

Ultrasonic punching for clean cutting edges

Combining lightweight construction with good looks

PLASTIC WELDING

METAL WELDING

CUTTING

CLEANING

SCREENING



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Lightweight construction is an important trend in the automotive industry. As well as cutting down on weight, it enables significant cost savings. However, conventional separation methods struggle to meet requirements to produce high-quality paint-finished Class A surfaces in the automotive industry, for example. Ultrasonic cutting or punching produces much better results. These methods enable the openings for parking sensors or headlamp cleaning systems with radial embossing, for example, to be punched or cut directly into ready painted bumpers, achieving visually outstanding quality.

Lamborghini launched the Urus, which combines the features of a sports car with the functionality typical of an SUV, in mid-2018. Driving dynamics, performance and design make this car a genuine super sports utility vehicle that is setting new standards in the premium market segment. Approximately 3500 units of what is currently the world's fastest SUV are set to leave the new production line and paint shop in the Italian town of Sant'Agata Bolognese every year. This powerhouse of a car, which has an output of 650 HP and can accelerate from 0 to 100 km/h in just 3.6 seconds, has been designed to meet the very highest of standards not only in technology but also aesthetics. Alongside function, looks – i.e. shape and paint finish – play a decisive role.

Exacting standards of appearance

For a car to look its best, even the tiniest details have to be taken into account in production. To stop the plastic material used in the bumpers being visible at the edges underneath the paint, incredibly neat cutting edges with defined radial embossing are required for the cut-outs for the parking sensors in the paint-finished front and rear bumpers and the openings for the headlamp cleaning systems (Figure 2 and 3).



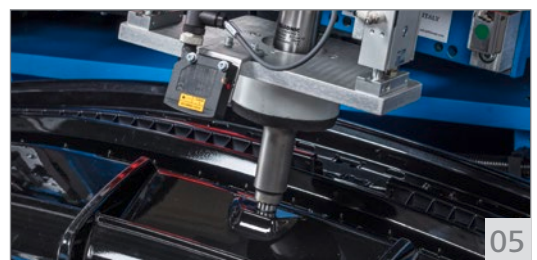
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- 04 F.T. Famat Srl developed cutting systems featuring a variety of ultrasonic systems and high-precision mechanics to punch the holes into the bumpers.
- 05 The ultrasonic sonotrode applies relatively little force to punch complex shapes achieving the required level of quality, leaving no marks on the highly-sensitive visible side of the paint-finished plastic bumpers, which are prepared and ready for installation.

It was with these requirements in mind that the Italian car-makers selected an ultrasonic solution to punch the cut-outs into the paint-finished bumpers of the new SUV, and specifically a solution that led to a partnership being formed between Turin-based F.T. Famat Srl and Switzerland's Telsonic AG. The use of high-quality and high-precision mechanics – and in particular proven sonotrodes – makes it possible to punch complex shapes achieving the required level of quality yet with relatively little force having to be applied. The process leaves no marks on the highly-sensitive visible side of the plastic bumpers, which have been painted and prepared for the sensors to be fitted in an upstream stage of the process. Because the technology introduced by F.T. Famat Srl enables the sleeve for the sensor mount to be glued into place in the same punching operation, the need for a subsequent work step is eliminated. The side visible from the exterior remains entirely unaffected. Furthermore, the defined radius with the paint layer is embossed cleanly, i.e. the paint is pulled into the cut-outs gently and without visible or noticeable marks being left behind. In fact, there is no resulting damage or deformation whatsoever, and the parking sensor can be inserted directly and accurately or the pump for the headlamp cleaning system can be fitted.

Punching neat cut-outs

It's easy to understand how the process works: the ultrasonic vibrations produced by a piezo-converter cause a sonotrode to vibrate at high frequency; this is particularly effective in resonance yet at the same time requires little power (Figure 5). As the high-precision mechanics can be finely-tuned, the ultrasonic vibrations are not able to heat and deform the paint-finished plastic in the cutting zone. As a result, the cut remains neat and less force (compared with mechanical punching) is required. The process is thus reliable and the finished result looks fantastic.

Furthermore, this process also offers additional advantages which make it particularly suitable for cutting into paint-finished lightweight bumpers. This combination means that in contrast to mechanical milling, ultrasonic cutting does not cause any material loss, nor does it damage the paint-finished part. As there are no chips and the cut edges are smooth and clean, time and money does not have to be spent on rework. No cutting medium is required, as would be the case with water jet cutting, for example. This means that the material being cut remains dry and clean. The cutting depth can be precision-adjusted as required (scoring). What's more, ultrasonic cutting is also quiet, so noise protection measures are not necessary. In addition, in contrast to laser cutting, the surface of the material being cut does not have to fulfil any special quality criteria. The process does not produce combustion gases, and the cut edges are rounded off rather than looking burnt. Even the acquisition and operating costs are extremely low compared to other processes. Therefore, this combination makes ultrasonic cutting a practical solution not only for cutting out openings in the bumpers of the Urus but also for other many lightweight applications.

Geared to application requirements

To punch the cut-outs into the bumpers, F.T. Famat Srl, an Italian company specialising in the manufacture of automation machines, and Telsonic AG, a specialist manufacturer of ultrasonic systems, developed a punching system featuring various ultrasonic systems (Figure 4) to produce and machine a variety of bumpers in one and the same operational phase by inserting the sensor sleeve directly. The parts of the front and rear bumpers, the cut-outs for the headlamp cleaning system and the diversity of the individual components of the bumpers in the Urus models have enabled the supplier of the end component to save both space and money. As production figures of approx. 25 units per day are relatively low, the workpieces are fed in manually and also removed by hand once automatic punching and gluing has been completed in accordance with the job data stored in the control system.

The generators that produce the ultrasonics have been designed for installation inside a control cabinet and manage communication with the controller of each individual system. The MAG generator is designed with the clear aim of accomplishing complex cutting tasks in special-purpose systems and production lines and supports nearly all standard fieldbus interfaces (Ethernet/IP, EtherCAT, ProfiNet, Profibus, Sercos III, Powerlink and Modbus RTU). All of the equipment built by F.T. Famat Srl is networked with the automatic management of product and phase selection and with the automatic downloading of the inventory and the purchase order. The ultrasonic systems are also an integral component of the automated system. Finally, the entire system has been integrated into the wider context of industrial automation and Industry 4.0. A software development kit that contains function modules and programming examples is available for control programming so that even the most challenging tasks can be performed quickly. The Italian/Swiss partnership has truly established itself during the production of the sport SUV. As the method is suitable for wall thicknesses between 2.5 and 4mm, there are bound to be many more potential areas of application in the booming lightweight construction sector.

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