



CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

VACS Ltd.
15 Regan Road, Unit 6
Brampton, ON L7A 1E3 Canada
(and satellite locations as shown on the scope)

Fulfills the requirements of

ISO/IEC 17025:2017

and national standard

ANSI/NCSL Z540-1-1994 (R2002)

In the field of

CALIBRATION

This certificate is valid only when accompanied by a current scope of accreditation document.
The current scope of accreditation can be verified at www.anab.org.

R. Douglas Leonard Jr., VP, PILR SBU

Expiry Date: 29 July 2023

Certificate Number: AC-1402



This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017.
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 April 2017).

**SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017
AND ANSI/NCSL Z540-1-1994 (R2002)**

VACS Ltd.

15 Regan Road, Unit 6
Brampton, ON L7A 1E3
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CALIBRATION

Valid to: **July 29, 2023**

Certificate Number: **AC-1402**

Satellite locations in:

[Edmonton, AB Canada](#)

[Burnaby, BC Canada](#)

Accredited Services performed at Main Site Laboratory

VACS Ltd.

15 Regan Road, Unit 6
Brampton, ON L7A 1E3
Derek Magee 905-840-7651
derekmagee@calibrations.ca

Electrical – DC/Low Frequency

Brampton, ON

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Measure ¹	Up to 100 mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1 000) V	1.6 μ V 10 μ V 0.3 mV 1.6 mV 30 mV	Agilent 3458A 8.5 Digit Multimeter
DC Voltage – Source ¹	Up to 20 mV (20 to 200) mV (0.2 to 2) V (2 to 20) V (20 to 200) V (200 to 1 000) V	6.1 μ V 0.13 mV 40 μ V 0.43 mV 4.3 mV 40 mV	Fluke 5100B Multifunction Calibrator, Agilent 3458A 8.5 Digit Multimeter
DC Current – Measure ¹	Up to 100 μ A (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	4.3 nA 40 nA 0.39 μ A 6.3 μ A 0.19 mA	Agilent 3458A 8.5 Digit Multimeter
DC Current – Source ¹	Up to 200 μ A (0.2 to 2) mA (2 to 20) mA (20 to 200) mA (0.2 to 1) A	30 nA 0.18 μ A 2.2 μ A 50 μ A 0.2 mA	Fluke 5100B Multifunction Calibrator, Agilent 3458A 8.5 Digit Multimeter
Resistance – Measure ¹	(1 to 10) Ω (10 to 100) Ω (0.1 to 1) k Ω (1 to 10) k Ω (10 to 100) k Ω (0.1 to 1) M Ω (1 to 10) M Ω	16 $\mu\Omega/\Omega$ + 87 $\mu\Omega$ 19 $\mu\Omega/\Omega$ + 0.25 m Ω 10 $\mu\Omega/\Omega$ + 2.1 m Ω 11 $\mu\Omega/\Omega$ + 12 m Ω 11 $\mu\Omega/\Omega$ + 0.12 Ω 22 $\mu\Omega/\Omega$ + 1.2 Ω 92 $\mu\Omega/\Omega$ + 23 Ω	Agilent 3458A 8.5 Digit Multimeter

Electrical – DC/Low Frequency

Brampton, ON

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Source ¹ (Simulation-Fixed Points)	1 Ω 10 Ω 100 Ω 1 k Ω 10 k Ω 100 k Ω 1 M Ω 10 M Ω	0.29 m Ω 1.2 m Ω 6.3 m Ω 60 m Ω 0.63 Ω 6.1 Ω 0.12 k Ω 5.9 k Ω	Fluke 5100B Multifunction Calibrator (6-months)
Resistance – Source ¹ (Fixed Artifacts)	1 Ω 10 Ω	0.64 m Ω 1.2 m Ω	GR 1440 Resistors
	100 Ω 1 k Ω 10 k Ω	6.5 m Ω 62 m Ω 0.62 Ω	Vishay S102K Resistors
Electrical Calibration of Thermocouple Indicating Devices – Source/Measure ¹	Type E (-20 to 1 000) $^{\circ}\text{C}$ Type J (-210 to 1 200) $^{\circ}\text{C}$ Type K (-200 to 1 372) $^{\circ}\text{C}$ Type N (-200 to 1 300) $^{\circ}\text{C}$ Type T (-200 to 1 300) $^{\circ}\text{C}$ Type R, S (0 to 1 767) $^{\circ}\text{C}$	0.3 $^{\circ}\text{C}$ 0.3 $^{\circ}\text{C}$ 0.4 $^{\circ}\text{C}$ 0.6 $^{\circ}\text{C}$ 0.4 $^{\circ}\text{C}$ 1.1 $^{\circ}\text{C}$	Fluke Process Calibrator
Electrical Simulation of RTD Indicating Devices – Source ¹	100 Ω , Pt 385 (-200 to 0) $^{\circ}\text{C}$ (0 to 400) $^{\circ}\text{C}$ (400 to 800) $^{\circ}\text{C}$ 1 000 Ω , Pt 385 (-200 to 0) $^{\circ}\text{C}$ (0 to 400) $^{\circ}\text{C}$ (400 to 800) $^{\circ}\text{C}$ 100 Ω , Pt 3926 (-200 to 0) $^{\circ}\text{C}$ (0 to 630) $^{\circ}\text{C}$ 100 Ω , Pt 3916 (-200 to 0) $^{\circ}\text{C}$ (0 to 630) $^{\circ}\text{C}$	0.1 $^{\circ}\text{C}$ 0.2 $^{\circ}\text{C}$ 0.4 $^{\circ}\text{C}$ 0.1 $^{\circ}\text{C}$ 0.2 $^{\circ}\text{C}$ 0.4 $^{\circ}\text{C}$ 0.1 $^{\circ}\text{C}$ 0.2 $^{\circ}\text{C}$ 0.1 $^{\circ}\text{C}$ 0.2 $^{\circ}\text{C}$	Fluke Process Calibrator
Resistance Thermometers ¹ (Artifacts)	(10 to 400) Ω	6 m Ω	Resistance Standards

Length – Dimensional Metrology

Brampton, ON

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Calipers ^{1,2}	Up to 24 in	$(289 + 7.3L) \mu\text{in}$	Gauge Blocks, Micrometer Setting Standards
Outside Micrometer ^{1,2}	Up to 6 in	$(32 + 14L) \mu\text{in}$	Grade 2 Gauge Blocks
Gauge Blocks ¹	Up to 4 in (200 mm)	40 μin (1 μm)	Grade 2 Gauge Blocks, Heidenhain CT60 Length Gauge
Indicators ¹	(0 to 1) in 50 μin resolution 100 μin resolution (0 to 2) in 50 μin resolution 100 μin resolution	35 μin 60 μin 50 μin 70 μin	Gage Blocks, Comparator Stand
Indicators ¹ (Mounted in stands or custom fixtures)	(0 to 1) in 500 μin resolution 1 000 μin in resolution	335 μin 600 μin	Gauge Blocks
Measuring Microscope ¹	Up to 5 mm	0.96 μm	Stage Micrometer
Displacement Transducer ¹	Up to 5 in (5 to 40) in	600 μin 0.1 % of reading	Height Gauge
Optical Comparators ^{1,2} X-Y Length	Up to 50 mm	5 μm	Glass Scale Angle Blocks
Angle	Up to 90 °	0.5'	
Material Testing Machine ^{1,2} Displacement	(0.01 to 0.4) in (0.4 to 40) in	600 μin $(600 + 200L) \mu\text{in}$	ASTM E2309; Height Gauge, MT25B Heidenhain Length Gauge;
Speed	(0.01 to 20) in/min	0.5 % of reading	ASTM E2658; Timer
Extensometer, Type 1 Strain ^{1,2}	Gauge length of 0.5 in: (0.06 to 1) in/in (0.002 to 0.06) in/in Gauge length of 1 in : (0.025 to 1) in/in (0.001 to 0.025) in/in Gauge length of 2 in : (0.000 5 to 0.5) in/in	$(64 + 715L) \mu\text{in/in}$ 88 $\mu\text{in/in}$ $(27 + 300L) \mu\text{in/in}$ 40 $\mu\text{in/in}$ $(17 + 126L) \mu\text{in/in}$	Extensometer Calibrator; ASTM E83
Extensometer, Type 1 Gauge Length ¹	(0.5 to 2) in	400 μin	Extensometer Calibrator; ASTM E83

Length – Dimensional Metrology

Brampton, ON

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Torque Drive Arms ¹ (2-point Dimensional Measurement)	(4 to 60) in	0.1 % of arm length	Height Gauge, 60 in Steel Rule, Length Standards
Protractors, Inclinometers ²	Up to 90 °	0.5'	Angle Blocks, Surface Plate

Mass and Mass Related

Brampton, ON

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Aircraft Wheel Scales ¹	(1 to 100 000) lbf	0.05 % of reading	Dead Weight Machine, Loading Weights, Secondary Standards
Force Testing Machines, Force Measuring Systems ¹ Tension	1 gf to 471 kgf (1 to 500 000) lbf	0.25 % of reading	Loading Weights, Reference Standard Load Cells; ASTM E4
Compression	1 gf to 471 kgf (1 to 1 000 000) lbf	0.25 % of reading	
Durometer ¹ (Types A, B, C, D, DO, E, M, O, OO) Force Only	(1 to 5 000) gf	0.25 % of reading	Balance per ASTM D2240
Load Cells ¹	1 gf to 471 kgf	0.005 % of reading	Loading Weights; ASTM E74
Force Gages, Crane Scales, Dynamometers, Load Cells ¹ (Tension and Compression)	(10 to 1 040) lbf (1 000 to 500 000) lbf	0.01 % of reading 0.05 % of reading	Dead Weight Machine, Calibration Load Frames with Secondary Standards; ASTM E74
Liquid Flow	(4 to 40) lph	0.75 % of reading	Digital Balance, Stop Watch, Thermometer, Distilled Water

Mass and Mass Related

Brampton, ON

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Analytical Balances ^{1,3}	Up to 10 g (10 to 200) g 200 g to 35 kg 200 g to 220 kg	60 µg 0.12 mg 0.000 25 % of reading 0.000 2 % of reading	ASTM E617 Class 1, OIML Class F1, NIST Class F Weights and NIST Handbook 44 utilized for calibration of the weighting system.
Conventional Mass ¹ (non-integral weights) (SI)	(1 to 100) kg	0.003 % of reading	Electronic Balances, ASTM E617 Class 0 and Class 1 Weights
Conventional Mass ¹ (Avoirdupois)	(0.01 to 0.05) lb (0.05 to 5) lb (5 to 220) lb	23 mg/lb 4.5 mg/lb 14 mg/lb	Electronic Balances, NIST Class F1 Weights
Conventional Mass ¹ (SI)	1 mg 2 mg 3 mg 5 mg 10 mg 20 mg 30 mg 50 mg 100 mg 200 mg 300 mg 500 mg 1 g 2 g 3 g 5 g 10 g	8.8 µg 8.8 µg 8.8 µg 8.8 µg 8.8 µg 8.8 µg 8.8 µg 8.8 µg 8.8 µg 8.8 µg 8.8 µg 8.8 µg 10 µg 11 µg 23 µg 23 µg 44 µg	Electronic Balances, ASTM E617 Class 0 and Class 1 Weights
Conventional Mass ¹ (SI)	20 g 30 g 50 g 100 g 200 g 300 g 500 g 1 kg	39 µg 50 µg 50 µg 68 µg 0.28 mg 1.3 mg 1.3 mg 1.5 mg	Electronic Balances, ASTM E617 Class 0 and Class 1 Weights

Mass and Mass Related

Brampton, ON

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Conventional Mass ¹ (SI)	2 kg 3 kg 5 kg 10 kg 20 kg	12 mg 12 mg 0.12 g 0.12 g 0.35 g	Electronic Balances; ASTM E617 Class 0 and Class 1 Weights
Deadweight Testers			
Effective Area	(0.01 to 0.5) in ²	0.033 % of reading	Ametek DWT (PK-854, HK-1000, R-50)
Dead Weights	(0.01 to 10) lb	0.005 % of reading	Electronic Balance, ASTM E617 Class 1 Weights
Pressure Calibrators ¹	(4 to 854) in H ₂ O (30 to 1 000) psig (1 000 to 10 000) psig	0.033 % of reading 0.014 % of reading 0.033 % of reading	Ametek DWT (PK-854, HK-1000, R-50)
Pressure Indicators, Pressure Gauges ¹	Up to 1 in H ₂ O Up to 5 psig Up to 30 psig Up to 500 psig (100 to 1 000) psig (1 000 to 10 000) psig	0.005 in H ₂ O 0.002 5 psi 0.015 psi 0.05 psi 0.25 % of reading 0.25 % of reading	Pressure Modules, Pressure Transducers
Vacuum Devices ¹	Up to 28 inHg	0.042 inHg	MKS 270B Signal Conditioner with MKS 390HA/270 Vacuum Gauge
Absolute Pressure ¹	0 torr	0.000 1 % of reading	MKS PVS-6/Ion Gauge
	(1 to 10) torr (100 to 1 000) torr	0.08 % of reading 0.08 % of reading	MKS 390HA/270 Vacuum Gauge
Torque Testers, Analyzers, Transducers ¹	(8 to 36) lbf·in (40 to 300) lbf·in (22 to 651) lbf·ft	0.19 % of reading 0.19 % of reading 0.19 % of reading	ASTM E2428; Torque Arms, Loading Weights
Torque Wrenches ¹	(8 to 36) lbf·in (40 to 300) lbf·in (22 to 651) lbf·ft	0.75 % of reading 0.75 % of reading 0.75 % of reading	ASTM E2624; Torque Testers
Direct Verification of Hardness Testing Machines ¹ Verification of Test Force	(1 to 3 000) kgf	0.25 % of reading	ASTM E10, ASTM E18, ASTM E92, ASTM E384 Working Force Standards
Verification of the Indentation Measuring System	(0.01 to 5) mm	1 µm	Stage Micrometer
Deflection Measuring System	(0.025 to 0.05) mm	0.1 µm	Gauge Blocks

Mass and Mass Related

Brampton, ON

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Rockwell Hardness Testers ¹	(< 70) HRA	0.28 HRA	Indirect verification per ASTM E18, ASTM E110 using Rockwell Test Blocks
	(≥ 70 and < 80) HRA	0.17 HRA	
	(≥ 80) HRA	0.16 HRA	
	(< 60) HRBW	1.4 HRBW	
	(≥ 60 to < 88) HRBW	0.87 HRBW	
	(≥ 88) HRBW	0.42 HRBW	
	(< 35) HRC	0.4 HRC	
	(≥ 35 to < 60) HRC	0.36 HRC	
	(≥ 60) HRC	0.32 HRC	
	(< 51) HRD	0.27 HRD	
	(≥ 51 to < 71) HRD	0.26 HRD	
	(≥ 71) HRD	0.18 HRD	
	(< 84) HREW	0.54 HREW	
	(≥ 84 to < 93) HREW	0.54 HREW	
	(≥ 93) HREW	0.54 HREW	
Rockwell Hardness Testers ¹	(< 80) HRFW	0.54 HRFW	Indirect verification per ASTM E18, ASTM E110 using Rockwell Test Blocks
	(≥ 80 to < 94) HRFW	0.4 HRFW	
	(≥ 94) HRFW	0.4 HRFW	
	(< 55) HRGW	0.76 HRGW	
	(≥ 55 to < 80) HRGW	0.36 HRGW	
	(≥ 80) HRGW	0.36 HRGW	
	(< 96) HRHW	0.54 HRHW	
	(≥ 96) HRHW	0.41 HRHW	
	(< 65) HRKW	0.64 HRKW	
	(≥ 65 to < 85) HRKW	0.4 HRKW	
	(≥ 85) HRKW	0.4 HRKW	
	(90 to 114) HRLW	0.36 HRLW	
	(115 to 130) HRL W	0.36 HRLW	
	(70 to 99) HRMW	0.56 HRMW	
	(100 to 130) HRMW	0.56 HRMW	

Mass and Mass Related

Brampton, ON

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Rockwell Superficial Hardness Testers ¹	(40 to 84) HRPW	0.91 HRPW	Indirect verification per ASTM E18, ASTM E110 using Rockwell Test Blocks
	(85 to 130) HRPW	0.65 HRPW	
	(100 to 119) HRRW	0.41 HRRW	
	(120 to 130) HRRW	0.24 HRRW	
	(110 to 111) HRSW	0.95 HRSW	
	(112 to 130) HRSW	0.2 HRSW	
	(80 to 103) HRVW	0.95 HRVW	
	(104 to 130) HRVW	0.2 HRVW	
	(< 78) HR15N	0.39 HR15N	
	(≥ 78 to < 90) HR15N	0.19 HR15N	
	(≥ 90) HR15N	0.19 HR15N	
	(< 55) HR30N	0.55 HR30N	
	(≥ 55 to < 77) HR30N	0.28 HR30N	
	(≥ 77) HR30N	0.28 HR30N	
	(< 37) HR45N	0.43 HR45N	
Rockwell Superficial Hardness Testers ¹	(≥ 37 to < 66) HR45N	0.22 HR45N	Indirect verification per ASTM E18, ASTM E110 using Rockwell Test Blocks
	(≥ 66) HR45N	0.19 HR45N	
	(< 81) HR15TW	0.37 HR15TW	
	(≥ 81 to < 87) HR15TW	0.21 HR15TW	
	(≥ 87) HR15TW	0.21 HR15TW	
	(< 57) HR30TW	0.9 HR30TW	
	(≥ 57 to < 70) HR30TW	0.66 HR30TW	
	(≥ 70) HR30TW	0.39 HR30TW	
	(< 33) HR45TW	0.73 HR45TW	
	(≥ 33 to < 53) HR45TW	0.41 HR45TW	
	(≥ 53) HR45TW	0.41 HR45TW	
	(80 to 88) HR15WW	0.67 HR15WW	
	(89 to 100) HR15WW	0.67 HR15WW	
	(40 to 64) HR30WW	0.9 HR30WW	
	(65 to 100) HR30WW	0.76 HR30WW	

Mass and Mass Related

Brampton, ON

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Rockwell Superficial Hardness Testers ¹	(10 to 47) HR45WW (48 to 100) HR45WW (80 to 87) HR15XW (88 to 100) HR15XW (60 to 78) HR30XW (79 to 100) HR30XW (40 to 68) HR45XW (69 to 100) HR45XW (85 to 93) HR15YW (94 to 100) HR15YW (60 to 87) HR30YW (88 to 100) HR30YW (60 to 81) HR45YW (82 to 100) HR45YW	0.3 HR45WW 0.13 HR45WW 0.62 HR15XW 0.33 HR15XW 0.99 HR30XW 0.15 HR30XW 0.81 HR45XW 0.35 HR45XW 1.3 HR15YW 0.63 HR15YW 0.82 HR30YW 0.37 HR30YW 0.94 HR45YW 0.3 HR45YW	Indirect verification per ASTM E18, ASTM E110 using Rockwell Test Blocks
Brinell Hardness Testers ¹	1/62.5 (200 to 400) HBW (400 to 600) HBW 2.5/187.5 (200 to 400) HBW (400 to 600) HBW 10/500 (20 to 100) HBW (100 to 150) HBW 5/1 000 (200 to 400) HBW (400 to 600) HBW 10/1 000 (200 to 400) HBW (400 to 600) HBW 10/1 500 (200 to 400) HBW (400 to 600) HBW	9.5 HBW 25 HBW 6.2 HBW 15 HBW 1 HBW 1.5 HBW 4 HBW 8 HBW 3.3 HBW 7 HBW 2.7 HBW 6.5 HBW	Indirect verification per ASTM E10 using Brinell Test Blocks and Brinell Scope

Mass and Mass Related

Brampton, ON

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Brinell Hardness Testers ¹	10/2 000 (200 to 400) HBW (400 to 600) HBW 10/2 500 (200 to 400) HBW (400 to 600) HBW 10/3 000 (200 to 400) HBW (400 to 600) HBW	2.2 HBW 5.2 HBW 2 HBW 4.4 HBW 1.9 HBW 4.9 HBW	Indirect verification per ASTM E10 using Brinell Test Blocks and Brinell Scope
Vickers Hardness Testers ¹ ≥ 1 kgf	HV 1 200 HV 400 HV 700 HV HV 2 200 HV 400 HV 700 HV HV 5 200 HV 400 HV 700 HV HV 10 200 HV 400 HV 700 HV HV 20 200 HV 400 HV 700 HV HV 30 200 HV 400 HV 700 HV HV 50 200 HV 400 HV 700 HV	4.1 HV 8 HV 18 HV 3 HV 8 HV 14 HV 3 HV 6 HV 11 HV 3 HV 6 HV 11 HV 3 HV 6 HV 11 HV 3 HV 4 HV 7 HV 3 HV 4 HV 7 HV	Indirect verification per ASTM E92, ASTM E384 using Hardness Test Blocks

Mass and Mass Related

Brampton, ON

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Vickers Hardness Testers ¹ < 1 kgf	HV 0.01		Indirect verification per ASTM E92, ASTM E384 using Hardness Test Blocks
	200 HV	10 HV	
	400 HV	20 HV	
	700 HV	35 HV	
	HV 0.025		
	200 HV	10 HV	
	400 HV	20 HV	
	700 HV	35 HV	
	HV 0.05		
	200 HV	10 HV	
	400 HV	20 HV	
	700 HV	35 HV	
	HV 0.1		
	200 HV	8 HV	
	400 HV	20 HV	
	700 HV	35 HV	
	HV 0.2		
	200 HV	8 HV	
	400 HV	18 HV	
	700 HV	35 HV	
	HV 0.3		
	200 HV	5 HV	
	400 HV	14 HV	
	700 HV	24 HV	
	HV 0.5		
	200 HV	5 HV	
	400 HV	12 HV	
	700 HV	24 HV	
	HV 1		
	200 HV	4 HV	
	400 HV	8 HV	
	700 HV	17 HV	

Mass and Mass Related

Brampton, ON

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Knoop Micro-Indentation Hardness Testers ¹	HK 0.01		Indirect verification per ASTM E92, ASTM E384 using Hardness Test Blocks
	200 HK	7 HK	
	400 HK	16 HK	
	700 HK	33 HK	
	HK 0.025		
	200 HK	7 HK	
	400 HK	14 HK	
	700 HK	22 HK	
	HK 0.05		
	200 HK	7 HK	
	400 HK	14 HK	
	700 HK	20 HK	
	HK 0.1		
	200 HK	7 HK	
	400 HK	12 HK	
	700 HK	19 HK	
	HK 0.2 and 0.3		
	200 HK	5 HK	
	400 HK	8 HK	
	700 HK	17 HK	
	HK 0.5 and 1		
	200 HK	5 HK	
	400 HK	7 HK	
	700 HK	15 HK	

Thermodynamic

Brampton, ON

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature – Source ¹	0 °C	0.01 °C	Ice Bath, Secondary Standard PRT, Instrulab 4312A Thermometer
	(-78 to 150) °C	0.1 °C	Baths, Secondary Standard PRT, Instrulab 4312A Thermometer
	(150 to 660) °C	1.2 °C	Dry Block, Standard PRT, Instrulab 4312A Thermometer

Thermodynamic

Brampton, ON

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature – Measure ¹	(-78 to 660) °C	0.05 °C	Secondary Standard PRT, Instrulab 4312A Thermometer
	(660 to 1 200) °C	5.5 °C	Type N Thermocouple Probe, Fluke 744 Process Calibrator
Dry-well Calibrators ¹	(-78 to 660) °C	0.5 °C	Secondary Standard PRT, Instrulab 4312A Thermometer
PRT/RTD Probes ¹	(-78 to 660) °C	0.1 °C	Ice Bath, Liquid baths, Dry Block Calibrator, Secondary Standard PRT, Instrulab 4312A Thermometer
Thermocouple Probes ¹	(-78 to 660) °C	0.5 °C	Ice Bath, Liquid baths, Dry Block Calibrator, Secondary Standard PRT, Instrulab 4312A Thermometer
Liquid-in-Glass Thermometers ¹	(-78 to 150) °C	0.1 °C	
Radiation (Infrared) Thermometers ¹	0 °C 100 °C 200 °C 300 °C 400 °C 500 °C	0.34 °C 0.7 °C 1.1 °C 1.3 °C 1.7 °C 2 °C	Radiometric Method using Blackbody Calibrator (Flat Plate) $\epsilon = 0.95$, $\lambda = (8 \text{ to } 14) \mu\text{m}$
Radiation (Infrared) Thermometer Calibrators ¹	0 °C 100 °C 200 °C 300 °C 400 °C 500 °C 600 °C	0.34 °C 0.6 °C 1 °C 1.1 °C 1.6 °C 1.7 °C 1.8 °C	Radiometric Method using Heitronics KT19.82 Reference Radiation Thermometer
Humidity – Source ¹	(11, 33, 57, 75, & 90) %RH	0.75 %RH	Custom Humidity Chamber, Salts, Vaisala Humidity Transmitter

Time and Frequency

Brampton, ON

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Timers ¹	1 min to 24 h	0.25 s	NRC Time Signal
Frequency – Measure ¹	(1 to 40) Hz 40 Hz to 10 MHz	0.81 mHz/Hz + 0.83 mHz 0.16 mHz/Hz + 6.5 mHz/Hz	Agilent 3458A 8.5 Digit Multimeter
Frequency – Source ¹	1 Hz to 10 MHz	0.12 mHz/Hz + 0.62 mHz	RIGOL DG 1022 Generator

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Accredited Services performed at Satellite Laboratory

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Electrical – DC/Low Frequency

Edmonton, AB

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Measure ¹	(-110 to 110) mV (-1 to 1) V (-11 to 11) V (-110 to 110) V (-300 to 300) V	2.9 mV/V + 17 μ V 2.9 mV/V + 55 μ V 2.9 mV/V + 0.55 mV 0.58 mV/V + 5.5 mV 0.57 mV/V + 15 mV	Fluke 743B Process Calibrator
DC Voltage – Source ¹	(-110 to 110) mV (-1 to 1) V (-15 to 15) V	0.16 mV/V + 5.5 μ V 0.12 mV/V + 55 μ V 0.12 mV/V + 0.75 mV	Fluke 743B Process Calibrator
DC Current – Measure ¹	(0 to 22) mA (0 to 30) mA (0 to 110) mA	0.26 mA/A + 6.6 μ A 0.17 mA/A + 4.5 μ A 0.17 mA/A + 17 μ A	Fluke 743B Process Calibrator
DC Current – Source ¹	(0 to 22) mA	0.17 mA/A + 3.3 μ A	Fluke 743B Process Calibrator
DC Current – Simulate ¹ (Loop)	(4 to 20) mA	0.26 mA/A + 6.6 μ A	Fluke 743B Process Calibrator
Resistance – Measure ¹	Up to 11 Ω Up to 110 Ω Up to 1.1 k Ω Up to 11 k Ω	0.62 m Ω / Ω + 50 m Ω 0.58 m Ω / Ω + 50 m Ω 0.59 Ω / Ω + 0.5 Ω 1.2 Ω /k Ω + 10 Ω	Fluke 743B Process Calibrator
Resistance – Source ¹	Up to 11 Ω Up to 110 Ω Up to 1.1 k Ω Up to 11 k Ω	0.17 m Ω / Ω + 20 m Ω 0.15 m Ω / Ω + 40 m Ω 0.25 Ω / Ω + 0.5 Ω 0.35 Ω /k Ω + 5 Ω	Fluke 743B Process Calibrator
Electrical Calibration of Thermocouple Indicating Devices – Source/Measure ¹	Type E (-20 to 1 000) $^{\circ}$ C Type J (-210 to 1 200) $^{\circ}$ C Type K (-200 to 1 372) $^{\circ}$ C Type N (-200 to 1 300) $^{\circ}$ C	0.3 $^{\circ}$ C 0.3 $^{\circ}$ C 0.4 $^{\circ}$ C 0.6 $^{\circ}$ C	Fluke 743B Process Calibrator

Electrical – DC/Low Frequency

Edmonton, AB

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of Thermocouple Indicating Devices – Source/Measure ¹	Type T (-200 to 1 300) °C Type R (0 to 1 767) °C Type S (0 to 1 767) °C	0.4 °C 1.1 °C 1.1 °C	Fluke 743B Process Calibrator
Electrical Simulation of RTD Indicating Devices – Source ¹	Pt 385, 100 Ω (-200 to 0) °C (0 to 400) °C (400 to 800) °C Pt 385, 1 000 Ω (-200 to 0) °C (0 to 400) °C (400 to 800) °C	0.1 °C 0.2 °C 0.4 °C 0.1 °C 0.2 °C 0.4 °C	Fluke 743B Process Calibrator
	Pt 3926, 100 Ω (-200 to 0) °C (0 to 630) °C Pt 3916, 100 Ω (-200 to 0) °C (0 to 630) °C	0.1 °C 0.2 °C 0.1 °C 0.2 °C	

Length – Dimensional Metrology

Edmonton, AB

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Calipers ^{1,2}	Up to 24 in	(289 + 7.3L) μin	Gauge Blocks, Micrometer Setting Standards
Outside Micrometer ^{1,2}	Up to 6 in	(32 + 14L) μin	Grade 2 Gauge Blocks
Gauge Blocks ¹	Up to 4 in (200 mm)	40 μin (1 μm)	Grade 2 Gauge Blocks, Heidenhain CT60 Length Gauge
Indicators ¹	(0 to 1) in 50 μin resolution 100 μin resolution (0 to 2) in 50 μin resolution 100 μin resolution	35 μin 60 μin 50 μin 70 μin	Gage Blocks, Comparator Stand

Length – Dimensional Metrology

Edmonton, AB

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Indicators ¹ (Mounted in stands or custom fixtures)	(0 to 1) in 500 µin resolution 1 000 µin in resolution	335 µin 600 µin	Gauge Blocks
Measuring Microscope ¹	Up to 5 mm	0.96 µm	Stage Micrometer
Displacement Transducer ¹	Up to 5 in (5 to 40) in	600 µin 0.1 % of reading	Height Gauge
Optical Comparators ^{1,2} X-Y Length	Up to 50 mm	5 µm	Glass Scale Angle Blocks
Angle	Up to 90 °	0.5'	
Material Testing Machine ^{1,2} Displacement	(0.01 to 0.4) in (0.4 to 40) in	600 µin (600 + 200L) µin	ASTM E2309; Height Gauge, MT25B Heidenhain Length Gauge;
Speed	(0.01 to 20) in/min	0.5 % of reading	ASTM E2658; Timer
Extensometer, Type 1 Strain ^{1,2}	Gauge length of 0.5 in: (0.06 to 1) in/in (0.002 to 0.06) in/in Gauge length of 1 in : (0.025 to 1) in/in (0.001 to 0.025) in/in Gauge length of 2 in : (0.000 5 to 0.5) in/in	(64 + 715L) µin/in 88 µin/in (27 + 300L) µin/in 40 µin/in (17 + 126L) µin/in	Extensometer Calibrator; ASTM E83
Extensometer, Type 1 Gauge Length ¹	(0.5 to 2) in	400 µin	Extensometer Calibrator; ASTM E83
Torque Drive Arms ¹ (2-point Dimensional Measurement)	(4 to 60) in	0.1 % of arm length	Height Gauge, 60 in Steel Rule, Length Standards
Protractors, Inclinometers ²	Up to 90 °	0.5'	Angle Blocks, Surface Plate

Mass and Mass Related

Edmonton, AB

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Force Testing Machines, Force Measuring Systems ^{1,4} Tension Compression	1 gf to 471 kgf (1 to 500 000) lbf 1 gf to 471 kgf (1 to 1 000 000) lbf	0.25 % of reading 0.25 % of reading	Loading Weights, Reference Standard Load Cells; ASTM E4
Force Gages, Crane Scales, Dynamometers, Load Cells, Tension Links ^{1,4} (Tension and Compression)	(1 to 100 000) lbf	0.25 % of reading	Calibration Load Frame, Reference Standard Load Cells; ASTM E4
Durometer ¹ (Types A, B, C, D, DO, E, M, O, OO) Force Only	Up to 90 Duro	0.6 Duro	Balance per ASTM D2240
Analytical Balances ^{1,3}	Up to 10 g (10 to 200) g 200 g to 35 kg 200 g to 220 kg	60 µg 0.12 mg 0.000 25 % of reading 0.000 2 % of reading	ASTM E617 Class 1, OIML Class F1, NIST Class F Weights and NIST Handbook 44 utilized for calibration of the weighting system.
Conventional Mass ¹ (non-integral weights) (SI)	1 g 2 g 3 g 5 g 10 g 20 g 30 g 100 g 200 g 300 g 1 kg 2 kg 3 kg 5 kg 10 kg 20 kg 25 kg 30 kg	10 µg 10 µg 20 µg 20 µg 20 µg 40 µg 50 µg 80 µg 0.12 mg 1.2 mg 1.4 mg 12 mg 13 mg 0.12 g 0.12 g 0.12 g 0.12 g 0.12 g	Electronic Balances; ASTM E617 Class 0 and Class 1 Weights

Mass and Mass Related

Edmonton, AB

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Conventional Mass ¹ (Avoirdupois)	0.062 5 oz 0.125 oz 0.25 oz 0.5 oz 0.005 lb 0.01 lb 0.02 lb	10 µg 20 µg 30 µg 30 µg 10 µg 20 µg 30 µg	Electronic Balances; ASTM E617 Class 1 and OIML Class F1 Weights
Conventional Mass ¹ (Avoirdupois)	0.05 lb 0.1 lb 0.2 lb 0.5 lb 1 lb 2 lb 5 lb 10 lb 25 lb 50 lb	40 µg 0.1 mg 0.13 mg 1.2 mg 1.2 mg 1.5 mg 12 mg 12 mg 0.12 g 0.12 g	Electronic Balances; ASTM E617 Class 1 and OIML Class F1 Weights
Pressure Calibrators ^{1,4}	(0.3 to 300) psig (30 to 1 000) psig (1 000 to 10 000) psig	0.015 % of reading 0.015 % of reading 0.25 % of reading	Ametek RK-300 DWT Ametek HK-1000 DWT Gefran 10kpsi
Pressure Indicators, Pressure Gauges ^{1,4}	(30 to 1 000) psig (1 000 to 10 000) psig	0.015 % of reading 0.25 % of reading	Ametek HK-1000 DWT, Gefran 10kpsi, Standard Pressure Modules and Pressure Transducers
Vacuum Devices ^{1,4}	(-14 to 0) psiv	0.05 psi	Fluke Pressure Calibrator, Fluke Vacuum Module
Torque Wrenches ¹	(8 to 300) lbf·in (22 to 651) lbf·ft	0.75 % of reading 0.75 % of reading	ASTM E2624; Torque Testers
Direct Verification of Hardness Testing Machines ¹ Verification of Test Force	(1 to 3 000) kgf	0.25 % of reading	ASTM E10, ASTM E18, ASTM E92, ASTM E384 Working Force Standards
Verification of the Indentation Measuring System	(0.01 to 5) mm	1 µm	Stage Micrometer
Deflection Measuring System	(0.025 to 0.05) mm	0.1 µm	Gauge Blocks

Mass and Mass Related

Edmonton, AB

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Rockwell Hardness Testers ¹	(< 70) HRA	0.28 HRA	Indirect verification per ASTM E18, ASTM E110 using Rockwell Test Blocks
	(≥ 70 and < 80) HRA	0.17 HRA	
	(≥ 80) HRA	0.16 HRA	
	(< 60) HRBW	1.4 HRBW	
	(≥ 60 to < 88) HRBW	0.87 HRBW	
	(≥ 88) HRBW	0.42 HRBW	
	(< 35) HRC	0.4 HRC	
	(≥ 35 to < 60) HRC	0.36 HRC	
	(≥ 60) HRC	0.32 HRC	
	(< 51) HRD	0.27 HRD	
	(≥ 51 to < 71) HRD	0.26 HRD	
	(≥ 71) HRD	0.18 HRD	
	(< 84) HREW	0.54 HREW	
	(≥ 84 to < 93) HREW	0.54 HREW	
	(≥ 93) HREW	0.54 HREW	
	(< 80) HRFW	0.54 HRFW	
	(≥ 80 to < 94) HRFW	0.4 HRFW	
	(≥ 94) HRFW	0.4 HRFW	
	(< 55) HRGW	0.76 HRGW	
	(≥ 55 to < 80) HRGW	0.36 HRGW	
	(≥ 80) HRGW	0.36 HRGW	
	(< 96) HRHW	0.54 HRHW	
	(≥ 96) HRHW	0.41 HRHW	
	(< 65) HRKW	0.64 HRKW	
	(≥ 65 to < 85) HRKW	0.4 HRKW	
	(≥ 85) HRKW	0.4 HRKW	
	(90 to 114) HRLW	0.36 HRLW	
	(115 to 130) HRL W	0.36 HRLW	
	(70 to 99) HRMW	0.56 HRMW	
	(100 to 130) HRMW	0.56 HRMW	

Mass and Mass Related

Edmonton, AB

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Rockwell Superficial Hardness Testers ¹	(40 to 84) HRPW	0.91 HRPW	Indirect verification per ASTM E18, ASTM E110 using Rockwell Test Blocks
	(85 to 130) HRPW	0.65 HRPW	
	(100 to 119) HRRW	0.41 HRRW	
	(120 to 130) HRRW	0.24 HRRW	
	(110 to 111) HRSW	0.95 HRSW	
	(112 to 130) HRSW	0.2 HRSW	
	(80 to 103) HRVW	0.95 HRVW	
	(104 to 130) HRVW	0.2 HRVW	
	(< 78) HR15N	0.39 HR15N	
	(≥ 78 to < 90) HR15N	0.19 HR15N	
	(≥ 90) HR15N	0.19 HR15N	
	(< 55) HR30N	0.55 HR30N	
	(≥ 55 to < 77) HR30N	0.28 HR30N	
	(≥ 77) HR30N	0.28 HR30N	
	(< 37) HR45N	0.43 HR45N	
	(≥ 37 to < 66) HR45N	0.22 HR45N	
	(≥ 66) HR45N	0.19 HR45N	
	(< 81) HR15TW	0.37 HR15TW	
	(≥ 81 to < 87) HR15TW	0.21 HR15TW	
	(≥ 87) HR15TW	0.21 HR15TW	
	(< 57) HR30TW	0.9 HR30TW	
	(≥ 57 to < 70) HR30TW	0.66 HR30TW	
	(≥ 70) HR30TW	0.39 HR30TW	
	(< 33) HR45TW	0.73 HR45TW	
	(≥ 33 to < 53) HR45TW	0.41 HR45TW	
	(≥ 53) HR45TW	0.41 HR45TW	
	(80 to 88) HR15WW	0.67 HR15WW	
	(89 to 100) HR15WW	0.67 HR15WW	

Mass and Mass Related

Edmonton, AB

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Rockwell Superficial Hardness Testers ¹	(40 to 64) HR30WW	0.9 HR30WW	Indirect verification per ASTM E18, ASTM E110 using Rockwell Test Blocks
	(65 to 100) HR30WW	0.76 HR30WW	
	(10 to 47) HR45WW	0.3 HR45WW	
	(48 to 100) HR45WW	0.13 HR45WW	
	(80 to 87) HR15XW	0.62 HR15XW	
	(88 to 100) HR15XW	0.33 HR15XW	
	(60 to 78) HR30XW	0.99 HR30XW	
	(79 to 100) HR30XW	0.15 HR30XW	
	(40 to 68) HR45XW	0.81 HR45XW	
	(69 to 100) HR45XW	0.35 HR45XW	
Brinell Hardness Testers ¹	(85 to 93) HR15YW	1.3 HR15YW	Indirect verification per ASTM E10 using Brinell Test Blocks and Brinell Scope
	(94 to 100) HR15YW	0.63 HR15YW	
	(60 to 87) HR30YW	0.82 HR30YW	
	(88 to 100) HR30YW	0.37 HR30YW	
	(60 to 81) HR45YW	0.94 HR45YW	
	(82 to 100) HR45YW	0.3 HR45YW	
	/62.5	9.5 HBW	
	(200 to 400) HBW	25 HBW	
	(400 to 600) HBW		
	2.5/187.5	6.2 HBW	
	(200 to 400) HBW	15 HBW	
	(400 to 600) HBW		
	10/500	1 HBW	
	(20 to 100) HBW	1.5 HBW	
	(100 to 150) HBW		
	5/1 000	4 HBW	
	(200 to 400) HBW	8 HBW	
	(400 to 600) HBW		
	10/1 000	3.3 HBW	
	(200 to 400) HBW	7 HBW	
	(400 to 600) HBW		

Mass and Mass Related

Edmonton, AB

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Brinell Hardness Testers ¹	10/1 500 (200 to 400) HBW (400 to 600) HBW 10/2 000 (200 to 400) HBW (400 to 600) HBW 10/2 500 (200 to 400) HBW (400 to 600) HBW 10/3 000 (200 to 400) HBW (400 to 600) HBW	2.7 HBW 6.5 HBW 2.2 HBW 5.2 HBW 2 HBW 4.4 HBW 1.9 HBW 4.9 HBW	Indirect verification per ASTM E10 using Brinell Test Blocks and Brinell Scope
Vickers Hardness Testers ¹ ≥ 1 kgf	HV 1 200 HV 400 HV 700 HV HV 2 200 HV 400 HV 700 HV HV 5 200 HV 400 HV 700 HV HV 10 200 HV 400 HV 700 HV HV 20 200 HV 400 HV 700 HV HV 30 200 HV 400 HV 700 HV HV 50 200 HV 400 HV 700 HV	4.1 HV 8 HV 18 HV 3 HV 8 HV 14 HV 3 HV 6 HV 11 HV 3 HV 6 HV 11 HV 3 HV 6 HV 11 HV 3 HV 4 HV 7 HV 3 HV 4 HV 7 HV	Indirect verification per ASTM E92, ASTM E384 using Hardness Test Blocks

Mass and Mass Related

Edmonton, AB

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Vickers Hardness Testers ¹ < 1 kgf	HV 0.01		Indirect verification per ASTM E92, ASTM E384 using Hardness Test Blocks
	200 HV	10 HV	
	400 HV	20 HV	
	700 HV	35 HV	
	HV 0.025		
	200 HV	10 HV	
	400 HV	20 HV	
	700 HV	35 HV	
	HV 0.05		
	200 HV	10 HV	
	400 HV	20 HV	
	700 HV	35 HV	
	HV 0.1		
	200 HV	8 HV	
	400 HV	20 HV	
	700 HV	35 HV	
	HV 0.2		
	200 HV	8 HV	
	400 HV	18 HV	
	700 HV	35 HV	
	HV 0.3		
	200 HV	5 HV	
	400 HV	14 HV	
	700 HV	24 HV	
	HV 0.5		
	200 HV	5 HV	
	400 HV	12 HV	
	700 HV	24 HV	
	HV 1		
	200 HV	4 HV	
	400 HV	8 HV	
	700 HV	17 HV	
Knoop Micro-Indentation Hardness Testers ¹	HK 0.01		Indirect verification per ASTM E92, ASTM E384 using Hardness Test Blocks
	200 HK	7 HK	
	400 HK	16 HK	
	700 HK	33 HK	

Mass and Mass Related

Edmonton, AB

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Knoop Micro-Indentation Hardness Testers ¹	HK 0.025		Indirect verification per ASTM E92, ASTM E384 using Hardness Test Blocks
	200 HK	7 HK	
	400 HK	14 HK	
	700 HK	22 HK	
	HK 0.05		
	200 HK	7 HK	
	400 HK	14 HK	
	700 HK	20 HK	
	HK 0.1		
	200 HK	7 HK	
	400 HK	12 HK	
	700 HK	19 HK	
	HK 0.2 and 0.3		
	200 HK	5 HK	
	400 HK	8 HK	
	700 HK	17 HK	
	HK 0.5 and 1		
	200 HK	5 HK	
	400 HK	7 HK	
	700 HK	15 HK	

Thermodynamic

Edmonton, AB

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature – Source ¹	0 °C	0.01 °C	Ice Bath, Secondary Standard PRT, Instrulab 4312A Thermometer
	(> 0.01 to 90) °C	0.1 °C	Baths, Secondary Standard PRT, Instrulab 4312A Thermometer
	(> 90 to 660) °C	1.2 °C	Dry Block, Fluke Process Calibrator Thermocouple Probe
Temperature – Measure ¹	(-78 to 200) °C	0.05 °C	Secondary Standard PRT, Instrulab 4312A Thermometer

Thermodynamic

Edmonton, AB

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature – Measure ¹	(200 to 660) °C	1.2 °C	Type N Thermocouple Probe, Fluke 744 Process Calibrator
PRT/RTD Probes ¹	(> 0.01 to 90) °C	0.1 °C	Ice Bath, Liquid baths, Dry Block Calibrator, Secondary Standard PRT, Instrulab 4312A Thermometer
Thermocouples ¹	(> 90 to 660) °C	0.5 °C	
Liquid-in-Glass Thermometers ¹	(> 0.01 to 90) °C	0.1 °C	
Infrared Thermometers ¹	0 °C 100 °C 200 °C 300 °C 400 °C 500 °C	0.34 °C 0.7 °C 1.1 °C 1.3 °C 1.7 °C 2 °C	Radiometric Method using Blackbody Calibrator (Flat Plate) $\epsilon = 0.95$, $\lambda = (8 \text{ to } 14) \mu\text{m}$
Humidity – Measure ¹	(11 to 90) %RH	1 %RH	Vaisala Humidity Transmitter

Time and Frequency

Edmonton, AB

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Timers ¹	1 min to 24 h	0.25 s	NRC Time Signal
Frequency – Measure ¹	(1 to 109.99) Hz (110 to 1 099.9) Hz (1.1 to 10.999) kHz (11 to 50) kHz	0.11 mHz/Hz + 50 mHz 0.1 mHz/Hz + 0.5 Hz 0.75 Hz/kHz + 50 Hz 0.22 Hz/kHz + 50 Hz	Fluke 743 Process Calibrator
Frequency – Source ¹	Up to 10.99 Hz (11 to 109.99) Hz (110 to 1 099.9) Hz (1 100 to 21 999) Hz (22 to 50) kHz	1.1 mHz/Hz + 10 mHz 0.54 mHz/Hz + 0.1 Hz 0.1 mHz/Hz + 0.1 Hz 45 $\mu\text{Hz/Hz}$ + 2 Hz 0.1 Hz/kHz + 5 Hz	Fluke 743 Process Calibrator

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Electrical – DC/Low Frequency

Burnaby, BC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Measure ¹	(-110 to 110) mV (-1 to 1) V (-11 to 11) V (-110 to 110) V (-300 to 300) V	2.9 mV/V + 17 µV 2.9 mV/V + 55 µV 2.9 mV/V + 0.55 mV 0.58 mV/V + 5.5 mV 0.57 mV/V + 15 mV	Fluke 743B Process Calibrator
DC Voltage – Source ¹	(-110 to 110) mV (-1 to 1) V (-15 to 15) V	0.16 mV/V + 5.5 µV 0.12 mV/V + 55 µV 0.12 mV/V + 0.75 mV	Fluke 743B Process Calibrator
DC Current – Measure ¹	(0 to 22) mA (0 to 30) mA (0 to 110) mA	0.26 mA/A + 6.6 µA 0.17 mA/A + 4.5 µA 0.17 mA/A + 17 µA	Fluke 743B Process Calibrator
DC Current – Source ¹	(0 to 22) mA	0.17 mA/A + 3.3 µA	Fluke 743B Process Calibrator
DC Current – Simulate ¹ (Loop)	(4 to 20) mA	0.26 mA/A + 6.6 µA	Fluke 743B Process Calibrator
Resistance – Measure ¹	Up to 11 Ω Up to 110 Ω Up to 1.1 kΩ Up to 11 kΩ	0.62 mΩ/Ω + 50 mΩ 0.58 mΩ/Ω + 50 mΩ 0.59 Ω/Ω + 0.5 Ω 1.2 Ω/kΩ + 10 Ω	Fluke 743B Process Calibrator
Resistance – Source ¹	Up to 11 Ω Up to 110 Ω Up to 1.1 kΩ Up to 11 kΩ	0.17 mΩ/Ω + 20 mΩ 0.15 mΩ/Ω + 40 mΩ 0.25 Ω/Ω + 0.5 Ω 0.35 Ω/kΩ + 5 Ω	Fluke 743B Process Calibrator
Electrical Calibration of Thermocouple Indicating Devices – Source/Measure ¹	Type E (-20 to 1 000) °C Type J (-210 to 1 200) °C Type K (-200 to 1 372) °C Type N (-200 to 1 300) °C	0.3 °C 0.3 °C 0.4 °C 0.6 °C	Fluke 743B Process Calibrator

Electrical – DC/Low Frequency

Burnaby, BC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of Thermocouple Indicating Devices – Source/Measure ¹	Type T (-200 to 1 300) °C	0.4 °C	Fluke 743B Process Calibrator
	Type R (0 to 1 767) °C	1.1 °C	
	Type S (0 to 1 767) °C	1.1 °C	
Electrical Simulation of RTD Indicating Devices – Source ¹	Pt 385, 100 Ω (-200 to 0) °C	0.1 °C	Fluke 743B Process Calibrator
	(0 to 400) °C	0.2 °C	
	(400 to 800) °C	0.4 °C	
	Pt 385, 1 000 Ω (-200 to 0) °C	0.1 °C	
	(0 to 400) °C	0.2 °C	
	(400 to 800) °C	0.4 °C	
	Pt 3926, 100 Ω (-200 to 0) °C	0.1 °C	
	(0 to 630) °C	0.2 °C	
	Pt 3916, 100 Ω (-200 to 0) °C	0.1 °C	
	(0 to 630) °C	0.2 °C	

Length – Dimensional Metrology

Burnaby, BC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Calipers ^{1,2}	Up to 24 in	$(289 + 7.3L) \mu\text{in}$	Gauge Blocks, Micrometer Setting Standards
Outside Micrometer ^{1,2}	Up to 6 in	$(32 + 14L) \mu\text{in}$	Grade 2 Gauge Blocks
Gauge Blocks ¹	Up to 4 in (200 mm)	40 μin (1 μm)	Grade 2 Gauge Blocks, Heidenhain CT60 Length Gauge
Indicators ¹	(0 to 1) in 50 μin resolution	35 μin	Gage Blocks, Comparator Stand
	100 μin resolution	60 μin	
	(0 to 2) in 50 μin resolution	50 μin	
	100 μin resolution	70 μin	

Length – Dimensional Metrology

Burnaby, BC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Indicators ¹ (Mounted in stands or custom fixtures)	(0 to 1) in 500 µin resolution 1 000 µin in resolution	335 µin 600 µin	Gauge Blocks
Measuring Microscope ¹	Up to 5 mm	0.96 µm	Stage Micrometer
Displacement Transducer ¹	Up to 5 in (5 to 40) in	600 µin 0.1 % of reading	Height Gauge
Optical Comparators ^{1,2} X-Y Length	Up to 50 mm	5 µm	Glass Scale Angle Blocks
Angle	Up to 90 °	0.5'	
Material Testing Machine ^{1,2} Displacement	(0.01 to 0.4) in (0.4 to 40) in	600 µin (600 + 200L) µin	ASTM E2309; Height Gauge, MT25B Heidenhain Length Gauge;
Speed	(0.01 to 20) in/min	0.5 % of reading	ASTM E2658; Timer
Extensometer, Type 1 Strain ^{1,2}	Gauge length of 0.5 in: (0.06 to 1) in/in (0.002 to 0.06) in/in Gauge length of 1 in : (0.025 to 1) in/in (0.001 to 0.025) in/in Gauge length of 2 in : (0.000 5 to 0.5) in/in	(64 + 715L) µin/in 88 µin/in (27 + 300L) µin/in 40 µin/in (17 + 126L) µin/in	Extensometer Calibrator; ASTM E83
Extensometer, Type 1 Gauge Length ¹	(0.5 to 2) in	400 µin	Extensometer Calibrator; ASTM E83
Torque Drive Arms ¹ (2-point Dimensional Measurement)	(4 to 60) in	0.1 % of arm length	Height Gauge, 60 in Steel Rule, Length Standards
Protractors, Inclinometers ²	Up to 90 °	0.5'	Angle Blocks, Surface Plate

Mass and Mass Related

Burnaby, BC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Force Testing Machines, Force Measuring Systems ^{1,4} Tension Compression	1 gf to 471 kgf (1 to 500 000) lbf 1 gf to 471 kgf (1 to 1 000 000) lbf	0.25 % of reading 0.25 % of reading	Loading Weights, Reference Standard Load Cells; ASTM E4
Force Gages, Crane Scales, Dynamometers, Load Cells, Tension Links ^{1,4} (Tension and Compression)	(1 to 100 000) lbf	0.25 % of reading	Calibration Load Frame, Reference Standard Load Cells; ASTM E4
Durometer ¹ (Types A, B, C, D, DO, E, M, O, OO) Force Only	Up to 90 Duro	0.6 Duro	Balance per ASTM D2240
Analytical Balances ^{1,3}	Up to 10 g (10 to 200) g 200 g to 35 kg 200 g to 220 kg	60 µg 0.12 mg 0.000 25 % of reading 0.000 2 % of reading	ASTM E617 Class 1, OIML Class F1, NIST Class F Weights and NIST Handbook 44 utilized for calibration of the weighting system.
Conventional Mass ¹ (non-integral weights) (SI)	1 g 2 g 3 g 5 g 10 g 20 g 30 g 100 g 200 g 300 g 1 kg 2 kg 3 kg 5 kg 10 kg 20 kg 25 kg 30 kg	10 µg 10 µg 20 µg 20 µg 20 µg 40 µg 50 µg 80 µg 0.12 mg 1.2 mg 1.4 mg 12 mg 13 mg 0.12 g 0.12 g 0.12 g 0.12 g 0.12 g	Electronic Balances; ASTM E617 Class 0 and Class 1 Weights

Mass and Mass Related

Burnaby, BC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Conventional Mass ¹ (Avoirdupois)	0.062 5 oz 0.125 oz 0.25 oz 0.5 oz 0.005 lb 0.01 lb 0.02 lb	10 µg 20 µg 30 µg 30 µg 10 µg 20 µg 30 µg	Electronic Balances; ASTM E617 Class 1 and OIML Class F1 Weights
Conventional Mass ¹ (Avoirdupois)	0.05 lb 0.1 lb 0.2 lb 0.5 lb 1 lb 2 lb 5 lb 10 lb 25 lb 50 lb	40 µg 0.1 mg 0.13 mg 1.2 mg 1.2 mg 1.5 mg 12 mg 12 mg 0.12 g 0.12 g	Electronic Balances; ASTM E617 Class 1 and OIML Class F1 Weights
Pressure Calibrators ^{1,4}	(0.3 to 300) psig (30 to 1 000) psig (1 000 to 10 000) psig	0.015 % of reading 0.015 % of reading 0.25 % of reading	Ametek RK-300 DWT Ametek HK-1000 DWT Gefran 10kpsi
Pressure Indicators, Pressure Gauges ^{1,4}	(30 to 1 000) psig (1 000 to 10 000) psig	0.015 % of reading 0.25 % of reading	Ametek HK-1000 DWT, Gefran 10kpsi, Standard Pressure Modules and Pressure Transducers
Vacuum Devices ^{1,4}	(-14 to 0) psiv	0.05 psi	Fluke Pressure Calibrator, Fluke Vacuum Module
Torque Wrenches ¹	(8 to 300) lbf·in (22 to 651) lbf·ft	0.75 % of reading 0.75 % of reading	ASTM E2624; Torque Testers
Direct Verification of Hardness Testing Machines ¹ Verification of Test Force	(1 to 3 000) kgf	0.25 % of reading	ASTM E10, ASTM E18, ASTM E92, ASTM E384 Working Force Standards
Verification of the Indentation Measuring System	(0.01 to 5) mm	1 µm	Stage Micrometer
Deflection Measuring System	(0.025 to 0.05) mm	0.1 µm	Gauge Blocks

Mass and Mass Related

Burnaby, BC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Rockwell Hardness Testers ¹	(< 70) HRA	0.28 HRA	Indirect verification per ASTM E18, ASTM E110 using Rockwell Test Blocks
	(≥ 70 and < 80) HRA	0.17 HRA	
	(≥ 80) HRA	0.16 HRA	
	(< 60) HRBW	1.4 HRBW	
	(≥ 60 to < 88) HRBW	0.87 HRBW	
	(≥ 88) HRBW	0.42 HRBW	
	(< 35) HRC	0.4 HRC	
	(≥ 35 to < 60) HRC	0.36 HRC	
	(≥ 60) HRC	0.32 HRC	
	(< 51) HRD	0.27 HRD	
	(≥ 51 to < 71) HRD	0.26 HRD	
	(≥ 71) HRD	0.18 HRD	
	(< 84) HREW	0.54 HREW	
	(≥ 84 to < 93) HREW	0.54 HREW	
	(≥ 93) HREW	0.54 HREW	
	(< 80) HRFW	0.54 HRFW	
	(≥ 80 to < 94) HRFW	0.4 HRFW	
	(≥ 94) HRFW	0.4 HRFW	
	(< 55) HRGW	0.76 HRGW	
	(≥ 55 to < 80) HRGW	0.36 HRGW	
	(≥ 80) HRGW	0.36 HRGW	
	(< 96) HRHW	0.54 HRHW	
	(≥ 96) HRHW	0.41 HRHW	
	(< 65) HRKW	0.64 HRKW	
	(≥ 65 to < 85) HRKW	0.4 HRKW	
	(≥ 85) HRKW	0.4 HRKW	
	(90 to 114) HRLW	0.36 HRLW	
	(115 to 130) HRL W	0.36 HRLW	
	(70 to 99) HRMW	0.56 HRMW	
	(100 to 130) HRMW	0.56 HRMW	

Mass and Mass Related

Burnaby, BC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Rockwell Superficial Hardness Testers ¹	(40 to 84) HRPW	0.91 HRPW	Indirect verification per ASTM E18, ASTM E110 using Rockwell Test Blocks
	(85 to 130) HRPW	0.65 HRPW	
	(100 to 119) HRRW	0.41 HRRW	
	(120 to 130) HRRW	0.24 HRRW	
	(110 to 111) HRSW	0.95 HRSW	
	(112 to 130) HRSW	0.2 HRSW	
	(80 to 103) HRVW	0.95 HRVW	
	(104 to 130) HRVW	0.2 HRVW	
	(< 78) HR15N	0.39 HR15N	
	(≥ 78 to < 90) HR15N	0.19 HR15N	
	(≥ 90) HR15N	0.19 HR15N	
	(< 55) HR30N	0.55 HR30N	
	(≥ 55 to < 77) HR30N	0.28 HR30N	
	(≥ 77) HR30N	0.28 HR30N	
	(< 37) HR45N	0.43 HR45N	
	(≥ 37 to < 66) HR45N	0.22 HR45N	
	(≥ 66) HR45N	0.19 HR45N	
	(< 81) HR15TW	0.37 HR15TW	
	(≥ 81 to < 87) HR15TW	0.21 HR15TW	
	(≥ 87) HR15TW	0.21 HR15TW	
	(< 57) HR30TW	0.9 HR30TW	
	(≥ 57 to < 70) HR30TW	0.66 HR30TW	
	(≥ 70) HR30TW	0.39 HR30TW	
	(< 33) HR45TW	0.73 HR45TW	
	(≥ 33 to < 53) HR45TW	0.41 HR45TW	
	(≥ 53) HR45TW	0.41 HR45TW	
	(80 to 88) HR15WW	0.67 HR15WW	
	(89 to 100) HR15WW	0.67 HR15WW	

Mass and Mass Related

Burnaby, BC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Rockwell Superficial Hardness Testers ¹	(40 to 64) HR30WW	0.9 HR30WW	Indirect verification per ASTM E18, ASTM E110 using Rockwell Test Blocks
	(65 to 100) HR30WW	0.76 HR30WW	
	(10 to 47) HR45WW	0.3 HR45WW	
	(48 to 100) HR45WW	0.13 HR45WW	
	(80 to 87) HR15XW	0.62 HR15XW	
	(88 to 100) HR15XW	0.33 HR15XW	
	(60 to 78) HR30XW	0.99 HR30XW	
	(79 to 100) HR30XW	0.15 HR30XW	
	(40 to 68) HR45XW	0.81 HR45XW	
	(69 to 100) HR45XW	0.35 HR45XW	
Brinell Hardness Testers ¹	(85 to 93) HR15YW	1.3 HR15YW	Indirect verification per ASTM E10 using Brinell Test Blocks and Brinell Scope
	(94 to 100) HR15YW	0.63 HR15YW	
	(60 to 87) HR30YW	0.82 HR30YW	
	(88 to 100) HR30YW	0.37 HR30YW	
	(60 to 81) HR45YW	0.94 HR45YW	
	(82 to 100) HR45YW	0.3 HR45YW	
	1/62.5 (200 to 400) HBW	9.5 HBW	
	(400 to 600) HBW	25 HBW	
	2.5/187.5 (200 to 400) HBW	6.2 HBW	
	(400 to 600) HBW	15 HBW	
	10/500 (20 to 100) HBW	1 HBW	
	(100 to 150) HBW	1.5 HBW	
	5/1 000 (200 to 400) HBW	4 HBW	
	(400 to 600) HBW	8 HBW	
	10/1 000 (200 to 400) HBW	3.3 HBW	
	(400 to 600) HBW	7 HBW	

Mass and Mass Related

Burnaby, BC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Brinell Hardness Testers ¹	10/1 500 (200 to 400) HBW (400 to 600) HBW 10/2 000 (200 to 400) HBW (400 to 600) HBW 10/2 500 (200 to 400) HBW (400 to 600) HBW 10/3 000 (200 to 400) HBW (400 to 600) HBW	2.7 HBW 6.5 HBW 2.2 HBW 5.2 HBW 2 HBW 4.4 HBW 1.9 HBW 4.9 HBW	Indirect verification per ASTM E10 using Brinell Test Blocks and Brinell Scope
Vickers Hardness Testers ¹ ≥ 1 kgf	HV 1 200 HV 400 HV 700 HV HV 2 200 HV 400 HV 700 HV HV 5 200 HV 400 HV 700 HV HV 10 200 HV 400 HV 700 HV HV 20 200 HV 400 HV 700 HV HV 30 200 HV 400 HV 700 HV HV 50 200 HV 400 HV 700 HV	4.1 HV 8 HV 18 HV 3 HV 8 HV 14 HV 3 HV 6 HV 11 HV 3 HV 6 HV 11 HV 3 HV 6 HV 11 HV 3 HV 4 HV 7 HV 3 HV 4 HV 7 HV	Indirect verification per ASTM E92, ASTM E384 using Hardness Test Blocks

Mass and Mass Related

Burnaby, BC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Vickers Hardness Testers ¹ < 1 kgf	HV 0.01		Indirect verification per ASTM E92, ASTM E384 using Hardness Test Blocks
	200 HV	10 HV	
	400 HV	20 HV	
	700 HV	35 HV	
	HV 0.025		
	200 HV	10 HV	
	400 HV	20 HV	
	700 HV	35 HV	
	HV 0.05		
	200 HV	10 HV	
	400 HV	20 HV	
	700 HV	35 HV	
	HV 0.1		
	200 HV	8 HV	
	400 HV	20 HV	
	700 HV	35 HV	
	HV 0.2		
	200 HV	8 HV	
	400 HV	18 HV	
	700 HV	35 HV	
	HV 0.3		
	200 HV	5 HV	
	400 HV	14 HV	
	700 HV	24 HV	
	HV 0.5		
	200 HV	5 HV	
	400 HV	12 HV	
	700 HV	24 HV	
	HV 1		
	200 HV	4 HV	
	400 HV	8 HV	
	700 HV	17 HV	
Knoop Micro-Indentation Hardness Testers ¹	HK 0.01		Indirect verification per ASTM E92, ASTM E384 using Hardness Test Blocks
	200 HK	7 HK	
	400 HK	16 HK	
	700 HK	33 HK	

Mass and Mass Related

Burnaby, BC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Knoop Micro-Indentation Hardness Testers ¹	HK 0.025		Indirect verification per ASTM E92, ASTM E384 using Hardness Test Blocks
	200 HK	7 HK	
	400 HK	14 HK	
	700 HK	22 HK	
	HK 0.05		
	200 HK	7 HK	
	400 HK	14 HK	
	700 HK	20 HK	
	HK 0.1		
	200 HK	7 HK	
	400 HK	12 HK	
	700 HK	19 HK	
	HK 0.2 and 0.3		
	200 HK	5 HK	
	400 HK	8 HK	
	700 HK	17 HK	
	HK 0.5 and 1		
	200 HK	5 HK	
	400 HK	7 HK	
	700 HK	15 HK	

Thermodynamic

Burnaby, BC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature – Source ¹	0 °C	0.01 °C	Ice Bath, Secondary Standard PRT, Instrulab 4312A Thermometer
	(> 0.01 to 90) °C	0.1 °C	Baths, Secondary Standard PRT, Instrulab 4312A Thermometer
	(> 90 to 660) °C	1.2 °C	Dry Block, Fluke Process Calibrator Thermocouple Probe
Temperature – Measure ¹	(-78 to 200) °C	0.05 °C	Secondary Standard PRT, Instrulab 4312A Thermometer

Thermodynamic

Burnaby, BC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature – Measure ¹	(200 to 660) °C	1.2 °C	Type N Thermocouple Probe, Fluke 744 Process Calibrator
PRT/RTD Probes ¹	(> 0.01 to 90) °C	0.1 °C	Ice Bath, Liquid baths, Dry Block Calibrator, Secondary Standard PRT, Instrulab 4312A Thermometer
Thermocouples ¹	(> 90 to 660) °C	0.5 °C	
Liquid-in-Glass Thermometers ¹	(> 0.01 to 90) °C	0.1 °C	
Radiation (Infrared) Thermometers ¹	0 °C 100 °C 200 °C 300 °C 400 °C 500 °C	0.34 °C 0.7 °C 1.1 °C 1.3 °C 1.7 °C 2 °C	Radiometric Method using Blackbody Calibrator (Flat Plate) $\epsilon = 0.95$, $\lambda = (8 \text{ to } 14) \mu\text{m}$
Humidity – Measure ¹	(11 to 90) %RH	1 %RH	Vaisala Humidity Transmitter

Time and Frequency

Burnaby, BC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Timers ¹	1 min to 24 h	0.25 s	NRC Time Signal
Frequency – Measure ¹	(1 to 109.99) Hz (110 to 1 099.9) Hz (1.1 to 10.999) kHz (11 to 50) kHz	0.11 mHz/Hz + 50 mHz 0.1 mHz/Hz + 0.5 Hz 0.75 Hz/kHz + 50 Hz 0.22 Hz/kHz + 50 Hz	Fluke 743 Process Calibrator
Frequency – Source ¹	Up to 10.99 Hz (11 to 109.99) Hz (110 to 1 099.9) Hz (1 100 to 21 999) Hz (22 to 50) kHz	1.1 mHz/Hz + 10 mHz 0.54 mHz/Hz + 0.1 Hz 0.1 mHz/Hz + 0.1 Hz 45 μ Hz/Hz + 2 Hz 0.1 Hz/kHz + 5 Hz	Fluke 743 Process Calibrator

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Calibration and Measurement Capability (CMC) is expressed in terms of the measurement parameter, measurement range, expanded uncertainty of measurement and reference standard, method, and/or equipment. The expanded uncertainty of measurement is expressed as the standard uncertainty of the measurement multiplied by a coverage factor of 2 ($k=2$), corresponding to a confidence level of approximately 95%.

Notes:

1. On-site calibration service is available for this parameter, since on-site conditions are typically more variable than those in the laboratory, larger measurement uncertainties are expected on-site than what is reported on the accredited scope.
2. L = length in inches; ' = arc-minute.
3. The CMC for scales and balances is highly dependent upon the resolution of the unit under test. The CMC presented here does not include the resolution of the unit under test. The resolution will be included in the reported measurement uncertainty at the time of calibration.
4. The resolution will be included in the reported measurement uncertainty at the time of calibration.
5. This scope is formatted as a part of a single document including Certificate of Accreditation No. AC-1402. Site specific sections are identified by the city and state above each table.



R. Douglas Leonard Jr., VP, PILR SBU

