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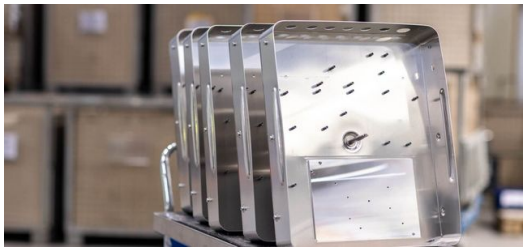
Laser meets aluminum: Tight weld seams for sunny prospects

CooolCase has exactly what the photovoltaic industry needs right now: a reliable process for welding aluminum housings for inverters en masse. With completely tight seams.

"We never expected to be so successful with this technology!" says Melinda Krusemark, Head of Sales and Marketing at CooolCase. By "this technology", she means the production of aluminum housings for inverters. Inverters convert the direct current from photovoltaic cells into alternating current and thus make it usable in the grid in the first place. The appliances are usually located outdoors and are exposed to wind and weather. It is therefore important that the inverter housings are absolutely leak-proof and do not allow any moisture into the interior, where the sensitive electronics are at work.

Metal enclosures with such special requirements are exactly what the Dresden-based company CooolCase do best. Melinda Krusemark and her brother Marvin Michel are currently taking over the company from their father - and at the best time! The two young entrepreneurs are now entering the solar industry with a new laser welding method. And are doing great business.

Melinda Krusemark and the CooolCase team are ready to take the step into the solar industry.



CooolCase manufactures housings for the inverters of solar systems.

A MAJOR ORDER THANKS TO STICKERS

The industrial fairytale from Dresden begins a few months earlier in Aachen: RWTH Aachen University conducts a study on behalf of a major manufacturer of solar inverters. The initial question: What is the most efficient way to produce sealed aluminum enclosures? The usual method until then was die casting. Functional, but wasteful. The process requires a lot of aluminum because the walls are unnecessarily thick for production reasons, which drives up the costs per housing. The RWTH study showed that laser welding is the most economical production method: instead of casting thick-walled housings, it is better to weld thin aluminum sheets together.

The problem is that it is not so easy to reliably seal aluminum alloys that are prone to porous hot cracks. A process suitable for industrial use has not been on the market for long and accordingly, today only a few companies have mastered the technology. The inverter manufacturer is struggling to find a suitable contract manufacturer for its enclosures. During their research, however, they came across a sample of tightly welded aluminum seams. Manufacturer unknown. Only a small, blue-gray sticker with the name "CooolCase". In a different context, the Dresden team once carried out a few welding tests at TRUMPF. And now it is paying off. The inverter manufacturer calls CooolCase and teases the prospect of a major order.

LASER WELDING HALVES MATERIAL USE

Melinda Krusemark remembers: "It was definitely unexpected! As a company of only 85 people, we were too small for this order. But we believe in our abilities." From an entrepreneurial and technological perspective, it made perfect sense, explains Marvin Michel, Managing Director of CooolCase GmbH: "Solar inverters are in huge demand right now. And with high volumes, unit costs are becoming increasingly important. That's why the laser welding process pays off: compared to casting, we use 50 percent less material per housing! What's more, we don't use any tools that wear out." The siblings take a chance.

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> Melinda Krusemark, Head of Sales and Marketing at CooolCase

But there is still some way to go before CooolCase can really start welding inverter housings on a large scale. The housing that the customer wants may look unspectacular, but it has a lot to offer in terms of welding technology. CooolCase therefore enlists TRUMPF as a partner to find the optimum parameters and welding strategies. The experts opt for the TruLaser Weld 5000 laser welding system from TRUMPF and start the development phase on the actual customer product.

Together with TRUMPF, the two young entrepreneurs from CooolCase are working on the optimum welding processes.

The welded seams of the housing must be completely sealed so that the electronics of the inverter are optimally protected against environmental influences.

With the fast cycle time of the TruLaser Weld 5000's rotary table, CooolCase produces 100 housings a day.

THREE TICKY WELDING TASKS

Making the component involves three tricky welding tasks for which CooolCase and TRUMPF have to use all of their expertise. Firstly, there are the seams on the sides and the rounded corner joints. Here, CooolCase relies on precisely dosed heat conduction welding, which introduces as little energy as possible into the component. "Otherwise, hot cracks form on the weld seams and they start to leak," says Michel. Secondly, a stiffening plate must be welded onto the housing. To do this, the laser system switches the welding process to deep penetration welding: the laser light welds through two millimeter thick aluminum and ensures a reproducibly tight seam that does not allow any H_2O molecules of moisture can pass through.

Now comes the welding highlight: CooolCase attaches a heat sink to an opening on the housing roof. However, it is made of an aluminum alloy that is difficult to weld and also differs from the material of the rest of the component. "This alloy is particularly susceptible to hot cracking. That is exactly what must not happen with the housing under any circumstances." This is why the TruLaser Weld 5000 switches the welding method again and now uses a supplementary wire via FusionLine. "Finding the right parameters was a tightrope act here." He grins: "But I won't give away any details." In any case, the housing is now sealed and the electronics inside are safe from wind and weather.

CooolCase uses the TruLaser Weld 5000 to solve three tricky welding tasks in the production of inverter housings.

With the TruLaser Weld 5000, CooolCase cuts the production time for an inverter housing by 2.5 minutes.

A BRIGHT FUTURE FOR THE SOLAR INDUSTRY

Now CooolCase can start mass production of inverter housings. Thanks to the high productivity of the laser during welding and the fast cycle time of the rotary changer on the TruLaser Weld 5000, they now produce 100 housings a day. And just at the right time! This is because manufacturers of inverters for solar systems are facing a double onslaught: the energy transition is continuing to ensure a massive expansion of photovoltaic systems and thus a surge in demand. In addition, many inverters that are already used in older, existing systems currently have to be replaced due to age. "Our company is experiencing solid growth thanks to the inverter order," says Melinda Krusemark: "It feels like we have won the lottery."

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TRUMPF GROUP COMMUNICATIONS