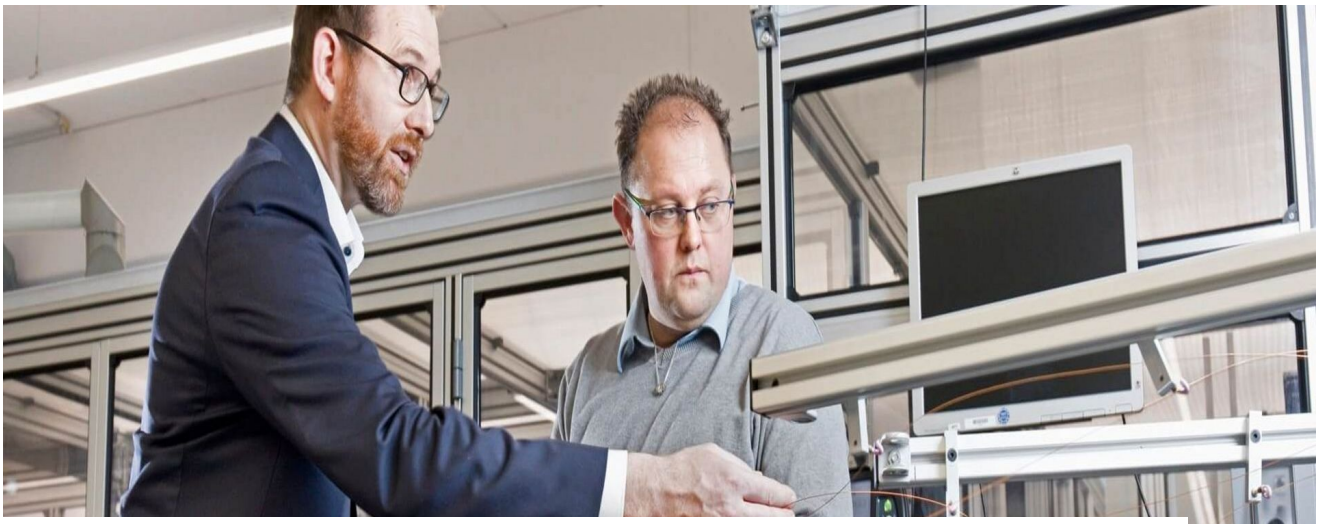


JENNIFER LIEB

For a direct connection: TRUMPF laser removes insulating varnish

Magnet-Schultz manufactures electromagnetic actuators, sensors and valves. The company manufactures the copper wire coils for its components in-house. However, the insulating varnish on the wire interferes with electrical contacting. This is resolved by using a laser beam to remove the varnish.

When newborns need mechanical ventilation, it is vital that the oxygen is delivered to their sensitive lungs at a precisely controlled pressure. Gas volume control valves must therefore operate accurately and reliably. Here's how it works: An electromagnetic actuator – essentially a metal pin attracted by an electromagnetic field – moves, opening and closing the valve. Electromagnetic actuators are always used where electrical signals have to be converted into mechanical movements.

The family-owned company, based in Memmingen and now in its fourth generation of management, has been developing electromagnetic actuators and sensors for applications ranging from the deep sea to outer space since 1912. Magnet-Schultz serves various branches of industry, including the automotive and aerospace sectors, as well as medical technology, hydraulics, pneumatics and electromechanics.

Magnet-Schultz originally employed TRUMPF marking lasers just for marking its parts.

A TruMark Station 5000 was used.

Marking parts with matrix codes is employed for internal traceability of process steps.

Ready for electrical contacting

Copper wire coils are at the heart of Magnet-Schultz's products. In Memmingen and on a former German armed forces site in Memmingerberg, the manufacturer produces millions of coils per year, which are used in hydraulic or pneumatic valves, for example, to regulate oil circuits or airflow. But why does the coil wire need to be cleaned – or rather stripped of varnish?

An insulating varnish is applied to the copper wire on the coil. Without insulation, the coil cannot function as an electromagnet, as the wound wire would effectively behave as a solid block of copper. However, it does cause interference at one point: the electrical contact, also referred to as the winding pin. That's why the varnish has to be removed from the wire. Bernd Pfadler works in process engineering at Magnet-Schultz and explains: "The enamel is removed from the copper wire at the winding pin, as this is the point of electrical contact with the coil."

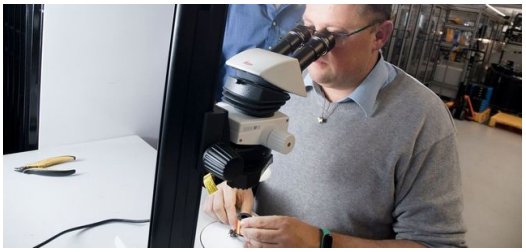
» The laser boosts our productivity and is entirely wear-free.

Bernd Pfadler, process engineer at Magnet-Schultz

From blade to laser

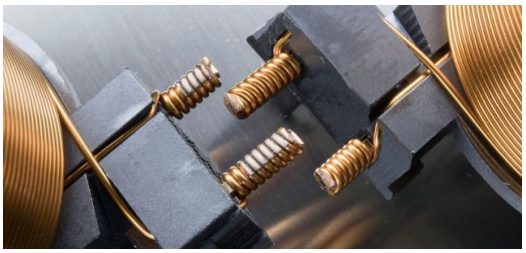
Initially, Magnet-Schultz removed the enamel mechanically with three cutters that rotated around the copper wire. The problem with this method is that adjusting the cutters is complicated, and the blades wear out over time. This causes the quality to fluctuate, and can sometimes unintentionally reduce the thickness of the wire. "The copper wires have different diameters, between 0.5 and 0.6 millimetres. We had to set the cutters differently for each wire, which was time-consuming and cost us cycle time," notes Pfadler. "The cutters also generated a lot of mess."

The process engineers at Magnet-Schultz kept working on various ways of removing the varnish. Ultimately, they came across TRUMPF's marking lasers. Some have been in use the production hall for over two decades, and are used to mark all types of plastic and metal. Pfadler remembers the start of the project: "We conducted an initial test using our lasers to determine whether they could effectively remove the enamel from the copper wire."



Bernd Pfadler checks the varnish removal under the microscope.

The TruMark 5010 laser first removed the insulating varnish from the copper wire. The coil was then electrically contacted.



Left: the winding pins after removal of the insulating varnish; right: the copper wire before laser cleaning.

Stripping integrated into the production line

Once this approach proved effective, Magnet-Schultz collaborated with TRUMPF to incorporate laser cleaning into an existing special machine. In just a few steps, the machine fully automatically prepares the coil for further processing. Accordingly, the laser needs to match the cycle time of the machine. After receiving the request, TRUMPF tests different TruMark Series 5000 lasers to find the right one for stripping. "The winding pins represent a small cleaning area, and our machine's cycle time is relatively short", says Pfadler.

In the end, the selection was a compact laser – the TruMark 5010. Magnet-Schultz has traditionally used laser technology for welding and marking, and now also for part stripping. "The laser boosts our productivity and is entirely wear-free", explains Pfadler. This not only removes the varnish, but also means less work for the production staff.

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