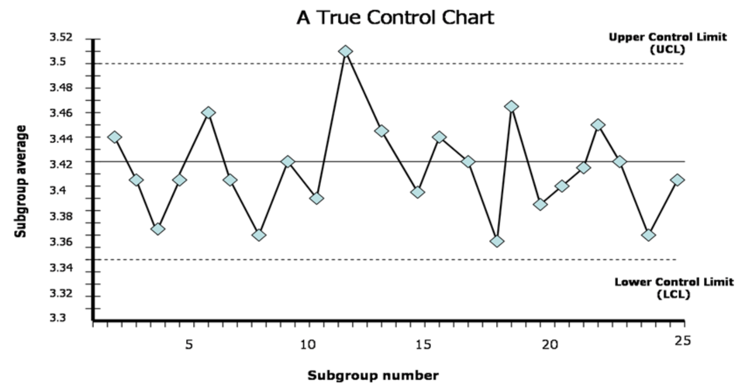
ISO/IEC 17025:2017 7.6 & 7.7 - Evaluation of Measurement Uncertainty & Validity of Results



Presented by:

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ISO/IEC 17025:2017 7.6 & 7.7 - Evaluation of Measurement Uncertainty & Validity of Results

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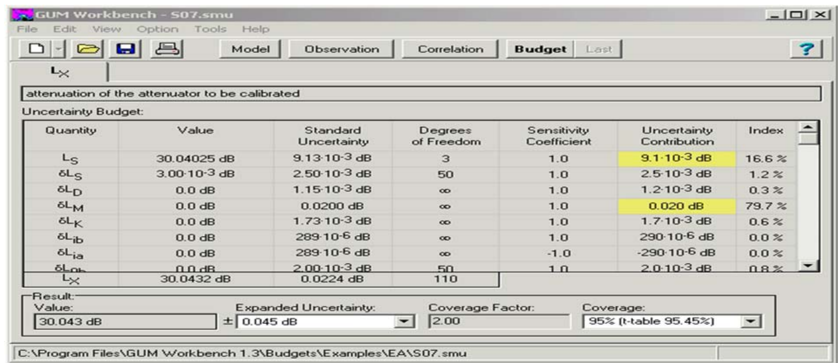
Also individual slides of this and previous presentation are available.

There is a space on your screen to ask questions. Please keep question related to today's topic. At the conclusion of the webinar, received questions will be reviewed and answered.

Duration of webinar is set for one hour.

7.6 Evaluation of Measurement Uncertainty

7.6.1 Laboratories shall identify the contributions to measurement uncertainty. When evaluating measurement uncertainty, all contributions that are of significance, including those arising from sampling, shall be taken into account using appropriate methods of analysis.



Quantity	Value	Standard Uncertainty	Degrees of Freedom	Sensitivity Coefficient	Uncertainty Contribution	Index
L_S	30.04025 dB	$9.13 \cdot 10^{-3}$ dB	3	1.0	$9.1 \cdot 10^{-3}$ dB	16.6 %
δL_S	$3.00 \cdot 10^{-3}$ dB	$2.50 \cdot 10^{-3}$ dB	50	1.0	$2.5 \cdot 10^{-3}$ dB	1.2 %
δL_D	0.0 dB	$1.15 \cdot 10^{-3}$ dB	∞	1.0	$1.2 \cdot 10^{-3}$ dB	0.3 %
δL_M	0.0 dB	0.0200 dB	∞	1.0	0.020 dB	79.7 %
δL_K	0.0 dB	$1.73 \cdot 10^{-3}$ dB	∞	1.0	$1.7 \cdot 10^{-3}$ dB	0.6 %
δL_{ib}	0.0 dB	$289 \cdot 10^{-6}$ dB	∞	1.0	$290 \cdot 10^{-6}$ dB	0.0 %
δL_{ia}	0.0 dB	$289 \cdot 10^{-6}$ dB	∞	-1.0	$-290 \cdot 10^{-6}$ dB	0.0 %
[illegible]	0.0 dB	$2.00 \cdot 10^{-3}$ dB	50	1.0	$2.0 \cdot 10^{-3}$ dB	0.8 %
L_X	30.0432 dB	0.0224 dB	110			

Sounds like an uncertainty budget as specified in PL-3 “PJLA Policy on Measurement Uncertainty”

ISO/IEC 17025:2017 does not require a formal procedure as specified in the 2005 Standard, however a procedure can still be used to incorporate the required elements of 7.6.1

7.6 Evaluation of Measurement Uncertainty

Uncertainty contributors are categorized as "Type A" or "Type B" based on the manner in which they are evaluated.

A Type A evaluation involves evaluation by statistical methods of a series of results.

Type B evaluation is evaluation by any means other than statistical (Reference books, published values, experience, judgment etc

$\sqrt{3}$

7.6 Evaluation of Measurement Uncertainty

Several types of distribution are commonly encountered in estimating uncertainty

1. *Normal Distribution (1 standard deviation is 1 standard uncertainty*
2. *Rectangular Distribution (1 standard deviation is obtained by dividing the limits of the distribution by* $\sqrt{3}$*)*
3. *Triangular Distribution (1 standard deviation is obtained by dividing the limits of the distribution by* $\sqrt{6}$*)*
4. *U Distribution (1 standard deviation is obtained by dividing the limits of the distribution by* $\sqrt{2}$*)*

Uncertainty contributors need to be ***identified****,* ***quantified*** *and* ***combined***

7.6 Evaluation of Measurement Uncertainty

expanded uncertainty for infrared temperature

uncertainty	description	uncertainty [in K]	source	distribution	divisor	standard uncertainty [in K]	comments
u1	homogeneity of black body	0.4	testing	Gaussian	2	0.20	Temperature profile from top to bottom of the black body
u2	repeatability	0.07	testing	Gaussian	1	0.07	Comparison of results of calibrations using two reference instruments
u3	uncertainty reference system	0.0034	Calibration Certificate	Gaussian	2	0.00	Measurement uncertainty of the reference calibration
u4	drift of reference	0.03	calibration certificate derivation	rectangular	$\sqrt{3}$	0.02	Reference standard drift - derived from past 2 years' calibration data
u5	digit error reference 2	0.0005	manufacturer information/ estimation	rectangular	$\sqrt{3}$	0.00	Least significant digit on digital display
u6	influence of emissivity	0.5	manufacturer information/ estimation	rectangular	$\sqrt{3}$	0.29	Temperature difference due to deviation of stated emissivity from actual
simple uncertainty with k=1 (68.3%) (RSS Method)						0.36	Emissivity is a measure of the efficiency in which a surface emits thermal energy. It is defined as the fraction of energy being emitted relative to that emitted by a thermally black surface (a black body)
expanded uncertainty with k=2 (95%)						**0.72**	

7.6 Evaluation of Measurement Uncertainty

Common Sources of Uncertainty

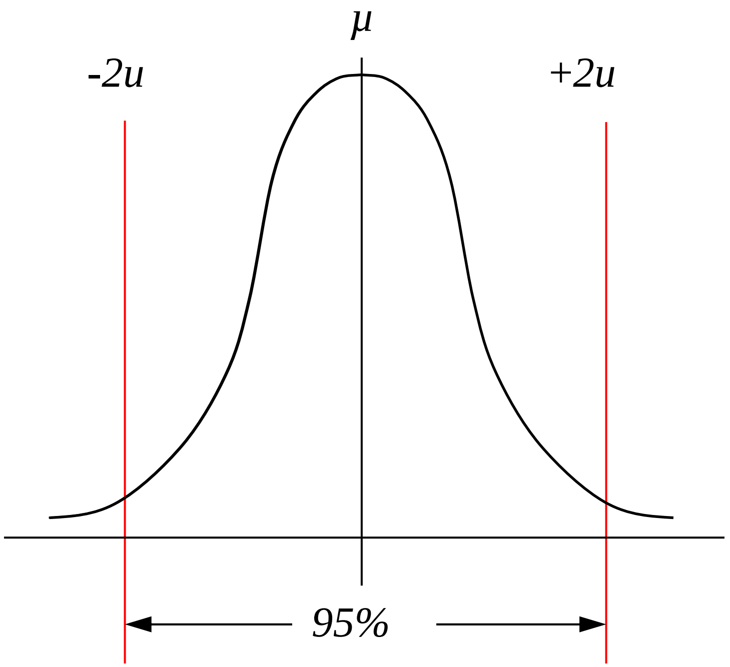
- *Uncertainty associated with the standard used*
- *Uncertainty associated with limited resolution*
- *Uncertainty due to repeatability*
- *Uncertainty associated with the environment*
- *Uncertainty associated with equipment accuracy, ie drift*
- Uncertainty in regards to properties and condition of the unit under test-e.g., reflectance, hardness, unit exhibits wear
- Manufacturer Specifications
- Homogeneity or Uniformity

7.6 Evaluation of Measurement Uncertainty

Distribution Types: Four common types of error distributions

***Normal distribution**:*

- *Defined by the mean (μ) and the standard deviation (u). +/- 2 standard deviations*
- *Frequently encountered in uncertainty analysis.*
- *Usually has a divisor of 1 or 1 standard deviation. Usually associated with Type A (statistical)*

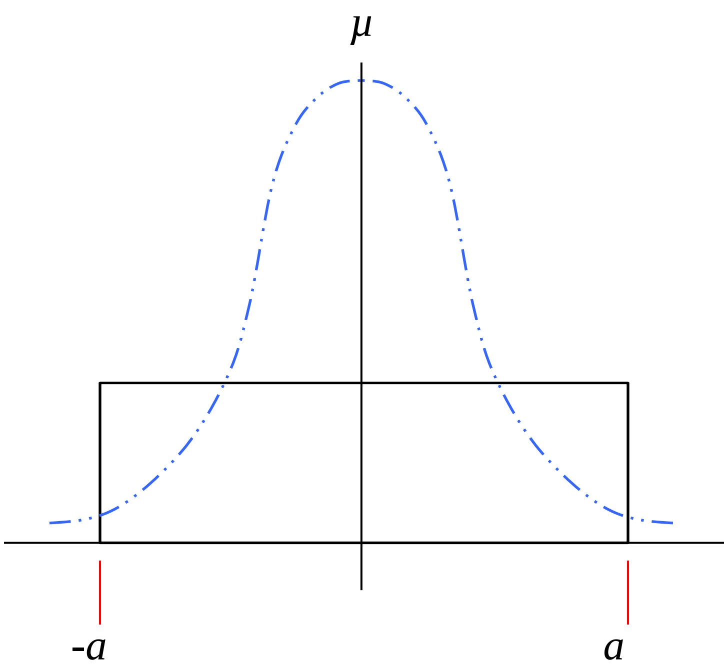


7.6 Evaluation of Measurement Uncertainty

Distribution Types: Four common types of error distributions

Uniform (Rectangular) *distribution:*

- *Not fully defined by the mean (μ) and the standard uncertainty (u).* $u = \frac{a}{\sqrt{3}}$ = *1.73*
- *Population has finite boundaries and all elements have an equal probability of occurrence.*

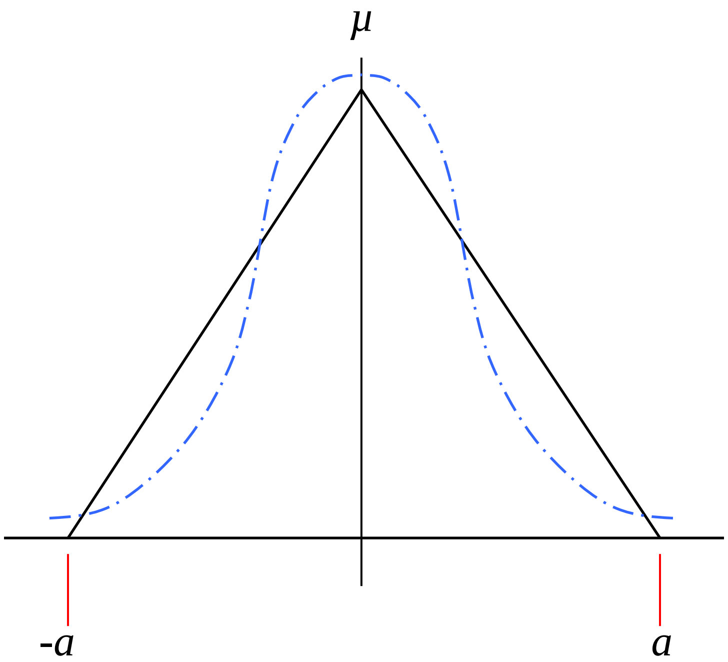


7.6 Evaluation of Measurement Uncertainty

Distribution Types: Four common types of error distributions

***Triangular** distribution:*

- *Not fully defined by the mean (μ) and the standard uncertainty (u).* $u = \frac{a}{\sqrt{6}} = 2.45$
- *Population has finite boundaries and elements near the center have a higher probability of occurrence.*

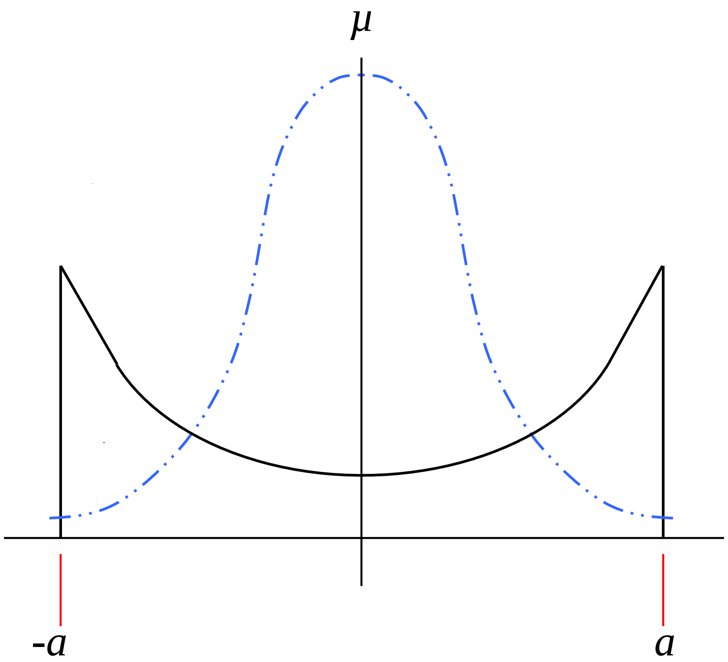


7.6 Evaluation of Measurement Uncertainty

Distribution Types: Four common types of error distributions

U *distribution: (Do not confuse with "U" the expanded uncertainty)*

- *Not fully defined by the mean (μ) and the standard uncertainty (u).* $u = \frac{a}{\sqrt{2}} = 1.41$
- *Population has finite boundaries and elements near the boundaries have a higher probability of occurrence.*



7.6 Evaluation of measurement uncertainty

The terms estimation and evalution is utilized in ISO/IEC 17025:2017 concerning uncertainty requirements

Where the test method precludes rigorous evaluation of measurement uncertainty, an **estimation** shall be made

A laboratory performing calibrations, including of its own equipment, shall **evaluate** the measurement uncertainty

7.6 Evaluation of Measurement Uncertainty

7.6.2 A laboratory performing calibrations, including of its own equipment, shall **evaluate** the measurement uncertainty for all calibrations.

In-house calibrations are specified in PJLA PL-2 for traceability.

Example: Testing lab calibrates their own balances which are used in testing activities.

Source of Uncertainty	Value a_i	Units	Probability Distribution	Divisor	Sensitivity Coefficient c_i	Standard Uncertainty $U_i(y)$ (mm)
Calibration Uncertainty	0.01	mm	Normal (k=2)	2	1	0.005
Resolution	0.005	mm	Triangular	√6	1	0.002
Cosine error	3	deg	Rectangular	√3	0.046	0.080
Temperature	2	C	Rectangular	√3	0.0023	0.003
Repeatability	0.02	mm	Normal (k=1)	1	1	0.020
Combined Standard Uncertainty $u_c(y)$						0.082
Expanded Uncertainty (k=2, 95% confidence) U						0.165

7.6 Evaluation of Measurement Uncertainty

7.6.3 A laboratory performing testing shall **evaluate** measurement uncertainty. Where the test method precludes rigorous evaluation of measurement uncertainty, an **estimation** shall be made based on an understanding of the theoretical principles or practical experience of the performance of the method.

What does this Mean?

7.6 Evaluation of Measurement Uncertainty

NOTE 1 In those cases where a well-recognized test method specifies limits to the values of the major sources of measurement uncertainty and specifies the form of presentation of the calculated results, the laboratory is considered to have satisfied 7.6.3 by following the test method and reporting instructions.

Rapid method kits that specify limits to the values of the major sources (contributors) of uncertainty, as well as well-recognized rapid methods where kits are used to determine qualitative results,

7.6 Evaluation of Measurement Uncertainty

NOTE 2 For a particular method where the measurement uncertainty of the results has been established and verified, there is no need to evaluate measurement uncertainty for each result if the laboratory can demonstrate that the identified critical influencing factors are under control.

NOTE 3 For further information, see ISO/IEC Guide 98-3, ISO 21748 and the ISO 5725 series.

ISO/IEC Guide 98-3 - Uncertainty of measurement —Part 3: Guide to the expression of uncertainty in measurement (GUM:1995

ISO 21748 -Guidance for the use of repeatability, reproducibility and trueness estimates in measurement uncertainty evaluation

ISO 5725 - Accuracy (trueness and precision) of measurement methods and results - Part 3: Intermediate measures of the precision of a standard measurement method

7.6 Evaluation of Measurement Uncertainty

NOTE 1 In those cases where a well-recognized test method specifies limits to the values of the major sources of measurement uncertainty and specifies the form of presentation of the calculated results, the laboratory is considered to have satisfied 7.6.3 by following the test method and reporting instructions

ASTM D130-10

Standard Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test"

Tests the corrosiveness of copper to aviation fuels, gasoline, kerosene, cleaners, distillates, lubricating oil or other hydrocarbons

ASTM D130

Summary

1) *Polished copper strip immersed in a specific volume of sample tested*
2) *Heated under temperature and time specific to class of material*
3) *Strip removed, washed and color and tarnish assessed against ASTM Copper Strip Corrosion Standard*

ASTM D130

Very detailed specifications for the equipment, materials, test strips, multiple procedures, interpretation of results, reporting – but no conventional uncertainty

Apparatus – Copper strip corrosion pressure vessel, test baths, and materials – *<u>Wash solvents, surface preparation/polishing materials, copper strip/preparation, ashless filter paper, disposable gloves</u>*

<u>ASTM Copper Strip Corrosion Standards – source and care/monitoring</u>

<u>Samples – collection, containers, headspace/fill, water filtering</u>

<u>Preparation of the copper strips</u>

<u>Procedures – Pressure vessels -aviation fuels, natural gasoline; test tube – diesel fuel, fuel oil, cleaners/solvents and kerosine, lubricating oils</u>

ASTM D130

Examination and Interpretation

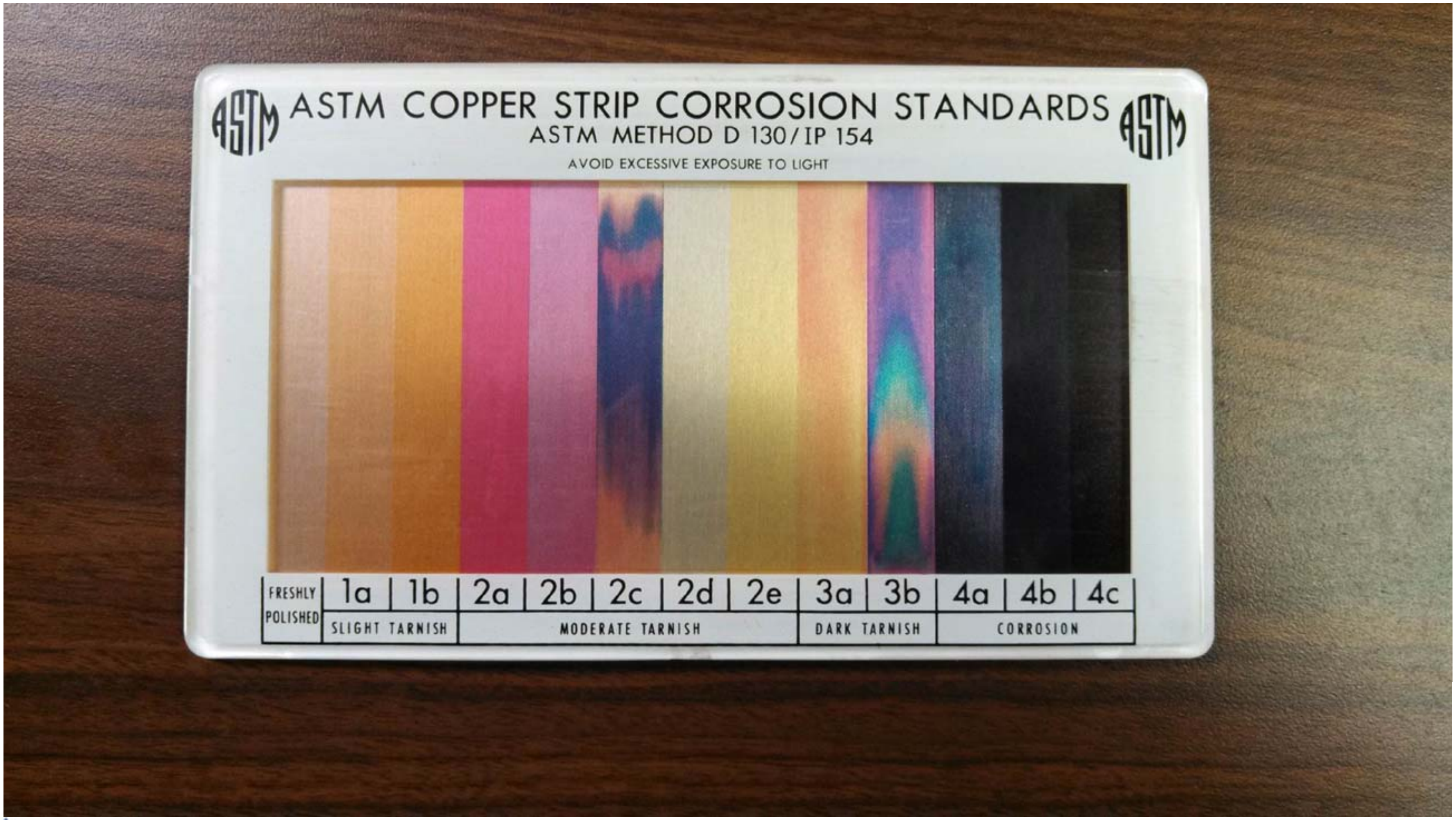
Empty contents of container, immediately withdraw strip, dry/blot or air dry, hold strip and ASTM standards such that light reflected at approximately 45 degrees will be observed

Interpretation of results – if in comparison to the standards the specimen is between – pick the most tarnished classification

Rules for resolving "uncertainties" between various standards – to put the strip into one of four categories and its "description"

Repeat test if fingerprint blemishes are seen, or spots due to water, or if sharp edges appear in another classification

ASTM D130



ASTM COPPER STRIP CORROSION STANDARDS
ASTM METHOD D 130/IP 154
AVOID EXCESSIVE EXPOSURE TO LIGHT
FRESHLY POLISHED
1a
1b
2a
2b
2c
2d
2e
3a
3b
4a
4b
4c
SLIGHT TARNISH
MODERATE TARNISH
DARK TARNISH
CORROSION

ASTM D130

Reporting

“Corrosion copper strip (Xh/Y°C), Classification Zp

Z = 1,2,3,4   p = classification description – a,b,c etc.

So how do you meet the requirements of ISO/IEC 17025:2017 7.6.3?
Following the method and by Note 1 – also simulation study in standard

How do you account for uncertainty? – reporting per method

Traceability – ASTM Copper Strip Corrosion Standard

What kind of data – classifications 1-4: slight tarnish, moderate tarnish, dark tarnish, corrosion

)

7.7 Ensuring the Validity of Results

Formerly ISO/IEC 17025:2005 – Section 5.9 – ‘Assuring the Quality of Test and Calibration Results’

PROFICIENCY TESTING

7.7 Ensuring the Validity of Results

7.7.1 The laboratory shall have a procedure for monitoring the validity of results. The resulting data shall be recorded in such a way that trends are detectable and, where practicable, statistical techniques shall be applied to review the results. This monitoring shall be planned and reviewed and shall include**, where appropriate**, but not be limited to:

7.7 Ensuring the Validity of Results

a) use of reference materials or quality control materials;

b) **use of alternative instrumentation that has been calibrated to provide traceable results**

c) functional check(s) of measuring and testing equipment;

7.7 Ensuring the Validity of Results

d) use of check or working standards with control charts, where applicable;

e) intermediate checks on measuring equipment;

f) replicate tests or calibrations using the same or different methods;

g) retesting or recalibration of retained items;

h) correlation of results for different characteristics of an item;

i**) review of reported results**

j) **intralaboratory comparisons;**

k) testing of blind sample(s).

Records should be made to support that these activities are being performed.

7.7 Ensuring the Validity of Results

7.7.2 *The laboratory shall monitor its performance by comparison with results of other laboratories,* ***where available and appropriate****. This monitoring shall be planned and reviewed and shall include, but not be limited to, either or both of the following:*

a) participation in proficiency testing;

NOTE: ISO/IEC 17043 contains additional information on proficiency tests and proficiency testing providers. Proficiency testing providers that meet the requirements of ISO/IEC 17043 are considered to be competent.

b) participation in interlaboratory comparisons other than proficiency testing

CHANGE!

7.7.2 – Requirement for participation in **either or both** Proficiency Testing (3.5) (PT) or Interlaboratory comparisons (3.3)

If your organization currently complies with PL-1 “PJLA Policy on Proficiency Testing”, then your organization will be meeting this requirement.

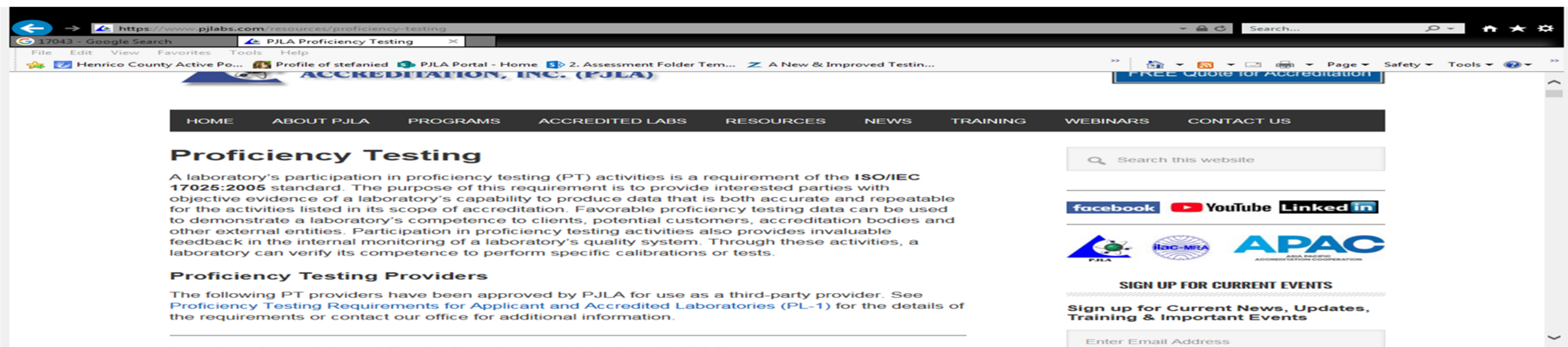
7.7 Ensuring the Validity of Results

interlaboratory comparison

organization, performance and evaluation of measurements or tests on the same or similar items by two or more laboratories in accordance with predetermined conditions

proficiency testing

evaluation of participant performance against pre-established criteria by means of *interlaboratory comparisons*



7.7 Ensuring the Validity of Results

From with PL-1 "PJLA Policy on Proficiency Testing",

7.2 When use of the above approved methods is considered by the organization as being impractical as a means of demonstrating proficiency the following activities, listed in their order of preference, may be used pending prior approval by PJLA:

7.2.1 intra-laboratory comparisons, and; 7.2.2 repeatability studies.

7.2.2.1 *Note:* If an organization wishes to proceed with one of the

above mentioned means, they must state in writing why

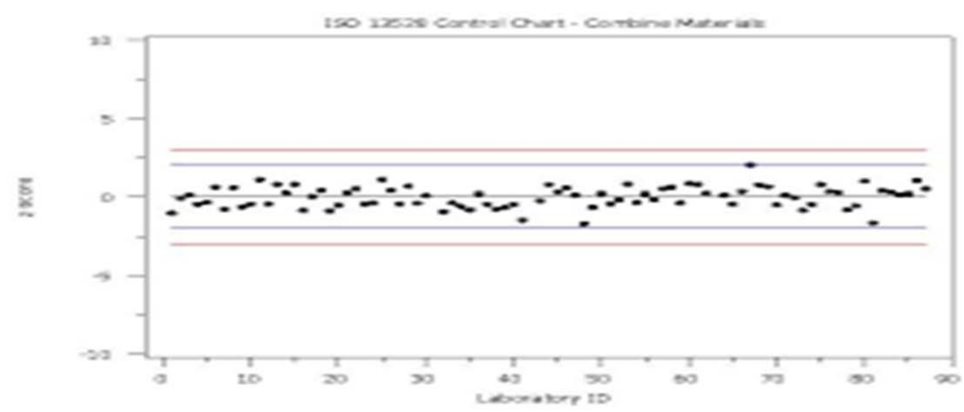
third party or inter laboratory comparisons are not feasible

and how they plan to conduct the test and analyze the data. . This document shall be submitted to PJLA headquarters for review and approval.

7.7 Ensuring the Validity of Results

7.7.3 *Data from monitoring activities shall be analyzed, used to control and, if applicable, improve the laboratory's activities. If the results of the analysis of data from monitoring activities are found to be outside pre-defined criteria, appropriate action shall be taken to prevent incorrect results from being reported.*

– concept of analyzing QC data to "control" and "improve" laboratory activities is additional



7.7 Ensuring the Validity of Results

The 2017 Standard is placing more emphasizes on interlaboratory comparison and proficiency testing. Other than the fact that ISO/IEC 17025:2017 and PJLA PL-1 requires it. They are beneficial tools for the laboratory to check the reliability of their results by comparison within their peer group and to demonstrate their performance to clients and accreditation bodies. With the increasing availability of PT schemes in many technical fields, the criteria for the selection of an appropriate scheme are becoming more important.

7.7 Ensuring the Validity of Results

Relevance of interlaboratory comparisons

Interlaboratory comparisons (ILCs) are performed for various reasons [1], e.g.,

- to validate test procedures,
- to certify reference materials,
- to assess the competence of laboratories

  or

- more general, to investigate the degree of comparability among laboratories.

7.7 Ensuring the Validity of Results

Irrespective of the specific aim(s) of an Inter Laboratory Comparison, the results can be used by a participating laboratory

- to check the performance of its test procedures and / or its staff,
- to demonstrate its competence towards clients and accreditation bodies,
- to gain useful information for the evaluation of its measurement uncertainty

For additional information regarding proficiency testing please visit the PJLA website:

http://www.pjlabs.com/resources/proficiency-testing

Thank You

Any Questions?

This time is allocated for questions. You should have a space provided for submitting questions.

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If a question is not answered, please submit directly to webinar@pjlabs.com

Save the Date

ISO/IEC 17025:2017 "Personnel"

Next scheduled webinar is set for 25-January-2021