



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

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CALIBRATION

Valid To: October 31, 2021

Certificate Number: 3467.02

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations^{1, 8}:

I. Acoustic

Parameter/Equipment	Range	CMC ² (±)	Comments
Sound Level Meter ³	114 dB @ 1 kHz	1.3 dB	In comparison with Dawe (acoustic calibrator)
	94 dB, 104, 114 dB @ 1 kHz	0.77 dB	CEL Inst. (digital sound level meter)
Acoustic Level Calibrator ³	94 dB, 104, 114 dB @ 1 kHz	0.77 dB	CEL Inst. (digital sound level meter)

II. Chemical

Parameter/Equipment	Range	CMC ² (±)	Comments
Conductivity Meter ³	180 µS/cm 980 µS/cm 1416 µS/cm 1992 µS/cm	11 µS/cm 16 µS/cm 36 µS/cm 26 µS/cm	Comparison to standard solution

Parameter/Equipment	Range	CMC ^{2,5} ($\pm$)	Comments
TDS Meter ³	90 ppm 490 ppm 996 ppm	5.1 ppm 7.7 ppm 13 ppm	Comparison to standard solution
pH Meter ³	4.02 pH 6.98 pH 9.99 pH	0.026 pH 0.039 pH 0.052 pH	Comparison to standard solution

III. Dimensional

Parameter/Equipment	Range	CMC ² ($\pm$)	Comments
Micrometer ³ (Inside and Outside)	Up to 25 mm (>25 to 75) mm (>75 to 100) mm	1.1 μ m 1.1 μ m 1.1 μ m	Gage blocks (Mitutoyo M103)
Calipers ³	Up to 300 mm Up to 100 mm (>100 to 600) mm	12 μ m 6.4 μ m 12 μ m/m + 3.5 μ m	Gage blocks (Mitutoyo M103) Caliper checker
Dial Indicators	Up to 25 mm Up to 1 in	6.1 μ m 110 μ in	Dial indicator calibrator
Height Gauge – Vertical Instrument ³	(5 to 100) mm (>100 to 600) mm (0.5 to 4) in (>4 to 16) in	1.2 μ m + 2.0 μ m/m 0.3 μ m + 10 μ m/m 50 μ in + 1.5 μ in/in 100 μ in + 3.0 μ in/in	Gage blocks, setting rods (Mitutoyo)

IV. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2, 6} ($\pm$)	Comments
DC Voltage – Generate	(0 to 329.9999) mV (0.33 to 3.299 999) V (3.3 to 32.999 99) V (33 to 329.9999) V (330 to 1000) V	25 μ V/V + 1.3 μ V 14 μ V/V + 2 μ V 14 μ V/V + 30 μ V 21 μ V/V + 300 μ V 22 μ V/V + 2.0 mV	Fluke 5520A, Fluke 5522A
High Voltage Measure ³	(1 to 5) kV dc (5 to 40) kV pulse	0.1 % + 0.0079 kV dc 0.2 % + 0.08 kV pulse	Pipeline Inspection Co. (high voltage meter)
DC Voltage – Measure ³	(0 to 100) mV (0 to 1) V (0 to 10) V (0 to 100) V (0 to 1000) V	50 μ V/V + 5.4 μ V 40 μ V/V + 16 μ V 45 μ V/V + 55 μ V 50 μ V/V + 1.3 mV 55 μ V/V + 13 mV	Fluke 8846A
DC Voltage – Measure	(0 to 200) mV (0 to 2) V (0 to 20) V (0 to 200) V (0 to 1000) V	10 μ V/V + 0.07 μ V 5.0 μ V/V + 1.4 μ V 5.0 μ V/V + 14 μ V 8.0 μ V/V + 36 μ V 10 μ V/V + 0.4 μ V	Fluke 8508A
DC Current – Generate	(0 to 329.999) μ A (0.33 to 3.299 99) mA (3.3 to 32.9999) mA (33 to 329.999) mA (0.33 to 2.999 99) A (3.0 to 10) A (>10 to 19) A (10 to 500) A (>500 to 1000) A	180 μ A/A + 0.023 μ A 140 μ A/A + 0.02 μ A 120 μ A/A + 0.3 μ A 130 μ A/A + 3 μ A 0.45 mA/A + 58 μ A 0.6 mA/A + 0.5 mA 1.2 mA/A + 0.2 mA (3 mA/A + 0.09) A (3.2 mA/A + 0.09) A	Fluke 5522A Fluke 5522A, Fluke 5500A (coil)
DC Current – Measure ³	(0 to 100) μ A (0 to 1) mA (0 to 10) mA (0 to 100) mA (0 to 400) mA (0 to 1) A (0 to 3) A (0 to 10) A	0.65 mA/ A + 0.03 μ A 0.61 mA/A + 0.07 μ A 0.61 mA/A + 2.3 μ A 0.61 mA/A + 6.3 μ A 0.6 mA/A + 0.11 mA 0.8 mA/A + 0.2 mA 1.2 mA/A + 0.8 mA 2.1 mA/A + 1 mA	Fluke 8846A

Parameter/Equipment	Range	CMC ^{2, 4, 6} ($\pm$)	Comments
DC Current – Measure	(0 to 200) μ A (0 to 2) mA (0 to 20) mA (0 to 200) mA (0 to 2) A (0 to 20) A	42 μ A/A + 0.0023 μ A 26 μ A/A + 0.003 μ A 28 μ A/A + 0.03 μ A 65 μ A/A + 0.82 μ A 220 μ A/A + 0.02 μ A 0.48 mA/A + 0.40 mA	Fluke 8508A
Resistance – Generate	Up to 32.9999 Ω (33 to 329.9999) Ω 330 Ω to 3.299 99 k Ω (3.3 to 32.9999) k Ω (33 to 329.9999) k Ω 330 k Ω to 3.299 999 M Ω (3.3 to 32.999 99) M Ω (33 to 100) M Ω	0.029 % 67 $\mu\Omega/\Omega$ 64 $\mu\Omega/\Omega$ 64 $\mu\Omega/\Omega$ 67 $\mu\Omega/\Omega$ 100 $\mu\Omega/\Omega$ 0.07 % 0.068 %	Fluke 5522A
Resistance – Generate Fixed Points ³	1 k Ω 10 k Ω 100 k Ω 1 M Ω 10 M Ω 100 M Ω 1 G Ω 10 G Ω 100 G Ω	0.000 08 k Ω 0.0008 k Ω 0.008 k Ω 0.008 k Ω 0.002 M Ω 0.05 M Ω 0.0005 G Ω 0.01 G Ω 0.2 G Ω	High resistance decade box/Tinsley 4721
Resistance – Generate ³	(0.1 to 1) Ω (1 to 10) Ω 10 Ω to 100 k Ω 100 k Ω to 1 M Ω (1 to 10) M Ω (10 to 100) M Ω	200 $\mu\Omega/\Omega$ 30 $\mu\Omega/\Omega$ 20 $\mu\Omega/\Omega$ 25 $\mu\Omega/\Omega$ 100 $\mu\Omega/\Omega$ 20 $\mu\Omega/\Omega$	IET HARS series – high accuracy decade resistance substituter
Resistance – Measure ³	(0 to 10) Ω (0 to 100) Ω (0 to 1) k Ω (0 to 10) k Ω (0 to 100) k Ω (0 to 1) M Ω (0 to 10) M Ω (0 to 100) M Ω	0.11 m Ω/Ω + 4.2 m Ω 0.11 m Ω/Ω + 6.3 m Ω 0.13 m Ω/Ω + 0.012 Ω 0.13 m Ω/Ω + 0.12 Ω 0.13 m Ω/Ω + 1.32 Ω 0.16 m Ω/Ω + 9 Ω 0.55 m Ω/Ω + 3 k Ω 9 m Ω/Ω + 0.04 M Ω	Fluke 8846A

Parameter/Equipment	Range	CMC ^{2, 6} ($\pm$)	Comments
Resistance – Measure	(0 to 2) Ω (0 to 20) Ω (0 to 200) Ω (0 to 2) k Ω (0 to 20) k Ω (0 to 200) k Ω (0 to 2) M Ω (0 to 20) M Ω (0 to 200) M Ω (0 to 2) G Ω	55 $\mu\Omega/\Omega$ + 3 $\mu\Omega$ 23 $\mu\Omega/\Omega$ + 8 $\mu\Omega$ 13 $\mu\Omega/\Omega$ + 0.1 m Ω 11 $\mu\Omega/\Omega$ + 0.5 m Ω 10 $\mu\Omega/\Omega$ + 0.01 Ω 13 $\mu\Omega/\Omega$ + 0.1 Ω 19 $\mu\Omega/\Omega$ + 1.55 Ω 30 $\mu\Omega/\Omega$ + 0.16 k Ω 240 $\mu\Omega/\Omega$ + 0.008 M Ω 2 m Ω/Ω + 1 M Ω	Fluke 8508A

Parameter/Frequency	Range	CMC ^{2, 6} ($\pm$)	Comments
AC Voltage – Generate 45 Hz to 10 kHz	(1 to 32.999) mV (33 to 329.999) mV (0.33 to 3.299 99) V (3.3 to 32.9999) V (33 to 329.999) V (330 to 1020) V	0.045 % + 1.5 μ V 0.025% + 15 μ V 0.02 % + 40 μ V 0.02 % + 600 μ V 0.024 % + 2.5 mV 0.033 % + 10 mV	Fluke 5522A
AC Voltage – Measure ³ (10 to 20) kHz	(0 to 100) mV (0 to 1) V (0 to 10) V (0 to 100) V (0 to 1000) V	0.075 % + 0.048 mV 0.075 % + 0.35 mV 0.075 % + 3.4 mV 0.075 % + 34 mV 0.075 % + 260 mV	Fluke 8846A
AC Voltage – Measure 10 Hz to 20 kHz	(0 to 200) mV (0 to 2) V (0 to 20) V (0 to 200) V (0 to 1000) V	0.022 % + 0.004 mV 0.011 % + 0.03 mV 0.012 % + 0.28 mV 0.012 % + 3.5 mV 0.018 % + 23 mV	Fluke 8508A

Parameter/Frequency	Range	CMC ^{2, 6} (±)	Comments
AC Current – Generate			
45 Hz to 1 kHz	(29 to 329.99) μ A (0.33 to 3.2999) mA (3.3 to 32.999) mA (33 to 329.99) mA (0.33 to 1.099 99) A	0.18 % + 0.01 μ A 0.12 % + 0.1 μ A 0.052 % + 2 μ A 0.052 % + 20 μ A 0.063 % + 0.02 mA	Fluke 5522A
(45 to 100) Hz	(1.1 to 10.9999) A (11 to 20.5) A	0.08 % + 2.3 mA 0.17 % + 2 mA	
(45 to 100) Hz	(10 to 50) A (>50 to 100) A (>100 to 500) A (>500 to 1000) A	0.3 % + 0.15 A 0.27 % + 0.2 A 0.32 % + 0.2 A 0.36 % + 0.2 A	Fluke 5522A with coil
AC Current – Measure ³			
10 Hz to 5 kHz	100 μ A 1 mA (0 to 10) mA (0 to 100) mA (0 to 400) mA (0 to 1) A (0 to 3) A (0 to 10) A	0.25 % + 0.07 μ A 0.16 % + 0.47 μ A 0.2 % + 6.8 μ A 0.13 % + 52 μ A 0.13 % + 0.46 mA 0.13 % + 0.5 mA 0.25 % + 2 mA 0.2 % + 7 mA	Fluke 8846A
AC Current – Measure			
10 Hz to 5 kHz	(0 to 200) μ A (0 to 2) mA (0 to 20) mA (0 to 200) mA (0 to 2) A (0 to 20) A	0.038 % + 0.022 μ A 0.035 % + 0.26 μ A 0.038 % + 0.002 μ A 0.038 % + 0.02 μ A 0.070 % + 0.30 mA 0.29 % + 0.0023 A	Fluke 8508A

Parameter/Equipment	Range	CMC ^{2, 6} (±)	Comments
Electrical Calibration of Thermocouples – Generate			
Type B	(600 to 800) °C (>800 to 1000) °C (>1000 to 1550) °C (>1550 to 1820) °C	0.55 °C 0.45 °C 0.41 °C 0.44 °C	Fluke 5522A
Type E	(-250 to -100) °C (>-100 to -25) °C (>-25 to 350) °C (>350 to 650) °C (>650 to 1000) °C	0.59 °C 0.22 °C 0.20 °C 0.22 °C 0.27 °C	
Type J	(-210 to -100) °C (>-100 to -30) °C (>-30 to 150) °C (>150 to 760) °C (760 to 1200) °C	0.33 °C 0.22 °C 0.20 °C 0.23 °C 0.29 °C	
Type K	(-200 to -100) °C (>-100 to -25) °C (>-25 to 120) °C (>120 to 1000) °C (>1000 to 1372) °C	0.40 °C 0.24 °C 0.22 °C 0.32 °C 0.48 °C	
Type N	(-200 to -100) °C (-100 to -25) °C (>-25 to 120) °C (>120 to 410) °C (>410 to 1300) °C	0.48 °C 0.28 °C 0.25 °C 0.24 °C 0.33 °C	
Type R	(0 to 250) °C (>250 to 400) °C (>400 to 1000) °C (>1000 to 1767) °C	0.69 °C 0.46 °C 0.44 °C 0.51 °C	
Type S	(0 to 250) °C (>250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C	0.58 °C 0.47 °C 0.48 °C 0.58 °C	
Type T	(-250 to -150) °C (>-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.74 °C 0.30 °C 0.22 °C 0.20 °C	

Parameter/Equipment	Range	CMC ^{2, 6} (±)	Comments
Electrical Calibration of Thermocouples – Measure			
Type B	(600 to 800) °C (>800 to 1000) °C (>1000 to 1550) °C (>1550 to 1820) °C	0.55 °C 0.45 °C 0.41 °C 0.44 °C	Fluke 5522A
Type E	(-250 to -100) °C (>-100 to -25) °C (>-25 to 350) °C (>350 to 650) °C (>650 to 1000) °C	0.59 °C 0.22 °C 0.20 °C 0.22 °C 0.27 °C	
Type J	(-210 to -100) °C (>-100 to -30) °C (>-30 to 150) °C (>150 to 760) °C (760 to 1200) °C	0.33 °C 0.22 °C 0.20 °C 0.23 °C 0.29 °C	
Type K	(-200 to -100) °C (>-100 to -25) °C (>-25 to 120) °C (>120 to 1000) °C (>1000 to 1372) °C	0.40 °C 0.24 °C 0.22 °C 0.32 °C 0.48 °C	
Type N	(-200 to -100) °C (-100 to -25) °C (>-25 to 120) °C (>120 to 410) °C (>410 to 1300) °C	0.48 °C 0.28 °C 0.25 °C 0.24 °C 0.33 °C	
Type R	(0 to 250) °C (>250 to 400) °C (>400 to 1000) °C (>1000 to 1767) °C	0.69 °C 0.46 °C 0.44 °C 0.51 °C	
Type S	(0 to 250) °C (>250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C	0.58 °C 0.47 °C 0.48 °C 0.58 °C	
Type T	(-250 to -150) °C (>-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.74 °C 0.30 °C 0.22 °C 0.20 °C	

Parameter/Equipment	Range	CMC ^{2, 6} (±)	Comments
Electrical Calibration of Thermocouples – Generate			
Type B	(600 to 1800) °C	2.0 °C	Martel MC-1200
Type E	(-200 to 0) °C (>0 to 980) °C	0.4 °C + 0.3 % 0.3 °C + 0.01 %	
Type J	(-150 to 0) °C (>0 to 500) °C (>500 to 1100) °C	0.33 °C + 0.18 % 0.34 °C 0.3 °C + 0.016 %	
Type K	(-190 to 0) °C (>0 to 1350) °C	0.42 °C + 0.21 % 0.4 °C + 0.05 %	
Type N	(-190 to 0) °C (>0 to 1280) °C	0.53 °C + 0.3 % 0.58 °C	
Type R	(>0 to 1700) °C	1.8 °C	
Type S	(>0 to 1700) °C	1.8 °C	
Type T	(-200 to 0) °C (>0 to 380) °C	0.4 °C + 0.3 % 0.3 °C + 0.01 %	
Electrical Calibration of Thermocouples – Measure ³			
Type J	(-100 to 0) °C (>0 to 100) °C (>100 to 1100) °C	0.32 °C + 0.15 % 0.32 °C + 0.025 % 0.2 °C + 0.03 %	Martel MC-1200
Type K	(-190 to 0) °C (>0 to 1300) °C	0.42 °C + 0.21 % 0.4 °C + 0.05 %	
Type T	(-200 to 0) °C (>0 to 390) °C	0.36 °C + 0.05 % 0.30 °C + 0.01 %	
Type E	(-100 to 0) °C (>0 to 100) °C	0.34 °C + 0.3 % 0.30 °C + 0.01 %	

Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Calibration of RTD – Generate			
Pt 385, 100 Ω	(-200 to -80) °C (-80 to 0) °C (>0 to 100) °C (>100 to 300) °C (>300 to 400) °C (>400 to 630) °C (>630 to 800) °C	0.061 °C 0.061 °C 0.083 °C 0.11 °C 0.12 °C 0.14 °C 0.27 °C	Fluke 5522A
Pt 385, 200 Ω	(-200 to -80) °C (>-80 to 0) °C (>0 to 100) °C (>100 to 260) °C (>260 to 300) °C (>300 to 400) °C (>400 to 600) °C (>600 to 630) °C	0.05 °C 0.05 °C 0.05 °C 0.061 °C 0.14 °C 0.16 °C 0.17 °C 0.19 °C	
Pt 385, 500 Ω	(-200 to -80) °C (>-80 to 0) °C (>0 to 100) °C (>100 to 260) °C (>260 to 300) °C (>300 to 400) °C (>400 to 600) °C (>600 to 630) °C	0.050 °C 0.061 °C 0.061 °C 0.072 °C 0.094 °C 0.094 °C 0.110 °C 0.130 °C	
Pt 385, 1000 Ω	(-200 to -80) °C (>-80 to 0) °C (0 to 100) °C (>100 to 260) °C	0.040 °C 0.040 °C 0.050 °C 0.061 °C	

Parameter/Equipment	Range	CMC ^{2, 4, 6} ($\pm$)	Comments
Electrical Calibration of RTD – Measure ³			
Pt 385, 100 Ω	(-190 to 0) °C (>0 to 780) °C	0.26 °C + 0.012 % 0.18 °C + 0.1 %	Martel MC-1200
Pt 385, 200 Ω	(-190 to 0) °C (>0 to 620) °C	0.93 °C 0.93 °C + 0.06 %	
Pt 385, 500 Ω	(-190 to 0) °C (>0 to 620) °C	0.48 °C 0.48 °C + 0.06 %	
Pt 385, 1000 Ω	(-190 to 0) °C (>0 to 620) °C	0.25 °C 0.30 °C + 0.04 %	

V. Fluid Quantities

Parameter/Equipment	Range	CMC ^{2, 4, 9} ($\pm$)	Comments
Anemometer / Airflow Meter ³	2.5 m/s 5 m/s 10 m/s 15 m/s	0.047 m/s 0.14 m/s 0.60 m/s 0.78 m/s	Airflow calibrator, digital anemometer
Air Velocity / Air Flow – Measure	Up to 5 m/s >5 to 10 m/s >10 to 15 m/s	0.15 m/s 0.30 m/s 0.55 m/s	Digital anemometer
Gas Flow ³	(1 to 20) cc/m (>20 to 50) cc/m (>50 to 150) cc/m (>150 to 240) cc/m	0.5 % + 0.013 cc/m 0.7 % + 0.012 cc/m 0.5 % + 0.06 cc/m 0.4 % + 0.21 cc/m	Airflow calibrator with low flow cell
	(20 to 250) cc/m (>250 to 1500) cc/m (>1500 to 3500) cc/m (>3500 to 5500) cc/m	0.8 % + 0.3 cc/m 0.25 % + 0.7 cc/m 0.12 % + 0.5 cc/m 0.12 % + 1.0 cc/m	Airflow calibrator with medium flow cell
	(2 to 5) LPM (>5 to 12) LPM (>12 to 20) LPM (>20 to 29) LPM	0.5 % + 0.001 LPM 0.1 % + 0.01 LPM 0.22 % + 0.01 LPM 0.7 % + 0.01 LPM	Airflow calibrator with high flow cell

Parameter/Equipment	Range	CMC ^{2, 4, 5, 9} (±)	Comments
Kinematic and Dynamic Viscosity Oil Std. ³ (15 to 45) °C	<10 mm ² /s (10 to 100) mm ² /s (100 to 1000) mm ² /s (1000 to 10 000) mm ² /s (10 000 to 100 000) mm ² /s	0.21 % + 0.6R 0.29 % + 0.6R 0.38 % + 0.6R 0.60 % + 0.6R 0.70 % + 0.6R	Comparison to certified viscosity reference standard
Volume Measurements Gravimetric Method	(1 to 10) µl (>10 to 100) µl (>0.100 to 20) ml 100 µl (>100 to 1000) µl (>1 to 10) ml (>10 to 100) ml (>100 to 200) ml	0.0045 µl 0.0069 µl 0.041 µl 0.093 µl 0.073 µl 0.24 µl 1.1 µl 2.7 µl	Mettler Toledo, XP26C Mettler Toledo, AG285
Volume Measurements Gravimetric Method ³	(10 to 100) ml (>100 to 1000) ml (>1000 to 2000) ml (>2000 to 4000) ml ≤ 10 L (>10 to 20) L (>20 to 30) L (>20 to 100) L (>100 to 300) L (>300 to 500) L	0.010 ml 0.032 ml 0.028 ml 0.061 ml 0.36 ml 0.59 ml 1.8 ml 0.034 L 0.079 L 0.15 L	Mettler Toledo, GC4002-S Mettler Toledo, XPE32001L Mettler Toledo, IND 221
Volume – Liquid as Medium ³	Up to 10 000 ml Up to 500 L	0.40 % 0.32 %	Graduated volumetric cylinder, volumetric container
Flow Meter – Water as a Medium ³	Up to 6000 m ³ /hr Up to 100 000 LPM	0.057 %	Comparison to ultrasonic flow meter
Flow Meter – Water as a Medium ³	Up to 30 m ³ /hr Up to 500 LPM	2.5 %	Balance and stopwatch

Parameter/Equipment	Range	CMC ^{2, 4, 9} ($\pm$)	Comments
Hydrometers ³	(0.700 to 0.950) SP.G (>0.950 to 1.070) SP.G (>1.070 to 1.370) SP.G (1.480 to 1.550) SP.G	0.000 73 SP.G 0.000 32 SP.G 0.000 57 SP.G 0.000 73 SP.G	Comparison with certified hydrometers

VI. Mechanical

Parameter/Equipment	Range	CMC ^{2, 4, 5, 9} ($\pm$)	Comments
Pressure – Measuring Equipment	(10 to 100) psi (1 to 6 bar) (>100 to 10 000) psi (>6 to 700) bar	0.026 % of rdg	Dead weight tester, Budenberg 480
Pressure Valves Hydrostatic Pressure Testing – LPG and Gas Regulators ³	(20 to 6000) psi	0.10 % of FS	Test gauges
Pressure Gauge – Pressure Measurements ³	Up to 5000 psi	0.12 % of rdg psi	Pressure calibrator, digital gauges (Crystal XP2i)
Tachometer (Non-Contact Type) RPM Measurements ³	(100 to 900) RPM (>900 to 10 000) RPM	0.11 RPM 1.1 RPM	Solex (digital stroboscope and signal generator)
Rotational Speed – RPM Measurements ³	(100 to 900) RPM (>900 to 10 000) RPM	0.11 RPM 1.1 RPM	Digital tachometer
Torque – Measuring Equipment (Clockwise Only)	(50 to 100) Nm (>100 to 1000) Nm	1.5 % 1.3 %	Torque transducers

Parameter/Equipment	Range	CMC ^{2, 4} (±)	Comments
Force – Universal Testing Machine ³			
Tension and Compression	(10 to 100) kN (>100 to 500) kN (100 to 1000) kN	0.93 % 0.58 % 1.3 kN	Load cell dynamometer field calibration using a universal strain gauge and load cell
Compression	Up to 10 kN (>10 to 30) kN (>30 to 50) kN (>50 to 300) kN (>300 to 1000) kN (>1000 to 3000) kN	0.068 % 0.043 % 0.026 % 0.07 % 0.031 % 0.011 %	
Weights	(1 to 10) mg (>10 to 100) mg (>100 to 500) mg (>500 to 5000) mg (>5 to 20) g (10 to 500) g (>50 to 500) g Up to 500 g (>500 to 2000) g 5 kg 10 kg 20 kg 5 kg 10 kg 20 kg 500 kg	4.5 µg 2.2 % + 4.5 µg 0.8 % + 5.5 µg 0.2 % + 9 µg 0.1 % + 0.01 mg 0.048 mg 0.07 mg + 0.04 % 1.2 mg 1.0 mg + 0.03 % 8.1 mg 8.6 mg 9.1 mg 0.10 g 0.15 g 0.25 g 0.032 kg	Digital comparator Mettler Toledo, XP26C Class E2 Mettler Toledo XPE505C Class E2 Mettler Toledo XPE2004SC Class E2 Mettler Toledo, XPR26003LC Class E2 Mettler Toledo, SG32001 Class E2, F1 Mettler Toledo, IND221

Parameter/Equipment	Range	CMC ^{2, 4, 5, 9} ($\pm$)	Comments
Scales and Balances ³			
Accuracy Class I	(1 to 10) mg (>10 to 100) mg (>100 to 500) mg (0.5 to 5) g (>5 to 50) g (>50 to 200) g (>200 to 500) g	0.002 mg 0.003 % + 0.002 mg 0.002 % + 0.002 mg 0.12 % + 0.01 mg 0.02 % + 0.02 mg 0.02 % + 0.05 mg 0.03 % + 0.10 mg	Class E2
Accuracy Class II	(20 to 100) mg (>100 to 500) mg (>0.5 to 5) g (>5 to 50) g (>50 to 300) g (>0.3 to 2) kg (>2 to 10) kg (>10 to 120) kg	0.003 % + 0.002 mg 0.002 % + 0.002 mg 0.12 % + 0.01 mg 0.02 % + 0.02 mg 0.02 % + 0.05 mg 0.1 % + 0.012 g 0.002 % + 0.012 g 0.07 % + 0.012 g	Class E2, F1, F2
Accuracy Class III and Class IV	500 g to 2 kg (>2 to 20) kg (>20 to 500) kg	0.1 % + 0.01 g 0.1 % + 0.2 g 1.3 % + 0.2 g	Class M1
Weighing and Batch Plant Scales (Build-up) ³	(>500 to 2000) kg (>500 to 5000) kg	1.1 % + 1 g 0.012 % kg	Class M1 Class M and M2
Force and Tension – Weights and Test Weights Measurement ³	(0 to 1000) kgf (0 to 2500) lbf (0 to 10 000) lbf (0 to 50 000) kgf	0.02 % + 0.06 kgf + 0.6R 0.07 % + 0.28 lbf + 0.6R 0.08 % + 1.8 lbf + 0.6R 0.08 % of FS + 0.6R	S-load cell Dillon dynamometer
Nuclear Moisture – Density Gauge ³	Up to 200 pcf Up to 3200 kg/m ³	0.05 pcf + 0.6R 1.2 kg/m ³ + 0.6R	NDG Validator

VII. Thermodynamics

Parameter/Equipment	Range	CMC ² (±)	Comments
Ovens – Direct Verification ³	Up to 200 °C	0.77 °C	Multifunction calibrator (probe)
Chiller and Incubator – Direct Verification ³	(-15 to 100) °C (>100 to 600) °C	0.50 °C 0.2 % + 0.3 °C	Multifunction calibrator thermocouple probe

VIII. Time and Frequency

Parameter/Equipment	Range	CMC ^{2,9} (±)	Comments
Frequency – Measure ³	Up to 10 Hz (>10 to 100) Hz >100 Hz to 1 kHz (>1 to 10) kHz (>10 to 100) kHz >100 kHz to 1 MHz (>1 to 10) MHz (>10 to 100) MHz	0.008 mHz 0.20 mHz 0.0004 Hz 0.004 Hz 0.04 Hz 0.0004 kHz 0.004 kHz 0.008 kHz	TTi TF830 universal counter
Timers and Stopwatches ³	(60 to 1800) sec (>1800 to 32 400) sec	1.5 sec 17 sec	Stopwatch

MECHANICAL³

Test

Destruction/ Deflection

Electrical Continuity of Connections

Screw Thread Test Repeatability

Reusable Mechanical Connection Repeatability

Test Impact for Resistance

Test Methods

NEMA VE-1 or IEC 61537

NEMA VE-1 or IEC 61537

NEMA VE-1 or IEC 61537

NEMA VE-1 or IEC 61537

IEC 61537

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 In Statement of CMC, percentages are percentage of reading, unless otherwise indicated.
- ⁵ In Statement of CMC, R is the resolution of the unit under test and FS is full scale, ppm stands for parts in 10^6 .
- ⁶ The stated measured values are determined using the indicated instrument (see comments). The capability is suitable for the calibration of the devices intended to measure or generate the measured value in the ranges indicated, CMC's 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.
- ⁷ The contribution from the "best existing device" are not included in the CMC claim.
- ⁸ This scope meets A2LA's *P112 Flexible Scope Policy*.
- 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.



Accredited Laboratory

A2LA has accredited

AL HOTY CALIBRATION SERVICES CO. WLL

Um Al Hassam, Manama, KINGDOM OF BAHRAIN

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 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 23rd day of October 2019.

A blue ink signature of a person, likely the Vice President of Accreditation Services, written over a horizontal line.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3467.02
Valid to October 31, 2021

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