



National Research  
Council Canada

Institute for National  
Measurement Standards

Conseil national  
de recherches Canada

Institut des étalons  
nationaux de mesure



## Calibration Laboratory Assessment Service

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CLAS Certificate Number 2001-02

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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 of Calibration:**

Dimensional, Mechanical

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

Accredited Laboratory No. 10  
First issued 1984-06-05 (testing)  
First issued 2001-09-20 (calibration)

This scope of 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 capabilities of the named laboratory for performing the listed calibrations at the given level of uncertainty with traceability to the national measurement standards of Canada. The total uncertainty of the following capabilities, in each case, has a confidence level of at least 95% and includes the NRC (or other recognized national laboratory) uncertainty, and uncertainties associated with the measurements made by the accredited laboratory. The uncertainty quoted does not include the possible effects on the customer's device of transportation, long term stability or intended use. See Supplementary Notes. For clients requiring a confidence level of 99%, the laboratory is able to adjust the uncertainty accordingly.

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<b>Type I Capability</b>		
Measured Quantity & Range or Instrument	Calibration and Measurement Capability expressed as an Uncertainty ( $\pm$ ) (see Supplementary Notes)	Remarks
<b>DIMENSIONAL</b>		
<b>Steel gauge block, rectangular and square. length:</b>		ANSI/ASME B89.1.2M, FED SPEC GGG-G-15C
0 to 1 in	4.6 $\mu$ in	
> 1 to 4 in	(3.5 + 1.1L) $\mu$ in (Note: L in 'inches')	
> 4 to 12 in	(2.3 + 2.4L) $\mu$ in (Note: L in 'inches')	
0 to 25 mm	0.117 $\mu$ m	
> 25 to 100 mm	(0.089 + 0.0011L) $\mu$ m (Note: L in 'millimetres')	
> 100 to 305 mm	(0.058 + 0.0024L) $\mu$ m (Note: L in 'millimetres')	
<b>Gauge block, variation in length:</b>		Parallelism of gauge blocks.
0 to 12 in	1 $\mu$ in	
0 to 300 mm	0.025 $\mu$ m	
<b>Cylindrical ring gauge, diameter:</b>		ANSI/ASME B89.1.6M
0 to 12 in	(15 + 4.1L) $\mu$ in (Note: L in 'inches')	
0 to 300 mm	(0.38 + 0.0041L) $\mu$ m (Note: L in 'millimetres')	

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<b>Type I Capability</b>		
Measured Quantity & Range or Instrument	Calibration and Measurement Capability expressed as an Uncertainty ( $\pm$ ) (see Supplementary Notes)	Remarks
<b>Cylindrical plug gauge, diameter:</b>		ANSI/ASME B89.1.5
0 to 12 in	(15 + 4.1L) $\mu$ in (Note: L in 'inches')	
0 to 300 mm	(0.38 + 0.0041L) $\mu$ m (Note: L in 'millimetres')	
<b>Thread wire, diameter:</b>		ANSI/ASME B1.2-App.B (Unified), ANSI/ASME B1.16M- App.B (Metric)
0 to 1 in	12 $\mu$ in	
0 to 25 mm	0.31 $\mu$ m	
<b>60 degree thread plug gauge and thread setting plug gauge:</b>		ANSI/ASME B1.2, ANSI/ASME B1.16M
<b>Pitch diameter (measured over thread wires)</b>		The pitch diameter of a thread plug gauge is determined by measuring the diameter over thread wires inserted in the thread groove on opposite sides of the axis. The preferred term for this measurement is 'thread groove diameter'. Other names for this measurement are 'simple effective diameter' and 'simple pitch diameter'.
0 to 1.5 in	100 $\mu$ in	
> 1.5 to 6 in	200 $\mu$ in	
> 6 to 12 in	300 $\mu$ in	
0 to 35 mm	2.5 $\mu$ m	
> 35 to 150 mm	5.1 $\mu$ m	
> 150 to 300 mm	7.6 $\mu$ m	
<b>Major diameter</b>		
0 to 12 in	(15 + 4.7L) $\mu$ in (Note: L in 'inches')	
0 to 300 mm	(0.38 + 0.0047L) $\mu$ m (Note: L in 'millimetres')	

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<b>Type II Capability</b>		
Measured Quantity & Range or Instrument	Calibration and Measurement Capability expressed as an Uncertainty ( $\pm$ ) (see Supplementary Notes)	Remarks
<p><b>60 degree adjustable thread ring gauge:</b> Set to thread setting plug</p> <p><b>NPT/NPTF Thread plug and ring</b></p> <p style="padding-left: 40px;"><u>Standoff</u></p> <p style="padding-left: 40px;">1/16 to 2 inch</p> <p><b>Micrometer setting standard:</b></p> <p>0 to 13 in</p> <p>&gt; 13 to 60 in</p> <p>0 to 330 mm</p> <p>&gt; 330 to 1500 mm</p> <p><b>Indicators, Analog:</b></p> <p>Inch, 0.00005 in graduation (Range: 0 to 4 in)</p> <p>Metric, 0.001 mm graduation (Range: 0 to 100 mm)</p>	<p>The adjustable thread ring gauge is set to the functional diameter of the thread setting plug</p> <p style="text-align: center;">200 <math>\mu\text{in}</math></p> <p style="text-align: center;">(10 + 4.4L) <math>\mu\text{in}</math> (Note: L in 'inches')</p> <p style="text-align: center;">(50 + 4L) <math>\mu\text{in}</math> (Note: L in 'inches')</p> <p style="text-align: center;">(0.26 + 0.0044L) <math>\mu\text{m}</math> (Note: L in 'millimetres')</p> <p style="text-align: center;">(1.3 + 0.004L) <math>\mu\text{m}</math> (Note: L in 'millimetres')</p> <p style="text-align: center;">(10 + 1.2x10<sup>6</sup>R) <math>\mu\text{in}</math> (Note: R in 'inches')</p> <p style="text-align: center;">(0.25 + 1200R) <math>\mu\text{m}</math> (Note: R in 'millimetres')</p>	<p>ANSI/ASME B1.2, ANSI/ASME B1.16M</p> <p>ITC Procedure CAL.013</p> <p>CAN/CGSB-39.18, T.O. 33K6-4-369-1</p> <p>ANSI/ASME B89.1.10M, R is the discernable resolution (for example 1/2, 1/4 or 1/5 of the graduation), Up to 4 inch travel</p> <p>Up to 100 mm travel</p>

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Type II Capability		
Measured Quantity & Range or Instrument	Calibration and Measurement Capability expressed as an Uncertainty ( $\pm$ ) (see Supplementary Notes)	Remarks
<b>Indicators, Digital:</b>		
Inch, 0.00001 in resolution (Range: 0 to 4 in)	$(10 + 6.0 \times 10^5 R) \mu\text{in}$ (Note: R in 'inches')	ANSI/ASME B89.1.10M, R is the resolution, Up to 4 inch travel
Metric, 0.0002 mm resolution (Range: 0 to 100 mm)	$(0.25 + 600R) \mu\text{m}$ (Note: R in 'millimetres')	Up to 100 mm travel
<b>Micrometer: outside</b>		CAN/CGSB-39.18, T.O. 33K6-4-661-1, T.O. 33K6-4-15-1
0 to 6 in	$(30 + 3L) \mu\text{in}$ (Note: L in 'inches')	
> 6 to 60 in	$(60 + 5L) \mu\text{in}$ (Note: L in 'inches')	
0 to 150 mm	$(0.76 + 0.003L) \mu\text{m}$ (Note: L in 'millimetres')	
> 150 to 1500 mm	$(1.5 + 0.005L) \mu\text{m}$ (Note: L in 'millimetres')	
<b>Micrometer: inside</b>		CAN/CGSB-39.18, T.O. 33K6-4-661-1, T.O. 33K6-4-15-1
0 to 24 in	$(160 + 8L) \mu\text{in}$ (Note: L in 'inches')	
> 24 to 60 in	$(150 + 6L) \mu\text{in}$ (Note: L in 'inches')	
0 to 600 mm	$(4.1 + 0.008L) \mu\text{m}$ (Note: L in 'millimetres')	
> 600 to 1500 mm	$(3.8 + 0.006L) \mu\text{m}$ (Note: L in 'millimetres')	

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<b>Type II Capability</b>		
Measured Quantity & Range or Instrument	Calibration and Measurement Capability expressed as an Uncertainty ( $\pm$ ) (see Supplementary Notes)	Remarks
<b>Micrometer: depth</b>		CAN/CGSB-39.18, T.O. 33K6-4-661-1, T.O. 33K6-4-15-1
0 to 24 in	(240 + 9L) $\mu$ in (Note: L in 'inches')	
0 to 600 mm	(6.1 + 0.009L) $\mu$ m (Note: L in 'millimetres')	
<b>Caliper: outside</b>		CAN/CGSB-39-19
0 to 60 in	(290 + 5L) $\mu$ in (Note: L in 'inches')	
0 to 1500 mm	(7.4 + 0.005L) $\mu$ m (Note: L in 'millimetres')	
<b>Caliper: inside</b>		CAN/CGSB-39-19
0 to 60 in	(300 + 5L) $\mu$ in (Note: L in 'inches')	
0 to 1500 mm	(7.6 + 0.005L) $\mu$ m (Note: L in 'millimetres')	
<b>Caliper: depth</b>		CAN/CGSB-39-19
0 to 24 in	(300 + 6L) $\mu$ in (Note: L in 'inches')	
0 to 600 mm	(7.6 + 0.006L) $\mu$ m (Note: L in 'millimetres')	

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Type II Capability		
Measured Quantity & Range or Instrument	Calibration and Measurement Capability expressed as an Uncertainty ( $\pm$ ) (see Supplementary Notes)	Remarks
<p><b>Adjustable snap gauge (without indicator)</b></p> <ul style="list-style-type: none"> <li>Up to 12 in</li> <li>Up to 300 mm</li> </ul>	<p>125 <math>\mu</math>m</p> <p>3.2 <math>\mu</math>m</p>	ITC Procedure CAL.009
<p><b>Height gauge</b></p> <p>0 to 40 in:</p> <p>0.0001 in resolution</p> <p>0.0005 in resolution</p> <p>0.001 in resolution</p> <p>0 to 1000 mm:</p> <p>0.001 mm resolution</p> <p>0.01 mm resolution</p> <p>0.02 mm resolution</p>	<p>(86 + 7L) <math>\mu</math>m (Note: L in 'inches')</p> <p>(295 + 7L) <math>\mu</math>m (Note: L in 'inches')</p> <p>(580 + 7L) <math>\mu</math>m (Note: L in 'inches')</p> <p>(1.7 + 0.007L) <math>\mu</math>m (Note: L in 'millimetres')</p> <p>(6.0 + 0.007L) <math>\mu</math>m (Note: L in 'millimetres')</p> <p>(11.7 + 0.007L) <math>\mu</math>m (Note: L in 'millimetres')</p>	NAVAIR 17-20MD-17, FED SPEC GGG-G111C

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<b>Type II Capability</b>		
<b>Measured Quantity &amp; Range or Instrument</b>	<b>Calibration and Measurement Capability expressed as an Uncertainty (<math>\pm</math>) (see Supplementary Notes)</b>	<b>Remarks</b>
<b>MECHANICAL</b>		
<b>Vacuum</b>		
-15 to 0 psi	0.05% of reading or $\pm 0.05$ psi, whichever is greater	Gauge, ITC Procedure CAL.038
<b>Pressure</b>		
0 to 300 psi	0.05% of reading or $\pm 0.05$ psi, whichever is greater	Gauge, ITC Procedure CAL.038
300 to 3000 psi	0.06% of reading or $\pm 0.6$ psi, whichever is greater	Gauge, ITC Procedure CAL.038
3000 to 10000 psi	0.1 % of reading	Gauge, ITC Procedure CAL.038
<b>Calibration of load cells</b>		
<b>Tension</b>		
0 to 270000 lbf	0.1 % of reading	ITC Procedure CAL.040, In place of the pound-force (lbf) unit, calibration or verification may be performed using the SI unit, the Newton (N). 1 lbf is equivalent to 4.448222 N.
<b>Compression</b>		
0 to 270000 lbf	0.1 % of reading	
<b>Calibration of force testing machines</b>		
<b>Tension</b>		
0 to 270000 lbf	0.25 % of reading over the Class A loading range of the standard	ASTM E4. 300 lbf, 2 klb, 10 klb, 60 klb and 270 klb standards. In place of the pound-force (lbf) unit, calibration or verification may be performed using the SI unit, the Newton (N). 1 lbf is equivalent to 4.448222 N.
<b>Compression</b>		
0 to 270000 lbf	0.25 % of reading over the Class A loading range of the standard	

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<b>Type III Capability</b>		
Measured Quantity & Range or Instrument	Calibration and Measurement Capability expressed as an Uncertainty ( $\pm$ ) (see Supplementary Notes)	Remarks
<b>Hardness</b>		
<b>Indirect verification of Brinell hardness testers</b>	Governed by the uncertainty of the standardized test block used to perform the indirect verification	ASTM E10, ITC Procedure CAL.049, Standardized Test Blocks per ASTM E10 On-site calibration available.
<b>Indirect verification of Rockwell hardness testers</b>	Governed by the uncertainty of the standardized test block used to perform the indirect verification	ASTM E18, ITC Procedure CAL.050, Standardized Test Blocks per ASTM E18 On-site calibration available.
<b>Indirect verification of Rockwell Superficial Hardness Testers</b>	Governed by the uncertainty of the standardized test block used to perform the indirect verification	ASTM E18, ITC Procedure CAL.050, Standardized Test Blocks per ASTM E18 On-site calibration available.
<b>Indirect verification of Knoop hardness testers</b>	Governed by the uncertainty of the standardized test block used to perform the indirect verification	ASTM E384, ITC Procedure CAL.051, Standardized Test Blocks per ASTM E384 On-site calibration available.
<b>Indirect verification of Vickers Macro hardness testers</b>	Governed by the uncertainty of the standardized test block used to perform the indirect verification	ASTM E384, ITC Procedure CAL.051, Standardized Test Blocks per ASTM E384 On-site calibration available.
<b>Indirect verification of Vickers Micro hardness testers</b>	Governed by the uncertainty of the standardized test block used to perform the indirect verification	ASTM E384, ITC Procedure CAL.051, Standardized Test Blocks per ASTM E384 On-site calibration available.
<b>Indirect verification of Portable hardness testers</b>	Governed by the uncertainty of the standardized test block used to perform the indirect verification	ASTM E110, ITC Procedure CAL.052, Standardized Test Blocks per ASTM E110 On-site calibration available.

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<b>Type III Capability</b>		
<b>Measured Quantity &amp; Range or Instrument</b>	<b>Calibration and Measurement Capability expressed as an Uncertainty (<math>\pm</math>) (see Supplementary Notes)</b>	<b>Remarks</b>
<b>Surface plate</b> 17 to 161 inch diagonal  Flatness  Repeat reading	$(30 + 0.8D) \mu\text{in}$ (Note: D in 'inches')  $25 \mu\text{in}$	Federal Specification GGG-P-463, On-site calibration available.  D is the diagonal length

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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. Laboratories are certified by the NRC's Calibration Laboratory Assessment Service (CLAS) for one or more of the following capabilities:
- 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 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" includes the uncertainty associated with the calibration of the accredited 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 accredited laboratory, uncertainties of the calibration process in the accredited laboratory, and uncertainties due to the behaviour of the highest quality device available for each specific technology device during its calibration. These uncertainties include components which could have been evaluated by statistical methods on a series of repeated measurements and which can be characterized 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 characterized 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. For clients requiring a confidence level of 99%, the laboratory is able to adjust the uncertainty accordingly.
- D. The uncertainty of a specific calibration by an accredited 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. As a rule, the smaller the uncertainty sought the greater the cost. Users should not demand uncertainties inappropriate to the device being calibrated or its intended use.
- F. SCC accreditation and CLAS certification is the formal recognition of specific calibration capabilities. Neither the NRC nor the SCC guarantee the accuracy of individual calibrations by recognized laboratories.