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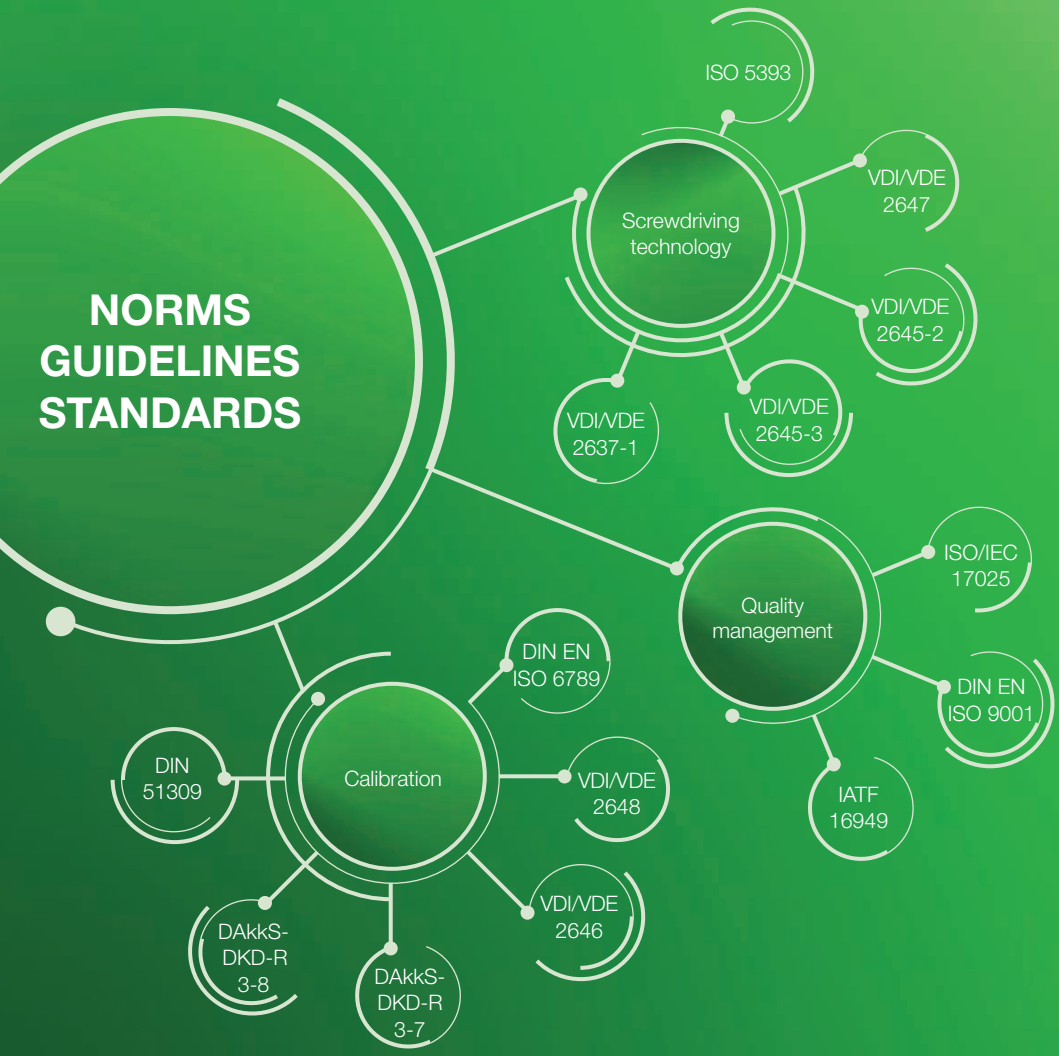
machines unlimited


# VERIFICATION AND CALIBRATION

for screwdriving technology

The use of appropriate measuring and testing equipment is of fundamental importance for the manufacture of high-quality products. This is reflected in the requirements for the calibration and verification of measurement instruments in current quality management standards, such as DIN EN ISO 9001 and IATF 16949. It is a question of establishing evidence of the suitability of resources used for monitoring and measurement and to ensure the traceability of measurement results.




We encounter standards every day – often without realising it. We routinely seal an A4 sheet in its envelope, intuitively take the stairs and naturally begin a new calendar week on a Monday. Thousands of standards regulate product specifications, services, procedures or technologies.

# STANDARDS
# RELATING TO SCREWDRIVING TECHNOLOGY

The most important norms and standards – associated with screwdriving technology – are briefly explained below.

## Quality management

*DIN EN ISO 9001:2015*
The globally acknowledged standard defines the requirements for quality management within companies.

*DIN EN ISO/IEC 17025*
The norm describes the general requirements for competence in verification and calibration laboratories.

*IATF 16949:2016*
The international standard applies to quality management (QM) in the automotive sector based on the general QM standard ISO 9001:2015.

## Calibration procedures for measurement equipment

*DIN 51309*
The DIN 51309 defines the procedure for the calibration of torque transducers for static torques.

*VDI/VDE 2646*
This guideline describes the minimum requirements for the calibration of torque transducers in comparison to the execution of DIN 51309.

*DIN EN ISO 6789*
This norm defines the procedure for the calibration of torque wrenches.

*DAkkS-DKD-R 3-5*
This guideline defines the procedure for the calibration of torque measurement devices for static alternating torques.

## Test procedures for screwdriving technology

*VDI/VDE 2645-2*
This guideline defines the procedure for machine capability tests of screwdriving technology devices.

*VDI/VDE 2645-3*
The 2646-3 describes methods for the verification of process capability for threaded joints.

*VDI/VDE 2647*
The VDI/VDE 2647 is a guideline defining the procedure for type testing of screwdriving tools.

*ISO 5393*
The ISO 5393 is an international standard for the execution of functional checks of rotary tools for threaded joints.

*VDI/VDE 2637-1*
The guideline describes the appropriate qualification of personnel associated with screwdriving technology and is aimed at all persons and sectors involved with screwdriving technology.

# CALIBRATION OF MEASUREMENT EQUIPMENT

## Why calibrate?

In accordance with ISO 9001:2015, measurement equipment management requires the regular calibration or verification of all measuring instruments subject to verification on the basis of measurement values which are traceable to national norms. The IATF16949 contains further requirements for the verification of test processes and the assessment of measurement systems by accredited calibration laboratories.

## Definition

Calibration identifies any deviations from the correct measurement reading on the display or in the output of a measuring instrument. In addition, compliance with prescribed tolerances can be monitored and a reconciliation or realignment can be carried out.

## Requirements

The calibration of measurement equipment necessitates compliance with the general requirements for calibration laboratories described in DIN EN ISO/IEC 17025. These are based on the appropriate calibration procedure for a specific measuring instrument. For example, the calibration of torque sensors is based on DIN 51309 or VDI/VDE 2646.

Additional requirements for conducting a calibration are the measurement instrument's suitability for calibration and traceability to applied calibration standards.

## Results and analysis

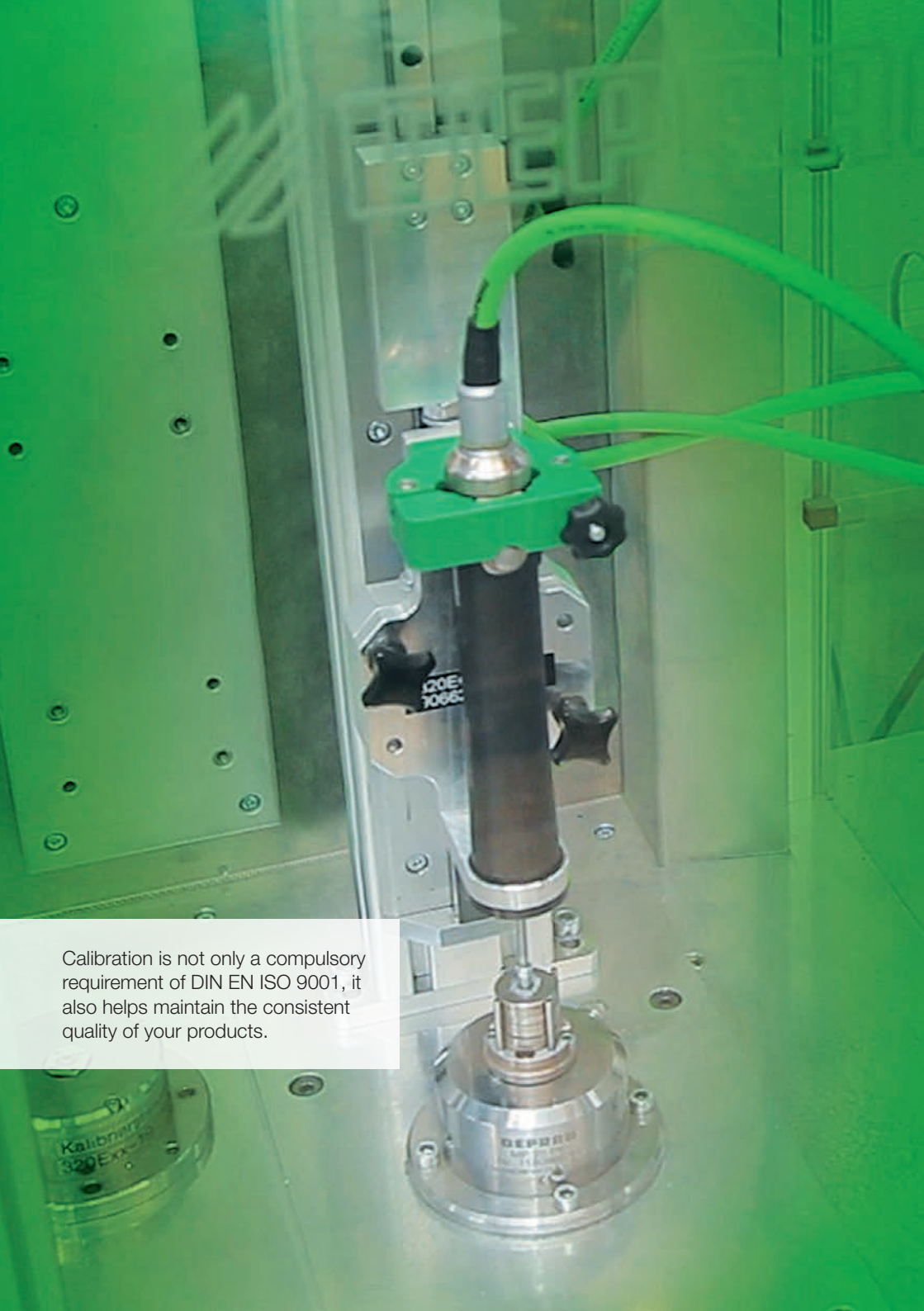
The results of a calibration are taken from the relationship between the input and output readings at defined points of measurement. The input reading is the physical value measured, such as force, torque or angle. The output reading is usually an electronic signal, such as an electric charge or voltage.

The content of calibration certificate is prescribed by the normative definition of the calibration procedure and guidelines from the national accreditation body (DAkkS). Minimum requirements are, amongst other things, details of the calibration procedure used and the measurement uncertainty determined at each point of measurement. Statements relating to conformity or fulfilment of specifications are not usually included.

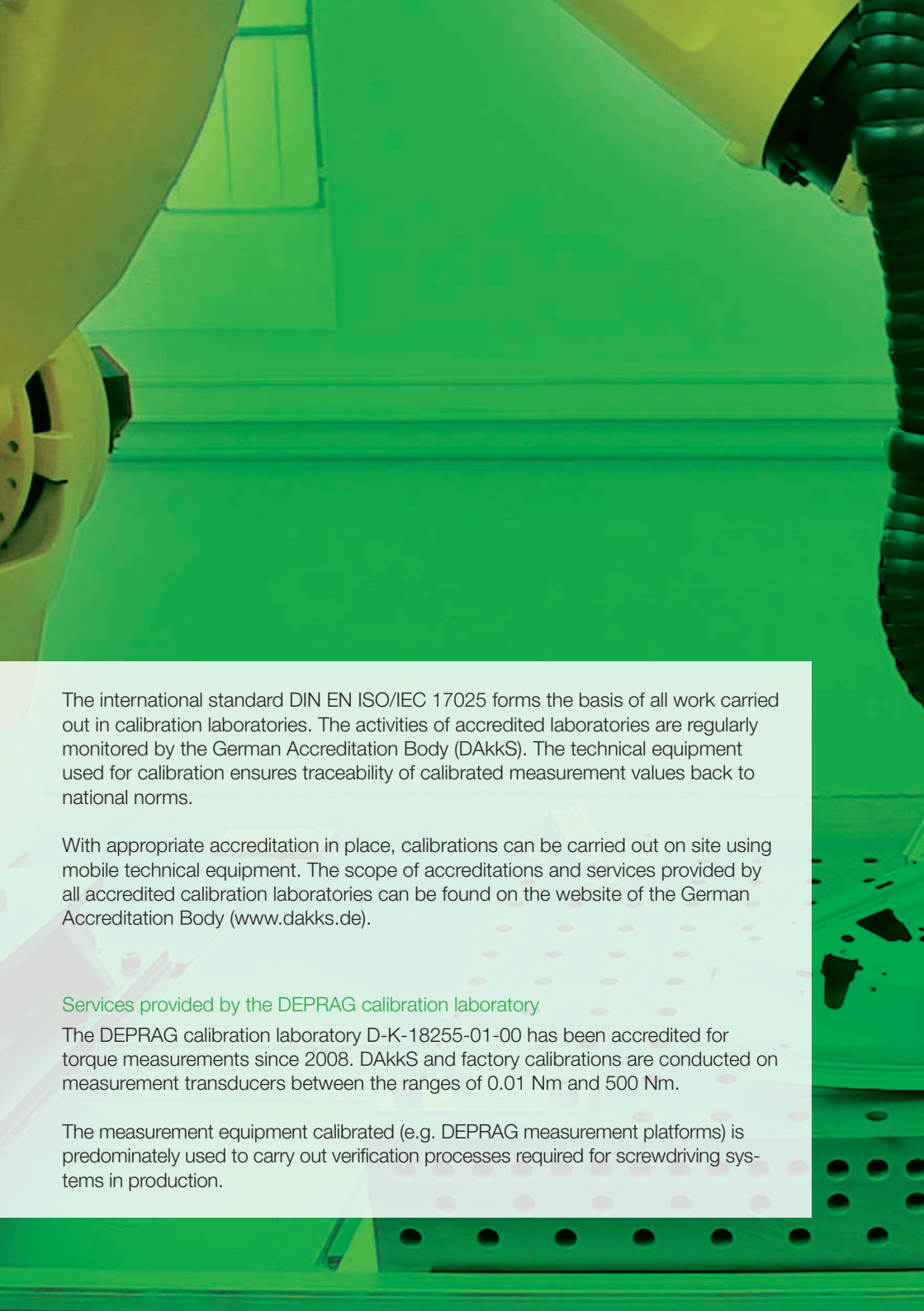
The suitability of a measuring instrument for a test procedure is dependent on the required accuracy of the measurement and must be assessed by the user according to the information on the calibration certificate.

## Calibration intervals

The ISO 9001 requires users to define a set time interval for checking measurement equipment. Aspects such as stress on the instrument, the risk of incorrect measurements, the calibration history and costs should be considered. Conducting calibrations too frequently can lead to high costs and production downtimes. If a calibration interval is too long, the risk of unchecked measurement inaccuracies increases. It is often sensible to adopt an interdependent system: specific checks on site at regular intervals and external calibrations at longer time intervals.



Calibration is not only a compulsory requirement of DIN EN ISO 9001, it also helps maintain the consistent quality of your products.



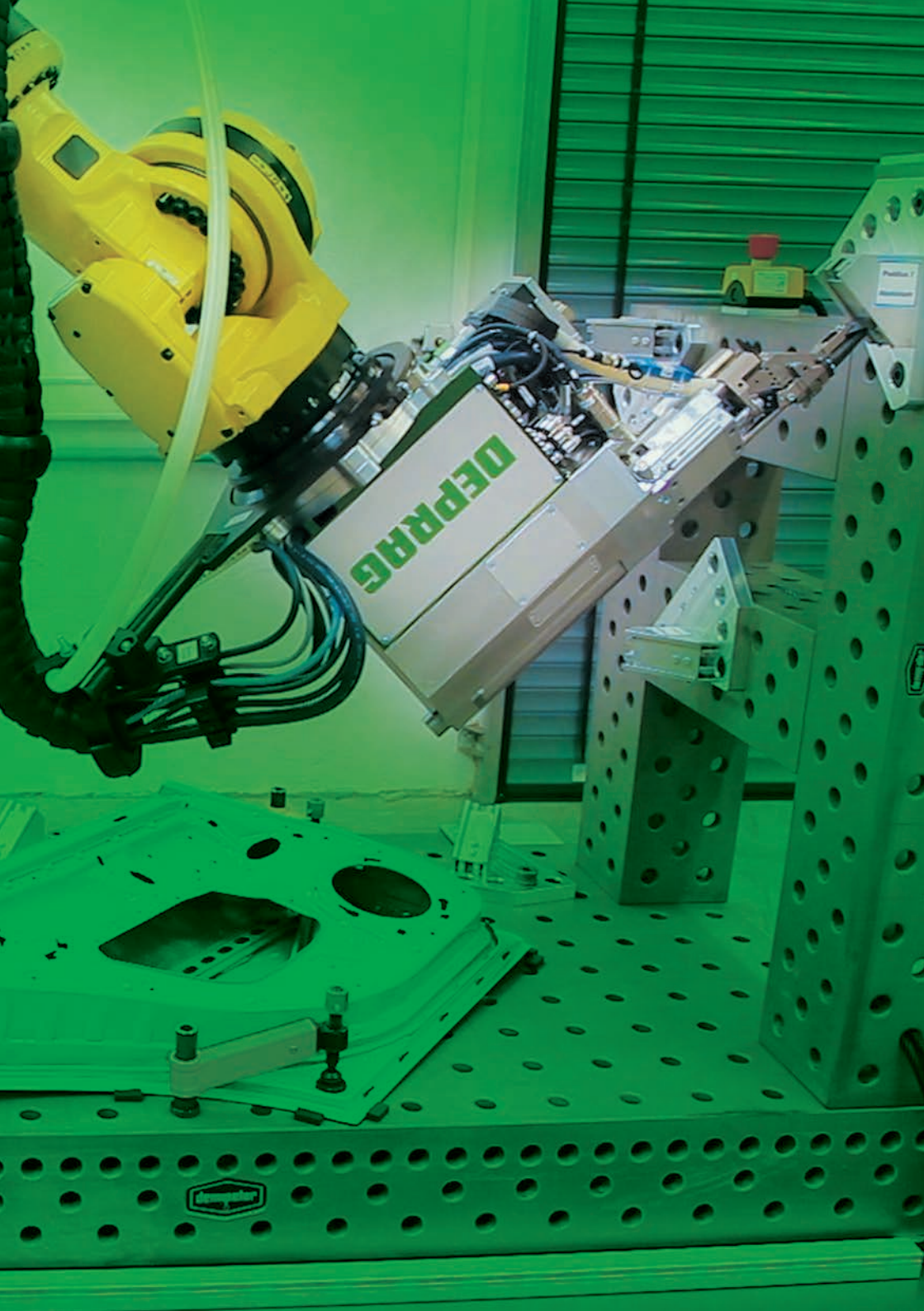
The international standard DIN EN ISO/IEC 17025 forms the basis of all work carried out in calibration laboratories. The activities of accredited laboratories are regularly monitored by the German Accreditation Body (DAkkS). The technical equipment used for calibration ensures traceability of calibrated measurement values back to national norms.

With appropriate accreditation in place, calibrations can be carried out on site using mobile technical equipment. The scope of accreditations and services provided by all accredited calibration laboratories can be found on the website of the German Accreditation Body (www.dakks.de).

## Services provided by the DEPRAG calibration laboratory

The DEPRAG calibration laboratory D-K-18255-01-00 has been accredited for torque measurements since 2008. DAkkS and factory calibrations are conducted on measurement transducers between the ranges of 0.01 Nm and 500 Nm.

The measurement equipment calibrated (e.g. DEPRAG measurement platforms) is predominately used to carry out verification processes required for screwdriving systems in production.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# VERIFICATION PROCESSES FOR SCREWDRIVING TECHNOLOGY

In contrast to measurement and verification equipment appropriate for calibration, there are alternative procedures applied to equipment used in electric screw assembly systems to ascertain suitability of use in production.

There is no measurement standard for the dynamic calibration of torque, therefore, it is not possible to calibrate an electric screwdriving system. Where appropriate, a static calibration of the measurement transducer integrated in a screwdriver may be conducted. However, in production processes with additional influences, such as rotating masses, it may not be possible to obtain reliable readings with regard to the complete screwdriving system and consequently is not usually advisable.

## Verification of screwdriving tools

Screwdriving tools are tested for their compliance to specific data during manufacture. Type and performance test procedures are conducted (e.g. in accordance with VDI/VDE 2647, ISO 5393), as well as procedures for the realignment of shut-off accuracy under application-dependent dynamic operating conditions.

Furthermore, cyclical tests in production processes are envisaged to ensure the continuous fulfilment of accuracy requirements.

## Additional guidelines

The general valid guidelines for conducting testing processes – including required competencies and qualifications, such as described in the ISO 9001, the IATF 16949 and the ISO/IEC 17025 – are substantiated with additional guidelines for the screwdriving technology sector.

It is necessary to conduct regular dynamic verification of the measurement accuracy and repeatability of the screwdriving system equipment used in production. Suitable methods include regular verification, if applicable, including realignment of the reference values and the execution of machine capability tests (MFU). Machine capability tests can be conducted in relation to a tool – according to defined criteria in regards to screw joint hardness, speed and screw assembly – or in relation to the screw location – through analysis and simulation of a precise application.

Qualification requirements for personnel involved in all activities relating to screwdriving technology are prescribed in the VDI/VDE2637-1 in the form of coordinated qualification modules.

Calibration and verification procedures for screwdriving technology

| *Product group* | *Procedure* | *Documentation* |
|---|---|---|
| Measurement instrument | Calibration | DAkkS calibration certificate<br>Factory calibration certificate |
| Screwdriving technology | Realignment<br>Verification<br>Proof of capability | Factory certificate<br>Verification certificate<br>Machine capability certificate |

International service locations

- Amberg, Germany
- Lázně Bělohrad, Czech Republic
- Suzhou, China
- Lewisville, USA
- Whitchurch, United Kingdom
- Penang, Malaysia
- Zapopan, Mexico
- Chennai and Navi Mumbai, India

# DEPRAG SERVICES

We are glad to support you in the value retention and quality assurance of your products and can provide a wide range of services.

In order to maintain the reliability of your tools, we can set a precisely defined torque or can support you with the optimal parameterisation of your screwdriving procedure by conducting a screw joint analysis. We also offer machine capability studies as well as suitable testing equipment and the calibration of these instruments. Comprehensive training, maintenance and repair packages round off our program of services.

Further information relating to our services can be found in the product catalogs D3330 or D0080.

# ON-THE-SPOT SERVICE

For customers using DEPRAG production resources in their facilities, verification can also be carried out on location – from counter measurement and realignment, right up to machine capability studies. The global availability of the DEPRAG on-the-spot service enables rapid implementation. Further information can be found in the product catalog D3330.

## Our on-the-spot services

- Counter measurement/realignment including certificate
- Machine capability study including certificate
- Emergency service in case of system failure
- Maintenance and repairs
- Training

# BASIC PRINCIPLES AND TERMINOLOGY

## Calibration

Calibration is defined as the establishment and recording of deviations from accurate values by measurement tool readings under predetermined conditions (DAkkS-DKD-4).

## Realignment

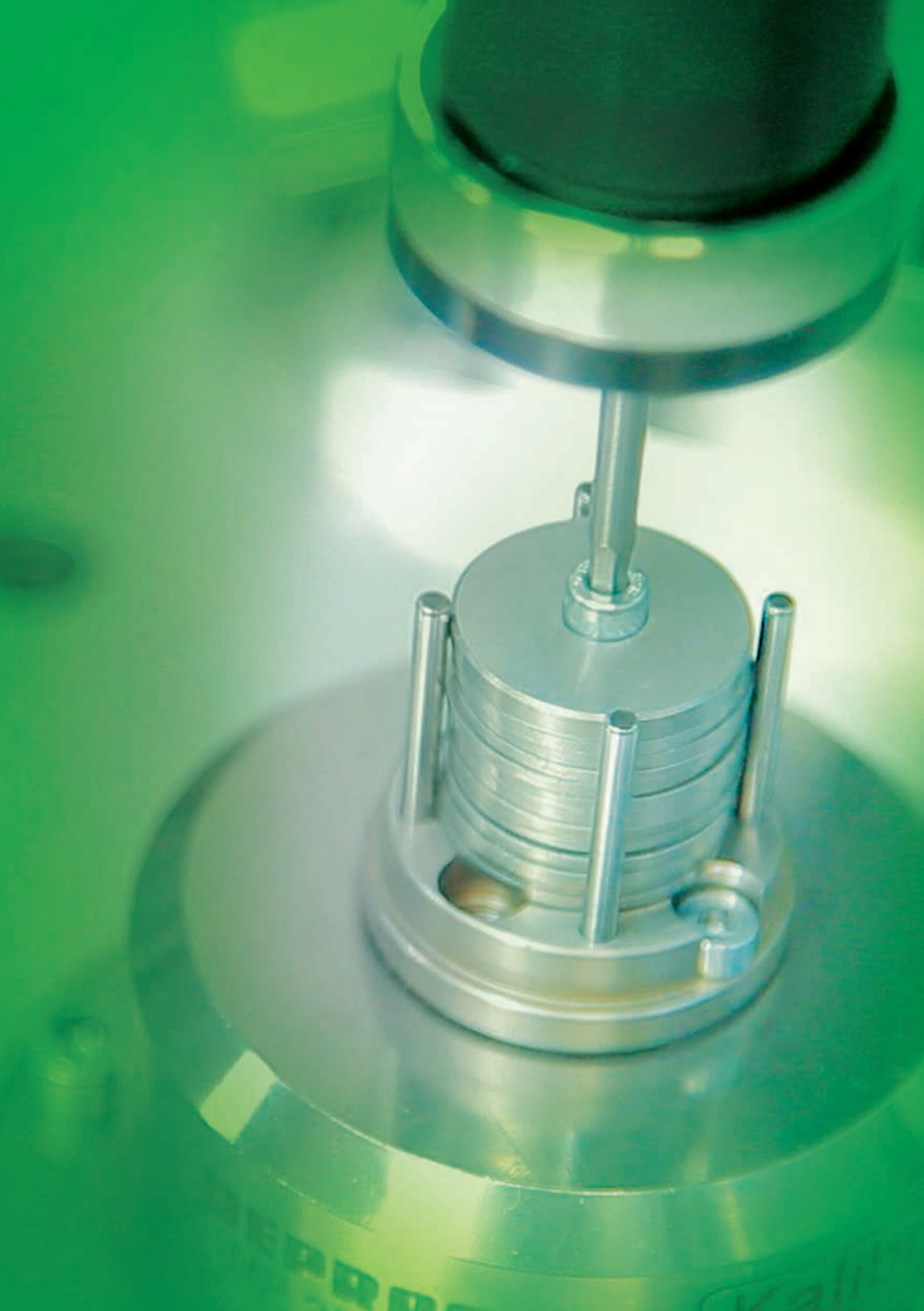
Realignment is the procedure undertaken to eliminate known systematic deviations between measurement tool readings and accurate measurement values.

## Verification/Testing/Counter measurement

Verification comprises the evidence of fulfilment of defined specifications and can be carried out routinely as an intermediate examination of a measurement tool to complement the calibration.

## Traceability

Traceability describes a procedure through which a measurement tool's readings can be compared at one or more stages with a national standard for relevant measurement values (DAkkS-DKD-4).



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