

What is Measurement Traceability?

by:

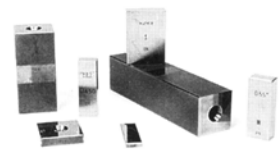
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An unbroken & verifiable chain of gage accuracy is vital in ensuring fastener dimensional accuracy.

calibration laboratory “transfers” their NIST number onto the fastener supplier’s gage calibration certificates.

The same NIST traceability number will appear on all gages calibrated by one calibration laboratory, whether the certificates are for gage blocks, ring gages, plug gages, etc. It is possible for two or more calibration labs to have the same NIST traceability number if all of those labs purchased their master gage blocks from the same gage block manufacturer.



Measurement traceability is the ability of a party to be able to prove that the measurements provided by its measuring instruments are linked to an internationally known value through an unbroken series of controlled measurement transfers. Measurement traceability is what gives a fastener supplier the confidence he needs that the products he ships conform to the product’s applicable standards.

Traceability: Simple, Yet Widely Misunderstood

Most people in the fastener industry have heard the term “Traceable to NIST,” but few actually know what this means. NIST stands for the **National Institute of Standards and Technology**. It is a part of the **U.S. Department of Commerce** who’s job it is to maintain the known standards of measurement to which all manufactured goods are made and compared.

In the fastener industry, the critical measurement for size is the careful maintenance of the measurement of length. To assure consistent quality production, manufacturers should maintain a definable link and relationship to the known measurement values by what is called “measurement transfer.”

Gage Block: Foundational Traceability Element

The fundamental length standard is the “gage block,” sometimes called the “jo block.” Gage blocks are usually purchased in inch sets having nine to 81 pieces ranging in lengths from 0.1000” to 4.0000” and in metric sets having 47 to 112 pieces ranging in lengths from 1.000 to 100.000 mm. Gage blocks are available in *Grades 1, 2 and 3*. *Grade 1* represents the highest order, meaning that it has the smallest deviation from its designated length value. In gage blocks 1” and shorter the allowable tolerances are shown below:

Grade 1	Grade 2	Grade 3
± 0.000002	$+0.000004/-0.000002$	$+0.000008/-0.000004$

Grade 1 gage blocks are generally used only in calibration laboratories for the purpose of calibrating other types of master gages. *Grade 2* and *Grade 3* gage blocks are generally used on the shop floor for setting and checking working gages.

NIST Numbers Transfer Down Traceability Chain

The most common series of measurement transfers is:



Gage block manufacturers send their master set of gage blocks to NIST for calibration. NIST certifies the blocks and issues a calibration certificate having a unique NIST number. The gage block makers then use those master blocks to control the manufacture of the sets of gage blocks they produce. The gage block manufacturers then “transfer” their NIST numbers to the calibration certificates associated with the blocks they produce and sell. Calibration labs (several of which are within gage manufacturing facilities) purchase their gage blocks from the block manufacturers. When the gage calibration laboratory performs calibrations on either new gages or on gages sent to them for recertification from fastener suppliers, the

Foundational Requirements Pertaining to the Verifiability of Measurement Traceability

The international accreditation standard for testing and calibration laboratories is *ISO 17025*. All *ISO 17025* testing laboratories are required to use only the calibration services of calibration laboratories that are also *ISO 17025* accredited to assure that measurement traceability is established and maintained by very stringent, verifiable procedures.

It is important for manufacturing accuracy that this traceability chain be carefully maintained at every link. The method and environmental controls for calibrating gage blocks in the USA are dictated by the **American Society of Mechanical Engineers (ASME)**, committee ASME B89.1.2M.

Some ask, “Why don’t all companies send their gage blocks directly to NIST to have them calibrated to shorten the traceability chain?” The answer is simple economics. NIST charges a minimum of US\$85.00 per block, plus a set-up charge to calibrate gage blocks. This makes the cost of calibrating an 81-piece gage block set over US\$7500.00. Gage block manufacturers generally charge approximately US\$5.00 per block and most calibration laboratories charge around US\$2.50 per block for calibrations.

Conclusion

Measurement traceability is critical in producing consistently conforming fasteners. Measurement traceability is not complicated. One measurement source “transfers” its measurement verification to the next party in the traceability chain. The maintenance of this unbroken, verifiable chain of measurements is critical in assuring fastener suppliers that the products they ship have accurate, NIST-traceable dimensions.

Using *ISO 17025*-accredited gage manufacturers and calibration labs can provide fastener suppliers with the greatest level of confidence that traceability chain integrity has been maintained due to the rigorous requirements of this internationally recognized standard. For more details on measurement traceability, contact the author or **Circle 209**. **FTI**

Greenslade & Company, Inc. is an ISO 17025 accredited provider of dimensional calibration services to suppliers of mechanical fasteners in the USA. The firm offers the “Three Guarantee Calibration Program” that guarantees five day or less turnaround, error-free certificates and the meeting or beating of all published calibration prices within the scope of Greenslade’s accreditation. The firm also supplies a range of fastener inspection equipment.

Joe Greenslade is a regular contributor of articles to this magazine. Greenslade has been active in the fastener industry since 1970 and has held positions with major fastener producing firms.

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