

Press Release

Quality management in Mass Production

Leading edge measurement technology helps to prevent product recalls.

Monitoring the screwdriving assembly process to detect errors sooner

Product recalls are the fear of every industry. Automobile defects are especially in the public eye. An automobile recall is mandatory when stemming from an unforeseen, unavoidable and imminent threat to personal safety. When a particular vehicle type is identified as a risk, the original automobile manufacturer will initiate a "vehicle recall". With the support of the government automobile registration authority, individual owners of the affected vehicles are identified. With this information, the manufacturer can notify the owners directly to return the vehicle to their local service provider for modification. Additional to this the automobile registration authority maintains the statistics for vehicle recalls. For example: in 2008 the German "Kraftfahrtbundesamt" documented 148 cases involving 726,000 vehicles which were recalled by the manufacturer.

For the past few years, vehicle recall statistics for Germany would imply a downward trend. There were 148 cases in 2008, whereas 2007 recorded 157 recalls and in 2006 167. Possibly these improved figures represent a general effort within the automobile manufacturing industry, including the full supply chain (for example 2nd and 3rd tier suppliers), to improve process monitoring and control of safety-related components during assembly. Due to product liability as set out by legislation, quality management in the automobile manufacturing industry and increasingly for all manufacturers involved in automated production enjoys the highest priority.

A particularly demanding task in the assembly process is screw assembly. To monitor, control and document the screwdriving process is the task of "measurement technology" in an automated or semi-automated process. The goal is to identify and avoid or at least segregate screw joints which do not meet the required assembly criteria, during production. In the arena of screwdriving technology the Bavarian company DEPRAG SCHULZ GMBH u. CO. has made their mark, providing high-



quality servo electric and pneumatic screwdrivers for manual and fully automated industrial installations. Equipped

with an accredited DKD Calibration laboratory, the German company with approximately 600 employees in over 50 countries offers high expertise in the field of measurement technology.

Screw assembly is subject to the laws of physics which the applied measurement techniques use to their advantage. The aim of the screw assembly process is to apply a specific pretension to the screw joint (clamp force) or a specific screw threading sequence or screw position adjustment attained by the assembly and/or disassembly of the screw. When the task is screw sequence or screw position adjustment, process measurement is via longitudinal displacement of the screw (screw RH or LH - screw depth) or by control of a defined angular displacement of the screw (number of revolutions). These measurements can be attained directly via numerically controlled measurement devices or indirectly by measuring time factors.

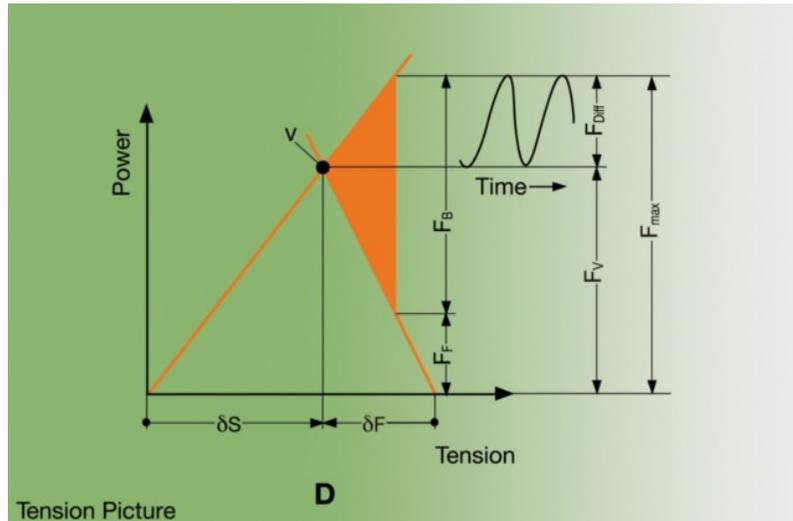
In most screwdriving applications the screw is assembled to a specific clamp force. The resulting holding force is intended to insure that every possible design function of the screw joint is attained (please see diagram 1) while not exceeding the permissible screw joint limits. Undefined variations associated with screw seating (material tolerances, etc.) and variations in the assembly process are problematic with respect to the pretension force.

Torque is the important process variable in the screwdriving process. Due to the fact, there is no practical method available for controlling the pretension force in series with a screwdriver or a Nutrunner during the production process, supervision of the assembly cycle is usually controlled by indirect measurement variables. In general, this is the shut-off torque of the screw driver: a variable which can be calculated from the required pretension force using the formulas of the VDI guideline 2230.

The measuring means comparing: a measuring instrument compares something known to something unknown. Thus, if the torque is the measured value, it must be compared with the "national norm" or "national standard". For example, in Germany, the "Nationale Normale", established by the "Physikalisch-Technischen-Bundesanstalt, Braunschweig" is the highest national measurement standard. In the USA this organization is known as ANSI (American National Standards Institute).

A key requirement for quality assurance is the calibration traceability of a measuring instrument. This traceability is awarded when a measuring instrument is calibrated with direct reference to an unbroken chain up to the national standard. The German Calibration Service (DKD) has been in existence since 1977, taking over the role of calibration service to the industry while the Braunschweiger Authority is dedicated to high-level calibration.

Since 2008 DEPRAG SCHULZ GMBH u. CO is equipped with an accredited DKD testing and calibration laboratory underscoring the company's extensive experience and dedication to the field of torque measurement. Beyond that, the specialists for screwdriving technology and automation manufacture a broad range of measuring platforms, measuring wrenches, transducers, monitors, and software for the measurement and collection of torque data. In addition, they can offer the outfitting of complete test measurement stations starting with the workbench up to the precise measuring system. For quality management purposes, periodic calibration and counter measuring of the highly technical systems with a traceable measuring device is a requirement for certification.



Measuring Instruments

Selection of the appropriate measuring instrument depends entirely upon the individual application.

Example 1:

Using a DEPRAG pneumatic screwdriver, MICROMAT® or MINIMAT®, an operator assembles the same screw type into the same joint on a shift by shift basis. Torque control is provided by the calibrated automatic shut-off clutch. In order to verify the repeatability of the screwdriver clutch, it is periodically counter measured by a torque transducer and the clutch recalibrated. DEPRAG measuring platforms are very flexible: they can be used stationary in a quality assurance laboratory or portable mounted on a trolley. With a highly polished steel base plate which can be fixed to a flat surface, they provide the most accurate results and are not influenced by lateral forces or bending.

Example 2:

In an automated assembly line, a routine torque check of screwdriver spindles is ongoing. For this task, DEPRAG measuring wrenches in straight or angle form are completely portable. This handheld device can be used directly on the screwdriver spindle while installing in the machinery. Also, re-measuring of assembled screw joints by retightening or loosening the screw/fastener is possible with these devices.

Example 3:

The relevant torque data from the screw driving process are transferred to a processor or a data collection device for documentation. Therefore supervision of the process is secured, which is especially important for critical safety-related sub-assemblies and components. Inline DMS transducers in combination with DEPRAGs sophisticated measuring systems provide torque measurement, screw joint analysis and data collection techniques to the highest standard for optimal quality assurance.

Example 4:

Real-time, in process torque measurement, can also be accomplished using DEPRAG MICROMAT®/MINIMAT® C pneumatic screwdriver spindles. In process torque and angle measurement/control using DEPRAG MICROMAT®/MINIMAT® EC electric driver with current control, or DEPRAG MICROMAT®/MINIMAT® EC-Servo, electric screwdrivers with inline transducer control. Here the torque measurement capability is integrated into the screwdriver spindle itself. EC servo screwdrivers, for example, should always be applied for the assembly of components known as category A "threat to life and limb" for which the maximum process security method is required. EC and EC-Servo screwdrivers are, of course, also capable of measurement and control of angular displacement through an integrated encoder.

Measurement Principle

For the measurement of torque certain principles are employed. DEPRAG relies upon strain gauge technology (DMS) and the piezoelectric (PE) techniques. Selection of the more appropriate of the two is justified by the details of the application. Jürgen Hierold, Sales Director of DEPRAG: „Through a multitude of adaptations for all usual threaded fastener assembly tasks we are able to offer a suitable solution to every application“. DMS transducers are known to be particularly cost-effective. PE transducers are very convincing due to their extremely wide measuring range, their superior accuracy, and their very robust mechanical construction.

Documentation

Modern quality management requires more than just examination of torque results. Documentation and evaluation of collected torque data are a must. DEPRAG also offers a broad selection of electronic monitoring and data evaluation equipment. Used in conjunction with the DMS and PE torque transducers they not only display the data but also provide storage and sophisticated data analysis. Thus the performance of manual screwdrivers and well as automated screwdrivers can be set, trend monitored and controlled. The control and calibration of a torque wrench is also possible as well as the monitoring and documentation of the assembly quality.

The portable monitor version ME5000, with integrated battery and docking station, allows flexible testing at the point of use. It can be connected to DMS and PE-type transducers and torque data can be transferred to a PC by the use of the optional software. For static applications in a quality laboratory environment, for example, version ME5400 is developed for direct connection to a PC. The device is capable of transferring boundless amounts of ASCII data over USB 2.0 allowing complete statistical analysis and the plotting of a high-resolution map of the entire screwdriving joint in an interactive curve diagram using DEPRAG software. Version ME5600 additionally includes an integrated touch panel and power supply. The instantaneous analog output with very high data resolution is another distinct advantage.

Traceability

With the accredited DKD calibration laboratory DEPRAG SCHULZ GMBH u. CO. in Amberg Germany is your on-demand consultant for all questions concerning quality management in the arena of the threaded fastener assembly. With their test laboratory, they offer the complete program for the verification of measurement equipment. Factory calibration at the customer's site or even for manufacturers of compressed air or electric power tools, factory calibration with a complete measurement traceability protocol and the re-calibration of the entire measurement chain. Dagmar Dübbelde DEPRAG marketing: In modern manufacturing, it is not only necessary to use proven, durable and reliable technology. In connection with their own ISO certification, it is essential to calibrate the measurement equipment according to the protocol on a periodic basis ensuring measurement accuracy and repeatability. Only then, the process reliability is guaranteed.

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