TRIDONIC

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Labour standards

ESD protection

1. What is the danger of electrostatic discharge (ESD)?

1.1. How does ESD arise?

Electrostatic discharge is caused by the transfer of charge between bodies with different electrical potentials. The charges strongly depend on humidity. The following table shows some typical values for charges in modern workplaces.

Source	10 – 20 % humidity	65 - 90 % humidity
Walking on carpet	35,000 Volt	1,500 Volt
Walking on plastic base	12,000 Volt	250 Volt
Working at work table	6,000 Volt	100 Volt
Vinyl covers	7,000 Volt	600 Volt
Plastic bag (picked up from work table)	20,000 Volt	1,200 Volt
Work chair with foam cushion	18,000 Volt	1,500 Volt

1.2. Why can ESD cause damage to electronic components?

ESD can cause damage by generating an overload in electronic components. Electrostatic discharge does not only take place through direct contact but also via an air gap. For this reason, the ESD sensitivity of a component is usually specified in its data sheets.

2. Measures for the protection of ESD sensitive modules

2.1. Common standards for ESD protection

- DIN EN 61340-5-1: Protection of electronic devices from electrostatic phenomena – General Requirements
- ANSI/ESD S20.20: Protection of Electrical and Electronic Parts, Assemblies and Equipment
- IPC-A-610: Acceptability of Electronic Assemblies

The following are some examples of ESD protection measures from the DIN EN 61340-5-1 standard.

2.2. ESD control program

- Training plan for employees
- ESD control program plan
- Compliance verification plan

2.3. Protection measures related to personell

- Personell grounding (wrist straps / footwear)
- Garnments (ESD protective clothing)
- ESD protective shoes

2.4. Protection measures related to work place

- Conductive or antistatic work surface
- ESD protected floor covering
- ESD suitable seating
- ESD protected area
- No use of non-essential insulators in ESD protected areas (e.g. plastic foils, coffee mugs, styrofoam)
- use of ionizers to reduce electrostatic charge in the production process

2.5. Working guidelines

An EOS/ESD-safe workstation (see Fig. 1 and Fig. 2) prevents damage or potential damage to sensitive electronic components caused by voltage peaks and static discharges.

An earth connection must be provided to divert static discharges, otherwise the discharges may pass to the components. Workplaces with conductive or anti-static surfaces must be used. The employee must also be connected to earth by an armband to divert any static charges caused by clothing.

The connection between the employee to earth must be via resistors connected in series so that the employee is protected in the event of a malfunction. This is also necessary to ensure a soft discharge and prevent arc-overs.

The following table indicates permitted values for resistors and the discharge times for safe electrostatic working.

Discharge for the employee via...	Maximum permitted resistance	Maximum permitted discharge time
Floor mat to earth	1,000 MΩ	Less than 1 second
Desk mat to earth zur Erde	1,000 MΩ	Less than 1 second
Armband to earth	100 MΩ	Less than 0.1 second

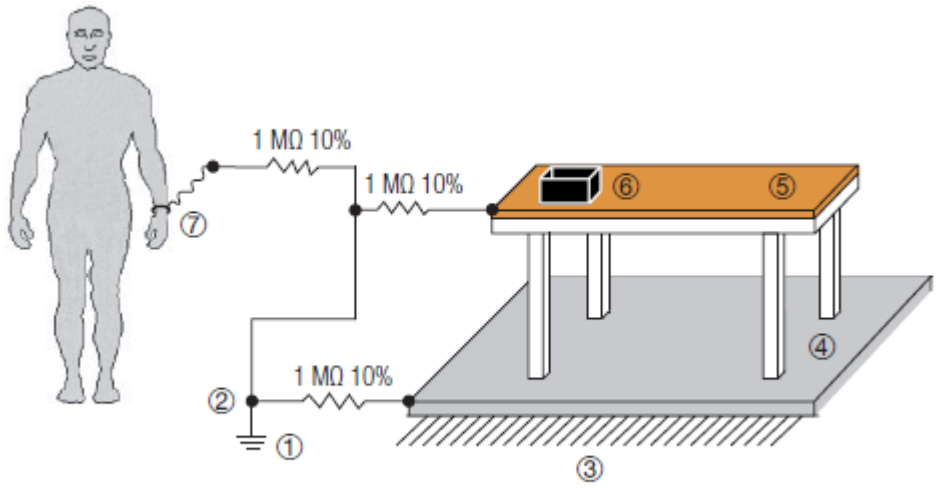
⚠ CAUTION!

The workplace must be free of any material that contains

- plastics
- polystyrene or
- unsuitable ESD protective cases or folders.

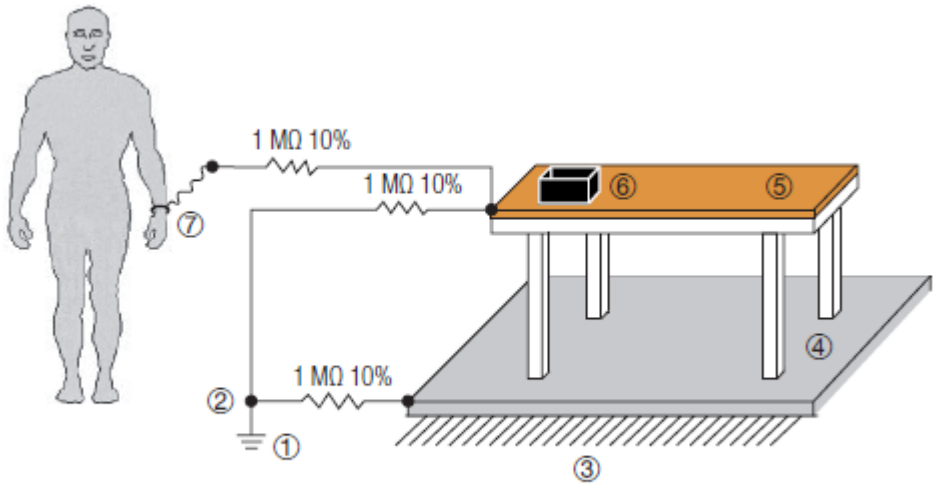
EOS/ESD workplaces must be inspected regularly to ensure they provide adequate protection. Tools and other work materials must be maintained and checked regularly for correct operation.

Fig. 1:



ESD specification:
Specifications according to IEC 61000-4-2 (HBM 150 pF + 330 Ω)

Fig. 2:



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(1)	(2)	(3)	(4)	(5)	(6)	(7)
Earth	Common earthing point	Floor or building	EOS-protected flooring or mat	EOS-protected desk surface	EOS-protected bowls, containers, etc.	Personal armband

3. Example of an ESD control program

		ESD immunity level			
		1 (1)	2 (1)	3 (1)	4 (1)
		100 V (2)	Contact: 4 kV / Air: 4 kV (3)	Contact: 6 kV / Air: 8 kV (3)	Contact: 8 kV / Air: 15 kV (3)
Administrative requirements (5)	ESD control program plan	✅	✅	✅	✅
	Training plan	✅	✅	✅	✅
	Compliance verification plan	✅	✅	✅	✅
Technical requirements (5)	No use of non-essential insulators (e.g. plastic foils, coffee mugs)	✅	✅	✅	✅
	Analysis of process essential insulators	✅	✅	✅	✅
	Ionization	✅ (4)	✅ (4)	✅ (4)	✅ (4)
	Working surfaces, storage racks and trolleys	✅	✅ (4)	✅ (4)	
	Flooring	✅	✅ (4)	✅ (4)	
	Personell grounding (wrist straps / footwear)	✅	✅ (4)	✅ (4)	
	Protective earth common ground points	✅	✅	✅	
	Seating	✅	✅	✅	
	Garnments	✅	✅	✅	
	Packaging (static dissipative)	✅	✅	✅	
	Packaging (discharge shielding)	✅			

(1) Severity level

(2) according to IEC 61340-5-1

(3) according to IEC 61000-4-2

(4) Recommendation is dependent on results regarding analysis of process essential insulators

(5) for exact regulations and limits for these requirements see IEC 61340-5-1