

## Orbital riveting process for permanently tight rivet joints



The orbital riveting process is also used to manufacture capacitor housings. The rivet simultaneously forms the capacitor contact and is connected gastight to the housing lid by the orbital riveting process.

KMT Produktions- und Montagetechnik GmbH, based in Villingen Schwenningen, Germany, manufactures production systems for special riveting processes. The company presented its modular machine concept for a CNC orbital riveter cell at the Motek 2010 trade show for assembling and handling technology. Equipped with a PC- and EtherCAT-based control platform from Beckhoff, the machine can cope with all customer requirements with regard to process speed.

## Beckhoff automation technology guarantees fast process cycles

The orbital riveting process is a recognized and established joining process all over the world and has proven itself in a wide range of applications. It is used to connect not only metals with one another, but also differing and sometimes sensitive materials, such as ceramics, leather or plastics. Users also include leading car manufacturers and their suppliers, electrical appliance manufacturers, companies that make fittings, sensor manufacturers and many others.

### Technology proven in a wide range of applications

The term 'orbital riveting' comes from the 'orbital' movement of the riveting die (peen), which is moved in a circular path over the rivet head: due to the fixed inclination of the riveting spindle axis, the peen rotates during the riveting procedure with a metered vertical pressure on a circular path around its own axis. At the points where the rivet is touched, a deformation is produced, which continues along the line of contact between the riveting die and the rivet. "The advantage of the orbital riveting process is that only one tenth to one fifth of the force required in press riveting needs to be applied to achieve the same deformation or material joint," says Marc Heiter, managing director of KMT. "We need about 100 kg of compressive force per millimeter diameter for the material deformation. For 5 mm it would then be 500 kg." Marc Heiter also describes the gentle treatment of the surfaces as a particular advantage of the orbital riveting process. "Metallic coatings and coatings applied by electroplating are simply formed with the material," he explains. "In the orbital riveting process, the riveting die runs completely on the rivet head, so that there is only very slight impairment of the surface."

### High throughput figures in series production

The process becomes particularly interesting, however, when throughput in series production is considered. Specifically, it is a question of how many riveted joints can be manufactured in a certain time. "I would claim that we manufacture the fastest orbital riveters in Europe," declares Marc Heiter. "We can accomplish an orbital riveted joint in 0.6 to 0.7 seconds. In the application area of the manufacturing of fittings, we have proven that our machines can manufacture an orbital riveted joint with solid steel rivets of 4 mm in diameter in only 0.8 s. It is in any case interesting that hollow rivets can also be riveted cleanly and permanently using the orbital riveting process."

If several riveted joints must be achieved in a short space of time for reasons connected with the production cycle, e.g. in the case of workpieces that are fed in multiple-up production, KMT offers a so-called multi-spindle orbital riveting head.

### PC-based automation as the basis for a standardized, scalable machine concept

With their CNC orbital riveter cell, KMT has developed a modular machine concept that allows the customer to assemble its plant as if from a building kit, according to requirements. The basis for this is the flexible PC-based control concept, which is expandable depending on the scope of the plant. The control platform consists of a Beckhoff CX1020 Embedded PC with 12-inch Control Panel, EtherCAT Terminals along with Beckhoff Servo Drives and servomotors. "The orbital riveter is selected from the standard KMT range according to the spec-



The new CNC orbital riveter cell from KMT is based on a modular machine concept that allows a customized solution on basis of standard components.

tive requirements and integrated into the production cell," explains Marc Heiter. "For example, the workpieces can be fed via a rotary indexing table or a swivelling unit. Alternatively, a workpiece carrier/transport system could also be used for this. The concept is also open with regards to the operation of the machine, which can be either manual or fully automatic."

The dynamics of the orbital riveter cell are achieved by a cross table with two servo axes for the XY positioning. An EtherCAT Servo Drive of the type AX5203 is employed for this. The orbital stroke is implemented by a pneumatic Z axis. "However, further servo axes may be added, depending on the task and the customer's automation requirements," stresses Marc Heiter.

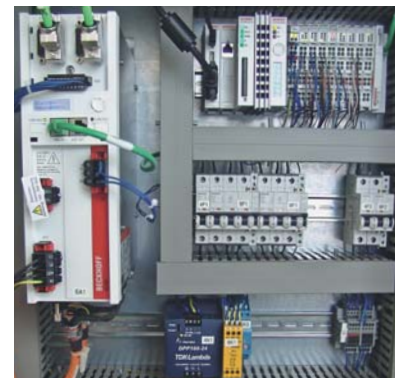
In addition to the cycle time, further process variables are important in orbital riveting, such as the continuous measurement of force and distance and the measurement of the raw rivet length by means of differential pressure measurement at the start of riveting. "The differential pressure measurement that we developed in 1996 enables the exact determination for the raw rivet length as the basis for the desired process parameters," explains the KMT managing director. "This is important in all production areas where components subject to compulsory documentation are manufactured, e.g. in the automotive industry, in the production of ABS components, airbag steering wheels and the like."

#### Operation and monitoring via touch panel

The CNC orbital riveting cell offers three modes of operation: base position drive, setup and automatic operation. The associated operational sequences are displayed on the touch panel, which is installed on a mounting arm. A total of 100 riveting programs, each with up to 100 positions are stored in the controller. The riveting positions can be input with an accuracy of 0.01 mm. The adjustment value for the raw rivet length can also be specified. These parameters and the rivet positions can be entered by the user as absolute values or specified during



Marc Heiter, Managing Director of KMT Produktions- und Montagetechnik GmbH from Villingen Schwenningen



The control cabinet accommodated at the side of the machine bed contains the Beckhoff CX1010-0112 Embedded PC, EtherCAT I/O terminals and the Beckhoff AX5203 Servo Drive for two motor outputs. The Servo Drive and PC communicate over EtherCAT.

online programming using the teach-in method. The riveting travel or stroke can be provided with a positive and negative tolerance. Furthermore, two riveting pressure steps can be defined.

#### High speed requirements fulfilled

With regard to procedural scalability, the individual processes are monitored and documented by sensors. "The Beckhoff EtherCAT Terminal system offers a wide range of possibilities for sensor integration. However, speed was much more important to us," says Marc Heiter, and he goes on: "The Beckhoff controller was the first control solution to fulfil our high speed requirements. In earlier machines and in stand-alone concepts we always had to combat speed problems. From the process point of view, the following must be considered: driving to the rivet and the concluding upward drive take place in just 0.26 seconds in the case of a 10 mm stroke. During this time slot the force/distance measurement system must determine whether the raw rivet is too long or too short. This simply cannot be achieved with conventional control systems."

KMT Produktions- und Montagetechnik GmbH [www.kmt-montagetechnik.de](http://www.kmt-montagetechnik.de)