SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

FRANK COX METROLOGY
(Formerly CANADIAN CENTRAL GAUGE LABORATORY)
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CALIBRATION

Valid To: January 31, 2015 Certificate Number: 1165.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations[1, 4]:

I. Dimensional

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Gage Blocks –			
Steel, Ceramic, Carbide, Chrome Carbide			
Length	(0.5 to 100) mm	(0.075 + 0.025*L*) µm	ANSI B89.1.9
Flatness		0.1 µm	
Parallelism		0.05 µm	
Length	(0.010 to 4) in	(3 + 1*L*) µin	
Flatness		4 µin	
Parallelism		2 µin	
Plain Plug Gages –	(0.007 to 4) in	(4 + 1.5*L*) µin	ANSI B89.1.5
	(>4 to 24) in	(10 + 3*L*) µin	
Thread Measure Wire	Up to 80 TPI	4 µin	ANSI B891.17
Plain Ring Gages	(0.04 to 6) in	(7 + 1.5*L*) µin	ANSI B89.1.6M
	(6 to 12) in	(15 + 1.5*L*) µin	

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Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Micrometers –			By comparison
Outside[3]	Up to 1 in (2 to 36) in	(0.6*R* + 10*L*) µin (0.6*R* + 5*L*) µin	
Height Setting [3]	(6 to 24) in	(0.6*R* + 10*L*) µin	
High Resolution	Up to 4 in	10 µin	
Depth Gages[3]	(1 to 24) in	(0.6*R* + 10*L*) µin	By comparison
Squares	18 in	22 µin/in	Square checker
Thread Plug Gages –			
Simple Pitch Diameter	Up to 4 in (4 to 12) in	85 µin (85 + 5*L*) µin	By comparison
Linear Pitch Variation	Up to 16 in	35 µin per 4 in	Helical path analyzer or ULM
Flank Angle	Up to 16 in	3 min of arc depending on pitch	Optical comparator
Thread Ring Gages – Adjustable Type			
Functional Pitch Diameter	(0.06 to 12) in	(320 + 15*L*) µin	By comparison, fit to master plug
Flank Angle	(0.06 to 12) in	3 min of arc depending on pitch	By cast method

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Thread Ring Gages – Non-Adjustable Type			
Simple Pitch Diameter	(0.5 to 6) in	120 µin	By comparison
Lead Variation	(0.5 to 2) in	25 µin per 4 in	
Flank Angle	(0.5 to 2) in	3 min of arc depending on pitch	By cast method
Thread Caliper Gauges – Adjustable			
Knife Edge	Up to 12 in	(420 + 5*L*) µin	Fit to master
Roller Type	Up to 12 in	(250 + 10*L*) µin	
Vernier, Dial, and Digital Calipers[3]	Up to 60 in	(0.6*R* + 4.5*L*) µin	By comparison
Dial, Digital, and Test Indicators –	Up to 2 in	30 µin	ANSI B89.1.10M
High-Resolution/Digital	(0.001 to 0.05) in	1.2 µin	
High-Resolution/Analog	Up to 0.1 in	4.5 µin	
Bore Gages	(0.5 to 24) in	(0.6*R* + 3*L*) µin	By comparison
Length Standards – Setting Rods	(1 to 36) in	(6 + 4.5*L*) µin	By comparison
Surface Plates[3] - Repeat Reading	0.020 in	4.5µin	GGG-P-463c; *D* is the length of the diagonal in feet.
Flatness	Up to 20 ft diagonal	(50 + 4*D*) µin	

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Optical Comparators[3] –			
Magnification	Up to 100x	Lens: < 1% magnification	Opti-master, mag rule, angle blocks, balls
Linearity	18 in travel	200 µin	
Angle	Up to 360°	Angle: 2.7 min	
High Resolution Comparators	2 in	1.5 µin	Master blocks
Digital, Dial, and Vernier Height Gauges[3]	(6 to 48) in	$(0.6R + 5.2L)$ µin	By comparison
Sine Bars and Plates	Up to 10 in	30 µin/5 in	By comparison
Precision Levels	Up to 20 in	$(0.6R + 5.5)$ µin	Level test rig
Autocollimator	5 min	0.31 arc sec	Gauge blocks and sine equipment
Plain Snap Gages[3]	Up to 12 in	$(120 + 3L)$ µin	By comparison
Steel Rules	Up to 24 in	0.003 in	Optical comparator

II. Mechanical

Parameter	Range	CMC[2] (±)	Comments
Indirect Verification of Rockwell Hardness Testers[3]	HRA (25 to 35) HRA (36 to 59) HRA (60 to 85) HRA	 0.43 HRA 0.54 HRA 0.35 HRA	Indirect verification method per ASTM E18

Parameter	Range	CMC[2, 5] (±)	Comments
Indirect Verification of Rockwell Hardness Testers[3] – (cont)	HRBW (40 to 59) HRB (60 to 79) HRB (80 to 100) HRB HRC (20 to 30) HRC (31 to 55) HRC (56 to 65) HRC HREW (55 to 75) HREW (76 to 90) HREW (91 to 115) HREW HR15N (35 to 65) HR15N (66 to 75) HR15N (76 to 95) HR15N HR15TW (45 to 69) HR15TW (70 to 84) HR15TW (85 to 95) HR15TW HR30N (40 to 50) HR30N (55 to 74) HR30N (75 to 85) HR30N HR30TW (25 to 49) HR30TW (50 to 70) HR30TW (71 to 85) HR30TW HR45N (35 to 49) HR45N (50 to 65) HR45N (66 to 75 HR45N HR45TW (30 to 55) HR45TW (56 to 70) HR45TW (71 to 75) HR45TW	 1.2 HRB 0.81 HRB 0.55 HRB 0.49 HRC 0.74 HRC 0.38 HRC 0.67 HREW 0.75 HREW 0.56 HREW 0.49 HR15N 0.71 HR15N 0.32 HR15N 0.61 HR15TW 0.47 HR15TW 0.58 HR15TW 0.49 HR30N 0.99 HR30N 0.45 HR30N 0.74 HR30TW 0.45 HR30TW 0.50 HR30TW 0.66 HR45N 0.82 HR45N 0.44 HR45N 0.77 HR45TW 0.52 HR45TW 0.57 HR45TW	Indirect verification method per ASTM E18
Torque Tools[3] Torque Testers	450 ft·lbf 5500 in·lbf	1.0 % IV 0.16 % IV	Torque tester Standard weights

Parameter	Range	CMC[2, 5] (±)	Comments
Force Gauges	250 lbf	1.5 % IV	By comparison with standard weights
Direct Verification of Durometers –	Shore Types A, B, C, D, DO, M, O, and OO		ASTM D 2240
Indentor Shape and Extension:			
Extension at Zero	---	0.0003 in	
35° Conical Frustum Indentor	Diameter at frustum base	0.0003 in	
	Diameter at top of frustum	0.0003 in	
	Cone angle	8 arcmin	
30° Cone Indentor	Diameter at base of cone	0.0003 in	
Indentor Shape and Extension:			
1.2 mm Radius Indentor	Cone angle	8 arcmin	
	Tip Radius	0.0003 in	
	Indentor diameter Indentor radius	0.0002 in 0.0003 in	
Verification of the Durometer Spring	---	1.6 grams	Durocalibrator

[1] This laboratory offers commercial calibration service and field 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] Field calibration service is available for this calibration and this laboratory meets A2LA *R104 – General Requirements: Accreditation of Field Testing and Field Calibration Laboratories* for these calibrations. Please note the actual measurement uncertainties achievable on a customer's site can normally be expected to be larger than the CMC found on the A2LA Scope. Allowance must be made for aspects such as the environment at the place of calibration and for other possible adverse effects such as those caused by transportation of the calibration equipment. The usual allowance for the actual uncertainty introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the actual measurement uncertainty achievable on a customer's site being larger than the CMC.

[4] This laboratory offers metric equivalent capability for all items listed.

[5] In the statement of CMC, *L* is the numerical value of the nominal length of the device measured in inches; *R* is the numerical value of the resolution of the device in microinches; *D* is the numerical value of the nominal diameter of the device measured in inches except where noted; IV is the percent of indicated value.

American Association for Laboratory Accreditation

Accredited Laboratory

A2LA has accredited

FRANK COX METROLOGY

Brampton, Ontario, Canada

for technical competence in the field of

Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. This laboratory also meets any additional program requirements in the field of calibration. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009*).

Presented this 25th day of February 2013.

President & CEO
For the Accreditation Council
Certificate Number 1165.01
Valid to January 31, 2015

For the calibrations to which this accreditation applies, please refer to the laboratory's Calibration Scope of Accreditation.