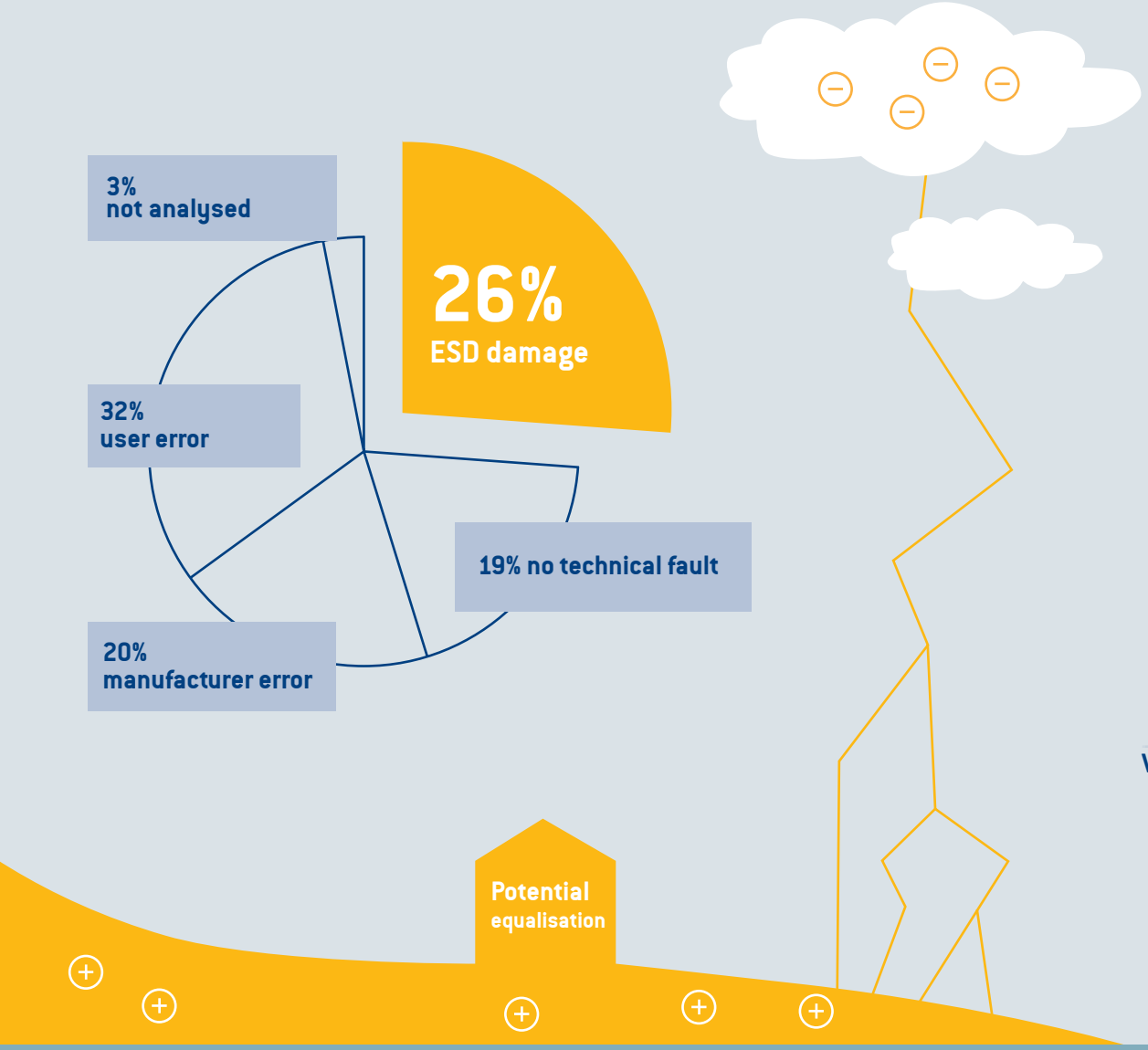
WHAT IS ESD?

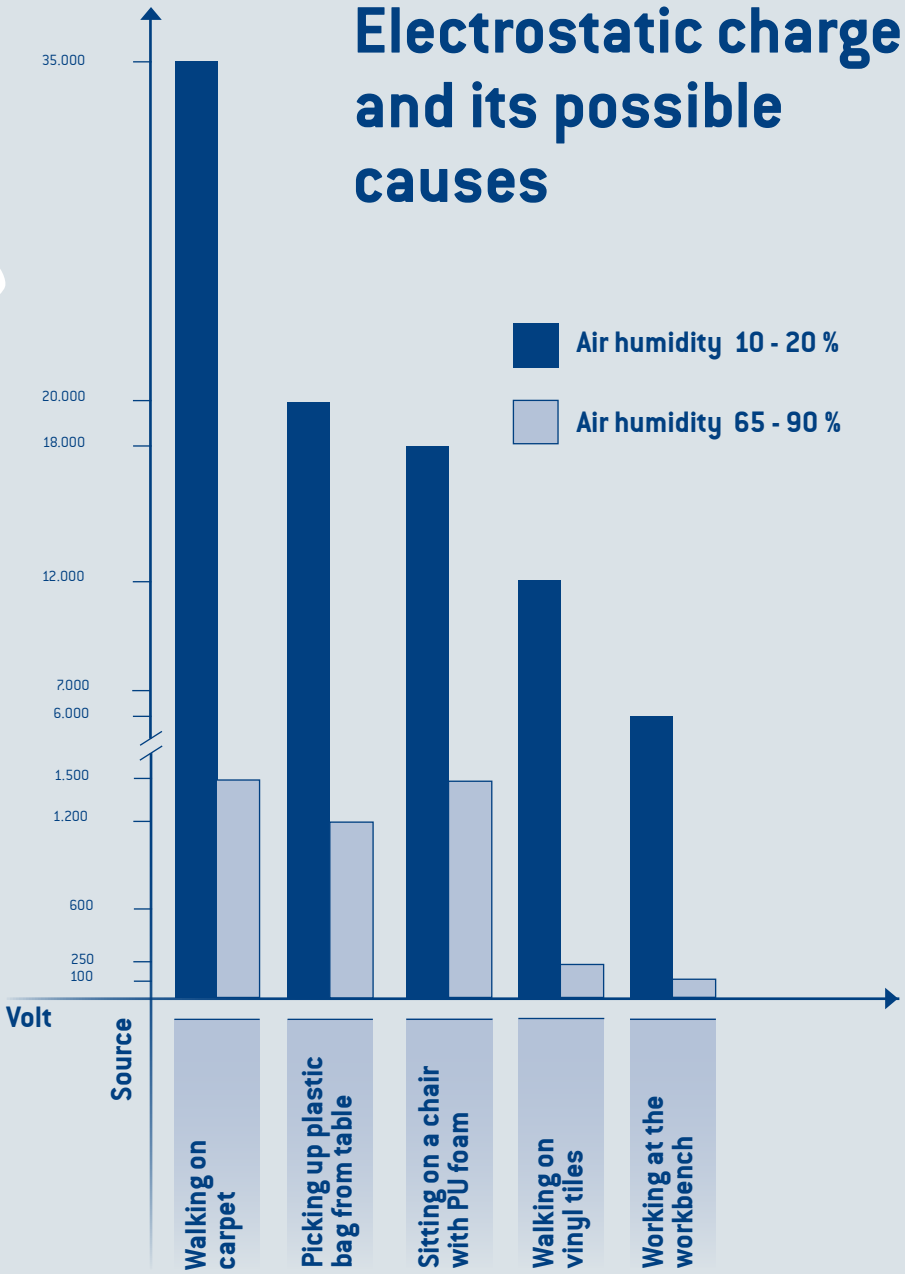
AND WHY SHOULD YOU TAKE ESD PROTECTION SERIOUSLY?

ESD

Most frequent cause of failure for electronic components



Electrostatic charge and its possible causes



ESD – the invisible danger

What does ESD mean?
ESD is the term used for the electrostatic discharge between two differently charged objects.
If the charge is suddenly balanced – through contact, for example – high current peaks can occur briefly. For this reason, rigorous ESD protection – including for tools and holding devices – is important during work on sensitive components.

How does electrostatic charge arise?
Every object contains positive and negative charges which are normally balanced, so that the object is electrically neutral. If electrons are removed or added, an electric potential is created and the body is charged. When the charge is balanced suddenly, high current peaks can occur which damage sensitive electronics through electrostatic discharge (ESD).

Greeting

Door handle

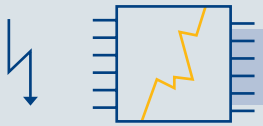
Car door

Electrostatic discharge in everyday life
The most visible form of electrostatic discharge is lightning, where different potentials are balanced suddenly. A similar thing happens when you walk on carpet, for example: if you then touch a door handle, the body discharges. Such mini-discharges, often unnoticeable, are called ESD.

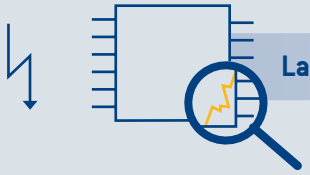
Sensitivity of components
Miniaturisation makes components more sensitive to ESD. Less space for protective circuits and lower power reserves increase the risk of damage.

Voltages as low as 50 V can damage a blue LED, SMD components are often at risk from voltages from 100 V upwards. In comparison, humans generally only feel discharge from 3,500 V upwards, hear it from 4,500 V and see it from 10,000 V.

Recognising and eliminating faults
ESD damage is usually invisible. However, small amounts of discharge can cause immediate failure, which becomes apparent during quality inspection. Latent damage is much more critical, however: the assembly works fine at first, but fails later. Such concealed defects cause high costs, which is why consistent prevention is important.



Direct fault



Latent fault

ESD – how to protect yourself and your components

You can most reliably protect ESD-sensitive components when you store, handle, pack and transport them in an environment protected against ESD. In these areas, specific measures are taken to ensure that electrostatic charge does not occur in the first place or to discharge it in a controlled way. Crucial for this is the slow, defined dissipation, through which differences in potential are gradually neutralised before a critical moment occurs. Because the real danger is caused by sudden discharge. Here, a very high discharge current flows within an extremely short time and can damage sensitive electronics.

ESD

Icons and their meaning

Surface resistances
In the ESD area, materials are classified according to their resistance properties, particularly according to the surface resistance, in other words, the resistance on the surface on which components are placed or which they come into contact with. A distinction is made between shielding, conductive, dissipative and insulating materials.

Measurement of resistances in the ESD area
In the ESD area, materials are evaluated on the basis of their resistance properties. The surface resistance is particularly important; in other words, the behaviour at the surface that the components are in contact with. In addition, the discharge resistance (to ground), the volume resistance (through the material) and the point-to-point resistance (between two electrodes) are decisive.

ESD grounding point
marks the grounding point for all ESD components

ESD safe
marks ESD-safe tools and objects

ESD susceptible
marks components and areas at risk

ESD protective equipment
(ESD Protected Area) marks ESD-safe materials

EPA

ESD safe workstation

Personal and workstation equipment

Effective ESD protection only works as a complete system covering the person (clothing/grounding) and workstation (dissipative surfaces, ESD furniture) These stop charges becoming critical. This is why it is worth considering all contact and voltage points at the workstation, because holding devices and tools should also have an ESD-safe design if assemblies are then machined directly.

Maintenance and cleaning

Grounding and equipment should be checked regularly for long-term reliable ESD protection: connections, mats and grounding modules weekly, grounding wrist straps daily if possible. Suitable ESD cleaners prevent insulating residues. Effective personal grounding always remains a basic principle.

Stationary and mobile work area

To carry out work and measurements on components at risk from electrostatic charge safely and correctly, an ESD workstation is essential – independently of whether it is set up permanently or used in a mobile way.

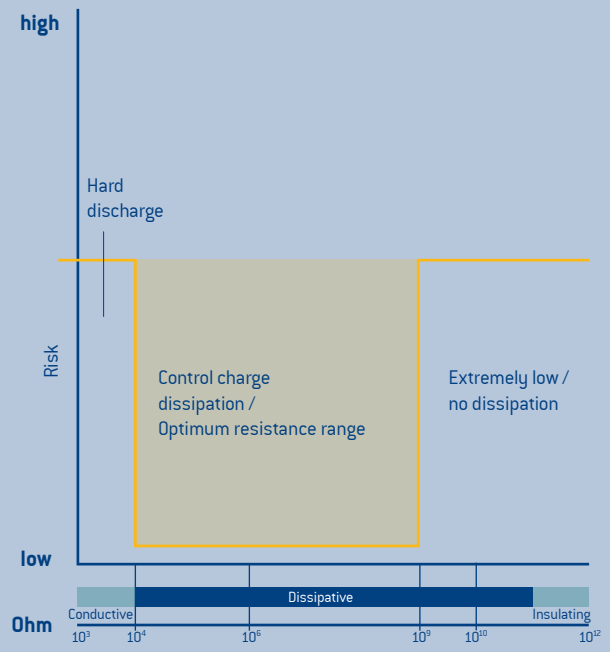
Stationary work area

In stationary ESD protected areas (EPA), all elements which are in contact with people or components must be dissipative – e.g. mats, workstation supports and some assemblies. Grounding is achieved through grounding modules or connectors. Clothing and tools should be ESD-safe (ESD logo). For work on assembly, tools and holding devices should also be incorporated into the ESD concept.

Mobile work area

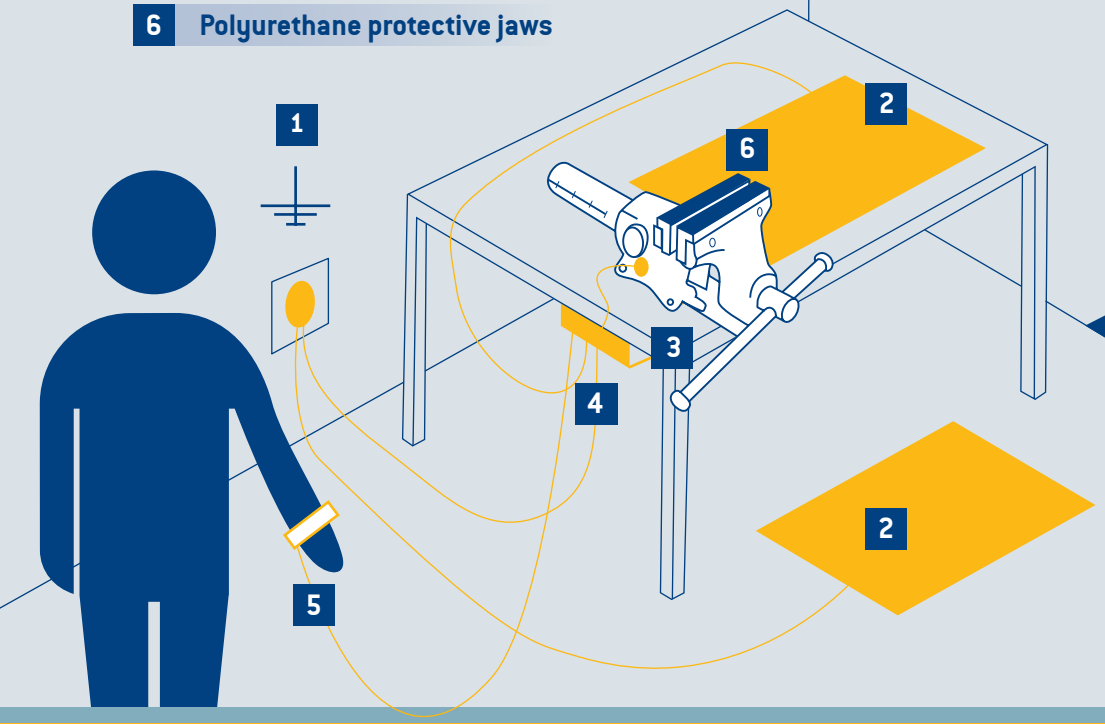
Not all assemblies can be machined in the EPA – this applies to already mounted components or on-site work, for example. Mobile ESD workstations (handling sets) are available for these, with mat, grounding wrist strap and grounding cable. If there is no socket available, connection is possible to a grounded metal surface (e.g. by crocodile clip). Important: the resistance "hand to grounding" must be less than 3.5 × 107 Ohm.

ESD resistance area and charge dissipation



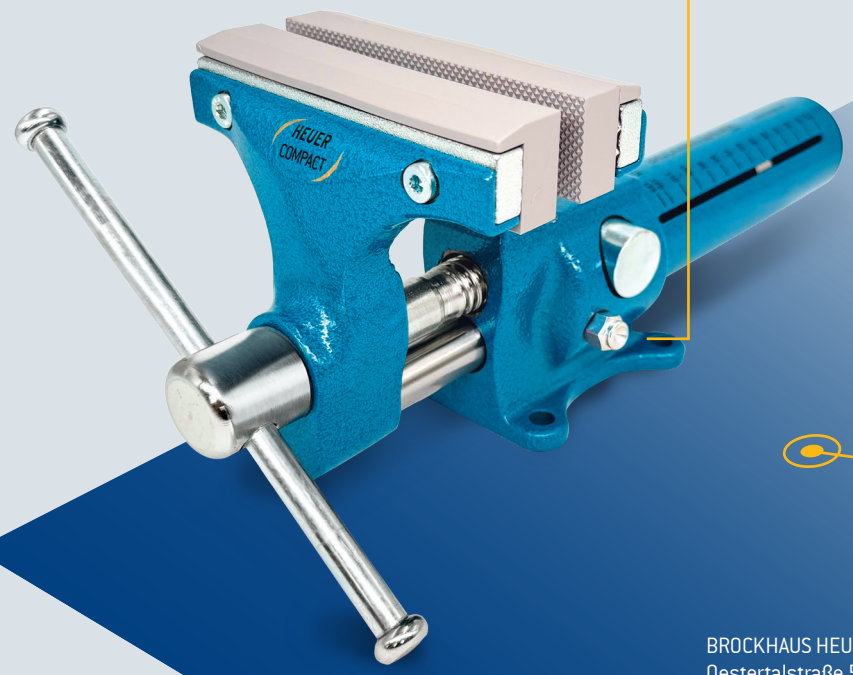
Correct component set-up

1. Grounding point
2. Work surface / floor mat
3. ESD vice
4. Grounding module
5. Grounding strap
6. Polyurethane protective jaws



ESD contact connection

Connection point for connection of the grounding cables to the grounding components



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