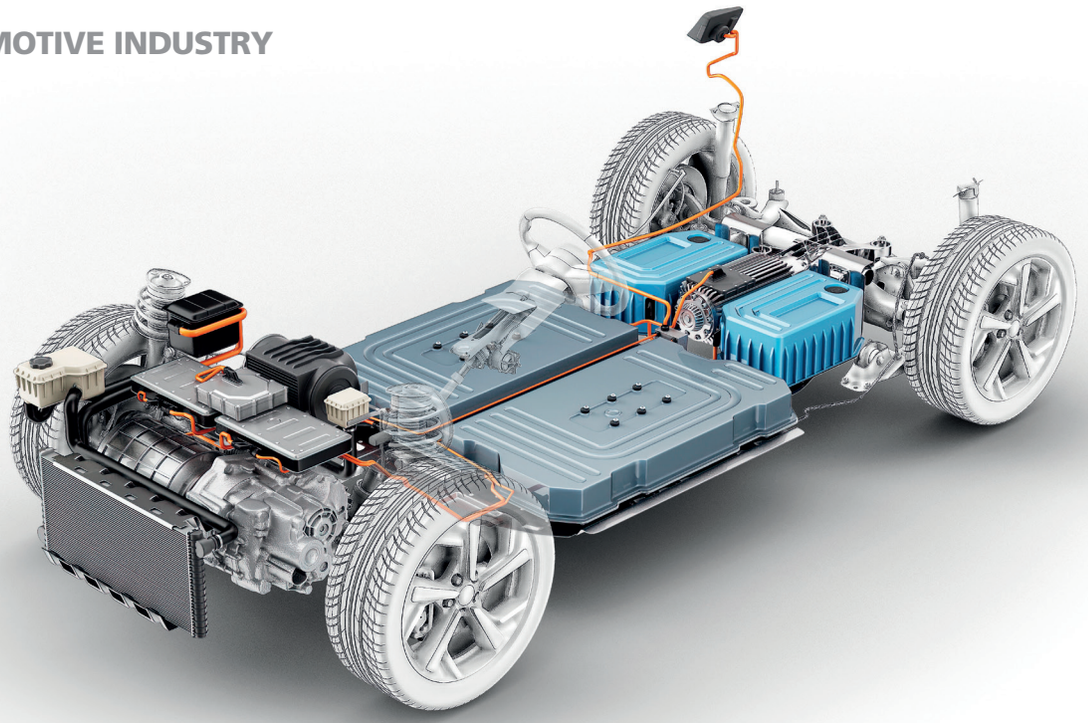
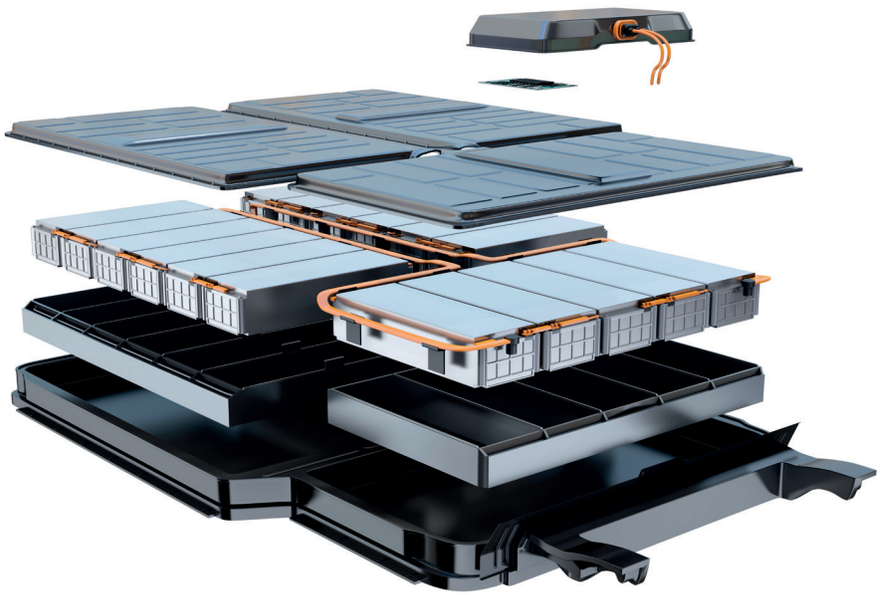


Robotized cleaning for 'Battery Housing' in electric cars

Vehicle electrification brings along new production needs and new components, imposing a paradigm shift also in the cleaning treatment processes. The production of the battery housings for the electric motors fits into this perspective. Tecnofirma developed high productivity machines in the internal combustion engines production, ensuring quality standards with high cadences. The adoption of robotized and automated solutions has proved essential.

by Luca D'Addea

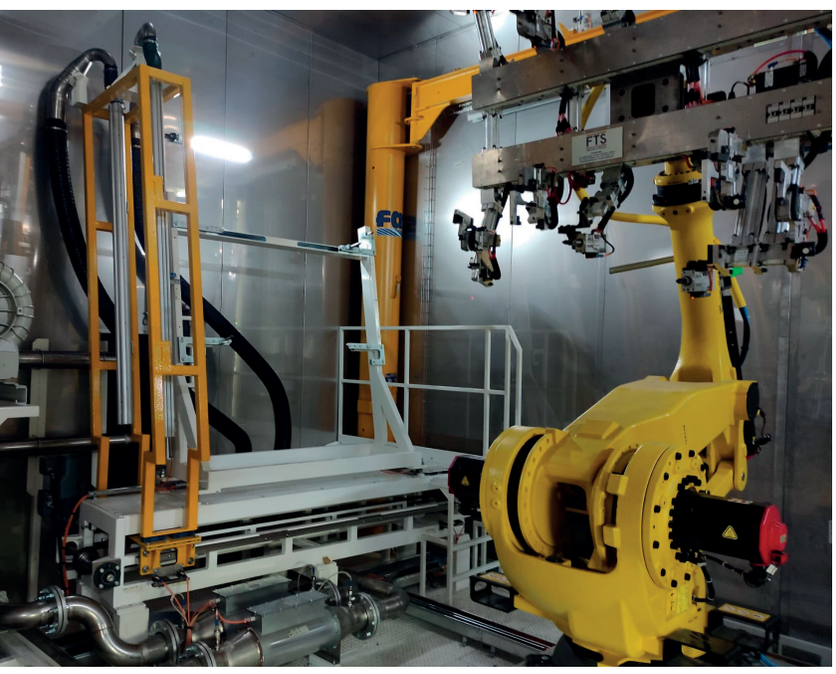
The transition from fossil fuel vehicles to electric powertrain vehicles has become a trend-topic in the global industry. In the face of impacts at a socio-economic level of difficult definition, this structural shift (definitions such as 'epochal' or 'revolutionary' are perhaps extreme) will happen very soon. As a numerical figure, in 2021 have been registered over 6.6 million electric vehicles worldwide. In the 2012 the vehicles sold were just 120.000. Forecasts for 2022 estimate a value of 7.7 million cars sold. However, these volumes, are not equally distributed: in 2021 in



China, 3.3 million, in Europe 2.3 million, in the USA (only) 630,000 units, around 400,000 in the rest of the world.
More recently, European Parliament has decided to stop internal combustion engine (ICE), (petrol /diesel / LPG, hybrids) vehicle sales, from 2035 onwards. A similar decision can be expected shortly also for heavy vehicles (buses, trucks, agricultural vehicles), especially since there are already applications on the market of this kind. It is interesting, however, to note how this is 'Structural change' is (almost) a return to origins of the automotive industry ...

Historical notes and current situation. Actually, the history of the electric vehicles dates back in the 19th century: the first engine historically reported electric (BC) was developed in 1828 by the Hungarian physicist Anyos Jedlik, who showed its potential. The first applications of electric motors on vehicles begin in the second half of the century: in 1890 the 'Jamais Contente' (a four-wheeled vehicle with a missile shape) reached 100 km / h, driven only by electric power. At the beginning of twentieth century, in the United States, one in three cars it was electrically powered. What led to the 'disappearance' of the electric drive just after the First World War in favor of ICE?
In the occasion of the first London Motor Show, the British Medical Journal wrote (1903): "Electricity has the advantage which works without smell and with less noise and vibrations, but the disadvantage of the cost of accumulators, and the impossibility to recharge except where the electricity supply is available".
Words from over a hundred years ago, but wonderfully current ... At that time, the environmental impacts and the danger to humans and other species related to the use of fuels fossils were unknown, but the weak points of the electric drive had already been well highlighted: cost of accumulators and charging limits. These two weak points would have decreed the end of the electric motor in a favor of ICE, cheap to produce and easily 'rechargeable'. Environmental awareness developed in the last 40-50 years has revived the idea of producing electric cars, whose technical

Chips blowing area Loading / unloading area external view



Multistage positioned washing machine for battery housings.
Dip washing machine for battery housings.

and technological shortcomings were not solved yet. The development of electronics (mobile phones and laptops) have unintentionally contributed to address these issues, thanks to development of accumulators with significant lifetimes and reduced weights.
The knowledge developed at the beginning of the 21st century allowed, therefore, to face positively the technical difficulties already identified more than a century earlier: even now, like a century ago, there are hearsays averse to the electric drive, such as low battery life and long charging time, but the steps forward occurred in the last two decades are definitely relevant. Just to give some numbers, in the period 2010-2020 the maximum range of the electric vehicles rose by an average of about 150 km to over 600 km, and the charging times reduced up at values less than 30/40 minutes (from several hours).

General production aspects. The electrification of the vehicle brings with it the creation of new products, and consequently, new production needs.
The production of battery housings for the electric motor fits into this perspective. To date, there are two schools of thought: the first that introduces the complete set 'accumulator + wiring' produced by third parties, dealing only with the electronic management, and the second that involves the assembly of cells, boxes and wiring by the OEM, a bit like with combustion engines.
In both cases, however, the need arises to produce the various components in a 'safe' manner, and to assemble, test and install them into the vehicle. Battery housings, for example, require high levels of cleaning, given the risk of short circuits (due to residual metallic particles) or malfunctions (due to residual non-metallic particles). The answer to this technical need collides with the production aspect: in the automotive field, generally, the components for the electric powertrain are made of metal, aluminum or ferrous materials (from extrusion and welding, casting, pressure die-casting, etc.).

Tecnofirma's answer. The several years' experience gained by Tecnofirma as a partner in the cleaning of metal components for combustion engines has been very significant to face the challenge of treating battery housings for electric vehicles. Tecnofirma had to face additional technical difficulties in this new sector: requests with high levels of cleaning tolerance on parts with dimensions up to over 2.5 x 2 sqm.; machines with high functional flexibility to manage different production rates, both for current and future scenarios, as well as to handle different type of products, even for different projects.
Tecnofirma's response to these new requests from the market has been structured following three lines of improvement: development of automation in the handling and treatment of the parts; development of standard machines for similar types of products; development of alternative/additional cleaning techniques compared to traditional cleaning.
Automation development has proven to be essential to allow the creation of flexible islands, with robotized handling and robotized treatments.
If the use of the robot during the handling phase is often mandatory with parts of considerable size (and weight) such as battery housings, the scope of the treatments is different.

The use of nozzles installed on the robot wrist allows to carry out high-pressure washing and/or deburring processes in areas difficult to reach, or blowing processes in critical areas where water could deposit (typical problem of 'tank'-shaped parts, such as battery housings or inverters). In the context of battery housings, this technology brings further advantages, as the customer wishes to treat different components of the same type at the same time. The use of robotized cleaning systems allows to process critical points of different parts, guaranteeing the quality. To give some numbers, with these systems it is possible to guarantee on battery housing absence of particles with size over the 800-1000 microns.

The main limit of these machines is in the (relative) lower flexibility: with very different parts, it is necessary to retool (pallet, hook or rack) with batch management of the parts themselves.

Tecnofirma has therefore developed 'oversized' lift and carry and rotating table machines, in order to combine productivity and quality, while maintaining adequate flexibility for any new parts.

The last Tecnofirma improvement axis in its range of proposals for electric-vehicle components is the insertion of new cleaning techniques, alternative or additional to traditional cleaning.

Historically, some techniques have already been used, such as brushing or plasma treatment. Other systems, such as ultrasounds, seem to be less suitable for large-sized cases such as battery housings. Tecnofirma has already gained experience in these areas: it has recently added to his line-up steam washing or vacuum cleaning systems (instead of blowing).

These last two techniques proved to be very functional where the battery casings are obtained using dry or with MQL (Minimal Quantity of Lubrication) machining processes, or through FSW (Friction Steer Welding) systems.

Reduced quantities of swarf and lubricant-coolant can make effective steam cleaning (until now mainly linked to very different applications, such as watchmaking) or swarf suction systems, with multiple advantages: reduced use of water (only for steam treatment); absence of emissions into the environment; reduced maintenance costs (no filters, no wastewater treatment system, etc.); thanks to the steam, very high surface tension levels (> 40 mN/m) are obtained, with longer durations than plasma (allowing better adhesion of glues, for example).

Conclusions. The electric vehicles industry is imposing a paradigm shift dealing with cleaning treatment of their components: high quality requests, considerable dimensions or complex configurations, variability of products and volumes, reduced installation and startup times, are all parameters that are contributing to a revision of today's washing market.

The key concepts needed to face this evolution are above all performance safety and ability to adapt known methods and processes to the new applications. These features are effectively in Tecnofirma's DNA which, over the course of its several years of experience, has always managed to combine technological development, flexibility of use and adjustment to customer requests. The evolution of the electric automotive industry will be a further challenge that Tecnofirma is ready to accept.

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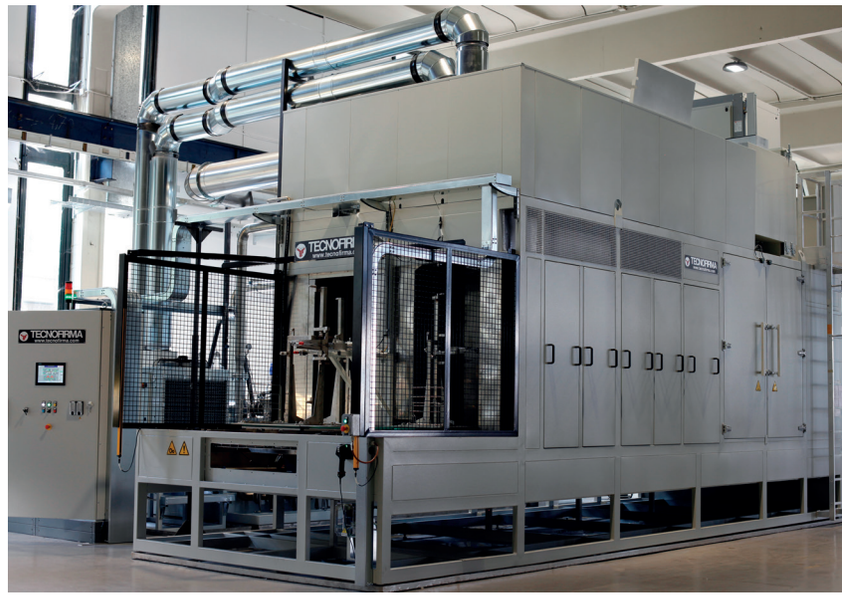

Sat-Lin washing machine for battery housings.
Intermediate dip washing machine for battery housings.