



Measurement Traceability & the Misuse of NIST Test Report Numbers

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This document details the traceability requirements of ANSI/ISO/IEC 17025:2017 “*General Requirements for the Competency of Testing and Calibration Laboratories*”. Additionally, the misuse of “NIST Test Report Numbers” as a requirement to show traceability is discussed.

What is Traceability?

Measurement traceability is the process of ensuring **calibrations and measurement results** are traceable to the International System of Units (SI) (*Système International d’unités*). The *International Vocabulary of Metrology—Basic and General Concepts and Associated Terms: 2008*, (VIM) defines traceability as: **Traceability (metrological)** – property of a measurement result whereby the result can be related to a reference through a documented unbroken chain of calibrations, each contributing to the measurement uncertainty. [VIM: 2008, 2.41]

The following included documents explain measurement traceability and the often misuse of NIST test numbers.

- Appendix A – *A2LA Policy on Measurement Traceability*
- Appendix B – *Quality 101-NIST Traceability* – Quality Magazine
- Appendix C – *Other Dimensions—Changing the Rules* – Quality Magazine
- Appendix D – Fluke Policy statement regarding the provision of NIST test numbers

ANSI/ISO/IEC 17025:2017 Metrological Traceability Requirements

The following excerpts from ANSI/ISO/IEC 17025:2017 Section 6.5 *Metrological Traceability* detail the requirements for establishing traceability for calibrations and measurement results. Laboratories fulfilling this requirement meet the requirements for traceability. Florida Standards Laboratory maintains traceability for measurement results by maintaining accreditation to ANSI/ISO/IEC 17025:2017 and using sub-contractors accredited to 17025 or by using certified reference materials for calibration of laboratory equipment.

“ANSI/ISO/IEC 17025:2017 Section 6.5 Metrological Traceability”

- **6.5.1** The laboratory shall establish and maintain metrological traceability of its measurement results by means of a documented unbroken chain of calibrations, each contributing to the measurement uncertainty, linking them to an appropriate reference.

NOTE1: In ISO/IEC Guide 99, metrological traceability is defined as the “**property of a measurement result** whereby the result can be related to a reference through a documented unbroken chain of calibrations, each contributing to the measurement uncertainty”.



- **6.5.2** The laboratory shall ensure that measurement results are traceable to the International System of Units (SI) through:
 - a) calibration provided by a **competent laboratory**; or

NOTE 1: Laboratories fulfilling the requirements of this document are considered to be competent.

- b) certified values of certified reference materials provided by a competent producer with stated metrological traceability to the SI; or
- c) direct realization of the SI units ensured by comparison, directly or indirectly, with national or international standards.
- **6.5.3** When metrological traceability to the SI units is not technically possible, the laboratory shall demonstrate metrological traceability to an appropriate reference, e.g.:
 - a) certified values of certified reference materials provided by a competent producer.
 - b) results of reference measurement procedures, specified methods or consensus standards that are clearly described and accepted as providing measurement results fit for their intended use and ensured by suitable comparison.

NIST Statement of Policy for Traceability

The following excerpts are from the NIST *Statement of Policy for Traceability*. The complete text of the document is available on the NIST website at <https://www.nist.gov/traceability/traceability-table-contents>.

NIST *Statement of Policy for Traceability* Section I.A.1 “What is traceability?”

The definition of traceability that has achieved global acceptance in the metrology community is contained in the *International Vocabulary of Metrology - Basic and General Concepts and Associated Terms* [1]: “...***property of a measurement result*** whereby the result can be related to a reference through a documented unbroken chain of calibrations, each contributing to the measurement uncertainty.

It is important to note that ***traceability is the property of the result of a measurement***, not of an instrument or calibration report or laboratory. It is not achieved by following any one particular procedure or using special equipment. Merely having an instrument calibrated, even by NIST, is not enough to make the measurement result obtained from that instrument traceable to realizations of the appropriate SI unit or other specified references. The measurement system by which values and uncertainties are transferred must be clearly understood and under control.

I.A.2 Is it correct to say that measurements or standards are traceable?

Only ***measurement results*** are traceable.

I.A.3 Is it correct to say that an organization is traceable?

Organizations cannot be traceable. Only ***measurement results*** can be traceable.



I.B.4 Is a NIST Test Report Number necessary and/or sufficient evidence of traceability?

Test report numbers issued by NIST are intended to be used solely for administrative purposes. Although they are often used to uniquely identify documents which bear evidence of traceability, test report numbers themselves do not address the issue of traceability and should not be used nor required as the sole proof of traceability.

I.C.3 What is meant by the phrase "traceable to NIST"?

According to the internationally recognized VIM (*International Vocabulary of Metrology—Basic and General Concepts and Associated Terms: 2008*) definition, metrological traceability is a property of a measurement result by which that result is related to specified reference standards, not to institutions. Accordingly, the phrase "traceable to NIST", in its most proper sense, is shorthand for "metrologically traceable to NIST's practical realization of the definition of a measurement unit" (see 2.43 in Reference [1]).



Appendix A – A2LA Policy on Measurement Traceability

American Association for Laboratory Accreditation (A2LA) – Document P102 – *A2LA Policy on Measurement Traceability*

Use of NIST Test Report Numbers as Evidence of Traceability

The NIST Calibration Program often receives calls to verify the authenticity of a NIST Report of Test numbers appearing on another organization's report. Although NIST can verify the authenticity of its report numbers, having an authentic number does not provide assurance or evidence that the measurement value provided by another organization is traceable. Not only should there be an unbroken chain of comparisons, each measurement should be accompanied by a statement of uncertainty associated with the farthest link in the chain from NIST, that is, the last facility providing the measurement value. NIST does not have that information; only the facilities that provided the measurement values to the customer can provide the associated uncertainties and describe the traceability chain.

To establish an audit trail for traceability, a proper calibration result should include: the assigned value, a stated uncertainty, identification of the standards used in the calibration, and the specification of any environmental conditions of the calibration where correction factors should be applied, if the standard or equipment were to be used under different environmental conditions.

Similarly, it is the policy of the National Conference of Standards Laboratories International (NCSLI) that test report numbers issued by NIST are intended to be used solely for administrative purposes. Although they are often used to uniquely identify documents which bear evidence of traceability, test report numbers shall not be used nor required as proof of the adequacy or traceability of a test or measurement.

It should also be noted that nationally and internationally recognized standards dealing with test and measurement quality requirements such as ANSI/NCSL Z540-1, ISO 10012, ISO/IEC 17025 and the ISO9000 series **do not require the use or reporting of NIST test report numbers to establish traceability.**



Appendix B -- Quality 101: Traceable to NIST, Explained

Quality 101: Traceable to NIST, Explained -- by Rich Rhoney -- Quality Magazine-Posted: December 2, 2010

The term NIST traceable is deciphered.

Many gage calibration and repair facilities often find themselves discussing the topic of National Institute of Standards and Technology (NIST) traceability with customers going through ISO audits. Confirming or tracking NIST gage traceability are concepts with which more ISO accredited manufacturers should familiarize themselves.

Most manufacturers have seen the statements on calibration certificates that read, "All measurements are traceable to NIST," when they purchase a micrometer, caliper or gage block set. But many of them still question what the word traceable really means.

The definition of traceability that has achieved global acceptance in the metrology community is contained in the International Vocabulary of Metrology (VIM) as "property of a measurement result whereby the result can be related to a reference through a documented unbroken chain of calibrations, each contributing to the measurement uncertainty."

Identifying Traceability

It is important to note that traceability is the property of the result of a measurement, not of an instrument or calibration report or laboratory. It is not achieved by following any one particular procedure or using special equipment.

Merely having an instrument calibrated, even by NIST, is not enough to make the measurement result obtained from that instrument traceable to realizations of the appropriate International System of Units (SI) or other specified references. The measurement system by which values and uncertainties are transferred must be clearly understood and under control.

The VIM definition states that metrological traceability is a property of a measurement results by which that result is related to specified reference standards, not to institutions. Accordingly, the phrase "traceable to NIST," in its most proper sense, is shorthand for metrologically traceable to NIST's practical realization of the definition of a measurement unit.

Referencing the NIST Number

Many imported gage certificates will state that equipment used for inspection is directly traceable to NIST and then a NIST test number will follow. Having a NIST test number is only a reference number for tracking internal documents at NIST. But how does one know its specific application?

Again, the NIST definition for test numbers helps explain.

"Test report numbers issued by NIST are intended to be used solely for administrative purposes," NIST says. "Although they are often used to uniquely identify documents which bear evidence of traceability, test report numbers themselves do not address the issue and should not be used nor required as the sole proof of traceability."

When reading that statement, one should contact the manufacturer of the gage he is using and ask what instruments or measurements the manufacturer is referring to.



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As the operator of that instrument, one must provide proof of an unbroken chain of traceability if an ISO auditor asks for that information, and an ISO/IEC 17025:2005 accredited laboratory is required to prove that its processes and procedures are traceable to NIST. The above procedures make that possible.



Appendix C -- Other Dimensions: Changing the Rules

Other Dimensions: Changing the Rules -by Hill Cox -- Quality Magazine -- Posted: December 2, 2010

Cal labs provide a bunch of numbers. What is done with those numbers is up to the customer.

Most of the world seems to function quite well using ISO 17025 as a standard for calibration laboratories. Unfortunately, some people are not content with this and must get their fingerprints all over it with interpretations or special requirements to get it to suit their industry. The fact that similar industries around the world don't feel the need to do so just doesn't seem to register.

To make matters worse, the basic functions of a calibration laboratory don't seem to be understood by many who want to download processes and conditions on them. Often these additional requirements are attempts to make up for lack of knowledge by users of the reports.

For the record, I should explain my understanding of what a calibration laboratory is all about—without getting too technical, of course. Basically, it is a place where you send your stuff to get calibrated and they issue a report with their measurements and a qualifier as to how good they think those measurements are—the uncertainty statement.

That's it. Their service provides you with a whole bunch of numbers. Sorry about that technical term there. What is done with those numbers is up to the customer. Now, if you want some sort of analysis, quality processes done with the data or reverse engineering, most labs will be pleased to accommodate you for an additional fee.

But all too often, everyone expects this additional service to be included in the calibration cost. It is not uncommon for the \$50 calibration job to consume \$200 worth of consulting, teaching, training, analyzing, reviewing and making decisions the customer alone should be making.

On a less dramatic scale, many requests that cal labs deal with are of little value to anyone so they can be just as problematic. In some cases, these gems are written into a version of ISO 17025 or are requested because an auditor says they should be on a report. Here are some examples:

Traceability numbers. Usually, they want to see a NIST number, which on its own means nothing and may not relate to anything in the lab issuing the report. Word on the street is that NIST is becoming increasingly fed up with its numbers decorating reports, often implying something that doesn't exist. A properly accredited ISO 17025 lab cannot be accredited without the actual documents being checked. **The standard makes it clear that reports do not have to show these numbers.**

Compliance statements. The lab is asked to state whether the item calibrated meets certain criteria, some of which may be values from the customer rather than a published standard. If the lab has provided the data and the customer knows the criteria, why is the lab's opinion required?

Acceptance criteria. Labs are frequently asked to provide acceptance criteria when that information is more reliably provided by the customer who knows how the equipment will be used. Too often numbers are lifted from published standards whose numbers are for new, not used, items.

Re-cal dates. This type of information may be requested so the report reader can see when the equipment used to do the calibration is due for calibration. I'm not sure what benefit will be derived from this information without knowing a lot more about the equipment and conditions of use.



Other requests in this regard relate to having the report show when the item that has been calibrated should be calibrated again. Because the standard forbids labs from doing so unless the customer has advised the frequency, the whole process seems redundant.

Equipment used. To comply with this request, the lab is supposed to list the principal equipment used for the calibration. The brevity of such listings often makes them useless. For example, for thread gage pitch diameter it might show “bench mike and wires.” I don’t know about you, but such a listing would not prove to me that they had the right hardware.

Massaging the data from the calibration report to make decisions has some of my colleagues concerned. Why? It looks like the customer is downloading decision-making to the lab to avoid responsibility. When the wheels fall off, all fingers will point to the lab that said the gage was “good.”

As can be expected, only the lawyers will win.



Appendix D – Fluke Policy statement regarding the provision of NIST test numbers



27 May 2014

Policy statement regarding the provision of NIST test numbers

Dear Customer.

We would first like to thank you for using **Fluke Corporation** metrology services. We hope your experience with our service was more than adequate in meeting your requirements.

In order to keep in stride with the most current metrological and quality assurance policies, **Fluke Corporation** no longer provides NIST test report numbers on our calibration reports or in supplemental documents. Providing these numbers is not considered to be sufficient evidence that the measurements taken on your device are traceable. To quote NIST from their policies listed on their website <https://www.nist.gov/traceability/traceability-table-contents>.

“Test report numbers issued by NIST are intended to be used solely for administrative purposes. Although they are often used to uniquely identify documents which bear evidence of traceability, test report numbers themselves do not address the issues listed in I.B.1 (what is involved with establishing metrological traceability) and should not be used nor required as the sole proof of traceability.”

Fluke Corporation maintains a corporate quality system that requires all calibrations to be performed with instruments that have a documented path of traceability to the International System of Units (SI). If you have purchased an accredited calibration, this provides additional assurance that the accreditation body has also thoroughly assessed the laboratory providing your calibration for appropriate traceability requirements. If you require evidence of traceability for a particular parameter to supplement what is on your certificate of calibration, please contact us and we can provide further information.

We hope this will suffice to help you meet your quality assurance requirements. Please do not hesitate to contact us if you require additional assistance.

Jeff C. Gust
Chief Corporate Metrologist

Fluke Corporation

Policy statement regarding the provision of NIST test numbers

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