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Automatic Weber screwdriving systems ensure tough body assembly for Audi TT

The latest RSF automatic screwdriving systems, developed and manufactured by Weber Automatic Assembly Systems, are playing an important role on the new Audi TT production line in Ingolstadt, Germany. In particular, the RSF systems are being used as part of an innovative method of fixing vehicle body panels, using flow drill screws rather than rivets or welding, that enables tough joints to be achieved faster and more efficiently, without affecting the strength or long term integrity of the vehicle.

Many of the body panels on the current Audi TT are manufactured from aluminium, either as die-formed sheets or extrusion profiles, which have to be joined both together and to other materials used in the overall vehicle construction. The method of fixing chosen by Audi's engineers is to use self piercing and extruding flow drilling screws (FDS), from EJOT, applied via specially developed Weber automatic screwdriving systems, fitted to each of 15 production robots operating on the body in white assembly line.

The Weber RSF screw-driving system has been designed as a modular, self-contained unit, which interfaces directly with the host robot to ensure accurate and repeatable positioning, with a sophisticated sensor system to ensure that each screw is inserted with consistent torque and depth.

The RSF systems automatically positions itself using a linear transducer to measure the initial compression as the unit comes into contact with the surface of the vehicle, then sorts and blow-feeds individual screws to a combined screwdriving spindle and chuck, or nose-piece, unit.

The system then advances each screw, increasing the speed of rotation to 5,000rpm and the force applied to 1.5kN; this effectively causes localised heating and enables each screw to pierce the panel surface and then form a thread without the need for a pilot hole or the generation of swarf or other debris inside the panel. Once the threads are formed the speed is reduced, to just 200rpm, and the screw is driven home, with a long thread engagement creating a tough, long lasting join. The entire operation is typically completed within three to four seconds.

The RSF system incorporates a specially designed spindle drive mechanism, with a dynamic servo controller and a low mass, three phase synchronous motor; this is capable of extremely rapid start/stop operation, of handling high speeds and loads, and is maintenance-free. In addition, a separate measurement transducer is used to monitor applied torque, plus speed, angle and direction of rotation, with the measured data being fed back to a controller, enabling screwdriving parameters to be changed instantly. The spindle and chuck unit are extended and retracted pneumatically.

A further benefit of the system is that the various components and assemblies used on all 15 of the RSF machines are standard and interchangeable, helping Audi reduce still further its maintenance and staff training costs, with an additional off-line unit also been installed for training purposes.

Weber Assembly Automation Systems' UK Managing Director, James Mayo, explained that, "Our design and engineering team in Germany worked closely with Audi over a number of months to develop a solution that met the specific demands of the new TT production line. In particular, the complex space frame body shape and the location of the panel fixing points meant that in many instances it was only possible to access fixing points from one side of each panel, precluding the use of conventional fixing methods. In addition, it was important to carry out each fixing operation quickly and consistently, to maximise productivity without affecting build quality. The solution developed by our team, based on our proven RSF technology, is compact, relatively lightweight and extremely reliable, requiring minimal long term maintenance, yet provides exceptional levels of accuracy, repeatability and overall performance".

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