

## ESD - Electro Static Discharge

Kärcher Production



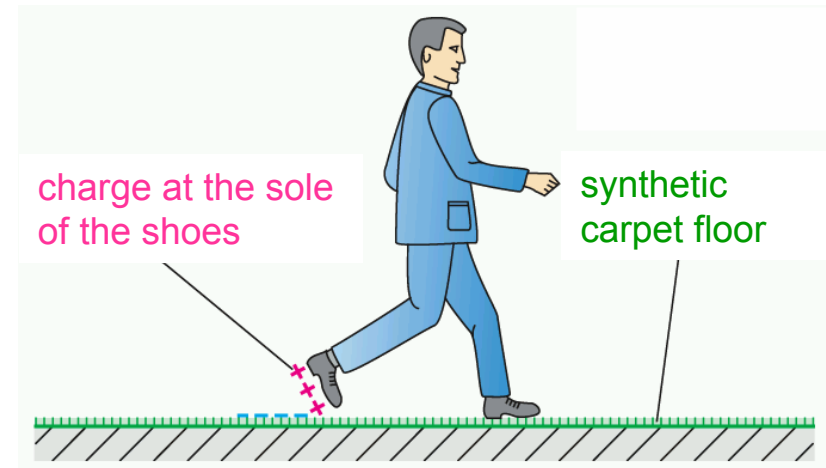
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## Definition and Causing

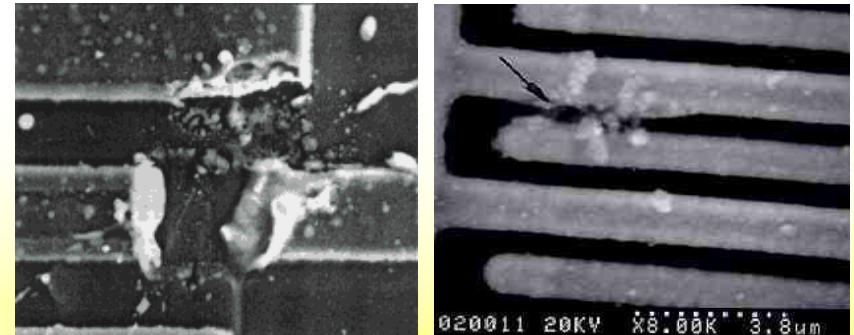
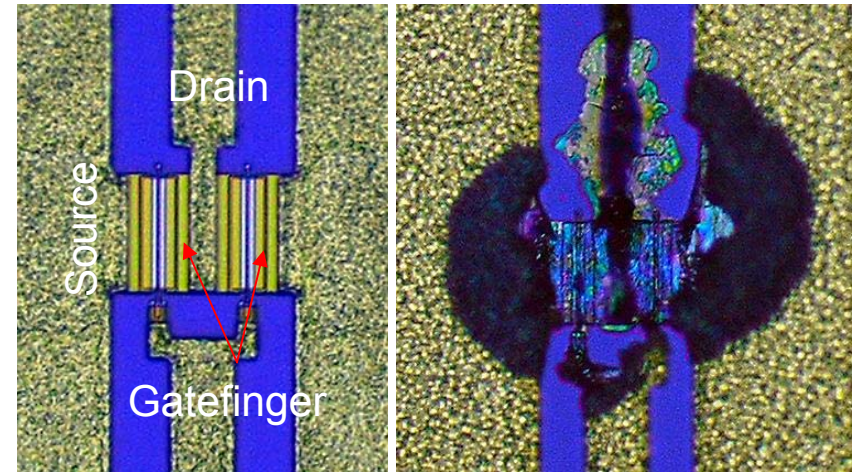
- Large difference of potential (voltage) between electrically insulated materials
  - caused by: friction, walking over carpet floors, moving via escalators, or at fast moving production lines
  - supported by „low air humidity“ in winter
- high voltage → Spark
- → Very short current impulse
  - (very high voltage – small electrical charge - power more than 100 W)



## Perception and Effects

- A person will notice electrostatic discharge from about 1,500 V to 3,000 V
- The **discharge power is very small**
- Electrostatic discharge might cause **damages** to semi-conductors

2-gatefinger FET transistor damaged by overvoltage:



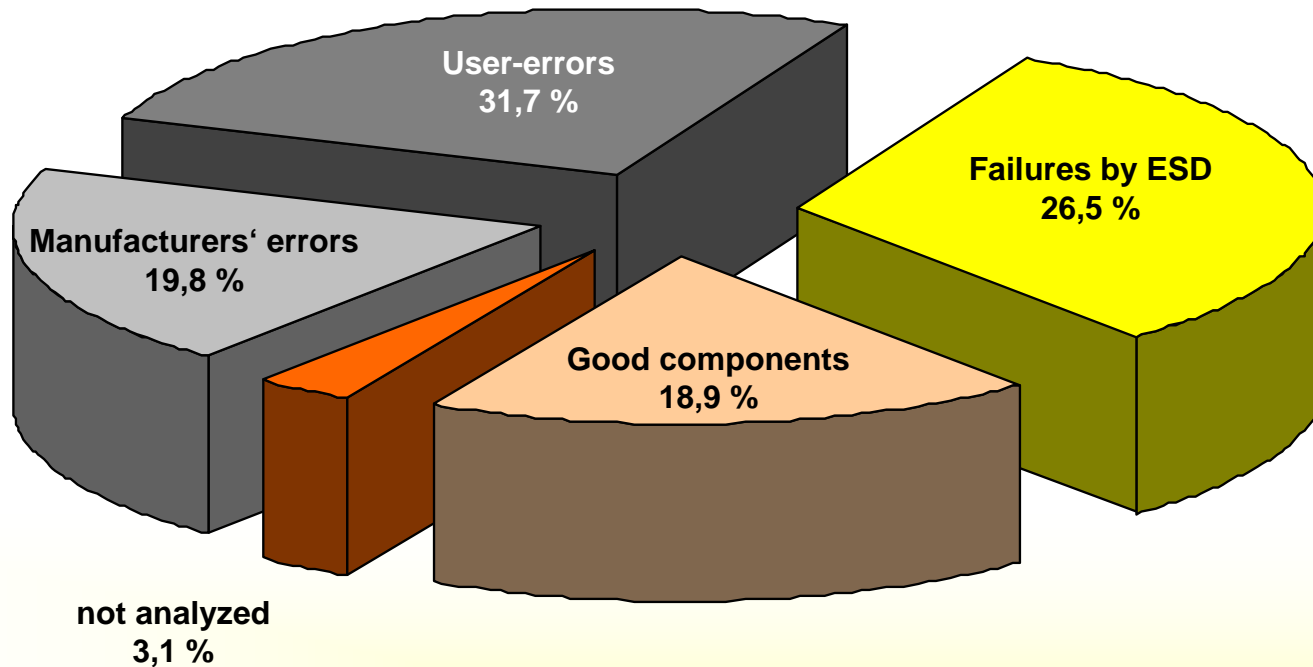
## Pre-damages

- Parts which have been damaged by ESD do not necessarily fail instantly:
  - parts might already be pre-damaged during the production process
  - the real failure occurs not until the part is used by the customer
  - the effect is that these parts are returned to the manufacturer
    - bad electronics...does not work properly...
  - Image of electronics is bad!
- high warranty expenses and high GEWA figures



# Spreading of damages

Spreading of damages caused by semi-conductor circuits



# Actions according DIN EN 61340-5-1

## Discharging

- conductive shoes
- conductive floors / surfaces
- all components and persons should have the same potential (voltage level) (= components and persons should be earthed)

## Preventing electrostatic charge

- shoes / clothes
- components are transported in special ESD-packages from the moment of the delivery to the assembly
- no transfer into non-conductive transport containers when arriving at the customers facilities



## Actions according DIN EN 61340-5-1

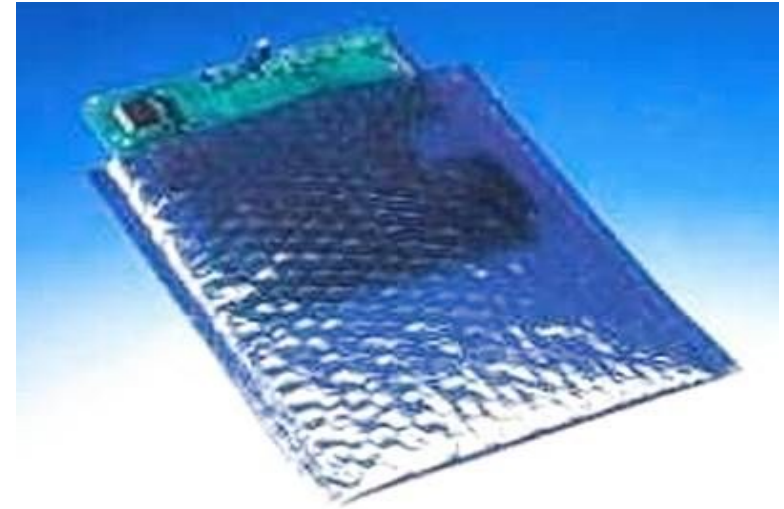
**Packages** for transporting ESD-sensitive parts must consist of **electrically conductive materials**:

- conductive foils
- conductive filler material and foam plastic
- **no styrofoam or standard foils!**

### Hint:

Conductive packages are labeled with the ESD symbol.

→ **Never open these packages without taking care of ESD actions!!!**

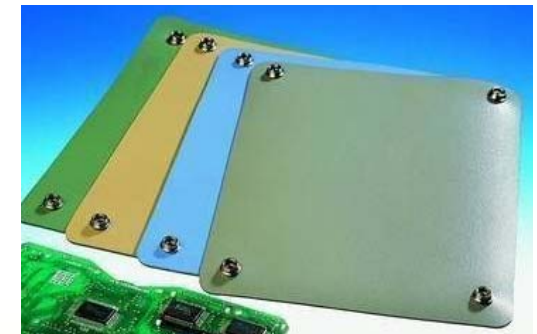




# Actions according DIN EN 61340-5-1

## Environment

- Workbenches and tables with conductive surfaces
  - Earthing (grounding) with a resistance of 1 MOhm at the protective earthing conductor
- Conductive floors
  - Earthing with a resistance of 1 MOhm at the protective earthing conductor
- Conductive chairs
- conductive trolleys
- Ionized air



## Actions according DIN EN 61340-5-1

### Personal equipment

- Earthing straps for the wrist with helix cable for earthing purposes
  - electric charge is discharged
- Conductive shoes
  - electric charge is discharged
  - Protection against electric charge caused by friction
- Conductive antistatic working clothes
  - Protection against electrical fields by clothes



# Actions according DIN EN 61340-5-1

## Summary

- ESD workplaces are especially designed for discharging electrostatic charges and for preventing electrostatic charges caused by friction by means of
  - conductive surfaces,
  - conductive floors,
  - antistatic earthing straps,
  - conductive furniture and plastic boxes,
  - clothes and shoes,
  - ionized air and
  - the earthing of all components and parts (assembly line)



## Actions - Investments

Possible actions regarding at Kärcher Winnenden

Complete material costs	Costs (approx.)	Amount	Amount
Table mats	27.00 €	.... pcs.	... €
Material in order to paint the floors per m <sup>2</sup>	12.00 €	... m <sup>2</sup>	... €
Floor mats	133.00 €	... pcs.	... €
ESD shoes	45.00 €	... employee	... €
<b>Total material costs:</b>			<b>... €</b>
<b>Setup costs 70 grounding points</b> (painting, remodelling tables and trolleys)			
Earthing	50.00 €	... grounding points	... €
Painting	40.00 €	... m <sup>2</sup>	... €
Labeling (per workplace)	25.00 €	... workplaces	... €
<b>Total setup costs:</b>			<b>... €</b>
<b>Other costs</b>			
Shoe tester	250.00 €	... pcs.	... €
<b>Total investments</b>			<b>... €</b>

# Actions

Kärcher Winnenden	Deadline/ responsible	Comments
examination of ESD-suitable workplace surfaces – every ½ year		
examination of ESD-suitable floor coverings- every ½ year		
examination of ESD-suitable transportation boxes - every ½ year		
examination of ESD-suitable shoes - every month		
examination of the shoe tester - once a year		
Training concept (in cooperation with an occupational safety training) Training for new employees and annual training for all employees in general		

## Guidelines for service-engineers

actions	Comments
Use of ESD shoes	Particularly for non-discharging surfaces like e.g. gym floors
Make sure that you first get in contact with the negative pole of a battery when repairing the electronic system of a machine	In order to ensure charge balance
Leave all the delivered components in their ESD-package as long as possible (bubble wrap)	Remove the bubble wrap just in time when the component is needed for assembly. Make sure to wear ESD shoes and earth yourself by touching f.e. a radiator or an earth socket
Dismounted components should be deposited onto ESD foil only!	Not only components which are to be reassembled but also defective components (in order to be adjudged)
Dismounted defective components should be returned in ESD-packages only!	In order to make sure that the adjudgement can be done correctly