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With an eye on precision: How hago brings aluminum for electromobility into series production

Pressure-tight aluminum welding? In large series production? Not a problem for hago. This is made possible by a technology developed by TRUMPF, which is already being used successfully for gas-tight stainless steel welding.

Tough challenges are not uncommon for Joseph Gampp and his sales team at Feinwerktechnik hago. “It is part of hago's philosophy that we find a solution for all customer requirements, no matter how complex they are,” explains Joseph Gampp, Head of Product Management at hago, confidently. However, when the task of producing a 900x200 millimeter aluminum cooling device for an automotive supplier came up, even Gampp's production specialists were sceptical. The cooling device is used to protect the thermal management of the power electronics in the battery management controller (BMC) of an electric car from heat. This requires both components to be joined pressure-tight with a three-meter-long circumferential weld seam.

Even the most optimistic of hago's production specialists initially considered it impossible to implement this using a laser in large-scale production. This is because aluminum is a tricky material: its high susceptibility to cracking due to stresses that arise when the weld pool cools or the high reflection of the metal make non-porous laser welding difficult and impair the weld seam quality. “But we didn't want to let this exciting job go that easily, and mastering tricky challenges is what sets hago apart, from the rest” says Gampp with a smile.

<p>Proud pioneers: Marcel Wegmann, Joseph Gampp and Patrick Kuner

<p>With the help of the TruLaser Cell 7040 laser system with BrightLine

from Feinwerktechnik hago are the first TRUMPF customers to weld aluminum pressure-tight in series.

The combination of BrightLine Weld and Multifocus optics developed by TRUMPF makes it possible to produce pressure-tight weld seams on aluminum. The process is also already being used successfully for pressure-tight and gas-tight welding of stainless steel.

Weld and ESO optics with Multifocus technology from TRUMPF, Feinwerktechnik hago is gaining a competitive edge in laser welding.

Marcel Wegmann, Managing Director of Feinwerktechnik hago (right), has Oliver Quirin, Business Development Manager of TRUMPF Laser- + Systemtechnik, demonstrate the quality of the pressure-tight aluminum weld seam.

First attempts fail under pressure

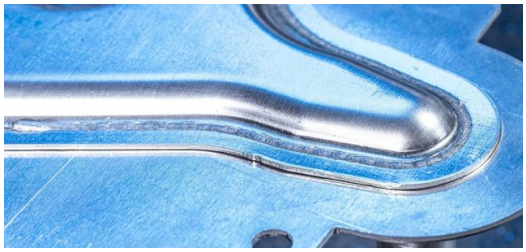
When it comes to laser processing, hago has relied on TRUMPF for years. An extensive range of laser machines covers all production methods. “Our experts therefore wanted to run tests on our existing machines first,” explains Gampp. It turns out that the aluminum can generally be tightly welded. However, the weld seams regularly cracked under pressure. “That's where our weld seam was lagging behind. And that was a vital criterion,” says Gampp and explains: ”The approval of the complete assembly requires it to withstand a pressure pulsation test in which it is subjected to a certain pressure at least 100,000 times.”

Gas-tight stainless steel welding already works

Joseph Gampp turns to TRUMPF. The experts there already had experience with gas-tight and media-tight laser welding of stainless steel. And the attempts to weld aluminum gas-tight were also promising. But in a large-scale application? Making this a reality was also an irresistible challenge for the TRUMPF specialists. Although hago did not yet have the customer's order, the teams from hago and TRUMPF got to work in the Laser Application Center. They weren't starting from scratch: TRUMPF hadbeen offering BrightLine Weld, a tried and tested laser welding process that allows for fast, non-porous and gas-tight welding of stainless steel, for years.

Since 2021, the innovative Multifocus optics have been ensuring a new level of quality. The optics split the laser beam of a TruDisk laser into a ring and core beam, which are split into four spots and positioned in such a way that a common weld pool is created. The resulting, continuously open “keyhole” - a small, vapor-filled channel in the material created by the laser beam - enables a pore-free seam without gas inclusions, even at high welding speeds. Together with BrightLine Weld, it can even be used to weld aluminum.

Thanks to its wide range of technologies, Feinwerktechnik hago is also able to supply components that require several complex production steps.



The cooling plate made of drawn aluminum with dimensions of 900x200 millimeters is used for thermal management of the power electronics in the battery management controller (BMC) of an electric car. At Feinwerktechnik hago, it is provided with pressure-tight - virtually pore-free - weld seams.

Patrik Kuner, head of the 3D department at Feinwerktechnik hago, is delighted with the successful use of the combination of BrightLine Weld and Multifocus optics developed by TRUMPF. He and his team would not have thought this possible.

Within the next six years, Feinwerktechnik hago plans to produce over 610,000 cooling units on the TruLaser Cell 7040 with BrightLine Weld and ESO optics with Multifocus technology.

The laser picks up the pressure and welds without distortion

Extensive tests have shown that BrightLine Weld and Multifocus optics not only produce optimum welding results, but also pressure-resistant ones. And that's not all, the laser process also overcomes another hurdle thanks to distortion-free welding, says Gampp: "We can use the laser to manufacture the cooling device with process reliability and reproducibility with a flatness of less than one millimeter."

Why is that important? The battery management controller monitors important functions such as charge level, charge cycles and battery temperature. The power electronics, which are also installed, convert the direct current from the battery into the alternating current required for the drive. This generates heat that can affect the electronics. The cooling device must therefore always be in contact with the power electronics for efficient cooling, and it is therefore necessary for it to lie absolutely flat.

Pressure-tight aluminum welding in series? Mission accomplished!

After the order was placed, hago invested in a TruLaser Cell 7040 laser system with BrightLine Weld and ESO optics with Multifocus technology from TRUMPF. This means that around 3,000 cooling devices have already been produced in the pre-series. This was preceded by months of development work, during which hago repeatedly optimized the component together with the customer. "But we created the essential basic prerequisite together with TRUMPF - the reliable, pressure-tight welding of the aluminum cooling device with the laser, which is suitable for large-scale production," Gampp sums up proudly and is pleased that hago has once again made the impossible possible.

About hago

Feinwerktechnik hago GmbH is an expert in sheet metal processing. Since 1970, the Swabian company has established itself in various sectors, particularly in the automotive industry, with its wide range of technologies and depth of manufacturing expertise. A strong development and design department as well as in-house toolmaking enable hago to support customers from design optimization to parts processing and testing. Their range extends from simple stamped parts to complex assemblies and handmade sample parts through to large series - always tailored to customer requirements.

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