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

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CALIBRATION

Valid until: June 30, 2010 Certificate Number: 1278.01

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

I. Electrical – DC/Low Frequency

Parameter/Equipment	Range	Best Uncertainty[2, 5, 6] (±)	Comments
DC Voltage – Measure[4]	Up to 100 mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 1000) V	7 μV/V + 0.3 μV 6 μV/V + 0.3 μV 6 μV/V + 0.5 μV 8 μV/V + 30 μV 8 μV/V + 12 $(V_{IN}/1000)^2$ μV/V + 0.1 mV	HP 3458A opt 002
DC Voltage – Generate[4]	(0 to 220) mV 220 mV to 2.2V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V	9 μV/V + 0.8 μV 8 μV/V + 1.2 μV 8 μV/V + 4 μV 8 μV/V + 8 μV 9 μV/V + 100 μV 11 μV/V + 600 μV	Fluke 5700A

Parameter/Equipment	Range	Best Uncertainty[2, 5, 6] (±)	Comments
DC Current – Measure[4]	Up 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	35 µA/A + 0.04 nA 25 µA/A + 0.04 nA 25 µA/A + 0.1 nA 25 µA/A + 0.86 nA 25 µA/A + 5 nA 25 µA/A + 50 nA 40 µA/A + 0.5 µA 0.012 % + 10 µA	HP 3458A opt 002
	(1 to 2) A	51 µA/A + 0.05 ppm	HP 3458A with L&N 4221B current shunt
	(2 to 10) A	0.016 % + 0.05 µA/A	HP 3458A with L&N 4222B current shunt
	(10 to 50) A (50 to 100) A	0.58 % rdg 1.2 % rdg	HP 3458A with Rubicon 1168, 300 A current shunt
DC Current – Generate[4]	(0 to 220) µA 220 µA to 2.2 mA (2.2 to 22) mA	60 µA/A + 10 µA 60 µA/A + 10 µA 60 µA/A + 100 µA	Fluke 5700A
	(22 to 220) mA	70 µA/A + 1 µA	Add (200 x I^2) µA/A for I > 100 mA
	220 mA to 2.2 A	95 µA/A + 30 µA	Add (10 x I^2) µA/A for I > 1 A
	(2.2 to 11) A	0.06 % rdg	Fluke 5500A
	(11 to 100) A	0.03 % rng + 0.03 % rdg	Vallhalla 2555A

Parameter/Equipment	Range	Best Uncertainty[2, 5, 6] (±)	Comments
Resistance – Measure[4]	Up 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 (10 to 100) MΩ 100 MΩ to 1 GΩ	18 μΩ/Ω + 50 μΩ 15 μΩ/Ω + 500 μΩ 13 μΩ/Ω + 500 μΩ 13 μΩ/Ω + 5 mΩ 13 μΩ/Ω + 50 mΩ 18 μΩ/Ω + 2 Ω 53 μΩ/Ω + 100 Ω 0.05 % + 1 kΩ 0.5 % + 10 kΩ	HP 3458A opt 002
Resistance – Generate, Fixed Values[4]	(1, 1.9) Ω 10 Ω 19 Ω (100, 190) Ω (1, 1.9) kΩ (10, 19) kΩ (100, 190) kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	0.011 % rdg 33 parts in 10^6 31 parts in 10^6 20 parts in 10^6 15 parts in 10^6 14 parts in 10^6 16 parts in 10^6 23 parts in 10^6 24 parts in 10^6 46 parts in 10^6 55 parts in 10^6 0.013 % rdg	Fluke 5700A

Parameter/Range	Frequency	Best Uncertainty[2, 5] (±)	Comments
AC Voltage – Measure[4]			
(0 to 10) mV	(10 to 20) Hz (20 to 40) Hz (40 to 100) Hz 100 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 250) kHz	0.4 % + 0.32 % 0.15 % + 0.25 % 0.06 % + 0.25 % 0.02 % + 0.25 % 0.15 % + 0.25 % 0.7 % + 0.35 % 4 % + 0.7 %	HP 3458A opt 002

Parameter/Range	Frequency	Best Uncertainty[2, 5] (±)	Comments
AC Voltage – Measure[4] (cont)			
(10 to 100) mV	(10 to 20) Hz (20 to 40) Hz (40 to 100) Hz 100 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 250) kHz (250 to 500) kHz 500 kHz to 1 MHz (1 to 2) MHz	0.4 % + 0.02 % 0.15 % + 0.02 % 0.06 % + 0.01 % 0.02 % + 0.01 % 0.15 % + 0.04 % 0.6 % + 0.08 % 2 % + 0.5 % 3 % + 0.6 % 5 % + 2 % 10 % + 5 %	HP 3458A opt 002
100 mV to 1 V	(10 to 20) Hz (20 to 40) Hz (40 to 100) Hz 100 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 250) kHz (250 to 500) kHz 500 kHz to 1 MHz (1 to 2) MHz	0.4 % + 0.02 % 0.15 % + 0.02 % 0.06 % + 0.01 % 0.02 % + 0.01 % 0.15 % + 0.04 % 0.6 % + 0.08 % 2 % + 0.5 % 3 % + 0.6 % 5 % + 2 % 10 % + 5 %	
(1 to 10) V	(10 to 20) Hz (20 to 40) Hz (40 to 100) Hz 100 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 250) kHz (250 to 500) kHz 500 kHz to 1 MHz (1 to 2) MHz	0.4 % + 0.02 % 0.15 % + 0.02 % 0.06 % + 0.01 % 0.02 % + 0.01 % 0.15 % + 0.04 % 0.6 % + 0.08 % 2 % + 0.5 % 3 % + 0.6 % 5 % + 2 % 10 % + 5 %	
(10 to 100) V	(10 to 20) Hz (20 to 40) Hz (40 to 100) Hz 100 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 250) kHz (250 to 500) kHz 500 kHz to 1 MHz	0.4 % + 0.02 % 0.15 % + 0.02 % 0.06 % + 0.01 % 0.03 % + 0.01 % 0.15 % + 0.04 % 0.6 % + 0.08 % 2 % + 0.5 % 3 % + 0.6 % 5 % + 2 %	

Parameter/Range	Frequency	Best Uncertainty[2, 5, 6] (±)	Comments
AC Voltage – Measure[4] (cont)			
(100 to 700) V	(10 to 20) Hz (20 to 40) Hz (40 to 100) Hz 100 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	0.42 % + 0.03 % 0.17 % + 0.03 % 0.08 % + 0.02 % 0.06 % + 0.02 % 0.15 % + 0.04 % 0.6 % + 0.2 %	HP 3458A opt 002
AC Voltage – Generate[4]			
Up to 2.2 mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.06 % + 5 µV 0.024 % + 5 µV 0.012 % + 5 µV 0.041 % + 5 µV 0.095 % + 8 µV 0.13 % + 15 µV 0.18 % + 30 µV 0.36 % + 30 µV	Fluke 5700A
(2.2 to 22) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.06 % + 6 µV 0.024 % + 6 µV 0.012 % + 6 µV 0.041% + 6 µV 0.095 % + 8 µV 0.13 % + 15 µV 0.18 % + 30 µV 0.36 % + 30 µV	
(22 to 220) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.06 % + 16 µV 0.024 % + 10 µV 0.011 % + 10 µV 0.036 % + 10 µV 0.09 % + 30 µV 0.11 % + 30 µV 0.18 % + 40 µV 0.36 % +100 µV	
220 mV to 2.2 V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.06 % + 100 µV 0.018 % + 30 µV 85 µV/V + 7 µV 0.014 % + 20 µV 0.028 % + 80 µV 0.048 % + 150 µV 0.12 % + 400 µV 0.24 % + 1 mV	

Parameter/Range	Frequency	Best Uncertainty[2, 5, 6] (±)	Comments
AC Voltage – Generate[4] (cont)			
(2.2 to 22) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.06 % + 1 mV 0.018 % + 300 µV 85 µV/V + 70 µV 0.014 % + 200 µV 0.028 % + 400 µV 0.06 % + 1.7 mV 0.14 % + 5 mV 0.30 % + 9 mV	Fluke 5700A
(22 to 220) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.06 % + 10 mV 0.018 %+ 3 mV 90 µV/V+ 1 mV 0.025 % + 4 mV 0.06 % + 10 mV 0.16 % + 110 mV 0.54 % + 110 mV 1.3 % + 220 mV	
(220 to 1100) V	50 Hz to 1 kHz	90 µV/V + 4 mV	
AC Current – Measure[4]			
(20 to 100) µA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 1 kHz	0.4 % + 0.03 µA 0.15 % + 0.03 µA 0.06 % + 0.03 µA 0.06 % + 0.03 µA	HP 3458A opt 002
100 µA to 1 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 % + 0.2 µA 0.15 % + 0.2 µA 0.06 % + 0.2 µA 0.03 % + 0.2 µA 0.06 % + 0.2 µA 0.4 % + 0.4 µA 0.55 % + 1.5 µA	
(1 to 10) 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 % + 2 µA 0.15 % + 2 µA 0.06 % + 2 µA 0.03 % + 2 µA 0.06 % + 2 µA 0.4 % + 4 µA 0.55 % + 15 µA	

Parameter/Range	Frequency	Best Uncertainty[2, 5, 6] (±)	Comments
AC Current – Measure[4] (cont)			HP 3458A opt 002
(10 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 % + 20 µA 0.15 % + 20 µA 0.06 % + 20 µA 0.03 % + 20 µA 0.06 % + 20 µA 0.4 % + 40 µA 0.55 % + 150 µA	
100 mA 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 % + 0.2 mA 0.16 % + 0.2 mA 0.08 % + 0.2 mA 0.1 % + 0.2 mA 0.3 % + 0.2 mA 1 % + 0.4 mA	
(1 to 2) A	10 Hz to 1 kHz	0.011 % rdg	HP 3458A with L&N 4221B current shunt
(2 to 10) A	(60 to 100) Hz	0.18 % rdg	HP 3458A with L&N 4222B current shunt
(10 to 100) A	(60 to 100) Hz	1.2 % rdg	Rubicon 300A shunt with HP 3458A
AC Current – Generate[4]			
(0 to 220) µA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.08 % + 30 nA 0.042 % + 25 nA 0.016 % + 20 nA 0.07 % + 50 nA 0.18 % + 80 nA	Fluke 5700A
220 µA to 2.2 mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.08 % + 50 nA 0.042 % + 40 nA 0.016 % + 40 nA 0.07 % + 500 nA 0.18 % + 1 µA	
(2.2 to 22) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.08 %+ 500 nA 0.042 % + 420 nA 0.016 % + 400 nA 0.07 % + 5 µA 0.18 % + 10 µA	

Parameter/Range	Frequency	Best Uncertainty[2, 5, 6] (±)	Comments
AC Current – Generate[4] (cont)			
(22 to 220) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.08 % + 5 µA 0.042 % + 4 µA 0.018 % + 4 µA 0.07 % + 50 µA 0.18 % + 100 µA	Fluke 5700A
220 mA to 2.2 A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.075 % + 40 µA 0.085 % + 100 µA 1 % + 200 µA	
(2.2 to 11) A	(45 to 65) Hz (65 to 500) Hz 500 to 1 kHz	0.06 % + 2 mA 0.1 % + 2 mA 0.33 % + 2 mA	Fluke 5500A
(11 to 100) A	20 Hz to 10 kHz	0.2 % rng + 0.2 % rdg	Vallhalla 2555A
Capacitance – Generate[4]			
(0.33 to 11) nF (11 to 110) nF (110 to 330) nF (0.33 to 1.1) µF (1.1 to 3.3) µF (3.3 to 11) µF (11 to 33) µF (33 to 110) µF (110 to 330) µF (330 to 1.1) mF	50 Hz to 1 kHz 50 Hz to 1 kHz 50 Hz to 1 kHz 50 Hz to 1 kHz 50 Hz to 1 kHz (50 to 400) Hz (50 to 400) Hz (50 to 200) Hz (50 to 100) Hz (50 to 100) Hz	0.5 % + 0.01 nF 0.25 % + 0.1 nF 0.25 % + 0.3 nF 0.25 % + 1 nF 0.35 % + 3 nF 0.35 % + 10 nF 0.4 % + 30 nF 0.5 % + 100 nF 0.7 % + 300 nF 1 % + 300 nF	Fluke 5500A
Capacitance – Generate, Fixed Points[4]			
1 pF	100 Hz to 1 kHz 1 kHz to 1 MHz (1 to 2) MHz (2 to 3) MHz (3 to 4) MHz (4 to 5) MHz (5 to 10) MHz (10 to 13) MHz	0.11 % 0.12 % 0.12 % 0.15 % 0.23 % 0.33 % 0.94 % 1.6 %	HP 16381A

Parameter/Equipment	Frequency	Best Uncertainty[2, 5] (±)	Comments
Capacitance – Generate, Fixed Points[4] (cont)			
(10, 100) pF	100 Hz to 1 kHz 1 kHz to 1 MHz (1 to 2) MHz (2 to 3) MHz (3 to 4) MHz (4 to 5) MHz (5 to 10) MHz (10 to 13) MHz	0.11 % 0.11 % 0.11 % 0.11 % 0.11 % 0.12 % 0.18 % 0.23 %	HP 16382A, 16383A
1000 pF	100 Hz to 1 kHz 1 kHz to 1 MHz (1 to 2) MHz (2 to 3) MHz (3 to 4) MHz (4 to 5) MHz (5 to 10) MHz (10 to 13) MHz	0.11 % 0.12 % 0.12 % 0.15 % 0.19 % 0.23 % 0.55 % 0.76 %	HP 16384A

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Inductance – Generate, Fixed Points[4]	1 mH 10 mH 100 mH 1 H	2 % rdg 1 % rdg 0.75 % rdg 0.75 % rdg	Gen Rad 1490D
Oscilloscope – Generate[4]			
DC Signal			
50 Ω load	(0 to 2.2) V	0.25 % output + 100 µV	Fluke 5500A SC600
1 MΩ load	(0 to 33) V	0.25 % output + 100 µV	

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Oscilloscope – Generate[4] (cont)			
Squarewave Signal			
50 Ω	1.8 mV to 2.2 V_{pk-pk}	0.25 % output + 100 µV	Fluke 5500A SC600
1 MΩ	1.8 mV to 105 V_{pk-pk}	0.25 % output + 100 µV	
Edge Characteristics into 50 Ω	5 mV to 2.5 V	2 % output + 200 µV	
Risetime	< 300 ps	+ 0 / - 100 ps	
Level Sine Wave, 50 Ω, Absolute Uncertainty 5 mV to 5.5 V	50 kHz reference 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz	2 % output + 300 µV 3.5 % output + 300 µV 4 % output + 300 µV 6 % output + 300 µV	
Time Marker, 50 Ω	5 s to 50 ms 20 ms to 100 ns 50 ns to 20 ns 10 ns (5 to 2) ns	(25 + 1000*t*) µs/s 2.5 µs/s 2.5 µs/s 2.5 µs/s 2.5 µs/s	*t* is the time in seconds
Oscilloscope – Measure[4]			
Risetime	Up to 12.4 GHz	63 ps	HP 54120B
DC High Voltage – Measure[4]	Up to 40 kV	0.062 % rdg + 0.02 % rng	Vitrek 4640A
DC High Voltage – Generate[4]	(1 to 10) kV	0.3 % output	Fluke 410B, Vitrek 4640A
AC High Voltage – Measure[4]			
Up to 20 kV	(20 to 60) Hz	0.56 % rdg + 0.1 % rng	HP 3458A opt 002, Vitrek 4640A

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Electrical Calibration of Thermocouple Indicating Devices[4] –			
Type J	-210 °C to -100 °C -100 °C to 760 °C 760 °C to 1200 °C	0.27 °C 0.17 °C 0.23 °C	Fluke 5500A
Type K	-200 °C to -100 °C -100 °C to 120 °C 120 °C to 1000 °C 1000 °C to 1372 °C	0.33 °C 0.18 °C 0.26 °C 0.40 °C	
Type T	-250 °C to -150 °C -150 °C to 0 °C 0 °C to 400 °C	0.63 °C 0.24 °C 0.16 °C	
Type E	-250 °C to -100 °C -100 °C to 650 °C 650 °C to 1000 °C	0.50 °C 0.16 °C 0.21 °C	

II. Electrical – RF/Microwave

Parameter/Range	Frequency	Best Uncertainty[2] (±)	Comments
Attenuation[4] – (2.5 to 1300) MHz	(0 to -100) dB (-100 to -120) dB	0.015 dB + 0.005 db/10 dB step + 1 digit 0.015 dB + 0.050 db/10 dB step + 1 digit	HP 8902A w/opt 50
RF Power – Measure[4], (20 to -127) dBm	(0.1 to 1.3) GHz (1.3 to 26.5) GHz	0.29 dB 0.64 dB	HP 8902A w/opt 050 HP 8902A w/11793A down converter, HP 8673D

Parameter/Range	Frequency	Best Uncertainty[2] (±)	Comments
RF Power – Generate[4]			
(+11 to 0) dBm (0 to -10) dBm (-10 to -20) dBm (-20 to -30) dBm < -30 dbm	(0.05 to 6.6) GHz	1.3 dB 1 dB 1.5 dB 1.7 dB 2 dB	HP 8673D
(+11 to 0) dBm (0 to -10) dBm (-10 to -20) dBm (-20 to -30) dBm < -30 dbm	(6.6 to 12.3) GHz	1.5 dB 1.3 dB 1.8 dB 2 dB 2.3 dB	
(+11 to 0) dBm (0 to -10) dBm (-10 to -20) dBm (-20 to -30) dBm < -30 dbm	(12.3 to 18.6) GHz	1.8 dB 1.5 dB 2.1 dB 2.3 dB 2.7 dB	
(+11 to 0) dBm (0 to -10) dBm (-10 to -20) dBm (-20 to -30) dBm < -30 dbm	(18.6 to 26) GHz	2.3 dB 2 dB 2.6 dB 2.9 dB 3.3 dB	
Amplitude Modulation – Measure[4]			
Rate: 50 Hz to 10 kHz Depths: 5 % to 99 %	150 kHz to 10 MHz	2.0 % rdg + 1 digit	HP 8902A
Rate: 20 Hz to 10 kHz Depths: to 99 %	150 kHz to 10 MHz	3.0 % rdg + 1 digit	
Rate: 50 Hz to 50 kHz Depths: 5 % to 99 %	10 MHz to 1.3 GHz	1.0 % rdg + 1 digit	
Rate: 20 Hz to 100 kHz Depths: to 99 %	10 MHz to 1.3 GHz	3.0 % rdg + 1 digit	

Parameter/Range	Frequency	Best Uncertainty[2] (±)	Comments
Frequency Modulation – Measure[4]			
Rate: 20 Hz to 10 kHz Dev: ≤ 40 kHz pk	250 kHz to 10 MHz	2 % rdg + 1 digit	HP 8902A
Rate: 50 Hz to 100 kHz Dev: ≤ 400 kHz pk	10 MHz to 1.3 GHz	1 % rdg + 1 digit	
Rate: 20 Hz to 200 kHz Dev: ≤ 400 kHz pk	10 MHz to 1.3 GHz	5 % rdg + 1 digit	
Phase Modulation – Measure[4]			
Rate: 200 Hz to 10 kHz	150 kHz ≤ f_c < 10 MHz	4 % rdg + 1 digit	HP 8902A; f_c represents the frequency carrier
Rate: 200 Hz to 20 kHz	10 MHz ≤ f_c ≤ 1.3 GHz	3 % rdg + 1 digit	

III. Time and Frequency

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Timers & Stopwatches[4]	(0 to 24) hours	0.1 s/day	Vibrograf TM-4500
Frequency[4]	10 MHz reference	2 parts in 10^{11}	Loran C

IV. Thermodynamics

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Temperature – Measure[4]	-170 °C to 660 °C	0.03 °C	Hart 5626 PRT probe with Azonix 1011 display

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Temperature Measuring Equipment[4]	35 °C to 200 °C	0.031 °C	Hart 5626 PRT with Azonix 1011 display, Hart 6102 bath
Relative Humidity[4] – at 20 °C	(10 to 90) % RH	1.5 % RH	Vaisala HMT-337

V. Mechanical

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Torque Measuring Equipment[4]	1 in·oz to 650 ft·lb	0.1 % rdg	Torque cell system
Pressure (Liquid)[4]	(5 to 10 000) psi	0.025 % rdg	Dead weight
Force[4]	(1 to 300) lbf	0.16 lbf	ASTM 6, weights
Scales[4]	1 g to 300 lb	0.16 lb	Class F weights

VI. Dimensional

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Dial Indicators[4]	(0.001 to 1) in	91 µin	Dial indicator calibrator
Micrometers[4]	(0.005 to 8) in (1 to 18) in	190 µin 430 µin	Gage blocks Reference bar
Calipers[4]	(0.001 to 8) in (1 to 18) in	790 µin 910 µin	Gage blocks

Parameter/Equipment	Range	Best Uncertainty[2, 3](±)	Comments
Height Gages[4]	(1 to 18) in	(99 + 17*L*) µin	Reference bar with Mu meter
Pin Gages[4]	(0 to 1) in	220 µin	Bench mic w/gage blocks
Thickness Gages[4] –			
Blade	(0 to 1) in	750 µin	Bench mic
Dial	(0 to 1) in	790 µin	Gage blocks
Bore Gages[4]	(0.001 to 1) in	91 µin	Dial Indicator calibrator
ID Gages[4]	(1 to 18) in	790 µin	Gage blocks
Thread Plugs[4] – Major Diameter and Pitch Diameter only	Non-Tapered, (4 to 80) TPI	86 µin	Bench mic w/thread wires
Toolmaker's Microscope[4]	(0 to 2) in	180 µin	Mitutoyo 172-117 optical scale

[1] This laboratory offers commercial calibration service and on-site calibration service (where noted).

[2] "Best Uncertainty" 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 of nearly ideal measuring equipment. Best uncertainties represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of $k = 2$. The best uncertainty of a specific calibration performed by the laboratory may be greater than the best uncertainty due to the behavior of the customer's device and to influences from the circumstances of the specific calibration. Where uncertainty values are presented in "ppm", this term represents "parts in 10^6".

[3] *L* represents the length of the unit under test in inches.

[4] On-Site calibration service is available for this parameter. The uncertainties achievable on a customer's site can be expected to be larger than the Best Measurement Capabilities (BMC) that the accredited laboratory has been assigned as Best Uncertainty 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 uncertainty

introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the calibration uncertainty being larger than the BMC.

[5] The measurands stated are measured with the HP 3458A, 16381A, 16382A, 16383A, and 16384A. This capability is suitable for the calibration of the devices intended to generate the measurand in the ranges indicated. Best measurement uncertainties 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 5500A & 5700A series of instruments. This capability is suitable for the calibration of the devices intended to measure the stated measurand in the ranges indicated. Best measurement uncertainties are expressed as either a specific value that covers the full range or as a fraction of the reading plus a fixed floor specification. Where the term "ppm" is used, this represents a part in 10^6.

THE AMERICAN ASSOCIATION FOR LABORATORY ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

TRU CAL INTERNATIONAL INC.

Bensenville, IL

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 18 June 2005*).

Presented this 6th day of May 2008.

President
For the Accreditation Council
Certificate Number 1278.01
Valid to June 30, 2010
Revised May 28, 2010

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