

# Calibration Myths, Misunderstandings & Mistakes

## How Not to Worry about Calibration in Your Next ISO Audit

ASQ Section 1508

St Petersburg, FL

May 9, 2011

# What is calibration?

- To verify by comparison
- It is part of the science of measurement known as metrology
- Calibrations are performed on instruments used to measure (IMTE – inspection, measurement, test equipment) often referred to as gages
- Another instrument of known magnitude or correctness is used called a standard
- It is not the adjustment, cleaning, repair or other service performed on the gage

# What is verified in a calibration?

- Gage parameters
- There are 5 independent units of measure
  - temperature interval
  - linear distance
  - electrical current
  - frequency
  - mass
- All other measurement types are one or more of these independent units
  - example – torque is a combination of length and mass measured in foot pounds or Newton meters

# What is verified in a calibration?

- Most common parameters in manufacturing
  - Physical/dimensional
    - Force, mass, temperature, humidity, torque, length
  - Electronic
    - High frequency
      - Time, RF power, DC to 50 Ghz
    - Low frequency
      - AC/DC current and voltage, resistance

# Traceability

- An unbroken chain of comparisons
- NIST (National Institute of Standards and Technology) is part of the US Dept of Commerce
- NIST traceable means that the standard used to perform a calibration is traceable back to NIST.
- NIST traceable does not mean a calibration is accredited

# What does “accreditation” mean?

- In the US it usually means ISO/IEC 17025
- In January 2009 17025 superseded 9001:2008
- Prior to 1999 referred to as Guide 25
- Multiple accrediting bodies (AB)
  - A2LA, NVLAP, L-A-B, etc.
- Only an accredited lab can issue an accredited certificate of calibration
- A 17025 accredited lab no longer needs to maintain separate 9001 certification

# Tiers or levels of calibration

- Pass/fail sometimes called “short form”
- With data sometimes called “as found/as left” or “long form”
- Accredited – includes uncertainty data
  - Only accredited cals have the AB’s logo
- A lab can only perform an accredited cal if that parameter is included under their scope of accreditation



**SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005  
& ANSI/NC SL Z540-1-1994**

TECHNICAL MAINTENANCE INC.  
12530 Telecom Drive  
Temple Terrace, FL 33637  
Jack Shuler Phone: 813 978 3054

**CALIBRATION**

Valid To: March 31, 2012

Certificate Number: 1378.02

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations<sup>1</sup>:

**I. Chemical**

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
pH <sup>3</sup> – Individual Values	(4, 7, 10) pH	0.02 pH	Standard pH buffers
Conductivity <sup>3</sup> – Solution	(2 to 10 000) µS	1 %	Standard conductivity solutions

**II. Electrical – DC/Low Frequency**

Parameter/Equipment	Range	CMC <sup>2, 5, 6</sup> (±)	Comments
DC Current – Generate <sup>3</sup>	Up to 220 µA 220 µA to 22 mA (22 to 220) mA 220 mA to 2.2 A (2.2 to 11) A	67 µA/A + 10 nA 67 µA/A + 10 nA 76 µA/A + 1 µA 99 µA/A + 30 µA 0.037 % + 480 µA	Fluke 5720A
	(11 to 20.5) A	0.1 % + 750 µA	Fluke 5520A
DC Current – Measure <sup>3</sup>	Up to 100 nA 100 nA to 1 µA (1 to 100) µA 100 µA to 10 mA (10 to 100) mA 100 mA to 1 A	31 µA/A + 0.04 nA 21 µA/A + 0.04 nA 21 µA/A + 0.8 nA 21 µA/A + 0.05 nA 37 µA/A + 0.5 µA 0.012 % + 10 µA	HP 3458A

Sample first page of a Scope of Accreditation

# Accreditation issues

- Can an accredited lab perform a non accredited calibration? Yes
- Lab locations are accredited – not the company
  - A company can advertise being accredited at a location, but check the scope of accreditation to determine what parameters are accredited
- Non accredited cals are typically performed to ANSI/NCSL Z540-1-1994 (the old mil std)

# How does calibration fit into your quality management system?

Quality management systems call for an effective metrology system which includes formal, periodic, and **documented** calibration of all measuring instruments. ISO 9000 and ISO 17025 sets of standards and require that these traceable actions are to a high level and set out how they can be quantified.

**Documentation** can be divided into two types:

- One related to the task
- The other related the administrative program.

# Example of what task documentation must address

When should a gage be calibrated?

- With a new instrument
- When a specified time period is elapsed
- When a specified usage (operating hours) has elapsed
- When an instrument has had a shock or vibration which potentially may have put it out of calibration
- Sudden changes in weather or environment
- Whenever observations appear questionable

# Examples of what administration of the program documentation must address

- Where should the gage be calibrated
- Who is responsible for ensuring the gages are calibrated
- What tracking tool is utilized – ie database
- Where are the certificates of calibration maintained

# ISO audits

- Auditors usually dig into calibration
  - Easy to find errors
  - There is a lot of misinformation/misunderstandings about calibration they like to find
- The administrative documentation is usually the weak link
- For outsourced cals the supplier's accreditation is usually sufficient to satisfy an auditor
- Gages without supporting documentation (stickers, certs) of current cals are common targets

# Avoiding calibration issues in your ISO audits

- Establish on-going program
  - Don't just clean up a few weeks/months before audit
- Assign a central point of control
  - Distributed responsibility gives inconsistent results
  - Person assigned as central POC must have quality manager's on-going support
  - Be creative to meet your specific issues/problems and document those processes
- Acquire or develop an easy to use database
  - Track and report past due gages
- Perform internal audits

# Questions?



# Question

Some manufacturers recommend calibration for their equipment such as digital multi-meters but don't provide certificates of calibration or affix stickers when the units are purchased. Then there are some that do offer the certs and stickers at an additional fee. Does NIST actually have a standard that recommends calibration intervals based upon the device type? If so is it possible to gain access to this data?

# Answer

NIST does not recommend cal cycles. The best place to start to decide what a cal interval should be is what the OEM recommends. Then in order to properly determine what the cal interval should be for a particular item look at a history of the recent calibration reports and determine if the history of the item is stable enough to lengthen the recommended cal cycle. This works the other way too if you have a unit that is failing cal every year then the cal cycle needs to be moved from maybe 1 year to every six months. And one other major factor to consider before changing any recommended cal cycle is what the calibration cost is in relation to the potential loss of revenue due to bad or faulty parts being shipped out

# Question

We have come to the conclusion that digital multi-meters need to be considered somewhat as disposable equipment. Many of the DMMs are well built and priced such that it is more economical to buy them, use them for a year and then replace them as opposed to recalibrating them. Have you seen any trends such as this?

# Answer

The average cost of a decent multi meter is around \$300. The average cal cost is around \$35 and most meters can last several years if maintained correctly, so in short if a good meter such as a Fluke is purchased it can last a very long time and should only be replaced when repair charges exceed 50-75% of the replacement cost. Also many new Fluke meters have a life time warranty.

# Question

Can calibration labs can be a useful reference for test and measurement equipment based upon their observations of the “as found” condition of various equipment? In other words I have seen some quality standards written where frequency of calibration is based upon the calibration customer’s standard as opposed to the manufacturer or NIST standards. Do calibration labs accumulate data to support this sort of recommendation or is totally based upon data accumulated by the calibration customer? I know from my prior dealings with TMI you have been able to make equipment purchase recommendations.

# Answer

Yes, a good calibration lab stores all of this data and can filter thru it and make recommendations on their use. TMI calibrates well over a 100,000 items each year and have a lot of data in the parameters we test. However one thing that must always be considered is how the equipment is treated. Even the best and most expensive test equipment can fail very fast if mistreated or mishandled.