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Press Release

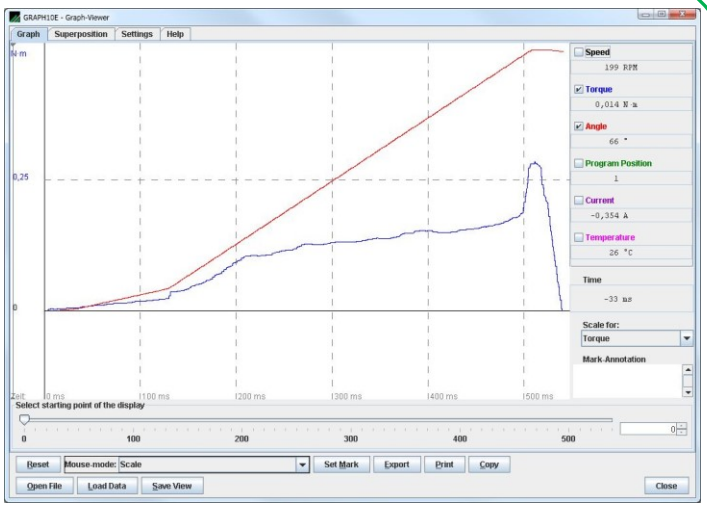
DEPRAG friction torque procedure ensures a constant pre-load force

AVOID PROBLEMS BY USING THE FRICTION VALUE PROCEDURE

Processing reliability for the assembly of self-forming and self-drilling screws

Screwdriving technology is the most popular form of joining technology. More and more complex assembly tasks, increased requirements for processing reliability and higher quality standards require sophisticated procedures, which can fulfill these high specifications. In the automotive industry for example, aluminum, light metals, and plastics are used more frequently due to the need for lightweight construction. Pump housings, ECUs (Electronic Control Units), airbags, and interior components – all these products are normally assembled using self-forming or self-drilling screws. In the processing of these screws, a tapped hole is used, but the screw itself acts as the thread forming or cutting tool. For mass production assemblies, the established screwdriving procedure for self-forming or self-cutting screws tightening is based on a defined final torque. The torque guided screwdriving-process has always been the most adequate solution, but only if the thread-forming torque lies at a constant value.

The actually required force for connecting these two or more components - to ensure a reliable and safe connection - is the pre-load force. The lack of any practical method to measure this pre-load force means that you are usually relying on the torque as an aide in mass-assembly. When assembling with pre-cut threads, the applied torque is the same as the pre-load force. But for self-forming or self-cutting screws a share of the applied torque is used during the thread forming or thread cutting process. The other share of the torque generates the pre-load force.



Graph showing a Friction Torque Assembly

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"As long as all influencing factors are repeated accurately within an acceptable framework then the assembly result with the tightening strategy "screw assembly to torque" is also repeated accurately and the reliable process is assured", explains Jürgen Hierold, VP Sales at DEPRAG SCHULZ GMBH u. CO.

A fluctuating tightening torque influences the pre-load force

Screw shaft-diameter tolerances in the tapped hole, varying materials and divergent surface properties of the components to be assembled or of the connection elements, can directly influence the forming- or cutting torque. They also directly influence the share of the torque which is responsible for applying the preload force. Jürgen Hierold explains: "Imagine the following case: A connection element with a shaft diameter at the upper end of the tolerance comes into contact with a tapping drill hole whose diameter is at the lower end of the tolerance range. We establish during the screw joint analysis that the thread forming or cutting process requires approx. 60% of the applied torque and just 40% is left to generate the preload force. If however the tolerances change and a smaller shaft-diameter comes into contact with a larger tapped hole, then the screw assembly to torque seems to be ok at first glance. However, the screw joint analysis will show that the forming and cutting process requires just 30% and the share of the torque responsible for the preload force requires 70%. This can either lead to the destruction of the component or to an insufficient, faulty and unreliable screw assembly".

If you judge the quality of the screw assembly of self-forming or self-cutting screws on the basis of the torque values, then the results received seem at first glance to be ok. The sensors in the screwdriver spindle register the specified final tightening value as ok. "However we know that the applied torque is proportionally shared in the forming or cutting process versus preload force". The aim of every screw assembly is therefore not a constant final torque value but a constant preload force".

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In order to ensure a constant preload force even with fluctuating drilling torque, DEPRAG has developed the friction torque value procedure. The friction torque value procedure guarantees a constant preload force as the drilling torque has already been registered and calculated during the assembly process in order to determine the final torque required for the preload force.

Generate the preload force using the friction torque value procedure

Screw assemblies using the friction torque value procedure from DEPRAG are based on results from the screw joint analysis. In the torque development graph, a threshold value for the angle measurement is assigned, and based on the analysis a range for the friction torque value measurement is defined. From a sequence of torque measurements, an average or peak torque – the friction torque value – is calculated. A "difference" torque is added to this. The shut-off torque is the sum of the friction torque value and "difference" torque. "Using this method the differences in this procedure to those of other manufacturers is clearly shown. We generate the friction value over the angle range compared to others who use the connecting surface", states Jürgen Hierold. "The friction torque value determination via connecting surface relies on the increase in measurement value; we are relying on a measurement range with many individual values and take the average from this. That is a much more reliable method".

The preload force is reliably applied via the friction dependent torque, despite the appearance of fluctuations in the forming or cutting process. "Unfortunately regardless of all these advantages, there is also a disadvantage in this procedure", said Hierold. "The final tightening values are not constant due to the fluctuation forming torque. A quality evaluation of individual screw assemblies, which is usually determined by the final tightening torque – for example, such as the Cmk-Index – is no longer an option". The only viable measurements for quality evaluation are the one measuring the different torque values or angle values from the threshold up to the point where the shut-off torque is reached. The success of the screw assembly can be tested optimally during the screwdriving process, but the results at the end of the screw assembly are difficult to verify.

Nevertheless, the friction measurement procedure is already well established in the automotive-, electronic-, electro-technical-, the cell-phone-, and telecommunications industries, as well as in the appliance- and medical industries.

DEPRAG SCHULZ GMBH u. CO is headquartered in Amberg, Germany and is well positioned as one of the leading screwdriving technology companies with a range of services including screw joint analysis, DAkkS accredited calibration laboratory and a comprehensive product program. DEPRAG has over 600 employees in more than 50 countries worldwide.

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