CustomerStory

FINSTERLE SCHWEISSKONSTRUKTIONEN

Joining fine-grained steels with robots

Automated preheating and welding in one clamping

For (load-bearing) steel components made of fine-grained steels to be welded without cracking, they have to be preheated. This is usually carried out manually, but with batch sizes of over 1,000 units – and due to a skilled worker shortage – an automated solution was the only option for Finsterle GmbH, a company located in Dürmentingen, Germany. As the metal construction company had already had positive experiences with manual welding machines from EWM, it only made sense to commission the Mündersbach-based manufacturer of welding solutions for the construction of a robot system as well.

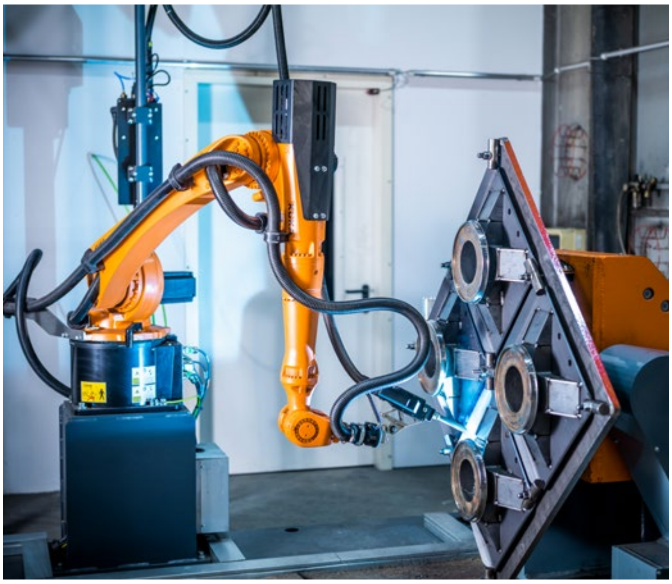
As a contract manufacturer, flexibility is of major importance to Finsterle GmbH with regard to both applications and components. "We don't know what kinds of orders customers will approach us with, but we want to be able to complete them all," said Thomas Finsterle, technical managing director of Finsterle GmbH, summarising his day-to-day challenges. That's why a robot system was commissioned to provide precisely the flexibility required.

The welding torch in its parking position. The robot can pick up the torch using a pneumatic coupling situated above. The torch cleaning station is located to the right.

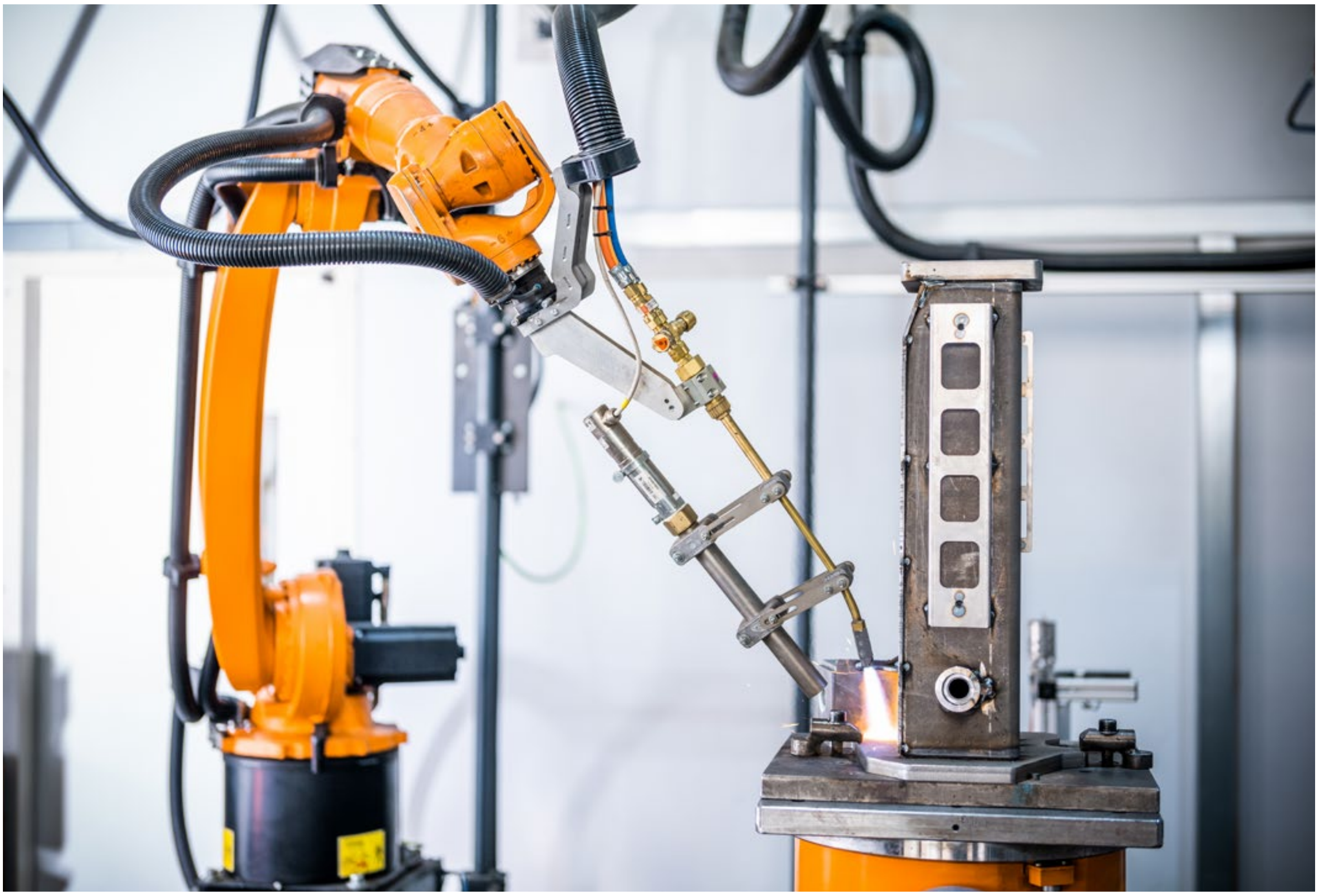
MAG welding the taught-in contour of the preheated fine-grained steel component. The component is clamped in the positioner with a load-bearing capacity of 500 kg.

Two separate robot welding cells with positioners

The development of needs-based robot welding cells is a core area of expertise of the EWM sales and technology centre in Neu-Ulm. EWM drafted the basic design for the robot system very quickly following the enquiry from Finsterle. Two separate welding cells, each with a positioner with a load-bearing capacity of 500 kg or 1,100 kg, would be needed. Adjustable counter bearings would provide additional flexibility while processing components. To weld fine-grained steels, preheating units would have to be integrated into these robot welding cells.



Welding on the positioner with a load-bearing capacity of 1,100 kg. The adjustable counter bearing is located in the front on the left. The oxyacetylene torch in its parking position is above it.



Preheating the component on the positioner with a load-bearing capacity of 500 kg. A protective pipe with an optical sensor is mounted parallel to the oxyacetylene torch. This checks the torch flame.

Automatic preheating unit

Preheating is carried out with an oxyacetylene torch. A protective pipe with an optical sensor is mounted parallel to the torch pipe. This is aligned directly with the torch flame and checks whether it ignites if needed. The robot arm is outfitted with a pneumatically operated tool changer which traverses to the parking position of the oxyacetylene torch and picks it up. It then traverses to an external ignition station. The control starts the flow of gas and ignites the torch flame, monitored by the sensor. The preheating process can now begin, whereby the robot guides the oxyacetylene torch flame over the component.

From preheating to welding

Following preheating, the system control cuts off the gas flow and the torch flame is extinguished. The robot traverses the oxyacetylene torch to its parking position and sets it down there. It then switches to the opposite side of the system, where the welding torch is located in its parking position. This arrangement prevents the hoses of the various torches interfering with one another during operation. The welding torch is equipped with the same pneumatically operated coupling, which makes swapping very easy. Once coupling has been carried out, the welding process can begin.

Fully welded booth arms. Manual tack welding of the parts takes 45 minutes, and subsequent welding with the robot (including preheating above and below) takes 35 minutes.

Programmer Lukas Kegel teaches in the welding paths of the component by running the torch along the welding seams and saving the path & welding speed.

Preheating the components on the positioner with a load-bearing capacity of 1,100 kg. The protective pipe with integrated optical sensor for monitoring the oxyacetylene torch flame is located parallel to the torch.

Teaching in the robot path

Programming of the welding path and preheating both occur through a teach-in process. This greatly simplifies the work of the programmer, as both take place using the same system. Naturally, the components have to exhibit a high degree of precision so that the robot can also weld the weld seams at the intended location. "The conversion to automation creates totally new demands for our suppliers with regard to component precision," said Markus Finsterle, commercial managing director at Finsterle, describing the far-reaching implications of conversion. However, once everything is properly set – both precision and the teach-in path – nothing else stands in the way of automated production.

Using the welding torch, the robot detects the exact position of the component put in place. It uses the wire tip of the filler metal as a probe and detects the short circuit. From this, the program derives the exact position of the component.

Compensating for thermal distortion

Most components can be reliably welded using teach-in paths and correspondingly wide weld seams. When it comes to thin-walled components for attachment, though, thermal distortion may be too much for teaching in alone. In this case, the exact position of the component must be determined. This occurs with the help of the filler metal in the welding torch. The filler wire of the welding torch is shortened to exactly 15 mm at a torch cleaning station. The welding wire then functions as a sensor. It's guided to the component from above, and a short circuit occurs as soon as contact is made. In this way, the program is able to deduce the exact component position based on the position of the robot. To determine the lateral orientation of the component, the welding wire has to contact the component laterally at any point. Six of these tactile-measurement points are sufficient for precise positioning and orientation of the component and reliable welding results.

The system control, welding machines and filler material in the drums are located behind the rear panel of the welding booth to prevent exposure to soiling.

Equipped for any welding task

To prevent exposure to soiling in the welding booth, both EWM Titan XQ 400 puls welding machines are located behind the rear panel of the booth. With its large repertoire of welding programs and potential uses, the Titan XQ is perfect for the diverse applications of a contract manufacturer. The robot controls are located between the two welding machines, and the drums with the filler material are just beside the machines. These drums only have to be replaced about every three weeks, which makes a long period of welding possible. Additional drives ensure the reliable and consistent transport of the material to the welding torch, despite the long distance that has to be covered.

Countering the shortage of skilled workers

The shortage of skilled workers is significantly affecting welding companies at the moment. This makes it all the more important to break new ground and find alternatives, just like Finsterle GmbH have done. "I can have untrained employees insert parts and start the welding process with the robot," explained Thomas Finsterle. Welders handle special one-off components and small batch sizes, as these tasks require a great deal of specialist knowledge. Thanks to the new robot cell, the Finsterle brothers are able to meet the latest challenges in the labour market.


A separate wire feeder ensures reliable transport of the filler material.

Lukas Kegel (steel constructor and programmer at Finsterle GmbH), Markus Finsterle (technical managing director), Thomas Finsterle (commercial managing director) and Oliver Hosch (EWM site manager in Neu-Ulm) are all pleased with the robot system.

In collaboration with
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However, it is still subject to alterations, misspellings and mistakes.