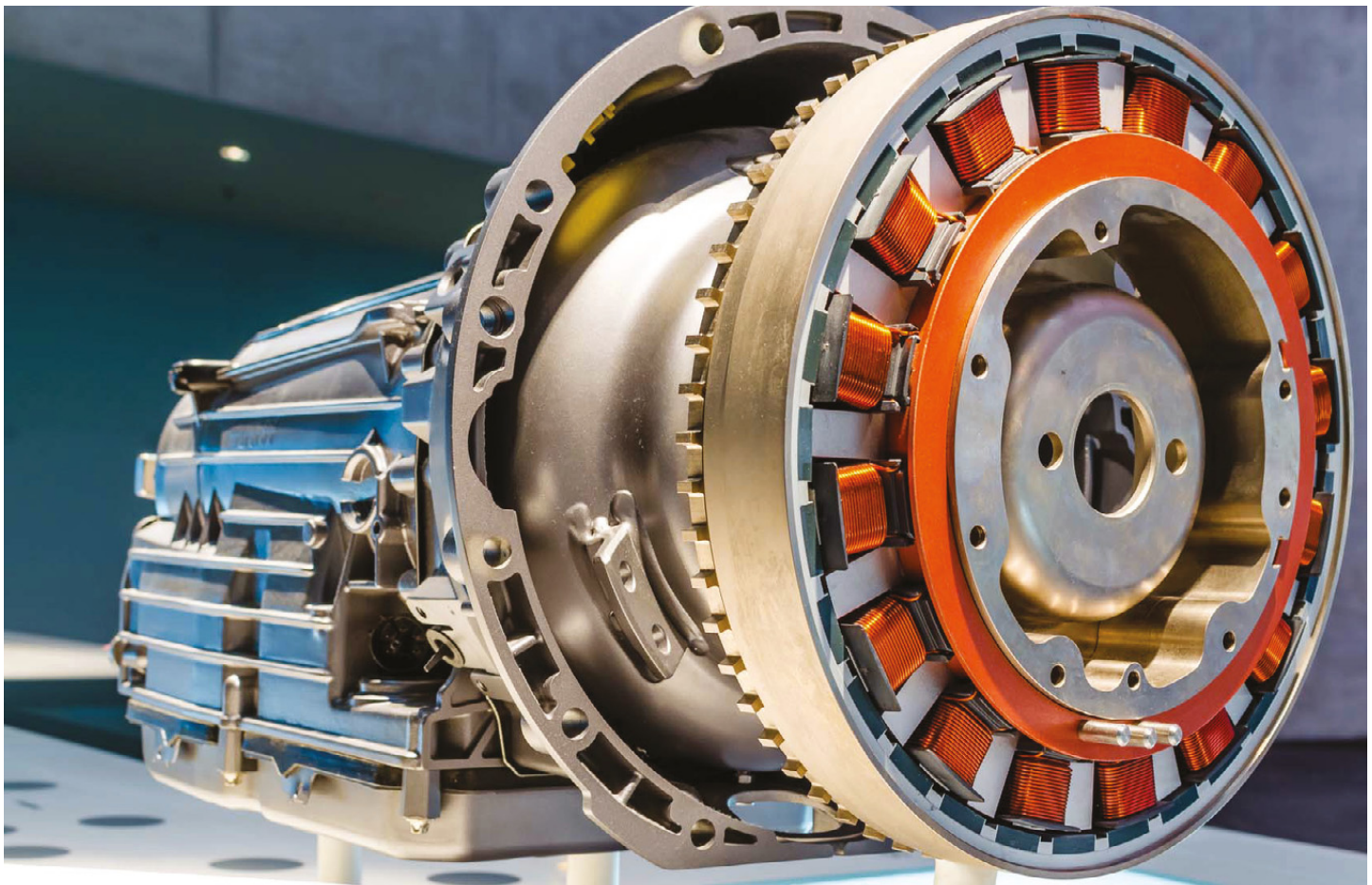


Welding and crimping

# Magnetoforming at the service of the electric motor

**Developed by Smart Factory (Gruppo Mondial) EMP Integrator exploits the electromagnetic properties in electrically conductive materials, to carry out machining operations efficiently and precisely, even on mass productions: from the welding of components to the crimping of cables to connectors**

by Gianandrea Mazzola





Due to their modular design, PSTproducts pulse generators find application both as stand-alone workstations and also integrated into automated lines equipped with automations and/or robotic systems, to satisfy high mass-productions

**E**MP Integrator is the innovative system implemented by Smart Factory, member company of Gruppo Mondial, in collaboration with the Germany company PSTproducts, which allows welding metal alloys that are not mutually weldable with conventional methods, managing the cutting and forming in the same process, thermoforming without the male mould and performing cable joints.

«We are speaking of a system – explains Andrea Zanin, Application Engineer of Gruppo Mondial – that is based on magnetoforming, an electromagnetic-pulse technology whose engineering permits to cold and contactless work metals. The base principle resides in fact in the capability of the system itself of generating some electromagnetic forces in electrically conductive materials, then suitably transformed to execute machining operations such as welding, forming, sheet metal cutting or cable crimping».

### The main parts of the system

The plant essentially consists of three main components: a control cabin that manages the electric current flow, condensers, and the coil, the core of the process where the machining actually occurs.

«Manufactured by PSTproducts – Zanin adds – the pulse generator is broadly tested also for the mass production, then apt for processing millions of pieces; it needs user-friendly maintenance and it is also provided with intuitive operational software and communication interfaces that make its use immediate and simple. Use that, through the modular design, can be easily calibrated and adapted to single and specific requirements, like stand-alone workstation, and also integrated into automated lines equipped with automations and/or robotic systems supplied by Smart Factory, too».

More in detail, the pulse generators implemented by PSTproducts are available

“With the EMP Integrator system it is possible to weld various motor components, like for instance the stator housing or the aluminium bars that compose the squirrel cage rotor. Moreover, by using the adequate field shaper, that is to say the tool on which the electromagnetic pulse is discharged, the EMP Integrator system allows crimping electric cables to connectors, so achieving excellent results in terms of mechanical strength and electrical conductivity”



Andrea Zanin, Application Engineer of Gruppo Mondial

in two standardized high-voltage variants: EMP Integrator 25kV and EMP Integrator 16kV. The first variant is suitable for processing very thin thicknesses, included between 0.1 and 1 mm, and ensures an energy range of about 40 ÷ 50 kJ. «This means – Zanin confirms– it is possible to process small junction zones, up to an area of about 14 x 14 mm, besides the possible crimping execution of small-section cables. According to the above characteristics, the system grants

## HIGHLIGHTS OF EMPT TECHNOLOGY

The ElectroMagnetic Pulse Technology, renowned also with the acronym EMPT, allows executing operations of sheet metal and tube welding, cable cutting, forming and crimping, involving numerous operational benefits deriving from its use:

- No zone affected by heat
- Proven reliability also for mass productions
- User-friendly automation
- Monitoring of process parameters

Furthermore, the electromagnetic pulse technology can be combined with any other forming technology, assuring absolutely new and exclusive process highlights, such as:

- Utmost precision and strength
- High quality of the machined surface that keeps all its characteristics intact
- High execution speed
- Reduction of energy consumptions
- Decrease of rejects

a fast magnetoforming cycle, due to the higher frequencies of electromagnetic pulses per time unit».

The 16kV version is instead devised and implemented to allow the machining of higher thicknesses, included between 1 and 10 mm, also thanks to the bigger energy range (16 ÷ 112 kJ), for more than doubled junction zones compared to the 25kV-version.

«The possibility of welding higher thicknesses with maximum lengths of 2 metres and of crimping cables with bigger section – comments Zanin – implies a working cycle with inferior electromagnetic pulse frequencies and then a slightly slower process».

## From the welding of motor components to the cable crimping to connectors

The EMPT technology offers broad applicative opportunities in the variegated world of the electric motor and, more in general, in the transversal e-mobility sector. «With the EMP Integrator system – confirms Zanin – it is possible to weld various motor components, like for instance the stator housing or the aluminium bars that compose the squirrel cage rotor. Moreover, by using the adequate field shaper, that is to say the tool on which the electromagnetic pulse is discharged, the EMP Integrator system also allows crimping electric cables to connectors, so achieving excellent results in terms of mechanical strength and electrical conductivity».

## The heat absence speeds up the successive process phases

However, in these ambits what are the differentiating features and the operational benefits compared to the technologies generally used?

«On the motor – Zanin underlines – it is possible to crimp cables with whatever material, no matter whether they are made of steel, of copper, of aluminium and so on, obtaining more mechanical strength and electric conductivity than with conventional systems. Since the EMPT technology does not provide for parts in contact, during the forming and welding it is possible to lock the stator directly in the housing, sparing some production phases. Moreover, it is worth reminding that welding is “cold” executed, without developing any heat, and therefore components are directly ready for the successive machining phases».

The EMPT technology does not use heat for welding, but it exploits the high impact speed among materials. This enables the welding among dissimilar materials, without heat generation. Moreover, the junction area has a very high mechanical strength.

«These characteristics – Zanin points out – have allowed the large use of the EMP Integrator system also on mass productions, in the manufacturing of bus-bars and to weld batteries’ anode and cathode terminals made of different materials, such as aluminium and copper».

In September and October 2022, it will be possible to see the innovative EMPT technology in operation and to test personally one of EMP Integrator plants, booking an individual visit in the exclusive mechatronic laboratory of Mondial Group: MechLab.

EMP Integrator can be largely used also on mass productions, to weld batteries’ anode and cathode terminals made of different materials, such as aluminium and copper, as well as for busbar production

The EMPT system assures crimping-to-crimping process times of 5 sec, 0 % mechanical wear (contactless), 100% of reproducibility and process control, 2,000,000 of pulses (warranty on the most important parts) and a better electric conductivity

