DEPRAG NORTH AMERICA
Screwdriving Technology
OFFERING ASSEMBLY SOLUTIONS
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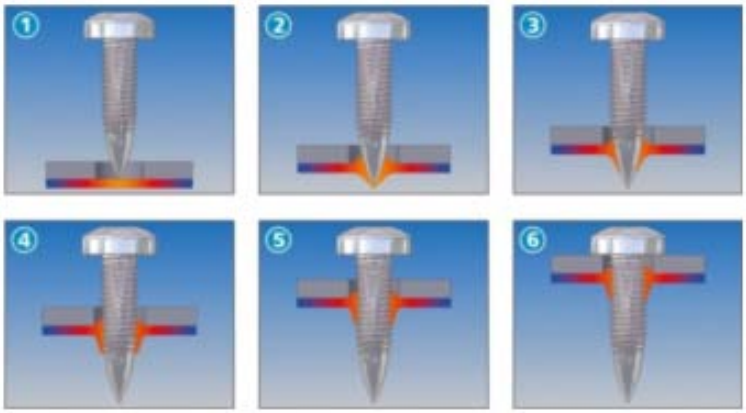
Press Release

Mixed materials for car bodies require alternative fastening techniques

Lightweight construction moves into the fast lane!

DEPRAG flow drilling screw fastening assembly system also copes with tight spaces.



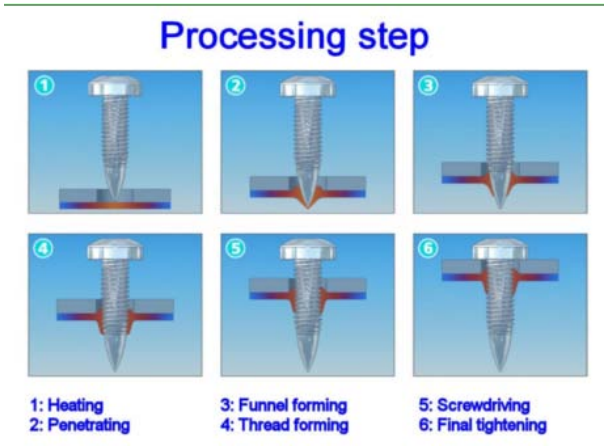
Fierce competition has always been part of the automotive industry. Who can build the lightest car? The lower the weight, the more likely it is to meet the requirements for maximum energy efficiency. Cars of the future are measured by their fuel consumption and their CO_2 emissions. Regardless of whether the car is powered by an electrical drive system, a hybrid drive, or has a conventional combustion engine - the lightweights will come out on top! However, car bodies must lose none of the necessary rigidity. Modern car body engineers are experimenting with suitable compound materials, combining different metals such as steel and aluminum. This means a rethinking of the assembly process. With these material combinations, conventional fastening techniques such as resistance welding are extremely impractical and other joining processes need to be applied. Fasteners, such as rivets are experiencing a revival, if access to the fastening point is possible from both sides.

If access from both sides is not possible, an alternative fastening process is required. In such cases, screw fastening made with flow drilling screws have come to the forefront as a solution to the problem. Flow drilling screws create a high-strength fastener connection and form a process-reliable joint for different types of sheet metals. In industrial robotic manufacturing processes, these modern fasteners are placed by automated screwdriving systems. This is a market where DEPRAG, the well-known supplier of fastening technology, is currently providing some innovative developments.

The new DEPRAG system is recommended principally due its ability to adjust flexibly in places where space is very limited. For those applications, robotic screwdrivers are specially designed to deal with situations where space is limited. By using a 1:1 ratio offset gear to offset the drive motor and screwdriving axis to the side, the DEPRAG screwdriving system can access screw positions located as little as 14-millimeters away from an obstacle! The screwdriving module can turn in any direction, so can easily be deployed in any position. DEPRAG is well-known in the automation industry. Established product lines such as the proven MINIMAT-EC and MICROMAT-EC hand-held screwdrivers, DEPRAG measurement technology, DEPRAG feeding equipment, as well as its screwdriving stations and assembly machines have proven themselves a hundred-fold. Those well-established technologies are the basis for the new flow drilling screwdriving system.

What happens when a flow drilling fastener is used? There are six steps involved in inserting these special screws, which are supplied by several well-known manufacturers. A flow drilling screw is positioned onto the aluminum or sheet-metal, which has not been pre-drilled, and the screwdriving process begins. The screw is applied with a high down-force, and rotates at high speed, generating a high level of friction heat, which first of all forms a “crater”. As it goes through the sheet metal, the screw creates a “through-funnel”, which allows the forming of a standard thread at reduced pressure. This standard machine thread can also accept a “standard” screw in the event that repair is required. Once the thread has been formed, the speed reduces and the screw is tightened to preliminary torque. A final fastening step then tightens the screw to the pre-configured torque and angle parameters. The entire process generally takes less than 2 seconds. Additional fastener elements such as nuts or bolts are not required, because the screw's through-hole and thread are optimally adapted. The screw “is seated” correctly. There is no need to pre-drill or punch the component.

Flow drilling fastener assembly has now become an established technique used by car body engineers in the automotive industry. In automotive plants, robot-supported screwdriving systems process component after component. Depending on the design, several hundred screws will be inserted into some of the larger vehicles. On long robot assembly lines the routes from the screw feeder system to the screwdriver can often be a hindrance to fast cycle times. There is another advantage offered by DEPRAG's latest innovation due to the fact that there are always two flow drilling screws in the screwdriver system. While the first screw is being fastened, the next one is fed through and on standby behind the nosepiece. This reduces the time it takes to refill the system and results into improved cycle times. The fastener to be inserted is held in position by a lock- and positioning device, which opens by pneumatic control. A sensor monitors the “seek” process, to ensure a solid connection between the bit and the screw-drive. The locking device opens as soon as the screw has penetrated the sheet metal. The DEPRAG screwdriving-system can also easily swivel and be optimally deployed into any position.



The new DEPRAG screwdriving system may be adapted to flow drilling screws supplied by all well-known suppliers. For the spindle drive motor, the designers used the tried and tested EC motor from the MINIMAT and MICROMAT series with a speed of 6,000 rpm and torque of 15 Nm. An air cylinder provides the forward feed for the screwdriver's connection with the fastener. A proportional valve controls the air cylinder. The down-force for the screw process (max 2.500 N) is also regulated by an air cylinder using a proportional valve. The 1:1 lateral offset ratio of the EC motor gear keeps the screwdriver structure slim, and is the reason it can be deployed even where space is very limited. A strain gauge transducer at the motor spindle controls the torque.

A digital positioning sensor monitors every step of the joining process. As the fastener approaches and is positioned to the car body, the sensor system in the mouthpiece and the DEPRAG screwdriver stroke compares the “is” status against a configured reference value. If the parts geometry does not match the “should” value, for example because the car body has flexed, the screwdriving process and the torque parameters automatically adjust to the relevant screw environment. An enable signal is emitted to start the tightening process. Finally, the last step is to check the condition of the joining process. All parameters associated with a screw assembly - speed, down-force, torque and angle - are separately analyzed, compared against the specified values and - provided they are within the tolerances - confirmed with an “OK message”.

The parameter-setting of the various process steps required for flow drill tightening, is particularly tricky. While during the heating and flow phases, the system works at maximum down-force and a high revolution rate, when it comes to the thread-forming process, the speed and down-force are reduced. The speed and down-force reduce a second time for the steps involving preliminary tightening and when applying final torque. The AST32 process control software used to control these delicate steps of the process is based on the proven standards used in the sensor-controlled DEPRAG EC-Servo screwdriver. Jürgen Hierold points out: “This software is trusted and well-established. It is recognized as being particularly user-friendly in operation, and it is easy to configure for the complex flow drill assembly-process.” The automation specialist is offering an additional component in its high-quality DPU system control unit (DEPRAG PROCESSING UNIT) with operator-friendly standard software, as well as suitable screw feeders.

DEPRAG SCHULZ GMBH u. CO has 600 employees in more than 50 countries, and is based in Amberg, Bavaria. It has made a name for itself as a full service provider in automation. Its high level of expertise in the field of high-quality EC servo screwdrivers and EC screwdrivers, sophisticated technology, innovative feeders, air motors and industrial power tools means that it has a solution wherever there is a need for automated production.

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