Testo
Whitepaper
testo DiSCmini

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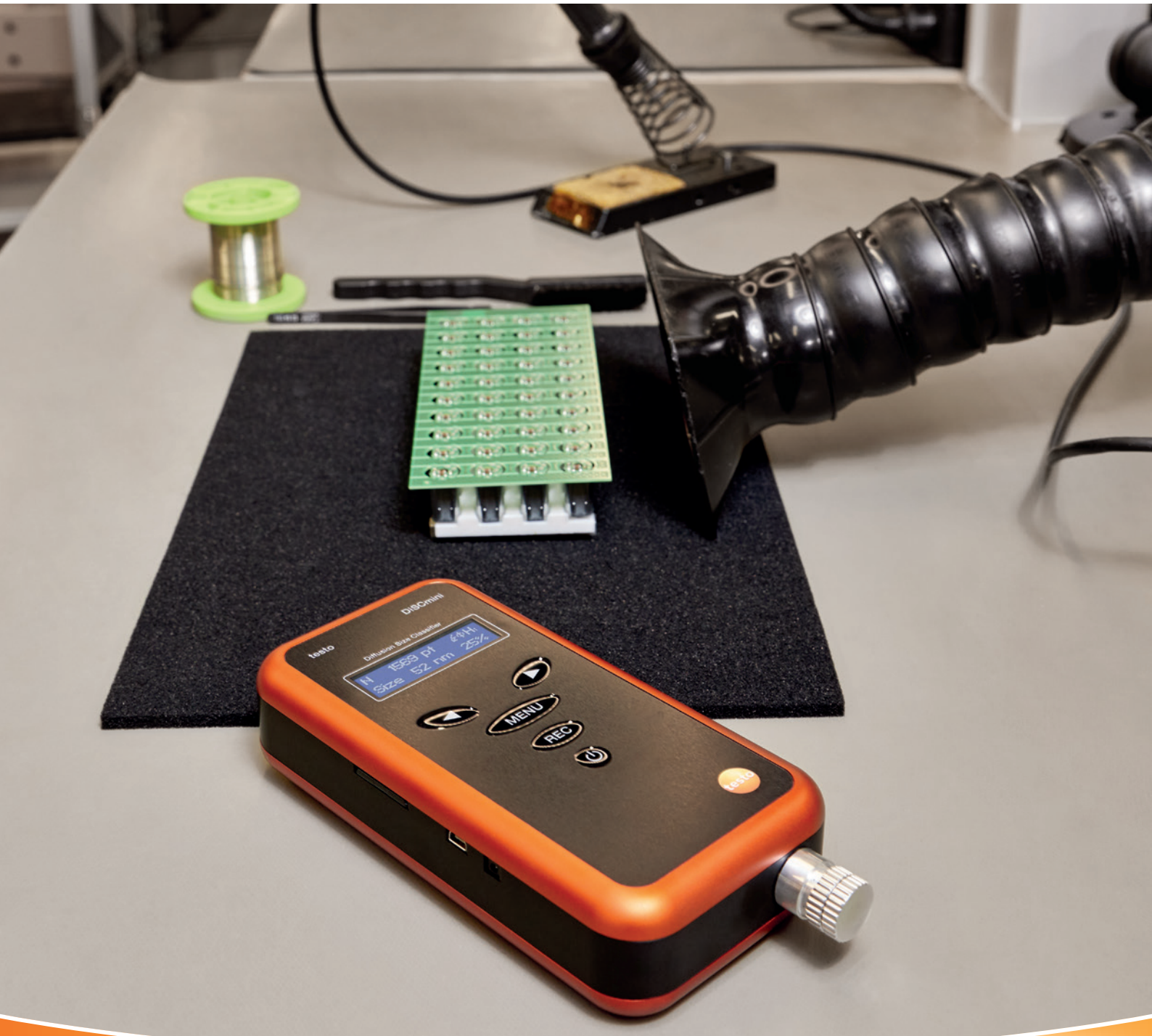
Verifying the efficiency of soldering fume extraction and measuring nanoparticle exposure during soldering with an iron with the testo DiSCmini



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Safe working conditions?

That manual soldering produces harmful substances in the form of aerosols is a known problem in the electric and electronic industry. The lead-free electronics solders used today have done little to change that. The soldering fumes still contain particles which are formed by the solder and the flux agent. These particles have a high potential of causing permanent damage to the workers' health. Due to their small diameter between 10 and 150 nm, they can penetrate all the way into the alveoli. But numerous studies also show that nanoparticles can reach all areas of the body through the bloodstream [1].

According to the definition of the Technical Regulations for Hazardous Substances 528 [2], hard soldering and soft soldering are welding processes and are treated in the scope of occupational medicine and hygiene. For reasons of prevention, employers have a duty to reduce the hazards for employees to a minimum for these processes. In practical application, this is usually achieved with ventilation measures such as extracting the soldering fumes where they arise.

Until now, it was difficult to verify the effectiveness of the safety measures accurately. Detecting nanoparticles and particularly determining their number with reproducible results required complex instruments until now. Gravimetric analyses also proved unsuitable for determining particle concentration in the workplace due to the low mass of nanoparticles. Verification of the safety measures was therefore usually limited to using flow tubes or vane anemometers to detect the function of the ventilation. This process left many questions unanswered, however: What is the particle exposure for the worker? What is the particle emission from the soldering fumes? Which particle volumes are already present in the ambient air? Does the workstation have a practical setup or could a changed arrangement already achieve essential improvements?

Comprehensive measuring with the testo DiSCmini!

The testo DiSCmini nanoparticle measuring instrument quickly and easily records all parameters relevant for assessing health and safety:

- the particle number in Pt/cm^3 for nanoparticles with a diameter from 10 to 700 nm for assessing the exposure
- the modal value of the particle size, i.e. the size of the particles with the highest number concentration, for nanoparticles with a diameter from 10 to 300 nm for evaluating the particle size distribution
- the active particle surface area as LDSA (lung deposited surface area) in µm^2/cm^3 for evaluating the impact on the human organism.

In the following, the suitability of the testo DiSCmini for evaluating health and safety measures is demonstrated on the example of several measurements at a soldering workstation. First, the particle number and the modal value of the particle size in the background levels are measured without extraction and without soldering. In a second step, the two measurement parameters and additionally the LDSA value are recorded during soldering, once with and once without extraction.

The measuring setup

A temperature-controlled soldering station of type Weller WSD81 at a temperature of 360 °C is used for the test measurement together with lead-free tin solder with colophonium in a composition of SN95 5AG3.8 Cu0.7. The model Easy ARM 1 from ERSA is used for extracting the soldering fumes.

The nanoparticle measuring instrument testo DiSCmini picks up the air at the workstation through an impactor which is positioned to the right of the workpiece. The position of the of the impactor as the sampling location corresponds to the height and position of the worker's face from the soldering point. This means only those particles are measured [illegible] probability.

The impact[illegible] nm as thes[illegible] Impactor and measuring instrument are connected with a special hose made of a material which prevents the aspired particles fr[illegible]

Fig. 1: testo DiSCmini.

Would you like to read the other pages of our Book of Abstracts as well and learn more about the verification of health and safety measures using the testo DiSCmini nanoparticle measuring instrument?

Then please register here.

After registering, you will receive an email with a link for downloading the complete white paper.

Fig. 2: Setup of the measuring environment with soldering station and extraction.