National Voluntary Laboratory Accreditation Program

CALIBRATION LABORATORIES **NVLAP LAB CODE 200902-0**

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

Transcat – Philadelphia 100 Dobbs Lane, Suite 108-110 Cherry Hill, NJ 08034 Mr. Derek Still Phone: 856-489-9453; Fax: 856-489-9743 E-mail: dstill@transcat.com URL: http://www.transcat.com	**Fields of Calibration** Dimensional Electromagnetics – DC/Low Frequency Time and Frequency Mechanical Optical Radiation Electromagnetics – RF/Microwave Thermodynamic This laboratory is compliant to ANSI/NCSL Z540-1-1994; Part 1. ((20/A01)

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	**Range**	**Uncertainty (*k*=2)** Note 3	**Remarks**
DIMENSIONAL			
ANGULAR (20/D01)			
Angles	0° to 75° 90°	6.3” 1.1”	Angle Blocks Master Square
LENGTH and DIAMETER (20/D05)			
Micrometers and Calipers – Outside, Inside, Depth Field calibrations available Note 4	0.01 in to 1 in 1 in to 9 in 4 in to 15 in 15 in to 40 in	16 µin + 1 µin/in 11 µin + 4 µin/in 13 µin + 4.5 µin/in 15 µin + 4.6 µin/in	Comparison to Gage Blocks
Anvil Flatness Field calibrations available Note 4	0 in to 1 in	4.4 µin	Optical Flats
Anvil Parallelism Field calibrations available Note 4	0 in to 1 in	8.2 µin	Optical Parallel
Digital and Dial Indicators Field calibrations available Note 4	0 in to 1 in 1 in to 6 in	21 µin + 1 µin/in 17 µin + 3 µin/in	Gage Blocks with Surface Plate

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Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) Note 3	Remarks
Length Measurement – Single Axis	0 in to 1 in 1 in to 10 in	13 µin + 1 µin/in 8 µin + 5 µin/in	Supermicrometer and Gage Blocks
Height Gages Field calibrations available Note 4	0 in to 8 in 8 in to 32 in 32 in to 44 in	26 µin + 5 µin/in 15 µin + 7 µin/in 23 µin + 7 µin/in	Gage Blocks with Surface Plate
Optical Comparators Field calibrations available Note 4	0 in to 12 in 0 in to 12 in 0 in to 12 in 10x to 50x	290 µin 290 µin 730 µin 180 µin	Glass Grid; X Axis Y Axis X-Y Axis
SPHERICAL DIAMETER; PLUG / RING GAGES (20/D11)			
Outer Spherical Diameter	0 in to 1 in	86 µin	P&W Model B
SURVEYING RODS and TAPES (20/D13)			
Tapes and Rulers	0 ft to 100 ft	0.0017 in	Glass Grid
TWO DIMENSIONAL GAGES (20/D15)			
Linear Dimension – Optical 2 Axis (X-Y)	6 in x 6 in	120 µin	Optical Comparator
Radius	0 in to 12 in	120 µin	

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (*k*=2) Note 3,5	Remarks
ELECTROMAGNETICS – DC/LOW FREQUENCY				
AC RESISTORS and CURRENT (20/E02)				
AC Current – Measuring Equipment Field calibrations available Note 4	0 µA to 220 µA	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	0.030 % + 16 nA 0.019 % + 10 nA 0.015 % + 8 nA 0.030 % + 12 nA 0.11 % + 65 nA	Fluke 5700A-EP

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) Note 3,5	Remarks
	0.22 mA to 2.2 mA	10 Hz to 20 Hz	0.030 % + 40 nA	
		20 Hz to 40 Hz	0.018 % + 35 nA	
		40 Hz to 1 kHz	0.013 % + 35 nA	
		1 kHz to 5 kHz	0.021 % + 0.11 µA	
		5 kHz to 10 kHz	0.11 % + 0.65 µA	
	2.2 mA to 22 mA	10 Hz to 20 Hz	0.039 % + 0.40 µA	
		20 Hz to 40 Hz	0.019 % + 0.35 µA	
		40 Hz to 1 kHz	0.014 % + 0.35 µA	
		1 kHz to 5 kHz	0.021 % + 0.55 µA	
		5 kHz to 10 kHz	0.11 % + 5 µA	
	22 mA to 220 mA	10 Hz to 20 Hz	0.033 % + 4 µA	
		20 Hz to 40 Hz	0.018 % + 3.5 µA	
		40 Hz to 1 kHz	0.014 % + 2.5 µA	
		1 kHz to 5 kHz	0.021 % + 3.5 µA	
		5 kHz to 10 kHz	0.11 % + 10 µA	
	0.22 A to 2.2 A	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	
	2.2 A to 11 A	40 Hz to 1 kHz	0.048 % + 170 µA	Fluke 5700A-EP with 5725A
		1 kHz to 5 kHz	0.096 % + 380 µA	
		5 kHz to 10 kHz	0.36 % + 750 µA	
	11 A to 20 A	45 Hz to 100Hz	0.092 % + 3.9 mA	Fluke 5522A
		100 Hz to 1 kHz	0.12 % + 3.9 mA	
		1 kHz to 5 kHz	2.3 % + 3.9 mA	
	20 A to 100 A	DC to 1 kHz	0.14 % + 0.04 A	Ohms Labs CS-100
Extended Frequency Ranges Field calibrations available Note 4	29 µA to 330 µA	10 kHz to 30 kHz	1.2 % + 0.31 µA	Fluke 5522A
	330 µA to 3.3 mA	10 kHz to 30 kHz	0.78 % + 0.47 µA	
	3.3 mA to 33 mA	10 kHz to 30 kHz	0.31 % + 3 µA	
	29 mA to 330 mA	10 kHz to 30 kHz	0.31 % + 0.16 mA	

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) Note 3,5	Remarks
Clamp-on Ammeter Toroidal Type Field calibrations available Note 4	20 A to 150 A	45 Hz to 65 Hz 65 Hz to 440 Hz	0.34 % + 35 mA 0.95 % + 66 mA	Fluke 5520A with 5500A/Coil
	150 A to 1000 A	45 Hz to 65 Hz 65 Hz to 440 Hz	0.38 % + 0.17 A 1.2 % + 0.29 A	
Clamp-on Ammeter Non-Toroidal Type Field calibrations available Note 4	20 A to 150 A	45 Hz to 65 Hz 65 Hz to 440 Hz	0.66 % + 0.26 A 1.2 % + 0.29 A	Fluke 5520A with 5500A/Coil
	150 A to 1000 A	45 Hz to 65 Hz 65 Hz to 440 Hz	0.68 % + 1.0 A 1.4 % + 1.1 A	
AC Current – Measure Field calibrations available Note 4	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 % + 35 nA 0.17 % + 35 nA 0.072 % + 35 nA 0.072 % + 35 nA	Agilent 3458A opt 002
	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 % + 0.23 µA 0.17 % + 0.23 µA 0.071 % + 0.23 µA 0.038 % + 0.23 µA	
	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 % + 2.3 µA 0.17 % + 2.3 µA 0.071 % + 2.3 µA 0.038 % + 2.3 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 % + 23 µA 0.17 % + 23 µA 0.071 % + 23 µA 0.038 % + 23 µA	
	100 mA to 1 A	10 Hz to 20 Hz 20 Hz to 45 Hz 45 Hz to 100 Hz 100 Hz to 5 kHz	0.46 % + 0.23 mA 0.19 % + 0.23 mA 0.097 % + 0.23 mA 0.12 % + 0.23 mA	

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) Note 3,5	Remarks
	1 A to 10 A	100 Hz to 10 kHz	0.18 % + 6.9 mA	Fluke 8846A
	10 A to 100 A	1Hz to 1 kHz	0.13 % + 0.04 A	CS-100 with Fluke 8846A
AC Resistance – Measure Field calibrations available Note 4	10 Ω to 100 kΩ	12 Hz to 99.9 kHz	0.039 % + 0.01 Ω	GenRad 1689M

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Uncertainty (k=2) Note 3,5	Remarks
DC RESISTANCE and CURRENT (20/E05)			
DC Resistance – Measuring Equipment and Measure Field calibrations available Note 4	0 Ω to 25 Ω	42 μΩ	Bridge with Decade Resistor
	25 Ω to 400 Ω	1.3 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 + 58 μΩ	Agilent 3458A with Decade Resistor
	10 Ω to 100 Ω	15 μΩ/Ω + 0.6 mΩ	
	100 Ω to 1 kΩ	12 μΩ/Ω + 0.58 mΩ	
	1 kΩ to 10 kΩ	12 μΩ/Ω + 5.8 mΩ	
	10 kΩ to 100 kΩ	12 μΩ/Ω + 58 mΩ	
	100 kΩ to 1 MΩ	19 μΩ/Ω + 2.3 Ω	
	1 MΩ to 10 MΩ	62 μΩ/Ω + 0.12 kΩ	
	10 MΩ to 100 MΩ	588 μΩ/Ω + 1.2 kΩ	
	100 MΩ to 1 GΩ	0.58 % + 10 kΩ	
DC Resistance – Measuring Equipment Field calibrations available Note 4	1 mΩ	59 μΩ/Ω	Fixed Resistor
	10 mΩ	58 μΩ/Ω	
	100 mΩ	58 μΩ/Ω	
	1 Ω	58 μΩ/Ω	
	100 Ω	1.3 μΩ/Ω	
	2 GΩ to 10 GΩ	0.58 %	IET HRRS-B-7-100k-5KV
	20 GΩ to 100 GΩ	1.2 %	
	200 GΩ to 1 TΩ	2.6 %	

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Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) Note 3,5	Remarks
DC Current – Measuring Equipment and Measure Field calibrations available Note 4	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	26 µA/A + 0.9 nA 26 µA/A + 6 nA 26 µA/A + 58 nA 43 µA/A + 0.58 µA 128 µA/A + 12 µA	Agilent 3458A with Current Source
	1 A to 3 A 3 A to 10 A	0.11 % + 0.69 mA 0.17 % + 0.92 mA	Fluke 8846A
	10 A to 100 A	0.14 % + 40 mA	CS-100 with Fluke 8846A
DC Current – Measuring Equipment Field calibrations available Note 4	0 µA to 220 µA 0.22 mA to 2.2 mA 2.2 mA to 22 mA 22 mA to 220 mA 0.22 A to 2.2 A 2.2 A to 11 A	41 µA/A + 6 nA 36 µA/A + 7 nA 36 µA/A + 40 nA 57 µA/A + 0.7 µA 202 µA/A + 12 µA 403 µA/A + 0.48 mA	Fluke 5700A-EP with 5725A
	11 A to 20 A	0.096 % + 580 µA	Fluke 5522A
Clamp-on Ammeter Non-Toroidal Type	20 A to 1000 A	0.58 % + 0.52 A	Fluke 5522A with 5500A/Coil
DC VOLTAGE (20/E06)			
DC Voltage – Measure Field calibrations available Note 4	1 kV to 10 kV 10 kV to 15 kV 15 kV to 25 kV 25 kV to 50 kV 50 kV to 75 kV 75 kV to 100 kV	0.05 % 0.072 % 0.080 % - 4.4 V 0.098% - 8 V 0.15% - 34 V 0.22% - 86 V	Vitrek 4700 Vitrek 4700/HVL-70 Vitrek 4700/HVL-100
DC Voltage – Measure Equipment Field calibrations available Note 4	0 to 220 mV 220 mV to 2.2 V 2.2 V to 11 V 11 V to 22 V	8.0 µV/V + 0.4 µV 5.4µV/V + 0.7 µV 4 µV/V + 2.5 µV 4 µV/V + 4 µV	Fluke 5700A-EP with 5725A

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Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) Note 3,5	Remarks
DC Voltage – Measuring Equipment and Measure Field calibrations available Note 4	22 V to 220 V 220 V to 1100 V 0 V to 100 mV 100 mV to 1V 1 V to 10 V 10 V to 100 V 100 V to 500 V 500 V to 800 V 800 V to 1000 V	6.2 µV/V + 40 µV 7.6 µV/V + 400 µV 7.1 µV/V + 0.5 µV 5.0 µV/V + 0.5 µV 5.1 µV/V + 0.5 µV 7.6 µV/V + 35 µV 11 µV/V +120 µV 17 µV/V + 120 µV 21 µV/V + 120 µV	Agilent 3458A opt 2 with Fluke 5700A-EP
pH – Measuring Equipment Field calibrations available Note 4	4 pH 7 pH 10 pH	0.011 pH 0.010 pH 0.011 pH	Standard Buffer Solutions

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (*k*=2) Note 3,5	Remarks
LF AC VOLTAGE (20/E09)				
AC High Voltage – Measure Field calibrations available Note 4	0.7 kV to 1 kV 0.7 kV to 1 kV 1 kV to 10 kV 1 kV to 10 kV 10 kV to 15 kV 10 kV to 15 kV 15 kV to 25 kV 15 kV to 25 kV 25 kV to 50 kV 25 kV to 50 kV 50 kV to 70 kV 50 kV to 70 kV	10 Hz to 200 Hz 200 Hz to 450 Hz 10 Hz to 200 Hz 200 Hz to 450 Hz 30 Hz to 100 Hz 100 Hz to 450 Hz 30 Hz to 100 Hz 100 Hz to 450 Hz 30 Hz to 70 Hz 70 Hz to 200 Hz 30 Hz to 70 Hz 70 Hz to 200 Hz	0.36 % 0.74 % 0.17 % + 0.8 V 0.47 % + 1.0 V 0.41 % 2.9 % 0.32 % - 32 V 2.9 % 0.18 % + 4 V 1.3 % 0.21 % - 21 V 1.3 %	Vitrek 4700 Vitrek 4700/HVL-70 Vitrek 4700/HVL-100
AC Voltage – Measure Field calibrations available Note 4	0 mV to 10 mV	1 Hz to 40 Hz 40 Hz to 1 kHz	0.039 % + 3.5 µV 0.028 % + 1.3 µV	Agilent 3458A

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) Note 3,5	Remarks
		1 kHz to 20 kHz	0.038 % + 1.3 µV	
		20 kHz to 50 kHz	0.15 % + 1.3 µV	
		50 kHz to 100 kHz	0.59 % + 1.3 µV	
		100 kHz to 300 kHz	4.6 % + 2.3 µV	
	10 mV to 100 mV	1 Hz to 40 Hz	0.013 % + 5 µV	
		40 Hz to 1 kHz	0.0094 % + 2.3 µV	
		1 kHz to 20 kHz	0.017 % + 2.3 µV	
		20 kHz to 50 kHz	0.037 % + 2.3 µV	
		50 kHz to 100 kHz	0.093 % + 2.3 µV	
		100 kHz to 300 kHz	0.36 % + 12 µV	
		300 kHz to 1 MHz	1.2 % + 12 µV	
	100 mV to 1 V	1 Hz to 40 Hz	0.0098 % + 46 µV	
		40 Hz to 1 kHz	0.0094 % + 23 µV	
		1 kHz to 20 kHz	0.017 % + 23 µV	
		20 kHz to 50 kHz	0.036 % + 23 µV	
		50 kHz to 100 kHz	0.093 % + 23 µV	
		100 kHz to 300 kHz	0.35 % + 0.12 mV	
		300 kHz to 1 MHz	1.2 % + 0.12 mV	
	1 V to 10 V	1 Hz to 40 Hz	0.0094 % + 0.46 mV	
		40 Hz to 1 kHz	0.0095 % + 0.23 mV	
		1 kHz to 20 kHz	0.017 % + 0.23 mV	
		20 kHz to 50 kHz	0.036 % + 0.23 mV	
		50 kHz to 100 kHz	0.093 % + 0.23 mV	
		100 kHz to 300 kHz	0.35 % + 1.2 mV	
		300 kHz to 1 MHz	1.2 % + 1.2 mV	
	10 V to 100 V	1 Hz to 40 Hz	0.024 % + 4.6 mV	
		40 Hz to 1 kHz	0.024 % + 2.3 mV	
		1 kHz to 20 kHz	0.024 % + 2.3 mV	
		20 kHz to 50 kHz	0.041 % + 2.3 mV	
		50 kHz to 100 kHz	0.14 % + 2.3 mV	
		100 kHz to 300 kHz	0.46 % + 12 mV	
		300 kHz to 1 MHz	1.7 % + 12 mV	

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) Note 3,5	Remarks
AC Voltage – Measuring Equipment Field calibrations available Note 4	100 V to 700 V	1 Hz to 40 Hz	0.047 % + 46 mV	Fluke 5700A-EP
		40 Hz to 1 kHz	0.047 % + 23 mV	
		1 kHz to 20 kHz	0.071 % + 23 mV	
		20 kHz to 50 kHz	0.14 % + 23 mV	
		50 kHz to 100 kHz	0.35 % + 23 mV	
	0 mV to 2.2 mV	10 Hz to 20 Hz	0.16 % + 4 µV	
		20 Hz to 40 Hz	0.16 % + 4 µV	
		40 Hz to 20 kHz	0.10 % + 4 µV	
		20 kHz to 50 kHz	0.12 % + 4 µV	
		50 kHz to 100 kHz	0.17 % + 5 µV	
		100 kHz to 300 kHz	0.33 % + 10 µV	
		300 kHz to 500 kHz	0.47 % + 20 µV	
		500 kHz to 1 MHz	0.58 % + 20 µV	
	2.2 mV to 22 mV	10 Hz to 20 Hz	0.044 % + 4 µV	
		20 Hz to 40 Hz	0.035 % + 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	
		300 kHz to 500 kHz	0.16 % + 20 µV	
		500 kHz to 1 MHz	0.30 % + 20 µV	
	22 mV to 220 mV	10 Hz to 20 Hz	0.028 % + 12 µV	
		20 Hz to 40 Hz	0.017 % + 7 µV	
		40 Hz to 20 kHz	0.010 % + 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	
	220 mV to 2.2 V	10 Hz to 20 Hz	0.028 % + 40 µV	
		20 Hz to 40 Hz	0.016 % + 15 µV	
		40 Hz to 20 kHz	0.006 % + 8 µV	

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) Note 3,5	Remarks
		20 kHz to 50 kHz	0.008 % + 10 µV	
		50 kHz to 100 kHz	0.012 % + 30 µV	
		100 kHz to 300 kHz	0.043 % + 80 µV	
		300 kHz to 500 kHz	0.10 % + 0.20 mV	
		500 kHz to 1 MHz	0.18 % + 0.30 mV	
	2.2 V to 22 V	10 Hz to 20 Hz	0.028 % + 0.4 mV	
		20 Hz to 40 Hz	0.016 % + 0.15 mV	
		40 Hz to 20 kHz	0.005 % + 0.05 mV	
		20 kHz to 50 kHz	0.008 % + 0.1 mV	
		50 kHz to 100 kHz	0.011 % + 0.2 mV	
		100 kHz to 300 kHz	0.030 % + 0.6 mV	
		300 kHz to 500 kHz	0.10 % + 2 mV	
		500 kHz to 1 MHz	0.17 % + 3.2 mV	
	22 V to 220 V	10 Hz to 20 Hz	0.028 % + 4 mV	
		20 Hz to 40 Hz	0.010 % + 1.5 mV	
		40 Hz to 20 kHz	0.006 % + 0.6 mV	
		20 kHz to 50 kHz	0.009 % + 1 mV	
		50 kHz to 100 kHz	0.016 % + 2.5 mV	
		100 kHz to 300 kHz	0.09 % + 16 mV	
		300 kHz to 500 kHz	0.44 % + 40 mV	
		500 kHz to 1 MHz	0.80 % + 80 mV	
	220 V to 1100 V	50 Hz to 1 kHz	0.011 % + 4 mV	Fluke 5720A-EP with 5725A
		1 kHz to 20 kHz	0.017 % + 6 mV	
		20 kHz to 30 kHz	0.061 % + 11 mV	
	220 V to 750 V	30 kHz to 50 kHz	0.061 % + 11 mV	
		50 kHz to 100 kHz	0.23 % + 45 mV	
LF CAPACITANCE (20/E10)				
Capacitance – Measure Field calibrations available Note 4	Up to 10 pF	0.1 kHz to 1 kHz	0.5 % + 0.05 pF	GenRad 1689M
	10 pF to 100 pF		0.59 % + 0.05 pF	
	100 pF to 1 µF		0.024 % + 0.05 pF	
	1 µF to 100 µF		0.12 %	

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	100 µF to 1000 µF		0.24 %	
Measuring Equipment Field calibrations available Note 4	0.19 nF to < 1.1 nF	10 Hz to 10 kHz	0.39 % + 7.8 pF	5520A
	1.1 nF to < 3.3 nF	10 Hz to 3 kHz	0.39 % + 7.8 pF	
	3.3 nF to < 11 nF	10 Hz to 1 kHz	0.21 % + 7.8 pF	
	11 nF to < 110 nF	10 Hz to 1 kHz	0.21 % + 78 pF	
	110 nF to < 330 nF	10 Hz to 1 kHz	0.21 % + 0.23 nF	
	0.33 µF to < 1.1 µF	10 Hz to 600 Hz	0.21 % + 0.78 nF	
	1.1 µF to < 3.3 µF	10 Hz to 300 Hz	0.21 % + 2.3 nF	
	3.3 µF to < 11 µF	10 Hz to 150 Hz	0.21 % + 7.8 nF	
	11 µF to < 33 µF	10 Hz to 120 Hz	0.32 % + 23 nF	
	33 µF to < 110 µF	10 Hz to 80 Hz	0.36 % + 78 nF	
	110 µF to < 330 µF	DC to 50 Hz	0.36 % + 0.23 µF	
	0.33 mF to < 1.1 mF	DC to 20 Hz	0.35 % + 0.78 µF	
	1.1 mF to < 3.3 mF	DC to 6 Hz	0.35 % + 2.3 µF	
	3.3 mF to < 11 mF	DC to 2 Hz	0.35 % + 7.8 µF	
	11 mF to < 33 mF	DC to 0.6 Hz	0.58 % + 23 µF	
	33 mF to < 110 mF	DC to 0.2 Hz	0.85 % + 78 µF	
LF INDUCTANCE (20/E11)				
Field calibrations available Note 4	1 mH to 10 mH	0.1 kHz to 1 kHz	0.041 % + 0.1 µH	GenRad 1689M
	10 mH to 10 H		0.035 % + 1.4 µH	
Inductance – Measure Equipment Field calibrations available Note 4	1 mH	1 kHz	0.13 %	Fixed Inductor
	10 mH		0.13 %	
	100 mH		0.13 %	
	1 H		0.13 %	
LF POWER/ENERGY (20/E12)				
Power – Measuring Equipment (for current range listed below) DC Power 0.33 mA to 330 mA	11 µW to 1.1 mW	DC	0.024 %	Fluke 5520A
	1.1 mW to 110 mW	DC	0.027 %	
	0.11W to 110 W	DC	0.024 %	
	110 W to 330 W	DC	0.018 %	

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0.33 A to 3 A	11 W to 110 mW	DC	0.044 %	
	0.11 W to 990 W	DC	0.053 %	
	1 W to 3 kW	DC	0.0096 %	
3 A to 20.5 A	0.099 W to 0.99 W	DC	0.088 %	
	0.99 W to 6.8 kW	DC	0.07 %	
	6.8 W to 20.5 kW	DC	0.04 %	
AC Power Note 8 (PF = 1)				
3.3 mA to 9 mA	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	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 %	
33 mA to 90 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 %	
90 mA to 330 mA	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 %	
0.33 A to 0.9 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 %	
0.9 A to 2.2 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 %	
2.2 A to 4.5 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 %	
PHASE METERS (20/E15)				
Phase Meters – Measure Equipment Field calibrations available Note 4	0° to 180°	10 Hz to 65 Hz 65 Hz to 500 Hz	0.09° 0.20°	Fluke 5520A

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) Note 3,5	Remarks
		500 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz 10 kHz to 20 kHz	0.39° 1.9° 3.9° 7.8°	
CONDUCTIVITY METERS (20/E21)				
Conductivity Meters – Measuring Equipment	10 µS 100 µS 1000 µS 10 000 µS 100 000 µS		0.50 µS 2.2 µS 5.8 µS 36 µS 430 µS	Standard Solutions
TIME and FREQUENCY				
FREQUENCY DISSEMINATION (20/F01)				
Frequency – Source and Measure In-Lab Field Note 4	 10 MHz 10 MHz		 5.8×10^{-10} 2.1×10^{-7}	 Rubidium Oscillator Agilent 53132A
OSCILLATOR CHARACTERIZATION (20/F03)				
Total Harmonic Distortion	0 dB to -80 dB	20 Hz to 20 kHz 20 kHz to 100 kHz	1.1 dB 2.0 dB	Agilent 8903B
Total Harmonic Distortion 5 Hz to 600 kHz Fundamental Input Voltage Range < 30 V	100 % to 0.3 %	10 Hz to 1 MHz 1 MHz to 3 MHz	3 % 6 %	Agilent 334A
	0.1 %	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	12 % 6 % 3 % 6 % 12 %	
Input Voltage Range > 30 V	100 % to 0.3 %	10 Hz to 300 kHz 300 kHz to 500 kHz	3 % 6 %	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (*k*=2) Note 3,5	Remarks
		500 kHz to 3 MHz	12 %	
	0.1 %	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) Notes 1,2

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) Note 3,5	Remarks
PULSE WAVEFORM (20/F04)			
Rise Time – Measuring Equipment Field calibrations available Note 4	250 ps nominal	51 ps Note 9	5520A SC1100
Rise Time – Measure Field calibrations available Note 4	≥ 700 ps	0.8 ns	HP 54615B
MECHANICAL			
FLOW RATE (20/M05)			
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 % 0.59 %	DH Molbloc
FORCE (20/M06)			
Compression/Tension	0.1 lbf to 500 lbf	0.024 %	Dead Weight
MASS DETERMINATION (20/M08)			
Mass – Metric	10 kg 5 kg 3 kg 2 kg 1 kg 500 g 300 g 200 g 100 g	3.4 mg 1.3 mg 1.2 mg 1.1 mg 0.22 mg 91 µg 62 µg 41 µg 25 µg	Echelon II

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) Note 3,5	Remarks
	50 g	12 µg	
	30 g	12 µg	
	20 g	9.0 µg	
	10 g	6.5 µg	
	5 g	4.0 µg	
	3 g	3.5 µg	
	2 g	2.9 µg	
	1 g	2.9 µg	
	500 mg	1.7 µg	
	300 mg	1.7 µg	
	200 mg	1.7 µg	
	100 mg	1.7 µg	
	50 mg	1.7 µg	
	30 mg	1.7 µg	
	20 mg	1.7 µg	
	10 mg	1.7 µg	
	5 mg	1.7 µg	
	3 mg	1.7 µg	
	2 mg	1.7 µg	
	1 mg	1.7 µg	
	25 kg	0.10 g	Echelon III
	20 kg	0.10 g	
	10 kg	9.7 mg	
	5 kg	4.4 mg	
	3 kg	2.9 mg	
	2 kg	2.4 mg	
	1 kg	0.84 mg	
	500 g	0.42 mg	
	300 g	0.25 mg	
	200 g	0.17 mg	
	100 g	88 µg	
	50 g	43 µg	
	30 g	29 µg	
	20 g	25 µg	
	10 g	17 µg	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) Note 3,5	Remarks
	5 g	11 µg	
	3 g	12 µg	
	2 g	11 µg	
	1 g	11 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	
Mass – Avoirdupois	50 lb	0.10 g	Echelon III
	25 lb	0.10 g	
	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	
	0.5 oz	20 µg	
	0.25 oz	20 µg	
	0.125 oz	12 µg	
	0.0625 oz	12 µg	
	0.03125 oz	12 µg	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) Note 3,5	Remarks
VIBRATION (20/M11)			
Acceleration	10 Hz to 2 kHz 2 kHz to 10 kHz	2.8 % 3.4 %	PCB Standard Accelerometer
Vibration	100 Hz	1.2 %	
VOLUME (20/M12)			
Volume	1 mL to 10 mL 10 mL to 5000 mL	0.2 % + 0.02 mL 0.2 %	Gravimetric
HARDNESS (20/M13)			
Rockwell Hardness Field calibrations available Note 4	High Middle Low High Middle Low	0.43 HRC 0.59 HRC 0.78 HRC 1.0 HRBW 1.0 HRBW 1.1 HRBW	ASTM E18
Durometer	Type A, B, E, 0 Type D, C, DO Type OO	0.31 duro 0.16 duro 0.31 duro	Duro Calibrator Balance
TORQUE (20/M15)			
Torque – Measure Field calibrations available Note 4	5 ozf-in to 15 ozf-in 15 ozf-in to 600 lbf-ft 5 lbf-in to 800 lbf-ft	0.6 ozf-in 0.5 % 1.3 %	Torque Calibrator Stahlwille Torque Cells With Loader
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	0.09 % 0.05 % 0.06 %	Torque Wheel w/Weights Torque Butterfly w/Weights
WEIGHING INSTRUMENTS (20/M16)			
Balances Field calibrations available Note 4 Metric	25 kg	62 mg	Characterized Class 1 Weights

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) Note 3,5	Remarks
	10 kg	7.4 mg	
	5 kg	3.7 mg	
	3 kg	2.1 mg	
	2 kg	1.5 mg	
	1 kg	0.72 mg	
	500 g	0.38 mg	
	300 g	0.21 mg	
	200 g	0.14 mg	
	100 g	0.080 mg	
	50 g	0.042 mg	
	30 g	0.024 mg	
	20 g	0.020 mg	
	10 g	0.014 mg	
	5 g	0.0083 mg	
	3 g	0.0078 mg	
	2 g	0.0077 mg	
	1 g	0.0077 mg	
	500 mg	0.0024 mg	
	300 mg	0.0024 mg	
	200 mg	0.0024 mg	
	100 mg	0.0024 mg	
	50 mg	0.0024 mg	
	30 mg	0.0024 mg	
	20 mg	0.0024 mg	
	10 mg	0.0024 mg	
	5 mg	0.0024 mg	
	3 mg	0.0024 mg	
	2 mg	0.0024 mg	
	1 mg	0.0024 mg	
Balances – Avoirdupois	50 lb	59 mg	Characterized Class 4 Weights
	25 lb	58 mg	
	20 lb	58 mg	
	15 lb	51 mg	
	10 lb	2.3 mg	
	7.5 lb	2.3 mg	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) Note 3,5	Remarks
	5 lb 2 lb 1 lb 0.5 lb	1.9 mg 0.84 mg 0.61 mg 0.16 mg	
OPTICAL RADIATION			
PHOTOMETRIC (20/O02)			
Illuminance	5.4 lx to 10 764 lx 10 764 lx to 21 258 lx 21 258 lx to 32 300 lx	1.1 % 1.7 % 2.1 %	Standard Lamp
ELECTROMAGNETICS – RF/MICROWAVE			
RF/MICROWAVE POWER (20/R17)			
Absolute RF Power Field calibrations available Note 4 100 kHz to 1.3 GHz	20 dBm to -30 dBm	2.5 %	Agilent 437B/8482A
Sine Wave Flatness Field calibrations available Note 4	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 to100 MHz	0.018 % 0.065 % 0.095 % 0.18 % 0.32 % 0.38 %	Thermal Converter
THERMODYNAMIC			
HUMIDITY (20/T02)			
Relative Humidity Generate (0 °C to 70 °C)	10 % RH to 95 % RH	0.5 % RH	Thunder Scientific 2500
Measure (10 °C to 30 °C)	10 % RH to 80 % RH	1.3 % RH	Vaisala HMI41/HMP46
LABORATORY THERMOMETERS, DIGITAL and ANALOG (20/T03)			
Temperature In-Lab Measuring Equipment and Measure	-100 °C to -40 °C -40 °C to 100 °C	0.0019 °C 0.0012 °C	Hart 5699 SPRT with Precision Bath

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Measured Parameter or Device Calibrated	Range	Uncertainty (k=2) Note 3,5	Remarks
	100 °C to 270 °C	0.0022 °C	
	270 °C to 400 °C	0.0046 °C	
	400 °C to 600 °C	0.021 °C	Hart 5699 SPRT with Furnace
In-Lab Measure	600 °C to 1000 °C	0.68 °C	Type-S TC
	1000 °C to 1450 °C	2.9 °C	
Field Temperature Measure Note 4	-195 °C to 0 °C	0.013 °C	Hart Black Stack with SPRT
	0 °C to 420 °C	0.028 °C	
	420 °C to 600 °C	0.034 °C	
PRESSURE (20/T05)			
Absolute Pressure – Source	0 psia to 30 psia	0.0026 psia	DHI RPM4
	30 psia to 300 psia	0.0088 % psia	
	300 psia to 1000 psia	0.01 %	
Gage Pressure Source - Pneumatic Field calibrations available Note 4	-15 psig to 3 psig	0.015 %	Cosa Instruments T3500/3
	3 psig to 500 psig	0.0065 %	
In – Lab Only	-60 inH_2O to -22 inH_2O	0.0090 % + 150 µinH_2O	DHI PPC4-ui
	-22 inH_2O to 22 inH_2O	0.002 inH_2O	
	22 inH_2O to 60 inH_2O	0.0090 % + 150 µinH_2O	
	60 inH_2O to 72 inH_2O	0.0065 inH_2O	
	72 inH_2O to 804 inH_2O	0.0090 % + 150 µinH_2O	
	-15 psig to 30 psig	0.0021 psig	DHI RPM4
	30 psig to 1000 psig	0.0066 % + 0.0001 psig	
Hydraulic Field calibrations available Note 4	500 psig to 15 000 psig	0.011 %	Ametek T-150
RESISTANCE THERMOMETRY (20/T07)			
SPRT Calibration by Fixed Point			
TPW Cell	0.010 °C	0.51 mK	Comparison
In Fixed Point Cell	156.598 °C	2.2 mK	
Sn Fixed Point Cell	231.928 °C	2.1 mK	

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Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) Note 3,5	Remarks
Zn Fixed Point Cell	419.527 °C	3.5 mK	
Al Fixed Point Cell	660.323 °C	8.6 mK	
SPRT Comparison	-38.8 °C	0.85 mK	Hart 5681 SPRT with Precision Bath
	-78 °C	0.90 mK	
	-195 °C	1.2 mK	Hart 5681 SPRT with NBPLN2
TEMPERATURE INDICATORS (20/T08)			
Electrical Calibration of Thermocouple Devices Field calibrations available Note 4			
Type J	-210 °C to -180 °C	0.13 °C	Ectron 1140A
	-180 °C to -120 °C	0.11 °C	
	-120 °C to -50 °C	0.09 °C	
	-50 °C to 1200 °C	0.08 °C	
Type K	-270 °C to -255 °C	2.20 °C	
	-255 °C to -195 °C	0.70 °C	
	-195 °C to -115 °C	0.13 °C	
	-115 °C to -55 °C	0.10 °C	
	-55 °C to 1000 °C	0.08 °C	
	1000 °C to 1372 °C	0.09 °C	
Type T	-270 °C to -255 °C	1.80 °C	
	-255 °C to -240 °C	0.50 °C	
	-240 °C to -210 °C	0.30 °C	
	-210 °C to -150 °C	0.18 °C	
	-150 °C to -40 °C	0.13 °C	
	-40 °C to 100 °C	0.09 °C	
	100 °C to 400 °C	0.08 °C	
Type E	-270 °C to -245 °C	1.20 °C	
	-245 °C to -195 °C	0.18 °C	
	-195 °C to -155 °C	0.11 °C	
	-155 °C to 1000 °C	0.09 °C	

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Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) Note 3,5	Remarks
Type R	-50 °C to -30 °C -30 °C to 45 °C 45 °C to 160 °C 160 °C to 775 °C 775 °C to 1768.1 °C	0.65 °C 0.55 °C 0.40 °C 0.30 °C 0.22 °C	
Type S	-50 °C to -30 °C -30 °C to 45 °C 45 °C to 105 °C 105 °C to 310 °C 310 °C to 1768.1 °C	0.62 °C 0.56 °C 0.40 °C 0.33 °C 0.29 °C	
Type N	-270 °C to -260 °C -260 °C to -200 °C **-200 °C to -140 °C** -140 °C to -70 °C -70 °C to 25 °C 25 °C to 1300 °C	5.00 °C 1.00 °C **0.23 °C** 0.16 °C 0.13 °C 0.11 °C	
Type B	250 °C to 350 °C 350 °C to 445 °C 445 °C to 580 °C 580 °C to 750 °C 750 °C to 1000 °C 1000 °C to 1820 °C	0.95 °C 0.74 °C 0.58 °C 0.45 °C 0.37 °C 0.29 °C	
VACUUM and LOW PRESSURE GAGES (20/T09)			
Vacuum	5 mTorr 0 Torr to 10 Torr 10 Torr to 100 Torr	1 mTorr 0.06 % + 4 mTorr 0.06 % + 40 mTorr	MKS Vacuum System
THERMOCOUPLES (20/T11)			
Measuring Equipment	600 °C to 1000 °C 1000 °C to 1200 °C	0.83 °C 2.9 °C	Type-S TC with Furnace
END			

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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 with a level of confidence of approximately 95 %, typically using a coverage factor of $k = 2$. However, laboratories may report a coverage factor different than $k = 2$ to achieve the 95 % level of confidence. 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.

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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.
Note 9: The stated uncertainty is the laboratory's ability to source a fast rise pulse that is approximately 250 ps. In the typical application of measuring rise time of an oscilloscope, this value is one of the contributing factors, but other factors are derived from the DUT. The known source rise time is mathematically removed from the total measured rise time measured on the DUT.

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