

Splicing of multi-conductors and twisted wires by Ultrasonic

PLASTIC WELDING

METAL WELDING

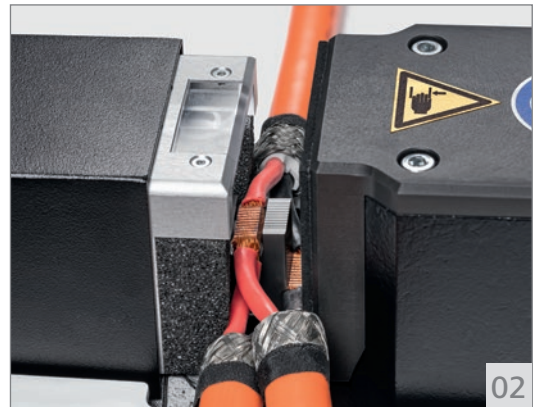
CUTTING

CLEANING

SCREENING



01



02

Bronschhofen (CH), 12/2017

Ultrasonic welding is increasingly used to create electrical connections, e.g. in the automotive industry. Typical applications are stranded wire splicing in benchtop as well as final assembly boards for wire harnesses. Today other applications such as splicing of aluminum and copper-to-aluminum combinations can be welded with the same machine. Also splicing of twisted cables or multi-conductors cables are ergonomically possible. A simple tooling change-over can utilize the same machine for standard wire splicing and such special cases.

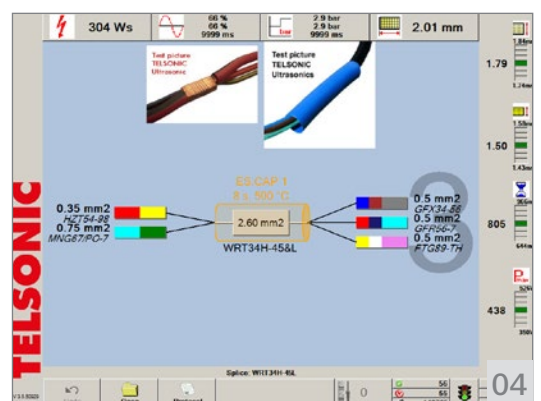


03

The high quality standards of the automotive industry require constant cost optimization and the highest degree of process reliability from suppliers, while continuing to drive down costs. This also applies for splicing stranded wires. At least several kilometers of cable are laid in modern vehicles. As the «nervous system» they ensure that the vehicle starts up, the headlights come on or that tire pressure and oil level are shown on the on-board computer. The countless cables must have fault-free connections in order to function reliably throughout the service life of a car. Ultrasonic welding is often the best choice for this, both technically and economically.

Technically and economically impressive

Ultrasonic welding is a form of cold friction welding that joins parts together by vibrating them against each other at high mechanical frequency. The parts are clamped together while a vibrating tool called a horn transfers ultrasonic energy to the joint interface. The vibrations are parallel to the weld surfaces. The process is fast and environmentally friendly because it does not require additives such as adhesive, solder or other consumables. The process is reliable and secure as the welding process can be configured using just a few parameters and 100% quality control monitoring of variables such as time, compaction, and power.



04

- 01 Welded connection on a high-voltage cable
- 02 Teslo®splice welding system
- 03 Welded connection on a twisted bus cable
- 04 Menu-driven, self-explanatory control software with touchscreen operation

Today's trend towards miniaturization applies to cables and connections too. The housing that protects the connections should be as small as possible so they require as little installation room as possible. This means the wires length out of the conductor and the strip length stripped cable ends become ever shorter. While, previously, loose wire lengths of 6 to 8 cm were considered standard, today 4 cm is becoming ever more common or even only 3 cm is desired. The same applies to welding twisted cables. To avoid faults the untwisted loose ends should be as short as possible. These conditions create a challenge for loading the wires and conduct the splicing process.

Everything is smaller and the tools adapt to suit

Telsonic AG has now acted and developed special tools for its standard Telos®Splice ultrasonic welding systems. The standard tooling, consisting of sonotrode, anvil and anvil plate was modified in such a way that even short loose cables and short untwisted cable ends can be welded together easily, and fast.

This new method is already proven in production environment, e.g. with high-voltage cables. Three cables each with two wires come together here in such a way that like-colored wire strands are welded in a Y-connection (so 2 by 1). In this case the strip length of the wire strands is 15 mm, the loose cable on each side 3.5 cm. The entire connection (compacting) is thus only 70 mm long. This represents a more practical alternative to the more cumbersome crimping processes.

There are other advantages when twisted cables are welded, e.g. for CANbus applications: the cables should remain twisted here up to around 40 mm in front of the connection. Figure 3 shows an example. Here, two pairs of wires twisted around one another are joined; like-colored wire strands are welded. The cable cross section here is typically between 0.25 mm² and 2.5 mm². The wire strands are stripped to a length of approx. 16 mm, the untwisted wire strand in front of the connection is approx. 40 mm long.

User-friendly

Easy and fast tooling change-over make the machine versatile for standard wire splicing, multi-conductor cable and twisted wires. Aluminum and copper-to-aluminum combinations can be welded with the same machine. The Telos®Splice machine can reliably weld stranded wire splices with a cross-section of 0.26 mm² to 40 mm². Making splices sequentially is also possible. The ultrasonic generator with a power of 3.6 kW works at a frequency of 20 kHz. With its touchscreen operation and clear structure, the menu-driven software enables efficient set-up and work. A splice editor makes it possible to create new configurations quickly. The self-explanatory control software with touchscreen operation and clear organization also ensures efficient work. The prescribed quality control simplifies quality tolerance windows, which are set for all welding results in set-up mode. Upper and lower threshold values can be set for splice height, welding time as well as maximum output. An alarm is triggered if these values are exceeded or under run. Statistical analysis, automatic calibration, maintenance menu for maintenance work, reference mode and an ultrasonic test mode extend its functions.

by Arvydas Litvinas, Key Account Manager Metal Welding at Telsonic AG, and Ellen-Christine Reiff, Redaktionsbüro Stutensee