



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005
& ANSI/NCSL Z540-1-1994

GULF METROLOGY LABORATORY (GEMS)
 PB Box 10166
 Jubail Industrial City, Saudi Arabia 31961
 Kevin Sterling Phone: +966-3-341-9451

CALIBRATION

Valid To: January 31, 2013

Certificate Number: 3097.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations¹:

I. Acoustical

Parameter/Equipment	Range	CMC ² (±)	Comments
Sound Level Calibrators, Fixed Points	94 dB, 104 dB and 114 dB	0.6 dB	B&K model 4226 and Quest model 2700

Parameter/Range	Frequency	CMC ² (±)	Comments
Acoustical Levels Sound Level Meters, Noise Dosimeters – 94 dB, 104 dB and 114 dB	31.5 Hz to 4 kHz, Octave Step 8 kHz 12.5 kHz to 16 kHz	0.4 dB 0.5 dB 0.7 dB	B&K model 4226 Multifunction acoustic calibrator

II. Dimensional

Parameter/Equipment	Range	CMC ^{2,3,4} (±)	Comments
Angle – Measure	1 to 90 Degrees	2 arc minutes	Sine bar, gage blocks and comparator
Angle – Measuring Equipment	1 to 90 Degrees	2 arc minutes	Mitutoyo model 981-101 and 981-203 with sine bar and gage blocks
Length – Measure	(0 to 4) in	(2 + 0.5L) μin	Pratt & Whitney measuring system – LabMaster
	(0 to 40) m	1.7 μm/m	Agilent model 5530 laser measuring system
Length – Measuring Equipment	Up to 84 in	6.8 μin/in	Gage blocks
Surface Flatness	Up to 50 ft	0.2 %	Agilent model 5530 laser measuring system
Diameter – Measure Inside, Outside Class X Master Rings, Plugs & Discs	(0.05 to 12)” (1.5 mm to 305 mm)	33 μin	Federal model 136B-5 comparator

III. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2, 4, 5, 6} (±)	Comments	
DC Voltage – Measure	Up to 200 mV 200 mV to 2 V (2 to 20) V (20 to 200) V (200 to 1000) V	5.3 $\mu\text{V}/\text{V}$ + 0.1 μV 3.6 $\mu\text{V}/\text{V}$ + 0.4 μV 4.0 $\mu\text{V}/\text{V}$ + 8 μV 5.3 $\mu\text{V}/\text{V}$ + 0.08 mV 5.7 $\mu\text{V}/\text{V}$ + 1 mV	Fluke 8508A	
	10 V	0.46 $\mu\text{V}/\text{V}$	Fluke732B with HP 3458A DMM and dataproof scanner	
DC Voltage – Generate	(0 to 220) mV (0.22 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V	8.8 $\mu\text{V}/\text{V}$ + 0.4 μV 5.5 $\mu\text{V}/\text{V}$ + 0.7 μV 3.6 $\mu\text{V}/\text{V}$ + 2.5 μV 3.6 μV / + 4 μV 9.4 $\mu\text{V}/\text{V}$ + 40 μV 6.6 $\mu\text{V}/\text{V}$ + 400 μV	Fluke 5700A/EP with 5725A	
	10 V	0.46 $\mu\text{V}/\text{V}$	Fluke 732B	
DC High Voltage – Measure	(0 to 200) kV	0.2 %	Ross Engineering model VMP300-5Y with HP 3458A DMM	
DC Current – Generate	220 μA 2.2 mA 22 mA 220 mA 2.2 A 11 A	40 $\mu\text{A}/\text{A}$ + 6 nA 44 $\mu\text{A}/\text{A}$ + 7 nA 36 $\mu\text{A}/\text{A}$ + 40 nA 46 $\mu\text{A}/\text{A}$ + 0.7 μA 0.015 % + 12 μA 0.038 % + 480 μA	Fluke 5700A /EP with 5725A	
	Up to 100 A	0.06 %	Fluke 5500A with Valhalla 2555A	
DC Current – Generate & Measure				
	Clamp-On Ammeters (Toroidal)	(20 to 150) A (150 to 1000) A	0.28 % + 0.015 A 0.29 % + 0.05 A	Fluke model 5520A with 5500A coil
	(Non-Toroidal)	(20 to 150) A (150 to 1000) A	0.58 % + 0.014 A 0.58 % + 0.5 A	

Parameter/Equipment	Range	CMC ^{2,4,5} (±)	Comments
DC Current - Measure	200 µA 2 mA 20 mA 200 mA 2 A 20 A (20 to 2000) A	14 µA/A 14 µA/A 15 µA/A 40 µA/A 0.018 % 0.04 % 0.25 %	Fluke 8508A Fluke 8508A with current shunts
DC Resistance – Generate (Fixed Points)	0.1 Ω 1 Ω 10 Ω 25 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ to 1 GΩ 1 GΩ	0.23 µΩ/Ω 0.04 µΩ/Ω 0.22 µΩ/Ω 0.48 µΩ/Ω 0.49 µΩ/Ω 1.1 µΩ/Ω 0.07 µΩ/Ω 1.1 µΩ/Ω 7.8 µΩ/Ω 10 % of value 13 µΩ/Ω	L&N 4000 & 4200 series standards with oil bath Victoreen resistors Fluke 8508A-7000k
DC Resistance – Measure	1 mΩ to 100 mΩ (0.1 to 1) Ω (1 to 10) Ω (10 to 100) Ω 100 Ω to 1 kΩ (1 to 10) kΩ (10 to 100) kΩ 100 kΩ to 1 MΩ (1 to 10) MΩ 20 MΩ 200 MΩ 2 GΩ 20 GΩ	1.6 µΩ/Ω + 1.0 µΩ/Ω /Ratio 0.58 µΩ/Ω 0.12 µΩ/Ω 0.25 µΩ/Ω 0.50 µΩ/Ω 1.1 µΩ/Ω 0.18 µΩ/Ω 0.40 µΩ/Ω 1.2 µΩ/Ω 15 µΩ/Ω + 100 Ω 60 µΩ/Ω + 1 kΩ 0.053 % + 0.001 GΩ 0.053 % + 0.001 GΩ	Guildline 6675A with model 6623 Guildline 6675A with standard resistors and oil bath Fluke 8508A (normal mode) Fluke 8508A (high voltage)

Parameter/Range	Frequency	CMC ^{2,4,6} (±)	Comments
AC Voltage – Generate			
(0 to 2.2) mV	(10 to 20) Hz (20 to 40) Hz (0.04 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz	0.03 % + 4 μV 0.017 % + 4 μV 0.015 % + 4 μV 0.027 % + 4 μV 0.061 % + 5 μV 0.12 % + 10 μV 0.16 % + 20 μV 0.29 % + 20 μV	Fluke 5700A/EP
(2.2 to 22) mV	(10 to 20) Hz (20 to 40) Hz (0.04 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz	0.03 % + 4 μV 0.017 % + 4 μV 0.014 % + 4 μV 0.027 % + 4 μV 0.061 % + 5 μV 0.12 % + 10 μV 0.16 % + 20 μV 0.29 % + 20 μV	
(22 to 220) mV	(10 to 20) Hz (20 to 40) Hz (0.04 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz	0.026 % + 12 μV 96 μV/V + 7 μV 85 μV/V + 7 μV 0.021 % + 7 μV 0.048 % + 17 μV 0.092 % + 20 μV 0.15 % + 25 μV 0.28 % + 45 μV	
(0.22 to 2.2) V	(10 to 20) Hz (20 to 40) Hz (0.04 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz	0.025 % + 40 μV 93 μV/V + 15 μV 46 μV/V + 8 μV 78 μV/V + 10 μV 0.012 % + 300 μV 0.044 % + 80 μV 0.11 % + 200 μV 0.18 % + 300 μV	
(2.2 to 22) V	(10 to 20) Hz (20 to 40) Hz (0.04 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz	0.025 % + 400 μV 93 μV/V + 150 μV 51 μV/V + 50 μV 78 μV/V + 100 μV 0.011 % + 200 μV 0.03 % + 600 μV 0.11 % + 2 mV 0.16 % + 3.2 mV	

Parameter/Range	Frequency	CMC ^{2, 4, 5, 6} (±)	Comments
AC Voltage – Generate (cont)			
(22 to 220) V	(10 to 20) Hz (20 to 40) Hz (0.04 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz	0.029 % + 4 mV 94 μV/V + 1.5 mV 57 μV/V + 0.6 mV 95 μV/V + 1 mV 0.017 % + 2.5 mV 0.09 % + 16 mV 0.44 % + 40 mV 0.08 % + 80 mV	Fluke 5700A/EP
(220 to 1100) V	(0.04 to 1) kHz (1 to 20) kHz (20 to 30) kHz	90 μV/V + 2 mV 0.012 % + 6 mV 0.06 % + 11 mV	Fluke 5700A/EP with 5725A
(229 to 750) V	(30 to 50) kHz (50 to 100) kHz	0.06 % + 11 mV 0.23 % + 45 mV	
AC Voltage – Measure AC-DC Difference			
0.006 V	10 Hz 20 Hz 40 Hz 100 Hz 1 kHz 10 kHz 20 kHz 50 kHz 100 kHz 300 kHz 500 kHz 800 kHz 1 MHz	0.08 % 0.06 % 0.06 % 0.06 % 0.06 % 0.06 % 0.06 % 0.06 % 0.08 % 0.12 % 0.2 % 0.24 % 0.24 % 0.24 %	Fluke model 792A AC/DC transfer standard
0.01 V	10 Hz 20 Hz 40 Hz 100 Hz 1 kHz 10 kHz 20 kHz 50 kHz 100 kHz 300 kHz 500 kHz 800 kHz 1 MHz	0.5 % 0.5 % 0.5 % 0.5 % 0.5 % 0.5 % 0.5 % 0.5 % 0.5 % 0.7 % 0.1 % 0.16 % 0.18 % 0.18 %	

Parameter/Range	Frequency	CMC ^{2,4,5} (±)	Comments
AC Voltage – Measure AC-DC Difference (cont)			
0.02 V	10 Hz	0.03 %	Fluke model 792A AC/DC transfer standard
	20 Hz	0.024 %	
	40 Hz	0.02 %	
	100 Hz	0.02 %	
	1 kHz	0.02 %	
	10 kHz	0.02 %	
	20 kHz	0.02 %	
	50 kHz	0.03 %	
	100 kHz	0.06 %	
	300 kHz	0.1 %	
	500 kHz	0.12 %	
	800 kHz	0.14 %	
	1 MHz	0.14 %	
	0.06 V	10 Hz	
20 Hz		0.02 %	
40 Hz		0.014 %	
100 Hz		0.01 %	
1 kHz		0.01 %	
10 kHz		0.01 %	
20 kHz		0.01 %	
50 kHz		0.03 %	
100 kHz		0.036 %	
300 kHz		0.1 %	
500 kHz		0.12 %	
800 kHz		0.14 %	
1 MHz		0.14 %	
0.10 V		10 Hz	0.02 %
	20 Hz	0.016 %	
	40 Hz	90 µV/V	
	100 Hz	90 µV/V	
	1 kHz	90 µV/V	
	10 kHz	90 µV/V	
	20 kHz	90 µV/V	
	50 kHz	0.011 %	
	100 kHz	0.02 %	
	300 kHz	0.038 %	
	500 kHz	0.05 %	
	800 kHz	0.06 %	
	1 MHz	0.06 %	

Parameter/Range	Frequency	CMC ^{2,4,5} (±)	Comments	
AC Voltage – Measure AC-DC Difference (cont)	0.20 V	10 Hz	0.016 %	Fluke model 792A AC/DC transfer standard
		20 Hz	0.012 %	
		40 Hz	80 µV/V	
		100 Hz	80 µV/V	
		1 kHz	80 µV/V	
		10 kHz	80 µV/V	
		20 kHz	80 µV/V	
		50 kHz	0.01 %	
		100 kHz	0.02 %	
		300 kHz	0.032 %	
		500 kHz	0.04 %	
		800 kHz	0.052 %	
	1 MHz	0.052 %		
	0.60 V	10 Hz	0.016 %	
		20 Hz	0.014 %	
		40 Hz	50 µV/V	
		100 Hz	36 µV/V	
		1 kHz	36 µV/V	
		10 kHz	36 µV/V	
		20 kHz	36 µV/V	
		50 kHz	60 µV/V	
		100 kHz	90 µV/V	
		300 kHz	0.02 %	
		500 kHz	0.022 %	
		800 kHz	0.024 %	
	1 MHz	0.024 %		
	1.00 V	10 Hz	0.024 %	
		20 Hz	0.01 %	
		40 Hz	44 µV/V	
		100 Hz	24 µV/V	
		1 kHz	24 µV/V	
		10 kHz	24 µV/V	
		20 kHz	24 µV/V	
		50 kHz	50 µV/V	
		100 kHz	60 µV/V	
		300 kHz	0.02 %	
500 kHz		0.021 %		
800 kHz		0.022 %		
1 MHz	0.022 %			

Parameter/Range	Frequency	CMC ^{2,4,5} (±)	Comments
AC Voltage – Measure AC-DC Difference (cont)			
2.00 V	10 Hz	0.024 %	Fluke model 792A AC/DC transfer standard
	20 Hz	70 µV/V	
	40 Hz	40 µV/V	
	100 Hz	16 µV/V	
	1 kHz	16 µV/V	
	10 kHz	16 µV/V	
	20 kHz	16 µV/V	
	50 kHz	40 µV/V	
	100 kHz	50 µV/V	
	300 kHz	0.02 %	
	500 kHz	0.021 %	
	800 kHz	0.022 %	
	1 MHz	0.022 %	
	6.00 V	10 Hz	
20 Hz		80 µV/V	
40 Hz		40 µV/V	
100 Hz		18 µV/V	
1 kHz		18 µV/V	
10 kHz		18 µV/V	
20 kHz		18 µV/V	
50 kHz		50 µV/V	
100 kHz		60 µV/V	
300 kHz		0.02 %	
500 kHz		0.021 %	
800 kHz		0.022 %	
1 MHz		0.022 %	
10.00 V		10 Hz	0.024 %
	20 Hz	90 µV/V	
	40 Hz	50 µV/V	
	100 Hz	24 µV/V	
	1 kHz	24 µV/V	
	10 kHz	24 µV/V	
	20 kHz	24 µV/V	
	50 kHz	40 µV/V	
	100 kHz	50 µV/V	
	300 kHz	0.02 %	
	500 kHz	0.021 %	
	800 kHz	0.022 %	
	1 MHz	0.022 %	

Parameter/Range	Frequency	CMC ^{2,4,5} (±)	Comments
AC Voltage – Measure AC-DC Difference (cont)			
20.00 V	10 Hz	0.024 %	Fluke model 792A AC/DC transfer standard
	20 Hz	80 µV/V	
	40 Hz	44 µV/V	
	100 Hz	24 µV/V	
	1 kHz	24 µV/V	
	10 kHz	24 µV/V	
	20 kHz	24 µV/V	
	50 kHz	40 µV/V	
	100 kHz	50 µV/V	
	300 kHz	0.011 %	
	500 kHz	0.022 %	
	800 kHz	0.023 %	
	1 MHz	0.023 %	
	60.00 V	10 Hz	
20 Hz		80 µV/V	
40 Hz		30 µV/V	
100 Hz		30 µV/V	
1 kHz		30 µV/V	
10 kHz		30 µV/V	
20 kHz		80 µV/V	
50 kHz		90 µV/V	
100 kHz		0.02 %	
100.00 V		10 Hz	0.028 %
	20 Hz	0.01 %	
	40 Hz	50 µV/V	
	100 Hz	40 µV/V	
	1 kHz	40 µV/V	
	10 kHz	40 µV/V	
	20 kHz	90 µV/V	
	50 kHz	0.01 %	
200.0 V	10 Hz	0.028 %	
	20 Hz	0.01 %	
	40 Hz	50 µV/V	
	100 Hz	40 µV/V	
	1 kHz	40 µV/V	
	10 kHz	40 µV/V	
	20 kHz	90 µV/V	
	50 kHz	0.01 %	

Parameter/Range	Frequency	CMC ^{2, 4, 5, 6} (\pm)	Comments
AC Voltage – Measure AC-DC Difference (cont)			
600.0 V	10 Hz 20 Hz 40 Hz 100 Hz 1 kHz 10 kHz 20 kHz 50 kHz	0.036 % 0.012 % 60 μ V/V 46 μ V/V 40 μ V/V 40 μ V/V 90 μ V/V 0.011 %	Fluke model 792A AC/DC transfer standard
1000 V	10 Hz 20 Hz 40 Hz 100 Hz 1 kHz 10 kHz 20 kHz 50 kHz	0.038 % 90 μ V/V 46 μ V/V 46 μ V/V 44 μ V/V 44 μ V/V 90 μ V/V 0.012 %	
AC High Voltage – Measure			Ross Engineering VMP300-5Y with HP 3458A DMM
(0 to 75) kV	60 Hz	4 %	
AC Current – Generate			
(0 to 220) μ A	(10 to 20) Hz (20 to 40) Hz (0.04 to 1) kHz (1 to 5) kHz (5 to 10) kHz	0.027 % + 16 nA 0.017 % + 10 nA 0.013 % + 8 nA 0.029 % + 12 nA 0.12 % + 65 nA	Fluke 5700A/EP with 5725A
(0.22 to 2.2) mA	(10 to 20) Hz (20 to 40) Hz (0.04 to 1) kHz (1 to 5) kHz (5 to 10) kHz	0.029 % + 40 nA 0.02 % + 35 nA 0.018 % + 35 nA 0.024 % + 110 nA 0.12 % + 650 μ A	
(2.2 to 22) mA	(10 to 20) Hz (20 to 40) Hz (0.04 to 1) kHz (1 to 5) kHz (5 to 10) kHz	0.029 % + 400 nA 0.02 % + 350 nA 0.017 % + 350 nA 0.024 % + 550 nA 0.12 % + 5000 nA	

Parameter/Range	Frequency	CMC ^{2, 4, 5, 6} (\pm)	Comments
AC Current –Generate (cont)			
(22 to 220) mA	(10 to 20) Hz (20 to 40) Hz (0.04 to 1) kHz (1 to 5) kHz (5 to 10) kHz	0.027 % + 4 μ A 3.5 μ V/V + 3.5 μ A 0.013 % + 3.5 μ A 0.027 % + 3.5 μ A 0.12 % + 10 μ A	Fluke 5700A/EP
(0.22 to 2.2) A	(0.02 to 1) kHz (1 to 5) kHz (5 to 10) kHz	0.027 % + 35 μ A 0.046 % + 80 μ A 0.7 % + 160 μ A	
(2.2 to 11) A	(0.04 to 1) kHz (1 to 5) kHz (5 to 10) kHz	0.048 % + 170 μ A 0.097 % + 380 μ A 0.37 % + 750 μ A	
(11 to 20) A	(45 to 100) Hz (0.1 to 1) kHz (1 to 5) kHz	0.12 % of rdg + 5 mA 0.15 % of rdg + 5 mA 3 % of rdg + 5 mA	
AC Current – Generate/Measure			
Toroidal, Type Clamps (10 to 1025) A	(45 to 65) Hz (65 to 440) Hz	3 % + 0.09A 3.1 % + 0.025A	Fluke model 5500A/coil with 5520A
“Other type” of Clamps (10 to 1025) A	(45 to 65) Hz (65 to 440) Hz	3.1 % + 0.9 A 3.2 % + 0.25 A	
AC Current – Measure			
Up to 200 μ A	10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.032 % + 0.02 μ A 0.068 % + 0.02 μ A 0.41 % + 0.02 μ A	Fluke model 8508A
200 μ A to 2 mA	10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.03 % + 0.0002 mA 0.068 % + 0.0002 mA 0.41 % + 0.002 mA	
(2 to 20) mA	10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.03 % + 0.002 mA 0.067 % + 0.002 mA 0.41 % + 0.002 mA	

Parameter/Range	Frequency	CMC ^{2,4,5} (±)	Comments
AC Current – Measure (cont)			
(20 to 200) mA	10 Hz to 10 kHz (10 to 30) kHz	0.027 % + 0.02 mA 0.061 % + 0.02 mA	Fluke model 8508A
200 mA to 2 A	10 Hz to 2 kHz (2 to 10) kHz 10 to 30) kHz	0.062 % + 0.2 mA 0.075 % + 0.2 mA 3 % + 0.2 mA	
(2 to 20) A	10 Hz to 2 kHz (2 to 10) kHz	0.082 % + 0.002 A 2.5 % + 0.002 A	

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Capacitance – Measure			
1 KHz	(5 to 1000) pf	5.2 parts in 10 ⁶	Andeen Hagerling model 2500A capacitance bridge
120 (100) Hz, 10 KHz	1 nf to 10 mF	1.2 %	HP model 4262A
Capacitance – Generate			
1000 Hz	100 pf	2.6 μF/F	Andeen Hagerling model AH11A
1 kHz	2 pf 100 pf 1000 pf 1800 pf 10 nF 100 nF 1 μF 10 μF 1000 μF	0.9 % 0.03 % 0.03 % 0.03 % 0.02 % 0.02 % 0.02 % 0.02 % 0.8 %	HP DUT box model 16361A
10 kHz	1 pf 10 pF 19 pF 100 pf 1000 pf 10 nF	0.9 % 0.06 % 0.94 % 0.02 % 0.04 % 0.03 %	HP DUT box model 16362A

Peter Mlynar

Parameter/Equipment	Range	CMC ^{2,4,6} (±)	Comments
Capacitance - Generate (cont)			
10 kHz	100 nF 1000 nF 10 µF 100 µF	0.03 % 0.04 % 0.4 % 0.5 %	HP DUT box model 16362A
@ 1 kHz	(0.19 to 0.3999) nF (0.4 to 1.0999) nF (1.1 to 3.2999) nF (3.3 to 10.9999) nF (11 to 32.999) nF (33 to 109.999) nF (110 to 329.999) nF (0.33 µF to 1.09999 µF (1.1 to 3.299999) µF (3.3 to 10.9999) µF (11 to 32.9999) µF (33 to 109.9999) µF (110 to 329.999) µF (0.33 to 1.09999) mF (1.1 to 3.2999) mF (3.3 to 10.9999) mF (11 to 32.9999) mF (33 to 110) mF	0.6 % + 0.01 nF 0.5 % + 0.01 nF 0.5 % + 0.01 nF 0.25 % + 0.01nF 0.25 % + 0.1 nF 0.32 % + 0.1 nF 0.28 % + 0.3 nF 0.46 % + 1 nF 0.25 % + 3 nF 0.33 % + 10 nF 0.40 % + 30 nF 0.64 % + 100 nF 0.45 % + 300 nF 0.45 % + 1 µF 0.45 % + 3 µF 0.45 % +10 µF 0.75 % + 30 µF 1.1 % + 100 µF	Fluke 5520A

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
Inductance – Generate (Fixed Point)	10 mHz, 1 kHz 100 mHz, 1 kHz 100 µHz, 1 kHz	0.01 mHz 0.5 mHz 0.36 µHz	GR model 1482-B, 1482-H, 1482-L
Inductance – Measure	0.01 µHz to 1999 Hz	0.3 %	HP model 4262A digital LCR meter

Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Calibration of Thermocouple Devices			
Type B	(600 to 800) °C (800 to 1000) °C (1000 to 1550) °C (1550 to 1820) °C	0.44 °C 0.34 °C 0.30 °C 0.33 °C	Fluke 5520A
Type C	(0 to 150) °C (150 to 650) °C (650 to 1000) °C (1000 to 1800) °C	0.30 °C 0.26 °C 0.31 °C 0.50 °C	
Type E	(-250 to -100) °C (-100 to -25) °C (-25 to 250) °C (350 to 650) °C (650 to 1000) °C	0.50 °C 0.16 °C 0.14 °C 0.16 °C 0.21 °C	
Type J	(-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.27 °C 0.16 °C 0.14 °C 0.17 °C 0.23 °C	
Type K	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.33 °C 0.18 °C 0.16 °C 0.26 °C 0.40 °C	
Type L	(-200 to -100) °C (-100 to 800) °C (800 to 900) °C	0.37 °C 0.26 °C 0.17 °C	
Type N	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1300) °C	0.40 °C 0.22 °C 0.19 °C 0.18 °C 0.27 °C	
Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.57 °C 0.35 °C 0.33 °C 0.40 °C	

Parameter/Equipment	Range	CMC ² (±)	Comments
Electrical Calibration of Thermocouple Devices (cont)			
Type S	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.57 °C 0.35 °C 0.33 °C 0.40 °C	Fluke 5520A
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.63 °C 0.24 °C 0.16 °C 0.14 °C	
Type U	(-200 to 0) °C (0 to 600) °C	0.56 °C 0.27 °C	

IV. Electrical – RF/Microwave

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
RF Absolute Power – Measure	Power Reference 1mW, Type N (f), 50 Ω, 50 MHz	9 μW	HP 436A with HP 8485A Sensor
	(-30 to + 20) dBm (100 kHz to 2 GHz) 75 Ω	4.4 % VSWR: ≤ 1.2:1	HP 436A with HP 8483A Sensor
	(-30 to + 20) dBm (100 kHz to 4.2 GHz) 50 Ω	3.6 % VSWR: ≤ 1.6:1	HP 436A with HP 8482A Sensor
	(-30 to + 20) dBm (50 MHz to 26.5) 50 Ω	3.7 % VSWR: ≤ 1.25:1	HP 436A with HP 8485A Sensor
	(-70 to + 20) dBm (50 MHz to 26.5) 50 Ω	4.4 % VSWR: ≤ 1.29:1	HP 436A with HP 8485D Sensor
Tune RF Power – Absolute – Measure Relative – Measure	100 KHz to 26.5 GHz (+30 to -130) dBm 50Ω	0.99 dB	Rohde & Schwarz Model FSMR 26

Parameter/Equipment	Range	CMC ² (±)	Comments
RF Absolute Power Generate	(+10 to -135) dBm ≤ 2.5 GHz	1.2 dB VSWR <2.5:1	HP 8648C signal generator
	(+10 to -135) dBm ≤ 3.25 GHz	1.8 dB VSWR <1.5:1	

V. Mechanical

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Torque	(0 to 2000) ft·lb	0.12 %	AKO model TSD 2050/3000
	(0 to 200) in·lb	0.12 %	
Acceleration Sensitivity – Frequency Response	(20 to 10 000) Hz Sensitivity 10 mV/g	6.4 %	Vibration test systems with 3120A accelerometer
Force	Up to 55 000 lbf	0.05 %	Tovey Engineering model 55K
Mass – Fixed Points	5 kg 2 kg 1 kg 500 g 50 g 20 g 10 g 5 g 2 g 1 g 500 mg 200 mg 100 mg 50 mg 20 mg 10 mg 5 mg 2 mg 1 mg	5.4 mg 2.4 mg 0.49 mg 0.99 mg 0.29 mg 0.025 mg 0.018 mg 0.016 mg 0.013 mg 0.014 mg 0.0088 mg 0.0064 mg 0.0062 mg 0.0054 mg 0.0050 mg 0.0052 mg 0.0050 mg 0.0050 mg 0.0040 mg	OIML Class E1 OIML Class E2 OIML Class E1 OIML Class F1 weights and comparators

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Mass Comparators –	20 g 200 g 3 kg 10 kg 30 kg	0.0012 mg 0.0056 mg 0.5 mg 3.0 mg 50 mg	Reverifications comparators
Digital Scales/ Comparator	100 g 50 kg 2 kg 10 kg	0.25 mg 5 mg 0.01 mg 7.7 mg	Ainsworth 100A Mettler Toledo XP 64003L Mettler Toledo AX2005 Mettler Toledo PR1003
Pressure – Measuring Equipment			
Hydraulic	(7.25 to 20 000) psi (10 to 16 000) psi	0.0051 % 0.015 %	Ruska model 2485-930S Pressurements model M2800-3-S
Pneumatic	(2 to 500) psi	0.008 %	Pressurements model T3500/3

VI. Thermodynamics

Parameter/Equipment	Range	CMC ² (±)	Comments
Temperature – Measure	(-195 to 600) °C (601 to 1100) °C	0.0019 °C 0.60 °C	SPRT and super thermometer Thermocouple and scanner 1560

Parameter/Equipment	Range	CMC ² (±)	Comments
Temperature – Measuring Equipment (Fixed Points)	Triple Point of water	0.21 mK	TPW cell
	660.323 °C	3.6 mK	FP aluminum cell
	231.928 °C	2.6 mK	FP tin cell
	419.537 °C	2.6 mK	FP zinc cell
	-38.7344 °C	2.6 mK	TP mercury cell
	-195 °C	3.1 mK	Liquid nitrogen Comparison calibrator
	(-80 to 500) °C	0.0023 °C	Hart model 7190 Hart 1590 super thermometer Hart SPRT
	(501 to 600) °C	0.63 °C	Hart model 7380 Hart model 7012
	(601 to 1100) °C	0.83 °C	Hart model 6035 Hart model 6050 Omega model LMF 3550 Hart 1590 super thermometer Hart SPRT
Relative Humidity	(10 to 95) % RH	0.51 % RH	Thunder Scientific model 2500

VII. Time and Frequency

Parameter/Equipment	Range	CMC ² (±)	Comments
Frequency – Measure	10 MHz	1.2 X 10 ⁻¹² Hz	Fluke model 910R GPS
Sinewave Frequency – Measuring Equipment	0.1 Hz to 20 MHz 200 Hz to 80 MHz	5.8 µHz/Hz 0.0058 Hz	HP 3325A/HP 5345A HP 3335A Opt. 001/ HS 20/ 54610B/910R
	10 MHz to 20 GHz	0.17 Hz	HP 83712B/910R
Sinewave Frequency – Measure	(0 to 400) MHz (0.4 to 1.6) GHz (1.5 to 26) GHz	8.1 X 10 ⁻⁵ Hz 5.8 Hz 2.4 Hz	HP 5345A HP 5345A/ HP 5355A HP 5345A/HP 5355A/ HP 5356B

Parameter/Equipment	Range	CMC ² (±)	Comments
Time Interval	10 nS to 20 000 S	2.3 nS	HP 5345A
Stop Watches	(0.4 to 24) hours	0.02 % of time interval	Fluke 910R GPS

¹ This laboratory offers commercial 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 In the statement of CMC, L is the numerical value of the nominal length of the device measured in inches.

⁴ In the statement of CMC, the value is defined as the percentage of reading, unless otherwise noted.

⁵ The measurands stated are measured with the Fluke 8508A or Fluke 792A. This capability is suitable for the calibration of the devices intended to generate the measurand in the ranges indicated. CMCs are expressed as either a specific value that covers the full range or as a combination of the fraction of the reading/output plus a range specification.

⁶ The measurands stated are generated with the Fluke 5500 series of instruments or Fluke 5700A/EP. This capability is suitable for the calibration of the devices intended to measure the stated measurand in the ranges indicated. CMCs are expressed as either a specific value that covers the full range or as a combination of the fraction of the reading/output plus a range specification.



World Class Accreditation

The American Association for Laboratory Accreditation

Accredited Laboratory

A2LA has accredited

GULF METROLOGY LABORATORY (GEMS)

Jubail Industrial City, SAUDI ARABIA

for technical competence in the field of

Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and any additional program requirements in the field of calibration. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009*).

Presented this 21st day of December 2010.





Peter Meyer

President & CEO
For the Accreditation Council
Certificate Number 3097.01
Valid to January 31, 2013

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