

A reliable solution for connecting plastic parts

Efficient joining technology in the form of ultrasonic welding

PLASTIC WELDING

METAL WELDING

CUTTING

CLEANING

SCREENING



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Ultrasonic welding is one of today's fastest and least expensive ways of connecting and assembling plastic parts. What helps it stand out is the lack of adhesives, connection elements, or solvents it uses, making it a highly eco-friendly and efficient process. Given these benefits, ultrasonic welding is applied in virtually every industry from packaging and food to textiles, medical technology, and automotive engineering. As this case study illustrates, it provides an ideal method for connecting the kinds of lightweight materials found in the automotive and utility vehicles sector.

Electrically powered windows have been installed in cars since as far back as the 1950s and 1960s, and they now count among the standard features that we expect to find in today's vehicles – including utility vehicles. Windows of this kind are wound by an electrical motor and a set of wire winch reels in a specific arrangement. The electrical motor works with a worm gear or spur gear to rotate one of the drums. The car doors and the paneling on the door interiors also play a vital role by keeping the window panes stable so that they are able to open and close automatically at the touch of a button. The interior sides of the doors feature what are known as plastic brace structures that secure the guide rails for the cables.



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- 01 IVECO Stralis
- 02 28 sonotrodes per machine compartment
- 03 Left and right-hand panels can be welded simultaneously

Brace structures for car window guide rails

In a project for the utility vehicle manufacturer IVECO, Italian mechanical engineering specialist CEMAS Elettra has now developed a production machine that automates the process of securing these brace structures to the door panel interiors in the new Stralis model. The same process also affixes storage pockets (for sunglasses, hand-held scanners, and so on) to the other side of the panels. The operator places the panels, pockets, and three brace structure elements manually into the machine, where they are welded together using an ultrasonic method. The machine even features two processing stations, making it possible to weld the panels for the left and right-hand sides at the same time.

In ultrasonic welding, an acoustic tool known as the sonotrode transmits high-frequency, mechanical vibrations that set the top joining element vibrating, while the counter-tool (called the anvil) prevents the lower joining element from vibrating along with it. This process generates heat, which breaks open the material limits and welds the joining partner elements together as a result. With this method, strong bonded joints can be produced without exposing either the product or its environment to high thermal stress.



04 MAG ultrasonic generators with bus modules

Seam and spot welding

The ultrasonic welding system is made up of a generator that produces the ultrasonic source and a converter that uses piezo-ceramic components to convert the ultrasonic source into mechanical vibrations. These vibrations are then transmitted to the sonotrode, and may in some cases be amplified by a booster. The system uses some 56 sonotrodes of this type (28 per machine compartment) to connect the brace structures for the window guide rails to the panels. Their supplier is Telsonic AG, a company with which CEMAS Elettra has been cultivating a successful relationship over many years. For some five decades now, the ultrasonic specialist has been developing and selling production-ready ultrasonic solutions for all kinds of applications across the globe.

In CEMAS Elettra's case, it was possible to use dual sonotrodes for the door panels as the joining processes require welding to take place at particular spots and along seams. This is a huge advantage in areas where the welding points on the seams are relatively close together. With two blades, a dual sonotrode is able to manage two welding points at the same time but only requires one converter and booster to apply mechanical vibrations.

Telsonic's MAG generators produce the 35 kHz ultrasonic source for the sonotrodes in the two machine compartments. An ideal solution for complex cutting tasks in specialized machines and production lines, they are designed to be installed in control cabinets and are each able to switch between 16 sonotrodes. Based on this, CEMAS Elettra only had to install four generators to accommodate the 56 sonotrodes and meet the requirements for its door panel processing machine. The machine is able to weld each door leaf with a cycle time of 70 to 90 seconds; while more generators would allow for even shorter cycle times, the application does not need any more than it already has. The operator is also able to work on the two sides of the machine independently from one another – which eliminates delays because the time that the machine spends welding one door panel can be used to insert the parts for the next door panel in the other compartment.

The generators use Profibus to communicate with the plastic processing machine's controller, but they support other common fieldbus interfaces, too (Ethernet/IP, EtherCAT, ProfiNet, Sercos III, Powerlink, and Modbus RTU). A software development kit that contains function modules and programming examples is available for control programmers so that even the most challenging tasks can be performed quickly.

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