EJOT FDS® in the „body in white“ of the Audi TT

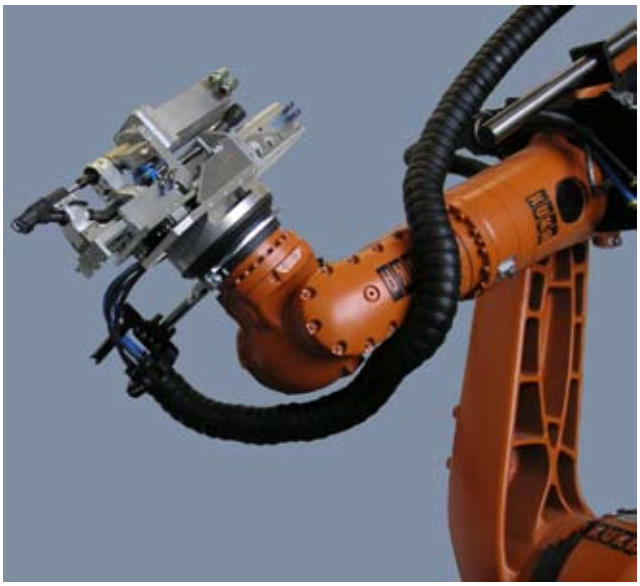
Body construction has always made very high demands on joining elements. For example mixed construction using different materials such as steel and aluminium is increasingly implemented in production. Fastening elements must meet extremely high requirements in this production method. For example in order to join aluminium extruded profiles, the mixed construction method used for the production of the new Audi TT requires one-sided accessibility which is possible with the FDS® screw.

The EJOT FDS® screw can be fastened in a process-sure manner even in complex operating conditions. It allows sheet thicknesses of up to 4 mm in aluminium or up to 2.0 mm in steel to be fastened with a unilateral joining direction without a pre-punched hole.
The self-piercing FDS® screw enables high strength sheet joints due to the increase of thread engagement in the previously formed rim hole. The female thread formed without cutting during the insertion process is true to gauge size so that a standard machine screw can be used for repair purposes.
The positive properties of the screw were so convincing in the construction phase of the new Audi TT that the FDS® screw is being used at 229 positions in the body construction of the Audi TT Coupe.

Apart from screws other fasteners are naturally used. Here is an overview of the joining elements in the new Audi TT:

- 1606 Semi-tubular punch rivets
- 96 Solid punch rivets
- 174 Clinch points (so-called clinching)
- 1271 Weld points
- 97 m Bonded joint (structure, lining, folds)
- 26m Weld seam (laser and MIG welding)
- 229 FDS® screws
- 232 Threaded bolts

Robot-assisted fastening system
The FDS® screws are joined by means of a robot-assisted fastening system with automatic feeding in the body construction. The complete fastening station is supplied by Weber Schraubautomaten.



Robot-assisted fastening system supplied by Weber Schraubautomaten

The FDS® screws are used for different material thicknesses at Audi in Ingolstadt at 16 robot stations with various fastening programs. The fastening materials include not only 1.5 to 3.5 mm thick aluminium profiles but also aluminium die cast parts with wall thicknesses up to 3 mm into which the FDS® are placed without pre-punching. In most instances, a single component structure adhesive is applied between the components to reinforce the shear tensile strength of the body. Hardening of the adhesive takes place during the cataphoretic paint drying process in which the entire body runs through an oven.

The friction warmth required for piercing is provided, depending on the fastening material and thickness, by a high screwdriver speed of the electric motor of up to 5000 r.p.m. and a contact pressure of up to 1.8 kN.

Joining process

During the joining process the FDS® screw is fed from the conveying unit via a tube into the mouth piece of the fastening spindle and fixed there. The actual fastening process is divided into several program steps.

After the screw is positioned on the fastening part, the so-called pressure pad pushes the component to be fastened into position. Then the speed and the contact pressure are increased until the pierced hole is formed.

When the screw-in torque at which all threads are formed in the counter material is reached, the speed and the contact pressure are reduced. Then the screw is screwed through until the screw head rests on the clamping part and is tightened at a previously defined torque. The complete process sequence after positioning takes 3 seconds as a rule.

The process parameters torque (controlling parameter), speed and path (responsible for the switchover points) are constantly monitored, and the torque and rotation angle are documented.

FDS® fastening process steps

1. Heating
2. Piercing
3. Forming rim hole
4. Thread grooving
5. Screwing through
6. Tightening

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