

New production systems for asynchronous motors

(SWD AG Stator- und Rotortechnik, Georg Senn, Thomas Stäuble, Thomas Weber)

Punching technology of the stator and rotor of an asynchronous motor today

Compound die punching is well known, often used for the production of electrical sheet stacks for electric motors and means that stator stack and rotor stack are punched from the same raw material stripe. The growing complexity of the sheet geometries result in more complex punching steps and higher wear of the tools. The production capability is heavily stressed in relation to differences in the material and to requested tolerances. The result are expensive, service intense and very large compound die tools. The separation of the stator lamination and the rotor lamination in the compound die tool requires complex and costly devices to evacuate the laminations free of damage. After the evacuation, the laminations follow different production steps. The stator is insulated and wound to build the electric coils. The rotor is die casted with aluminium or copper. The die casting process is complex and costly. The influences of the raw material insulation and raw material lots, punched from the same material as the stator stack, result in pores and blow holes.

The number of sheet for stator laminations and rotor laminations is always the same, although the required volume is different and needs to be scrapped.

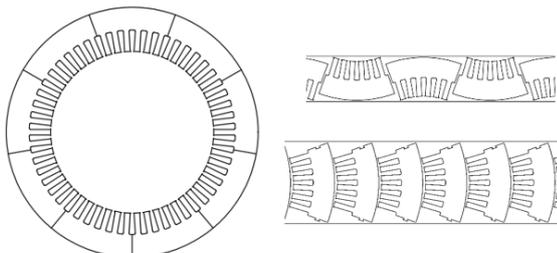
Materialusage is (not) a topic

The compound die process bases on the opinion that the process ensures the highest possible material usage and is the most competitive solution. This is not true anymore. The requirements for the stator stack include primarily magnetic and electrical properties. These properties are influenced by the material characteristics, thickness and stacking technology of the single laminations. At this point, already a huge universe of possibilities to optimise performance and material usage opens up. Material usage, which becomes a more and more important issue in the near future. For the rotor stack, beside the magnetic and electrical properties, the mechanical properties are very important due to the high centrifugal forces. During the die casting process, properties as outgazing, pores and blow holes are important, but can be reduced by selecting the right materials. The result are thinner geometries to optimise the induction currents and the efficiency of the motor. Again, a huge universe of possibilities to optimise performance and costs opens up.

New technologies

Across to the well know compound die punching process, SWD AG has developed new technologies which emerge into the market.

The stator stack is segmented based on the BPS – Backpaketiersystem® developed from SWD AG. The system is a fully automatic production line for segmented stators with bonding varnish (Backlack). Each single stack is 100% process controlled, monitored and registered for easy quality control.



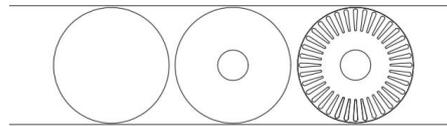
Picture 1: Stator and stator segments

In contrast to interlocking or welding, the bonded stacks have almost no shortcuts in between the single sheet and the electrical

performance improves (it is even possible to achieve 100% insulation – remark: see our factsheet about bonding varnish). In regard to costs, the material quality can be reduced and the material thickness increased while achieving the same performance. In any case, the best material for the stator stack at highest material usage can be selected. No dependency from the rotor needs to be considered.

The single segments can be assembled loose or, equipped with a coupling, fully automated be assembled to a complete, stiff stator again. The design of the coupling will be based 100% on the requirements of the mounting process and the electrical and magnetical properties. The length of the different stator segments can be controlled very accurately.

The rotor lamination is punched in a one- or multi lane, compound die punching tool. The material will be selected based on the requirements of the rotor design and the die casting process, independent from the stator material.



Picture 2: Rotor lamination example

The result is more affordable raw material. Insulations, if required, can be very thin or the material will be insulation glown after the punching process. The stack can be integrated into the die casting process.

Conclusion

The emerging technologies tap new potentials for performance and costs.

- Optimised stators, fully automated produced with highest stiffness and with very narrow length tolerances of +/- 0.1mm; segments with one or several slots loose, or assembled to a complete stator
- Optimised rotors, die casted with aluminium or copper
- Less complex blanking tools with less wear and lower service costs
- Stator stack and rotor stack independently produced, smaller punching machines
- Reduction of material and process costs
- Highest process capability and quality

SWD AG Stator- und Rotortechnik is your partner for your next generation of electric motors. As a technology leader, we develop electrical sheet stacks which ensure your competitive advantage. We support you from your idea to the efficient serial production and produce the stacks in each phase.

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