



# National Voluntary Laboratory Accreditation Program



## CALIBRATION LABORATORIES

NVLAP LAB CODE 200893-0

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

<b>Transcat - Anaheim</b> 720 N. Valley Street, Suite G Anaheim, CA 92801 Mr. Tony Kutch Phone: 714-817-8160 Fax: 714-817-8163 E-mail: <a href="mailto:tkutch@transcat.com">tkutch@transcat.com</a> URL: <a href="http://www.transcat.com">www.transcat.com</a>	<b>Parameter(s) of Accreditation</b> Dimensional Electromagnetics – DC/Low Frequency Time and Frequency Mechanical Electromagnetics – RF/Microwave Thermodynamic
	This laboratory is compliant to ANSI/NCSL Z540-1-1994; Part 1. (NVLAP Code: 20/A01)

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

Measured Parameter or Device Calibrated	Range	Uncertainty ( $k=2$ ) <sup>Note 3</sup>	Remarks
<b>DIMENSIONAL</b>			
<b>NVLAP Code: 20/D05</b> <b>LENGTH &amp; DIAMETER;</b> <b>STEP GAGES</b> Micrometers and Calipers— Outside, Inside, Depth <sup>Note 4</sup>	0 in to 8 in 8 in to 42 in	Where L is the length in inches of device under test.  $15 \mu\text{in} + 3L \mu\text{in}$ $10 \mu\text{in} + 4L \mu\text{in}$	Comparison to Gage Blocks
Anvil Flatness Field calibrations available <sup>Note 4</sup>	0 in to 1 in	$5.8 \mu\text{in}$	Optical Flats
Anvil Parallelism Field calibrations available <sup>Note 4</sup>	0 in to 1 in	$5.8 \mu\text{in}$	Optical Parallel
Dial Indicators Field calibrations available <sup>Note 4</sup>	0 in to 1 in 1 in to 6 in	$8 \mu\text{in}$ $4 \mu\text{in} + 4L \mu\text{in}$	Gage Blocks
Length – Single Axis Inner Dimensions Outer Dimensions	0.06 in to 4.7 in 0 in to 3.5 in 3.5 in to 10 in	$3 \mu\text{in} + 4L \mu\text{in}$ $3 \mu\text{in} + 4L \mu\text{in}$ $10 \mu\text{in} + 4L \mu\text{in}$	Horizontal Comparator  Super Micrometer

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

Measured Parameter or Device Calibrated	Range	Uncertainty ( $k=2$ ) <small>Note 3</small>	Remarks
Height Measuring Equipment	0 in to 8 in 8 in to 26 in	22 $\mu$ in + 3L $\mu$ in 12 $\mu$ in + 4L $\mu$ in	Gage Blocks with Surface Plate
<b>NVLAP Code: 20/D14</b> <b>THREADED PLUGS &amp; RING GAGES</b> Threaded Plugs – Inner Diameter Outer Pitch Diameter	0 in to 6 in 0 in to 6 in	150 $\mu$ in 83 $\mu$ in	Comparison to Set Plugs Super Micrometer/ Thread Wires

### 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
<b>ELECTROMAGNETICS – DC/LOW FREQUENCY</b>				
<b>NVLAP Code: 20/E02</b> <b>AC RESISTORS AND CURRENT</b> AC Current – Measuring Equipment Field calibrations available <small>Note 4</small>	0 $\mu$ A to 220 $\mu$ A	10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	0.028 % + 16 nA 0.019 % + 10 nA 0.014 % + 8.0 nA 0.030 % + 12 nA 0.11 % + 65 nA	Fluke 5700A-EP
	0.22 mA to 2.2 mA	10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	0.027 % + 40 nA 0.017 % + 35 nA 0.014 % + 35 nA 0.021 % + 0.11 $\mu$ A 0.11 % + 0.65 $\mu$ A	
	2.2 mA to 22 mA	10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	0.028 % + 0.40 $\mu$ A 0.018 % + 0.35 $\mu$ A 0.014 % + 0.35 $\mu$ A 0.021 % + 0.55 $\mu$ A 0.11 % + 5.0 $\mu$ A	

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AC Current – Generate Field calibrations available <small>Note 4</small>	22 mA to 220 mA	10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	0.028 % + 4.0 $\mu$ A 0.018 % + 3.5 $\mu$ A 0.014 % + 2.5 $\mu$ A 0.022 % + 3.5 $\mu$ A 0.11 % + 10 $\mu$ A	Fluke 5700A-EP
	0.22 A to 2.2 A	20 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	0.027 % + 35 $\mu$ A 0.047 % + 80 $\mu$ A 0.71 % + 160 $\mu$ A	
	2.2 A to 11 A	40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	0.049 % + 0.17 mA 0.098 % + 0.38 mA 0.37 % + 0.75 mA	Fluke 5700A-EP with 5725A
	11 A to 20.5 A	45 Hz to 100 Hz 100 Hz to 1 kHz 1 kHz to 5 kHz	0.095 % + 3.9 mA 0.12 % + 3.9 mA 0.10 % + 0.10 A	Fluke 5520A
Extended Frequency Ranges Field calibrations available <small>Note 4</small>	29 $\mu$ A to 329.99 $\mu$ A 330 $\mu$ A to 3.299 mA 3.3 mA to 32.99 mA 33 mA to 329.99 mA	10 kHz to 30 kHz 10 kHz to 30 kHz 10 kHz to 30 kHz 10 kHz to 30 kHz	1.2 % + 0.31 $\mu$ A 0.78 % + 0.47 $\mu$ A 0.31 % + 3.1 $\mu$ A 0.31 % + 0.16 mA	Valhalla 2575A with Agilent 3458A
Clamp-on Ammeter Toroidal Type Field calibrations available <small>Note 4</small>	20 A to 150 A 150 A to 1000 A	45 Hz to 65 Hz 65 Hz to 440 Hz 45 Hz to 65 Hz 65 Hz to 440 Hz	0.30 % + 26 mA 0.83 % + 47 mA 0.35 % + 0.12 A 1.1 % + 0.22 A	Fluke 5520A with 5500A/Coil
Clamp-on Ammeter Non-Toroidal Type Field calibrations available <small>Note 4</small>	20 A to 150 A 150 A to 1000 A	45 Hz to 65 Hz 65 Hz to 440 Hz 45 Hz to 65 Hz 65 Hz to 440 Hz	0.57 % + 0.25 A 1.0 % + 0.25 A 0.60 % + 0.90 A 1.3 % + 0.92 A	Fluke 5520A with 5500A/Coil

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty ( $k=2$ ) <small>Note 3,5</small>	Remarks
AC Current – Measure Field calibrations available <small>Note 4</small>	0 μA to 100 μA	10 Hz to 20 Hz 20 Hz to 45 Hz 45 Hz to 100 Hz 100 Hz to 5 kHz	0.46 % + 30 nA 0.17 % + 30 nA 0.072 % + 30 nA 0.072 % + 30 nA	Agilent 3458A
	100 μA to 1 mA	10 Hz to 20 Hz 20 Hz to 45 Hz 45 Hz to 100 Hz 100 Hz to 5 kHz	0.46 % + 200 nA 0.17 % + 200 nA 0.071 % + 200 nA 0.038 % + 200 nA	
	1 mA to 10 mA	10 Hz to 20 Hz 20 Hz to 45 Hz 45 Hz to 100 Hz 100 Hz to 5 kHz	0.46 % + 2 μA 0.17 % + 2 μA 0.071 % + 2 μA 0.038 % + 2 μA	
	10 mA to 100 mA	10 Hz to 20 Hz 20 Hz to 45 Hz 45 Hz to 100 Hz 100 Hz to 5 kHz	0.46 % + 20 μA 0.17 % + 20 μA 0.071 % + 20 μA 0.037 % + 20 μA	
	100 mA to 1 A	10 Hz to 20 Hz 20 Hz to 45 Hz 45 Hz to 100 Hz 100 Hz to 1 kHz	0.46 % + 0.20 mA 0.19 % + 0.20 mA 0.097 % + 0.20 mA 0.12 % + 0.20 mA	
	1 A to 2 A	50 Hz to 5 kHz	0.031 % + 2 mA	Valhalla 2575A with
	2 A to 20 A	50 Hz to 5 kHz	0.10% + 20 mA	Agilent 3458A
	20 A to 100 A	50 Hz to 5 kHz	0.10 % + 0.10 A	

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Measured Parameter or Device Calibrated	Range	Uncertainty ( $k=2$ ) <small>Note 3,5</small>	Remarks
<b>NVLAP Code: 20/E05</b> <b>DC RESISTANCE AND CURRENT</b> DC Resistance – Measuring Equipment and Measure Field calibrations available <small>Note 4</small>	0 Ω to 10 Ω 10 Ω to 100 Ω 100 Ω to 1 kΩ 1 kΩ to 10 kΩ 10 kΩ to 100 kΩ 100 kΩ to 1 MΩ 1 MΩ to 10 MΩ 10 MΩ to 100 MΩ 100 MΩ to 1 GΩ	17 μΩ/Ω + 50 μΩ 16 μΩ/Ω + 0.5 mΩ 11 μΩ/Ω + 0.5 mΩ 10 μΩ/Ω + 5.0 mΩ 13 μΩ/Ω + 50 mΩ 19 μΩ/Ω + 2.0 Ω 53 μΩ/Ω + 100 Ω 0.056 % + 1.0 kΩ 0.50 % + 10 kΩ	Agilent 3458A with Decade Resistor
DC Resistance – Measuring Equipment Field calibrations available <small>Note 4</small>	1 mΩ 10 mΩ 100 mΩ 2 GΩ to 10 GΩ 20 GΩ to 100 GΩ 200 GΩ to 1 TΩ	18 μΩ/Ω 18 μΩ/Ω 18 μΩ/Ω 0.59 % 1.2 % 2.6 %	L&N 4221B L&N 4222B L&N 4223B IET HRRS-B-3-1G-5KV
DC Current – Measuring Equipment and Measure Field calibrations available <small>Note 4</small>	0 μA to 100 μA 100 μA to 1 mA 1 mA to 10 mA 10 mA to 100 mA 100 mA to 1 A 1 A to 300 A	28 μA/A + 0.8 nA 26 μA/A + 5.0 nA 26 μA/A + 50 nA 42 μA/A + 0.50 μA 0.013 % + 10 μA 0.046 %	Agilent 3458A with Current Source Shunts with DVM & Source
Clamp-on Ammeter Non-Toroidal Type Field calibrations available <small>Note 4</small>	20 A to 150 A 150 A to 1000 A	0.50 % + 0.14 A 0.52 % + 0.50 A	Fluke 5520A with 5500A/Coil

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Measured Parameter or Device Calibrated	Range	Uncertainty ( $k=2$ ) <small>Note 3,5</small>	Remarks
<b>NVLAP Code: 20/E06</b>	0 mV to 100 mV	8.2 $\mu$ V/V + 0.50 $\mu$ V	
<b>DC VOLTAGE</b>	0.1 V to 10 V	5.2 $\mu$ V/V + 0.50 $\mu$ V	
DC Voltage – Measure and Measuring Equipment	10 V to 100 V	7.9 $\mu$ V/V + 30 $\mu$ V	
Field calibrations available <small>Note 4</small>	100 V to 500 V	12 $\mu$ V/V + 0.10 mV	
	500 V to 800 V	17 $\mu$ V/V + 0.10 mV	
	800 V to 1 kV	21 $\mu$ V/V + 0.10 mV	
	1 kV to 20 kV	0.036 %	Hipotronics KVM100-DO
	20 kV to 65 kV	0.073 %	HV Divider with
	65 kV to 100 kV	0.11 %	Agilent 34401A

### 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
<b>NVLAP Code: 20/E09</b>	0 mV to 10 mV	1 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz	0.039 % + 3.0 $\mu$ V 0.028 % + 1.1 $\mu$ V 0.038 % + 1.1 $\mu$ V 0.15 % + 1.1 $\mu$ V 0.59 % + 1.1 $\mu$ V 4.6 % + 2.0 $\mu$ V	
<b>LF AC VOLTAGE</b>	10 mV to 100 mV	1 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz	0.013 % + 4.0 $\mu$ V 0.0094 % + 2.0 $\mu$ V 0.017 % + 2.0 $\mu$ V 0.037 % + 2.0 $\mu$ V 0.093 % + 2.0 $\mu$ V 0.36 % + 10 $\mu$ V 1.2 % + 10 $\mu$ V	Agilent 3458A
AC Voltage – Measure	100 mV to 1 V	1 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 50 kHz	0.0098 % + 40 $\mu$ V 0.0094 % + 20 $\mu$ V 0.017 % + 20 $\mu$ V 0.036 % + 20 $\mu$ V	
Field calibrations available <small>Note 4</small>				

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty ( $k=2$ ) <small>Note 3,5</small>	Remarks
AC Voltage – Measure Field calibrations available <small>Note 4</small>	100 mV to 1 V	50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz	0.093 % + 20 $\mu$ V 0.35 % + 0.10 mV 1.2 % + 0.10 mV	
	1 V to 10 V	1 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz	0.015 % + 0.40 mV 0.0095 % + 0.20 mV 0.017 % + 0.20 mV 0.036 % + 0.20 mV 0.093 % + 0.20 mV 0.35 % + 1.0 mV 1.2 % + 1.0 mV	
	10 V to 100 V	1 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz	0.024 % + 4.0 mV 0.024 % + 2.0 mV 0.024 % + 2.0 mV 0.041 % + 2.0 mV 0.14 % + 2.0 mV 0.46 % + 10 mV 1.7 % + 10 mV	
	100 V to 700 V	1 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz	0.047 % + 20 mV 0.047 % + 20 mV 0.071 % + 20 mV 0.14 % + 20 mV 0.35 % + 20 mV	
	700 V to 5 kV 5 kV to 20 kV 20 kV to 70 kV	60 Hz 60 Hz 60 Hz	0.098 % 0.12 % 0.15 %	Hipotronics KVM100-DO HV Divider with Agilent 34401A
AC Voltage – Measuring Equipment Field calibrations available <small>Note 4</small>	0 mV to 2.2 mV	10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz	0.036 % + 4.0 $\mu$ V 0.033 % + 4.0 $\mu$ V 0.033 % + 4.0 $\mu$ V 0.033 % + 4.0 $\mu$ V 0.057 % + 5 $\mu$ V	Fluke 5700A-EP

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty ( $k=2$ ) <small>Note 3,5</small>	Remarks
AC Voltage – Measuring Equipment <small>Field calibrations available Note 4</small>	0 mV to 2.2 mV  2.2 mV to 22 mV  22 mV to 220 mV  220 mV to 2.2 V  2.2 V to 22 V	100 kHz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1 MHz  10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1 MHz  10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1 MHz  10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1 MHz  10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1 MHz	0.13 % + 10 $\mu$ V 0.20 % + 20 $\mu$ V 0.31 % + 20 $\mu$ V  0.044 % + 4.0 $\mu$ V 0.031 % + 4.0 $\mu$ V 0.015 % + 4.0 $\mu$ V 0.032 % + 4.0 $\mu$ V 0.060 % + 5.0 $\mu$ V 0.066 % + 10 $\mu$ V 0.17 % + 20 $\mu$ V 0.31 % + 20 $\mu$ V  0.029 % + 12 $\mu$ V 0.011 % + 7.0 $\mu$ V 0.0087 % + 7.0 $\mu$ V 0.021 % + 7.0 $\mu$ V 0.048 % + 17 $\mu$ V 0.094 % + 20 $\mu$ V 0.15 % + 25 $\mu$ V 0.28 % + 45 $\mu$ V  0.028 % + 40 $\mu$ V 0.010 % + 15 $\mu$ V 0.0049 % + 8.0 $\mu$ V 0.0083 % + 10 $\mu$ V 0.012 % + 30 $\mu$ V 0.044 % + 80 $\mu$ V 0.10 % + 0.20 mV 0.18 % + 0.30 mV  0.028 % + 0.40 mV 0.010 % + 0.15 mV 0.0050 % + 50 $\mu$ V 0.0084 % + 0.10 mV 0.012 % + 0.20 mV	Fluke 5700A-EP

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty ( $k=2$ ) <small>Note 3,5</small>	Remarks
AC Voltage – Measuring Equipment Field calibrations available <small>Note 4</small>	2.2 V to 22 V	100 kHz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1 MHz	0.031 % + 0.60 mV 0.11 % + 2.0 mV 0.17 % + 3.2 mV	Fluke 5700A-EP
	22 V to 220 V	10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1 MHz	0.028 % + 4.0 mV 0.0088 % + 1.5 mV 0.0056 % + 0.60 mV 0.0093 % + 1.0 mV 0.016 % + 2.5 mV 0.090 % + 16 mV 0.44 % + 40 mV 0.80 % + 80 mV	
	220 V to 750 V	30 kHz to 50 kHz 50 kHz to 100 kHz	0.061 % + 11 mV 0.24 % + 45 mV	Fluke 5700A-EP with 5725A
	220 V to 1100 V	40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 30 kHz	0.011 % + 4.0 mV 0.017 % + 6.0 mV 0.061 % + 11 mV	Fluke 5700A-EP with 5725A

### 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
<b>NVLAP Code: 20/E10</b> <b>LOW FREQUENCY CAPACITANCE</b> Capacitance – Measure Field calibrations available <small>Note 4</small>	0 pF to 10 pF 10 pF to 100 pF 100 pF to 25 µF 25 µF to 100 µF 100 µF to 1000 µF	1 kHz	0.47 % + 0.05 pF 0.058 % + 0.05 pF 0.024 % + 0.05 pF 0.035 % 0.24 %	GenRad 1689-9700

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty ( $k=2$ ) <small>Note 3,5</small>	Remarks
Capacitance – Measuring Equipment Field calibrations available <small>Note 4</small>	1 nF 2 nF 5 nF 10 nF 20 nF 50 nF 0.1 $\mu$ F 0.2 $\mu$ F 0.5 $\mu$ F 1 $\mu$ F	1 kHz	0.017 % 0.017 % 0.017 % 0.017 % 0.017 % 0.017 % 0.017 % 0.017 % 0.017 % 0.017 %	GenRad 1409 Series
	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 110 nF to < 330 nF 0.33 $\mu$ F to < 1.1 $\mu$ F 1.1 $\mu$ F to < 3.3 $\mu$ F 3.3 $\mu$ F to < 11 $\mu$ F 11 $\mu$ F to < 33 $\mu$ F 33 $\mu$ F to < 110 $\mu$ F 110 $\mu$ F to < 330 $\mu$ F 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 10 kHz 10 Hz to 3 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz 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	0.40 % + 7.8 pF 0.39 % + 7.8 pF 0.21 % + 7.8 pF 0.20 % + 78 pF 0.20 % + 0.24 nF 0.21 % + 0.78 nF 0.21 % + 2.4 nF 0.21 % + 7.8 nF 0.32 % + 24 nF 0.37 % + 78 nF 0.38 % + 0.24 $\mu$ F 0.36 % + 0.78 $\mu$ F 0.35 % + 2.4 $\mu$ F 0.35 % + 7.8 $\mu$ F 0.58 % + 24 $\mu$ F 0.86 % + 78 $\mu$ F	Fluke 5520A
<b>NVLAP Code: 20/E11</b> <b>LF INDUCTANCE</b> Measure Field calibrations available <small>Note 4</small>	1 mH to 10 H	1 kHz	0.039 %	GenRad 1689-9700
Measuring Equipment Field calibrations available <small>Note 4</small>	100 $\mu$ H 1 mH 10 mH	1 kHz	0.039 % 0.039 % 0.039 %	GenRad 1689-9700 with fixed sources

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Inductance	100 mH	1 kHz	0.039 %	GenRad 1689-9700
Measuring Equipment Field calibrations available <small>Note 4</small>	1 H		0.039 %	
	10 H		0.039 %	with fixed sources
<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	11 $\mu$ W to 1.1 mW 1.1 mW to 110 mW 0.11W to 110 W 110 W to 330 W	DC DC DC DC	0.024 % 0.027 % 0.024 % 0.018 %	Fluke 5520A
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 %	
3 A to 20.5 A	0.099 W to 0.99 W 0.99 W to 6.8 kW 6.8 W to 20.5 kW	DC DC DC	0.088 % 0.07 % 0.04 %	
AC Power <small>Note 8</small> (PF = 1)				
3.3 mA to 9 mA	0.11 mW to 3 mW 3 mW to 9 W	10 Hz to 65 Hz 10 Hz to 65 Hz	0.13 % 0.077 %	
9 mA to 33 mA	0.3 mW to 10 mW 10 mW to 33 W	10 Hz to 65 Hz 10 Hz to 65 Hz	0.089 % 0.077 %	
33 mA to 90 mA	1 mW to 30 mW 30 mW to 90 W	10 Hz to 65 Hz 10 Hz to 65 Hz	0.071 % 0.057 %	
90 mA to 330 mA	3.0 mW to 100 mW 100 mW to 300 W	10 Hz to 65 Hz 10 Hz to 65 Hz	0.089 % 0.078 %	
0.33 A to 0.9 A	11 mW to 300 mW 300 mW to 900 W	10 Hz to 65 Hz 10 Hz to 65 Hz	0.071 % 0.081 %	

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0.9 A to 2.2 A	30 mW to 720 mW 720 mW to 2 kW	10 Hz to 65 Hz 10 Hz to 65 Hz	0.089 % 0.079 %	
2.2 A to 4.5 A	80 mW to 1.4 W 1.4 W to 4.5 kW	10 Hz to 65 Hz 10 Hz to 65 Hz	0.088 % 0.18 %	
4.5 A to 20.5 A	150 mW to 6.7 W 6.7 W to 20 kW	10 Hz to 65 Hz 10 Hz to 65 Hz	0.17 % 0.17 %	
<b>NVLAP Code: 20/E15</b> <b>PHASE METERS</b> Measuring Equipment Field calibrations available <small>Note 4</small>	0° to 90°	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 30 kHz	0.13° 0.20° 0.39° 1.9° 3.9° 7.8°	Fluke 5520A

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

Measured Parameter or Device Calibrated	Range	Uncertainty ( $k=2$ ) <small>Note 3</small>	Remarks
<b>TIME AND FREQUENCY</b>			
<b>NVLAP Code: 20/F01</b> <b>FREQUENCY</b> <b>DISSEMINATION</b> Frequency – Measuring Equipment and Measure In Lab	10 MHz	$8.0 \times 10^{-11}$	Uncertainty values of derivatives of 10 MHz will differ due to resolution, noise and gating errors. GPS/Datum
Field Service <small>Note 4</small>	10 MHz	$3.1 \times 10^{-9}$	Agilent 53131A (010)

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## CALIBRATION LABORATORIES

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

Measured Parameter	Range	Frequency Range	Uncertainty ( $k=2$ ) <small>Note 3,5</small>	Remarks
<b>NVLAP Code: 20/F03</b>				
<b>SIGNAL</b>				
<b>CHARACTERIZATION</b>				
AM Depth – Measure				
Field calibrations available <small>Note 4</small>				
50 Hz to 10 kHz	5 % to < 40 % 40 % to 99 %	150 kHz to 10 MHz	(0.024AM + 0.014) % (0.024AM + 0.14) %	Agilent 8902A With 11722A
20 Hz to <50 Hz	5 % to < 40 % 40 % to 99 %	150 kHz to 10 MHz	(0.035AM + 0.014) % (0.035AM + 0.14) %	
50 Hz to 50 kHz	5 % to < 40 % 40 % to 99 %	10 MHz to 1.3 GHz	(0.013AM + 0.014) % (0.013AM + 0.14) %	
50 Hz to 50 kHz	5 % to < 40 % 40 % to 99 %	1.3 GHz to 26.5 GHz	(0.018AM + 0.014) % (0.018AM + 0.14) %	Agilent 8902A With 11722A,
(20 Hz to 50 Hz) or (50 kHz to 100 kHz)	5 % to < 40 % 40 % to 99 %	10 MHz to 26.5 GHz	(0.035AM + 0.014) % (0.035AM + 0.14) %	11792A, and 11793A
FM Modulation – Measure				
Field calibrations available <small>Note 4</small>				
20 Hz to 10 kHz	0 kHz to < 4 kHz 4 kHz to 40 kHz 40 kHz to 400 kHz	250 kHz to 10 MHz	(0.023FM + 20) Hz (0.023FM + 22) Hz (0.023FM + 100) Hz	Agilent 8902A With 11722A
50 Hz to 100 kHz	0 kHz to < 4 kHz 4 kHz to < 40 kHz 40 kHz to 400 kHz	10 MHz to 26.5 GHz	(0.012FM + 20) Hz (0.012FM + 22) Hz (0.012FM + 100) Hz	Agilent 8902A With 11722A, 11792A, and 11793A
20 Hz to <50 Hz	0 kHz to < 4 kHz 4 kHz to < 40 kHz 40 kHz to 400 kHz		(0.058FM + 20) Hz (0.058FM + 22) Hz (0.058FM + 100) Hz	
>100 kHz to 200 kHz	0 kHz to < 4 kHz 4 kHz to < 40 kHz 40 kHz to 400 kHz		(0.058FM + 100) Hz (0.058FM + 100) Hz (0.058FM + 100) Hz	
Phase Modulation – Measure				
Field calibrations available <small>Note 4</small>				
200 Hz to 10 kHz	0 rad to < 4 rad 4 rad to < 40 rad	150 kHz to 10 MHz	(0.047PM + 0.030) rad (0.047PM + 0.030) rad	Agilent 8902A With 11722A

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

Measured Parameter	Range	Frequency Range	Uncertainty (k=2) <small>Note 3,5</small>	Remarks
Harmonic Distortion Field calibrations available <small>Note 4</small>	200 Hz to 20 kHz  40 rad to 400 rad  0 rad to < 4 rad 4 rad to < 40 rad 40 rad to 400 rad  0 dBc to -80 dBc	40 rad to 400 rad  10 MHz to 26.5 GHz  30 Hz to 6.5 GHz 6.5 GHz to 22 GHz 22 GHz to 26.5 GHz	(0.047PM + 0.10) rad  (0.040PM + 0.030) rad (0.040PM + 0.030) rad (0.040PM + 0.10) rad  1.7 dB 2.6 dB 3.4 dB	8902A with 1722A, 11792A, And 11793A  Agilent 8563E
Total Harmonic Distortion Field calibrations available <small>Note 4</small>	0 dB to -80 dB	20 Hz to 20 kHz 20 kHz to 100 kHz	1.2 dB 2.3 dB	Agilent 8903B
AM Total Harmonic Distortion Field calibrations available <small>Note 4</small>	0 dB to -80 dB	20 Hz to 100 kHz	2.7 dB	
Total Harmonic Distortion 5 Hz to 600 kHz Field calibrations available <small>Note 4</small>	100 % to 0.3 %  0.1 %	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	3 % 6 % 12 % 6 % 3 % 6 % 12 %	Agilent 334A
Input Voltage Range < 30 V	100 % to 0.3 %  0.1 %	10 Hz to 300 kHz 300 kHz to 500 kHz 500 kHz to 3 MHz 20 Hz to 30 Hz 30 Hz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1.2 MHz	3 % 6 % 12 % 12 % 3 % 6 % 12 %	
Input Voltage Range > 30 V	100 % to 0.3 %  0.1 %	10 Hz to 300 kHz 300 kHz to 500 kHz 500 kHz to 3 MHz 20 Hz to 30 Hz 30 Hz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1.2 MHz	3 % 6 % 12 % 12 % 3 % 6 % 12 %	

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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
<b>NVLAP Code: 20/F04</b> <b>PULSE WAVEFORM</b> Rise Time – Measuring Equipment Rise Time – Measure	$\geq 25$ ps 25 ps to 250 ps $> 250$ ps	3.2 ps 11 % 3.9 %	Pulser Sampling System
<b>MECHANICAL</b>			
<b>NVLAP Code: 20/M06</b> <b>FORCE</b> Force/Tension Field calibrations available <small>Note 4</small>	0.03 lbf to 300 lbf	0.016 %	Deadweights
<b>MASS</b>			
Mass – Metric	30 kg 25 kg 20 kg 10 kg 5 kg 2 kg 1 kg 500 g 200 g 100 g 50 g 20 g 10 g 5 g 2 g 1 g	62 mg 61 mg 61 mg 21 mg 10 mg 4.1 mg 1.6 mg 2.5 mg 0.79 mg 0.12 mg 0.057 mg 0.025 mg 0.025 mg 0.025 mg 0.025 mg	Echelon III
Mass – Avoirdupois	50 lb 30 lb 20 lb 10 lb	61 mg 41 mg 21 mg 10 mg	Echelon III

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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
Mass - Avoirdupois	5 lb	5.0 mg	Echelon III
	3 lb	3.0 mg	
	2 lb	2.0 mg	
	1 lb	1.0 mg	
	8 oz	0.50 mg	
	4 oz	0.20 mg	
	2 oz	0.10 mg	
	1 oz	0.050 mg	
	0.5 oz	0.025 mg	
Balances Field calibrations available <small>Note 4</small>	5 kg	3.6 mg	ASTM Class 1 Weights
	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	
	200 mg	0.011 mg	
	100 mg	0.011 mg	
	50 mg	0.011 mg	
	20 mg	0.011 mg	
	10 mg	0.011 mg	
	5 mg	0.011 mg	
	1 mg	0.011 mg	

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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
Balances – Avoirdupois Field calibrations available <small>Note 4</small>	50 lb 30 lb 20 lb 10 lb 5 lb 3 lb 2 lb 1 lb 8 oz 4 oz 2 oz 1 oz 0.5 oz	2.3 g 1.4 g 0.91 g 0.46 g 0.23 g 0.14 g 91 mg 46 mg 23 mg 12 mg 5.7 mg 2.9 mg 1.4 mg	ASTM Class 4 Weights
<b>NVLAP Code: 20/M15</b> <b>TORQUE</b> Torque – Measure Field calibrations available <small>Note 4</small>	4 lbf-in to 250 lbf-in 250 lbf-in to 250 lbf-ft  250 lbf-ft to 600 lbf-ft	0.39 % 0.56 %  0.56 %	CDI 2000-400-02 with Loader  CDI 2000-12-02 with Loader
Torque – Measuring Equipment	5 ozf-in to 250 lbf-ft	0.058 %	Torque Wheels with Weights
<b>ELECTROMAGNETICS – RF/MICROWAVE</b>			
<b>NVLAP Code: 20/R02</b> <b>COAXIAL/WAVEGUIDE TERMINATIONS</b> VSWR Field calibrations available <small>Note 4</small>	5 MHz to 2 GHz 2 GHz to 18 GHz	0.012 rho (< 1.03 VSWR) 0.021 rho (< 1.05 VSWR)	Anritsu-Wiltron 60N50 Anritsu-Wiltron 87A50
<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	0.066 % 0.10 % 0.18 %	Thermal Voltage Converters

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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
Sine Wave Flatness Field calibrations available <small>Note 4</small>	30 MHz to 50 MHz 50 MHz to 80 MHz 80 MHz to 100 MHz	0.41 % 0.71 % 0.84 %	Thermal Voltage Converters
<b>NVLAP Code: 20/R13</b> <b>RF/MICROWAVE</b> <b>ATTENUATORS</b> Relative Tunes RF Power Field calibrations available <small>Note 4</small>			
100 kHz to 1.3 GHz	0 dB to -10 dB -10 dB to -20 dB -20 dB to -30 dB -30 dB to -40 dB -40 dB to -50 dB -50 dB to -60 dB -60 dB to -70 dB -70 dB to -80 dB -80 dB to -90 dB -90 dB to -100 dB -100 dB to -110 dB -110 dB to -127 dB	0.026 dB 0.042 dB 0.053 dB 0.062 dB 0.084 dB 0.090 dB 0.096 dB 0.10 dB 0.12 dB 0.12 dB 0.12 dB 0.25 dB	Agilent 8902A with 11722A
1.3 GHz to 26.5 GHz	0 dB to -10 dB -10 dB to -20 dB -20 dB to -30 dB -30 dB to -40 dB -40 dB to -50 dB -50 dB to -60 dB -60 dB to -70 dB -70 dB to -80 dB -80 dB to -90 dB -90 dB to -100 dB -100 dB to -110 dB -110 dB to -127 dB	0.053 dB 0.062 dB 0.070 dB 0.077 dB 0.095 dB 0.10 dB 0.11 dB 0.11 dB 0.12 dB 0.24 dB 0.25 dB 0.26 dB	Agilent 8902A with 11792A and 11793A

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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
<b>NVLAP Code: 20/R17</b> <b>RF/MICROWAVE POWER METERS</b> Absolute RF Power Field calibrations available <small>Note 4</small>	1 mW Reference	50 MHz	0.34 % (0.014 dBm)	Agilent 478A-H75, 432A, and 3458A
Absolute RF Power Field calibrations available <small>Note 4</small>	+30 dBm to -20 dBm	100 kHz to 2.6 GHz	2.0 %	Agilent 8902A with 11722A
		2.6 GHz to 12 GHz	3.3 %	8902A with 1722A, 11792A, And 11793A
		12 GHz to 19 GHz	4.0 %	
		19 GHz to 26.5 GHz	4.4 %	

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

Measured Parameter or Device Calibrated	Range	Uncertainty ( $k=2$ ) <small>Note 3,5</small>	Remarks
<b>THERMODYNAMIC</b>			
<b>NVLAP Code: 20/T02</b> <b>HUMIDITY</b> Relative Humidity Field calibrations available <small>Note 4</small>	20 % to 90 %	1.3 %	Vaisala HMI41 with HMP46
<b>NVLAP Code: 20/T03</b> <b>LABORTORY THERMOMETERS</b> Measure Field calibrations available <small>Note 4</small>	-195 °C to 660 °C	0.0087 °C + 0.003 %	Hart 5628 w/Black Stack
Measuring Equipment Field calibrations available <small>Note 4</small>	-80 °C to 110 °C	0.015 °C + 0.003 %	Hart 5628 w/Black Stack and Liquid Bath

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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
Measuring Equipment Field calibrations available <small>Note 4</small>	110 °C to 300 °C  300 °C to 600 °C	0.14 °C + 0.003 %  0.35 °C + 0.003 %	Hart 5628 w/Black Stack and Hart 9122  Hart 5628 w/Black Stack
<b>NVLAP Code: 20/T05</b> <b>PRESSURE</b>			
Absolute Pressure – Source	0 psia to 25 psia 25 psia to 500 psia	0.0019 psia 0.0065 % + 0.001 psia	Ruska 7250xi
Gage Pressure Measuring Equipment – Pneumatic Field calibrations available <small>Note 4</small>	-2 in H <sub>2</sub> O to 2 in H <sub>2</sub> O -14.7 psig to -0.5 psig 0.5 psig to 3 psig 3 psig to 25 psig 25 psig to 500 psig	0.0012 in H <sub>2</sub> O 0.017 % 0.017 % 0.0078 % 0.0066 %	Dwyer 1430 Pressurements T3500  Ruska 7250xi
Pressure Measuring Equipment – Hydraulic Field calibrations available <small>Note 4</small>	500 psig to 1500 psig 1500 psig to 15 000 psig	0.0080 % 0.016 %	Ametek T-150

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

Measured Parameter or Device Calibrated	Type	Range	Uncertainty ( $k=2$ ) <small>Note 3</small>	Remarks
<b>NVLAP Code: 20/T08</b> <b>TEMPERATURE INDICATORS</b>				
Electrical Calibration of Thermocouple Devices Field calibrations available <small>Note 4</small>	Type J Type K Type T Type E	-210 °C to 1200 °C -270 °C to 1372 °C -270 °C to 400 °C -270 °C to 1000 °C	0.090 °C 0.091 °C 0.098 °C 0.093 °C	Thermocouple Half Junctions
	Type R Type R Type R	0 °C to 250 °C 250 °C to 400 °C 400 °C to 1000 °C	0.44 °C 0.27 °C 0.26 °C	Fluke 5520A

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

Measured Parameter or Device Calibrated	Type	Range	Uncertainty ( $k=2$ ) <small>Note 3</small>	Remarks
Electrical Calibration of Thermocouple Devices Field calibrations available <small>Note 4</small>	Type R	1000 °C to 1767 °C	0.31 °C	Fluke 5520A
	Type S	0 °C to 250 °C	0.36 °C	
	Type S	250 °C to 1000 °C	0.28 °C	
	Type S	1000 °C to 1400 °C	0.29 °C	
	Type S	1400 °C to 1767 °C	0.36 °C	
	Type N	-200 °C to -100 °C	0.31 °C	
	Type N	-100 °C to 25 °C	0.17 °C	
	Type N	25 °C to 120 °C	0.15 °C	
	Type N	120 °C to 410 °C	0.14 °C	
	Type N	410 °C to 1300 °C	0.21 °C	
	Type B	600 °C to 800 °C	0.34 °C	
	Type B	800 °C to 1000 °C	0.26 °C	
	Type B	1000 °C to 1550 °C	0.23 °C	
	Type B	1550 °C to 1820 °C	0.26 °C	

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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. The CMC is described in the laboratory's scope of accreditation by: the measurement parameter/device being calibrated, the measurement range, the uncertainty associated with that range (see note 3), and remarks on additional parameters, if applicable.

**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. Exceptions to this occur when marketplace practice employs mixed units, such as when the artifact to be measured is labeled in non-SI units and the uncertainty is given in SI units (Example: 5 lb weight with uncertainty given in mg).

**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. The uncertainties quoted do not include possible effects on the calibrated device of transportation, long term stability, or intended use.

**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. Such special tests are not covered by the CMCs and are outside the laboratory's scope of accreditation. In this case, NVLAP requirements for the labeling, on calibration reports, of results outside the laboratory's scope of accreditation apply. These requirements are set out in Annex A.1.h. of NIST Handbook 150, Procedures and General Requirements.

**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. (This note applies only if marked in the body of the scope.)

**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. Power factors (PF) other than the one shown contribute to the power uncertainty. PF is related to the cosine of phase. Therefore, uncertainties track the laboratory's phase uncertainty closely at PF near one, but are magnified heavily as PF approaches zero. The lab may also report reactive power, apparent power, and power factor under this accreditation. If needed, contact laboratory for more information regarding uncertainties at frequency and power factor combinations other than the ones shown.

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