# Instructions For
# Proposed Scopes of Accreditation - Calibration

**Introduction**

The Scope of Accreditation is a formal document issued by L-A-B to accredited laboratories. The Scope is the expression of the calibration parameters, ranges, and an uncertainty for which accreditation has been granted.

The laboratory prepares the "Proposed Scope of Accreditation" as a part of its initial application and renewal application. The Proposed Scope is a working document and is not an indication of accreditation status. Therefore a proposed scope shall not be shared with any entity other than L-A-B or its authorized representatives.

The Proposed Scope of Accreditation, whether it is initial or renewal, shall not display any signature that would lead a reader to believe that the proposed scope has been approved by L-A-B. The signatures that appear on the proposed scope are to verify, at the time of the site assessment, that the assessor and client agree to the proposed scope and that the document will be sent to L-A-B for review.

Use of the Proposed Scope of Accreditation or alteration of the final Scope of Accreditation for the purpose of soliciting business may lead to suspension or termination of accreditation.

When accreditation has been granted, L-A-B will issue an approved final Scope of Accreditation. L-A-B is the final authority on the content of the Scope of Accreditation. This is an official document, which must be provided, in full, to any entity asking for a display of the laboratory's accredited scope. Per L-A-B SOP 306 a laboratory whose accreditation is suspended or terminated shall not use or display the Proposed Scope or the final Scope of Accreditation or the L-A-B name or logo in any way, including but not limited to business solicitations, advertising, correspondence, or web sites.

**Purpose**

The purpose of these guidelines is to assist L-A-B accreditation applicants (initial and renewal) and L-A-B assessors when filling out L-A-B Form 28 series ("Proposed Scope of Accreditation"). The applicant must fill out this form correctly and completely. It is the responsibility of the applicant to submit a properly completed client proposed scope of accreditation to L-A-B. Failure to submit a properly completed proposed scope of accreditation will delay the process for scheduling and granting accreditation. A properly completed form will assist L-A-B in developing the final Scope of Accreditation for the laboratory. The applicant and the assessors will agree to and sign off on a hard copy of the proposed scope at the time of the assessment. The lead assessor must submit the "Proposed Scope" in an electronic version to L-A-B Operations with the technical packet after the assessment. L-A-B staff will modify or edit the scope as appropriate after reviewing the technical packet submitted by the assessor.

**Details**

A separate line entry is needed for each parameter/discipline and/or each range listed for that parameter. An example would be for a parameter/discipline that has four ranges; each line would define each range listed. See DC Volts example table at the end of these instructions for additional insight.

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## Major Field Parameters with Related Disciplines

### Length – Dimensional Metrology

- **Hand Tools and Precision Gages 1D** parameter examples are Calipers, Micrometers, Height Gages, Indicators, Rulers, Bore Gages, etc.
- **Hand Tools and Precision Gages 2D** parameter examples are Bevel Protractors, Clinometers, Levels, 2-Axis Linear Measuring Machines, 2-Axis Measuring Microscopes, Optical Comparators, etc.
- **Hand Tools and Precision Gages 3D** parameter examples are CMM's, 3-Axis Vision Systems, Laser Trackers, etc.
- **Artifacts and Standards 1D** parameter examples are External/Internal Cylinders, Go No-Go Gages, Gage Blocks, lasers, Line Scales, Length Bars, Surface Plates, Sine Plates, Spheres, Cones, Stage Micrometers, Brinell Microscopes, etc.
- **Artifacts and Standards 2D** parameter examples are Angle Blocks, Autocollimator, Cones, Cylindrical Squares, Granite Squares, Obelisks, Index Tables, Optical Polygons, Optical Squares, Combination Sine Plates, etc.
- **Artifacts and Standards 3D** parameters examples are Ball Plates, Grid Plates, Fixtures, Functional Gages, etc.
- **Other** parameters examples are Gears, Groove Depth Standards, Pitch Masters, Profilometers, Roughness Standards, Threaded Devices, Tip Condition, etc

### Length – Laser Frequency

- **Dimensional Equipment** parameter example is Laser Interferometer.

### Electricity and Magnetism

- **Voltage** parameter examples are AC Volts Source, AC Volts Measure, DC Volts Source, DC Volts Measure, etc.
- **Resistance** parameter examples are Resistance Source, Resistance Measure, etc.
- **Current** parameter examples are AC Current Source, AC Current Measure, DC Current Source, DC Current Measure, etc.
- **Inductance** parameter examples are Inductance Source, Inductance Measure, etc.
- **Capacitance** parameter examples are Capacitance Source, Capacitance Measure, etc.
- **Magnetic Properties** parameter examples are Magnetic Fields Measure, Magnetic Fields Source, etc.
- **Electrical Millivolt Simulation** parameter examples are Thermodynamic Devices, Thermodynamic Controllers, Temperature Controllers, Process Controllers, Thermocouple Simulation, pH Meters, etc.
- **Electrical Resistance Simulation** parameter examples are Thermodynamic Devices, Thermodynamic Controllers, Temperature Controllers, Process Controllers, RTD Simulation, Conductivity Meters, etc.
- **Oscilloscopes** parameter examples are bandwidth, rise time, etc.

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**Ionizing Radiation**

- **Dosimetry** parameter examples are Dosimetric Measurements, etc.
- **Neutron Measurements** parameter examples are Neutron Measurements, etc.
- **Radioactivity** parameter examples are Radioactive Measurements, etc.

**Vibration**

- **Accelerometry** parameters are Single Axis Accelerometers, Dual Axis Accelerometers, Tri Axis Accelerometer, etc.
- **Vibration** parameters are Charge Amplifiers, Handheld Calibrators/Exciters, Signal Conditioners, Vibration Meter, etc.

**Time, Frequency, and Time Domain**

- **Frequency/Period** parameters are Frequency Source and Measure, Period Source and Measure, Stop Watches, Timers, Tachometers, etc.
- **Time Dissemination** parameters are Time etc.
- **Time Domain**

**Thermodynamic**

- **IR Devices** parameter examples are Infrared Guns, Infrared Sensors, IR Black Bodies, etc.
- **Humidity** parameter examples are hygrometers sensors, aqueous salt solutions, Dewpoint meters, Psychrometers, chilled-mirror hygrometers humidity chambers, etc.
- **Thermometers** parameter examples are Thermocouples, Thermistors, Resistance Temperature Detectors (RTD), Platinum Resistance Thermometers (PRT, SPRT), Bi-metallic,vapor-filled, and Liquid in Glass Thermometers, etc.
- **Thermodynamic Sources** parameter examples are temperature chambers, Drywells, Temperature Baths, Fixed Point Cells, etc.

**Sound in Air**

- **Acoustic parameter examples are A**nalogue Filters**, Digital Filters, Dosimeters, Frequency C**ounters, Level Recorders, Multi-Frequency Filters, Noise Analyzers, Phisonphone Calibrators, Signal Generators, Sound Intensity Meters, Sound Level Meters, etc.

**Photometry**

**Radiometry**

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**Mass**

- **Density** parameter examples are Density Gages, etc.
- **Force** parameter examples are dynamometers, force meters, load cells, proving rings, spring testers, tensile testers, wire tension meters, strain gages etc.
- **Gravity** parameter examples are gravimeter, etc.
- **Hardness** parameter examples are Durometers, Durometer Calibrator, Microhardness Testers, Microhardness Specimens, Rockwell Hardness Testers, Rockwell Hardness Specimens, Brinell Hardness Testers, Brinell Hardness Specimens, Shore, Friability Testers, Pill Hardness, IHRD Testers.
- **Scales and Balances** parameter examples are Balances, Bench Scales, Floor Scales, Truck Scales, Tanks and Hoppers, Rail Scales, etc.
- **Mass Standards**
- **Pressure** parameter examples are Dead Weight Testers, Manometers, Pressure Calibrators, Pressure Transducers, Dial and Digital Pressure Gages, Aneroid Barometers, Absolute Pressure Instruments, Fused Quartz Pressure Capsules, etc.
- **Vacuum** parameter examples are Vacuum Gages, McLeod Gauges, Vacuum Transducers, etc.
- **Torque** parameter examples are Torque Analyzers, Torque Devices Pneumatic, Torque Driver, Torque Transducers, Torque Watches, Torque Wrenches, Torque Multipliers, Torque Cells etc.

**Fluid Properties and Quantities**

- **Liquid Flow** parameter examples are flow rate, mass & volumetric flow
- **Air Flow** parameter examples are flow rate, mass & volumetric flow
- **pH/Conductivity** parameter examples are pH/ORP meters & transmitters, conductivity/TDS meters & transmitters using chemical solutions
- **Viscosity** parameter examples are dynamic & kinematic viscometers, efflux cups, capillary viscometers
- **Air/Gas Monitoring** parameter examples are personal gas monitors, ozone detectors, $CO_2$ detectors, Air Quality monitors, CO Monitors, oxygen concentration monitors, Stack gas monitors
- **Other** parameter examples are turbidity meters, densitometers, Differential Scanning Calorimeters, refractometers

**Amount of Substance**

- **Chemical parameters** are gas dividers, certified gasses
- **Gas** parameters are Combustion and Fusion
- **Particulate** parameters are smoke meters, optical emission spectroscopy

**Luminous Intensity**

- **Light** parameter examples are Light Booths, etc.

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**Parameter**

When filling out this field, the entry needs to represent the measurement, which is being provided by the laboratory. For Example, Accelerometry, AC Volts, DC Volts, AC Current, Dimensional - Calibration/Inspection, Force, Flow, Hardness, Humidity, Mass, Optical, Pressure, Vacuum, Surface Texture, Thermal, Time & Frequency, Vibration, Volume, Torque.

**Range**

Provide the lower and upper bounds for the range of the parameter. Care must be taken when zero is the lower bound and the uncertainty is given as a function of the range; in these cases the function must be in a form such that the uncertainty at zero is itself not equal to zero. For example, if the uncertainty is given as "10 μV/V", then this implies that at zero volts the uncertainty is zero volts since 10 μV/V of zero volts is zero. In these cases, a constant, or "floor spec" is included with the proportional part, e.g., "10 μV/V + 1 μV". The capabilities of the laboratory need to be clearly expressed in an easy to understand format.

The units which define the measurement **must comply** with acceptable engineering units, please refer to NIST SP 811 (c.f. "NIST SP 811 Checklist" for a handy reference), NIST SP 330 or

IEEE/ASTM SI-10 for further definition of units. Assessors and L-A-B staff will treat the presentation of improper or improperly expressed units of measure on a client proposed scope as a noncompliance and will be required to issue a non-conformance. It is the responsibility of the laboratory to insure that proper presentation of in expressed units.

The parameters should be grouped together to allow a smooth flow of the discipline(s) being defined.

**Calibration and Measurement Capability**

L-A-B grants accreditation on a laboratory's capability to make a measurement. This capability is defined in the "Scope of Accreditation" and that capability is further defined by the Calibration and Measurement Capability associated with that measurement capability. The CMC, expressed as an expanded uncertainty in the proposed scope, is defined as the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation.

The CMC displayed on the Client Proposed Scope of Accreditation must be achievable by the laboratory when calibrating a nearly ideal unit under test. They shall be supported or confirmed by experimental evidence. Note: The uncertainty budgets of the organization must support the CMC claimed by the applicant per L-A-B Policy 001.

**Remarks**

The remarks entry is to be used to define any useful information in respect to the measurement being provided by the laboratory. For example, type of equipment used in the calibration (not the manufacturer, type) and/or other relevant information useful for understanding the measurement capability of the laboratory. Detailed and specific notes should be added as comments under the table with footnote listed in the table if remarks column is not large enough to fully define any limitations or other noteworthy considerations associated with the parameter.

**Format**

The format of the example table must be followed. This includes font (Times New Roman), font size (11), column order and column headings, and placement of notes. Page number, total number of pages, and the date of the draft must be displayed on each page.

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**NIST SP 811 Checklist**

1. Only units of the SI and those units recognized for use with the SI are used to express the values of quantities. Equivalent values in other units are given in parentheses following values in acceptable units *only* when deemed necessary for the intended audience.

2. Abbreviations such as sec (for either s or second), cc (for either $cm^3$ or cubic centimeter), or mps (for either m/s or meter per second), are avoided and only standard unit symbols, SI prefix symbols, unit names, and SI prefixes are used.

3. The combinations of letters “ppm,” “ppb,” and “ppt,” and the terms part per million, part per billion, and part per trillion, and the like, are not used to express the values of quantities. The following forms, for example, are used instead: 2.0 µL/L or $2.0 \times 10^{-6}\ V$, 4.3 nm/m or $4.3 \times 10^{-9}\ l$, 7 ps/s or $7 \times 10^{-12}\ t$, where $V$, $l$, and $t$ are, respectively, the quantity symbols for volume, length and time.

4. Unit symbols (or names) are not modified by the addition of subscripts or other information. The following forms, for example, are used instead.

| | | |
|---|---|---|
| $V_{\mathrm{max}} = 1000$ V | *but not:* | $V = 1000\ \mathrm{V_{max}}$ |
| a mass fraction of 10 % | *but not:* | 10 % ($m/m$) or 10 % (by weight) |

5. Statements such as “the length $l_1$ exceeds the length $l_2$ by 0.2 %” are avoided because it is recognized that the symbol % represents simply the number 0.01. Instead, forms such as “$l_1 = l_2(1 + 0.2\ \%)$” or “$\mathit{\Delta} = 0.2\ \%$” are used, where $\mathit{\Delta}$ is defined by the relation $\mathit{\Delta} = (l_1 - l_2)/l_2$.

6. Information is not mixed with unit symbols (or names). For example, the form “the water content is 20 mL/kg” is used and not “20 mL $H_2O$/kg” or “20 mL of water/kg.”

7. It is clear to which unit symbol a numerical value belongs and which mathematical operation applies to the value of a quantity because forms such as the following are used:

| | | |
|---|---|---|
| 35 cm × 48 cm | *but not:* | 35 × 48 cm |
| 1 MHz to 10 MHz or (1 to 10) MHz | *but not:* | 1 MHz – 10 MHz or 1 to 10 MHz |
| 20 °C to 30 °C or (20 to 30) °C | *but not:* | 20 °C – 30 °C or 20 to 30 °C |
| 123 g ± 2 g or (123 ± 2) g | *but not:* | 123 ± 2 g |
| 70 % ± 5 % or (70 ± 5) % | *but not:* | 70 ± 5 % |
| 240 × (1 ± 10 %) V | *but not:* | 240 V ± 10 % (one cannot add 240 V and 10 %) |

8. Unit symbols and unit names are not mixed and mathematical operations are not applied to unit names. For example, only forms such as $kg/m^3$, $kg \cdot m^{-3}$, or kilogram per cubic meter are used and *not* forms such as kilogram/$m^3$, kg/cubic meter, kilogram/cubic meter, kg per $m^3$, or kilogram per $meter^3$.

9. Values of quantities are expressed in acceptable units using Arabic numerals and the symbols for the units.

| | | |
|---|---|---|
| $m = 5$ kg | *but not:* | $m$ = five kilograms or $m$ = five kg |
| the current was 15 A | *but not:* | the current was 15 amperes |

10. There is a space between numerical value and unit symbol, even when the value is used in an adjectival sense, except in the case of superscript units for plane angle.

    a 25 kg sphere *but not:* a 25-kg sphere

    an angle of 2°3’4” *but not:* an angle of 2 °3 ’4”

    If the spelled-out name of a unit is used, the normal rules of English are applied: “a roll of 35-millimeter film.”

11. The digits of numerical values having more than four digits on either side of the decimal marker are separated into groups of three using a thin, fixed space counting from both the left and right of the decimal marker. For example, 15 739.012 53 is highly preferred to 15 739.012 53. Commas are not used to separate digits into groups of three.

12. Equations between quantities are used in preference to equations between numerical values, and symbols representing numerical values are different from symbols representing the corresponding quantities. When a numerical-value equation is used, it is properly written and the corresponding quantity equation is given where possible.

13. Standardized quantity symbols such as those given in ISO 31 Parts 0 – 13 are used, for example $R$ for resistance and $A_\mathrm{r}$ for relative atomic mass, and not words, acronyms, or ad hoc groups of letters. Similarly, standardized mathematical signs and symbols such as are given in ISO 31–11 are used, for example, “tan $x$” and not “tg $x$.” More specifically, the base of “log” in equations is specified when required by writing $\log_a x$ (meaning log to the base $a$ of $x$), lb $x$ (meaning $\log_2 x$), ln $x$ (meaning $\log_\mathrm{e} x$), or lg $x$ (meaning $\log_{10} x$).

14. Unit symbols are in roman type, and quantity symbols are in italic type with superscripts and subscripts in roman or italic type as appropriate.

15. When the word “weight” is used, the intended meaning is clear. (In science and technology, weight is a force, for which the SI unit is the Newton; in commerce and everyday use, weight is usually a synonym for mass, for which the SI unit is the kilogram.)

16. A quotient quantity, for example, mass density, is written “mass divided by volume” rather than “mass per unit volume.”

17. An object and any quantity describing the object are distinguished. (Note the difference between “surface” and “area,” “body” and “mass,” “resistor” and “resistance,” “coil” and “inductance.”

18. The obsolete term normality and the symbol $N$, and the obsolete term molarity and the symbol M, are not used, but the quantity amount-of-substance concentration of B (more commonly called concentration of B), and its symbol $c_\mathrm{B}$ and SI unit mol/m$^3$ (or a related acceptable unit), are used instead. Similarly, the obsolete term molal and the symbol m are not used, but the quantity molality of solute B, and its symbols $b_\mathrm{B}$ or $m_\mathrm{B}$ and SI unit mol/kg (or a related SI unit), are used instead.

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**Example Scope of Accreditation**

The following table is an example of how a laboratory would fill out the table in a client proposed scope of accreditation. The information listed in the table is only an example. The information required by the applicant needs to fit the services provided by the laboratory.

The "Notes" at the bottom of the table are example notes only and the notes annotated in the proposed scope must be applicable to the proposed scope.

**Length - Dimensional Metrology – Artifacts and Standards 1D**

| Calibration Parameter/Equipment | Range | Calibration and Measurement Capability (+/-) [2] | Remarks |
|---|---|---|---|
| Gage Blocks | Up to 4 in | (3.1 + 1.6$L$) µin | Comparison made with Gage Block Comparator and Gage Blocks |

**Length - Dimensional Metrology – Artifacts and Standards 2D**

| Calibration Parameter/Equipment | Range | Calibration and Measurement Capability (+/-) [2] | Remarks |
|---|---|---|---|
| Angle Block | Up to 90º | 11" | Gage Blocks and Optical Flats used as standards |

**Length - Dimensional Metrology – Hand Tools and Precision Gages 1D**

| Calibration Parameter/Equipment | Range | Calibration and Measurement Capability (+/-) [2] | Remarks |
|---|---|---|---|
| Calipers[1] | 0 in to 6 in | (600 + 3$L$) µin | Gage Blocks and Optical Flats used as standards |

**Length - Dimensional Metrology – Hand Tools and Precision Gages 2D**

| Calibration Parameter/Equipment | Range | Calibration and Measurement Capability (+/-) [2] | Remarks |
|---|---|---|---|
| Optical Comparator[1] | 0 in to 12 in | (210 + 11$L$) µin | Glass Reticle used as standards |

**Length - Dimensional Metrology – Hand Tools and Precision Gages 3D**

| Calibration Parameter/Equipment | Range | Calibration and Measurement Capability (+/-) [2] | Remarks |
|---|---|---|---|
| Coordinate Measuring Machine[1] Linearity | 0 m to 10 m | (3 + 2.4$L$) µm | Laser Interferometer used as standard |
| Volumetric | 0 mm to 450 mm | (5 + 3.2$L$) µm | Step Gage used as standard |
| Repeatability | 25 mm | 1 µm | Sphere used as standard |

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**Length - Dimensional Metrology – Other**

| Calibration Parameter/Equipment | Range | Calibration and Measurement Capability (+/-) [2] | Remarks |
|---|---|---|---|
| Thread Plugs<br>Pitch Diameter<br>Major Diameter | 4 tpi to 80 tpi<br>Up to 4 in | (70 + 7*L*) µin<br>(64 + 3*L*) µin | Thread Wires and ULM used as standards |
| Thread Rings Split | 0.625 in to 4 in | (120 + 9*L*) µin | Thread Set Plug used as standard |

**Mass – Hardness**

| Calibration Parameter/Equipment | Range | Calibration and Measurement Capability (+/-) [2] | Remarks |
|---|---|---|---|
| Indirect Verification of Rockwell Hardness Testers[1] | HRC<br>Low<br>Middle<br>High | 0.32 HRC<br>0.36 HRC<br>0.4 HRC | ASTM E18 |

**Electricity and Magnestism - Voltage**

| Calibration Parameter/Equipment | Range | Calibration and Measurement Capability (+/-) [2] | Remarks |
|---|---|---|---|
| DC Volts | 100 µV to 100 mV | 70 µV/V + 30 µV | Comparisons performed with a Multifunction Calibrator and DMM |
| | 100 mV to 100 V | 90 µV/V + 30 mV | |
| | 100 V to 1.1 kV | 67 µV/V + 190 mV | |
| | 1.1 kV to 30 kV | 5.9 mV/V | kV Comparisons performed with a DMM and HV Probe |

Notes:
1) This laboratory offers calibration services at the laboratory's own facilities and at the client's or other agreed upon facilities.
2) Calibration and Measurement Capabilities are expressed as expanded uncertainties at approximately a 95 % level of confidence using a coverage factor of $k = 2$.

**If you have any additional questions please contact the L-A-B Operations 260-637-2705.**

## Revision History

| Revision | Date | Revised By | Brief Description of Revision |
|---|---|---|---|
| | | | |
| 9 | 07/08/2009 | Randy Long/ Ryan Fischer | Moved oscilloscope to Electricity and Magnetism and clarified thermodynamic disciplines, added Fluid Properties and Quantities, moved viscosity and flow to Fluid Properties and Quantities from Mass, moved pH and Conductivity to Fluid Properties and Quantities from Amount of Substance-Chemical, renamed Amount of Substance-Chemical to Amount of Substance, added Gas, Liquid and Particulate disciplines to Amount of Substance, added revision history block, Calibration and Measurement Capability is replacing the Best Measurement Capability per the international directive. |