

## SOP 1

### Recommended Standard Operating Procedure for Preparation of Calibration Certificates

#### 1. Introduction

- 1.1. Calibration certificates are the visible outputs of the testing laboratory. They should be prepared with utmost care to ensure that they accurately convey all information pertaining to the testing so that reports may be used with maximum benefit by all concerned. Carefully prepared calibration certificates must contain or refer to all information necessary to justify the test results.
- 1.2. The calibration certificate may consist of filling in the blanks in a form in the case of a routine measurement. A more detailed report, including narrative information, may be required for special calibrations or tests.
- 1.3. Regardless of the final form, the calibration certificate must contain the basic information described in the following sections (see also Section 5.10 of ISO/IEC 17025<sup>1</sup> and the attached Checklist for review of template reports and those provided by calibration suppliers).

#### 2. Content

- 2.1. Title (e.g., “Calibration Certificate”).
- 2.2. Name and address of the laboratory, or location at which tests were performed.
- 2.3. Unique identification of the calibration certificate, and on each page an identification in order to ensure that the page is recognized as part of the calibration certificate, and a clear identification of the end of the certificate.
- 2.4. Name and address of the client.
- 2.5. Method used – Describe how calibration was performed by reference to SOP(s). In the absence of SOP’s, brief but informative descriptions of the methodology should be included. Information describing deviations from previously agreed upon procedure must also be included.
- 2.6. Description of, the condition of, and unambiguous identification of the item calibrated (e.g., description and/or serial numbers). A laboratory number should be assigned and attached to each test item at the time of its acceptance for testing. The use of the

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<sup>1</sup> ISO/IEC 17025:2005 (reviewed 2010) - General Requirements for the Competence of Testing and Calibration Laboratories.

laboratory number will facilitate the internal control of test items during the testing process.

- 2.7. Date of receipt of calibration item where this is critical to the validity and application of the results, and the date of performance of calibration.
- 2.8. Reference to sampling plan or procedures, where relevant.
- 2.9. Calibration results with the units of measurement in tabular or other convenient form. (When an instrument or standard has been repaired or adjusted the calibration results before and after repair or adjustment are reported.)
- 2.10. Name, title, and signature of person authoring the report or certificate. Other signatures may be required, at the discretion of the laboratory director. Each signer accepts his/her share of responsibility for the technical accuracy of the report contents.
- 2.11. Where relevant, a statement to the effect that the results relate only to the items tested or calibrated.
- 2.12. Conditions (e.g., environmental) under which the calibrations were made that have an influence on the measurement results.
- 2.13. A statement of the estimated measurement uncertainty, components that were considered and included, a rationale for their inclusion, and the coverage factor and estimated confidence interval. When a standard coverage factor is not consistent for all items that were calibrated, an additional column may be added to the measurement result table.
- 2.14. Include evidence to support metrological traceability and a traceability statement. E.g., identification of the standards used and their traceability to national or international standards and to the International System of Units (SI), through a national metrology institute as appropriate or as requested by the customer.
- 2.15. Where relevant, a statement of compliance/non-compliance with requirements and/or specifications. Compliance refers to *all* criteria of a referenced standard and not just a portion (e.g., compliance to all specifications and tolerances versus tolerance only). When all criteria have not been assessed, the laboratory must identify which criteria have/have not been evaluated.
- 2.16. Where appropriate and needed, opinions and interpretations. When included, opinions and interpretations are clearly stated.
- 2.17. Additional information which may be required by specific methods, clients or groups of clients.
- 2.18. Hard copies of calibration certificates should also include the page number and total number of pages.

- 2.19. A statement specifying that the calibration certificate shall not be reproduced except in full, without written approval of the laboratory.
- 2.20. Calibration intervals only when required for legal applications or where requested by the customer.

### 3. Records

- 3.1. File all calibration certificates in a systematic manner for ease of retrieval, as necessary.
- 3.2. Retain copies of all calibration certificates according to the laboratory Quality Management System.
- 3.3. Appendix B may be used as a technical auditing tool to assess the calibration certificate templates of the laboratory and to assess calibration certificates that are submitted by approved suppliers.

**APPENDIX A - Example**

BUREAU OF STANDARDS  
PO Box 12345  
City, State 12345-1234

COMPLIANT CALIBRATION LABORATORY  
123 Some Ave.  
City, State 12312-1231

**CALIBRATION CERTIFICATE**  
FOR  
**1 kg to 10 mg weight kit**  
(Twenty-one metric weights)

Maker: DENTROM LAKE  
Serial No.: 27269

Lab Test No.: TI-01-056  
NMI Test No.: 822/1234

SUBMITTED BY

**YOUR CUSTOMER, INC.**

Customer's Address  
City, State

Nominal (g)	Conventional Mass (g)	Conventional Mass Correction (mg)	Expanded Uncertainty (approximately 95 % confidence interval) (mg)
1 000	1 000.000 82	0.82	0.92
500	500.000 71	0.71	0.53
300	299.999 87	- 0.13	0.27
200	200.000 67	0.67	0.18
100	100.000 411	0.411	0.091
50	50.000 318	0.318	0.051
30	30.000 117	0.117	0.028
20	19.999 987	- 0.013	0.023
10	10.000 011	0.011	0.018
5	5.000 022	0.022	0.015
3	3.000 112	0.112	0.013
2	1.999 965	- 0.035	0.012
1	1.000 117	0.117	0.010
0.500	0.500 013 2	0.013 2	0.005 1
0.300	0.300 022 3	0.022 3	0.004 8
0.200	0.200 001 7	0.001 7	0.004 3
0.100	0.100 001 3	0.001 3	0.004 2
0.050	0.050 001 8	0.001 8	0.004 0
0.030	0.030 001 1	0.001 1	0.003 7
0.020	0.020 000 9	0.000 9	0.003 3
0.010	0.009 999 7	- 0.000 3	0.003 1

The data in the above table of this report only applies to those items specifically listed on this report.

**Uncertainty statement:**

The combined standard uncertainty includes the standard uncertainty reported for the standard, the standard uncertainty for the measurement process, the standard uncertainty for any uncorrected errors associated with buoyancy corrections, and a component of uncertainty to account for any observed deviations from NIST values that are less than surveillance limits. The combined standard uncertainty is multiplied by a coverage factor ( $k$ ) of 2 to provide an expanded uncertainty, which defines an interval having a level of confidence of approximately 95 percent. The expanded uncertainty presented in this report is consistent with the ISO/IEC Guide to the Expression of Uncertainty in Measurement (2008). The expanded uncertainty is not to be confused with a tolerance limit for the user during application.

**Traceability statement:**

The Standards of the Compliant Calibration Laboratory are traceable to the International System of Units (SI) through the National Institute of Standards and Technology, and are part of a comprehensive measurement assurance program for ensuring continued accuracy and measurement traceability within the level of uncertainty reported by this laboratory. The laboratory test number identified above is the unique report number to be used in referencing measurement traceability for artifacts identified in this report only.

**Supplemental Information****Description of artifacts submitted for testing:**

Twenty one metric weights from 1 kg to 10 mg, marked ASTM Class 4. Weights from 1 kg to 1 g: two-piece weights, with assumed density of 8.0 g/cm<sup>3</sup>. Weights from 500 mg to 50 mg: sheet weights, with assumed density of 16.6 g/cm<sup>3</sup>. Weights from 30 mg to 10 mg: sheet weights, with assumed density of 2.7 g/cm<sup>3</sup>.

**Conditions of artifacts submitted for testing:**

Artifacts showed evidence of improper handling. Fingerprints and dents were visible on the surface of the weights.

**Treatment of artifacts prior to testing:**

Artifacts were cleaned with cheesecloth and ethyl alcohol. Thermal equilibrium time/conditions: ten days next to balances in mass lab.

**Equipment & Standards used for this calibration:**

Balance	Range	Standards Used	Calibration due
AT1005	1 kg to 200 g	Set H	2/31/2002
AT106	100 g to 10 g	Set H	2/31/2002
UMT5/6	5 g to 10 mg	Set H	2/31/2002

**Assumed Density of Reference Standards:**

1 kg to 1 g: 7.94 g/cm<sup>3</sup>      500 mg to 10 mg: 8.41 g/cm<sup>3</sup>

**Procedure used:**

Double Substitution (NISTIR 6969, SOP 4, 2014)

**Environmental conditions at time of test:**

Temperature: 20.1 °C to 20.2 °C      Barometric Pressure: 752.7 mm Hg      Relative Humidity: 43.35 % to 43.40 %

Date artifacts were received: February 15, 2014

Date of report preparation: March 3, 2014

Date of test: February 25, 2014

Due date per customer's request: February 25, 2014

*Josh Balani II*

Test performed by: Josh Balani II  
Metrology Expert

Member:

NCSLI  
NCWM  
ASQ

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**Appendix B - Calibration Certificate and Test Report Review Checklist**  
ISO/IEC 17025:2005 (NIST HB 143:2007), Section 5.10 - Reporting the Results

<b>Criteria Guide</b>		<b>Compliance</b>
5.10.1	Reported accurately, clearly, unambiguously and objectively; in accordance with method instructions; include all info requested by customer, necessary for interpretation of the results, & required by the method	
<b>Test Reports and Calibration Certificates</b> Include at least the following information, unless valid reasons for not		
5.10.2 a)	Title	
5.10.2 b)	Laboratory name & address; location where tests/calibrations carried out, if different from lab	
5.10.2 c)	Unique certificate/test report ID (e.g., SN #); ID on each page; clearly ID document end Note: Hard copies should include page number and total number of pages	
5.10.2 d)	Customer name & address	
5.10.2 e)	ID method used	
5.10.2 f)	Description of, the condition of, & unambiguous identification of the item(s) calibrated/tested	
5.10.2 g)	Item(s) receipt date where critical to validity/application of results; date(s) of cal/test performance	
5.10.2 h)	Reference to sampling plan & procedures used where relevant to validity or application of results	
5.10.2 i)	Calibration/test results with units of measurement, where appropriate	
5.10.2 j)	Name(s), function(s) & signature(s) or equivalent ID of person(s) authorizing the certificate/report	
5.10.2 k)	Where relevant, a statement to the effect that the results relate only to the items tested or calibrated Note: Recommend statement shall not be reproduced except in full, without written lab approval	
<b>Test Reports</b> In addition to 5.10.2, test reports shall include the following		
5.10.3.1a)	Deviations, additions, exclusions from method; info on specific test conditions (e.g., environmental conditions)	
5.10.3.1b)	Statement of compliance/non-compliance with requirements and/or specifications, where relevant	
5.10.3.1c)	Statement on estimated uncertainty, where applicable; uncertainty info needed when: relevant to results validity/application, customer's instructions requires, or uncertainty affects specification limit compliance	
5.10.3.1d)	Opinions and interpretations, where appropriate and needed	
5.10.3.1e)	Additional information which may be required by specific methods, customers or groups of customers	
<b>Test Reports</b> Containing the results of sampling		
5.10.3.2 a-f)	Sampling date, ID substance, material or product, location, diagrams, sketches, photographs; reference plan & procedures; environmental conditions; method/procedure, deviations, additions, or exclusions from specification	
<b>Calibration Certificates</b> In addition to 5.10.2, where necessary		
5.10.4.1 a)	Calibration conditions (e.g., environmental) that have an influence on the measurement results	
5.10.4.1 b)	Uncertainty and/or statement of compliance with an identified metrological specification or its clauses	
5.10.4.1 c)	Evidence that the measurements are traceable	
5.10.4.2	Relate only to quantities/ results of functional tests. IF compliance statement is made: ID clauses met/not met & account for uncertainty; Record & maintain results for reference if results/uncertainties omitted	
5.10.4.3	Report before and after adjustment or repair results, if available, when adjusted/repair are made	
5.10.4.4	No calibration interval on certificate/label except if agreed w/customer (superseded by legal regulations)	
<b>Opinions and Interpretations</b>		
5.10.5	Document basis of opinions and interpretations when included; clearly mark them	
<b>Format of Reports and Certificates</b>		
5.10.8	The format shall be designed to accommodate each type of test or calibration carried out and to minimize the possibility of misunderstanding or misuse	
<b>Amendments to Test Reports and Calibration Certificates</b>		
5.10.9	Amendments after issue made as further document/data transfer with statement, meet all requirements; New report/certificate is uniquely identified & reference to the original that it replaces	