Overview of the new ISO 6789 standards for hand torque tools due for publication in 2016

March 2016 update

ISO 6789 will consist of the following parts, under the general title *Assembly tools for screws and nuts — Hand torque tools*:

— *Part 1: Requirements and methods for design conformance testing and quality conformance testing — Minimum requirements for certificates of conformance*

— *Part 2: Requirements for calibration and determination of measurement uncertainty*

Why has the standard changed?

ISO standards are generally reviewed every five years to ensure that they remain relevant to their users. The current third edition of ISO 6789 from 2003 was reviewed in 2008 and the participating members of the sub-committee voted for a revision.

Why was the change necessary?

Torque tools are generally used for the accurate tightening of threaded fasteners and the understanding of this subject is wider now that it was thirty years ago. From the first 1984 edition of ISO 6789 the standard has been updated to better meet the needs of users. A significant step was made in 2003 when the standard was laid out to define the requirements for engineering design, manufacturing quality control and in-use calibration of torque tools. Since the last revision in 2003, there has been pressure from several national bodies to ensure that traceable calibration as described in ISO 6789 is in compliance with other relevant ISO standards and specifically ISO/IEC Guide 98.

Why are there now two parts to the standard?

There are costs associated with maintaining traceable calibration equipment and generating uncertainty budgets. Not all users require traceable calibration and they do not wish to pay for these additional costs. Purchasers and users of torque tools therefore now have two choices of certification to suit their needs.

The new fourth edition has been written to describe calibration in technical language familiar to metrologists in Part 2, whilst leaving Part 1 to focus on design and manufacturing requirements.

Do I need both parts of the standard?

The Part 1 is essential for manufacturers but it does contain the process for loading the torque tool and so users of Part 2 will also need it.

Part 2 is essential for calibration laboratories that wish to calibrate torque tools to this standard. Manufacturers may wish to understand the calibration requirements of the measuring systems that they will need.

The International Standards Organisation is using a new system of combining related standards in to one bundled digital document. This means that users can buy Parts 1 and 2 of the standard at a beneficial price and with hyperlinks between relevant passages.

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What is the biggest change?

The concept of calibration has been removed from Part 1 because it was determined that stating a calibration result without determining the associated uncertainty does not follow the guidelines defined in ISO/IEC Guide 98.

The manufacturer now is required to produce a certificate of conformance, which states that the torque tool, identified by serial number, conforms to all relevant aspects of the standard. A tool produced to Part 1 will therefore have no reference to a calibration certificate.

The certificate of conformance gives documented confidence that the tool is capable of delivering torque values within the limits stated on the certificate of conformance.

The certificate of conformance has no period of validity as it is a statement that when the tool was produced it was in specification. (A parallel example would be the documentation for a portable electrical appliance. As new it has a certificate of conformance with relevant safety standards. An end-user has no need to subject it to portable appliance testing (PAT) in the "as new" condition. It would be tested for the first time during the next annual schedule for the area of use.

Customers who wish or need to have a traceable calibration certificate must request a calibration in accordance with Part 2 from a laboratory. Some manufacturers may offer this as an optional extra service.

A calibration certificate according to Part 2 does not state whether or not a torque tool is within specification, but simply states the readings found together with the uncertainty of calibration. It is for the user to determine whether the result is appropriate for their particular use.

The method of calculating maximum allowable deviation for Part 1 is not compatible with the method used for calculating measurement error in Part 2. It is not possible to use a calibration certificate from Part 2 to declare conformance with Part 1.

What other key issues will I need to look for?

Hand torque tools produced prior to the issue of the new standard may not have scale dial or display markings in accordance with the new standard. Calibration laboratories will need to address this issue when receiving product from their customers.

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What is new in Part 1?

1. The specification for maximum torque limits now includes hexagon drives as well as square drives.
2. The lower operating limit of tools is not limited to 20% but the tool must perform within specification from the lowest marked value. For indicating tools the area between zero and the lowest marked value must be identified as not calibrated. The tool must be permanently marked with the minimum and maximum torque values.
3. There are some changes to resolution requirements for mechanical and electronic scales.
4. The term for accuracy is now called “maximum permissible deviation”.
5. Manufacturers can now claim a smaller maximum permissible deviation than the 4% or 6% defined in the standard but they must meet the consequent requirements including the specification of the measuring device used for certification.
6. The number of cycles per minute allowable for the 5000 cycle endurance test has changed.
7. The effect on torque values of geometric changes to the torque tool, such as extension handles and flexible heads, has been included.
8. The torque measurement device now has to be calibrated at an accredited laboratory or at least to the requirements of Part 2 Annex C.
9. The loading requirements have been generally modified to improve consistency between loading systems. The minimum time (and maximum for screwdrivers) for torque application from 80% to 100% is now variable according to the torque value being reached.
10. The loading sequence is now three exercise loadings at maximum torque value (or nominal value for certain tools) without recording followed five recorded loadings at each of the three target values. (ten at the nominal or lowest value for certain tools)
11. The calculation of deviation reverts to the second edition. The 4% limits for a tool at a target value of 100 N·m are once again 96.00 N·m and 104.00 N·m.
12. The requirements for a certificate of conformance are described.
13. The marking requirements now include the force loading point on the handle as well as both maximum and minimum torque values.

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What is in Part 2?

1. The guidelines on 'calibration during use' from the third edition are in Part 2.
2. The requirements for calibration are based on the procedures shown in Part 1.
3. The requirement for the torque calibration system requires the maximum *"Relative Uncertainty Interval"* of the calibration device not to exceed ¼ of the anticipated torque tool maximum *"Relative Uncertainty Interval"*.
4. Measurement error from the third edition used rather than deviation from the second edition.
5. The various sources of uncertainty are identified. Laboratories working to the standard must take account of these elements. They are :
    a. Resolution of the torque tool
    b. Reproducibility of the torque tool
    c. The possible eccentricity of the output drive axis
    d. The interface between tool and calibration device
    e. Susceptibility of the tool to loading point variation
    f. Repeatability of the torque tool (established during the calibration)
    g. The uncertainty of calibration of the calibration device (from its calibration certificate)
6. The *"Relative Expanded Uncertainty"* is calculated using a coverage factor k to ensure a 95% confidence interval for the calibration result.
7. The contents of the Certificate of Calibration are specified.
8. Because the standard is complex, Informative Annexes A and B show examples of uncertainty calculation for a Type I and a Type II torque tool.
9. Unlike the Informative Annexes A and B, Annex C is provided as a Normative annex. It is to be used where the calibration device does not have a certificate that shows the maximum relative uncertainty interval. Where one has such a certificate, as Norbar calibration devices now do, there is no need to use Annex C.
10. The annex has been written using BS 7882 and DIN 51903 as a basis and will be familiar to many UK and German laboratories.