



Laboratory  
Accreditation  
Bureau

Certificate of Accreditation

ISO/IEC 17025:2005

Certificate Number L2222

Indiana Standards Laboratory  
2919 Shelby Street  
Indiana Standards Laboratory

has met the requirements set forth in L-A-B's policies and procedures, and all requirements of ISO/IEC 17025:2005  
"General Requirements for the competence of Testing and Calibration Laboratories." 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 January 2009).

Accreditation valid through October 31, 2012

R. Douglas Leonard, Jr., Managing Director  
Laboratory Accreditation Bureau

\*Laboratory Accreditation Bureau is found to be in compliance with ISO/IEC 17011:2004 and recognized by ILAC (International Laboratory Accreditation Cooperation) and NACLA (National Cooperation for Laboratory Accreditation).

# Scope of Accreditation For Indiana Standards Laboratory

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In recognition of a successful assessment to ISO/IEC 17025:2005, accreditation is granted to **Indiana Standards Laboratory** to perform the following Calibrations:

Accreditation granted through: **October 31, 2012**

## Calibration

### Length - Dimensional Metrology – Hand Tools and Precision Gages 1D

Calibration Parameter/Equipment	Range	Best Measurement Capability (+/-) <sup>2</sup>	Remarks
Calipers & Linear Scales <sup>1</sup>	0 mm to 304.8 mm	(11 + 0.011 L) μm	Gage Block
	(304.8 to 1 524) mm	(11 + 0.022L) μm	
Tape Measures	Up to 30.48 m	(1.5 + 0.000 15L) mm	Steel Rule
Height Gages	0 mm to 610 mm	(23 + 0.009 3L) μm	Gage Block Surface Plate
Height Master & Riser Block	0 mm to 304.8 mm	(7.1 + 0.013L) μm	Gage Block
Indicators, Digital, Dial & Test <sup>1</sup>	0 mm to 101.6 mm	(2 + 0.004 3L) μm	Gage Block
Micrometers <sup>1</sup> , Inside, Outside, Depth, Bore Gages	25.4 mm to 101.6 mm	(1.4 + 0.014L) μm	Gage Block
	101.6 mm to 508 mm	(1.3 + 0.025L) μm	
Anvil/Spindle Flatness	Flatness	0.36 μm	Optical Flat Helium Light
Anvil/Spindle Parallelism	Parallelism	0.43 μm	Optical Flat Helium Light

**Length - Dimensional Metrology – Hand Tools and Precision Gages 2D**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Bubble Levels Level Vial Setting Vial Sensitivity	50 mm to 609.6 mm	3.81 $\mu$ m	Gage Block Surface Plate
Digital Protractors & Inclinometers	0 ° to 90 °	0.036 °	Gage Block Surface Plate Sine Bar
Measuring Microscopes <sup>1</sup> Linear Scale Angle	0 mm to 101.6 mm 0 ° to 90 °	5.08 $\mu$ m 2.6 min	Gage Blocks Angle Blocks
Optical Comparators <sup>1</sup> Linear Scale Angular Scales	0 mm to 254 mm 90 °	4.064 $\mu$ m 36 s	Linear Scale Angle Block

**Length - Dimensional Metrology – Artifacts and Standards 1D**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Cylindrical Pins, Plugs & Thread Wires	(0.127 to 101.6) mm	(0.94 + 0.0075 <i>L</i> ) $\mu$ m	ULM Grade 0 Gage Blocks
End Measuring Rods (Micrometer Standards)	25.4 mm to 304.8 mm	(0.93 + (0.002 7 <i>L</i> ) $\mu$ m	Master Blocks Test Indicator
Thickness Gages	(0.025 4 to 1.270) mm	(11 + 0.022 <i>L</i> ) $\mu$ m	ULM
Steel Rules	Up to 914.4 mm	(0.27 + 0.000 14 <i>L</i> ) mm	Steel Rule
Gage Blocks	2.54 mm to 101.6 mm	(0.091 + (0.001 8 <i>L</i> ) $\mu$ m	Comparator Grade 0 Blocks
	125 mm to 500 mm	(1.7 + (0.002 <i>L</i> ) $\mu$ m	Test Indicator Master Blocks
Plain Ring Gages	Up to 50.8 mm	(1.2 + 0.000 064 <i>L</i> ) $\mu$ m	ULM Master Ring
	50.8 mm to 101.6 mm	(1.2 + 0.000 34 <i>L</i> ) $\mu$ m	
	(101.6 to 203.2) mm	(1.3 + 0.000 59 <i>L</i> ) $\mu$ m	

**Length - Dimensional Metrology – Artifacts and Standards 2D**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Radius Gages	(0.396 24 to 25.4) mm	0.050 8 mm	Measuring Microscope Master Radius Gages

**Length - Dimensional Metrology – Other**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Profilometers <sup>1</sup> & Surface Roughness Testers <sup>1</sup>	16 Ra 119 Ra	0.104 1 μm	Roughness Standard
Thread Plug Gages Pitch Diameter	Up to 101.6 mm	(1.8 + 0.008 9 L) μm	ULM Gage Block Thread Wires
Major Diameter	Up to 101.6 mm	(0.72 + 0.005 5 L) μm	

**Mass – Scale and Balances**

Calibration Parameter/Equipment <sup>1</sup>	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Precision Balances (Resolution 0.1 mg)	0 g to 205 g	0.35 mg	Standard Mass
Analytical Balances (Resolution 1 mg) (Resolution 10 mg)	0 g to 500 g	0.8 mg	Standard Mass
	0 g to 3 200 g	8.1 mg	
Bench Scales (Resolution 0.1 g)	0 g to 32 kg	69 mg	Standard Mass
Floor Scales (Resolution 400 g)	0 g to 907 kg	100 g	Standard Mass

**Mass – Pressure**

Calibration Parameter/Equipment <sup>1</sup>	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Pressure-Pneumatic Gage and Absolute Gage Only	18 psia to 1 000 psia	0.002 3 % of reading	Ruska 2465 or Transducers <sup>1</sup>
	124.1 kPa to 6 894.7 kPa		
	0.2 psia to 18.2 psia	(0.003 1 + (-4.49 X 10 <sup>-5</sup> psi)) %	
	1.37 kPa to 124.1 kPa		
Pressure, Hydraulic Gage	1 000 psi to 15 000 psi	0.006 7 % of reading	Ruska 2485 or Portable Dead Weight Tester <sup>1</sup>
	6.894 MPa to 103.42 MPa		
Manometers	0 Pa to 4 981 Pa (0 mmH <sub>2</sub> O to 508 mmH <sub>2</sub> O)	0.7 Pa (0.003 inH <sub>2</sub> O)	Meriam Micromanometer
	0 Pa to 498 Pa (0 inH <sub>2</sub> O to 2 inH <sub>2</sub> O)	0.35 Pa (0.001 4 inH <sub>2</sub> O)	Dwyer Microtector

**Mass – Vacuum**

Calibration Parameter/Equipment <sup>1</sup>	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Vacuum	0.001 torr to 10 torr	0.016 torr	Capacitance Manometer High Vacuum Pump Diffusion Pump

**Mass – Torque**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Torque Analyzers	0 Nm to 1 356 Nm (0 lbf-ft to 1 000 lbf-ft)	0.036 % of range	Torque Arm Weights
Torque Wrenches <sup>1</sup>	0.05 Nm to 5.6 Nm (0.5 lbf-in to 50 lbf-in )	0.02 Nm (0.21 lbf-in)	Torque Calibrator
	5.6 Nm to 28 Nm (50 lbf-in to 250 lbf-in)	0.12 Nm (1 lbf-in)	
	28 Nm to 112 Nm (21 lbf-ft to 83 lbf-ft)	0.48 Nm (0.35 lbf-ft)	
	113 Nm to 339 Nm (83 lbf-ft to 250 lbf-ft)	1.46 Nm (1.1 lbf-ft)	
	339 Nm to 1 356 Nm (250 lbf-ft to 1 000 lbf-ft)	5.64 Nm (4.2 lbf-ft)	
Torque Watches <sup>1</sup>	2 Nm to 17 Nm (0.5 ozf-in to 2.5 ozf-in)	0.42 Nm (0.059 ozf-in)	Torque Watch Calibrator
	8 Nm to 70 Nm (2 ozf-in to 10 ozf-in)	0.64 Nm (0.091 ozf-in)	
	42 Nm to 303 Nm (6 ozf-in to 43 ozf-in)	1.56 Nm (0.22 ozf-in)	
	211 Nm to 1 518 Nm (30 ozf-in to 215 ozf-in)	6.76 Nm (0.96 ozf-in)	

**Mass – Force**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Force	9.8 mN to 4 452 mN	0.018 mN + 0.000 18 mN / mN	Dead Weight
	4.44 N to 2 224 N	7.4 mN + 0.12 mN / N	
	1.45 kN to 22.24 kN	7.82 N	5 000 lb Proving Ring
	5 kN to 89 kN	0.04 kN	20 000 lb Proving Ring
	8.5 kN to 222 kN	0.10 kN	50 000 lb Proving Ring
	39 kN to 445 kN	0.17 kN	100 000 lb Proving Ring

**Mass – Hardness**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Durometers Type A, B, E, M & O  Type C, D, & DO		0.026 N	Weights Equal Arm Balance
	0 % to 100 %	0.056 N	

**Mass – Flow**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Air Speed Velocity	1.5 m/s to 15.4 m/s	0.025 m/s / m/s	Pitot Tube Manometer
Gas Flow <sup>1</sup>	30 L/m to 400 L/m	0.2 L/m + 0.002 7 L/m / L/m	Bell Prover
	0.1 L/m to 35 L/m	0.002 L/m + 0.001 3 L/m / L/m	Piston Prover
	0 cm <sup>3</sup> /m to 100 cm <sup>3</sup> /m	0.42 cm <sup>3</sup> /m + 0.009 8 cm <sup>3</sup> /m / cm <sup>3</sup> /m	
Liquid Flow <sup>1</sup>	1 L/m to 190 L/m	0.001 4 L/m + 0.006 2 L/m / L/m	Turbine Flowmeter

**Mass – Mass Standards**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Weights	0 g to 3 g	7.2 μg + 0.003 5 μg / mg	Mettler M3 Balance Class 3 Weights
	0 g to 200 g	0.027 mg + 0.000 82 mg / g	Mettler H51 Balance Class 3 Weights
	0 g to 210 g	0.046 mg + 0.000 77 mg / g	Sartorius BP2100 Balance Class 3 Weights
	0 g to 5 000 g	0.83 mg + 0.000 65 mg / g	Voland Scale Class 3 Weights
	0 g to 32 500 g	57 mg + 0.000 38 mg/g	Sartorius F32000S Scale Class 3 Weights

**Mass – Viscosity**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Viscometers	< 10 Cp	0.3 % of reading	Viscosity Standard Thermometer Water Bath
	10 Cp to 100 Cp	0.46 % of reading	
	100 Cp to 1 000 Cp	0.5 % of reading	
	1 000 Cp to 10 000 Cp	0.68 % of reading	
	10 000 Cp to 100 000 Cp	0.71 % of reading	
Viscosity Cups	<10 cSt	0.98 % of reading	Viscosity Standard Thermometer Water Bath Stop Watch
	10 cSt to 100 cSt	1.7 % of reading	
	100 cSt to 1 000 cSt	1.7 % of reading	

**Electricity and Magnetism – Voltage**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
AC Voltage (Source) <sup>1</sup>	1 mV 50 Hz to 1 kHz	0.25 % of reading	Ratio Transformer
	10 mV 50 Hz to 1 kHz	120 $\mu$ V/V	
	100 mV 50 Hz to 1 kHz	46 $\mu$ V/V	
	100 mV 1 kHz to 20 kHz	0.035 %	Fluke 5200A
	100 mV 20 kHz to 100 kHz	0.081 %	
	0.25 V to 0.5 V 10 Hz to 1 MHz (min)	66 $\mu$ V/V	Holt 6A Thermal Transfer Standard
	0.25 V to 0.5 V 10 Hz to 1 MHz (max)	310 $\mu$ V/V	
	0.5 V to 1 V; 10 Hz to 1 MHz (min)	35 $\mu$ V/V	
0.5 V to 1 V; 10 Hz to 1 MHz (max)	200 $\mu$ V/V		

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
AC Voltage (Source) <sup>1</sup>	1 V to 5 V 10 Hz to 1 MHz (min)	27 $\mu\text{V/V}$	Holt 6A Thermal Transfer Standard
	1 V to 5 V 10 Hz to 1 MHz (max)	200 $\mu\text{V/V}$	
	5 V to 10 V 10 Hz to 1 MHz (min)	26 $\mu\text{V/V}$	
	5 V to 10 V 10 Hz to 1 MHz (max)	200 $\mu\text{V/V}$	
	10 V to 50 V 10 Hz to 200 MHz (min)	26 $\mu\text{V/V}$	
	10 V to 50 V 10 Hz to 200 MHz (max)	100 $\mu\text{V/V}$	
	50 V to 100 V 10 Hz to 100 MHz (min)	29 $\mu\text{V/V}$	
	10 V to 50 V 10 Hz to 100 MHz (max)	56 $\mu\text{V/V}$	
	100 V to 500 V 10 Hz to 50 kHz (min)	28 $\mu\text{V/V}$	
	100 V to 500 V 10 Hz to 50 kHz (max)	100 $\mu\text{V/V}$	
	500 V to 1000 V 10 Hz to 50 kHz (min)	38 $\mu\text{V/V}$	
	500 V to 1000 V 10 Hz to 50 kHz (max)	110 $\mu\text{V/V}$	
AC Voltage (Measure) <sup>1</sup>	1 mV 50 Hz to 1 kHz	0.26 % of reading	Ratio Transformer
	10 mV 50 Hz to 1 kHz	120 $\mu\text{V/V}$	
	100 mV 50 Hz to 1 kHz	49 $\mu\text{V/V}$	
	100 mV 1 kHz to 20 kHz	0.36 % of reading	Fluke 8506A
	100 mV 20 kHz to 50 kHz	0.069 % of reading	
	100 m 50 kHz to 100 kHz	0.23 % of reading	
	0.25 V to 0.5 V 10 Hz to 1 MHz (min)	66 $\mu\text{V/V}$	
	0.25 V to 0.5 V 10 Hz to 1 MHz (max)	310 $\mu\text{V/V}$	Holt 6A Thermal Transfer Standard
	0.5 V to 1 V 10 Hz to 1 MHz (min)	35 $\mu\text{V/V}$	
	0.5 V to 1 V 10 Hz to 1 MHz (max)	200 $\mu\text{V/V}$	
1 V to 5 V 10 Hz to 1 MHz (min)	27 $\mu\text{V/V}$		

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
AC Voltage (Measure) <sup>1</sup>	1 V to 5 V 10 Hz to 1 MHz (max)	200 $\mu\text{V/V}$	Holt 6A Thermal Transfer Standard
	5 V to 10 V 10 Hz to 1 MHz (min)	26 $\mu\text{V/V}$	
	5 V to 10 V 10 Hz to 1 MHz (max)	200 $\mu\text{V/V}$	
	10 V to 50 V 10 Hz to 200 MHz (min)	26 $\mu\text{V/V}$	
	10 V to 50 V 10 Hz to 200 MHz (max)	100 $\mu\text{V/V}$	
	50 V to 100 V 10 Hz to 100 MHz (min)	29 $\mu\text{V/V}$	
	10 V to 50 V 10 Hz to 100 MHz (max)	56 $\mu\text{V/V}$	
	100 V to 500 V 10 Hz to 50 kHz (min)	28 $\mu\text{V/V}$	
	100 V to 500 V 10 Hz to 50 kHz (max)	100 $\mu\text{V/V}$	
	500 V to 1000 V 10 Hz to 50 kHz (min)	38 $\mu\text{V/V}$	
	500 V to 1000 V 10 Hz to 50 kHz (max)	110 $\mu\text{V/V}$	
	AC High Voltage (Source)	0 V to 30 kV	
AC High Voltage (Measure)	0 V to 5 kV	0.34 % of reading	Voltage Divider Voltmeter
	0 V to 30 kV	0.35 % of reading	
	0 V to 200 kV	1.2 % of reading	
DC Voltage (Source) Lab References	10 V	3.5 $\mu\text{V/V}$	Fluke 732A
DC Voltage (Source) <sup>1</sup>	100 $\mu\text{V}$	4 100 $\mu\text{V/V}$	Fluke 732A Kelvin Varley Divider
	1 mV	480 $\mu\text{V/V}$	
	10 mV	50 $\mu\text{V/V}$	

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
DC Voltage (Source) <sup>1</sup>	100 mV	8.9 $\mu$ V/V	Fluke 732A Kelvin Varley Divider
	1 V	6.1 $\mu$ V/V	
	100 V	13 $\mu$ V/V	Fluke 5440B/AF Fluke 750A Reference Fluke 732A
	1000 V	13 $\mu$ V/V	
DC High Voltage (Source)	0 V to 70 kV	0.59 % of reading	Voltmeter Voltage Divider High Voltage Source
DC Voltage (Measure) <sup>(1)</sup>	100 $\mu$ V	4 500 $\mu$ V/V	Kelvin Varley Divider
	1 mV	510 $\mu$ V/V	
	10 mV	53 $\mu$ V/V	
	100 mV	9.1 $\mu$ V/V	
	1 V	6.1 $\mu$ V/V	Fluke 732A Reference Fluke 750A Reference Divider
	10 V	3.5 $\mu$ V/V	
	100 V	13 $\mu$ V/V	
	1000 V	13 $\mu$ V/V	
DC High Voltage (Measure)	0 V to 5 kV	0.13 % of reading	Voltmeter Voltage Divider
	0 V to 30 kV	0.044 % of reading	
	0 V to 100 kV	0.1 % of reading	
	0 V to 200 kV	0.7 % of reading	

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
DC Ratio (Source)	0 ratio to 0.1 ratio	0.28 $\mu\text{V}/\text{V}$ + (0.22 $\mu\text{V}/\text{V}$ of input X ratio)	Fluke 720A Kelvin Varley Divider
	0.1 ratio to 1 ratio	0.6 $\mu\text{V}/\text{V}$ of input ratio	

**Electricity and Magnetism – Resistance**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Resistance (Source) <sup>1</sup>	1 $\Omega$ Primary	0.64 $\mu\Omega/\Omega$	Leeds & Northrup 4210
	1 $\Omega$	1.6 $\mu\Omega/\Omega$	
	100 $\mu\Omega$	5 $\mu\Omega/\Omega$	Otto Wolff 0.0001
	1 m $\Omega$	2.9 $\mu\Omega/\Omega$	Leeds & Northrup 4223-B
	10 m $\Omega$	2.9 $\mu\Omega/\Omega$	Leeds & Northrup 4222-B
	100 m $\Omega$	1.8 $\mu\Omega/\Omega$	Leeds & Northrup 4221-B
	1 $\Omega$ Primary	1.6 $\mu\Omega/\Omega$	Leeds & Northrup 4020-B
	10 $\Omega$	1.1 $\mu\Omega/\Omega$	Leeds & Northrup 4025-B
	100 $\Omega$ Primary	0.63 $\mu\Omega/\Omega$	Leeds & Northrup 4030-B
	100 $\Omega$	1.4 $\mu\Omega/\Omega$	
	1 k $\Omega$	1.2 $\mu\Omega/\Omega$	Leeds & Northrup 4035-B
	10 k $\Omega$	1.7 $\mu\Omega/\Omega$	Leeds & Northrup 4040-B
	100 k $\Omega$	2.3 $\mu\Omega/\Omega$	Leeds & Northrup 4045-B
	1 M $\Omega$	3.3 $\mu\Omega/\Omega$	Leeds & Northrup 4050-B
	10 M $\Omega$	60 $\mu\Omega/\Omega$	Shallcross 980
	100 M $\Omega$	0.028 % of reading	
	1 G $\Omega$	0.37 % of reading	ISL Fixture SF51
	Resistance (Measure) <sup>1</sup>	100 $\mu\Omega$	5 $\mu\Omega/\Omega$
1 m $\Omega$		2.9 $\mu\Omega/\Omega$	
10 m $\Omega$		2.9 $\mu\Omega/\Omega$	
100 m $\Omega$		1.8 $\mu\Omega/\Omega$	
1 $\Omega$		1.6 $\mu\Omega/\Omega$	Guildline 9975 Leeds & Northrup 4210 Reference Resistor
10 $\Omega$		1.1 $\mu\Omega/\Omega$	Guildline 9975 100 $\Omega$ Reference Resistor
100 $\Omega$		1.4 $\mu\Omega/\Omega$	Guildline 9975 Leeds & Northrup 4030-B Reference Resistor
1 k $\Omega$		1.2 $\mu\Omega/\Omega$	
10 k $\Omega$		1.7 $\mu\Omega/\Omega$	Guildline 9975 Leeds & Northrup 4035-B Reference Resistor
100 k $\Omega$		2.3 $\mu\Omega/\Omega$	Guildline 9975 Leeds & Northrup 4040-B Reference Resistor

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Resistance (Measure) <sup>1</sup>	1 MΩ	3.3 μΩ/Ω	Guildline 9975 Leeds & Northrup 4045-B Reference Resistor
	10 MΩ	27 μΩ/Ω	Guildline 9975 Leeds & Northrup 4050-B Reference Resistor
	100 MΩ	0.013 % of reading	Leeds & Northrup 4232B Guarded Wheatstone Bridge
	1 GΩ	0.29 % of reading	

**Electricity and Magnetism – Current**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
AC Current (Source) <sup>1</sup>	100 μA 10 Hz to 5 kHz	0.008 8 % of reading	GR 1440 Fluke 8506A
	1 μA 10 Hz to 5 kHz	0.008 6 % of reading	
	1 mA 10 Hz to 5 kHz	0.008 6 % of reading	
	0.1 A 10 Hz to 5 kHz	44 μA/A	Holt CS1 Holt 6A
	0.1 A 10 Hz to 10 kHz	42 μA/A	
	1 A 10 Hz to 5 kHz	45 μA/A	
	10 A 10 Hz to 1 kHz	62 μA/A	
	20 A 10 Hz to 1 kHz	130 μA/A	
AC Current (Measure) <sup>1</sup>	100 μA 10 Hz to 5 kHz	0.008 8 % of reading	GR 1440 Fluke 8506A
	1 μA 10 Hz to 5 kHz	0.008 6 % of reading	
	1 mA 10 Hz to 5 kHz	0.008 6 % of reading	
	0.01 A 10 Hz to 10 kHz	48 μA/A	Holt CS1 Holt 6A
	0.1 A 10 Hz to 10 kHz	42 μA/A	
	1 A 10 Hz to 10 kHz	44 μA/A	
	10 A 10 Hz to 10 kHz	62 μA/A	
	20 A 10 Hz to 1 kHz	130 μA/A	
	20 A 10 Hz to 10 kHz	130 μA/A	

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
DC Current (Source) <sup>1</sup>	10 $\mu$ A	59 $\mu$ A/A	Multi-function Calibrator 10 V Reference
	100 $\mu$ A	6.9 $\mu$ A/A	
	1 mA	6.8 $\mu$ A/A	
	10 mA	7.5 $\mu$ A/A	
	100 mA	12 $\mu$ A/A	
	1 A	14 $\mu$ A/A	
	10 A	31 $\mu$ A/A	
	20 A	31 $\mu$ A/A	
DC Current (Measure) <sup>1</sup>	10 $\mu$ A	59 $\mu$ A/A	Multi-function Calibrator 10 V Reference
	100 $\mu$ A	6.9 $\mu$ A/A	
	1 mA	6.8 $\mu$ A/A	
	10 mA	7.5 $\mu$ A/A	
	100 mA	12 $\mu$ A/A	
	1 A	14 $\mu$ A/A	
	10 A	31 $\mu$ A/A	
	20 A	31 $\mu$ A/A	

**Electricity and Magnetism – Inductance**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Inductance (Source)	1 $\mu$ H	0.088 % of reading	GR 1482 Series GR Digibridge
	1 mH	0.085 % of reading	
	10 mH	0.085 % of reading	
	1 H	0.085 % of reading	
Inductance (Measure)	100 $\mu$ H	0.088 % of reading	GR Digibridge GR 1482 Reference
	1 mH	0.085 % of reading	
	10 mH	0.085 % of reading	
	100 mH	0.085 % of reading	
	1 H	0.085 % of reading	
Inductance (Reference)	100 mH	0.081 % of reading	GR 1482-L

**Electricity and Magnetism – Capacitance**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Capacitance (Source)	1 pF	77 $\mu$ F/F	1422-CD GR 1615A
	10 pF	23 $\mu$ F/F	GR1403G GR 1615A
	100 pF	11 $\mu$ F/F	GR 1404-B GR 1615A
	1 000 pF Primary	9.2 $\mu$ F/F	GR 1404A Reference
	10 nF	21 $\mu$ F/F	GR 1615
	100 nF	29 $\mu$ F/F	GR 1409
	1 $\mu$ F	65 $\mu$ F/F	GR 1615A

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Capacitance (Source)	10 $\mu$ F	0.041 % of reading	ISL 10 $\mu$ F Standard GR 1615A
	100 $\mu$ F	0.041 % of reading	ISL 100 $\mu$ F Standard GR 1615A
Capacitance (Measure)	1 pF	65 $\mu$ F/F	GR 1615A
	10 pF	20 $\mu$ F/F	GR1615A
	100 pF	9.6 $\mu$ F/F	GR 1615A
	1 000 pF	9.3 $\mu$ F	
	10 nF	17 $\mu$ F/F	
	100 nF	27 $\mu$ F/F	GR 1615A GR 1409-T
	1 $\mu$ F	64 $\mu$ F/F	
	10 $\mu$ F	0.026 % of reading	GR 1615A GR 1615-p1
	100 $\mu$ F	0.026 % of reading	GR 1615A Decade Capacitor Decade Resistor

**Electricity and Magnetism / Other**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
RF Power (Source)	10 $\mu$ W to 10 nW 10 MHz to 2 GHz	2.5 % of reading	HP437B Power Meter HP 8484A Sensor
	100 mW to 10 $\mu$ W 100 kHz to 2 GHz	2.6 % of reading	HP437B Power Meter HP 8482A Sensor
RF Power (Measure)	10 $\mu$ W to 1 nW 10 MHz to 2 GHz	2.8 % of reading	HP437B Power Meter HP 8484A Sensor
	100 mW to 10 $\mu$ W 100 kHz to 2 GHz	2.5 % of reading	HP437B Power Meter HP 8482A Sensor

**Electricity and Magnetism – Magnetic Properties**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Magnetometers / Flux Meters	0 G to 50 G	0.044 G + 0.011 G / G	Gaussmeter
	50 G to 20 kG	0.2 G + 0.007 1 G / G	Gaussmeter Magnetic Yoke

**Electricity and Magnetism – Electrical Temperature Simulation**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Electrical Calibration of RTD Indicators <sup>(1)</sup>	-200 °C to 0 °C	0.014 °C	Resistance Decade RTD Tables
	0 °C to 130 °C	0.024 °C	
	130 °C to 600 °C	0.12 °C	
	600 °C to 849 °C	0.16 °C	

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Thermocouple Indicators			Ectron 1100
Type E	-270 °C to 1 000 °C	0.02 % reading + 0.066 °C	
Type J	-200 °C to 760 °C	0.02 % reading + 0.06 °C	
Type K	-270 °C to 1 372 °C	0.02 % reading + 0.098 °C	
Type T	-270 °C to 400 °C	0.02 % reading + 0.077 °C	
Type S	-50 °C to 1 760 °C	0.02 % reading + 0.21 °C	
Type R	-50 °C to 1 760 °C	0.02 % reading + 0.2 °C	

**Electricity and Magnetism / Time and Frequency – Oscilloscopes**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Squarewave (Source) Amplitude (1 MΩ)	200 μV to 100 V	0.29 % of reading	Tektronix PG506
Time Mark (Source)	1 ns/div to 5 s/div	12 μs / s	Tektronix TG501
Leveled Sinewave (Source) Flatness	250 kHz to 50 MHz	1.4 % of reading	Tektronix SG503
	50 MHz to 250 MHz	3.5 % of reading	
	250 MHz to 500 MHz	4.5 % of reading	

**Time and Frequency – Frequency / Period**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Frequency (Measure)	0 Hz to 1.3 GHz	1.7 X 10 <sup>-9</sup> Hz / Hz	Electronic Counter
Frequency (Source)	0 Hz to 1.3 GHz	1.7 X 10 <sup>-9</sup> Hz / Hz	Electronic Counter Signal Generator
Stop Watches	1 s to 3 600 s	0.12 s	Timer Counter
Tachometers <sup>1</sup> (Contact)	(5.76 to 4 189) rad/s (55 to 40 000) rpm	(0.21 rad/s + 0.000 07 rad/s) rad/s (0.2 rpm + 0.000 07 rpm) rpm	Rpm Standard
Tachometers <sup>1</sup> (Non-Contact) Strobo & Photo <sup>1</sup>	(0.62 to 10 472) rad/s (6 to 100 000) rpm	(0.006 2 rad/s + 0.000 013 rad/s) rad/s (0.059 rpm + 0.000 013 rpm) rpm	Function Generator

**Thermodynamic – Humidity**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Humidity (Source) <sup>1</sup>	10 %RH to 95 %RH	0.59 %RH + 0.000 58 %RH / %RH	Thunder 2500
Humidity (Measure) <sup>1</sup>	10 %RH to 95 %RH	1.4 %RH	Vaisala HMP37E

**Thermodynamic – Thermocouples**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Temperature Measuring Equipment <sup>1</sup>	-196 °C to 0 °C 0 °C to 410 °C	(0.013 °C – 0.000 14 °C) °C (0.014 °C + 0.000 012 °C) °C	Rosemount SPRT Instrulab Indicator Bath
Thermocouple – Fixed Point	660 °C	0.54 °C	Aluminum Freeze Point Thermocouple Indicator

**Thermodynamic – Thermodynamic Devices (all)**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Oven Temperature Uniformity <sup>1</sup>	-196 °C to 1 000 °C	(1.2 °C + 0.000 59 °C) °C	Datalogger w/External CJC Thermocouple

**Thermodynamic – Rhodium – IR Devices**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Infrared Pyrometers	Ambient to 250 °C	(0.33 °C + 0.000 51 °C) °C	Blackbody Source RTD

**Sound in Air - Acoustic**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Sound Level	114 dB	0.47 dB	GR 1562A

**Photometry**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Refractive Index Brix	0 Brix to 20 Brix	0.2 % of reading	Scale Sugar Distilled Water

**Amount of Substance – Chemical – Conductivity and pH**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
pH <sup>1</sup>	4 pH 7 pH 10 pH	0.018 pH 0.018 pH 0.017 pH	Standard pH Buffers Thermometer 0.1 °C


Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
Conductivity Solution <sup>1</sup>	10 $\mu$ S	0.64 $\mu$ S	Standard Solutions
	100 $\mu$ S	1.2 $\mu$ S	
	1 000 $\mu$ S	4 $\mu$ S	
	10 000 $\mu$ S	36 $\mu$ S	
	100 000 $\mu$ S	320 $\mu$ S	
	1 412 $\mu$ S	4.3 $\mu$ S	

**Luminous Intensity**

Calibration Parameter/Equipment	Range	Best Measurement Capability(+/-) <sup>2</sup>	Remarks
UV (Black) Light Meters	1 $\mu$ W/cm <sup>2</sup> to 10 000 $\mu$ W/cm <sup>2</sup>	6.8 % of reading	Radiometer & Black Light Detector
White Light Meters	1 lx to 21 528 lx	2.1 % of reading	Radiometer & White Light Detector
	1 fl to 50 000 fl	2.3 % of reading	

**Notes:**

- 1) Laboratory offers calibration services at the laboratory's own facilities and at the client or other agreed upon facilities. 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 Scope. Allowance must be made for aspects such as the environmental 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 much larger than the BMC.
- 2) Best uncertainties represent expanded uncertainties at approximately the 95% confidence level using a coverage factor of k=2.

Approved by:  Date: October 31, 2009  
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