Welding aluminium pressure-tight in series with the laser

Feinwerktechnik hago GmbH manufactures 95% of its assemblies and parts for the automotive industry. With a wealth of experience and in-depth expertise, the production team is able to handle even ultra-complex requirements. However, an enquiry for an aluminium cooling device for the thermal management of the performance electronics in the battery management controller (BMC) of an electric car pushed the specialists at hago to their limits. And they demonstrated what experts once thought impossible: welding the nearly one-metre-long cooling unit, made up of two punched aluminium components and two VDA connectors, with a laser – reliably and in series. This is made possible by the combination of BrightLine Weld technology with the Multifocus optics developed by TRUMPF. After extensive joint trials and tests, hago and TRUMPF have proven that this process can be used to weld the cooling and protective aluminium cover of the BMC unit not only tightly, but also pressure-resistant, nearly flat and automatically in large-series production with the laser.

Feinwerktechnik hago GmbH

www.hago-ft.de

Feinwerktechnik hago GmbH is a generalist when it comes to sheet metal processing. With a high level of technological diversity and vertical range of manufacture as well as extensive expertise, the company based in Küssaberg, Baden-Württemberg, has made a name for itself in multiple industries since it was founded in 1970. The company's main focus is on the automotive industry. With a well-positioned development and design department along with its own tool-making department, hago supports customers with design optimisation and parts processing through to testing. hago supplies complex assemblies and sample parts produced by hand as well as large series, all tailored to customer requirements.

INDUSTRY

Automotive, electronics, furniture industries and medical technology

NUMBER OF EMPLOYEES

Over 700

LOCATION

Küssaberg (Germany)

TRUMPF PRODUCTS

- TruLaser Cell 7040 with BrightLine Weld and Multifocus optics

APPLICATIONS

- Laser welding

Challenges

The battery and the battery management controller (BMC) form the beating heart of electric vehicles.

The controller monitors, regulates and optimises the performance, safety and service life of the battery by managing parameters such as charging status, temperature and cell voltage. The built-in performance electronics convert the direct current from the battery into the alternating current required for the drive. This generates heat, which can affect the electronics. Modern cooling devices offer a solution. They can be integrated into the BMC housing as a media-tight cover and connected to the vehicle's cooling circuit. The cooling unit must be in direct contact with the performance electronics to ensure effective cooling. This requires the cooling device to be absolutely flat. They should also be lightweight so as not to increase the weight unnecessarily and still meet the pressure test requirements of the car manufacturers.

"Our customer requested a cooling plate made of drawn aluminium with dimensions of 900 x 200 millimetres - which was a real challenge, even for our most experienced specialists," explains Joseph Gampp, Head of Product Management at Feinwerktechnik hago. But challenging tasks are what drive the team. "After extensive trials and tests with TRUMPF, we have found a reliable solution and can now produce the cooling unit in series," Gampp notes proudly.



"When the request came from our customer, it was initially believed that production would not be technically feasible."

JOSEPH GAMPP
HEAD OF PRODUCT MANAGEMENT AT
FEINWERKTECHNIK HAGO

Solutions

With BrightLine Weld, TRUMPF provides a laser welding process that has been proven over the years, enabling fast, non-porous and gas-tight welding of stainless steel. The Multifocus optics developed in 2021 increases the range of applications even further. In combination with BrightLine Weld, it can even be used for pressure-tight welding of aluminium. The optics split the laser beam of a TruDisk laser into a ring and core beam, which in turn are split into four spots and positioned in such a way that a common weld pool is created. The continuously open keyhole prevents the keyhole from collapsing, enabling the creation of a pore-free weld seam without gas inclusions, even during the fast welding process.

Implementation

Initially, Joseph Gampp and his team tried to weld the aluminium cooling device using existing machines. The problem was that the initially tight weld seams could not withstand the required application pressures and eventually blew open. "That was a deal-breaker for our customer, as the car manufacturer requires pressure pulsation tests before approval," says Gampp, adding, "The entire assembly must withstand a specific pressure at least 100,000 times. As soon as we tried this out on our test components, our weld seams collapsed."

To address this, hago's specialists collaborated with TRUMPF to develop a stable and, most importantly, production-ready process. At the TRUMPF Laser Application Centre, it quickly becomes evident that all

challenges can be overcome with BrightLine Weld and Multifocus optics. The weld seam is sufficiently stable to withstand high pressures. The parameters can be set so flexibly that the laser can also weld long seams quickly, reliably and distortion-free. This is important because the cooling device must be absolutely flat so that it is in direct contact with the performance electronics in the BMC and can cool them effectively. "We now manufacture the part with a reproducible flatness of less than one millimetre," says Gampp.

By investing in a TruLaser Cell 7040 laser welding system with BrightLine Weld and welding optics with Multifocus technology, hago has laid the groundwork for series production of the cooling plate. The pre-series with around 3,000 parts has been completed. Within the next six years, over 610,000 cooling devices are expected to roll off hago's production line. "We have achieved what many people believed was impossible," says Gampp, adding proudly: "That's what sets us apart."







Forecast

The concept of integrated cooling in battery management controllers is relatively new, but has great potential. Joseph Gampp hopes to be able to apply the knowledge gained from his collaboration with TRUMPF to other projects. "The technology aligns perfectly with our strategic direction", he says and is confident that the extensive development efforts will yield positive results.

Find out more about our products



BrightLine Weld

You can weld materials such as mild, stainless steel, copper and aluminium almost entirely free of spatter thanks to TRUMPF's patented BrightLine Weld technology. TRUMPF's innovative 2-in-1°laser light cable (LLK) combines an inner and an outer fibre core. This design makes it possible to split the laser power flexibly between the core and the ring. This enables the power distribution to be precisely tailored to the specific material.

Zum Produkt



Multifocus optics

The new process was developed for gas-tight welding of stainless steel and aluminium. The centrepiece is the combination of Multifocus optics and BrightLine Weld technology. The laser beam of a TruDisk laser with multi-core fibre is split into a ring and core, and then split again into four spots by the optics. These work together in a weld pool, creating a continuously open keyhole. This prevents the keyhole from collapsing and avoids the formation of pores due to gas inclusions.

Zum Produkt



TruLaser Cell 7040

The TruLaser Cell 7040 laser system can be used to process two- or three-dimensional parts and tubes. The high dynamics and accuracy of the TruLaser Cell 7040 is a key requirement for reliable gas-tight welding of aluminium applications. The system enables flexible switching between cutting, welding and laser metal deposition. The modular design of the machine and the option of customisation and retrofitting mean that the TruLaser Cell 7040 can always be optimally adapted to a changing production environment and respond flexibly to different requirements.

Zum Produkt

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