

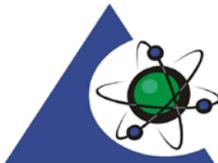
# Measurement Traceability Requirements and Calibration Certificate Review Exercise

Douglas Berg

Testing Technical Program Mgr

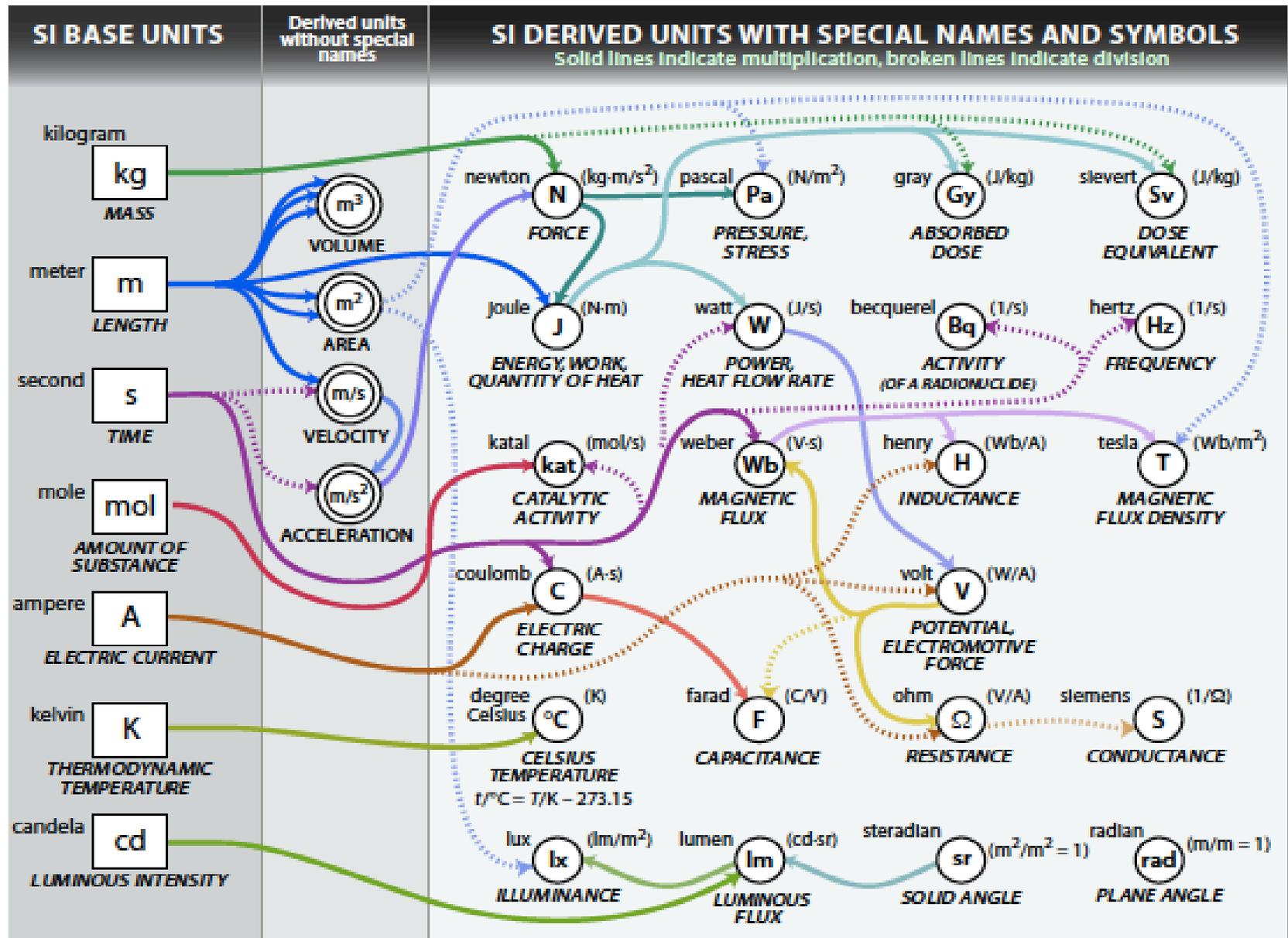
Perry Johnson Laboratory

Accreditation



# PJLA ...





# NIST Traceability ... What is Needed?

- **What do I need to do to support a claim of traceability?** To support a claim, the provider of a measurement result or value of a standard must document the measurement process or system used to establish the claim and provide a description of the chain of comparisons that were used to establish a connection to a particular stated reference. There are several common elements to all valid statements or claims of traceability:
  - a clearly defined particular quantity that has been measured
  - a complete description of the measurement system or working standard used to perform the measurement
  - a stated measurement result or value, with a documented uncertainty
  - a complete specification of the stated reference at the time the measurement system or working standards compared to it
  - an *internal measurement assurance* program for establishing the status of the measurement system or working standard at all times pertinent to the claim of traceability
  - an *internal measurement assurance* program for establishing the status of the stated reference at the time that the measurement system or working standard was compared to



# General Requirements in ISO 17025

- The general requirements for traceability in ISO/IEC 17025:2005:
  - *5.6.1 All equipment used for tests and/or calibrations, including equipment for subsidiary measurements (e.g. for environmental conditions) having a significant effect on the accuracy or validity of the result of the test, calibration or sampling shall be calibrated before being put into service.*



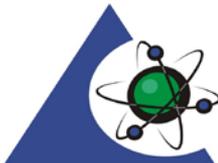
# General Requirements in ISO 17025

- It is an obligation of the laboratory to justify the need for calibration. In ISO/IEC 17025:2005, the further traceability requirement for calibration laboratories is:
  - *5.6.2.1.1 For calibration laboratories, the programme for calibration of equipment shall be designed and operated so as to ensure that calibrations and measurements made by the laboratory are traceable to the International System of Units (SI) (Système international d'unités).*



# General Requirements in ISO 17025

- For reference standards the traceability requirements of ISO/IEC 17025:2005 are:
  - *5.6.3.1 The laboratory shall have a programme and procedure for the calibration of its reference standards. Reference standards shall be calibrated by a body that can provide traceability as described in 5.6.2.1. Such reference standards of measurement held by the laboratory shall be used for calibration only and for no other purpose, unless it can be shown that their performance as reference standards would not be invalidated. Reference standards shall be calibrated before and after any adjustment.*



# General Requirements in ISO 17025

- Clause 5.6.2.1.1 in ISO/IEC 17025:2005 further states that “*When using external calibration services, traceability of measurement shall be assured by the use of calibration services from laboratories that can demonstrate competence, measurement capability and traceability*”.
- For equipment and reference standards that must be calibrated, *the ILAC policy is that they shall be calibrated by:*



# ILAC Policy ...

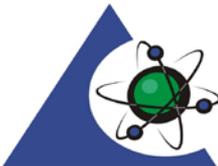
- 1) An NMI whose service is suitable for the intended need and is covered by the CIPM MRA. Services covered by the CIPM MRA can be viewed in Appendix C of the BIPM KCDB which includes the range and uncertainty for each listed service.
  - Note 1: Some NMIs may also indicate that their service is covered by the CIPM MRA by including the CIPM MRA logo on their calibration certificates, however the fixing of the logo is not mandatory and the BIPM KCDB remains the authoritative source of verification.
  - Note 2: NMIs from Member States participating in the Metre Convention may take traceability directly from the BIPM. The KCDB provides an automatic link to the relevant BIPM calibration services (including the range and uncertainty). Individual calibration certificates issued by the BIPM are also listed.



# ILAC Policy ...

2) An accredited calibration laboratory whose service is suitable for the intended need and is covered by the ILAC Arrangement or by Regional Arrangements recognised by ILAC.

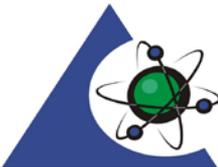
Note 3: Some calibration laboratories indicate that their service is covered by the ILAC Arrangement by including the ILAC laboratory combined mark or the accreditation symbol of the ***ILAC and/or regional MLA full member accreditation body*** on the calibration certificate and this may be taken as evidence of traceability.



# ILAC Policy ...

3a) An **NMI** whose service is **suitable** for the intended need but not covered by the **CIPM MRA**. In these cases *the accreditation body shall establish a policy to ensure that those services meet the relevant criteria for metrological traceability in ISO/IEC 17025:2005 and that the calibration certificate includes statements concerning measurement uncertainty and traceability.*

OR



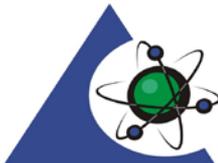
# ILAC Policy ...

- 3b) A **calibration laboratory** whose service is suitable for the intended need but not covered by the **ILAC Arrangement** or by **Regional Arrangements** recognised by **ILAC**. *In these cases the accreditation body shall establish a policy to ensure that those services meet the relevant criteria for metrological traceability in ISO/IEC 17025:2005 and that the calibration certificate includes statements concerning measurement uncertainty and traceability.*



# ILAC Policy ...

- Laboratories that have demonstrated traceability of their measurements through the use of calibration services offered according to 1) or 2) above have made use of services that have been subject to relevant peer review or accreditation. In the situation where 3a) or 3b) applies, this is not the case and the *laboratory must therefore ensure that appropriate evidence for claimed traceability and measurement uncertainty is available and the accreditation body shall assess this evidence. Further guidance is found in Annex A.*



# General Requirements in ISO 17025

*5.6.2.1.2 There are certain calibrations that currently cannot be strictly made in SI units. In these cases calibration shall provide confidence in measurements by establishing traceability to appropriate measurement standards such as:*

- the use of certified reference materials provided by a competent supplier to give a reliable physical or chemical characterization of a material;*
- the use of specified methods and/or consensus standards that are clearly described and agreed by all parties concerned.*

*Participation in a suitable programme of inter laboratory comparisons is required where possible.*



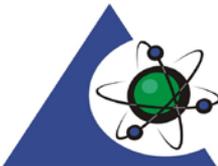
# ILAC Policy ...

4) Clause 5.6.2.1.2 can only be applied in the case in which the laboratory has demonstrated that the policy 1) to 3) cannot reasonably be met. *It is the responsibility of the laboratory to choose a way to meet 5.6.2.1.2 and to provide evidence that 5.6.2.1.2 is met. This evidence shall be documented and the documentation shall be assessed by the accreditation body.*



# ILAC Policy ... Testing

- The ILAC Arrangement in testing covers both testing laboratories accredited to ISO/IEC 17025:2005 as well as medical laboratories accredited to ISO 15189:2012. In ISO/IEC 17025:2005, the requirements for traceability in testing laboratories are:



# ILAC Policy ... Testing

*5.6.2.2.1 For testing laboratories, the requirements given in 5.6.2.1 apply for measuring and test equipment with measuring functions used, unless it has been established that the associated contribution from the calibration contributes little to the total uncertainty of the test result. When this situation arises, the laboratory shall ensure that the equipment used can provide the uncertainty of measurement needed.*

*NOTE The extent to which the requirements in 5.6.2.1 should be followed depends on the relative contribution of the calibration uncertainty to the total uncertainty. If calibration is the dominant factor, the requirements should be strictly followed.*



# ILAC Policy ... Testing

- 5) If the calibration of instruments used in testing contribute significantly to the overall uncertainty, the same policy for traceability applies (as detailed under 1) to 4) above).
- 6) *If a calibration is not a dominant factor in the testing result, the laboratory shall have quantitative evidence* to demonstrate that the associated contribution of a calibration contributes little (insignificantly) to the measurement result and the measurement uncertainty of the test and therefore traceability does not need to be demonstrated.



# ILAC Policy ... Testing

- In ISO/IEC 17025:2005 the further requirement for traceability for testing laboratories is:

*5.6.2.2.2 Where traceability of measurements to SI units is not possible and/or not relevant, the same requirements for traceability to, for example, certified reference materials, agreed methods and/or consensus standards, are required as for calibration laboratories (see 5.6.2.1.2).*



# ILAC Policy ... Testing

## ISO/IEC 17025:2005 5.6.3.2 *Reference materials:*

- *Reference materials shall, where possible, be traceable to SI units of measurement, or to certified reference materials. Internal reference materials shall be checked as far as is technically and economically practicable.*
- *At present, the ILAC Arrangement does not cover the accreditation of reference material producers (RMPs). At the regional level, APLAC & IAAC operate MRAs for RMPs and a number of countries operate systems for the accreditation of RMPs, and the number of accredited RMPs is therefore increasing*



# ILAC Policy ... RMPs

- The ILAC policy in regard to traceability provided by RMPs is:
  - 7) The values assigned to reference materials included in the BIPM KCDB or produced by *an accredited RMP under its accredited scope of accreditation to ISO Guide 34:2009, in combination with ISO/IEC 17025:2005, are considered to have established valid traceability (see ILAC General Assembly resolution ILAC 8.12).*



# ILAC Policy ... RMPs

- 8) The values assigned to reference materials covered by entries in the JCTLM database are considered to have established valid traceability.
- 9) *The majority of reference materials are produced by nonaccredited RMPs. These can be considered as critical consumables and the laboratory shall demonstrate that each reference material is suitable for intended use as required by clause 4.6.2 in ISO/IEC 17025:2005 or ISO 15189:2007.*



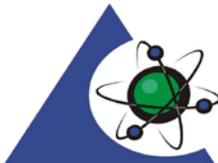
# Annex A

- Section 2 does not imply any hierarchy in the “quality” of traceability between options 1), 2), and 3a) and 3b). Each provides an acceptable route to establishing the traceability required by ISO/IEC 17025.
- However, when setting their traceability policy, accreditation bodies should encourage laboratories to make best use of these (note: internationally recognized) services whenever they are available.



# Annex A

- When traceability is established through either 3a) or 3b) of the policy ( ex: NMIs calibrating outside CIPM MRA, labs calibrating outside scope, labs not accredited at all):
  1. The accreditation body that must address this situation in its policy for traceability
  2. The laboratories will then need to comply with this policy
  3. Peer evaluators will assess the effectiveness of this policy during peer reviews in the regions



# Annex A

- Appropriate evidence for claimed metrological traceability may include but not be restricted to:
  - Records of calibration method validation (5.4.5)
  - Procedures for estimation of uncertainty calculations (5.4.6)
  - Documentation for traceability of measurements (5.6)
  - Documentation for assuring the quality of calibration results (5.9)
  - Documentation for competence of staff (5.2)
  - Documentation for accommodation and environmental conditions (5.3)
  - Audits to the calibration laboratory (4.6.4 and 4.14)



# ISO/IEC 17025 & ILAC P14

ISO/IEC 17025:2005 (clause 5.10.4.1 b) and ILAC-P14:12/2010 (section 6.1) establish three options which apply to calibration organizations when reporting the results of calibrations performed. These options are as follows:

- a) Report the measurement result and its associated uncertainty of measurement.
- b) Report the measurement result and a statement of compliance with an identified metrological specification or clauses thereof.
- c) Report the measurement result, its associated uncertainty of measurement and a statement of compliance with an identified metrological specification

If used for calibration – only a) and c) can be given.

If used for testing – b) can be applied, a) and c) encouraged.



# General Requirements for RMs - APLAC TC012

## Onus on the laboratories :

- Full records of identity, lot number, and source of each RMP
- Documentation of certified values includes: mode of establishing metrological traceability of assigned values, instructions on storage and use, homogeneity and stability, and expiration dates
- Matrix of reference materials should match application or effects accounted for
- Uncertainties of assigned values and verification of RMs appropriate for the test methods and contributions, if significant, included in estimation of the total measurement uncertainties.



# General Requirements for RMs - APLAC TC012

## Onus on the laboratories (cont'd):

- If standard test method specifies a particular RM for calibration, the lab using it has deemed to meet the ISO/IEC 17025 requirements
- Reports should state the method used
- Also if a regulation specifies a particular RM the laboratory has met the traceability requirement by using it



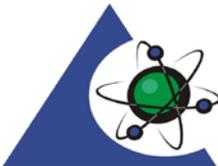
# RMs from NMIs or DIs - APLAC TC012

- CRMs from an appropriate National Metrology Institute (NMI) or Designated Institute (DI) are acceptable the the certificates include means of establishing traceability to SI or a reference and the uncertainties of the certified values
- ILAC “appropriate” means participation in BIPM ILCs or, for chemicals, CIPM Consultative Committee for Amount of Substance (CCQM)
- Laboratories using CRMs from NMIs and DIs should check the certificates carefully
- Give the large number of chemicals, concentration, and matrices ... other producers many have to be used ....



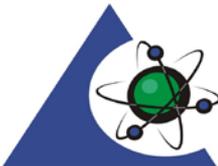
# Accredited Providers of RMs - APLAC TC012

- ILAC resolution 2005 – accreditation of RMPs to ISO Guide 34 with ISO/IEC 17025 to be included under ILAC MRA
  - ILAC working on it
  - APLAC – MRA for RMP in established 2007 – assess to ISO Guide 34 and ISO/IEC 17025
- RMPs accredited by APLAC MRA signatories are considered competent, use of their CRMs is considered to meet traceability requirements. Laboratories using these CRMs not required to verify competence or the CRMs produced



# Accredited Providers of RMs - APLAC TC012

- When CRMs are available from NMIs or DIs AND accredited RMPs .. Laboratories may chose the most appropriate source that meets their need.
- Factors include: matching matrices, analyte concentrations, measurement uncertainties of assigned values, costs, and the need to have certain results traceable to a particular NMI or DI ...



# Producers other than NMIs, DIs, or Accredited RMPs- APLAC TC012

- For these producers RMs and CRMs laboratories need to verify:
  - Assigned values are reliable
  - Materials are sufficiently homogeneous and stable for use
- Extent of verification depends on producers information, the nature of the RM/CRM and certified properties.



# Producers other than NMIs, DIs, or Accredited RMPs- APLAC TC012

- Laboratories should use two independent sources of RMs when available.
- As far as practicable verify the materials values agree within specified limits that are suitable for the application
- If another source is not available use a second lot from same source (less preferred)
- If these are not possible, consider using methods based on physical/chemical properties – melting point, boiling point, IR etc to confirm identity and purity



# Commercial Chemicals and Standard Solutions - APLAC TC012

- Laboratories use commercial chemicals to prepare “standard solutions”. Some purchase these commercially. These are often not certified and traceability is not provided by suppliers
- If these have a significant effect on the uncertainty – laboratories should have a defined system and procedure for verifying the standard solutions or calibration mixtures whether produced in-house or purchased.



# Traceability & Testing

- PJLA Policy PL-2
- While written with an emphasis on calibration activities ... Reinforces impact on testing organizations as described in ISO 17025
  - Testing organizations must demonstrate traceability to the SI through an unbroken chain supported by objective evidence.
  - If traceability to SI not applicable – traceability to applicable & accepted reference standards/materials produced by a *competent* supplier



# Traceability & Testing

- Must have documented procedures for verification, transportation and storage of reference standards/materials
- If organization chooses to reference traceability on reports etc. it must note how it is traceable to the SI or the standards/materials.
- Example: *“The test results published in this report were obtained using equipment capable of producing results that are traceable to NIST and through NIST to the International System of Units (SI)”* - or equivalent/same intent



# Traceability & Testing

- PJLA requires external calibration sources to be accredited or deemed competent by an NMI that is a CIPM signatory (ex. a NIST Certificate of Traceability issued to State Labs)
- PJLA recognizes the accreditation of other ILAC/APLAC MRA signatories – lab to have current certificates and scopes on file
- Use of non-accredited providers – requires extra work ...



# Traceability & Testing

- Non-accredited, external calibration providers approved on a case by case basis – PJLA Assessors and HQ
- Laboratory/organization solely responsible for verifying the traceability of the provider or the calibrations provided
- Copies of all documents provided by laboratory to PJLA along with a completed LF-123 Form – available from PJLA HQ



# Traceability & Testing

- All documents and records to be available to PJLA assessors and/or staff
- PJLA reserves right to reject a claim
- If traceability can not be established/supported
  - initiate removal of affected tests etc. from the scope
- Laboratories/organizations should reference NIST or other NMI web sites for information required to established traceability



# So Far: Questions? ... Discussion?... Comments?



# Let's Review some Certificates

- What follows are some calibration and CRM certificates and supporting information regarding the organization as a vendor/supplier.
- Based on the information on the previous slides, will they be appropriate and fit for use for the evident purpose and would they be adequate to meet the requirements for traceability?





# National Institute of Standards & Technology

## Certificate of Analysis

### Standard Reference Material 1766

#### Low Alloy Steel

(In Cooperation with the American Society for Testing and Materials)

This Standard Reference Material (SRM) is in the form of a disk, approximately 34 mm (1 3/8 in) in diameter and 19 mm (3/4 in) thick, and is intended for use in optical emission and X-ray spectrometric methods of analysis.

<u>Element</u>	<u>Certified Value<sup>1</sup></u> <u>% by Wt.</u>	<u>Estimated<sup>2</sup></u> <u>Uncertainty</u>
Carbon	0.015	0.001
Manganese	0.067	0.002
Phosphorus	0.002	0.001
Sulfur	0.0024	0.0002
Silicon	0.010	0.005
Copper	0.015	0.001
Nickel	0.021	0.002
Chromium	0.024	0.001
Vanadium	0.009	0.001
Molybdenum	0.0035	0.0005
Titanium	0.0005	0.0002
Cobalt	0.0020	0.0005
Tin	0.0010	0.0005
Aluminum	0.012	0.002
Niobium	0.005	0.001
Arsenic	0.0035	0.0005
Lead	0.003	0.001
Antimony	0.0005	0.0002
Silver	0.0005	0.0001
Boron	0.00012	0.00006
Nitrogen	0.0033	0.0003

<sup>1</sup>The certified value listed for a constituent is the present best estimate of the "true" value based on the results of the cooperative program for certification.

<sup>2</sup>The estimated uncertainty listed for a constituent represents an evaluation of the combined effects of method imprecision, possible systematic errors among methods, and material variability and is based on judgment. No attempt is made to derive exact statistical measures of imprecision because several methods were used in the determination of most constituents.

The overall coordination of the technical measurements leading to certification was performed under the direction of J.I. Shultz, Research Associate, ASTM/NIST Research Associate Program.

The technical and support aspects involved in the preparation, certification, and issuance of this Standard Reference Material were coordinated through the Standard Reference Materials Program by P.A. Lundberg.

Gaithersburg, MD 20899  
February 26, 1993  
(Revision of certificate dated 6-5-89)

William P. Reed, Chief  
Standard Reference Materials Program

(over)





# National Bureau of Standards

## Certificate

### Standard Reference Material 1452

#### Thermal Resistance

#### Fibrous Glass Blanket for High Precision Measurements

This Standard Reference Material (SRM) is intended for use in the evaluation of a guarded hot plate (GHP) or the calibration of a heat flow meter (HFM). Both of these apparatuses are used to measure the thermal resistance of insulating materials. Each unit of SRM 1452 is an individually characterized specimen from the same lot of material as SRM 1451 [4]. SRM 1452 consists of fibrous glass made into a low-density blanket bonded with phenolic resin. It is supplied as a fibrous glass batt of nominal dimensions 60 x 60 x 2.54 cm. The material was produced for NBS by Manville Corporation. The bulk density of the lot of material ranges from 10 to 16 kg/m<sup>3</sup> (0.6 to 1.0 lb/ft<sup>3</sup>).

The certified value of the material resistance,  $R_0$ , of specimen B4557 at 297.1 K and at a thickness of 2.540 cm is 0.6261 m<sup>2</sup>·K/W. The corresponding value of apparent thermal conductivity is 0.04057 Wm<sup>-1</sup>·K<sup>-1</sup>. The certified value was established with an estimated uncertainty of ±1.4 percent for a 95 percent confidence level. The statistical bases for the estimated uncertainty and the experimental details are described in reference [1]. The specimen was measured on a HFM apparatus with a guard size of 61.0 x 61.0 cm square, and a metered-area size of 25.4 x 25.4 cm, according to ASTM Test Method C-518 [2]. This HFM apparatus was calibrated with the NBS one-meter GHP apparatus [1], according to ASTM Test Method C-177 [3]. The estimated uncertainty is applicable for an apparatus with a metered area of 25.4 x 25.4 cm square. The estimated uncertainty is greater for other metered areas [1]. For example, if a user apparatus has a metered area that is one-half or twice this assumed metered area, the estimated uncertainty is ±1.8 percent for a 95 percent confidence level. The estimated uncertainty for an apparatus with a 10.2 x 10.2 cm metered area is ±2.1 percent for a 95 percent confidence level.

The overall direction and coordination of the certification of this SRM and technical measurements were performed by B.G. Rennex; assistance in certification measurements was given by T. Somers both of the Building Physics Division; and technical advice and collaboration was provided by J. Hust of the Chemical Engineering Science Division.

The technical support aspects in the preparation, certification, and issuance of this SRM were coordinated through the Office of Standard Reference Materials by R.K. Kirby and R.L. McKenzie.

April 14, 1986  
Gaithersburg, MD 20899

(Over)

Stanley D. Rasberry, Chief  
Office of Standard Reference Materials



## Calibration Certificate

201 Wolf Drive • P.O. Box 87 • Thorofare, NJ 08086-0087 • Phone: 856-686-1600 • Fax: 856-686-1601 • www.troemner.com • e-mail: troemner@troemner.com

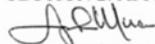
Page 1 of 7 Pages  
Weight

Certificate Number 698370-1  
Date of Calibration 08-JAN-2013

### SECTION 1: NAME AND ADDRESS OF CUSTOMER



### SECTION 2: APPROVED SIGNATORY



Joseph Moran, Metrology Manager

### SECTION 3: PERSON PERFORMING WORK

Annemarie Love

### SECTION 4: CERTIFICATE INFORMATION

Description of Masses: Test Weight

Accuracy Class	: NIST 105-1 Class F	Date Received	: 20-DEC-2012
Order Number	: 13414	Date of Calibration	: 08-JAN-2013
Construction	: Two Piece	Date of Issue	: 09-JAN-2013
Material	: Stainless Steel	Weight Range	: 100g

### SECTION 5: ENVIRONMENTAL CONDITIONS DURING TEST

Temperature: 21.22°C      Pressure: 767.97 mm Hg      Relative Humidity: 46%

### SECTION 6: PERTINENT INFORMATION

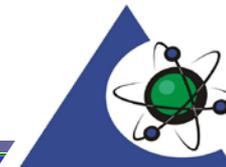
The Weights listed on this calibration report have been compared to reference mass standards that are directly traceable to the National Institute of Standards and Technology under Test No. 822-275872-11.

Reference standards and balances used to perform the calibration are listed in Section 10.

The weights calibrated for this report have been calibrated in accordance with Troemner's calibration process. The calibration performed meets Level I criteria as described in the NIST/NVLAP Technical Guide 150-2.

This calibration also meets specifications as outlined in ISO 9001, ISO/IEC 17025, ANSI/NCSL Z540-1-1994, NRC Document 10CFR50 Appendix B, and applicable documents.

This certificate of calibration shall not be reproduced except in full, without the written approval of Troemner, LLC. This certificate of calibration must not be used by the customer to claim product endorsement by NIST, NVLAP or any agency of the U.S. government.



Certificate No.: 030310-468-080515

Mettler Toledo  
Service Business Unit Laboratory  
1900 Polaris Parkway  
Columbus, OH 43240  
1-800-METTLER

# METTLER TOLEDO

ISO 17025 Accredited  
ANSI/NCSL Z540-1 Accredited



CALIBRATION CERT #1788.001

## Balance Calibration Certificate

### Customer

Company:

Address:

City:

Zip/Postal:

State/Province: Illinois

### Device

Manufacturer: Mettler Toledo Serial No.: B106109848

Model: XP6 Asset No.: N/A

Max Capacity: 6.1 g Readability: 0.000001 g

Dept./Room: BALANCE ROOM

Terminal Type: PAT Serial No. Terminal: B106109848

Procedure Statement: The device referenced in this document has been metrologically tested in accordance with METTLER TOLEDO Work Instruction AW1704L. All translations into other languages are based on the referenced work instruction, which is in English.  
This certificate refers to: As Found and As Left

Test Date: 5-Aug-2015 Next Cal. Due Date: 29-Feb-2016

Service Technician: Joe Krieb Signature: ELECTRONIC SIGNATURE

This certificate is issued in accordance with the conditions of accreditation granted by A2LA, which is based on ISO/IEC 17025. A2LA has assessed the measurement capability of the laboratory and its traceability to recognized national standards.

This certificate may not be partially reproduced, except with the prior written permission of the issuing laboratory and A2LA.

Form No.: AF1717L

Software Version: 4.6.1.5

This is an original document, an electronic copy is retained by METTLER TOLEDO

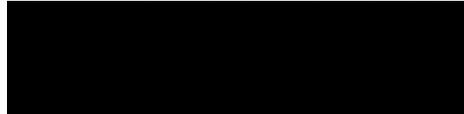
Page 1 of 4  
12/05



PJLA

**Mitutoyo**MITUTOYO CANADA INC.  
2121 Meadowvale Blvd.  
Mississauga, Ontario L5N 5N1  
Tel (905) 821-1261 Fax (905) 821-4968

# Certificate of Calibration

**Property of:****Certificate Number:** 10133363**Date of Calibration:** October 13, 2015**Name of Product:** DIGITAL CALIPER, 6 INCH**Date of Issue:** October 13, 2015**Model Number:** 500-752-10**Technician:** WJB**Serial Number:** 11563478**Temperature:** 20°C ± 0.1°C**Range:** 0- 6 in**Humidity:** 45 – 50% RH**Manufacturer:** MITUTOYO**Environment:** CLAS Type 1 Laboratory**Measurement Method:** Comparison**Procedure:** CLTM-1

*We hereby certify that the calibration results are the data shown in the attached sheet.*

*The calibration Laboratory Assessment Service (CLAS) of the National Research Council of Canada (NRC) has assessed and certified specific calibration capabilities of this laboratory and their traceability to recognize national measurement standards and to the International System of Units (SI). This certificate of calibration is issued in accordance with the conditions of certification granted by CLAS and the conditions of accreditation granted by the Standards Council of Canada (SCC). Neither the CLAS nor the SCC guarantees the accuracy of individual calibrations by accredited laboratories.*

**Measurement Uncertainties:** $\pm (290 + 1.6L) \mu\text{in}$ , L in inch

*Uncertainties specified in this report are expanded uncertainties representing a confidence level of approximately 95% obtained by multiplying the combined standard uncertainty by a coverage factor of k=2. For more detailed information refer to GUM (Guide to Expression of Uncertainty in Measurement, 2009 Edition).*

**Approved By:**

*Bill Baleka, Senior Calibration Technician*

*The issuing laboratory owns copyright of this certificate. The certificate may not be reproduced other than in full except with the prior written consent of the issuing laboratory.*

Page 1 of 2



## CALIBRATION CERTIFICATE

AS FOUND    AS LEFT    X

BJ151020-2L

	Contact: Eli Skaff Phone: (519) 737-6330
<b>Model #</b>	<b>Serial #</b>
Machine: CV-2000	540103

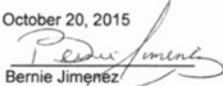
Calibration ID#	Certificate #	Gage Blocks	Nominal	Actual (mm) Downward
140682	10062515	1mm	1.00002 mm	1.0000 mm
140225	10062515	2mm	2.00001 mm	2.0011 mm
130748	10062515	4mm	4.00004 mm	3.9989 mm
150525	10062515	10mm	10.00004 mm	10.0013 mm
143502	10062515	20mm	20.00006 mm	19.9998 mm
150578	10062515	40mm	40.00003 mm	39.9989 mm

Pitch Gage ID#	Certificate #	Pitch (mm)	Actual Pitch X Axis (mm)
MIT-05788	478326	1.0000 mm	1.0001 mm

Pin Gage ID#	Certificate #	Diameter (mm)	Actual Diameter (mm)
12AAM098	FS10014096	4.0002 mm	3.9994 mm

Force Gage	Certificate #	Nominal Force (gf)	Actual Force (gf)
900278	478213	3 gf	3 gf

Temperature at time of calibration: 25 °C

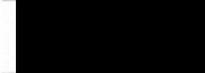
Date: October 20, 2015  
 Inspected by:   
 Bernie Jimenez



## Certificate of Calibration

Certificate No. 37989

### Customer Information



### Equipment Information

ID Number: 6  
Type: SCALE  
Manufacturer: METTLER TOLEDO  
Model: AE-100  
Serial Number: P31360  
Department: LAB  
Capacity: 100 G  
Graduation: 0.0001 G

### Calibration Information

Event Type: FIELD CALIBRATION  
Technician: BRET GLASS  
As Found Condition: PASS  
As Left Condition: PASS  
Calibration Date: 9/9/2015  
Next Due: 9/9/2016  
Temperature: 76 °F  
Humidity: 53 %  
Procedure: CM006  
Meas. Uncertainty: 1.7 DIV.

Description	Std. Nominal	- Tolerance	+ Tolerance	As Found	As Left	Units
LINEARITY (SPAN)	0.0000	-0.0001	0.0001	0.0000	0.0000	G
LINEARITY (SPAN)	25.0000	24.9997	25.0003	25.0000	25.0000	G
LINEARITY (SPAN)	50.0000	49.9997	50.0003	50.0000	50.0000	G
LINEARITY (SPAN)	75.0000	74.9997	75.0003	75.0000	75.0000	G
LINEARITY (SPAN)	100.0000	99.9997	100.0003	100.0000	100.0000	G
LINEARITY (SPAN)	0.0000	-0.0001	0.0001	0.0000	0.0000	G
SHIFT (POSITION 1)	30.0000	0.0000	0.0000	30.0000	30.0000	G
SHIFT (POSITION 2)	30.0000	0.0000	0.0000	30.0000	30.0000	G
SHIFT (POSITION 3)	30.0000	0.0000	0.0000	30.0000	30.0000	G
SHIFT (POSITION 4)	30.0000	0.0000	0.0000	30.0000	30.0000	G
TOTAL SHIFT ERROR	0.0000	-0.0003	0.0003	0.0000	0.0000	G

"A" - Adjusted and returned in tolerance

"F" - Indicates out of tolerance result

Standards Used	I.D. Number	Last Cal.	Cal. Due	Test Number
WEIGHTS	GRM003	3/19/2015	3/19/2017	150319-024

### Calibration Notes

Inspected and tested scale as shown, no calibration required. leveled scale prior to testing.

This unit has been tested with standards which are traceable to the National Institute of Standards and Technology (NIST). The results reported are at the time of testing for the unit listed above. Calibration can be impacted by many environmental factors outside the control of this provider and therefore are not warranted beyond the date of calibration. Calibration was performed in accordance with Grand Rapids Metrology procedures. Calibration is in compliance with ANSI/NCSL 2540 and ISO 17025. This document shall not be reproduced, except in full, without the written approval of Grand Rapids Metrology. The combined standard uncertainty is reported with a coverage factor of k=2, for a 95% confidence level.

Dave Warner  
Quality Manager  
Grand Rapids Metrology

Approved By



Signature

9/9/2015

Date



[Redacted]

[Redacted]

Description: FREEZER  
 Manufacturer: LABREPCO  
 Model: LABL-5-CT40  
 Range: 0 TO -40 °C  
 Accuracy: ±5°C  
 Gage ID: PWE-0158  
 Serial Number: 1314158  
 Cal Date: 07-Oct-15  
 Cal Due: 31-Oct-16

Date Received: ON-SITE CALIBRATION  
 Gage Condition: GOOD  
 Type of Calibration: NORMAL  
 Temp / Humidity: 22°C / 46% RH  
 Calibration Interval: 12 MONTHS  
 Cal Procedure: ACWP27079  
 Reference Std: OEM  
 As Found: PASS  
 As Left: PASS

CALIBRATION DATA								
Description	Nominal	As Found	As Left	Min	Max	Units	Uo	
Nominal Reading = Calibration Standard								
Applied Temperature								
-20.00 °C	-20.0	-19.9	✓ -19.9	✓ -25.0	-15.0	°C	0.54 °C	
-30.00 °C	-30.0	-30.0	✓ -30.0	✓ -35.0	-25.0	°C	0.54 °C	
-40.00 °C	-40.0	-39.9	✓ -39.9	✓ -45.0	-35.0	°C	0.54 °C	

Status:  In Tolerance     Out of Tolerance     Adjusted

CALIBRATION STANDARDS				
Traceable #	Gage ID	Description	Cal Date	Cal Due Date
500870	743B	CALIBRATOR, PROCESS	11/18/2014	11/30/2015

LOCATION OF LABORATORY			
Vendor ID	City	State	Zip
V-ACC99	CALIBRATED ON-SITE		





Purchase Order Nbr: 612890000SE

Work Order Nbr: 89925

Printed: 10/22/2015 2:36:12 PM

If requested, this calibration is accredited under the laboratory's compliance with ISO/IEC 17025 "General requirements for the competence of testing and calibration laboratories" and additional accreditation body requirements issued by ANSI-ISO National Accreditation Board (ANAB) (reference ACLASS document 3) as endorsed by the ACLASS Symbol on this certificate to our Certificate number ACT-1317. ACLASS is a full signatory to the International Laboratory Accreditation Cooperation (ILAC) arrangement, which greatly enhances the acceptance of our calibration data across the USA and other nations of the signatory countries.

All standards are traceable via calibration laboratories accredited by signatories to the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement (MRA) and by National Metrology Institutes (NMIs) - such as the National Institute of Standards and Technology (NIST) - under the International Committee of Weights and Measures (CIPM) MRA.

Calibration and Measurement Capability (CMC) is available to customers under normal conditions as published and described in our scope of accreditation (ACT-1317). Our accreditation also extends to ANSI/INCSL Z540-1-1994 Calibration Laboratories and Measuring and Test Equipment - General Requirements as defined in our scope of accreditation. Accreditation by an ILAC signatory accreditation body assures the Traceability is an unbroken chain of comparisons going back to a standard through accredited laboratories or a national or international standard bodies (e.g. NIST, NPL, etc.) and utilization of a documented accepted procedure as referenced by Accu-Chek, Inc.

The uncertainty applies to this calibration only and not the measurement of customer parts. In addition, Measurement Uncertainty (MU) for ISO/IEC 17025 is stated as the standard uncertainty of measurement multiplied by the coverage factor K (2) such that the coverage probability corresponds to approximately 95%. For ANSI/INCSL Z540-1, consistent with clause 10.2(b) we ensure that the calibration uncertainties are sufficiently small so that the adequacy of the measurement is not affected by collective uncertainty of the measurement standards by not exceeding 25% of the acceptable tolerance (e.g., manufacturer's specification) for each characteristic of the measuring and test equipment being calibrated expressed as a Test Accuracy Ratio (TAR) of 4:1. A TAR of 4:1 means that the tolerance being tested is equal to or greater than four times the combination of the uncertainties of all the measurement standards employed in the test.

Per the specific customer request, a statement of compliance issued without considering uncertainty in determining compliance to specification shall contain the results and the MU. The customer assumes partial risk of determining compliance.

"The statement of compliance in this certificate was issued without taking the uncertainty of measurement into consideration.  
The customer shall assess the results and uncertainty when determining if the results meet their needs."

Contributions to the uncertainty stated on this calibration certificate include contributions that can be reasonably attributed to the customer's device, (e.g. larger resolution values than the more precise Accu-Chek, Inc. standards). The statement of conformance to specification for the UUT is based on Accu-Chek, Inc.'s best estimate of the measurand being equal to or less than the specified accuracy of the UUT. If the measured value falls outside the stated specification, the UUT will be assumed to be out-of-tolerance.

Calibration due dates are determined by the client and do not imply continued conformance to specifications.

As indicated by the Joint IAF-ILAC-ISO Communiqué of 2009: "The management system requirements in ISO/IEC 17025:2005 (Section 4) are written in language relevant to laboratory operations and meet the principles of ISO 9001:2008 Quality Management Systems - Requirements and are aligned with its pertinent requirements".

In addition, the calibration and testing requirements of the following standards or regulations are representative of those that may be met when requested by the Customer: ISO 9001-2008, AS 9100 Rec C section 1, AS 9100 Rev. C Clause 7, 8, AS 9100 Rev. C section 2, Clause 4.11, MIL-STD-45662A, ISO/TS 16949 Rev 2 Clause 7, 8, 21CFR820, 72 and 21CFR58, 83 FDA Quality System, the US Nuclear Regulatory Commission requested 10CFR Part 56 Appendix B and 10 CFR Part 21 Quality Program, etc.

This certificate shall not be reproduced except in full, without written approval from Accu-Chek, Inc. This is an accredited certificate when accompanied with the ACLASS Logo.

  
Performed By Technician



  
Approved by Herschel G. Smith, President





INNOVATIVE CALIBRATION SOLUTIONS

625 East Bunker Court  
Vernon Hills, Illinois 60061  
PH: 866-466-8225  
Fax: 847-327-2993  
www.innocalsolutions.com

# NIST Traceable Calibration Report



766257

Reference Number: 860299  
PO Number: 19511

**Manufacturer:** Isotech North America  
**Model Number:** 935-14-116  
**Description:** Temperature, Platinum Probe  
**Asset Number:** CP132792  
**Serial Number:** 33165-1  
**Procedure:** DS Universal Temperature

**Calibration Date:** 06/17/2015  
**Calibration Due Date:** 06/17/2016  
**Condition As Found:** In Tolerance  
**Condition As Left:** In Tolerance, No adjustment

**Remarks:**

NIST-traceable calibration performed on the unit referenced above in accordance with customer requirements, published specifications and the lab's standard operating procedures. The probe was calibrated as a temperature system with asset CP132791 from certificate 766256 as the readout. Measurements and data below reflect performance of the total system; performance of individual components cannot be guaranteed. No adjustments were made to the unit.

### Standards Utilized

Asset No.	Manufacturer	Model No.	Description	Cal. Date	Due Date
CP108957	Hart Scientific	5699	Temperature, Probe, SPRT	10/04/2013	06/20/2015
CP32034	Hart Scientific	5628	Temperature, PRT - Sensor	04/28/2014	09/30/2015
CP32040	Hart Scientific	5899	Temperature, Probe, SPRT	01/27/2014	05/11/2016
CP50219	Hart Scientific	1590	Temperature, Super Thermometer	06/27/2013	07/31/2015

### Calibration Data

FUNCTION TESTED	Nominal Value	As Found	Out of Tol	As Left	Out of Tol	CALIBRATION TOLERANCE
Temperature	-38.834 °C	-39.857		Same		-38.874 to -38.764 °C [EMU 0.0098 °C]TUR 4.1:1]
	-0.010 °C	0.002		Same		-0.050 to 0.030 °C [EMU 0.0098 °C]TUR 4.1:1]
	231.826 °C	231.915		Same		231.888 to 231.968 °C [EMU 0.015 °C]TUR 2.7:1]
	419.527 °C	419.530		Same		419.467 to 419.567 °C [EMU 0.018 °C]TUR 2.2:1]

Temperature: 22° C  
Humidity: 48% RH  
Rpt. No.: 766257

Calibration Performed By:				Quality Reviewer:	
Sittinger, Peter J	330	Metrologist	847-327-5317	Szplitt, Tony	6/17/2015
Name	ID #	Title	Phone	Name	Date

This report may not be reproduced, except in full, without written permission of Innocal. The results stated in this report relate only to the items tested or calibrated. Measurements reported herein are traceable to SI units via national standards maintained by NIST and were performed in compliance with MIL-STD-45662A, ANSI/NCSL Z540-1-1994, 10CFR50, Appendix B, ISO 9002-94, and ISO 17025:2005. Guard Banding, if reported on this certificate, is applied at a Z-factor of 30% for test points with a test uncertainty ratio (TUR) below 4:1. The estimated measurement uncertainty (EMU), if reported on this certificate, is being reported at a confidence level of 95% or K=2 unless otherwise noted in the remarks section.





## Accredited Laboratory

A2LA has accredited

### INNOCAL

Vernon Hills, IL

for technical competence in the field of

## Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets the requirements of ANSI/NCSLI Z540-1-1994 and any additional program requirements in the field of calibration. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).



Presented this 29<sup>th</sup> day of September 2015.

A handwritten signature in black ink, reading 'Peter Meyer'.

President & CEO

For the Accreditation Council

Certificate Number 1746.01

Valid to October 31, 2017

For the calibrations to which this accreditation applies, please refer to the laboratory's Calibration Scope of Accreditation.



PJLA

## Certificate of Analysis

**1.0 DESCRIPTION: CONOSTAN Multi-Element Standard AM Special: 500 ppm**  
Catalogue Number: 150-250-023 / 150-250-010  
Lot Number: 150504-14  
Matrix: Base Oil 75 cSt  
Expiration Date: 12 months from date of shipment (see bottle for date of shipment)

**2.0 CERTIFIED VALUES AND ASSOCIATED UNCERTAINTY:**

Certified Concentrations, ppm ( $\mu\text{g/g}$ ):

Ba	500 $\pm$ 1	Ca	500 $\pm$ 3	Mg	500 $\pm$ 2	P	500 $\pm$ 2
Zn	500 $\pm$ 1						

Method of analysis and traceability:

This standard was prepared by weight measurements originating from assayed element Concentrates. A precursor blend was verified by atomic emission or absorption spectroscopy. Element concentrations for this standard are based on the Concentrate assay values and were prepared to within the uncertainty values listed above at the 95% Confidence Interval, as determined by weight measurements of blend components conducted on balances calibrated and verified with NIST traceable weights.

\*Each element Concentrate was assayed by classical wet chemical methods. Precision of assay measurement is  $\pm 0.5$  percent maximum, but typically  $\pm 0.3$  percent, or less. Assay accuracy is within one percent of measured value, but typically much less, as determined by co-measurement of, and traceability to, NIST Standards, or Certified Analytical Reagent Grade Chemicals, if no suitable NIST standards exists.

**3.0 REFERENCE VALUES:**

None

**4.0 APPROVAL AND DATE OF CERTIFICATION:**

Certification Date: May 05, 2015

Certification Approval:



Aiketa Mixha  
Conostan Production Manager





## Accredited Reference Material Producer

A2LA has accredited

### SCP SCIENCE

*Baie d'Urfe, Quebec, Canada*

This accreditation covers the specific materials listed on the agreed upon Scope of Accreditation.

This producer meets the requirements of ISO Guide 34:2009 *General Requirements for the Competence of Reference Material Producers*. This accreditation demonstrates technical competence for a defined scope and the operation of a quality management system.



Presented this 17<sup>th</sup> day of December 2015.

President & CEO

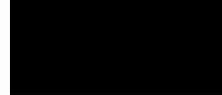
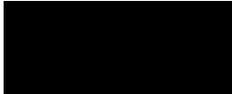
For the Accreditation Council  
Certificate Number 2885.02  
Valid to November 30, 2017

*For reference materials to which this accreditation applies, please refer to the reference material producer's Scope of Accreditation.*





Applied Technical Services  
 Certificate of Calibration  
 Certificate #1837965



**Instrument Information:**

**Manufacturer:** Vaisala  
**Model Number:** HMD70Y  
**Description:** Hygrometer / Thermometer, Transmitter  
**Asset Number:** ROOM CONTROL 8B  
**Serial Number:** ROOM 8B

**Calibration Information/Results:**

**As Found Condition :** In Tolerance  
**Action Taken / As Left:** In Tolerance - No Adjustment  
**Temperature:** 75° F  
**Humidity:** 45% RH  
**Calibration Date:** 15-Dec-2015  
**Calibration Due Date:** 15-Dec-2016  
**Calibration Interval:** 12 Months

**Calib. Procedure:** ATS-1021 Rev 3:Calibration of Temperature & Humidity Meters

This instrument has been calibrated using primary or secondary standards whose calibration is traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST) or applicable ASTM specification number for hardness testing equipment. Some measurements are traceable to natural, physical constants, consensus standards, or ratio type measurements.

The reported expanded measurement uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a confidence level of approximately 95%. The expanded measurement uncertainty is not considered when determining in-tolerance or out-of-tolerance conditions. Results are reviewed, if applicable, to establish where any measurement results exceeded the stated calibration tolerance and to communicate results by means of this certificate.

All calibrations are performed in accordance with the ATS Quality Manual QMI, Rev. 12, dated 03/01/14. Applied Technical Services, Inc.'s Quality System complies with the applicable requirements of ANS/NCSL Z540-1, ISO 9001:2008, 10CFR50 Appendix B, 10CFR Part 21, and ISO/IEC 17025:2005. The reported data is valid only at the time of the test and related only to the item calibrated. \*Calibration due dates appearing on this certificate and calibration label are determined by the client and do not imply continued conformance to specifications. This certificate shall not be reproduced except in full, without written permission of Applied Technical Services, Inc.

**Technical Remarks:**

Calibrated By: *Felton, Brent E* Field Technician  
Name Title

**Calibration Equipment Utilized**

Standard I.D.	Mfg.	Model No.	Description	Serial	Cal. Date	Due Date
ATS-01848	Fluke	741	Calibrator, Process	8561005	04/03/2015	04/03/2016
ATS-4096	Vaisala	HMI41 WIPROBE HMP46	Hygrometer / Thermometer, Meter	T2750205	11/10/2015	05/10/2016

**Calibration Data**

FUNCTION TESTED	Nominal Value	CALIBRATION TOLERANCE	As Found	Out of Tolerance	As Left
Center Room Temp	75.0 °F	74.5 to 75.5 °F [EMU 0.42 °F]	74.9		Same
	105.0 °F	104.5 to 105.5 °F [EMU 0.42 °F]	104.9		Same
Center Room Humidity	45.0 %RH	42.5 to 47.5 %RH [EMU 0.52 %RH]	45.4		Same
	75.0 %RH	72.5 to 77.5 %RH [EMU 0.87 %RH]	76.3		Same
Wind Speed	50 FPM	Pass/Fail	PASS		Same

End Of Report

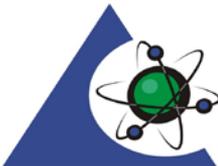
Applied Technical Services  
 1049 Triad Court  
 Marietta, GA 30062  
 Phone 770 423-1400 www.atslah.com

Page 1 of 1

ATS 501, 09/15

Issue date: 23-Dec-2015

Batch Number: 1597500





Applied Technical Services  
Certificate of Calibration  
Certificate #1837992

**Instrument Information:**

Manufacturer: Yokogawa  
Model Number: PR300  
Description: Final Tester, Power Meter  
Asset Number: T1K208654  
Serial Number: T1K208654

**Calibration Information/Results:**

As Found Condition : In Tolerance  
Action Taken / As Left: In Tolerance - No Adjustment  
Temperature: 75° F  
Humidity: 45% RH  
Calibration Date: 16-Dec-2015  
Calibration Due Date: 16-Dec-2016  
Calibration Interval: 12 Months

**Calib. Procedure:** ATS-1047 Rev 2-Calibration of Panel Meter

This instrument has been calibrated using primary or secondary standards whose calibration is traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST) or applicable ASTM specification number for hardness testing equipment. Some measurements are traceable to natural, physical constants, consensus standards, or ratio type measurements.

The reported expanded measurement uncertainty is based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a confidence level of approximately 95%. The expanded measurement uncertainty is not considered when determining in-tolerance or out-of-tolerance conditions. Results are reviewed, if applicable, to establish where any measurement results exceeded the stated calibration tolerance and to communicate results by means of this certificate.

All calibrations are performed in accordance with the ATS Quality Manual QM1, Rev. 12, dated 03/01/14. Applied Technical Services, Inc.'s Quality System complies with the applicable requirements of ANSI/NCCL Z540-1, ISO 9001-2008, 10CFR50 Appendix B, 10CFR Part 21, and ISO/IEC 17025:2005. The reported data is valid only at the time of the test and related only to the item calibrated. \*Calibration due dates appearing on this certificate and calibration label are determined by the client and do not imply continued conformance to specifications. This certificate shall not be reproduced except in full, without written permission of Applied Technical Services, Inc.

**Technical Remarks:**

Calibrated By: Jelena Brent E Field Technician  
Name Title

**Calibration Equipment Utilized**

Standard I.D.	Mfg	Model No.	Description	Serial	Cal. Date	Due Date
ATS-04852	Fluke	5522A/PQ-1G	Calibrator, Multi-Function	2034901	03/06/2015	03/06/2016

**Calibration Data**

FUNCTION TESTED	Nominal Value	CALIBRATION TOLERANCE	As Found	Bar /m	As Left
Amp @ 60 Hz	1.00 A	0.99 to 1.01 A [EMU 5.9 mA]	1.00		Same
Volts	100.0 V	99.7 to 100.3 V [EMU 63 mV]	100.0		Same
Watts	100.0 W	99.5 to 100.5 W [EMU 120 mW]	100.0		Same
Amp	4.00 A	3.99 to 4.01 A [EMU 8.2 mA]	4.00		Same
Volts	125.0 V	124.7 to 125.3 V [EMU 62 mV]	125.1		Same
Watts	500.0 W	497.5 to 502.5 W [EMU 520 mW]	500.5		Same
Amp	5.00 A	4.99 to 5.01 A [EMU 9.2 mA]	4.99		Same
Volts	200.0 V	199.3 to 200.7 V [EMU 68 mV]	200.2		Same
Watts	1000.0 W	995.0 to 1005.0 W [EMU 1 W]	1000.5		Same

Applied Technical Services  
1049 Triad Court  
Marietta, GA 30062

Phone 770 423-1400 www.atslab.com

Page 1 of 2

ATS 501, 09/15

Issue date: 23-Dec-2015

Batch Number: 1597500





American Association for Laboratory Accreditation

## Accredited Laboratory

A2LA has accredited

**APPLIED TECHNICAL SERVICES, INC.**

*Marietta, GA*

for technical competence in the field of

**Calibration**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and any additional program requirements in the field of calibration. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009*).

Presented this 30<sup>th</sup> day of April 2014.



A handwritten signature in black ink, reading "Peter Rhyne".

President & CEO  
For the Accreditation Council  
Certificate Number 1888.03  
Valid to January 31, 2016

*For the calibrations to which this accreditation applies, please refer to the laboratory's Calibration Scope of Accreditation.*



PJLA

# BRAMMER STANDARD COMPANY, INC.

## Certificate of Analysis

### BS 61G

Certified Reference Material for AISI 8620 - UNS Number G86200

	Certified Value <sup>1</sup>	Estimate of Uncertainty <sup>2</sup>	Certified Values <sup>3</sup>	Certified Value <sup>1</sup>	Estimate of Uncertainty <sup>2</sup>
Al	0.0223	0.0006	S	0.0271	0.0007
As	0.0043	0.0003	Sb	0.0014	0.0002
C	0.210	0.002	Si	0.215	0.002
Ca	0.0004	0.0001	Sn	0.0082	0.0004
Co	0.0073	0.0003	Ta	0.0020	0.0004
Cr	0.507	0.004	Ti	0.0015	0.0003
Cu	0.142	0.002	V	0.0026	0.0002
Mn	0.791	0.005	W	0.0024	0.0003
Mo	0.212	0.002	Zr	0.0008	0.0002
N	0.0067	0.0004			
Nb	0.0007	0.0002			
Ni	0.454	0.004			
O	0.0013	0.0004			
P	0.0106	0.0004			
Pb	0.0006	0.0001			

#### Informational Values<sup>3,4</sup>

B (0.0002)      Fe [97.3]\*      Mg (0.00014)

\* By difference

<sup>1</sup> For each element, the certified value listed is the present best estimate of the true value based on the mean of the weighted results of an interlaboratory testing program. See page 4 for more information on its calculation.

<sup>2</sup> For each element, the uncertainty listed is based on a statistical evaluation of the contributions of homogeneity and the interlaboratory testing program. See page 4 for more information on its calculation.

<sup>3</sup> Values are given in weight percent.

<sup>4</sup> Values in parentheses are not certified and are provided for information only.

Trace element information value for Ga is shown on page 4.

The requirements of ISO Guides 31, 34, and 35 were followed for the preparation of this Certified Reference Material and certificate of analysis. This is a Certified Reference Material as defined by ISO Guide 30.

Brammer Standard Company, Inc., 14603 Benfer Road, Houston, TX 77069-2895  
Telephone: (281) 440-9396 Fax: (281) 440-4432 Website: [www.brammerstandard.com](http://www.brammerstandard.com)  
Certificate Number 61G-061912 Page 1/6





## Accredited Reference Material Producer

A2LA has accredited

### **BRAMMER STANDARD COMPANY, INC.**

*Houston, TX*

This accreditation covers the specific materials listed on the agreed upon Scope of Accreditation.

This producer meets the requirements of ISO Guide 34:2009 *General Requirements for the Competence of Reference Material Producers*. This accreditation demonstrates technical competence for a defined scope and the operation of a quality management system.



Presented this 20<sup>th</sup> day of July 2015.

President & CEO

For the Accreditation Council

Certificate Number 0656.02

Valid to January 31, 2017

*For reference materials to which this accreditation applies, please refer to the reference material producer's Scope of Accreditation.*



# SUS

Distributed by:  
Analytical Reference Materials International  
700 Corporate Circle, Suite A  
Golden, Colorado 80401-5636 USA  
Tel: 303.216.2621, Fax: 303.216.2649  
Email: sales@armi.com

Ulrich Nell, Feldstr. 23, D - 46149 Oberhausen, Tel. 0208/658535 Fax 0208/658536

## Setting-up sample

Approximate composition of R E 12 / 136, high purity iron, Fe base  
Sample size approx. 40 mm dia. x 40 mm thickness

Composition:  
Description in ppm

Carbon .....	<50	Niobium .....	<10
Silicon .....	<30	Lead .....	<10
Manganese .....	<30	Tin .....	<10
Phosphor .....	<10	Titanium .....	<10
Sulphur .....	<10	Vanadium .....	<10
Chromium .....	<5	Tungsten .....	<10
Molybdenum .....	<5	Zirconium .....	<20
Nickel .....	<10	Calcium .....	<10
Aluminium .....	<10	Antimony	
Arsenic .....	<5	Tantalum	
Boron .....	<10	Tellurium	
Cobalt .....	<10	Bismuth	
Copper .....	<5	Nitrogen .....	<50

Intended use: routine drift correction for Spark-OES and XRF spectrometers  
Supplied and produced by SUS Ulrich Nell

The sample was produced by casting from melt

### Notes:

- This sample should be used only for checking and correcting the drift of spectrometers
- The concentration values presented are not certified as accurate, as this setting-up sample is not a reference material to be used for calibration
- The material has been checked for homogeneity and is suitable for Spark-OES spectrometers

Oberhausen, September 2011





# Calibration Certificate for

SIN71813009.0

High Stress Certified Reference Material

Proto Manufacturing Limited hereby certifies that this high stress certified reference material (CRM), for use in residual stress measurements using x-ray diffraction techniques number SIN71813009 was measured to be:

**-961 ± 50 MPa**

Using the following parameters:

- Material: IN718
- Manganese anode,  $\lambda = 2.103$  Angstroms
- Bragg Angle (2 $\theta$ ): 151.8°
- Crystallographic plane: (311)
- X-ray Elastic Constant,  $\frac{1}{2} S_2 = 6.33 \times 10^{-6} \text{ MPa}^{-1}$
- Aperture: 1mm round
- Location: Center of standard
- Direction of measure is parallel to indicated line
- Temperature of standard not to exceed 100°C
- Measurement as per ASTM E2860/SAE HS784/EN15305-2008
- Test Date: March 17, 2015
- Equipment: Lab 003,004,007

Laboratory Operator

Name: Eli Skaff

Date: October 30, 2015

Signature: 

Laboratory Quality Manager

Name: James Peneault

Date: October 30, 2015

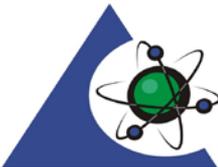
Signature: 

**Warning:**

*This CRM should not be cold worked in any way either by purpose or accidental. Measuring using a smaller or larger aperture, not measuring in the center or indicated direction will invalidate the use of the certified value of the property and the associated statement of uncertainty.*

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality managements system refer joint ISO-ILAC-IAF Communiqué date 18 June 2005.

2175 Solar Crescent, Oldcastle, Ontario Canada N0R 1L0  
Tel: (519) 737-6330 Tel: (313) 965-2900 Fax: (519) 737-1692  
e-mail: proto@protoxrd.com



**PJLA**



PERRY JOHNSON LABORATORY  
ACCREDITATION, INC.

*Certificate of Accreditation*

*Perry Johnson Laboratory Accreditation, Inc. has assessed the Laboratory of:*

***Proto Manufacturing***

***12350 Universal Drive, Taylor, MI 48180  
2175 Solar Crescent, Oldcastle, Ontario N0R 1L0***

*(Hereinafter called the Organization) and hereby declares that Organization is accredited in accordance with the recognized International Standard:*

**ISO/IEC 17025:2005**

This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (as outlined by the joint ISO-ILAC-IAF Communiqué dated January 2009):

***NDT, Mechanical and Chemical Testing-Residual Stress and Retained Austenite Measurement by X-Ray Diffraction***  
*(As detailed in the supplement)*

Accreditation claims for such testing and/or calibration services shall only be made from addresses referenced within this certificate. This Accreditation is granted subject to the system rules governing the Accreditation referred to above, and the Organization hereby covenants with the Accreditation body's duty to observe and comply with the said rules.

For PJLA:

<i>Initial Accreditation Date:</i>	<i>Issue Date:</i>	<i>Expiration Date:</i>
October 11, 2011	November 30, 2015	February 28, 2018

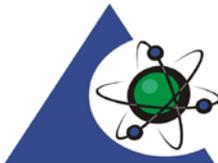
<i>Accreditation No.:</i>	<i>Certificate No.:</i>
---------------------------	-------------------------

71619	L15-396-1
-------	-----------

Tracy Szeszen  
President/Operations Manager

Perry Johnson Laboratory  
Accreditation, Inc. (PJLA)  
755 W. Big Beaver, Suite 1325  
Troy, Michigan 48084

*The validity of this certificate is maintained through ongoing assessments based on a continuous accreditation cycle. The validity of this certificate should be confirmed through the PJLA website: [www.pjabs.com](http://www.pjabs.com)*



# Smolder Test



# NIST SRM 1196

**2 Cartons  
(400 cigarettes)  
\$248**





National Institute of Standards & Technology

## Certificate of Analysis

Standard Reference Material<sup>®</sup> 1196

Standard Cigarette for Ignition Resistance Testing

This Standard Reference Material (SRM) is intended for use by test laboratories to test mattresses, upholstered furniture and its components, and thermal insulation for resistance to cigarette ignition in accordance with 16 CFR 1632 [1], 16 CFR 1634 (proposed) [2], and 16 CFR 1209 [3]. A unit of SRM 1196 consists of two cartons of cigarettes each containing 10 packs of 20 cigarettes.

**Certified Ignition Strength Value:** The certified ignition strength value is given in Table 1. A NIST certified value is a value for which NIST has the highest confidence in its accuracy, in that all known or suspected sources of bias have been investigated or taken into account. [4]. The certified value and its uncertainty were obtained by fitting a Bayesian hierarchical model [5] to the data using a binomial likelihood function and a flat, relatively non-informative prior distribution for the ignition strength of the cigarette. Tests for cigarette uniformity carried out by fitting a Bayesian hierarchical model to the data did not show evidence of any significant variation in ignition strength day-to-day or between cases, cartons, or packs [6].

The expanded uncertainty given in Table 1 is reported at the 95 % probability level. Although the expanded uncertainty of the certified value was not computed using the methods outlined in the ISO Guide [7], the results of the Bayesian analysis can be interpreted in essentially the same way as results from the ISO approach. The expanded uncertainty,  $U$ , can be expressed as  $U = k u_c$ , where  $u_c = 1.05$  % is the combined standard uncertainty, and the coverage factor,  $k = 2$ , is determined from the Student's  $t$ -distribution corresponding to 60 degrees of freedom. Alternatively, a Beta (722,80) posterior distribution for the certified ignition strength also may be used for subsequent Bayesian uncertainty calculations.

Table 1. Certified Ignition Strength Value for SRM 1196

Measurand	Test Method	Certified Ignition Strength Value
Ignition strength (on 6.35 mm brass plate plus 2 layers of filter paper)	ASTM E2187 [8] <sup>(a)</sup>	90.0 % $\pm$ 2.1 %

<sup>(a)</sup> Standard Test Method for Measuring the Ignition Strength of Cigarettes, as modified in NIST Technical Note 1627, Modification of ASTM E2187 for Measuring the Ignition Propensity of Conventional Cigarettes, June 2009.

**Expiration of Certification:** The certification of **SRM 1196** is valid, within the measurement uncertainty specified, until **31 August 2020**, provided the SRM is handled and stored in accordance with the instructions given in this certificate (see "Warning and Instructions for Handling, Storage, and Use"). The certification is nullified if the SRM is damaged, contaminated, or otherwise modified.

**Maintenance of SRM Certification:** NIST will monitor this SRM over the period of its certification. If substantive technical changes occur that affect the certification before the expiration of this certificate, NIST will notify the purchaser. Registration (see attached sheet) will facilitate notification.

The coordination of the technical measurements leading to certification was performed by R.G. Gann of the NIST Fire Research Division. Ignition strength measurements at NIST were made by A-M. Callsen of the NIST Fire Research Division.

Anthony P. Hamins, Chief  
Fire Research Division

Robert L. Watters, Jr., Director  
Office of Reference Materials

Gaithersburg, MD 20899  
Certificate Issue Date: 29 November 2012

[Certificate Revision History on Last Page](#)

SRM 1196

Page 1 of 2



FEB 25 2004

DEPARTMENT OF COMMERCE

BUREAU OF STANDARDS  
CERTIFICATE OF ANALYSES

OF

STANDARD SAMPLE NO. 107  
NICKEL-CHROMIUM-MOLYBDENUM CAST IRON

	<u>Percent</u>
Carbon (total).....	2.57
Carbon (graphitic).....	1.86
Manganese.....	.706
Phosphorus.....	.197
Sulfur (gravimetric).....	.090
Sulfur* (evolution with HCl, sp.gr. 1.18).....	.082
Silicon.....	2.34
Copper.....	.074
Nickel.....	.807
Chromium.....	455
Vanadium.....	.015
Molybdenum.....	.687
Titanium.....	.037
Arsenic.....	.01

\*Sample covered with graphite and annealed  
20 minutes at 685° C.

LYMAN J. BRIGGS,  
Director

Washington, D. C.

May 10, 1933.



# Questions? ... Discussion?...

## Comments?

