Scope of Accreditation
For
The Calibration Solution Inc.

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In recognition of a successful assessment to ISO/IEC 17025:2005 and ANSI/NCSL Z540.1:1994, accreditation is granted to **The Calibration Solution Inc.** to perform the following Calibrations:

Accreditation granted through: **May 20. 2016**

Calibration

Length - Hand Tools and Precision Gages 1D

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) [2]	Remarks
Bench Micrometer [1]	(0 to 2) in	(47 + 11*L*) µin	Gage Blocks
Calipers [1]	(0 to 24) in	(360 + 11*L*) µin	Gage Blocks / Ring Gage
	(24 to 72) in	(330 + 16*L*) µin	
Dial Bore Gage [1]	(1 to 10) in	41 µin	Supermic
Dial Indicator Calibrator	(0 to 1) in	(16 + 1*L*) µin	Gage Blocks / Electronic Amp
Dial/Test/Elect Indicators [1]	(0 to 4) in	(64 + 3*L*) µin	Gage Blocks
Electronic Amp	(0 to 0.2) in	14 µin	Gage Blocks
	(0 to 0.2) in	(9.9 + 3.5*L*) µin	Zeiss ULM
Height Gage [1]	(0 to 48) in	(45 + 6*L*) µin	Gage Blocks
Height Master [1]	(0 to 48) in	(42 + 3*L*) µin	Gage Blocks / Electronic Amp
Intramic / Bore Mic	(0.2 to 6) in	(150 + 27*D*) µin	Ring Gages
High Precision Indicators	0.002 in	4 µin	Grade 1 Gage Blocks
Micrometer, ID	(0 to 12) in	(37 + 3*L*) µin	Supermic
	(12 to 60) in	(42 + 3*L*) µin	Gage Blocks / Electronic Amp
Micrometer, OD [1]	(0 to 72) in	(47 + 11*L*) µin	Gage Blocks

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) [2]	Remarks
Micrometer, Depth [1]	(0 to 24) in	(110 + 8*L*) µin	Gage Blocks
Micrometer Head	(0 to 2) in	24 µin	Zeiss ULM
Supermic, OD [1]	(0 to 18) in	17 µin	Gage Blocks
Laser Micrometer	(0 to 1) in	(36 + 14*L*) µin	Master Pins

Length - Hand Tools and Precision Gages 2D

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) [2]	Remarks
Bench Centers [1]	(0 to 48) in	140 µin	Arbor / Electronic Amp
Dial Sink/ Counter bore Gage	(0 to 1) in	130 µin	Ring Gage
Levels	14 in	280 µin	Surface Plate
Optical Comparator [1] Linear	(0 to 6) in	(370 + 62*L*) µin	Glass Scale
Optical Comparator [1] Angular	0° to 360°	0.02°	
Profilometer [1]	(12 to 120) µin Ra	(3 + 0.02*H*) µin Ra	3 Patch Surface Finish Standard

Length - Artifacts and Standards 1D

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) [2]	Remarks
Caliper Checker	(0 to 72) in	(42 + 3*L*) µin	Gage Blocks / Electronic Amp
Geometric References Flatness, Parallelism, Straightness	(1 to 24) in	58 µin	Surface Plate / Electronic Amp
	(24 to 60) in	95 µin	
Gage Blocks, Steel	(0.01 to 4) in	(4 + 2.2*L*) µin	Gage Block Comparator
	(5 to 20) in	(0.9 + 2.5*L*) µin	Johansson Comparator & Surface Plate
Gage Blocks, TC/CC/Ceramic	(0.01 to 4) in	(3.8 + 4.2*L*) µin	Gage Block Comparator
Gage Block Comparator	0.01 in	2.3 µin	Gage Blocks
Kalmaster	(0 to 18) in	(42 + 3*L*) µin	Gage Blocks / Electronic Amp
Length Standards [1]	(0 to 72) in	(42 + 3*L*) µin	
Micrometer Master, Depth	(0 to 12) in	(42 + 3*L*) µin	Gage Blocks / Electronic Amp
Micrometer Master, OD	(0 to 12) in	(42 + 3*L*) µin	

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) [2]	Remarks
Optical Flats and Parallels Flatness	(1 to 6) inD^3	3 µin	Master Optical Flat
Optical Flats and Parallels Parallelism	Up to 1 in	3 µin	Gage Block Comparator
Parallels	(0 to 24) in	58 µin	Electronic Amp / Surface Plate
	(24 to 60) in	95 µin	
Pitch Gages (1 to 100) TPI	(0 to 0.1) in	(600 + 8L) µin	Optical Comparator
Plain Plug Gage [1]	(0 to 14) in	(22 + 2D) µin	Labmaster Universal
Plain Ring Gage [1]	(0.05 to 0.4) in	8 µin	Labmaster Universal
	(0.4 to 14) in	(8 + 3D) µin	
Steel Ball (size only)	(0.05 to 1) in	(37 + 3D) µin	Supermic / Gage Blocks
Steel Rule [1]	(1 to 96) in	(5700 + 2L) µin	Gage Blocks
Straight Edge	(1 to 24) in	58 µin	Elec Amp/Surface Plate
	(24 to 60) in	95 µin	
Thickness / Feeler / Pin Gages [1]	(0.001 to 1) in	(37 + 3D) µin	Supermic
Thread Measuring Wires	(0 to 0.25) in	30 µin	Supermic
Surface Plates			
Repeatability	0.002 in	(32 + 0.1L) µin	Repeat Reading Gage
Flatness	(24 to 144) in	(51 + 4L) µin	Autocollimator

Length - Artifacts and Standards 2D

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) [2]	Remarks
1-2-3 Blocks	(1 to 3) in	(42 + 3L) µin	Electronic Amp / Gage Blocks
Angle Gage Blocks	0° to 45°	6.3“	Sine Bar / Electronic Amp
Arbors	(0 to 14) in	58 µin	Supermic / Bench Center / Amp
Fixtures/Functional Gages	(0 to 6) in	(600 + 8L) µin	Optical Comparator
	0° to 360°	0.065°	
Protractor [1]	0° to 360°	0.07°	Optical Comparator
	0° to 45°	6.3”	Sine Bar / Gage Blocks

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) [2]	Remarks
Radius Gage	(0.0156 to 2) in	(600 + 8*D*) µin	Optical Comparator
Sine Plates/Bars	(5 to 20) in	58 µin	Electronic Amp, Surface Plate, Gage Blocks
Squares [1]	(1 to 24) in	(24 + 2.2*L*) µin	Granite Square / Electronic Amp
V Blocks	Up to 12 in^3	150 µin	Elec Amp, Arbor, Surface Plate, Square
NPT Thread Ring	(0.0625 to 2.5) in	(190 + 1*D*) µin	NPT Plugs
NPTF Taper Plugs	(0.0625 to 6) in	(56 + 2*D*) µin	Supermic / Sine Block
Surface Finish Standard [1]	(12 to 1000) µin Ra	(3.5 + 0.03*L*) µin Ra	Profilometer
Thread Plugs [1] (6 to 80) TPI	(0 to 14) in	(130 + 2*PD*) µin	Supermic / Thread Wires
Thread Plug Gage, tapered	(0.125 to 6) in	(140 + 2*D*) µin	Supermic / Thread Wires / Sine Block
Thread Ring Gage [1] (6 to 80) TPI	(0.1 to 1.5) in	(190 + 1*PD*) µin	Set Plugs
	(0.2 to 5) in	(200 + 1*PD*) µin	Zeiss ULM

Length - Artifacts and Standards 3D

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-) [2]	Remarks
Fixtures / Functional Gages	X Axis to 28 in Y Axis to 28 in Z Axis to 24 in	400 µin	CMM incorporated in Measurement Process
Plain Taper Arbor	(0 to 20) in	400 µin	CMM

Mass – Scales and Balances

Calibration Parameter/Equipment [1]	Range	Calibration and Measurement Capability(+/-)	Remarks
Weighing System (1 g resolution)	(0 to 6000) g	1.2 g	ASTM E617 Class 6 Weights and NIST Handbook 44 utilized for the calibration of the Weighing System
(0.001 lb resolution)	(0 to 12) lb	0.0015 lb	
Weighing System (0.01 lb resolution)	(0 to 220) lb	0.013 lb	NIST Class F Weights and NIST Handbook 44 utilized for the calibration of the Weighing Sytem
(0.1 lb resolution)	(0 to 220) lb	0.13 lb	
(1 lb resolution)	(0 to 220) lb	1.3 lb	
(2 lb resolution)	(0 to 220) lb	2.6 lb	

Mass – Pressure / Low Vacuum

Calibration Parameter/Equipment [1]	Range	Calibration and Measurement Capability(+/-)	Remarks
Pressure	(5 to 10 000) psi	0.14 % applied load	Deadweight Tester
	(0 to 300) psi	0.17 psi	Pneumatic Pressure Calibrator
	(-12.3 to 0) psi	0.17 psi	

Mass – Torque

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-)	Remarks
Torque Tools [1]	(0.4 to 1000) lbf·ft	0.4 % applied load	CDI Torque Tester
Torque Watches	(1 to 80) ozf·in	0.11 ozf·in + 0.0024 ozf·in/ozf·in	
Torque Transducer / Calibrator	(0.005 to 2000) lbf·ft	0.1% applied load	Torque Wheels and Class F Weights

Mass – Hardness

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-)	Remarks
Durometers			Comparison to Scale
Type A	(0 to 90) Duro	1.3 Duro	
Type D	(0 to 90) Duro	1.4 Duro	
Microhardness Testers [1] 500 gf load			ASTM E-384 Indirect Comparison
Knoop	Middle	18 HK	
Vickers	Middle	19 HV	
Brinell Hardness Testers [1]			ASTM-E-10 Indirect Verification
500 kgf load	Low Middle High	4.5 HB 4.9 HB 5.3 HB	
1500 kgf load	Low Middle High	4.7 HB 5.3 HB 5.4 HB	
3000 kgf load	Low Middle High	7.4 HB 6.4 HB 6.4 HB	
Rockwell Hardness Testers [1]			ASTM-E-18 Indirect Verification
HRA	Low Middle High	0.71 HRA 0.56 HRA 0.47 HRA	

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-)	Remarks
HRB	Low Middle High	1.1 HRB 0.94 HRB 0.71 HRB	
HRC	Low Middle High	0.74 HRC 0.53 HRC 0.47 HRC	
HR15T	Low Middle High	1 HR15T 1 HR15T 0.8 HR15T	
HR30T	Low Middle High	0.9 HR30T 1 HR30T 0.86 HR30T	
HR45T	Low Middle High	0.64 HR45T 0.87 HR45T 0.7 HR45T	
HR15N	Low Middle High	0.73 HR15N 0.84 HR15N 0.74 HR15N	
HR30N	Low Middle High	0.85 HR30N 0.9 HR30N 0.79 HR30N	
HR45N	Low Middle High	0.79 HR45N 0.76 HR45N 0.8 HR45N	

Electrical – Voltage

Calibration Parameter/Equipment [1]	Range	Calibration and Measurement Capability(+/-)	Remarks
DC Volts, Source	(0 to 330) mV	0.018 µV/mV + 2.4 µV	Fluke 5520A/SC1100
	(0.3 to 3.3) V	11 µV/V + 7.2 µV	
	(3.3 to 33) V	13 µV/V + 15 µV	
	(33 to 330) V	18 µV/V + 310 µV	
	(330 to 1000) V	19 µV/V + 1.4 mV	
AC Volts, Source (1 to 33) mV	(10 to 45) Hz	8 µV/mV + 61 µV	Fluke 5520A/SC1100
	45 Hz to 10 kHz	0.17 µV/mV + 37 µV	
	(10 to 20) kHz	0.28 µV/mV + 37 µV	
	(20 to 50) kHz	1 µV/mV + 36 µV	
	(50 to 100) kHz	3.4 µV/mV + 33 µV	
	(100 to 500) kHz	0.88 µV/mV + 37 µV	

AC Volts, Source (33 to 330) mV	(10 to 45) Hz	0.65 µV/mV + 51 µV	Fluke 5520A/SC1100
	45 Hz to 10 kHz	0.19 µV/mV + 37 µV	
	(10 to 20) kHz	0.29 µV/mV + 38 µV	
	(20 to 50) kHz	0.7 µV/mV + 38 µV	
	(50 to 100) kHz	1.1 µV/mV + 50 µV	
	(100 to 500) kHz	2.1 µV/mV + 92 µV	
AC Volts, Source (0.33 to 3.3) V	(10 to 45) Hz	640 µV/V + 0.26 mV	Fluke 5520A/SC1100
	45 Hz to 10 kHz	205 µV/V + 0.1 mV	
	(10 to 20) kHz	310 µV/V + 110 µV	
	(20 to 50) kHz	0.68 mV/V + 0.1 mV	
	(50 to 100) kHz	1.1 mV/V + 0.17 mV	
	(100 to 500) kHz	2.5 mV/V + 0.78 mV	
AC Volts, Source (3.3 to 33) V	(10 to 45) Hz	0.64 mV/V + 2.7 mV	Fluke 5520A/SC1100
	45 Hz to 10 kHz	0.21 mV/V + 1.1 mV	
	(10 to 20) kHz	0.4 mV/V + 1.1 mV	
	(20 to 50) kHz	0.89 mV/V + 1.1 mV	
	(50 to 100) kHz	2.2 mV/V + 1.6 mV	
AC Volts, Source (33 to 330) V	45 Hz to 1 kHz	0.64 mV/V + 5.4 mV	Fluke 5520A/SC1100
	(1 to 10) kHz	0.28 mV/V + 8.8 mV	
	(10 to 20) kHz	2.5 mV/V + 5 mV	
	(20 to 50) kHz	2.5 mV/V + 7.2 mV	
	(50 to 100) kHz	4.5 mV/V + 48 mV	
AC Volts, Source (330 to 1000) V	45 Hz to 1 kHz	0.68 mV/V + 18 mV	Fluke 5520A/SC1100
	(1 to 5) kHz	0.38 mV/V + 19 mV	
	(5 to 10) kHz	0.41 mV/V + 19 mV	
DC Voltage, Measure	(0 to 100) mV	0.0035 µV/mV + 2.1 µV	Agilent 3458A System Multimeter
	(0.1 to 1) V	7 µV/V + 1.8 µV	
	(1 to 10) V	7.8 µV/V + 2.7 µV	
	(10 to 100) V	9.7 µV/V + 72 µV	
	(100 to 1000) V	22 µV/V + 240 µV	
	(1000 to 6000) V	0.0091 V/V + 5.4 V	Greenlee 4.5 digit DMM and Fluke 80k-6 HV Probe

AC Voltage, Measure (1 to 100) mV	(1 to 40) Hz	0.066 µV/mV + 4.9 µV	Agilent 3458A System Multimeter
	40 Hz to 1 kHz	0.059 µV/mV + 4 µV	
	(1 to 20) kHz	0.13 µV/mV + 3.4 µV	
	(20 to 50) kHz	0.29 µV/mV + 3.3 µV	
	(50 to 100) kHz	0.77 µV/mV + 6.7 µV	
	(100 to 300) kHz	3.0 µV/mV + 12 µV	
	(0.3 to 1) MHz	20 µV/mV + 64 µV	
	(1 to 4) MHz	40 µV/mV + 77 µV	
	(4 to 8) MHz	40 µV/mV + 87 µV	
	(8 to 10) MHz	150 µV/mV + 100 µV	
AC Voltage, Measure (0.1 to 1) V	(1 to 40) Hz	68 µV/V + 44 µV	Agilent 3458A System Multimeter
	40 Hz to 1 kHz	68 µV/V + 23 µV	
	(1 to 20) kHz	140 µV/V + 21 µV	
	(20 to 50) kHz	300 µV/V + 24 µV	
	(50 to 100) kHz	800 µV/V + 20 µV	
	(100 to 300) kHz	3 mV/V + 0.1 mV	
	(0.3 to 1) MHz	20 mV/V + 0.5 mV	
	(1 to 4) MHz	40 mV/V + 0.7 V	
	(4 to 8) MHz	40 mV/V + 0.8 mV	
	(8 to 10) MHz	150 mV/V + 1 mV	
AC Voltage, Measure (1 to 10) V	(1 to 40) Hz	62 µV/V + 560 µV	Agilent 3458A System Multimeter
	40 Hz to 1 kHz	69 µV/V + 210 µV	
	(1 to 20) kHz	140 µV/V + 210 µV	
	(20 to 50) kHz	300 µV/V + 210 µV	
	(50 to 100) kHz	800 µV/V + 210 µV	
	(100 to 300) kHz	3 mV/V + 1 mV	
AC Voltage, Measure (1 to 10) V	(0.3 to 1) MHz	20 mV/V + 5 mV	Agilent 3458A System Multimeter
	(1 to 4) MHz	40 mV/V + 7 mV	
	(4 to 8) MHz	40 mV/V + 8 mV	
	(8 to 10) MHz	150 mV/V + 10 mV	
AC Voltage, Measure (10 to 100) V	(1 to 40) Hz	0.2 mV/V + 4.3 mV	Agilent 3458A System Multimeter
	40 Hz to 1 kHz	0.2 mV/V + 2.2 mV	
	(1 to 20) kHz	0.2 mV/V + 2.1 mV	
	(20 to 50) kHz	0.34 mV/V + 2.9 mV	

	(50 to 100) kHz	1.2 mV/V + 2.1 mV	
	(100 to 300) kHz	4 mV/V + 10 mV	
	(0.3 to 1) MHz	15 mV/V + 10 mV	
AC Voltage, Measure (100 to 1000) V	(1 to 40) Hz	0.4 mV/V + 41 mV	Agilent 3458A System Multimeter
	40 Hz to 1 kHz	0.4 mV/V + 22 mV	
	(1 to 20) kHz	0.6 mV/V + 21 mV	
	(20 to 50) kHz	1.2 mV/V + 21 mV	
	(50 to 100) kHz	3 mV/V + 20 mV	
AC Voltage, Measure (1000 to 3000) V	(45 to 500) Hz	0.02 V/V + 0.29 V	Greenlee 4.5 digit DMM and Fluke 80k-6 HV Probe
Millivolt Thermocouple Simulation Type B	(600 to 800) °C	0.47 °C	Fluke 5520A/SC1100
	(800 to 1000) °C	0.38 °C	
	(1000 to 1550) °C	0.34 °C	
	(1550 to 1820) °C	0.37 °C	
Type C	(0 to 150) °C	0.31 °C	Fluke 5520A/SC1100
	(150 to 650) °C	0.27 °C	
	(650 to 1000) °C	0.32 °C	
	(1000 to 1800) °C	0.51 °C	
	(1800 to 2316) °C	0.84 °C	
Type E	(-250 to -100) °C	0.5 °C	Fluke 5520A/SC1100
	(-100 to -25) °C	0.16 °C	
	(-25 to 350) °C	0.14 °C	
	(350 to 650) °C	0.16 °C	
	(650 to 1000) °C	0.21 °C	
Type J	(-210 to -100) °C	0.27 °C	Fluke 5520A/SC1100
	(-100 to -30) °C	0.16 °C	
	(-30 to 150) °C	0.14 °C	
	(150 to 760) °C	0.17 °C	
	(760 to 1200) °C	0.23 °C	

Type K	(-200 to -100) °C	0.33 °C	Fluke 5520A/SC1100
	(-100 to -25) °C	0.18 °C	
	(-25 to 120) °C	0.16 °C	
	(120 to 1000) °C	0.26 °C	
	(1000 to 1372) °C	0.4 °C	
Type N	(-200 to -100) °C	0.4 °C	Fluke 5520A/SC1100
	(-100 to -25) °C	0.22 °C	
	(-25 to 120) °C	0.19 °C	
	(120 to 410) °C	0.18 °C	
	(410 to 1300) °C	0.27 °C	
Type R	(0 to 250) °C	0.6 °C	Fluke 5520A/SC1100
	(250 to 400) °C	0.4 °C	
	(400 to 1000) °C	0.39 °C	
	(1000 to 1767) °C	0.45 °C	
Type S	(0 to 250) °C	0.51 °C	Fluke 5520A/SC1100
	(250 to 400) °C	0.41 °C	
	(400 to 1000) °C	0.42 °C	
	(1000 to 1767) °C	0.5 °C	
Type T	(-250 to -150) °C	0.63 °C	Fluke 5520A/SC1100
	(-150 to 0) °C	0.24 °C	
	(0 to 120) °C	0.16 °C	
	(120 to 400) °C	0.14 °C	

Electrical – Resistance

Calibration Parameter/Equipment [1]	Range	Calibration and Measurement Capability(+/-)	Remarks
Resistance Source	(0 to 11) Ω	9.1 μΩ/Ω + 990 μΩ	Fluke 5520A/SC1100
	(11 to 33) Ω	16 μΩ/Ω + 1.4 mΩ	
	(33 to 110) Ω	21 μΩ/Ω + 1.1 mΩ	
	(110 to 330) Ω	25 μΩ/Ω + 1.2 mΩ	
	(330 to 1100) Ω	27 μΩ/Ω + 0.0017 Ω	
	(1.1 to 3.3) kΩ	23 μΩ/Ω + 0.024 Ω	
	(3.3 to 11) kΩ	25 μΩ/Ω + 0.05 Ω	
	(11 to 33) kΩ	23 μΩ/Ω + 0.24 Ω	
	(33 to 110) kΩ	25 μΩ/Ω + 0.5 Ω	

Calibration Parameter/Equipment [1]	Range	Calibration and Measurement Capability(+/-)	Remarks
	(110 to 330) kΩ	29 μΩ/Ω + 1.3 Ω	
	(0.33 to 1.1) MΩ	32 μΩ/Ω + 1.9 Ω	
	(1.1 to 3.3) MΩ	77 μΩ/Ω + 1.3 Ω	
	(3.3 to 11) MΩ	140 μΩ/Ω + 4.4 Ω	
	(11 to 33) MΩ	260 μΩ/Ω + 1.3 kΩ	
	(33 to 110) MΩ	530 μΩ/Ω + 760 Ω	
	(110 to 330) MΩ	3.1 mΩ/Ω + 3.7 kΩ	
	(330 to 1100) MΩ	15 mΩ/Ω + 1.9 kΩ	
Resistance Measure	(0 to 10) Ω	13 μΩ/Ω + 79 μΩ	Agilent 3458A System Multimeter
	(10 to 100) Ω	11 μΩ/Ω + 700 μΩ	
	(0.1 to 1) kΩ	0.01 mΩ/Ω + 0.95 mΩ	
	(1 to 10) kΩ	0.01 mΩ/Ω + 9.6 mΩ	
	(10 to 100) kΩ	0.01 mΩ/Ω + 130 mΩ	
	(0.1 to 1) MΩ	15 Ω/MΩ + 3.6 Ω	
	(1 to 10) MΩ	79 Ω/MΩ + 75 Ω	
	(10 to 100) MΩ	0.5 kΩ/MΩ + 1.5 kΩ	
	(100 to 1000) MΩ	5 kΩ/MΩ + 14 kΩ	
Resistance RTD Simulation Cu 427, 10 Ω	(-100 to 260) °C	0.3 °C	Fluke 5520A/SC1100
Resistance RTD Simulation PtNi 385, 120 Ω	(-80 to 0) °C	0.081 °C	Fluke 5520A/SC1100
	(0 to 100) °C	0.081 °C	
	(100 to 260) °C	0.14 °C	
Resistance RTD Simulation Pt 3916, 100 Ω	(-200 to -190) °C	0.25 °C	Fluke 5520A/SC1100
	(-190 to -80) °C	0.041 °C	
	(-80 to 0) °C	0.051 °C	
	(0 to 100) °C	0.061 °C	
	(100 to 260) °C	0.071 °C	
	(260 to 300) °C	0.08 °C	
	(300 to 400) °C	0.09 °C	
	(400 to 600) °C	0.1 °C	
	(600 to 630) °C	0.23 °C	

Resistance RTD Simulation Pt 3926, 100 Ω	(-200 to -80) °C	0.051 °C	Fluke 5520A/SC1100
	(-80 to 0) °C	0.051 °C	
	(0 to 100) °C	0.071 °C	
	(100 to 300) °C	0.09 °C	
	(300 to 400) °C	0.1 °C	
	(400 to 630) °C	0.12 °C	
Resistance RTD Simulation Pt 385, 200 Ω	(-200 to -80) °C	0.043 °C	Fluke 5520A/SC1100
	(-80 to 0) °C	0.043 °C	
	(0 to 100) °C	0.043 °C	
	(100 to 260) °C	0.053 °C	
	(260 to 300) °C	0.12 °C	
	(300 to 400) °C	0.13 °C	
	(400 to 600) °C	0.14 °C	
	(600 to 630) °C	0.16 °C	
Resistance RTD Simulation Pt 385, 500 Ω	(-200 to -80) °C	0.056 °C	Fluke 5520A/SC1100
	(-80 to 0) °C	0.064 °C	
	(0 to 100) °C	0.064 °C	
	(100 to 260) °C	0.072 °C	
	(260 to 300) °C	0.089 °C	
	(300 to 400) °C	0.089 °C	
	(400 to 600) °C	0.098 °C	
	(600 to 630) °C	0.12 °C	
Resistance RTD Simulation Pt 385, 1000 Ω	(-200 to -80) °C	0.08 °C	Fluke 5520A/SC1100
	(-80 to 0) °C	0.08 °C	
	(0 to 100) °C	0.084 °C	
	(100 to 260) °C	0.089 °C	
	(260 to 300) °C	0.095 °C	
	(300 to 400) °C	0.1 °C	
	(400 to 600) °C	0.1 °C	
	(600 to 630) °C	0.24 °C	

Resistance RTD Simulation Pt 395, 100 Ω	(-200 to -80) °C	0.051 °C	Fluke 5520A/SC1100
	(-80 to 0) °C	0.051 °C	
	(0 to 100) °C	0.071 °C	
	(100 to 300) °C	0.09 °C	
	(300 to 400) °C	0.1 °C	
	(400 to 630) °C	0.12 °C	
	(630 to 800) °C	0.23 °C	

Electrical – Current

Calibration Parameter/Equipment [1]	Range	Calibration and Measurement Capability(+/-)	Remarks
DC Current, Source	(0 to 330) µA	0.15 nA/µA + 20 nA	Fluke 5520A/SC1100
	(0.3 to 3.3) mA	99 nA/µA + 54 nA	
	(3.3 to 33) mA	99 nA/µA + 290 nA	
	(33 to 330) mA	0.099 µA/mA + 2.9 µA	
	(0.33 to 1.1) A	200 µA/A + 44 µA	
	(1.1 to 3) A	380 µA/A + 45 µA	
	(3 to 11) A	490 µA/A + 620 µA	
	(11 to 20) A	0.99 mA/A + 1 mA	
	(50 to 150) A	19 mA/A + 2.2 mA	Fluke 5520A/SC1100 50 turn coil
	(150 to 550) A	24 mA/A + 35 mA	
	(550 to 1000) A	47 mA/A + 150 mA	
AC Current, Source (30 to 330) µA	(10 to 20) Hz	2.1 nA/µA + 420 nA	Fluke 5520A/SC1100
	(20 to 45) Hz	1.5 nA/µA + 430 nA	
	45 Hz to 1 kHz	1 nA/µA + 430 nA	
	(1 to 5) kHz	1.3 nA/µA + 5.2 µA	
	(5 to 10) kHz	5.2 nA/µA + 5 µA	
	(10 to 30) kHz	2.3 nA/µA + 35 µA	
AC Current, Source (0.33 to 3.3) mA	(10 to 20) Hz	2.3 µA/mA+ 0.98 µA	Fluke 5520A/SC1100
	(20 to 45) Hz	1.3 µA/mA+ 0.97 µA	
	45 Hz to 1 kHz	0.89 µA/mA+ 0.93 µA	
	(1 to 5) kHz	4 µA/mA + 3.8 µA	
	(5 to 10) kHz	9.2 µA/mA + 2.8 µA	
	(10 to 30) kHz	8.7 µA/mA + 29 µA	

Calibration Parameter/Equipment [1]	Range	Calibration and Measurement Capability(+/-)	Remarks
AC Current, Source (3.3 to 33) mA	(10 to 20) Hz	2.2 µA/mA + 4.5 µA	Fluke 5520A/SC1100
	(20 to 45) Hz	0.97 µA/mA + 4.1 µA	
	45 Hz to 1 kHz	0.69 µA/mA + 4.8 µA	
	(1 to 5) kHz	2.6 µA/mA + 4.9 µA	
	(5 to 10) kHz	6 µA/mA + 5.1 µA	
	(10 to 30) kHz	9 µA/mA + 9.8 µA	
AC Current, Source (33 to 330) mA	(10 to 20) Hz	2.2 µA/mA + 45 µA	Fluke 5520A/SC1100
	(20 to 45) Hz	0.98 µA/mA + 41 µA	
	45 Hz to 1 kHz	0.41 µA/mA + 44 µA	
	(1 to 5) kHz	1 µA/mA + 63 µA	
	(5 to 10) kHz	2.2 µA/mA + 110 µA	
	(10 to 30) kHz	6.3 µA/mA + 170 µA	
AC Current, Source (0.33 to 1.1) A	(10 to 45) Hz	1.7 mA/A + 1.7 mA	Fluke 5520A/SC1100
	45 Hz to 1 kHz	0.31 mA/A + 2 mA	
	(1 to 5) kHz	9.8 mA/A + 1.5 mA	
	(5 to 10) kHz	27 mA/A + 8.3 mA	
AC Current, Source (1.1 to 3) A	(10 to 45) Hz	2.3 mA/A + 1.1 mA	Fluke 5520A/SC1100
	45 Hz to 1 kHz	0.58 mA/A + 1.7 mA	
	(1 to 5) kHz	10 mA/A + 1.1 mA	
	(5 to 10) kHz	30 mA/A + 6.1 mA	
AC Current, Source (3 to 11) A	(45 to 100) Hz	1.7 mA/A + 3.3 mA	Fluke 5520A/SC1100
	100 Hz to 1 kHz	1.3 mA/A + 3.4 mA	
	(1 to 5) kHz	31 mA/A + 3 mA	
AC Current, Source (11 to 20) A	(45 to 100) Hz	2 mA/A + 5.3 mA	Fluke 5520A/SC1100
	100 Hz to 1 kHz	1.7 mA/A + 6 mA	
	(1 to 5) kHz	31 mA/A + 6.6 mA	
AC Current, Source (50 to 150) A	45 Hz to 1 kHz	18 mA/A + 190 mA	Fluke 5520A/SC1100 50 turn coil
AC Current, Source (150 to 550) A	(45 to 100) Hz	85 mA/A + 190 mA	Fluke 5520A/SC1100 50 turn coil
	100 Hz to 1 kHz	62 mA/A + 200 mA	
AC Current, Source (550 to 1000) A	(45 to 100) Hz	99 mA/A + 320 mA	Fluke 5520A/SC1100 50 turn coil
	100 Hz to 1 kHz	83 mA/A + 360 mA	

DC Current, Measure	(0 to 10) µA	0.0071 nA/µA + 0.67 nA	Agilent 3458A System Multimeter
	(10 to 100) µA	0.019 nA/µA + 0.99 nA	
	(100 to 1000) µA	0.018 nA/µA + 7.5 nA	
	(1 to 10) mA	18 nA/mA + 76 nA	
	(10 to 100) mA	0.034 µA/mA + 0.69 µA	
	(100 to 1000) mA	0.11 µA/mA + 16 µA	
	(1 to 5) A	0.001 A	Agilent 3458A System Multimeter and Current Shunt
	(5 to 10) A	0.002 A	
	(10 to 50) A	0.01 A	
	(50 to 100) A	0.02 A	
	(100 to 150) A	0.03 A	
AC Current, Measure (0 to 100) µA	(10 to 20) Hz	4 nA/µA + 31 nA	Agilent 3458A System Multimeter
	(20 to 45) Hz	1.5 nA/µA + 31 nA	
	(45 to 100) Hz	0.59 nA/µA + 32 nA	
	100 Hz to 5 kHz	0.59 nA/µA + 32 nA	
AC Current, Measure (0.1 to 1) mA	(10 to 20) Hz	4 µA/mA + 0.2 µA	Agilent 3458A System Multimeter
	(20 to 45) Hz	1.5 µA/mA + 0.2 µA	
	(45 to 100) Hz	0.6 µA/mA + 0.2 µA	
	100 Hz to 5 kHz	0.3 µA/mA + 0.21 µA	
	(5 to 20) kHz	0.6 µA/mA + 0.2 µA	
	(20 to 50) kHz	4 µA/mA + 0.4 µA	
	(50 to 100) kHz	5.5 µA/mA + 1.5 µA	
AC Current, Measure (1 to 10) mA	(10 to 20) Hz	4 µA/mA + 2 µA	Agilent 3458A System Multimeter
	(20 to 45) Hz	1.5 µA/mA + 2 µA	
	(45 to 100) Hz	0.6 µA/mA + 2.1 µA	
	100 Hz to 5 kHz	0.3 µA/mA + 2.1 µA	
	(5 to 20) kHz	0.6 µA/mA + 2.1 µA	
	(20 to 50) kHz	4 µA/mA + 4 µA	
	(50 to 100) kHz	5.5 µA/mA + 15 µA	
AC Current, Measure (10 to 100) mA	(10 to 20) Hz	4 µA/mA + 20 µA	Agilent 3458A System Multimeter
	(20 to 45) Hz	1.5 µA/mA + 21 µA	
	(45 to 100) Hz	0.6 µA/mA + 21 µA	
	100 Hz to 5 kHz	0.3 µA/mA + 21 µA	
	(5 to 20) kHz	0.6 µA/mA + 21 µA	

	(20 to 50) kHz	4 µA/mA + 40 µA	
	(50 to 100) kHz	5.5 µA/mA + 150 µA	
AC Current, Measure (100 to 1000) mA	(10 to 20) Hz	4 µA/mA + 200 µA	Agilent 3458A System Multimeter
	(20 to 45) Hz	1.6 µA/mA + 210 µA	
	(45 to 100) Hz	0.8 µA/mA + 210 µA	
	100 Hz to 5 kHz	1 µA/mA + 210 µA	
	(5 to 20) kHz	3 µA/mA + 200 µA	
	(20 to 50) kHz	10 µA/mA + 400 µA	
AC Current, Measure (1 to 5) A	(45 to 400) Hz	0.0012 A	Agilent 3458A System Multimeter and Current Shunt
AC Current, Measure (5 to 10) A	(45 to 400) Hz	0.0024 A	Agilent 3458A System Multimeter and Current Shunt
AC Current, Measure (10 to 50) A	(45 to 400) Hz	0.012 A	Agilent 3458A System Multimeter and Current Shunt
AC Current, Measure (50 to 100) A	(45 to 400) Hz	0.024 A	Agilent 3458A System Multimeter and Current Shunt
AC Current, Measure (100 to 150) A	(45 to 400) Hz	0.036 A	Agilent 3458A System Multimeter and Current Shunt

Electrical – Power

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-)	Remarks
DC Power, Source	(0 to 336) W	0.04 % of output	Fluke 5520A/SC1100
	(336 to 3060) W	0.054 % of output	
	(3060 to 20 910) W	0.13 % of output	
AC Power, Source (45 to 65) Hz	(0.11 to 3) mW	0.19 % of output	Fluke 5520A/SC1100
	(3 to 11) mW	0.14 % of output	
	(11 to 30) mW	0.17 % of output	
	(30 to 110) mW	0.12 % of output	
	(110 to 300) mW	0.29 % of output	
	(0.3 to 0.73) W	0.18 % of output	
	(0.73 to 1.5) W	0.28 % of output	
	(1.5 to 6.8) W	0.26 % of output	
	(6.8 to 9.2) W	0.19 % of output	

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-)	Remarks
	(9.2 to 34) W	0.14 % of output	
	(34 to 92) W	0.17 % of output	
	(92 to 337) W	0.12 % of output	
	(337 to 918) W	0.29 % of output	
	(918 to 2244))W	0.18 % of output	
	(2244 to 4590) W	0.28 % of output	
	(4590 to 20 910) W	0.26 % of output	

Electrical – Capacitance

Calibration Parameter/Equipment [1]	Range	Calibration and Measurement Capability(+/-)	Remarks
Capacitance, Source	(0.19 to 0.4) nF	0.014 nF	Fluke 5520A/SC1100
	(0.4 to 1.1) nF	0.015 nF	
	(1.1 to 3.3) nF	0.016 nF	
	(3.3 to 11) nF	0.017 nF	
	(11 to 33) nF	0.11 nF	
	(33 to 110) nF	0.14 nF	
	(110 to 330) nF	0.42 nF	
	(0.33 to 1.1) µF	1.4 nF	
	(1.1 to 3.3) µF	4.2 nF	
	(3.3 to 11) µF	14 nF	
	(11 to 33) µF	46 nF	
	(33 to 110) µF	190 nF	
	(110 to 330) µF	550 nF	
	(0.33 to 1.1) mF	1.6 µF	
	(1.1 to 3.3) mF	4.4 µF	
	(3.3 to 11) mF	15 µF	
	(11 to 33) mF	53 µF	
	(33 to 110) mF	210 µF	

Time and Frequency – Oscilloscopes

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-)	Remarks
DC Voltage, Source [1] Oscilloscopes into 50 Ω	(0 to 25) mV	100 µV	Fluke 5520A/SC1100
	(25 to 110) mV	330 µV	
	(0.11 to 2.2) V	5.5 mV	
	(2.2 to 6.6) V	17 mV	
DC Voltage, Source [1] Oscilloscopes into 1M Ω	(0 to 25) mV	54 µV	Fluke 5520A/SC1100
	(25 to 110) mV	54 µV	
	(0.11 to 2.2) V	1.2 mV	
	(2.2 to 11) V	5.7 mV	
	(11 to 130) V	90 mV	
Square Wave, Source [1] Oscilloscopes into 50 Ω	(0 to 25) mV	100 µV	Fluke 5520A/SC1100
	(25 to 110) mV	330 µV	
	(0.11 to 2.2) V	5.5 mV	
	(2.2 to 6.6) V	17 mV	
Square Wave, Source [1] Oscilloscopes into 1M Ω	(0 to 25) mV	66 µV	Fluke 5520A/SC1100
	(25 to 110) mV	170 µV	
	(0.11 to 2.2) V	2.3 mV	
	(2.2 to 11) V	11 mV	
	(11 to 130) V	140 mV	
Leveled Sine Wave Amplitude 50 kHz (reference)	5 mV to 5.5 V	22 mV/V + 21 µV	Fluke 5520A/SC1100
Leveled Sine Wave Amplitude 50 kHz to 100 MHz	5 mV to 5.5 V	36 mV/V + 13 µV	Fluke 5520A/SC1100
Leveled Sine Wave Amplitude (100 to 300) MHz	5 mV to 5.5 V	41 mV/V + 11 µV	Fluke 5520A/SC1100
Leveled Sine Wave Amplitude (300 to 600) MHz	5 mV to 5.5 V	61 mV/V + 7.9 µV	Fluke 5520A/SC1100
Leveled Sine Wave Amplitude (600 to 1100) MHz	5 mV to 3.5 V	71 mV/V + 6.7 µV	Fluke 5520A/SC1100
Leveled Sine Wave Flatness Relative to 50 kHz 50 kHz to 100 MHz	5 mV to 5.5 V	20 mV/V + 3 µV	Fluke 5520A/SC1100

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-)	Remarks
Leveled Sine Wave Flatness Relative to 50 kHz (100 to 300) MHz	5 mV to 5.5 V	24 mV/V + 2 µV	Fluke 5520A/SC1100
Leveled Sine Wave Flatness Relative to 50 kHz (300 to 600) MHz	5 mV to 5.5 V	42 mV/V + 1 µV	Fluke 5520A/SC1100
Leveled Sine Wave Flatness Relative to 50 kHz (600 to 1100) MHz	5 mV to 3.5 V	52 mV/V + 3 µV	Fluke 5520A/SC1100
Level Sine Wave Frequency	50 kHz to 1100 MHZ	2.7 Hz / 1 MHz	Fluke 5520A/SC1100
Leading Edge Risetime [1]	5 mV to 2.5 V	320 ps	Fluke 5520A/SC1100
Time Markers [1]	1 ns to 20 ms	2.7 ps/s	Fluke 5520A/SC1100
	50 ms	3.8 µs	
	0.1 s	13 µs	
	0.2 s	45 µs	
	0.5 s	260 µs	
	1 s	1 ms	
	2 s	4.1 ms	
	5 s	25 ms	

Time and Frequency – Time Dissemination

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-)	Remarks
Stopwatches and Timers	(0 to 3) h	0.04 s	Frequency Counter

Thermodynamic – Humidity

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-)	Remarks
Humidity Source	(10 to 90) % RH	3.1 % RH	Saturated Salts & Thermohygrometer

Thermodynamic – Thermometers and Probes

Calibration Parameter/Equipment	Range	Calibration and Measurement Capability(+/-)	Remarks
Temperature Generate	(-40 to 260) °C	0.11 °C	Temperature Bath & SPRT
	(50 to 600) °C	1.2 °C	Drywell calibrator & SPRT

Calibration and Measurement Capability (CMC) represents expanded uncertainties at approximately a 95% confidence level using a coverage factor of k=2.

Notes:

1) Laboratory offers calibration services at the laboratory's own facilities and at the client or other agreed upon facilities.
2) *L* = Length in inches, *D* = Diameter in inches, *PD* = Pitch Diameter in inches, *H* = Height in inches

Approved by: _____ Date: July 10, 2013

R. Douglas Leonard
Chief Technical Officer

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