DVS – DEUTSCHER VERBAND FÜR SCHWEISSEN UND VERWANDTE VERFAHREN E.V.

Ultrasonic Joining of Moulded Parts and Semi-Finished Parts of Thermoplastic Polymers in Mass Production, Machines and Equipment, Function Description and Requirements

Guideline DVS 2216-1

(August 1992)

Contents:

1 Field of validity

This Guideline describes machines, equipment and tools for the ultrasonic joining of moulded parts and semi-finished products made of thermoplastic polymers in terms of functions and requirements. The methodology and practical application are dealt with in the Guidelines DVS 2216 Parts 2 to 5.

2 Operating principle

In ultrasonic welding the electrical oscillations in the 20 kHz sound range produced by the generator are transformed in the ultrasonic transducer (acoustic head, converter) into mechanical vibrations of the same frequency and transferred to the parts to be joined via the transformer (booster) and the horn. In the process the generator, the ultrasonic transducer, the transformer and the horn are resonant.

The temperature rise of the thermoplastic polymer in the joining area is effected by thermal conversion as a result of alternating compressive stress caused by the mechanical vibrations introduced and the interface friction of the joint surfaces. Where the maximum alternating compressive stress occurs depends on the geometry of the parts to be joined.

3 Machines, equipment and tools

3.1 Construction and mode of operation

An ultrasonic welding unit consists basically of the welding tool, the power supply, the ultrasonic transducer with the transformer and the welding tool. The welding tool consists of the horn and holding fixture (anvil). The force necessary for the welding process is generated by the welding tool (see Fig. 1).

3.1.1 Ultrasonic generator

The ultrasonic generator converts the low-frequency electrical energy of the alternating current into high frequency electrical energy in the ultrasonic range. The operating frequencies used are between 20 and 70 kHz. The power of the generators used is between 0.1 and 3 kW.

3.1.2 Ultrasonic transducer

The acoustic transducer converts the high frequency electrical energy into mechanical vibratory energy of the same frequency. The commonly used piezo- and magnetostrictive ultrasonic transducers vibrate almost always in longitudinal direction, i.e. the sound-radiating surface of the vibratory element vibrates sinusoidally around the center node of the surface.

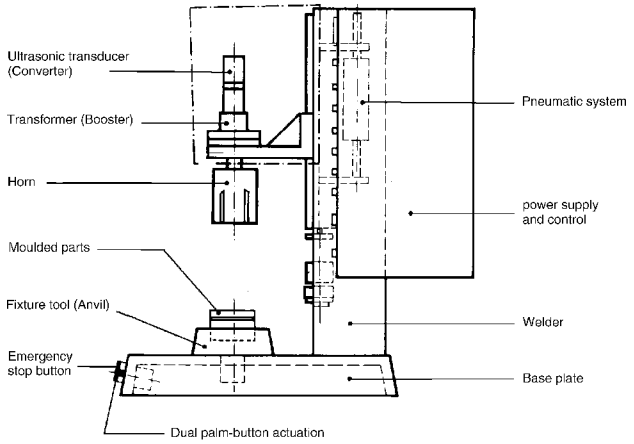

Fig. 1. Design of an ultrasonic unit.

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