ESD – THE INVISIBLE DANGER

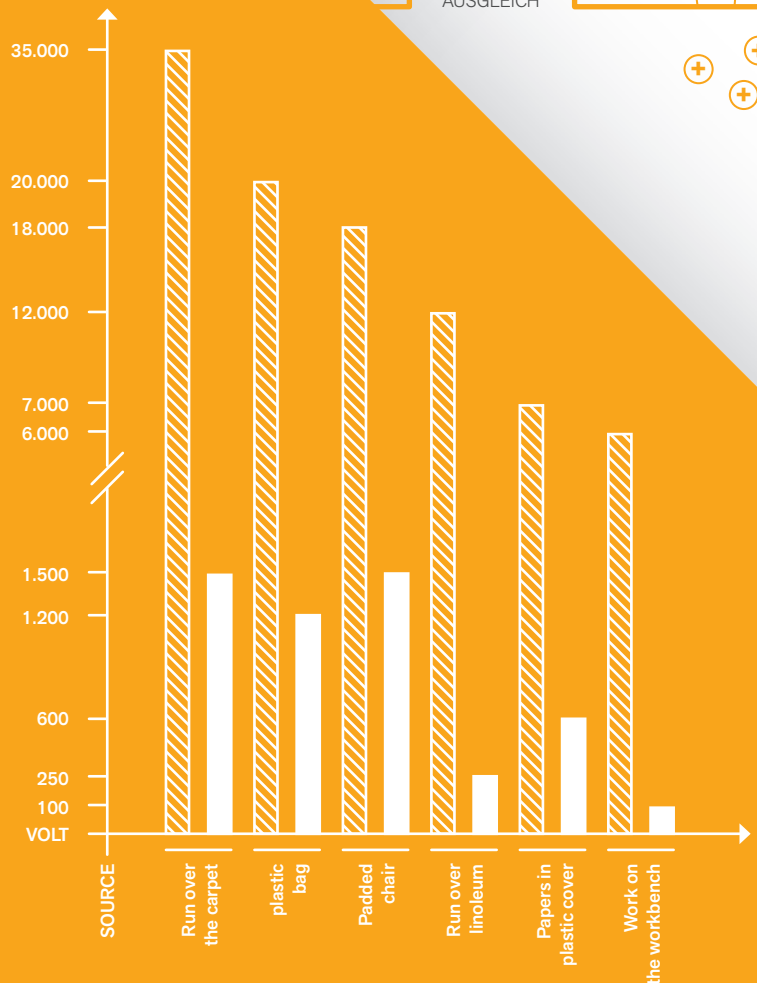
WHAT DOES ESD MEAN?

ESD stands for electrostatic discharge. It is caused by the sudden equalisation of charge between objects with a different charge potential. This discharge can generate a large amount of electrical current.

HOW IS ELECTROSTATIC CHARGE GENERATED?

Every object has positive and negative elementary particles. Positive and negative charges normally neutralise each other. Objects are electrically neutral. However, if an object loses electrons, an imbalance arises.

This imbalance is called the charge potential. Charged objects have a tendency to equalise by discharging. In the event of a sudden discharge, high currents flow in a small electronic component.



ELECTROSTATIC CHARGE AND THEIR POSSIBLE CAUSE

- air humidity 10-20%
- air humidity 65-90%

ELECTROSTATIC DISCHARGE IN EVERYDAY LIFE

The most visible form of electrostatic discharge is lightning during a storm, when clouds with different potentials abruptly discharge. All of us have at one point experienced a sudden discharge, such as after walking across a carpeted floor and then touching the handle of a door.

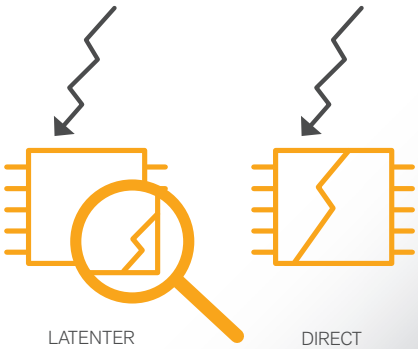
CAR DOOR DOOR LINK GREETING

FOLLOWS ELECTROSTATIC UNLOADING OF COMPONENTS

Date of damage detection	value	efforts
component level	1x	part costs production stop
assembled circuit board	10x	part costs production stop error search repair costs
finished, tested product	100x	part costs production stop error search repair costs inspection costs delivery delays
delivered product	1000x	Replacement/repair costs Field service / delivery costs compensation loss of reputation

COMPONENT SENSITIVITY

The ESD sensitivity of electronic components is rising as component parts are increasingly miniaturised. Moreover, ever smaller components offer less and less space for protective circuits on microchips. In order to save energy, components need to get by on less power. A discharge of just 50 volts is enough to cause damage to a blue LED, for example. SMDs are already at risk of damage at voltages higher than 100 V. In contrast to this, the human ability to perceive ESD is very limited.
Discharges are first noticeable from 3500 volts, audible from 4500 volts and visible from 10000 volts.

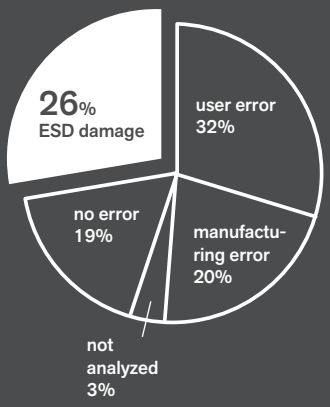


LATENTER ERROR (intrinsic error) DIRECT ERROR

DETECTING AND ELIMINATING FAULTS

Components damaged by ESD cannot normally be seen with the naked eye. Even tiny discharges can lead to complete failure. These direct failures can usually be identified during quality control. So-called latent failures are especially critical, as they only become apparent when products are in operation. The time and effort needed to eliminate these intrinsic failures cause the greatest costs. ESD damage generally concerns latent damage. It is therefore absolutely essential that the appropriate precautions are taken.

FAILURE CAUSE ELECTRONICAL COMPONENTS



ESD – HOW TO PROTECT YOURSELF AND YOUR COMPONENTS

HOW CAN YOU PROTECT COMPONENTS?

You can protect ESD-sensitive components by storing, handling and packing them in a completely ESD protected environment. Precautionary measures are taken in these areas to eliminate electrostatic build-up. The difference in potential is neutralised by slowly dissipating the charge, thereby preventing a sudden discharge. This abrupt release constitutes the real danger. A very short and rapid discharge generates a very high discharge current.

MARKINGS AND SYMBOLS

It is important to identify ESD-sensitive components, ESD-safe working areas and ESD-safe objects. Safe objects are identified by a black triangle on a yellow background with a stylised hand surrounded by a circular arc. In addition, the acronym EPA (ESD protected area) is added for ESD protected areas. For ESD-sensitive components, there is no black circular arc and there is a line running through the hand to indicate ESD-sensitive products. It also makes sense to use ESD inspection tags which display the date when the object was last inspected for protective effectiveness.

WHAT DOES THE NORM SAY?

DIN - EN 61340-5-1/VDE 0300, Part 5-1 „Protection of electronic devices from electrostatic phenomena“ General requirements; DIN - EN 61340-5-2 / VDE 0300, Part 5-2 „Protection of electronic devices from electrostatic phenomena“, User guide; DIN - EN 61340-2-1 / VDE 0300, Part 2-1 „Measurement methods – Ability of materials and products to dissipate static electric charge“; DIN - EN 61340-4-1/ VDE 0300, Part 4-1 „Standard test methods for specific applications – Electrical resistance of floor coverings and installed floors“; DIN - EN 61340-4-3/VDE 0300, Part 4-3 „Standard test methods for specific applications – Footwear“; DIN - EN 61340-4-5/VDE 0300, Part 4-5 „Standard test methods for specific applications – Methods for characterizing the electrostatic protection of footwear and flooring in combination with a person“.

ESD GROUNDING POINT

marked grounding point for all ESD components

SYMBOLS AND YOUR MEANING

ESD SAFED

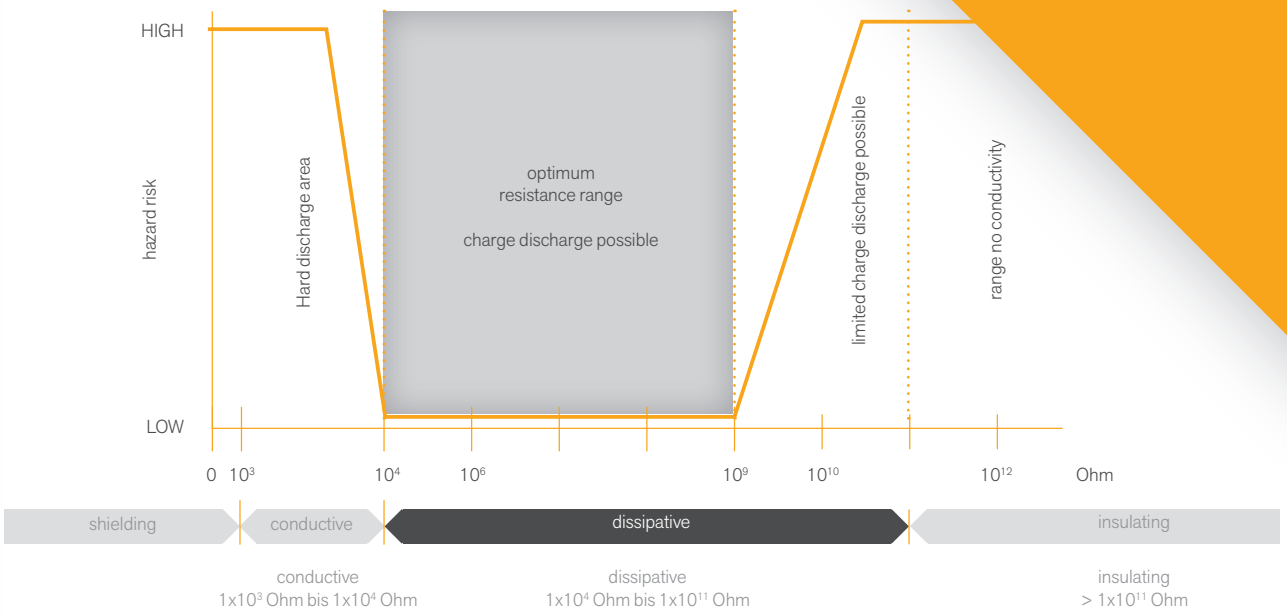
marked ESD safe tools and objects

ESD DANGERED

marked endangered components and domains

ESD protected area

marked ESD protected area



SURFACE RESISTANCES

The effectiveness of materials is classified according to their resistance properties. Here, surface resistance plays a particularly important role: it is the electrical resistance of a conductive layer on the surface. Depending on the resistance properties, a distinction is made between shielding materials, electrically conductive materials, electrically dissipative materials and insulating materials.

MEASUREMENT OF RESISTANCES IN THE ESD AREA

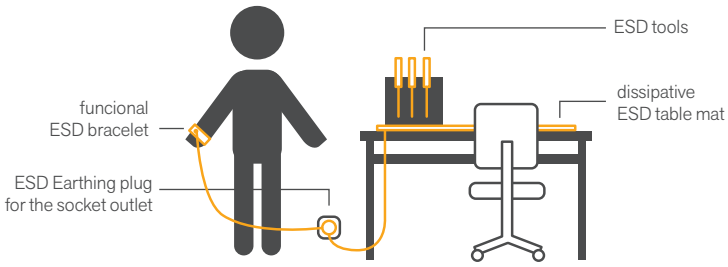
In addition to surface resistance, the following resistances are also important: the bleeder resistance (resistance against earth/protective conductor), volume resistance (resistance measured at opposite points of a material) and point-to-point resistance (resistance between two electrodes).

PERSONS AND WORKPLACES EQUIPMENT

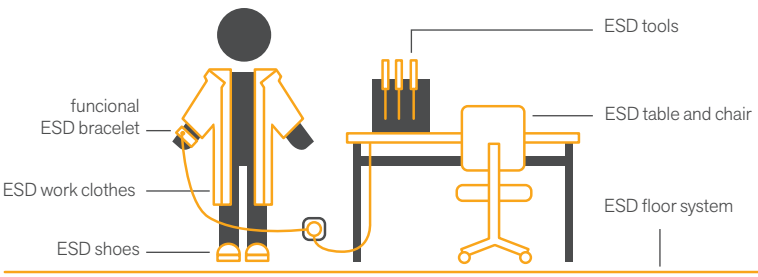
If ESD-sensitive components are being handled, people and workplace equipment need to be ESD compliant. The primary focus for people is ESD-compliant clothing (shoes, coats, antistatic wrist straps), for workplace equipment, conductive flooring is just as important as ESD-compliant workbenches and chairs. The most important measure is the proper grounding of personnel.

ESD COMPLIANT TOOL

ESD-compliant tools are also just as important. In the Bernstein catalogue, you will find a comprehensive range of ESD-compliant tools for use in ESD protected areas. Often work needs to be performed outside of these protected areas, in which ESD-sensitive components need to be installed. We offer solutions here too, which are suitable for mobile use, such as table covers, grounding plugs for power sockets, clamping equipment and hand tools.



Simple design of an ESD-safe workstation for mobile use



ESD-safe execution of a work schedule in the EPA area

HOW YOU SET UP YOUR WORKPLACE IN A ESD-SECURE WAY

STATIONARY WORKPLACE - WORK IN THE EPA AREA

An ESD-safe workplace is indispensable in order to safely and properly carry out work and measurements on electrostatically sensitive components.

In fixed installations, such as in EPAs (electrostatic discharge protected areas), all elements that come into contact with people and components should be electrostatically conductive.

Foot mats, workplace pads, large assemblies and personnel grounding are earthed by so-called earth bonding plugs, while it is important to pay attention to ESD logos for clothing and tools.

MOBILE WORKPLACE - WORK ON THE ROAD

It doesn't happen often that fully assembled components or assemblies can be handled, repaired or serviced in ESD protected areas. This is where so-called ESD workplaces are needed.

The traditional mobile workplace (also called a handling set) consists of a workplace pad, a wrist band for grounding of personnel and an earthing cable with a earthing plug.

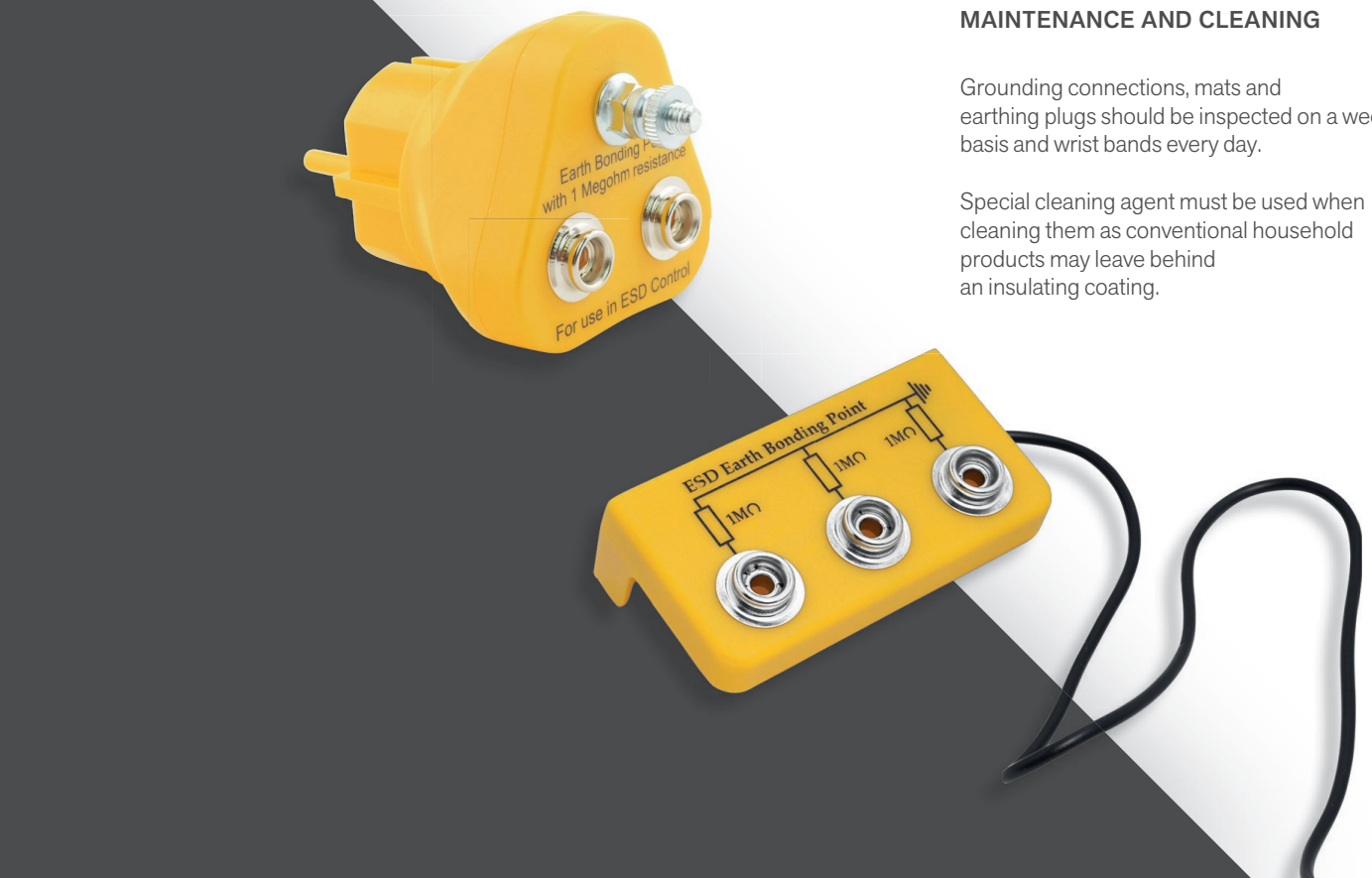
If there are no plug sockets available, the earthing cable can also be attached to grounded metal surfaces using a crocodile clip.

When properly set up, static electricity is discharged via the mat.
But when using this method, it is important to make sure that the hand-to-earth resistance is less than 3.5×10^7 ohms.

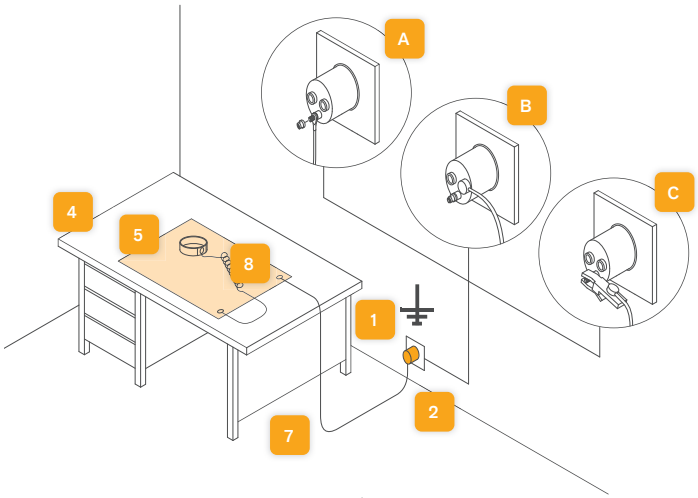
MAINTENANCE AND CLEANING

Grounding connections, mats and earthing plugs should be inspected on a weekly basis and wrist bands every day.

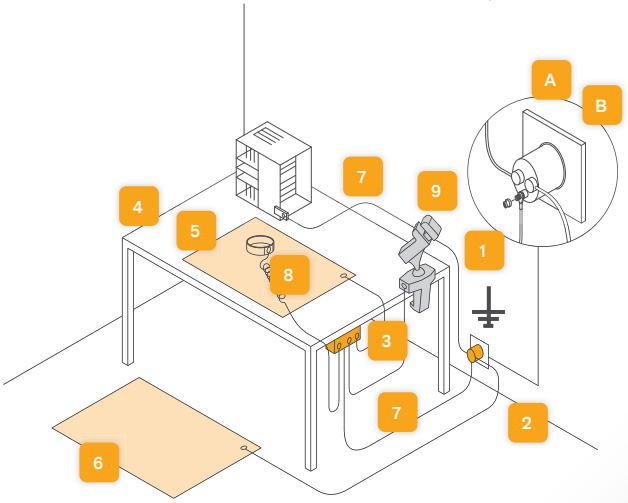
Special cleaning agent must be used when cleaning them as conventional household products may leave behind an insulating coating.



CORRECT STRUCTURE OF THE COMPONENTS ON **MOBILE WORKPLACE**



CORRECT STRUCTURE OF THE COMPONENTS ON **STATIONARY WORKPLACE**



Explanations to the graphics:

	BESTANDTEILE	PASSENDE PRODUKTE VON BERNSTEIN
1	grounding point	–
2	earthing	9-359-2 (for EU sockets) 9-353 (for clamping on metal)
3	earthing module	9-359-1 (for clamping on table)
4	workplace	–
5	working mat	9-354-100, 9-360-0, 9-361-0, 9-367-0, 2291, 2301, 9-334
6	floor mat	9-361-0, 9-367-0
7	earthing cables	9-343-1, 9-344-1
8	personal grounding/bracelet	9-341, 9-342
9	Components and devices	9-205 ESD more page 36

Our workplace requirements can also be used as shelf supports

EARTH VARIANTS AT THE EARTH PLUG

A	by thread
B	by button
C	by clip

On the following pages you will find an overview and more detailed information on suitable products.