

Welding of rotary assemblies

Starting point / Task definition

When Trützschler makes rotary drums for high-performance carding machines, i.e. machines for opening and cleaning in the textile industry, extremely high precision is demanded. Although the drums are made of solid steel plates, they must meet extremely tight tolerances at high rotational speeds. Since Trützschler had previously required considerable personnel resources for welding, it now wanted to automate its pulsed MAG welding process.

Implementation / Solution

The required quality is made possible by a KUKA KR 6 robot, which reliably controls the welding process using touch and arc sensors. The touch sensor is used for seam detection; with the aid of this tactile sensor, the robot detects, before the welding process, any geometrical variations on the component relative to the reference model used for programming. During the welding process, the KR 6 uses the arc sensor to track the seam. Changes in the arc length indicate to the controller any deviations of the welding torch from the center of the joint. In response to this, the robot compensates for the deviations by adjusting the axis positions.

The KR 6 is equipped with a welding torch and moves on a linear unit between two working stations, where it welds rotary drums of two sizes. The large drum has a diameter of 1200 mm and a plate thickness of 22 mm; the corresponding values for the small drum are 690 mm and 15 mm. The robot controller has to coordinate the motions of nine axes in all, since the robot has six axes, and the linear unit and the two workpiece positioners which are installed each have one axis.

The rotary drums are formed on a roll-bending machine and manually tack-welded using four spot welds. Then run-on and run-off plates are welded to both ends of the seam. This way, any weld defects which may occur at the beginning and end of the seam will be located on the outside of the drum. After that, the rotary assembly is set down on one of the workpiece positioners by a crane. To align the drum's longitudinal seam, the external robot axis is traversed manually in jog mode, while a laser beam provides a reference point for the seam center. After the robot has once more verified the position of the seam using the touch sensor, the longitudinal seams are welded inside and outside with the help of the arc sensor. The crane then lifts the drum out of the cell. Employees remove the run-on and run-off plates and tack in two end plates. The assembly is returned to the cell, where the robot welds on the end plates using circumferential seams.

System components / Scope of supply

- :: KUKA KR 6 robot with touch and arc sensors
- :: PC-based KUKA robot controller, including control panel with Windows interface
- :: Welding torch
- :: Development of the complete solution with verification of functional capability
- :: Robot programming
- :: Welding fume extraction system
- :: Safety installations
- :: Commissioning

The supplier was KUKA systems partner Paul von der Bank GmbH from Hilden near Düsseldorf, Germany.



Number of report:
R 156

Industry:
Metal products

Application:
Welding

Product:
Controller
KR C (Robot Controller)
Robots
Low payloads (3-16 kg)

Implementation:
16.02.1999

Customer:
Trützschler GmbH & Co.
KG Textilmaschinenfabrik,
Mönchengladbach,
Germany

Results / Success

:: High quality

The weld seams on the rotary drums have to be very uniform, since in operation they will be turning side by side with a clearance of 25 hundredths of a millimeter, and must be perfectly balanced.

:: Remarkable flexibility

The various welding programs can be retrieved from the controller, providing remarkable flexibility. The user can thus weld either of the two sizes of roller in any desired sequence. Other advantages compared with submerged-arc welding, for example, are the high level of automation and high customer benefit – a station can be loaded and unloaded while the robot works at the other station, without having to wait during the setting-up process. Thanks to its small size, the KR 6 is also able to move about when welding the insides of the drums.

:: Economic benefits

Trützschler has been able to reduce manufacturing times by 35% compared with manual handling, thus making the welding process much more efficient. Daily capacity of the robotic cell in single-shift operation is up to eight sets of two drums. During the cycle time, i.e. within 26 or 14 minutes, the robot welds a 1.1 m longitudinal seam and circumferential seams totalling 7.5 m on the large drum, and 4.3 m on the small one. Trützschler calculates that the payback period for the complete system will be three years.

:: High availability

The required high availability of over 95% is further enhanced by the geographic proximity and prompt service provide by KUKA systems partner von der Bank.

:: Acceptance through training

Von der Bank helped gain employee acceptance of this modern technology through appropriate training. The familiar Windows interface of the KUKA Control Panel was an advantage here.



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