.

Perspective:

- More sensitive ESDS requires less charged personal and material.
- 5 nm structures on wafers as products in 2024 in most productions.
- So what to do?





Qualification

- Follow the standards and improve your system!
- For qualification, the flooring system is tested in laboratories and after installation.
- The personal grounding system must be tested with a walking test on every flooring system and with every kind of shoe.
- But both are made in clean situation!
- Is it helpful to close the qualification process here?
- Who sets the limits?
- And is he aware of degradation?



Picture taken from: own



Verification

- Historical data tells us that the more frequently any system is audited, the more reliable it becomes.
- That's the reason for daily personal grounding tests!
- But what about the messing link?
- Often the floor gets dirty?
- How often the floor is measured?
- How often a walking test will be performed?
- And really, with every shoe on every flooring system inside the organization?



Picture taken from: own



Entrance checks today

- Modern systems are often combined with barriers or turnstiles.
- Beneath the good or bad LED often values of temp, rH and Values are displayed.
- IT connections made it more comfortable for the ESD-Koordinator
- But bringing trouble to the data protection officer.
- And what are these data graves useful for?
- How often a ESD coordinator in a small and medium organization has the time to check the storage data?



Picture taken from: own



Uncertain Correlation

- Testing one of two components is useful
- It helps identify bad shoes or wrong clothing like insulative tights or dry skin.
- 1 + 1 is not always 2! - The combination of shoe and flooring is often a cause for trouble.
- And often a source of uncertainties. If the system in combination is not working properly during a customer audit, how good was it, when a damaged product was handled?

42	Stuco Sandale	PVC 02-0202-90002	42 22 8 MOhm	5 V	ne
43	Stuco Sandale	Ecotile (ungereinigt)	42 22 15 GOhm	-105 V	ne
44	Stuco Sandale	PVC 02-0202-90012	42 22 200 MOhm	100 V	ne
45	Stuco Sandale	Metallplatte	42 22 9,5 MOhm		ne
46	Artra Sicherheitsschuh	Synthese Kautschuk Matte	42 22 15 MOhm	10 V	ge
47	Artra Sicherheitsschuh	PVC 02-0202-90002	42 22 3,5 MOhm	5 V	ge
48	Artra Sicherheitsschuh	Ecotile (ungereinigt)	42 22 15 GOhm	230 V	ge
49	Artra Sicherheitsschuh	PVC 02-0202-90012	42 22 350 MOhm	220 V	ge
50	Artra Sicherheitsschuh	Metallplatte	42 22 2 MOhm		ge
51	Abeba Business Men	CWS Sauberlaufmatte	43 21 200 GOhm	-180 V	ge
52	Abeba Business Men	Kunststofflaminat	43 21 150 GOhm	+350 V	ge
53	Abeba Business Men	ESD-Synthesekautschuk	43 21 60 MOhm	-5 V	ge
54	Abeba 31042	Ecotile 7mm	49 21 500 MOhm	140 V	ge
55	Abeba 31042	Ecotile 7mm	49 21 10 MOhm	25 V	ne
56	Stuco Office	Ecotile (ungereinigt)	49 21 250 GOhm	200 V	ge
57	Abeba 1575	Ecotile 7mm	49 21 100 MOhm	95 V	ne
58	Jalas	Betonestrich	61 25 150 GOhm	80 V	ge
59	Jalas	PVC 02-0202-90012	61 25 80 MOhm	10 V	ge
60	Abeba Light	PVC 02-0202-90012	61 25 2 MOhm	5 V	ge
61	Alpro Clog	PVC 02-0202-90012	61 25 1,5 MOhm	4 V	ge
62	Chuck Allstar Freizeitschuh	PVC 02-0202-90012	50 19 3,5 GOhm	120 V	ge
63	Puma Turnschuh	PVC 02-0202-90012	50 19 2 TOhm	250 V	ge
64	Rewa 2 Wanderschuh	PVC 02-0202-90012	50 19 200 MOhm	80 V	ge
65	Elten Office	Epoxy Boden	35 23 65 MOhm	20 V	ge
66	Stuco Deckshoe	Epoxy Boden	35 23 75 MOhm	20 V	ge
67	Abeba 5310-40	Fortelock ESD Fliesen	45 22 340 MOhm	25 V	lal
68	Elten Maddox red	Fortelock ESD Fliesen	31 22 400 MOhm	110 V	Fe
69	Elten Maddox red	Fortelock ESD Fliesen	31 22 400 MOhm	89 V	Fe
70	Elten Maddox red	Fortelock ESD Fliesen	31 22 250 MOhm	137 V	Fe
71	Within Schuh	Fortelock ESD Fliesen	31 22 1,5 GOhm	450 V	Fe
72	Vitaform FSD Clog	Fortelock ESD Fliesen	30 24 177 MOhm	35 V	lal

Picture taken from: own



Entrance checks tomorrow

- A better way could be to check if a person or material which is transferred to the EPA is charged or not.
- The possible upgrade at the EPA entrance is the **ESD-FIELD-GUARD**.
- At least an improved field meter which is able to see field strength changes.
- When a field passes the range of detection, the unit changes the color depending the user's choice.
- Combined with a motion detector a gate could be opened or a signal can be activated.

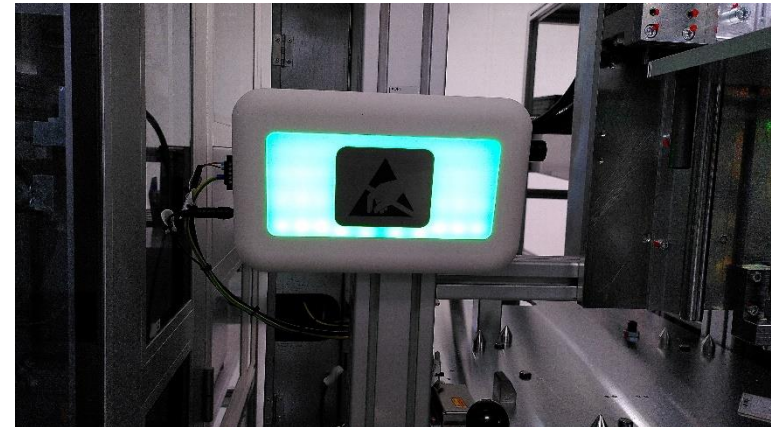


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Advanced options

- The **ESD-FIELD-GUARD** could be used to detect fields in various situations.
- One customer had used this unit to control the manual stations at his manufacturing line.
- If fields are detected during the production, a signal passed through the RS485 port and stops the line.
- Detected deviations during production:
 - Supplier uses the wrong packaging material
 - Person closed the smock not properly
 - Hair net was used in the wrong manner and hair was not covered completely.



Picture taken from: own



Trained personal is the first line of defence!

- The **ESD-FIELD-GUARD** helps to keep the awareness high
- Relations between materials and risks get obvious
- Involving trained person make sure the facts are remembered longer

Any electronic can sense what the **ESD-FIELD-GUARD** detects!



Picture taken from: own



Thank you for your attention - stay common connected



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