



Calibration Laboratory Assessment Service

CLAS Certificate Number 2003-02

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Clients Served:

All interested parties

Some calibration services are available on-site. These services are indicated in the "Remarks" column of the following pages.

Field(s) of Calibration:

[Mechanical](#), [torque](#), [dimensional](#), [electrical](#) (dc & lf) and [frequency](#)

**SCC Accreditation:
(ISO/IEC 17025)**

Accredited Laboratory No. 482
First issued: 2003-03-24

This scope of calibration capabilities is published by the CLAS program of the National Research Council of Canada (NRC) in close co-operation with the PALCAN program of the Standards Council of Canada (SCC), Canada's accreditation body for calibration and testing laboratories. The SCC accredits the capability of the named laboratory for being able to perform the listed calibrations at the given Best Measurement Capability (see Supplementary Notes C and D) with traceability to the International System of Units (SI) or to standards acceptable to the CLAS program.

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Measured Quantity & Range or Instrument	Calibration Measurement Capability expressed as an Uncertainty (\pm) (see Supplementary Notes)	Type	Remarks
<p>MECHANICAL</p> <p>Pressure, indicators and gauges: (gauge pressure)</p> <p>10 to 800 psi</p> <p>100 to 16000 psi</p>	<p>0.08 % of reading or 0.04 psi whichever greater</p> <p>0.08 % of reading or 0.8 psi whichever greater</p>	<p>II</p>	
<p>HARDNESS</p> <p>Indirect verification of Rockwell hardness testers</p> <ul style="list-style-type: none"> • HRB • HRC 	<p>Governed by the uncertainty of the standardized test block used to perform the indirect verification</p>	<p>III</p>	<p>ASTM E18 Standardized Test Blocks per ASTM E18 See notes 1, 2 and 3. On-site calibration available.</p>
<p>Gauge block, length: Steel, Rectangular and Square</p> <ul style="list-style-type: none"> • Inch, up to 4 inches • Inch, 4 to 20 inches • Metric, up to 100 mm • Metric, 100 to 500 mm 	<p>$\pm (2.7 + 3.3L) \mu''$ (Note: L in inches)</p> <p>$\pm (2.8 + 2.2L) \mu''$ (Note: L in inches)</p> <p>$\pm (0.069 + 0.003L) \mu m$ (Note: L in mm)</p> <p>$\pm (0.071 + 0.0022L) \mu m$ (Note: L in mm)</p>	<p>I</p>	<p>Comparison method with a reference gauge block set.</p> <p>ANSI / ASME B89.1.2M, FED SPEC GGG-G-15C</p>
<p>Cylindrical ring gauge, diameter:</p> <ul style="list-style-type: none"> • Inch up to 8 inches • Metric up to 200 mm 	<p>$\pm (17+ 9L) \mu''$ (Note: L in inches)</p> <p>$\pm (0.43 + 0.009L) \mu m$ (Note: L in mm)</p>	<p>I</p>	<p>Comparison method with ring gauges and Mahr model 828. ANSI / ASME B89.1.6M</p>

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Measured Quantity & Range or Instrument	Calibration Measurement Capability expressed as an Uncertainty (\pm) (see Supplementary Notes)	Type	Remarks
Cylindrical plug gauge, diameter: <ul style="list-style-type: none"> • Inch up to 8 inches • Metric up to 200 mm 	$\pm (17+ 6L) \mu''$ (Note: L in inches) $\pm (0.43 + 0.006L) \mu\text{m}$ (Note: L in mm)	I	ANSI / ASME B89.1.5
Thread wire, diameter: <ul style="list-style-type: none"> • Inch up to 1 inch • Metric up to 25 mm 	$\pm 27 \mu''$ $\pm 0.69 \mu\text{m}$	II	ANSI / ASME B1.2, ANSI / ASME B1.16M
60 degree thread plug gauge and thread setting plug gauge: <ul style="list-style-type: none"> • Pitch diameter <ul style="list-style-type: none"> - Inch up to 1.0 inches - over 1.0 to 6 inches • Major diameter <ul style="list-style-type: none"> - Inch, up to 8 inches - Metric up to 200 mm 	$\pm 110 \mu''$ $\pm 213 \mu''$ $\pm 2.8 \mu\text{m}$ $\pm 5.4 \mu\text{m}$ $\pm (17+ 6L) \mu''$ (Note: L in inches) $\pm (0.43 + 0.006L) \mu\text{m}$ (Note: L in mm)	II	ANSI / ASME B1.2 , ANSI / ASME B1.16M Diameter on flank, measured with thread wires.
60 degree adjustable thread ring gauge: <ul style="list-style-type: none"> • Set to thread setting plug <ul style="list-style-type: none"> - Inch or metric • Minor diameter <ul style="list-style-type: none"> - Inch, up to 3 inches - Metric up to 75 mm 	The adjustable thread ring gauge is set to the functional diameter of the thread setting plug	II	ANSI / ASME B1.2, ANSI / ASME B1.16M

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Measured Quantity & Range or Instrument	Calibration Measurement Capability expressed as an Uncertainty (\pm) (see Supplementary Notes)	Type	Remarks
Indicators: Analog <ul style="list-style-type: none"> • Inch, 0.001 inch graduations • Inch, 0.0001 inch graduations • Inch, 0.00002 inch graduations • Metric, 0.02 mm graduations • Metric, 0.002 mm graduations • Metric, 0.0002 mm graduations 	<ul style="list-style-type: none"> $\pm 897 \mu\text{m}$ $\pm 94.4 \mu\text{m}$ $\pm 18.9 \mu\text{m}$ $\pm 17.25 \mu\text{m}$ $\pm 1.88 \mu\text{m}$ $\pm 0.28 \mu\text{m}$ 	II	ANSI / ASME B89.1.10M Comparison with gauge blocks.
Indicators: Digital <ul style="list-style-type: none"> • Inch, 0.0005 inch resolution • Inch, 0.00005 inch resolution • Metric, 0.01 mm resolution • Metric, 0.001 mm resolution 	<ul style="list-style-type: none"> $\pm 680 \mu\text{m}$ $\pm 67.6 \mu\text{m}$ $\pm 10.77 \mu\text{m}$ $\pm 1.42 \mu\text{m}$ 	II	Comparison with gauge blocks.
Micrometer: Outside <ul style="list-style-type: none"> • Inch up to 6 inches • over 6 to 40 inches • Metric up to 150 mm • over 150 to 2000 mm 	<ul style="list-style-type: none"> $\pm (54 + 4L) \mu\text{m}$ (Note: L in inches) $\pm (37 + 8L) \mu\text{m}$ (Note: L in inches) $\pm (1.37 + .004L) \mu\text{m}$ (Note: L in mm) $\pm (0.94 + 0.008L) \mu\text{m}$ (Note: L in mm) 	II	CAN/CGSB - 39-18 Comparison with gauge blocks.
Micrometer: Inside <ul style="list-style-type: none"> • Inch up to 24 inches • over 24 to 60 inches • Metric, up to 600 mm 	<ul style="list-style-type: none"> $\pm 237 \mu\text{m}$ $\pm 526 \mu\text{m}$ $\pm 5.9 \mu\text{m}$ 	II	CAN/CGSB - 39-18 Comparison with gauge blocks.

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Measured Quantity & Range or Instrument	Calibration Measurement Capability expressed as an Uncertainty (\pm) (see Supplementary Notes)	Type	Remarks
<ul style="list-style-type: none"> over 600 to 1500 mm 	$\pm 13 \mu\text{m}$		
Micrometer: Depth <ul style="list-style-type: none"> Inch up to 12 inches Metric up to 300 millimetres 	$\pm 260 \mu\text{m}$ $\pm 6.6 \mu\text{m}$	II	CAN/CGSB - 39-18 Comparison with gauge blocks.
Micrometer: Three point internal <ul style="list-style-type: none"> Inch, up to 4 inches Metric up to 100 millimetres 	$\pm 144 \mu\text{m}$ $\pm 3.6 \mu\text{m}$	II	Comparison with ring gauges.
Micrometer setting standards: <ul style="list-style-type: none"> Inch up to 60 inches Metric up to 1500 millimetres 	$\pm (28+ 7L) \mu\text{m}$ (Note: L in inches) $\pm (0.71 + 0.007L) \mu\text{m}$ (Note: L in mm)	II	CAN/CGSB - 39-18 Comparison with gauge blocks.
Caliper: Outside <ul style="list-style-type: none"> Inch, up to 12 inches over 12 to 24 inches over 24 to 40 inches Metric, up to 300 mm over 300 to 600 mm over 600 to 1000 mm 	$\pm 330 \mu\text{m}$ $\pm 390 \mu\text{m}$ $\pm 480 \mu\text{m}$ $\pm 8.4 \mu\text{m}$ $\pm 9.9 \mu\text{m}$ $\pm 12 \mu\text{m}$	II	CAN/CGSB -39- 19 Comparison with gauge blocks.
Caliper: Inside <ul style="list-style-type: none"> Inch, up to 12 inches Metric up to 300 millimetres 	$\pm 330 \mu\text{m}$ $\pm 8.4 \mu\text{m}$	II	CAN/CGSB -39- 19 Comparison with gauge blocks.
Caliper: Depth <ul style="list-style-type: none"> Inch, up to 12 inches Metric up to 300 millimetres 	$\pm 330 \mu\text{m}$ $\pm 8.4 \mu\text{m}$	II	Comparison with gauge blocks.

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Measured Quantity & Range or Instrument	Calibration Measurement Capability expressed as an Uncertainty (\pm) (see Supplementary Notes)	Type	Remarks
Step gauges – Height gauges: <ul style="list-style-type: none"> • Inch up to 40 inches • Metric up to 1000 mm 	$\pm (176 + 5L) \mu''$ (Note: L in inches) $\pm (4.5 + 0.005L) \mu\text{m}$ (Note: L in mm)	II	FED SPEC GGG-G-111C Comparison with gauge blocks.
Torque wrenches & screwdrivers: Clockwise <ul style="list-style-type: none"> • 10 in•oz to 1000 ft•lb 	$\pm 1\%$ of reading	II	Electronic transducer system
ELECTRICAL Voltage, DC 0 V to 329.9999 mV 0.33 V to 3.299999 V 3.3 V to 32.9999 V 33 V to 329.9999 V 100 V to 1000 V 0 V to 100 mV 100 mV to 1 V 1 V to 10 V 10 V to 100 V 100 V to 1000 V 1 kV to 20 kV (20 kV range) 20 kV to 70 kV (70 kV range)	0.002 % + 1 μV 0.0011 % + 2 μV 0.0012 % + 15 μV 0.0018 % + 150 μV 0.0018 % + 1500 μV 0.0009 % + 0.3 μV 0.0008 % + 0.3 μV 0.0008 % + 0.5 μV 0.0010 % + 30 μV 0.0010 % + 100 μV 0.04% of reading + 0.02% of range + 0.1 ppm/volt 0.04% of reading + 0.02% of range + 0.07 ppm/volt	II	Source. For the calibration of dc voltage measuring devices. On-site calibration available. Measure. For the calibration of dc voltage generating devices. On-site calibration available. Measure. For the calibration of Hipot testers (dielectric strength testers) and other high voltage sources.

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Measured Quantity & Range or Instrument	Calibration Measurement Capability expressed as an Uncertainty (\pm) (see Supplementary Notes)	Type	Remarks
<p>Current, DC</p> <p>0 to 329.999 μA 0.33 mA to 3.29999 mA 3.3 mA to 32.9999 mA 33 mA to 329.999 mA 0 to 1.09999 A 1.1 A to 2.99999 A 0 to 10.9999 A 11 A to 20.5 A</p> <p>0 to 100 nA 100 nA to 1 μA 1 μA to 10 μA 10 μA to 100 μA 100 μA to 1 mA 1 mA to 10 mA 10 mA to 100 mA 100 mA to 1 A</p> <p>0.1μA to 2 A</p>	<p>0.015 % + 0.02 μA 0.01 % + 0.05 μA 0.01 % + 0.25 μA 0.01 % + 2.5 μA 0.02 % + 40 μA 0.038 % + 40 μA 0.05 % + 500 μA 0.1 % + 750 μA</p> <p>0.03 % + 0.04 nA 0.002 % + 0.04 nA 0.002 % + 0.1 nA 0.002 % + 0.8 nA 0.002 % + 5 nA 0.003 % + 50 nA 0.0035 % + 500 nA 0.011 % + 10 μA</p> <p>0.34%</p>	<p>II</p>	<p>Source. For the calibration of dc current measuring devices. On-site calibration available.</p> <p>Measure. For the calibration of dc current generating devices. On-site calibration available.</p> <p>Measure using a digital meter.</p>

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Measured Quantity & Range or Instrument	Calibration Measurement Capability expressed as an Uncertainty (\pm) (see Supplementary Notes)	T y p e	Remarks
<p>Electrical Calibration of Temperature Indicators</p> <p>RTD simulation</p> <p>-200 °C to 630 °C</p> <p>Thermocouple simulation</p> <p>Type J -210 °C to 1200 °C</p> <p>Type K -200 °C to 1372 °C</p> <p>Type T -250 °C to 400 °C</p>	<p>0.04 °C to 0.23 °C</p> <p>0.22 °C to 0.35 °C</p> <p>0.19 °C to 0.34 °C</p> <p>0.23 °C to 0.76 °C</p>	<p>II</p>	<p>Suitable for the calibration of temperature indicators and process calibrators by electrical simulation of temperature. On-site calibration available.</p> <p>Suitable for the calibration of temperature indicators by electrical simulation of temperature. On-site calibration available.</p>

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Measured Quantity & Range or Instrument	Frequency	Calibration Measurement Capability expressed as an Uncertainty (\pm) (see Supplementary Notes)	Type	Remarks
Frequency	1 Hz to 40 Hz 40 Hz to 10 MHz 0.01 Hz to 2 MHz	0.05 % 0.01 % 2.5 ppm + 5 μ Hz	II	Measure capability. On-site calibration available. Generate using a multifunction calibrator. On-site calibration available
Voltage, AC			II	
1 mV to 32.999 mV 33 mV to 329.999 mV 0.33 V to 3.29999 V 3.3 V to 32.9999 V 33 V to 329.999 V 330 V to 1020 V	10 Hz to 500 kHz 10 Hz to 500 kHz 10 Hz to 500 kHz 10 Hz to 100 kHz 45 Hz to 20 kHz 45 Hz to 10 kHz	0.0332 % to 5.8 % 0.0169 % to 0.41 % 0.0168 % to 0.42 % 0.0168 % to 0.14 % 0.0196 % to 0.35 % 0.0260 % to 0.033 %		For the calibration of sinewave voltage measurement devices. See Annex B for details. On-site calibration available.
1 mV to 1000 V	1 Hz to 2 MHz	0.007 % to 1.5 %		For the calibration of voltage sources using a digital multimeter. On-site calibration available.
1 kV to 20 kV (20 kV range)	60 Hz	0.2% of reading + 0.1% of range + 0.2 ppm/volt		Measure. For the calibration of Hipot testers (dielectric strength testers) and other high voltage sources.
20 kV to 70 kV (70 kV range)	60 Hz	0.4% of reading + 0.15% of range + 0.15 ppm/volt		
Current, AC			II	
0.029 mA to 0.32999 mA 0.33 mA to 329.999 mA 0.33 A to 2.9999 A 3.0 A to 20.5 A	10 Hz to 30 kHz 10 Hz to 30 kHz 10 Hz to 10 kHz 45 Hz to 5 kHz	0.16 % to 3 % 0.046 % to 1.2 % 0.06 % to 3 % 0.078 % to 3 %		For the calibration of sinewave current measurement devices. See Annex A for details. On-site calibration available. For the calibration of current sources using a

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Measured Quantity & Range or Instrument	Frequency	Calibration Measurement Capability expressed as an Uncertainty (\pm) (see Supplementary Notes)	Type	Remarks
10 μ A to 1 A	10 Hz to 100 kHz	0.03 % to 1 %		digital multimeter. On-site calibration available.
1 μ A to 2 A	60 Hz	0.66%		Measure using a digital meter.

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Measured Quantity & Range or Instrument	Frequency	Calibration Measurement Capability expressed as an Uncertainty (\pm) (see Supplementary Notes)	Type	Remarks
<p>Resistance</p> <p>0 Ω to 32.999 Ω 33 Ω to 109.9999 kΩ 110 kΩ to 1.099999 MΩ 1.1 MΩ to 3.29999 MΩ 3.3 MΩ to 10.99999 MΩ 11 MΩ to 32.99999 MΩ 33 MΩ to 109.9999 MΩ 110 MΩ to 329.9999 MΩ 330 MΩ to 1100 MΩ</p> <p>0.47 Ω to 10 Ω 10 Ω to 100 Ω 100 Ω to 1 kΩ 1 kΩ to 10 kΩ 10 kΩ to 100 kΩ 100 kΩ to 1 MΩ 1 MΩ to 10 MΩ 10 MΩ to 100 MΩ 100 MΩ to 1GΩ</p>		<p>0.003 % + 0.001 Ω 0.0028 % + 0.015 Ω 0.0032 % + 2 Ω 0.006 % + 30 Ω 0.013 % + 50 Ω 0.025 % + 2500 Ω 0.05 % + 3000 Ω 0.3 % + 100000 Ω 1.5 % + 500000 Ω</p> <p>0.0015 % + 50 $\mu\Omega$ 0.0012 % + 0.5 mΩ 0.001 % + 0.5 mΩ 0.001 % + 5 mΩ 0.001 % + 50 mΩ 0.0015 % + 2 Ω 0.005 % + 100 Ω 0.05 % + 1 kΩ 0.5 % + 10 kΩ</p>	II	<p>For the calibration of resistance measurement devices On-site calibration available.</p> <p>Measure capability using a digital multimeter. On-site calibration available.</p>
<p>Capacitance</p> <p>0.19 nF to 1.1 nF 1.1 nF to 3.3 nF 3.3 nF to 333 nF 0.33 μF to 1.1 μF 1.1 μF to 3.3 μF 3.3 μF to 11 μF 11 μF to 33 μF 33 μF to 110 μF 110 μF to 333 μF 0.33 mF to 1.1 mF 1.1 mF to 3.3 mF 3.3 mF to 11 mF 11 mF to 33 mF 33 mF to 110 mF</p>	<p>10 Hz to 10 kHz 10 Hz to 3 kHz 10 Hz to 1 kHz 10 Hz to 600 Hz 10 Hz to 300 Hz 10 Hz to 150 Hz 10 Hz to 120 Hz 10 Hz to 80 Hz DC to 50 Hz DC to 20 Hz DC to 6 Hz DC to 2 Hz DC to 0.6 Hz DC to 0.2 Hz</p>	<p>0.5 % to 5.8 % 0.8 % to 1.4 % 0.34 % to 0.55 % 0.35 % to 0.55 % 0.34 % to 0.52 % 0.34 % to 0.55 % 0.49 % to 0.67 % 0.54 % to 0.75 % 0.54 % to 0.72 % 0.45 % to 0.75 % 0.54 % to 0.72 % 0.55 % to 0.75 % 0.84 % to 1.0 % 1.2 % to 1.4 %</p>	II	<p>Source synthesized capacitance using a multiproduct calibrator. For the calibration of capacitance measuring devices. On-site calibration available.</p>

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Notes
<ol style="list-style-type: none">1. The Indirect Verification of Rockwell Hardness Testers is performed according to the requirements of ASTM E18.2. ASTM E18 is published by the American Society for Testing and Materials.3. The uncertainty of the hardness tester being calibrated is calculated for each specific test point and is dependant on the uncertainty of the specific hardness test block used and on the performance characteristics of the hardness tester itself.

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Supplementary Notes

- A. Calibration capabilities are traceable to the national measurement standards of Canada held or accepted by the National Research Council (NRC) or, with the agreement of NRC, to the national measurement standards of other countries and are thus traceable to the internationally accepted representation of the appropriate SI (Système International) unit.
- B. The laboratory's specific measurement capabilities are certified by the NRC's Calibration Laboratory Assessment Service (CLAS) and accredited by the Standards Council of Canada (SCC) in accordance with the following definitions:
- Type I: A capability of which the primary purpose is the calibration of measurement standards for other calibration laboratories. A laboratory with this type of capability has the appropriate reference standards, working standards, check standards, and calibration systems to be able to assess dynamically and to quantify its measurement uncertainty, and is able to monitor its measurement processes continually. The environmental conditions that affect the laboratory's measurements are closely monitored and controlled. A laboratory with this type of capability usually reports a measurement value accompanied by a comprehensive statement of uncertainty. A laboratory with this type of capability is often referred to as a standards or standards calibration laboratory.
- Type II: A capability of which the main purpose is the calibration and adjustment of test, measurement and diagnostic equipment for use in product testing, manufacturing, servicing, etc. A laboratory with this type of capability has the appropriate working standards and calibration systems to be able to calibrate to a manufacturer's specification and tolerance or calibrate to a written standard, using appropriate test uncertainty ratios (TUR). A laboratory with this type of capability usually reports a measurement value and indicates if the test equipment complies with a specification, tolerance or a written standard. It will, usually, base its capabilities on the specifications and tolerances of the working standards being used. It also has, normally, the means to check its working standards between calibrations and has available the appropriate environment(s). A laboratory with this type of capability is often referred to as a test equipment calibration laboratory.
- Type III: A calibration capability, within a laboratory, mobile or fixed, with the appropriate reference or working standards, of which the main purpose is to provide a reference. A laboratory with this type of capability usually has minimal means to monitor its calibration system. It relies mainly on the values assigned by higher echelon laboratories to its standards and uses these values with few other considerations to assign values or verify the compliance of equipment being calibrated to their specifications and tolerances or to written standards. This could be an on-site service subject to a wide range of environmental factors.
- C. The best measurement capability of the laboratory includes the uncertainty associated with the calibration of the laboratory's reference or transfer standard by NRC, or by a laboratory acceptable to CLAS, uncertainties caused by the transportation of the calibrated reference standard from NRC (or other laboratories) to the laboratory, uncertainties of the calibration process in the laboratory, and uncertainties due to the behaviour of the most ideal available standard or measurement device for a specific measurement technology. These uncertainties include components which could have been evaluated by statistical methods on a series of repeated measurements and which can be characterised by experimental standard deviations. The other components, which can also be characterized by standard deviations, are evaluated from assumed probability distributions based on experience or other information. These have been combined to form an expanded uncertainty $U = ku_c$ with U determined from a combined standard uncertainty u_c and a coverage factor $k = 2$. Since it can be assumed that the probability distribution characterised by the reported result and u_c is approximately normal, the value of a calibrated device can be asserted to lie in the interval represented by the expanded uncertainty U with a level of confidence of approximately 95 percent. The uncertainties quoted do not include the possible effects on the calibrated device of transportation, long term stability or intended use.
- D. The uncertainty of a specific calibration by the laboratory can be greater than the best measurement capability because it will include uncertainties due to the actual condition and behaviour of the customer's device during its calibration.
- E. CLAS certification and SCC accreditation is the formal recognition of specific calibration capabilities. Neither the NRC nor SCC guarantee the accuracy of individual calibrations by the laboratory.