R205c - Annex to Specific Requirements: Dimensional Testing Parameters on Scopes of Accreditation

May 2011

I. Description of the Dimensional Testing Requirements

1.0 Scope

1.1 This document describes the requirements for organizations seeking A2LA accreditation for dimensional testing parameters on their scope of accreditation. The dimensional testing requirements are based on ISO/IEC 17025:2005, *General requirements for the competence of calibration and testing laboratories*.

2.0 Background

Some of the organizations accredited under the Mechanical field of testing for dimensional testing are actually performing calibration measurements as part (or all) of the measurements that they make. This situation is especially prevalent in dimensional measurement laboratories using coordinate measuring machine (CMMs) to perform their measurements.

When the dimensional measurement laboratory is measuring what is commonly referred to as "hard tooling" or fixed gauges, there are times when that measured tool is going to be used by the laboratory's customer as the reference standard to measure their own parts. In those cases, the dimensional measurement laboratory is serving as a link in the traceability chain and must be treated by A2LA and our assessors as a calibration laboratory. In these situations the requirements found in *R205 – Specific Requirements: Calibration Laboratory Accreditation Program* must be applied in order to accredit the dimensional measurement organization for this service. Additionally these dimensional testing parameters are also required to meet *R218 – Applications for Calibration Scopes of Accreditation* for presentation on the scope.

It is understood that some of the dimensional measurements are performed as a small part of the mechanical scope or calibration scope of accreditation and that much of the work is taking measurements of automotive parts, for example, to ensure an appropriate fit on the automobile; this is considered dimensional testing.

If a situation arises where a mechanical testing organization desires to include dimensional testing capability for which the unit under test does serve as link in the traceability chain on their scope of accreditation or a calibration organization desires to include dimensional testing capability for which the unit under test does not serve as link in the traceability chain, A2LA will accredit the organization without requiring them to hold a separate Scope of Accreditation.

3.0 References

P101 – Reference to A2LA Accredited Status-A2LA Advertising Policy.

R101 – General Requirements: Accreditation of ISO/IEC 17025 Laboratories.

P102 – A2LA Policy on Measurement Traceability.

R103 – General Requirements: Proficiency Testing for ISO/IEC 17025 Laboratories.

R104 – General Requirements: Accreditation of Site Testing and Site Calibration Laboratories.

ANSI/ISO/ASQ Q9000:2000, *Quality management systems – Fundamentals and vocabulary*.
ANSI/NCSL Z540-2-1997, *U.S. Guide to the Expression of Uncertainty in Measurement*.

BIPM/IEC/ISO/OIML, *International vocabulary of basic and general terms in metrology (VIM)*: 2007.

EA-4/02, 1999, *Expression of the Uncertainty of Measurement in Calibration*.

EA-4/03, 1996, *Requirements for the Accreditation of Laboratories and Organisations Performing Site Calibrations*.

EAL-R4, 1996, *Conditions for Use of the National Accreditation Logo by Accredited Laboratories*.

ILAC, 2009, *2009-08-20_BMC to CMC Circular*

Guide to the Expression of Uncertainty in Measurement (GUM), issued by BIPM, IEC, IFCC, ISO, IUPAC, IUPAP, and OIML.

ILAC P10:2002, *ILAC Policy on Traceability of Measurement Results*.

ILAC G8:03/2009, *Guidelines on Assessment and Reporting of Compliance with Specification*.

ISO/IEC Guide 99:2007 *International Vocabulary of Metrology – Basic and General Concepts and Associated Terms.*

ISO Guide 5725-1 to 5725-6:1994 *Accuracy (Trueness and Precision) of Measurement Methods and Results.*

ISO/IEC 17025:2005, *General requirements for the competence of testing and calibration laboratories*.

ISO/IEC 17000: *Conformity assessment – Vocabulary and general principles.*

ISO/IEC 17043:2010: *Conformity assessment — General requirements for proficiency testing.*

NIST Technical Note 1297, *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*, Taylor, Barry N., Kuyatt, Chris E., U.S. Government Printing Office, Washington, D.C., 1993.

UKAS, *The Expression of Uncertainty and Confidence in Measurement* (M3003), 2007.

4.0 Definitions

4.1 For the purpose of these Requirements, the relevant terms and definitions given in ISO/IEC 17000 and the VIM apply. General definitions related to quality are given in Q9000, whereas ISO/IEC 17000 gives definitions specifically related to standardization, certification and laboratory accreditation. Where different definitions are given in Q9000, the definitions in ISO/IEC 17000 and VIM are preferred.

5.0 General Requirements

5.1 An application for accreditation must be completed in either the Mechanical field of testing or the field of Calibration. In cases where a CAB holds a current accreditation in another field the dimensional testing capability may be added as a second field to a current scope of accreditation (see *R101 – General Requirements: Accreditation of ISO/IEC 17025 Laboratories*).

5.2 Measurement traceability

5.2.1 Detailed information concerning measurement traceability and specific requirements pertaining to measurement traceability can be found in A2LA's *P102 – A2LA Policy on Measurement Traceability*.

5.3 Uncertainty of measurement

5.3.1 For each measurement parameter and associated range(s), the laboratory shall provide with the application an uncertainty budget showing how the claimed Calibration and Measurement Capability (CMC) was derived. The assumptions made for the determination of the uncertainty budgets, if any, must be specified and documented. A2LA accredited and enrolled calibration laboratories shall calculate measurement uncertainties using the method detailed in the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM)[1]. In accordance with international convention, uncertainties listed on A2LA scopes of accreditation will usually represent expanded uncertainties expressed at approximately the 95% level of confidence using a coverage factor of $k = 2$. The uncertainty quoted on a scope of accreditation will be taken to be the CMC. As defined in EA-4/02, Section 1.3, the *Best Measurement Capability*[2] is "the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation, when performing more or less routine calibrations of nearly ideal measurement standards".

5.3.2 CMC as stated on a Scope of Accreditation, implies that within its accreditation a laboratory is not entitled to claim a smaller uncertainty for a particular measurement parameter than the value listed on its scope.

Organizations are not permitted to claim a Calibration and Measurement Capability (CMC) on their scope of accreditation that is lower than the CMC claimed by the National Metrology Institute (as stated in the key comparison database listed on the BIPM website, www.bipm.org) through which traceability is achieved unless allowance is made by A2LA. A2LA may accept

[1] Guidance documents based on the GUM include EA-4/02, 1999, Expression of the Uncertainty of Measurement in Calibration, NIST Technical Note 1297, and UKAS M3003, The Expression of Uncertainty and Confidence in Measurement, 2007.

[2] Per the *ILAC 2009-08-20_BMC to CMC Circular* that states, "references to *BMC (Best Measurement Capability)* in scopes of accreditation for calibration facilities should be amended to *CMC (Calibration and Measurement Capability*", and, "this is considered a terminology change only, as 'BMC' and 'CMC' have been agreed to be equivalent," A2LA considers the *Best Measurement Capability* as defined in EA-4/02, Section 1.3 to be equivalent to *Calibration and Measurement Capability.*

uncertainties smaller than the NMI's "commercial" uncertainty that is provided to its own customers on a case-by-case basis.

5.3.3 Uncertainty budgets shall be reviewed and approved by A2LA before a laboratory is granted accreditation.

5.4 Proficiency testing

5.4.1 See *R103 – General Requirements: Proficiency Testing for ISO/IEC 17025 Laboratories* and the associated *R103a – Annex: Proficiency Testing for ISO/IEC 17025 Laboratories* for proficiency testing requirements for calibration laboratories.

5.5 Use of the A2LA accredited symbol and advertising policy

5.5.1 See *P101 – Reference to A2LA Accredited Status-A2LA Advertising Policy*, (Section XIII of the "General Requirements for Accreditation of Laboratories").

5.6 Field Testing and Calibration

5.6.1 See *R104 – General Requirements: Accreditation of Field Testing and Field Calibration Laboratories* for requirements pertaining to accreditation of mechanical tests or calibrations performed in the field. Accredited field calibrations shall be identified on the scope of accreditation.

6.0 Specific Requirements for Dimensional Testing

6.1 **For all dimensional testing parameters for which the unit under test *does* serve as link in the traceability chain (see section 2.0), the following requirements apply:**

1. 6.1.1 The CAB shall meet the requirements found in *R205 – Specific Requirements: Calibration Laboratory Accreditation Program and R218a – Annex A: General and Specific Editorial Considerations*.

Note: In accordance with R218, one minimal element on the scope of accreditation is "identification of the measuring instrument or type of instrument, measuring system, items calibrated; or reference materials or standards measured or calibrated, or parameters being calibrated." Therefore, the use of the term "length" without a qualifier is not permitted.

6.1.2 The organization shall use a footnote in the scope of accreditation identifying that the organization meets R205 – *Specific Requirements: Calibration Laboratory Accreditation Program* for the types of dimensional tests listed and is considered equivalent to that of a calibration.

6.1.4 See *P101 – Reference to A2LA Accredited Status-A2LA Advertising Policy* section 14 for requirements when issuing an endorsed, accredited calibration certificate.

Example <u>Mechanical Testing Scope or Calibration Scope</u> presentation when the dimensional test *does* serve as a link in the traceability chain:

I. Dimensional Testing/Calibration[1]

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
One Dimensional[3] – Length Radius	 Up to 6 in Up to 6 in	 320 µin 280 µin	 Optical comparator
Length Standards (1D)[3]	(0 to 25) in	(75 + 2*L*) µin	CMM

[1] This laboratory offers commercial dimensional testing/calibration service.

[2] Calibration and Measurement Capability (CMC) is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards or nearly ideal measuring equipment. Calibration and Measurement Capabilities represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of $k = 2$. The actual measurement uncertainty of a specific calibration performed by the laboratory may be greater than the CMC due to the behavior of the customer's device and to influences from the circumstances of the specific calibration.

[3] This laboratory meets R205 – *Specific Requirements: Calibration Laboratory Accreditation Program* for the types of dimensional tests listed above and is considered equivalent to that of a calibration.

[4] In the statement of CMC, *L* is the numerical value of the nominal length of the device expressed in inches.

6.2 For all dimensional testing parameters for which the unit under test does *not* serve as link in the traceability chain (see section 2.0), the following requirements apply:

6.2.1 See *P101 – Reference to A2LA Accredited Status-A2LA Advertising Policy section 14* for requirements when issuing an endorsed, accredited test report.

6.2.2 The following requirements apply for the presentation of the scope:

6.2.2.1 The parameter, range, CMC, and Technique and/or Test Method (Standard) are identified on the scope.

6.2.2.2 Units for Angle measurements degrees, minutes and seconds, use the following corresponding symbols: °, ’, ’’

6.2.2.3 The CMC must apply across the range and be identified as the uncertainty that corresponds to the largest point in the range.

6.2.2.4 The CMC cannot be listed as a range.

6.2.2.5 A “0.00” uncertainty is unacceptable. There is uncertainty in every measurement unless it’s a functional check.

6.2.2.6 For Parameters, each word is capitalized.

6.2.2.7 For Techniques, only first word is capitalized.

6.2.2.8 Only two (2) significant figures are allowed to represent CMCs and they are always rounded up. Example:

- Incorrect: 0.0215 mm
- Correct: 0.022 mm

6.2.2.9 The following footnote shall be included in the scope of accreditation “This test is not equivalent to that of a calibration.”

Example <u>Mechanical Testing or Calibration</u> Scope Presentation when dimensional testing does *<u>not</u>* serve as a link in the traceability chain:

I. Dimensional Testing[1]

Parameter	Range	CMC[2] (±)	Technique / Method
Angle[3]	0° to 360°	4.1’	Optical comparator
Radius[3]	(0.005 to 3) in	0.0022 in	Optical comparator

[1] This laboratory offers commercial dimensional testing service only.

[2] Calibration and Measurement Capability (CMC) is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine measurements of nearly ideal measurement standards or nearly ideal measuring equipment. Calibration and Measurement Capabilities represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of $k = 2$. The actual measurement uncertainty of a specific measurement performed by the laboratory may be greater than the CMC due to the behavior of the customer’s device and to influences from the circumstances of the specific measurement.

[3] This test is not equivalent to that of a calibration.

6.3 For dimensional testing parameters for which the unit under test *does* serve as link in the traceability chain for some parameters but *does not* serve as a link in the traceability chain for other parameters, the following requirements apply:

6.3.1 For those parameters that *do* serve as a link in the traceability chain, sections 6.1.1 through 6.1.5 from this document apply.

6.3.2 For the dimensional test that *does not* serve as link in the traceability chain, the scope of accreditation must be presented in accordance with section 6.2.2 of this document.

6.3.3 See *P101 – Reference to A2LA Accredited Status-A2LA Advertising Policy* section 14 for requirements when issuing an endorsed, accredited calibration certificate or test report.

Example Scope Presentation when dimensional testing *does* and *does not* serve as a link in the traceability chain:

I. Dimensional Testing/Calibration[1]

Parameter/Equipment	Range	CMC[2] (±)	Comments
Length Standards (1D)[3]	(0 to 25) in	(75 + 2*L*) µin	CMM
Gridplates (2D)[3]	(6 x 8) in	(60 + 5*L*) µin	Vision CMM
Fixture Gages (3D)[3]	(20 x 25 x 15) in	(200 + 5*L*) µin	CMM

II. Dimensional Testing[4]

Parameter	Range	CMC[2, 6] (±)	Technique/ Method
Angle[5]	0° to 360°	4.1’	Optical comparator
Workpiece Measurement[5]			
1D	(0 to 25) in	(125 + 3.5*L*) µin	CMM
2D	(20 x 25) in	(150 + 4*L*) µin	CMM
3D	(20 x 25 x 15) in	(200 + 5*L*) µin	CMM
1D	(0 to 8) in	(50 + 10*L*) µin	Vision CMM
2D	(6 x 8) in	(100 + 15*L*) µin	Vision CMM

[1] This laboratory offers commercial dimensional testing/calibration service.

[2] Calibration and Measurement Capability (CMC) is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards or nearly ideal measuring equipment. Calibration and Measurement Capabilities represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of $k = 2$. The actual measurement uncertainty of a specific calibration performed by the

laboratory may be greater than the CMC due to the behavior of the customer's device and to influences from the circumstances of the specific calibration.

[3] This laboratory meets R205 – *Specific Requirements: Calibration Laboratory Accreditation Program* for the types of dimensional tests listed above and is considered equivalent to that of a calibration.

[4] This laboratory offers commercial dimensional testing service only.

[5] This test is not equivalent to that of a calibration.

[6] In the statement of CMC, *L* is the numerical value of the nominal length of the device measured in inches.

Document Revision History

Date	Description
November 2010	Document Initiated.
May 2011	Updated section 5.1 to indicate that the listing of dimensional testing can be placed on the Scope of Accreditation for any field of testing; Removed 'Standards' column from tables in sections 6.2 and 6.3.