PRESS RELEASE
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Potential and limitations of jigless robot welding
Jigless showcase technology

Jigless robot welding is one of the most demanding disciplines in the automation industry. Jigless processes offer significant benefits – by reducing the cost of custom tooling and providing flexibility to process part variations with low batch sizes – but make high demands on robotics and the know-how of suppliers and users.

The immense advantages of fully automatic jigless welding with robots have made it a common topic of discussion. On the plus side, the elimination of manual activities and clamping fixtures, enabling greater flexibility and impressive autonomy in so-called “ghost shifts”, on the down side the technical complexity of the process and investments involved are cause for reservation.

“Anyone who is toying with the idea of investing in a jigless welding system should first check the complete spectrum of pending welding tasks for its jigless capability,” advises Yaskawa welding expert Sepp Hautzinger. “Not all components can be welded freely in space after positioning with a handling robot.” Put simply, repeatable parts that are not subject to significant weld distortion are favourable for jigless welding, whereas major production deviations from the specified contours and complex configurations can make the process far more difficult or even impossible.

Once the issue of feasibility has been positively decided, the matter of cost-efficiency of the process for the specified application must be clarified. Sepp Hautzinger, Sales Manager Office Austria of Yaskawa Europe GmbH, knows from a large number of realised applications that jigless is not automatically the cheapest variant. “Jigless robot welding is certainly the most elegant form of automation, but several factors determine cost-efficiency. Essentially, the process is suitable for components in a large number of variants and accordingly small to
medium batch sizes. Yet the most meaningful indicator has proved to be the ratio of non-productive to welding times.

**High-tech versus manual work**

If one compares jigless with conventional systems, the critical differences become immediately apparent. Jigless cells dispense with clamping fixtures, positioning tables and manual tasks such as clamping and tack welding. In return they require additional robots to ensure the exact positioning of the components, whilst welding robots carry out the joining process itself.

At first glance, investment in a jigless system appears to be more capital intensive due to the larger number of robots. However, depending on the batch size and number of variants, in practice some conventional welding systems require hundreds of clamping devices. These must be designed, constructed, stored and maintained. To this must be added the costs for manual clamping and tack welding work. A further advantage of jigless welding: in the case of component modifications there is no need for time- and cost-intensive adjustments to the welding fixtures. If a product line ends, the robots can be redeployed or reconfigured by simply changing end effectors and possibly the layout. Considering all these aspects, jigless technology scores major points on the cost side.

“Furthermore, unbelievable flexibility comes into play with jigless technology. We have already realised a number of systems that can work a complete shift completely autonomously. These ghost shifts hit the bull’s eye from an economic perspective, but require reliable mastering of all processes to ensure continuous, trouble-free operation,” stresses Hautzinger. Not only the competence of the plant manufacturer is required here; the user must also have in-depth experience with robots.

**Yaskawa: Master of robotics and motion control**

Technologically, jigless welding places high demands on robotics. Depending on the complexity of the welding task, the cooperation and coordination of different robots is essential. While handling robots accurately position the components to be welded, welding robots perform the joining. If perfect path behaviour and high precision are called for on the robot side, the control unit must be able to synchronise and coordinate a complete army of robots.
“Yaskawa satisfies all these requirements with flying colours. The Japanese have excellent handling and welding robots and superior control that can synchronise eight robots and up to 72 axes. Yaskawa thus sets a benchmark and is the ideal partner for jigless welding,” says Sepp Hautzinger. In addition, the company has decades of know-how in robot welding and can draw on a wealth of experience from thousands of realised applications.

The perfect robot coordination ensured by the new Yaskawa DX200 controller under all circumstances also has a positive influence on the welding result. In contrast to classical clamping fixtures with rigidly fixed parts, the handling robots can place the components in a perfect welding position freely in space. Each welding procedure is thus performed in the optimum flat position, significantly enhancing the welding quality and strength of the seams. Furthermore, Yaskawa is focusing on internally developed sensor technologies to ideally position the steps of all welding seams and is optimising welding sequences under the maxim of the lowest possible heat input, in order to minimise component distortion.

As the market leader in jigless welding, Yaskawa has realised many jigless applications in recent years. It is no longer only the major players in the automotive industry who are exploiting the benefits of the process, but increasingly small and medium-sized enterprises, as Sepp Hautzinger has observed: "We are building more and more jigless systems for innovative SMEs in different industries, primarily in the agricultural and construction machine industry, tank construction and, of course, wherever a high degree of flexibility is required. At Yaskawa we are convinced that in the coming years jigless technology is set to become the standard in a series of welding applications by virtue of the immense advantages it offers in terms of flexibility, quality and productivity."
Photo 1:  
A jigless special welding system assumes the automated assembly of crane booms in over 50 variants.   
Photo: Ralf Högel

Photo 2:  
Whilst a MOTOMAN ES200RN type six axis assumes the handling and preparation tasks, two MOTOMAN EA1900 welding robots perform the tack welding and subsequent final welding of the diagonal tubes.  
Photo: Ralf Högel

Photo 3:  
Thanks to superior control technology, Yaskawa can synchronise eight robots and up to 72 axes at the same time with a controller.  
Photo: Yaskawa

Photo 4:  
With the innovative jigless process, complex welding jig structures are a thing of the past. 
Photo: Yaskawa
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About YASKAWA:
With an annual sales volume of more than 360 billion Yen, YASKAWA is a world-leading manufacturer of servo drives (Sigma Series), inverter drives (such as the A1000), and Motoman industrial robots. Founded in 1915 in Japan, the company’s philosophy has been based on the principle of highest quality for 100 years, making YASKAWA a global leader.
The wide range of YASKAWA’s business activities covers drives (inverters), motion control (AC servo motors and drives, machine control), robotics (industrial robots and robotics systems), systems engineering (medium voltage inverters, generators, converters), and information technology (software-based products). VIPA GmbH in Herzogenaurach, which specialises in visualisation and process automation, has also formed part of YASAKWA since 2012. Furthermore, YASKAWA acquired The Switch Engineering Cooperation, which does business in the wind turbine sector, in October 2014. This makes YASKAWA one of the few global companies able to supply components and solutions for almost all industries from a single source.
Extensive investments in research and development have yielded numerous inventions, patents and innovations. These technological aspirations have enabled the Drives & Motion and Robotics divisions to achieve a leading market position in various industries including manufacturing systems and plant engineering (packaging machines, pumps/compressors, textile machines, digital printing machines, cranes and hoisting gear, equipment for semiconductor and electronics production, machines for producing and processing wood, glass, metal and stone) as well as lift, automotive, assembly and handling technology.
Today, YASKAWA Europe GmbH, based in Eschborn near Frankfurt, operates three divisions – Drives & Motion (drives and control technology), Robotics (industrial robots) and VIPA (automation and control technology) – and services the markets of Europe, Africa, the Middle East and the region of the former Soviet Union.

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