



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

CROSS TECHNOLOGIES, INC dba CROSS (FORMERLY J.A. KING)
7103 Juniper Road
Fairview, TN 37062
Connie Foster Phone: 800 327 7727

CALIBRATION

Valid To: May 31, 2023

Certificate Number: 1741.08

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations^{1,10}:

I. Chemical

Parameter/Equipment	Range	CMC ² (±)	Comments
pH Meters ³	4 pH 7 pH 10 pH	0.06 pH 0.04 pH 0.05 pH	Standard pH solutions
Conductivity Meters ³ – Fixed Points	10 µS/cm 100 µS/cm 1000 µS/cm	0.63 µS/cm 2.3 µS/cm 6.1 µS/cm	Standard conductivity solutions

II. Dimensional

Parameter/Equipment	Range	CMC ^{2,6} (±)	Comments
Pin Gage ³ – Class ZZ	Up to 2 in	80 µin	Micrometer
Calipers ³	Up to 120 in	(6 + 6.1L) µin + 0.6R	Gage blocks

Parameter/Equipment	Range	CMC ^{2,6} (±)	Comments
Micrometers ³ – Outside	Up to 48 in	$(6 + 9.7L) \mu\text{in} + 0.6R$	Gage blocks
Micrometers ³ – Inside	Up to 8 in	$(2.9 + 9.4L) \mu\text{in} + 0.6R$	Gage blocks
Linear Indicators ³ – Dial & Test	Up to 4 in	$(3.2 + 8.8L) \mu\text{in} + 0.6R$	Gage blocks
Height Gages ³	Up to 20 in (20 to 48) in	$(2.5 + 10L) \mu\text{in} + 0.6R$ $(9.5 + 9.7L) \mu\text{in} + 0.6R$	Gage blocks
Steel Rules ³	Up to 72 in	$(6.3 + 9.2L) \mu\text{in} + 0.6R$	Gage blocks
Tape Measures ³	Up to 25 ft	$(6.3 + 9.2L) \mu\text{in} + 0.6R$	Gage blocks
Angle Indicators & Protractors ³	15°, 30°, 45°, 60°, 75°, 90°	0.03°	Angle block set
Feeler/Thickness Gages ³	Up to 1 in	80 μin	Micrometer
Diameter /Radius/Fixture Gages/Weld Gages ³ –			
Diameter	Up to 2.0 in	430 μin	Optical comparator, measuring microscope
Radius	Up to 2.0 in	430 μin	
Length	Up to 12.0 in Up to 528 in	430 μin 0.049 in	Fluke laser distance meter
Circumference	(12 to 36) in	0.0062 in	Pi tape
Optical Comparators ³ –			
X-Y Linearity	Up to 6 in	150 μin	Glass master scales
Magnification	10x to 250x	0.014 in	
Angle	(0 to 90)°	0.1°	Angle block set

Parameter/Equipment	Range	CMC ^{2, 6} (\pm)	Comments
Microscope ³ – Reticle Linearity	Up to 1 mm (1 to 10) mm	0.005 mm + 0.6R 0.005 mm + 0.6R	Stage micrometer
Surface Plates ³ – Grades AA, A, & B Repeatability Flatness	0.002 in Up to 60 DL in (>60 to 120) DL in	26 μ in (31 + 0.2DL) μ in (30 + 0.3DL) μ in	Repeat-o-meter Federal level systems
Interim Verification of Coordinate Measuring Machines ³ – X, Y, Z Linearity Volumetric Performance	Up to 36 in Up to 10 in	(55 + 3L) μ in 180 μ in	Gage blocks Ball bar

III. Dimensional Testing / Calibration

Parameter/Equipment	Range	CMC ^{2, 6} (\pm)	Comments
Length ^{3,8} – X Axis Y Axis Z Axis Volumetric ³	Up to 138 in Up to 138 in Up to 138 in Up to 138 in	0.0034 in 0.0034 in 0.0034 in 0.0039 in	Faro Arm Quantum S

IV. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2, 4, 8} (±)	Comments
DC Voltage ³ – Measure	(0 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 1000) V Up to 10 kV (10 to 70) kV	11 μV/V + 0.3 μV 10 μV/V + 0.3 μV 10 μV/V + 0.5 μV 11 μV/V + 30 μV 27 μV/V + 100 μV 0.05 % + 0.03 V 0.07 % + 0.3 V	Agilent 3458A opt 002 Vitrek 4700 Vitrek 4700 w/ HVL-70
DC Voltage ³ – Generate	(0 to 330) mV 330 mV to 3.3 V (3.3 to 33) V (33 to 330) V (100 to 1020) V Up to 5 kV	25 μV/V + 1 μV 14 μV/V + 2 μV 15 μV/V + 15 μV 22 μV/V + 150 μV 22 μV/V + 1.5 mV 0.05 % + 0.03 V	Fluke 5522A Voltage source w/ Vitrek 4700
DC Power ³ – Generate 33 mV to 1020 V (0.33 to 329.99) mA (0.33 to 2.9999) A (3 to 20.5) A	(0.01 to 330) W (0.33 to 3.3) kW (3.3 to 20.5) kW	0.03 % 0.03 % 0.09 %	Fluke 5522A
DC Current ³ – Measure	(0 to 100) nA 100 nA to 1 μA (1 to 10) μA (10 to 100) μA 100 μA to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A Up to 50 A	32 μA/A + 0.04 nA 23 μA/A + 0.04 nA 23 μA/A + 0.1 nA 23 μA/A + 0.8 nA 23 μA/A + 5 nA 23 μA/A + 50 nA 37 μA/A + 0.5 μA 0.011 % + 10 μA 0.03 %	Agilent 3458A opt 002 Ohms Lab CS-50 w/ Agilent 3458A

Parameter/Equipment	Range	CMC ^{2, 4, 8} (±)	Comments
DC Current ³ – Generate	(0 to 330) μ A (0 to 3.3) mA (0 to 33) mA (0 to 330) mA (0 to 1.1) A (1.1 to 3) A (3 to 11) A (11 to 21) A	0.018 % + 0.02 μ A 0.012 % + 0.05 μ A 0.013 % + 0.25 μ A 0.015 % + 2.5 μ A 0.024 % + 40 μ A 0.046 % + 40 μ A 0.06 % + 500 μ A 0.12 % + 750 μ A	Fluke 5522A
DC Clamp-On Meters ³	Up to 1000 A	0.65 % + 0.5 A	Fluke 5522A w/5500 coil
Resistance ³ – Measure	(0 to 10) Ω (10 to 100) Ω 100 Ω to 1k Ω (1 to 10) k Ω (10 to 100) k Ω 100 k Ω to 1 M Ω (1 to 10) M Ω (10 to 100) M Ω 100 M Ω to 1 G Ω	18 $\mu\Omega/\Omega$ + 50 $\mu\Omega$ 15 $\mu\Omega/\Omega$ + 0.5 m Ω 14 $\mu\Omega/\Omega$ + 0.5 m Ω 12 $\mu\Omega/\Omega$ + 5 m Ω 12 $\mu\Omega/\Omega$ + 50 m Ω 17 $\mu\Omega/\Omega$ + 2 Ω 51 $\mu\Omega/\Omega$ + 100 Ω 0.051 % + 1 k Ω 0.11 % + 10 k Ω	Agilent 3458A opt 002
Insulation Resistance	1 M Ω , 10 M Ω , 100 M Ω , 1 G Ω , 10 G Ω 10 m Ω 100 m Ω to 5 Ω (5 to 200) Ω 200 Ω to 1 M Ω (1 to 10) M Ω 10 M Ω to 1 G Ω (1 to 10) G Ω 100 G Ω 350 M Ω to 99.99 G Ω (100 to 999.9) G Ω (1 to 10) T Ω	1.2 % 1.2 % 0.37 % + 10 m Ω 0.25 % + 10 m Ω 0.25 % 0.37 % 0.6 % 1.2 % 3.6 % 1.8 % 3 % 4.2 %	Local resistor set Fluke 5322A Fluke 5322A w/ resistance multiplier adapter

Parameter/Equipment	Range	CMC ^{2, 4, 8} (±)	Comments	
Resistance ³ – Generate	(0 to 11) Ω (11 to 33) Ω (33 to 110) Ω 110 Ω to 1.1 kΩ (1.1 to 11) kΩ (11 to 110) kΩ 110 kΩ to 1.1 MΩ (1.1 to 3.3) MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ (330 to 1100) MΩ	49 μΩ/Ω + 0.001 Ω 51 μΩ/Ω + 0.0015 Ω 34 μΩ/Ω + 0.0014 Ω 34 μΩ/Ω. + 0.002 Ω 34 μΩ/Ω + 0.02 Ω 34 μΩ/Ω + 0.2 Ω 39 μΩ/Ω + 2 Ω 73 μΩ/Ω + 30 Ω 0.016 % + 50 Ω 0.03 % + 2.5 kΩ 0.06 % + 3 kΩ 0.36 % + 100 kΩ 1.8 % + 500 kΩ	Fluke 5522A	
Fixed Values	1 mΩ 10 mΩ 100 mΩ	0.12 % 0.03 % 0.1 %	Standard resistors	
Capacitance ³ – Generate	(220.0 to 399.9) pF (0.4 to 1.0999) nF (1.1 to 3.2999) nF (3.3 to 10.9999) nF (11 to 109.999) nF (110 to 329.999) nF (0.33 to 1.09999) μF (1.1 to 3.29999) μF (3.3 to 10.9999) μF (11 to 32.9999) μF (33 to 109.999) μF (110 to 329.999) μF (.33 to 1.09999) mF (1.1 to 3.29999) mF (3.3 to 10.9999) mF (11 to 32.9999) mF (33 to 110) mF	(10 to 10 000) Hz (10 to 10 000) Hz (10 to 3000) Hz (10 to 1000) Hz (10 to 1000) Hz (10 to 1000) Hz (10 to 600) Hz (10 to 300) Hz (10 to 150) Hz (10 to 120) Hz (10 to 80) Hz (0 to 50) Hz (0 to 20) Hz (0 to 6) Hz (0 to 2) Hz (0 to 0.6) Hz (0 to 0.2) Hz	0.6 % + 10 pF 0.6 % + 0.01 nF 0.6 % + 0.01 nF 0.3 % + 0.01 nF 0.3 % + 0.1 nF 0.3 % + 0.3 nF 0.3 % + 1 nF 0.3 % + 3 nF 0.3 % + 10 nF 0.49 % + 30 nF 0.55 % + 100 nF 0.54 % + 300 nF 0.55 % + 1 μF 0.55 % + 3 μF 0.56 % + 10 μF 0.91 % + 30 μF 1.4 % + 100 μF	Fluke 5522A

Parameter/Range	Frequency	CMC ^{2, 4} (±)	Comments
AC Voltage ³ – Generate			
(1 to 33) mV	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.1 % + 6 μV 0.021 % + 6 μV 0.027 % + 6 μV 0.12 % + 6 μV 0.42 % + 12 μV 0.96 % + 50 μV	Fluke 5522A
(33 to 330) mV	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.036 % + 8 μV 0.018 % + 8 μV 0.02 % + 8 μV 0.042 % + 8 μV 0.096 % + 32 μV 0.24 % + 70 μV	
330 mV to 3.3 V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.036 % + 50 μV 0.018 % + 60 μV 0.023 % + 60 μV 0.036 % + 50 μV 0.084 % + 130 μV 0.29 % + 600 μV	
(3.3 to 33) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.036 % + 650 μV 0.018 % + 600 μV 0.029 % + 600 μV 0.042 % + 600 μV 0.11 % + 1.6 mV	
(33 to 330) V	45 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.023 % + 2 mV 0.024 % + 6 mV 0.03 % + 6 mV 0.036 % + 6 mV 0.24 % + 50 mV	
(330 to 1020) V	45 Hz to 10 kHz	0.036 % + 100 mV	
AC Voltage ³ – Measure			
Up to 10 mV	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.031 % + 0.03 % of rng 0.021 % + 0.011 % of rng 0.031 % + 0.011 % of rng 0.11 % + 0.011 % of rng 0.51 % + 0.011 % of rng 4.1 % + 0.02 % of rng	Agilent 3458A opt 002

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Voltage ³ – Measure (cont)			
10 mV to 10 V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.008 % + 0.004 % of rng 0.008 % + 0.002 % of rng 0.015 % + 0.002 % of rng 0.031 % + 0.002 % of rng 0.081 % + 0.002 % of rng 0.31 % + 0.01 % of rng	Agilent 3458A
(10 to 100) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.021 % + 0.004 % of rng 0.021 % + 0.002 % of rng 0.021 % + 0.002 % of rng 0.036 % + 0.002 % of rng 0.13 % + 0.002 % of rng 0.41 % + 0.01 % of rng	
(100 to 600) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.041 % + 0.004 % of rng 0.041 % + 0.002 % of rng 0.061 % + 0.002 % of rng 0.13 % + 0.002 % of rng 0.31 % + 0.002 % of rng	
Up to 10 kV ³	60 Hz	0.15 % + 0.1 V	Vitrek 4700
(10 to 50) kV ³	60 Hz	0.15 % + 0.6 V	Vitrek 4700 w/ HVL-70
AC Current ³ – Measure			
(0 to 100) μA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz 100 Hz to 5 kHz	0.4 % + 0.03 % range 0.15 % + 0.03 % range 0.06 % + 0.03 % range 0.06 % + 0.03 % range	Agilent 3458A opt 002
(0.1 to 100) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.4 % + 0.02 % range 0.15 % + 0.02 % range 0.06 % + 0.02 % range 0.03 % + 0.02 % range 0.06 % + 0.02 % range 0.4 % + 0.04 % range 0.55 % + 0.15 % range	

Parameter/Range	Frequency	CMC ^{2, 4, 5} (\pm)	Comments
AC Current ³ – Measure (cont)			
(0.1 to 1) A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz	0.4 % + 0.02 % range 0.16 % + 0.02 % range 0.08 % + 0.02 % range 0.1 % + 0.02 % range 0.3 % + 0.02 % range 1 % + 0.04 % range	Agilent 3458A opt 002
(1 to 50) A	DC to 60 Hz	0.03 %	Ohms Lab CS-50 w/ Agilent 3458A
AC Current ³ – Generate			Fluke 5522A
(0 to 0.33) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.24 % + 0.1 μ A 0.18 % + 0.1 μ A 0.15 % + 0.1 μ A 0.36 % + 0.15 μ A 0.96 % + 0.2 μ A 2 % + 0.4 μ A	
(0.33 to 3.3) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.24 % + 0.15 μ A 0.15 % + 0.15 μ A 0.12 % + 0.15 μ A 0.24 % + 0.2 μ A 0.6 % + 0.3 μ A 1.2 % + 0.6 μ A	
(3.3 to 33) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.22 % + 2 μ A 0.11 % + 2 μ A 0.05 % + 2 μ A 0.1 % + 2 μ A 0.24 % + 3 μ A 0.48 % + 4 μ A	
(33 to 330) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.22 % + 20 μ A 0.11 % + 20 μ A 0.05 % + 20 μ A 0.12 % + 50 μ A 0.24 % + 100 μ A 0.48 % + 200 μ A	
(0.33 to 1.1) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.22 % + 100 μ A 0.06 % + 100 μ A 0.72 % + 1 mA 3 % + 5 mA	

Parameter/Range	Frequency	CMC ^{2, 4, 5} (±)	Comments
AC Current ³ – Generate			Fluke 5522A
(1.1 to 3) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.22 % + 100 µA 0.08 % + 100 µA 0.72 % + 1 mA 3 % + 5 mA	
(3 to 11) A	45 Hz to 1 kHz (1 to 5) kHz	0.13 % + 2 mA 3.6 % + 2 mA	
(11 to 20.5) A	45 Hz to 1 kHz (1 to 5) kHz	0.18 % + 5 mA 3.6 % + 5 mA	
AC Power ³ – Generate			Fluke 5522A
(45 to 65) Hz; PF=1			
(33 to 330) mV Range			
(3.3 to 8.99) mA	110 µW to 3 mW	0.17 %	
(9 to 32.99) mA	(3 to 11) mW	0.12 %	
(33 to 89.99) mA	(1.1 to 30) mW	0.17 %	
(90 to 329.99) mA	(3 to 110) mW	0.12 %	
(0.33 to 0.8999) A	(11 to 300) mW	0.16 %	
(0.9 to 2.1999) A	(30 to 730) mW	0.14 %	
(2.2 to 4.4999) A	73 mW to 1.5 W	0.16 %	
(4.5 to 20.5) A	150 mW to 6.8 W	0.14 %	
330 mV to 1020 V Range			
(3.3 to 8.99) mA	1.1 mW to 9 W	0.15 %	
(9 to 32.99) mA	3 mW to 33 W	0.1 %	
(33 to 89.99) mA	11 mW to 90 W	0.15 %	
(90 to 329.99) mA	30 mW to 330 W	0.1 %	
(0.33 to 0.8999) A	110 mW to 900 W	0.14 %	
(0.9 to 2.1999) A	300 mW to 2200 W	0.11 %	
(2.2 to 4.4999) A	730 mW to 4500 W	0.15 %	
(4.5 to 20.5) A	(1.5 to 20.9) kW	0.12 %	

Parameter/Equipment	Range	CMC ² (±)	Comments
AC Clamp-On Meters ³ – (Up to 150) A			Fluke 5520A w/ 5500 coil
Toroidal	(45 to 65) Hz (65 to 440) Hz	0.49 % + 0.025 A 1 % + 0.027 A	
Non-Toroidal	(45 to 65) Hz (65 to 440) Hz	0.76 % + 0.25 A 1.3 % + 0.25 A	
(150 to 1025) A			
Toroidal	(45 to 65) Hz (65 to 440) Hz	0.49 % + 0.09 A 1 % + 0.1 A	
Non-Toroidal	(45 to 65) Hz (65 to 440) Hz	0.76 % + 0.9 A 1.3 % + 0.9 A	
Oscilloscopes ³ –			Fluke 5522A w/ SC1100
Square Wave Signal:			
50 Ω Load @ 1 kHz	1 mV to 6.6 V _{pk-pk}	0.31 % + 40 μV	
1 MΩ Load @ 1 kHz	1 mV to 130 V _{pk-pk}	0.14 % + 40 μV	
DC Volt Amplitude:			
50 Ω Load	(0 to 6.6) V	0.3 % + 40 μV	
1 MΩ Load	(0 to 130) V	0.06 % + 40 μV	
Level Sine Wave:			
Frequency	(0 to 1100) MHz	3.3 μHz/Hz	
Amplitude	50 kHz Reference 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (600 to 1100) MHz	2.4 % + 300 μV 4.2 % + 300 μV 4.8 % + 300 μV 7.2 % + 300 μV 8.4 % + 300 μV	
Flatness (Bandwidth)	0 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (600 to 1100) MHz	1.8 % + 100 μV 2.4 % + 100 μV 4.8 % + 100 μV 6 % + 100 μV	

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
Oscilloscopes ³ – (cont)			Fluke 5522A w/ SC1100
Time Markers:			
Into a 50 Ω Load	5 s to 50 ms 20 ms to 1 ns	(30 + 1000t) μs/s 3.5 μs/s	<i>t</i> is time in seconds
Rise Time:			
1 kHz to 2 MHz (2 to 10) MHz	≤ 300 ps ≤ 350 ps	130 ps	
Electrical Simulation of Thermocouples ³ –			Fluke 5522A
Type B	(600 to 800) °C (800 to 1820) °C	0.53 °C 0.43 °C	
Type E	(-250 to -100) °C (-100 to 650) °C (650 to 1000) °C	0.61 °C 0.21 °C 0.26 °C	
Type J	(-210 to -100) °C (-100 to 760) °C (760 to 1200) °C	0.33 °C 0.22 °C 0.29 °C	
Type K	(-200 to -100) °C (-100 to 1000) °C (1000 to 1372) °C	0.4 °C 0.32 °C 0.49 °C	
Type R	(0 to 250) °C (250 to 1000) °C (1000 to 1767) °C	0.70 °C 0.42 °C 0.50 °C	
Type S	(0 to 250) °C (250 to 1400) °C (1400 to 1767) °C	0.58 °C 0.46 °C 0.57 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 400) °C	0.76 °C 0.30 °C 0.21 °C	

Parameter/Range	Frequency	CMC ^{2, 4} (±)	Comments
Electrical Simulation of Thermocouples ³ – Type J Type K Type T	 (-200 to 1200) °C (-200 to 1372) °C (-250 to 400) °C	 0.07 °C 0.07 °C 0.07 °C	 Fluke 5522A w/ ice point reference
Electrical Simulation of RTDs ³ Pt 385, 100 Ω	 (-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C	 0.07 °C 0.10 °C 0.11 °C 0.13 °C 0.15 °C 0.28 °C	 Fluke 5522A

V. Fluid Quantities

Parameter/Equipment	Range	CMC ^{2, 5} (±)	Comments
Viscosity Meters ³	Up To 16 300 cP	0.46 %	Standard viscosity solution w/ bath
Viscosity Dip Cups ³ (Kinematic Viscosity, Efflux Time)	(0 to 100) mm ² /s (100 to 1000) mm ² /s	2.2 cSt 2.2 cSt	Certified viscosity oil
Volumetric Air Flow Measure & Measuring Equipment ³	(20 to 200) lpm	1.4 %	Reference flowmeter

VI. Mechanical

Parameter/Equipment	Range	CMC ^{2, 5, 6} (±)	Comments
Torque Testers /Analyzers, Transducers ³	Up to 250 ft·lbf	0.08 %	Class F weights & arm
Torque Wrenches ³	Up to 600 ft·lbf	0.64 %	CDI Suretest 5000-ST
Rotary Torque Tools (Pneumatic, DC, Pulse)	(0.02 to 2) N·m (0.5 to 5) N·m (1 to 10) N·m (2 to 20) N·m (2.5 to 25) N·m (7.5 to 75) N·m (18 to 180) N·m	0.03 N·m 0.07 N·m 0.15 N·m 0.29 N·m 0.36 N·m 1.1 N·m 2.6 N·m	Crane – torque star w/ rotary transducers
Scales & Balances ³	(1 to 20 000) g (> 20 to 5000) kg Up to 1000 lb (1000 to 120 000) lb (1 to 5) g (Up to 10) g (Up to 30) g (Up to 50) g (Up to 100) g (Up to 200) g (Up to 300) g (Up to 500) g (Up to 1000) g (> 1000) g	0.017 % + 0.6R 0.017 % per 20 kg + 0.6R 0.017 % + 0.6R 0.017 % per 1000 lb + 0.6R 0.041 mg + 0.6R 0.06 mg + 0.6R 0.089 mg + 0.6R 0.14 mg + 0.6R 0.3 mg + 0.6R 0.6 mg + 0.6R 0.9 mg + 0.6R 1.4 mg + 0.6R 3 mg + 0.6R 3 mg per 1000 g + 0.6R	Class F weights (applied load) Class 1 weights (applied load)
Force – Measuring Equipment ³	Up to 5000 lbf Up to 10 000 lbf	0.04 % + 0.6R 0.14 % of applied force	Class F weights Load cells w/ indicator

Parameter/Equipment	Range	CMC ^{2, 5} (±)	Comments
Pressure ³ – Measure & Measuring Equipment	Up to 1 in H ₂ O	0.63 % of full scale	Dwyer 475
	Up to 10 in H ₂ O	0.63 % of full scale	Dwyer 475
	Up to 200 in H ₂ O	0.13 % of full scale	Dwyer 477B
	0.5 to 100 psia	0.063 psia	Fluke 700GA6
	(0.01 to 100) psig (0.1 to 1000) psig (5 to 10 000) psig	0.07 % of full scale 0.07 % of full scale 0.07 % of full scale	Fluke 754 w/ 700 series modules
	(30 to 300) psig (300 to 3000) psig	0.03 % of full scale 0.03 % of full scale	Additel ADT-681 Additel ADT-681
Vacuum ³	(0.01 to 28.5) in·Hg	0.07 % of full scale	Fluke 754 w/ 700PD6
Indirect Verification of Brinell Hardness Testers at Test Condition ³ –			
HBW 2.5/187.5	79.2 HBW 145 HBW	4.0 HBW 4.0 HBW	Indirect verification ASTM E10
HBW 10/500	75.6 HBW 130 HBW	4.0 HBW 1.6 HBW	
HBW 5/750	118 HBW 148 HBW 180 HBW 289 HBW 420 HBW	4.0 HBW 4.0 HBW 4.0 HBW 1.6 HBW 4.5 HBW	
HBW 10/1000	182 HBW 299 HBW	4.4 HBW 4.4 HBW	
HBW 10/3000	418 HBW	3.2 HBW	

Parameter/Equipment	Range	CMC ² (±)	Comments
Indirect Verification of Rockwell Hardness Testers ³	HRA		Indirect verification per ASTM E18
	(20 to 65)	0.82 HRA	
	(70 to 78)	0.81 HRA	
	(80 to 84)	0.81 HRA	
	HRBW		
	(40 to 59)	0.82 HRBW	
	(60 to 79)	0.82 HRBW	
	(80 to 100)	0.81 HRBW	
	HRC		
	(20 to 30)	0.84 HRC	
	(35 to 55)	0.84 HRC	
	(60 to 65)	0.81 HRC	
	HR15N		
	(70 to 77)	0.82 HR15N	
	(78 to 88)	0.82 HR15N	
	(90 to 92)	0.81 HR15N	
	HR30N		
	(42 to 50)	0.81 HR30N	
	(55 to 73)	0.81 HR30N	
	(77 to 82)	0.81 HR30N	
	HR45N		
(20 to 31)	0.82 HR45N		
(37 to 61)	0.83 HR45N		
(66 to 72)	0.81 HR45N		
15T:			
Low	0.80 HRBW		
Medium	0.80 HRBW		
High	0.82 HRBW		
30T:			
Low	0.80 HRBW		
Medium	0.80 HRBW		
High	0.82 HRBW		

Parameter/Equipment	Range	CMC ^{2, 5} (±)	Comments
Speed ³ – Optic/Non-Contact: RPM	(5 to 200 000) rpm	0.018 %	Monarch PT200
Contact: RPM	(0.5 to 20 000) rpm	0.22 %	Monarch PT200
Totalizer/Rate Meters	(1 to 6561.7) rpm	0.22 %	
Speed/RPM/Rate Simulation	(6 to 200 000) rpm	0.003 %	Agilent 33220A

VII. Optical Quantities

Parameter/Equipment	Range	CMC ² (±)	Comments
Light Booths ³ – Illuminance	Up to 50 000 Lux	2.7 %	Illuminance spectrophotometer
Color Temperature (CCT) Incandescent	(2300 to 6500) K	54 K	

VIII. Thermodynamics

Parameter/Equipment	Range	CMC ^{2, 9} (±)	Comments
Infrared Thermometry ³ – Measuring Equipment	Up to 100 °C 100 to 200 °C 200 to 350 °C 350 to 500 °C	1 °C 1.2 °C 1.7 °C 2.3 °C	Fluke 4181
Temperature ³ – Measuring Equipment	(-15 to 350) °C (25 to 85) °C	0.14 °C 0.04 °C	Fluke 9009 w/ reference probe Water bath w/ reference probe
Temperature ³ – Measure	(-196 to 420) °C	0.029 °C	Fluke 1502A w/ PRT

Parameter/Equipment	Range	CMC ^{2,9} (±)	Comments
Relative Humidity ³ – Measuring Equipment	(20 to 80) % RH	1.5 % RH	Vaisala MI70 w/ HMP-76 w/ controlled environment
Relative Humidity ³ – Measure	(10 to 90) % RH	1.5 % RH	Vaisala MI70 w/ HMP-76

VIII. Time & Frequency

Parameter/Equipment	Range	CMC ^{2,9} (±)	Comments
Frequency ³ – Measuring Equipment	(0 to 1100) MHz	3.3 µHz/Hz	Fluke 5522A/1GHz
Frequency ³ – Measure	(0 to 350) MHz	1.3 µHz/Hz	Agilent 53220A
Timers & Stopwatches ³	(1 to 3600) s	0.017 s	Agilent 53220A

¹ This laboratory offers commercial calibration, dimensional testing and field calibration services, where noted.

² Calibration and Measurement Capability Uncertainty (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. CMCs 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. 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 The stated measured values are determined using the indicated instrument (see Comments). This capability is suitable for the calibration of the devices intended to measure or generate the measured value in the ranges indicated. CMCs are expressed as either a specific value that covers the full range or as a fraction/percentage of the reading plus a fixed floor specification.

⁵ In the statement of CMC, a percent (%) refers to a percent of reading unless otherwise noted.

⁶ In the statement of CMC, L is the numerical value of the nominal length of the device measured in inches. In the Calibration and Measurement Capability, R is the numerical value of the resolution of the device, and DL is the length of the diagonal in inches.

⁷ In the statement of CMC, t represents the time in seconds.

⁸ This laboratory meets R205 – *Specific Requirements: Calibration Laboratory Accreditation Program* for the types of dimensional tests listed above and is considered equivalent to that of a calibration.

⁹ The type of instrument or material being calibrated is defined by the parameter. This indicates the laboratory is capable of calibrating instruments that measure or generate the values in the ranges indicated for the listed measurement parameter.

¹⁰ This scope meets A2LA's *P112 Flexible Scope Policy*.



Accredited Laboratory

A2LA has accredited

CROSS TECHNOLOGIES, INC DBA CROSS (FORMERLY J.A. KING)

Fairview, TN

for technical competence in the field of

Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets the requirements of R205 – Specific Requirements: Calibration Laboratory Accreditation Program. 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*).



Presented this 16th day of June 2021.

A blue ink signature of the Vice President of Accreditation Services.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 1741.08
Valid to May 31, 2023

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