



**CALIBRATION LABORATORIES**

**NVLAP LAB CODE 200902-0  
Scope Revised: 2013-01-30**

**SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005**

<p><b>Transcat – Philadelphia</b> 2091 Springdale Road, Unit #3 Cherry Hill, NJ 08003 Mr. Derek Still Phone: 856-489-9453; Fax: 856-489-9743 E-mail: <a href="mailto:dstill@transcat.com">dstill@transcat.com</a> URL: <a href="http://www.transcat.com">http://www.transcat.com</a></p>	<p><b>Parameter(s) of Accreditation</b> Dimensional Electromagnetics – DC/Low Frequency Time and Frequency Mechanical Optical Radiation Electromagnetics – RF/Microwave Thermodynamic</p> <p>This laboratory is compliant to ANSI/NCSL Z540-1-1994; Part 1. (NVLAP Code: 20/A01)</p>
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**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)** <sup>Notes 1,2</sup>

Measured Parameter or Device Calibrated	Range	Uncertainty ( $k=2$ ) <sup>Note 3,9</sup>	Remarks
<b>DIMENSIONAL</b>			
<b>NVLAP Code: 20/D01</b> <b>ANGULAR</b> Angles	0° to 75° 90°	7.4" 1.2"	Angle Blocks Master Square
<b>NVLAP Code: 20/D05</b> <b>LENGTH and DIAMETER</b> Micrometers and Calipers – Outside, Inside, Depth Field calibrations available <sup>Note 4</sup>	0.01 in to 8 in 8 in to 40 in	15 $\mu$ m + 6L $\mu$ m 20 $\mu$ m + 7L $\mu$ m	Comparison to Gage Blocks
Anvil Flatness Field calibrations available <sup>Note 4</sup>	0 in to 1 in	4.5 $\mu$ m	Optical Flats
Anvil Parallelism Field calibrations available <sup>Note 4</sup>	0 in to 1 in	8.3 $\mu$ m	Optical Parallel
Digital and Dial Indicators Field calibrations available <sup>Note 4</sup>	0 in to 6 in	12 $\mu$ m + 6L $\mu$ m	Gage Blocks with Surface Plate

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Length Measurement – Single Axis	0 in to 6 in 6 in to 10 in	9 $\mu\text{in} + 4L \mu\text{in}$ 3 $\mu\text{in} + 5L \mu\text{in}$	Supermicrometer and Gage Blocks
Height Gages Field calibrations available <sup>Note 4</sup>	0 in to 8 in 8 in to 32 in 32 in to 44 in	26 $\mu\text{in} + 5L \mu\text{in}$ 15 $\mu\text{in} + 7L \mu\text{in}$ 23 $\mu\text{in} + 7L \mu\text{in}$	Gage Blocks with Surface Plate
Optical Comparators Field calibrations available <sup>Note 4</sup>	0 in to 12 in 0 in to 12 in 0 in to 12 in 10x to 50x	290 $\mu\text{in}$ 290 $\mu\text{in}$ 730 $\mu\text{in}$ 180 $\mu\text{in}$	Glass Grid; X Axis Y Axis X-Y Axis
<b>NVLAP Code: 20/D11 SPHERICAL DIAMETER; PLUG/RING GAGES</b> Outer Diameter – Plug Gages	0 in to 1 in	19 $\mu\text{in}$	Laser Micrometer
Laser Micrometers	0 in to 1 in	9.5 $\mu\text{in} + 3L \mu\text{in}$	Master Pins
<b>NVLAP Code: 20/D13 SURVEYING RODS and TAPES</b> Tapes and Rulers	0 ft to 100 ft	0.0017 in	Glass Grid
<b>NVLAP Code: 20/D15 TWO DIMENSIONAL GAGES</b> Linear Dimension – Optical 2 Axis (X-Y) Radius	6 in x 6 in 0 in to 12 in	120 $\mu\text{in}$ 120 $\mu\text{in}$	Optical Comparator

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**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) <sup>Notes 1,2</sup>**

Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) <sup>Note 3,5</sup>	Remarks	
<b>ELECTROMAGNETICS – DC/LOW FREQUENCY</b>					
<b>NVLAP Code: 20/E02 AC RESISTORS and CURRENT</b> AC Current – Measuring Equipment Field calibrations available <sup>Note 4</sup>	0 μA to 220 μA	10 Hz to 20 Hz	0.031 % + 16 nA	Fluke 5700A-EP	
		20 Hz to 40 Hz	0.02 % + 10 nA		
		40 Hz to 1 kHz	0.015 % + 8 nA		
		1 kHz to 5 kHz	0.03 % + 12 nA		
		5 kHz to 10 kHz	0.11 % + 65 nA		
		0.22 mA to 2.2 mA	10 Hz to 20 Hz		0.03 % + 40 nA
	2.2 mA to 22 mA	20 Hz to 40 Hz	0.018 % + 35 nA		
		40 Hz to 1 kHz	0.014 % + 35 nA		
		1 kHz to 5 kHz	0.021 % + 110 nA		
		5 kHz to 10 kHz	0.11 % + 650 nA		
		22 mA to 220 mA	10 Hz to 20 Hz		0.039 % + 400 nA
			20 Hz to 40 Hz		0.019 % + 350 nA
40 Hz to 1 kHz	0.014 % + 350 nA				
1 kHz to 5 kHz	0.021 % + 550 nA				
5 kHz to 10 kHz	0.11 % + 5 μA				
0.22 A to 2.2 A	10 Hz to 20 Hz		0.033 % + 4 μA		
	20 Hz to 40 Hz	0.019 % + 3.5 μA			
	40 Hz to 1 kHz	0.014 % + 2.5 μA			
	1 kHz to 5 kHz	0.021 % + 3.5 μA			
2.2 A to 11 A	5 kHz to 10 kHz	0.11 % + 10 μA			
	20 Hz to 1 kHz	0.027 % + 35 μA			
	1 kHz to 5 kHz	0.046 % + 80 μA			
	5 kHz to 10 kHz	0.70 % + 160 μA			
		40 Hz to 1 kHz	0.048 % + 170 μA	Fluke 5700A-EP with 5725A	
		1 kHz to 5 kHz	0.096 % + 380 μA		

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**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) <sup>Notes 1,2</sup>**

Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) <sup>Note 3,5</sup>	Remarks	
Extended Frequency Ranges Field calibrations available <sup>Note 4</sup>	11 A to 20 A	5 kHz to 10 kHz	0.36 % + 750 $\mu$ A	Valhalla 2575A and 2555A	
		DC to 1 kHz	0.03 A		
	20 A to 100 A	1 kHz to 10 kHz	0.13 A	Fluke 5520A	
		DC to 1 kHz	0.15 A		
	Clamp-on Ammeter Toroidal Type Field calibrations available <sup>Note 4</sup>	29 $\mu$ A to 330 $\mu$ A	10 kHz to 30 kHz	1.2 % + 3 $\mu$ A	Fluke 5520A with 5500A/Coil
			330 $\mu$ A to 3.3 mA	0.78 % + 0.5 $\mu$ A	
		29 mA to 330 mA	10 kHz to 30 kHz	0.31 % + 3 $\mu$ A	
			10 kHz to 30 kHz	0.31 % + 0.16 mA	
	Clamp-on Ammeter Non-Toroidal Type Field calibrations available <sup>Note 4</sup>	20 A to 150 A	45 Hz to 65 Hz	0.30 % + 26 mA	Fluke 5520A with 5500A/Coil
			65 Hz to 440 Hz	0.83 % + 47 mA	
150 A to 1000 A		45 Hz to 65 Hz	0.35 % + 0.12 A		
		65 Hz to 440 Hz	1.1 % + 0.22 A		
20 A to 150 A		45 Hz to 65 Hz	0.57 % + 0.25 A	Agilent 3458A opt 002	
		65 Hz to 440 Hz	1.0 % + 0.25 A		
150 A to 1000 A	45 Hz to 65 Hz	0.60 % + 0.90 A			
	65 Hz to 440 Hz	1.3 % + 0.92 A			
	0 $\mu$ A to 100 $\mu$ A	10 Hz to 20 Hz	0.40 % + 30 nA		Agilent 3458A opt 002
		20 Hz to 45 Hz	0.15 % + 30 nA		
45 Hz to 100 Hz		0.063 % + 30 nA			
100 Hz to 5 kHz		0.063 % + 30 nA			
100 $\mu$ A to 1 mA	10 Hz to 20 Hz	0.40 % + 200 nA			
	20 Hz to 45 Hz	0.15 % + 200 nA			
	45 Hz to 100 Hz	0.062 % + 200 nA			
	100 Hz to 5 kHz	0.034 % + 200 nA			
1 mA to 10 mA	10 Hz to 20 Hz	0.40 % + 2 $\mu$ A			
	20 Hz to 45 Hz	0.15 % + 2 $\mu$ A			
	45 Hz to 100 Hz	0.062 % + 2 $\mu$ A			
	100 Hz to 5 kHz	0.034 % + 2 $\mu$ A			
10 mA to 100 mA		10 Hz to 20 Hz	0.40 % + 20 $\mu$ A		

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**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) <sup>Notes 1,2</sup>**

Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) <sup>Note 3,5</sup>	Remarks
AC Resistance – Measure Field calibrations available <sup>Note 4</sup>	100 mA to 1 A	20 Hz to 45 Hz	0.15 % + 20 μA	Valhalla 2575A          GenRad 1689M
		45 Hz to 100 Hz	0.062 % + 20 μA	
		100 Hz to 5 kHz	0.033 % + 20 μA	
	1 A to 2 A 2 A to 20 A	10 Hz to 20 Hz	0.40 % + 200 μA	
		20 Hz to 45 Hz	0.16 % + 200 μA	
		45 Hz to 100 Hz	0.085 % + 200 μA	
		100 Hz to 5 kHz	0.10 % + 200 μA	
	20 A to 100 A	DC to 10 kHz	0.003 A	
		DC to 1 kHz	0.03 A	
	10 Ω to 100 kΩ	1 kHz to 10 kHz	0.13 A	
DC to 1 kHz		0.15 A		
		12 Hz to 99.9 kHz	0.039 % + 0.01 Ω	

**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) <sup>Notes 1,2</sup>**

Measured Parameter or Device Calibrated	Range	Uncertainty (k=2) <sup>Note 3,5</sup>	Remarks
<b>NVLAP Code: 20/E05</b> <b>DC RESISTANCE and CURRENT</b> DC Resistance – Measuring Equipment and Measure Field calibrations available <sup>Note 4</sup>	0 Ω to 25 Ω	36 μΩ	Bridge with Decade Resistor
	25 Ω to 400 Ω	1.5 μΩ/Ω	
	400 Ω to 1 kΩ	4.1 μΩ/Ω	
	1 kΩ to 40 kΩ	10 μΩ/Ω	
	0 Ω to 10 Ω	18 μΩ/Ω + 50 μΩ	Agilent 3458A with Decade Resistor
	10 Ω to 100 Ω	15 μΩ/Ω + 0.5 mΩ	
	100 Ω to 1 kΩ	12 μΩ/Ω + 0.5 mΩ	
	1 kΩ to 10 kΩ	12 μΩ/Ω + 5 mΩ	
	10 kΩ to 100 kΩ	12 μΩ/Ω + 50 mΩ	
	100 kΩ to 1 MΩ	19 μΩ/Ω + 2 Ω	
	1 MΩ to 10 MΩ	62 μΩ/Ω + 100 Ω	

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Measured Parameter or Device Calibrated	Range	Uncertainty (k=2) <sup>Note 3,5</sup>	Remarks
DC Resistance – Measuring Equipment Field calibrations available <sup>Note 4</sup>	10 MΩ to 100 MΩ	590 μΩ/Ω + 1 kΩ	Fixed Resistor
	100 MΩ to 1 GΩ	0.58 % + 10 kΩ	
	1 mΩ	58 μΩ/Ω	
	10 mΩ	58 μΩ/Ω	
	100 mΩ	58 μΩ/Ω	
	1 Ω	58 μΩ/Ω	
	100 Ω	1.1 μΩ/Ω	
	1 GΩ	0.58 %	
	10 GΩ	1.2 %	
	100 GΩ	1.8 %	
DC Current – Measuring Equipment and Measure Field calibrations available <sup>Note 4</sup>	1 TΩ	1.2 %	Agilent 3458A with Current Source
	0 μA to 100 μA	23 μA/A + 0.8 nA	
	100 μA to 1 mA	23 μA/A + 5 nA	
	1 mA to 10 mA	23 μA/A + 50 nA	
	10 mA to 100 mA	35 μA/A + 500 nA	
DC Current – Measuring Equipment Field calibrations available <sup>Note 4</sup>	100 mA to 1 A	110 μA/A + 10 μA	Valhalla 2575A with 2555A
	1 A to 2 A	460 μA	
	2 A to 20 A	5.2 mA	
DC Current – Measuring Equipment Field calibrations available <sup>Note 4</sup>	20 A to 100 A	58 mA	Fluke 5700A-EP with 5725A
	0 μA to 220 μA	41 μA/A + 6 nA	
	0.22 mA to 2.2 mA	37 μA/A + 7 nA	
	2.2 mA to 22 mA	36 μA/A + 40 nA	
	22 mA to 220 mA	63 μA/A + 0.7 μA	
	0.22 A to 2.2 A	220 μA/A + 12 μA	
Clamp-on Ammeter Non-Toroidal Type	2.2 A to 11 A	400 μA/A + 480 nA	Fluke 5520A with 5500A/Coil
	20 A to 150 A	0.51 % + 0.14 A	
<b>NVLAP Code: 20/E06</b> <b>DC VOLTAGE</b> DC Voltage – Measure Field calibrations available <sup>Note 4</sup>	150 A to 1000 A	0.52 % + 0.50 A	Vitrek 4600A
	1 kV to 2 kV	0.05 % + 0.4 V	
	2 kV to 20 kV	0.055 % + 4 V	

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Measured Parameter or Device Calibrated	Range	Uncertainty (k=2) <sup>Note 3,5</sup>	Remarks
DC Voltage – Measure Equipment Field calibrations available <sup>Note 4</sup>	20 kV to 100 kV	0.27 %	High Voltage Divider Fluke 5700A-EP with 5725A
	0 to 220 mV	7.6 μV/V + 0.4 μV	
	220 mV to 2.2 V	5.4 μV/V + 0.7 μV	
	2.2 V to 11 V	4 μV/V + 2.5 μV	
	11 V to 22 V	4 μV/V + 4 μV	
	22 V to 220 V	6.2 μV/V + 40 μV	
DC Voltage – Measuring Equipment and Measure Field calibrations available <sup>Note 4</sup>	220 V to 1100 V	7.6 μV/V + 400 μV	Agilent 3458A opt 2 with Fluke 5700A-EP
	0 V to 100 mV	6.5 μV/V + 0.5 μV	
	100 mV to 10 V	4.5 μV/V + 0.5 μV	
	10 V to 100 V	6.7 μV/V + 30 μV	
	100 V to 500 V	9.8 μV/V + 100 μV	
	500 V to 800 V	13 μV/V + 100 μV	
pH – Measuring Equipment Field calibrations available <sup>Note 4</sup>	800 V to 1000 V	18 μV/V + 100 μV	Standard Buffer Solutions
	4 pH	0.011 pH	
	7 pH	0.010 pH	
	10 pH	0.011 pH	

**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)** <sup>Notes 1,2</sup>

Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) <sup>Note 3,5</sup>	Remarks
<b>NVLAP Code: 20/E09</b> <b>LF AC VOLTAGE</b> AC High Voltage – Measure Field calibrations available <sup>Note 4</sup>	1 kV to 2 kV	20 Hz to 100 Hz	0.39 % + 2 V	Vitretek 4600A
	1 kV to 2 kV	100 Hz to 400 Hz	0.60 % + 2 V	
	2 kV to 20 kV	20 Hz to 100 Hz	0.37 % + 20 V	
AC Voltage – Measure Field calibrations available <sup>Note 4</sup>	20 kV to 85 kV	60 Hz	0.31 %	Ross Voltage Divider
	0 mV to 10 mV	1 Hz to 40 Hz	0.035 % + 3 μV	Agilent 3458A
		40 Hz to 1 kHz	0.026 % + 1 μV	
		1 kHz to 20 kHz	0.034 % + 1 μV	
		20 kHz to 50 kHz	0.14 % + 1 μV	
		50 kHz to 100 kHz	0.51 % + 1 μV	

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) <sup>Note 3,5</sup>	Remarks
	10 mV to 100 mV	100 kHz to 300 kHz	4.0 % + 2 μV	
		1 Hz to 40 Hz	0.012 % + 4 μV	
		40 Hz to 1 kHz	0.009 % + 2 μV	
		1 kHz to 20 kHz	0.015 % + 2 μV	
		20 kHz to 50 kHz	0.032 % + 2 μV	
		50 kHz to 100 kHz	0.081 % + 2 μV	
		100 kHz to 300 kHz	0.31 % + 10 μV	
		300 kHz to 1 MHz	1.0 % + 10 μV	
	100 mV to 1 V	1 Hz to 40 Hz	0.0089 % + 40 μV	
		40 Hz to 1 kHz	0.0085 % + 20 μV	
		1 kHz to 20 kHz	0.015 % + 20 μV	
		20 kHz to 50 kHz	0.031 % + 20 μV	
		50 kHz to 100 kHz	0.081 % + 20 μV	
		100 kHz to 300 kHz	0.30 % + 100 μV	
		300 kHz to 1 MHz	1.0 % + 100 μV	
		1 V to 10 V	1 Hz to 40 Hz	
	40 Hz to 1 kHz		0.0086 % + 200 μV	
	1 kHz to 20 kHz		0.015 % + 200 μV	
	20 kHz to 50 kHz		0.031 % + 200 μV	
	50 kHz to 100 kHz		0.081 % + 200 μV	
100 kHz to 300 kHz	0.30 % + 1 mV			
300 kHz to 1 MHz	1.0 % + 1 mV			
10 V to 100 V	1 Hz to 40 Hz		0.021 % + 4 mV	
	40 Hz to 1 kHz	0.021 % + 2 mV		
	1 kHz to 20 kHz	0.021 % + 2 mV		
	20 kHz to 50 kHz	0.036 % + 2 mV		
	50 kHz to 100 kHz	0.12 % + 2 mV		
	100 kHz to 300 kHz	0.40 % + 10 mV		
	300 kHz to 1 MHz	1.5 % + 10 mV		
	100 V to 700 V	1 Hz to 40 Hz	0.041 % + 40 mV	
40 Hz to 1 kHz		0.041 % + 20 mV		
1 kHz to 20 kHz		0.061 % + 20 mV		

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) <sup>Note 3,5</sup>	Remarks	
AC Voltage – Measuring Equipment Field calibrations available <sup>Note 4</sup>	0 mV to 2.2 mV	20 kHz to 50 kHz	0.12 % + 20 mV	Fluke 5700A-EP	
		50 kHz to 100 kHz	0.30 % + 20 mV		
		2.2 mV to 22 mV	10 Hz to 20 Hz		0.036 % + 4 μV
			20 Hz to 40 Hz		0.033 % + 4 μV
	40 Hz to 20 kHz		0.033 % + 4 μV		
	20 kHz to 50 kHz		0.033 % + 4 μV		
	50 kHz to 100 kHz		0.056 % + 5 μV		
	100 kHz to 300 kHz		0.17 % + 10 μV		
	300 kHz to 500 kHz		0.19 % + 20 μV		
	22 mV to 220 mV	500 kHz to 1 MHz	0.30 % + 20 μV		
		10 Hz to 20 Hz	0.044 % + 4 μV		
		20 Hz to 40 Hz	0.031 % + 4 μV		
		40 Hz to 20 kHz	0.015 % + 4 μV		
		20 kHz to 50 kHz	0.031 % + 4 μV		
		50 kHz to 100 kHz	0.059 % + 5 μV		
		100 kHz to 300 kHz	0.12 % + 10 μV		
	220 mV to 2.2 V	300 kHz to 500 kHz	0.16 % + 20 μV		
		500 kHz to 1 MHz	0.31 % + 20 μV		
		10 Hz to 20 Hz	0.028 % + 12 μV		
		20 Hz to 40 Hz	0.011 % + 7 μV		
40 Hz to 20 kHz		0.0086 % + 7 μV			
20 kHz to 50 kHz		0.021 % + 7 μV			
	50 kHz to 100 kHz	0.047 % + 17 μV			
	100 kHz to 300 kHz	0.092 % + 20 μV			
	300 kHz to 500 kHz	0.14 % + 25 μV			
	500 kHz to 1 MHz	0.28 % + 45 μV			
	10 Hz to 20 Hz	0.028 % + 40 μV			
	20 Hz to 40 Hz	0.010 % + 15 μV			
	40 Hz to 20 kHz	0.0048 % + 8 μV			
	20 kHz to 50 kHz	0.0081 % + 10 μV			
	50 kHz to 100 kHz	0.012 % + 30 μV			
	100 kHz to 300 kHz	0.043 % + 80 μV			

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) <sup>Note 3,5</sup>	Remarks
	2.2 V to 22 V	300 kHz to 500 kHz	0.10 % + 200 μV	Fluke 5720A-EP with 5725A
		500 kHz to 1 MHz	0.18 % + 300 μV	
		10 Hz to 20 Hz	0.028 % + 0.4 mV	
		20 Hz to 40 Hz	0.010 % + 0.15 mV	
		40 Hz to 20 kHz	0.0049 % + 50 μV	
		20 kHz to 50 kHz	0.0083 % + 0.10 mV	
		50 kHz to 100 kHz	0.011 % + 0.2 mV	
		100 kHz to 300 kHz	0.03 % + 0.6 mV	
	22 V to 220 V	300 kHz to 500 kHz	0.10 % + 2 mV	
		500 kHz to 1 MHz	0.17 % + 3.2 mV	
		10 Hz to 20 Hz	0.028 % + 4 mV	
		20 Hz to 40 Hz	0.010 % + 1.5 mV	
	220 V to 1100 V	40 Hz to 20 kHz	0.0056 % + 0.6 mV	
		20 kHz to 50 kHz	0.0093 % + 1 mV	
		50 kHz to 100 kHz	0.016 % + 2.5 mV	
	220 V to 750 V	50 Hz to 1 kHz	0.0094 % + 3.5 mV	
1 kHz to 20 kHz		0.017 % + 6 mV		
20 kHz to 30 kHz		0.060 % + 11 mV		
<b>NVLAP Code: 20/E10</b> <b>LF CAPACITANCE</b> Capacitance – Measure Field calibrations available <sup>Note 4</sup>	Up to 10 pF 10 pF to 100 pF 100 pF to 1 μF 1 μF to 100 μF 100 μF to 1000 μF	0.1 kHz to 1 kHz	0.47 % + 0.05 pF	GenRad 1689M
			0.058 % + 0.05 pF	
			0.024 % + 0.05 pF	
			0.041 %	
			0.24 %	
Measuring Equipment Field calibrations available <sup>Note 4</sup>	0.19 nF to < 1.1 nF 1.1 nF to < 3.3 nF 3.3 nF to < 11 nF 11 nF to < 110 nF	10 Hz to 10 kHz 10 Hz to 3 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz	0.39 % + 7.8 pF	5520A
			0.39 % + 7.8 pF	
			0.21 % + 7.8 pF	
			0.21 % + 7.8 pF	
			0.21 % + 78 pF	

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**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)** Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) <small>Note 3,5</small>	Remarks
	110 nF to < 330 nF 0.33 μF to < 1.1 μF 1.1 μF to < 3.3 μF 3.3 μF to < 11 μF 11 μF to < 33 μF 33 μF to < 110 μF 110 μF to < 330 μF 0.33 mF to < 1.1 mF 1.1 mF to < 3.3 mF 3.3 mF to < 11 mF 11 mF to < 33 mF 33 mF to < 110 mF	10 Hz to 1 kHz 10 Hz to 600 Hz 10 Hz to 300 Hz 10 Hz to 150 Hz 10 Hz to 120 Hz 10 Hz to 80 Hz DC to 50 Hz DC to 20 Hz DC to 6 Hz DC to 2 Hz DC to 0.6 Hz DC to 0.2 Hz	0.21 % + 0.23 nF 0.21 % + 0.78 nF 0.21 % + 2.3 nF 0.21 % + 7.8 nF 0.32 % + 23 nF 0.36 % + 78 nF 0.36 % + 0.23 μF 0.35 % + 0.78 μF 0.35 % + 2.3 μF 0.35 % + 7.8 μF 0.58 % + 23 μF 0.85 % + 78 μF	
<b>NVLAP Code: 20/E11</b> <b>LF INDUCTANCE</b> Field calibrations available <small>Note 4</small>	1 mH to 10 mH 10 mH to 10 H	0.1 kHz to 1 kHz	0.038 % + 0.1 μH 0.038 % + 1.4 μH	GenRad 1689M
Inductance – Measure Equipment Field calibrations available <small>Note 4</small>	1 mH 10 mH 100 mH 1 H 10 H	1 kHz	0.13 % 0.13 % 0.13 % 0.13 % 0.13 %	Fixed Inductor
<b>NVLAP Code: 20/E12</b> <b>LF POWER/ENERGY</b> Power – Measuring Equipment (for current range listed below) DC Power	0.33 mA to 330 mA	DC	0.024 %	Fluke 5520A
	11 μW to 1.1 mW	DC	0.027 %	
	1.1 mW to 110 mW	DC	0.024 %	
	0.11W to 110 W	DC	0.018 %	
	110 W to 330 W	DC	0.018 %	
0.33 A to 3 A	11 W to 110 mW 0.11 W to 990 W 1 W to 3 kW	DC DC DC	0.044 % 0.053 % 0.0096 %	

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**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)** Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) <small>Note 3,5</small>	Remarks
AC Power <small>Note 8</small> (PF = 1) 3.3 mA to 9 mA	3 A to 20.5 A	DC	0.088 %	
		DC	0.07 %	
		DC	0.04 %	
	0.099 W to 0.99 W			
	0.99 W to 6.8 kW			
	6.8 W to 20.5 kW			
	0.11 mW to 3 mW	10 Hz to 65 Hz	0.13 %	
	3 mW to 9 W	10 Hz to 65 Hz	0.077 %	
	9 mA to 33 mA	10 Hz to 65 Hz	0.089 %	
		10 Hz to 65 Hz	0.077 %	
33 mA to 90 mA	0.3 mW to 10 mW	10 Hz to 65 Hz	0.089 %	
	10 mW to 33 W	10 Hz to 65 Hz	0.077 %	
90 mA to 330 mA	1 mW to 30 mW	10 Hz to 65 Hz	0.071 %	
	30 mW to 90 W	10 Hz to 65 Hz	0.057 %	
0.33 A to 0.9 A	3.0 mW to 100 mW	10 Hz to 65 Hz	0.089 %	
	100 mW to 300 W	10 Hz to 65 Hz	0.078 %	
0.9 A to 2.2 A	11 mW to 300 mW	10 Hz to 65 Hz	0.071 %	
	300 mW to 900 W	10 Hz to 65 Hz	0.081 %	
2.2 A to 4.5 A	30 mW to 720 mW	10 Hz to 65 Hz	0.089 %	
	720 mW to 2 kW	10 Hz to 65 Hz	0.079 %	
4.5 A to 20.5 A	80 mW to 1.4 W	10 Hz to 65 Hz	0.088 %	
	1.4 W to 4.5 kW	10 Hz to 65 Hz	0.18 %	
4.5 A to 20.5 A	150 mW to 6.7 W	10 Hz to 65 Hz	0.17 %	
	6.7 W to 20 kW	10 Hz to 65 Hz	0.17 %	
<b>NVLAP Code: 20/E15 PHASE METERS</b> Phase Meters – Measure Equipment Field calibrations available <small>Note 4</small>	0° to 180°	10 Hz to 65 Hz 65 Hz to 500 Hz 500 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz 10 kHz to 20 kHz	0.01° 0.20° 0.37° 1.8° 3.6° 7.3°	Fluke 5520A

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**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) <sup>Notes 1,2</sup>**

Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) <sup>Note 3,5</sup>	Remarks
<b>NVLAP Code: 20/E21</b> <b>CONDUCTIVITY METERS</b> Conductivity Meters – Measure Equipment	10 μS 100 μS 1000 μS 10 000 μS 100 000 μS		0.31 μS 0.49 μS 3.8 μS 38 μS 350 μS	Standard Solutions
<b>TIME and FREQUENCY</b>				
<b>NVLAP Code: 20/F01</b> <b>FREQUENCY DISSEMINATION</b> Frequency – Source and Measure In-Lab Field <sup>Note 4</sup>	10 MHz 10 MHz		Uncertainty values of derivatives of 10 MHz will differ due to resolution, noise, and gating errors  5.8 x 10 <sup>-10</sup> 2.9 x 10 <sup>-9</sup>	Rubidium Oscillator Agilent 53132A
<b>NVLAP Code: 20/F03</b> <b>OSCILLATOR CHARACTERIZATION</b> Total Harmonic Distortion  Total Harmonic Distortion 5 Hz to 600 kHz Fundamental Input Voltage Range < 30 V  Input Voltage Range > 30 V	0 dB to -80 dB  100 % to 0.3 %  0.1 %  100 % to 0.3 %	20 Hz to 20 kHz 20 kHz to 100 kHz  10 Hz to 1 MHz 1 MHz to 3 MHz 10 Hz to 20 Hz 20 Hz to 30 Hz 30 Hz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1.2 MHz  10 Hz to 300 kHz 300 kHz to 500 kHz	1.1 dB 2.0 dB  3 % 6 % 12 % 6 % 3 % 6 % 12 %  3 % 6 %	Agilent 8903B  Agilent 334A

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) <sup>Note 3,5</sup>	Remarks
	0.1 %	500 kHz to 3 MHz	12 %	
		20 Hz to 30 Hz	12 %	
		30 Hz to 300 kHz	3 %	
		300 kHz to 500 kHz	6 %	
		500 kHz to 1.2 MHz	12 %	

**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)** <sup>Notes 1,2</sup>

Measured Parameter or Device Calibrated	Range	Uncertainty (k=2) <sup>Note 3,5</sup>	Remarks
<b>NVLAP Code: 20/F04</b> <b>PULSE WAVEFORM</b> Rise Time – Measuring Equipment Field calibrations available <sup>Note 4</sup>	≥ 300 ps	2.8 %	5520A SC1100
Rise Time – Measure Field calibrations available <sup>Note 4</sup>	≥ 700 ps	1.8 % + 100 ps	HP 54615B

**MECHANICAL**

<b>NVLAP Code: 20/M05</b> <b>FLOW RATE</b> Gas Flow	1 sccm to 200 sccm 0.2 slpm to 40 slpm 40 slpm to 80 slpm 80 slpm to 100 slpm	0.33 % 0.23 % 0.32 % 0.57 %	DH Molbloc
<b>NVLAP Code: 20/M06</b> <b>FORCE</b> Compression/Tension	0.1 lbf to 500 lbf	0.024 %	Dead Weight
<b>NVLAP Code: 20/M08</b> <b>MASS</b> Mass – Metric	10 kg 5 kg 3 kg	4.6 mg 2.1 mg 1.2 mg	Echelon II

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**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)** Notes 1,2

Measured Parameter or Device Calibrated	Range	Uncertainty ( $k=2$ ) <small>Note 3,5</small>	Remarks
	2 kg	0.85 mg	
	1 kg	0.41 mg	
	500 g	0.22 mg	
	300 g	0.12 mg	
	200 g	86 µg	
	100 g	53 µg	
	50 g	28 µg	
	30 g	17 µg	
	20 g	13 µg	
	10 g	10 µg	
	5 g	5.1 µg	
	3 g	4.0 µg	
	2 g	4.0 µg	
	1 g	4.0 µg	
	500 mg	1.5 µg	
	300 mg	1.5 µg	
	200 mg	1.5 µg	
	100 mg	1.5 µg	
	50 mg	1.5 µg	
	30 mg	1.5 µg	
	20 mg	1.5 µg	
	10 mg	1.5 µg	
	5 mg	1.5 µg	
	3 mg	1.5 µg	
	2 mg	1.5 µg	
	1 mg	1.5 µg	
	25 kg	100 mg	Echelon III
	20 kg	100 mg	
	10 kg	10 mg	
	5 kg	5.1 mg	
	3 kg	3.0 mg	
	2 kg	2.1 mg	
	1 kg	1.0 mg	
	500 g	0.52 mg	
	300 g	0.30 mg	

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**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)** <sup>Notes 1,2</sup>

Measured Parameter or Device Calibrated	Range	Uncertainty ( $k=2$ ) <sup>Note 3,5</sup>	Remarks
Mass – Avoirdupois	200 g	0.21 mg	Echelon III
	100 g	0.11 mg	
	50 g	55 µg	
	30 g	33 µg	
	20 g	29 µg	
	10 g	20 µg	
	5 g	12 µg	
	3 g	12 µg	
	2 g	12 µg	
	1 g	12 µg	
	500 mg	4.0 µg	
	300 mg	4.0 µg	
	200 mg	4.0 µg	
	100 mg	4.0 µg	
	50 mg	4.0 µg	
	30 mg	4.0 µg	
	20 mg	4.0 µg	
	10 mg	4.0 µg	
	5 mg	4.0 µg	
	3 mg	4.0 µg	
	2 mg	4.0 µg	
	1 mg	4.0 µg	
	50 lb	100 mg	
	25 lb	100 mg	
	20 lb	10 mg	
	15 lb	10 mg	
	10 lb	5.1 mg	
	7.5 lb	5.1 mg	
	5 lb	3.0 mg	
	2 lb	1.0 mg	
	1 lb	0.52 mg	
	8 oz	0.30 mg	
4 oz	0.11 mg		
2 oz	55 µg		
1 oz	33 µg		

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**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)** <sup>Notes 1,2</sup>

Measured Parameter or Device Calibrated	Range	Uncertainty ( $k=2$ ) <sup>Note 3,5</sup>	Remarks
Balances Field calibrations available <sup>Note 4</sup> Metric	0.5 oz	20 µg	Characterized Class 1 Weights
	0.25 oz	20 µg	
	0.125 oz	12 µg	
	0.0625 oz	12 µg	
	0.03125 oz	12 µg	
	25 kg	100 mg	
	10 kg	29 mg	
	5 kg	3.6 mg	
	3 kg	8.9 mg	
	2 kg	1.6 mg	
	1 kg	0.71 mg	
	500 g	0.22 mg	
	300 g	0.18 mg	
	200 g	0.18 mg	
	100 g	0.13 mg	
	50 g	0.091 mg	
	30 g	0.079 mg	
	20 g	0.026 mg	
	10 g	0.026 mg	
	5 g	0.022 mg	
	3 g	0.013 mg	
	2 g	0.019 mg	
	1 g	0.019 mg	
	500 mg	0.011 mg	
	300 mg	0.011 mg	
	200 mg	0.011 mg	
	100 mg	0.011 mg	
50 mg	0.011 mg		
30 mg	0.011 mg		
20 mg	0.011 mg		
10 mg	0.011 mg		
5 mg	0.011 mg		
3 mg	0.011 mg		
2 mg	0.011 mg		

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Measured Parameter or Device Calibrated	Range	Uncertainty ( $k=2$ ) <small>Note 3,5</small>	Remarks
Balances – Avoirdupois	1 mg	0.011 mg	Characterized Class 4 Weights
	50 lb	100 mg	
	25 lb	100 mg	
	20 lb	29 mg	
	15 lb	29 mg	
	10 lb	3.6 mg	
	7.5 lb	3.6 mg	
	5 lb	1.6 mg	
	2 lb	1.6 mg	
	1 lb	1.4 mg	
0.5 lb	0.18 mg		
<b>NVLAP Code: 20/M11</b> <b>VIBRATION</b> Acceleration	10 Hz to 2 kHz 2 kHz to 10 kHz	2.8 % 3.4 %	PCB Standard Accelerometer
Vibration	100 Hz	1.6 %	
<b>NVLAP Code: 20/M12</b> <b>VOLUME</b> Volume	1 mL to 10 mL 10 mL to 5000 mL	0.2 % + 0.02 mL 0.2 %	Gravimetric
<b>NVLAP Code: 20/M13</b> <b>HARDNESS</b> Rockwell Hardness Field calibrations available <small>Note 4</small>	High Middle Low	0.43 HRC 0.61 HRC 0.78 HRC	ASTM E18
Durometer	High Middle Low	1.0 HRBW 1.0 HRBW 1.1 HRBW	
	Type A, B, E, 0 Type D, C, DO Type OO	0.31 duro 0.16 duro 0.31 duro	

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Measured Parameter or Device Calibrated	Range	Uncertainty ( $k=2$ ) <small>Note 3,5</small>	Remarks
<b>OPTICAL RADIATION</b>			
<b>NVLAP Code: 20/M15</b> <b>TORQUE</b> Torque – Measure Field calibrations available <small>Note 4</small>	5 ozf-in to 15 ozf-in 15 ozf-in to 600 lbf-ft	0.6 ozf-in 0.5 %	Torque Calibrator
Torque – Measuring Equipment	5 ozf-in to 2.5 lbf-in 2.5 lbf-in to 50 lbf-in 50 lbf-in to 250 lbf-ft	0.058 % 0.07 % 0.09 %	Torque Wheel w/Weights Torque Butterfly w/Weights
<b>OPTICAL RADIATION</b>			
<b>NVLAP Code: 20/O02</b> <b>PHOTOMETRIC</b> Illuminance	5.4 lx to 10 764 lx 10 764 lx to 32 300 lx	1.1 % 2.1 %	Standard Lamp
<b>ELECTROMAGNETICS – RF/MICROWAVE</b>			
<b>NVLAP Code: 20/R11</b> <b>RF-DC VOLTAGE/ CURRENT CONVERTER</b> Sine Wave Flatness Field calibrations available <small>Note 4</small>	10 Hz to 1 MHz 1 MHz to 10 MHz 10 MHz to 30 MHz 30 MHz to 50 MHz 50 MHz to 80 MHz 80 MHz to 100 MHz	0.052 % 0.095 % 0.18 % 0.41 % 0.71 % 0.84 %	Thermal Converter
<b>NVLAP Code: 20/R17</b> <b>RF/MICROWAVE POWER METERS</b> Absolute RF Power 100 kHz to 1.3 GHz Field calibrations available <small>Note 4</small>	20 dBm to -30 dBm	2.3 %	Agilent 437B/8482A
<b>THERMODYNAMIC</b>			
<b>NVLAP Code: 20/T02</b> <b>HUMIDITY</b> Relative Humidity Generate	10 % RH to 95 % RH	0.5 % RH	Thunder Scientific 2500
Measure	10 % RH to 80 % RH	1.3 % RH	Vaisala HMI41/HMP46

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**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) <sup>Notes 1,2</sup>**

Measured Parameter or Device Calibrated	Range	Uncertainty ( $k=2$ ) <sup>Note 3,5</sup>	Remarks
<b>NVLAP Code: 20/T03 LABORATORY THERMOMETERS, DIGITAL and ANALOG</b> Temperature In-Lab Measuring Equipment and Measure  In-Lab Measure  Field Temperature Measure <sup>Note 4</sup>	-100 °C to -40 °C	2.0 mK	Hart 5699 SPRT with Precision Bath
	-40 °C to 100 °C	1.2 mK	
	100 °C to 270 °C	2.4 mK	
	270 °C to 400 °C	4.8 mK	Hart 5699 SPRT with Furnace
	400 °C to 600 °C	21 mK	
	600 °C to 1000 °C	0.68 °C	Type-S TC
	1000 °C to 1450 °C	2.9 °C	
	-195 °C to 0 °C	0.013 °C	Hart Black Stack with SPRT
	0 °C to 420 °C	0.024 °C	
	420 °C to 600 °C	0.034 °C	
<b>NVLAP Code: 20/T05 PRESSURE</b> Absolute Pressure – Source  Gage Pressure Source Pneumatic Field calibrations available <sup>Note 4</sup>  In – Lab Only  Hydraulic Field calibrations available <sup>Note 4</sup>	0 psia to 30 psia	0.0024 psia	DHI RPM4
	30 psia to 1000 psia	0.0066 % + 0.0048 psia	
	-15 psig to 3 psig	0.015 %	Pressurements T3500/3
	3 psig to 500 psig	0.0065 %	
	-2 inH <sub>2</sub> O to 2 inH <sub>2</sub> O	0.00012 inH <sub>2</sub> O	Dwyer 1430 DHI PPC4-ui
	-36 inH <sub>2</sub> O to -22 inH <sub>2</sub> O	0.0090 % + 150 µinH <sub>2</sub> O	
	-22 inH <sub>2</sub> O to 22 inH <sub>2</sub> O	0.002 inH <sub>2</sub> O	DHI RPM4
	22 inH <sub>2</sub> O to 60 inH <sub>2</sub> O	0.0090 % + 150 µinH <sub>2</sub> O	
	60 inH <sub>2</sub> O to 72 inH <sub>2</sub> O	0.0065 inH <sub>2</sub> O	DHI RPM4
	72 inH <sub>2</sub> O to 804 inH <sub>2</sub> O	0.0090 % + 150 µinH <sub>2</sub> O	
-15 psig to 30 psig	0.0021 psig	DHI RPM4	
30 psig to 1000 psig	0.0066 % + 0.0001 psig		
	500 psig to 15 000 psig	0.0096 %	Ametek T-150

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Measured Parameter or Device Calibrated	Range	Uncertainty ( $k=2$ ) <small>Note 3,5</small>	Remarks
<b>NVLAP Code: 20/T07</b> <b>RESISTANCE</b> <b>THERMOMETRY</b> SPRT Calibration by Fixed Point TPW Cell In Fixed Point Cell Sn Fixed Point Cell Zn Fixed Point Cell Al Fixed Point Cell  SPRT Comparison	0.010 °C 156.598 °C 231.928 °C 419.527 °C 660.323 °C  -195 °C -78 °C -38.8 °C	0.5 mK 2.2 mK 2.1 mK 3.5 mK 8.6 mK  2.4 mK 1.2 mK 0.9 mK	Comparison      Hart 5699 SPRT with NBPLN <sub>2</sub> Hart 5699 SPRT with Precision Bath
<b>NVLAP Code: 20/T08</b> <b>THERMOCOUPLES</b> Electrical Calibration of Thermocouple Devices Field calibrations available <small>Note 4</small> Type J Type K Type T Type E Type R Type S Type N Type B Type B Type B Type B	-210 °C to 1200 °C -270 °C to 1372 °C -270 °C to 400 °C -270 °C to 1000 °C -50 °C to 1767 °C -50 °C to 1767 °C -270 °C to 1300 °C 600 °C to 800 °C 800 °C to 1000 °C 1000 °C to 1550 °C 1550 °C to 1820 °C	0.1 °C 0.1 °C 0.1 °C 0.1 °C 0.24 °C 0.22 °C 0.17 °C 0.34 °C 0.26 °C 0.23 °C 0.26 °C	Thermocouple Half Junction

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**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)** <sup>Notes 1,2</sup>

Measured Parameter or Device Calibrated	Range	Uncertainty ( $k=2$ ) <sup>Note 3,5</sup>	Remarks
<b>NVLAP Code: 20/T09 VACUUM and LOW PRESSURE GAGES</b> Vacuum	5 mTorr 0 Torr to 10 Torr 10 Torr to 100 Torr 100 Torr to 1000 Torr	1 mTorr 0.06 % + 4 mTorr 0.06 % + 40 mTorr 0.06 % + 400 mTorr	MKS Vacuum System
<b>NVLAP Code: 20/T11 THERMOCOUPLES</b> In-Lab Measuring Equipment	600 °C to 1000 °C	0.89 °C	Type-S TC with Furnace
<b>END</b>			

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Notes

Note 1: A Calibration and Measurement Capability (CMC) is a description of the best result of a calibration or measurement (result with the smallest uncertainty of measurement) that is available to the laboratory's customers under normal conditions, when performing more or less routine calibrations of nearly ideal measurement standards or instruments.

Note 2: Calibration and Measurement Capabilities are traceable to the national measurement standards of the U.S. or to the national measurement standards of other countries and are thus traceable to the internationally accepted representation of the appropriate SI (Système International) unit.

Note 3: The uncertainty associated with a measurement in a CMC is an expanded uncertainty using a coverage factor, k = 2, with a level of confidence of approximately 95 %. Units for the measurand and its uncertainty are to match.

Note 3a: The uncertainty of a specific calibration by the laboratory may be greater than the uncertainty in the CMC due to the condition and behavior of the customer's device and specific circumstances of the calibration.

Note 3b: As the CMC represents the best measurement results achievable under normal conditions, the accredited calibration laboratory shall not report smaller uncertainty of measurement than that given in a CMC for calibrations or measurements covered by that CMC.

Note 3c: As described in Note 1, CMCs cover calibrations and measurements that are available to the laboratory's customers under normal conditions. However, the laboratory may have the capability to offer special tests, employing special conditions, which yield calibration or measurement results with lower uncertainties.

Note 4: Uncertainties associated with field service calibration may be greater as they incorporate on-site environmental contributions, transportation effects, or other factors that affect the measurements.

Note 5: Values listed with percent (%) are percent of reading or generated value unless otherwise noted.

Note 6: NVLAP accreditation is the formal recognition of specific calibration capabilities. Neither NVLAP nor NIST guarantee the accuracy of individual calibrations made by accredited laboratories.

Note 7: See NIST Handbook 150 for further explanation of these notes.

Note 8: The uncertainties shown are for the most favorable conditions. There is an increase in uncertainty that corresponds to the laboratory's AC voltage and current uncertainties at different frequencies other than the ones shown.

Note 9: Where L is used, it signifies the numeric value of the measured value in the same unit given in the range.

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