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Electro mobility – innovative machining concepts for all components

Electric mobility is becoming increasingly important in the automotive industry. The number of electrically powered vehicles produced is increasing. MAPAL already offers a wide range of innovative machining solutions for the manufacture of individual parts and components that are machined.

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High precision for large diameters using ultralight tools

The high-precision machining of the main bore in stator housing presents a challenge for tool and machine. All other steps in the production of the stator housing could be carried out on machines with HSK A63 spindle. For the main bore, however, a machine with HSK A100 spindle had to be used. That is due on the one hand to the high cutting torques of up to 500 Nm, and on the other hand to the maximum permissible tool weight and tilting moment. Cost-effective manufacturing with short cycle times calls for a solution in which the complete machining can be carried out on one machine with small connections, as these machines are characterised by their high spindle speeds, lower investment and operating costs and lower energy consumption. In order to meet these demands, MAPAL has developed a fine boring tool of ultralight design. The low weight of around 10 kg meets the precondition for use on machines with smaller spindles. In addition to the weight, MAPAL has also optimised the cooling channels, a special back-flushing system ensures a far more effective removal of the chips, thus preventing chips from scratching the machined surface.

Chatter-free machining of highly complex thin-walled battery housings

MAPAL offers the necessary tools with the optimum strategy for the different variants of the battery housing. PCD as cutting material and the MQL technology are used for maximum cost-effectiveness. Different milling technologies are employed to reduce the cutting forces, depending on the required stock removal, machining application and component. For certain contours, for example, the use of milling cutter for high-

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volume machining can be expedient. The SPM milling cutter from MAPAL is ideally suited to this application. Thanks to its high positive cutting edge geometry and the optimised chip flutes, the cutting force is reduced by up to 15% compared with conventional milling cutters. If, for example, deep pockets are to be machined, MAPAL employs special PCD milling cutters whose cutting edges are arranged with both positive and negative axis angle. In combination with the trochoidal milling strategy, the cutting force is kept very low even in this machining operation – despite the material removal rate over the entire depth of the pocket.

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Spiral forms with tolerances in the μm range

Not only the drive and the energy storage system are affected by the electrification of the vehicles, but also a number of auxiliary units. One example of this is the electric refrigerant compressor. The heart of an electric refrigerant compressor is two nested aluminium spirals – scroll stator and scroll rotor. The efficiency of the electric refrigerant compressor depends essentially on how precisely these parts are manufactured. The demands on shape and position tolerances here lie in the range of a few μm . A particular challenge here, for example, is the machining of the “screw”. A defined rectangularity of less than 0.04 mm and a surface roughness (R_z) in the single-digit μm range have to be assured. Despite these demands, the thin walls and the depth of the part, finishing has to be carried out in a single pass. MAPAL has developed an SPM milling cutter with finishing geometry and highly positive rake angle for this application. It ensures low-vibration cutting and has an additional chamfer on the diameter. It can perform the machining of base, wall and chamfer on the front face in a single step. As a result, the close tolerances for rectangularity and surface finish can be reliably achieved.

The tools for machining stator housings, battery housings and the electric refrigerant compressor are successfully used in practice. They show the multitude of processes and solutions that MAPAL offers for machining parts in electrically driven vehicles.



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Captions:

01: MAPAL has developed a fine boring tool in ultralight design for machining the main bore in stator housings.

02: For the chatter-free machining of the different variants of the battery housing MAPAL offers the necessary tools with the optimum strategy.

03: With the tools from MAPAL the close shape and position tolerances can be reliably achieved.

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Short profile MAPAL Dr. Kress KG

MAPAL – tooling the customer's success

MAPAL Präzisionswerkzeuge Dr. Kress KG is one of the leading international suppliers of precision tools for the machining of practically all materials. The company founded in 1950 supplies leading customers from the automotive and aerospace industries and from machine and plant engineering. With its innovations the family-owned company sets trends and standards in production and machining technology. MAPAL sees itself as a technology partner, supporting its customers with the development of efficient and resource-conserving machining processes using individual tool concepts. The company is represented with production facilities, sales subsidiaries and representatives in 44 countries worldwide. In 2017 the MAPAL Group had 5,250 employees, generating sales of EUR 610 million.