

CALIBRATION LABORATORIES

NVLAP LAB CODE 105000-0

**SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017**

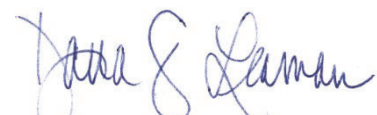
<p><b>Oak Ridge Metrology Center</b>                  P. O. Box 2009, MS8091                  Oak Ridge, TN 37831-8091                  Mr. Nicholas Eastman                  Phone: 865-576-1532 Fax: 865-574-2802                  E-mail: <a href="mailto:nicholas.eastman@pxy12.doe.gov">nicholas.eastman@pxy12.doe.gov</a>                  URL: <a href="https://www.y12.doe.gov/mission/global-security/manufacturing-and-technical-services/oak-ridge-metrology-center">https://www.y12.doe.gov/mission/global-security/manufacturing-and-technical-services/oak-ridge-metrology-center</a></p>	<p><b>Fields of Calibration</b>                  Dimensional                  Electromagnetics – DC/Low Frequency                  Time and Frequency                  Mechanical                  Thermodynamic</p>
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**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)** <sup>Notes 1,2</sup>

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty <sup>Note 3</sup>	Remarks
<b>DIMENSIONAL</b>			
<b>GAGE BLOCKS (20/D03)</b>			
Steel and Chrome Only <sup>Note 7</sup>	< 0.1 in 0.1 in to 1.0 in > 1.0 in to 4.0 in >4.0 in to 20 in	3.0 μin 2.9 μin (1.9 + 0.9L) μin (5.0 + 0.6L) μin	Mechanical Comparison
	< 2.6 mm 2.6 mm to 25 mm > 25 mm to 100 mm >100 mm to 500 mm	0.08 μm 0.07 μm (0.05 + 0.94L) μm (0.13 + 0.47L) μm	Mechanical Comparison
<b>LENGTH and DIAMETER; STEP GAGES (20/D05)</b>			
Length <sup>Note 7</sup>	0 m to 1.2 m	(0.31 + 0.40L) μm	Moore M48 CMM
<b>LINE STANDARDS (20/D06)</b>			
Line Standards <sup>Note 8</sup>	0 mm to 600 mm	(0.54 + 1.9L) μm	CMM (optical)
<b>OPTICAL REFERENCE PLANES (20/D08)</b>			
Glass Reticles, Stage Micrometer, Glass Magnification Scales and Calibration Charts	0.56 x 0.43 mm	1.5 μm	CMM (optical), Measurements taken within camera field-of-view

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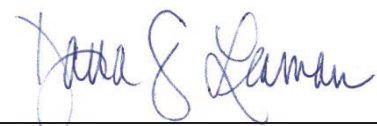
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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) <sup>Notes 1,2</sup>

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty <sup>Note 3</sup>	Remarks
Optical Grid Plates/Reference Planes <sup>Note 8</sup>	0 mm to 848 mm	(0.82 + 1.8L) μm	CMM (optical)
<b>ROUNDNESS (20/D09)</b>			
Roundness	4.0 mm to 152.4 mm	0.013 μm	Roundness Instrument
<b>SPHERICAL DIAMETER; PLUG / RING GAGES (20/D11) <sup>Note 7</sup></b>			
Spherical Diameter	≤ 4 in	16 μm	Bench micrometer
Cylindrical Diameter	≤ 1 in	14 μm	
Ring Gages (inside diam) <sup>Note 8</sup>	to 0.91 m	(0.25 + 1.1L) μm	Moore M48 CMM; 36 in
<b>SURFACE TEXTURE (20/D12)</b>			
Ra (Roughness Average)	41 μm to 120 μm (1.04 μm to 3.05 μm) 13 μm to 40 μm (0.33 μm to 1.02 μm) 12 μm (0.31 μm)	2.6 μm (0.065 μm) 1.1 μm (0.027 μm) 0.053 μm (0.014 μm)	Contact Profilometer
<b>TWO DIMENSIONAL GAGES (20/D15)</b>			
Diagonal <sup>Note 7</sup>	0 m to 1.3 m	(0.36 + 1.7L) μm	Moore M48 CMM
<b>COORDINATE MEASUREING MACHINES (20/D16)</b>			
Diagonal (3D) <sup>Note 7</sup>	0 m to 1.4 m	(0.61 + 2.6L) μm	Spatial Moore M48 CMM
<b>GEARS (20/D18)</b>			
Involute Profile	to 14 in diameter	(0.47 + 3.08L) μm	CMM
Infinite Lead/Helix	to 6 in diameter	0.80 μm	CMM
99 in Lead/Helix	to 6 in diameter	0.90 μm	
32 in Lead/Helix	to 6 in diameter	1.1 μm	
16 in Lead/Helix LH	to 6 in diameter	1.2 μm	
16 in Lead/Helix RH	to 6 in diameter	1.2 μm	
11 in Lead/Helix	to 6 in diameter	1.3 μm	
Pin/Journal diameter	to 6 in diameter	0.50 μm	CMM
Pin/Journal roundness	to 4 in diameter	0.025 μm	Roundness Instrument
Index and Runout	to 24 in	3.3 μm	CMM with rotary table



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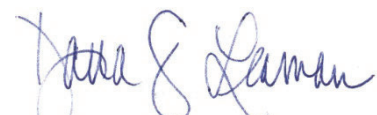
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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) <sup>Notes 1,2</sup>

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty <sup>Notes 3, 5</sup>	Remarks
<b>ELECTROMAGNETICS – DC/LOW FREQUENCY</b>				
<b>AC RESISTORS and CURRENT (20/E02)</b>				
AC Current Source	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	0.025 % + 16 nA 0.016 % + 10 nA 0.012 % + 8 nA 0.02 % + 12 nA 0.11 % + 65 nA	Fluke 5720A
	> 220 $\mu$ A 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	0.025 % + 42 nA 0.016 % + 37 nA 0.012 % + 37 nA 0.02 % + 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	0.025 % + 0.40 $\mu$ A 0.016 % + 0.35 $\mu$ A 0.012 % + 0.35 $\mu$ A 0.02 % + 0.56 $\mu$ A 0.11 % + 5 $\mu$ A	
	> 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	0.025 % + 4.2 $\mu$ A 0.016 % + 3.7 $\mu$ A 0.012 % + 2.8 $\mu$ A 0.02 % + 3.7 $\mu$ A 0.11 % + 10.1 $\mu$ A	
	> 220 mA to 2.2 A	20 Hz to 1kHz > 1 kHz to 5 kHz > 5 kHz to 10 kHz	0.027 % + 37 $\mu$ A 0.045 % + 81 $\mu$ A 0.70 % + 0.16 mA	
AC Current Measure	0 $\mu$ A to 200 $\mu$ A	10 Hz to 300 Hz > 300 Hz to 1 kHz > 1 kHz to 10 kHz	0.03 % + 20 nA 0.03 % + 20 nA 0.03 % + 20 nA	Fluke 8508A

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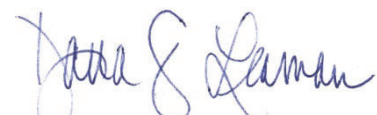
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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) <sup>Notes 1,2</sup>

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty <sup>Notes 3, 5</sup>	Remarks
	> 200 $\mu$ A to 2 mA	10 Hz to 300 Hz > 300 Hz to 1 kHz > 1 kHz to 10 kHz	0.03 % + 0.20 $\mu$ A 0.03 % + 0.20 $\mu$ A 0.03 % + 0.20 $\mu$ A	
	> 2 mA to 20 mA	10 Hz to 300 Hz > 300 Hz to 1 kHz > 1 kHz to 10 kHz	0.03 % + 2.0 $\mu$ A 0.03 % + 2.0 $\mu$ A 0.03 % + 2.0 $\mu$ A	
	> 20 mA to 200 mA	10 Hz to 300 Hz > 300 Hz to 1 kHz > 1 kHz to 10 kHz	0.032 % + 20 $\mu$ A 0.029 % + 20 $\mu$ A 0.029 % + 20 $\mu$ A	
	> 200 mA to 2 A	10 Hz to 2 kHz > 2 kHz to 10 kHz	0.073 % + 0.20 mA 0.087 % + 0.20 mA	
	> 2 A to 20 A	> 10 Hz to 2 kHz > 2 kHz to 10 kHz	0.21 % + 2.0 mA 0.31 % + 2.0 mA	

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty <sup>Notes 3, 5</sup>	Remarks
<b>DC RESISTANCE and CURRENT (20/E05)</b>			
DC Resistance Fixed Points (Shunts in air)	20 $\mu\Omega$ (to 1 000 A)	0.010 %	L&N 4372 Shunt
(Shunts in air)	0.001 $\Omega$ (to 500 A)	0.030 %	L&N 4364 Shunts
(Shunts in air)	0.01 $\Omega$ (to 100A)	0.010 %	L&N 4361 Shunts
	0.1 $\Omega$ (to 15 A)	0.010%	L&N 4360 Shunts
DC Resistance Fixed Points (in air)	1 $\Omega$	4.6 $\mu\Omega/\Omega$	Fluke 742A-1
	10 $\Omega$	3.4 $\mu\Omega/\Omega$	Fluke 742A-10
	100 $\Omega$	4.4 $\mu\Omega/\Omega$	Fluke 742A-100
	1 k $\Omega$	5.3 $\mu\Omega/\Omega$	Fluke 742A-1k
	10 k $\Omega$	3.8 $\mu\Omega/\Omega$	Fluke 742A-10k
	100 k $\Omega$	5.2 $\mu\Omega/\Omega$	Fluke 742A-100k
	1 M $\Omega$	6.2 $\mu\Omega/\Omega$	Fluke 742A-1M
	10 M $\Omega$	6.6 $\mu\Omega/\Omega$	Fluke 742A-10M



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Measured Parameter or Device Calibrated	Range	Expanded Uncertainty <sup>Notes 3, 5</sup>	Remarks
DC Resistance Source	1.9 Ω 19 Ω 190 Ω 1.9 kΩ 19 kΩ 190 kΩ 1.9 MΩ 19 MΩ 100 MΩ	96 μΩ/Ω 118 μΩ/Ω 81 μΩ/Ω 14 μΩ/Ω 116 μΩ/Ω 37 μΩ/Ω 24 μΩ/Ω 127 μΩ/Ω 496 μΩ/Ω	Fluke 5720A
DC Resistance Measure	0 Ω to 2 Ω > 2 Ω to 20 Ω > 20 Ω to 200 Ω > 200 Ω to 2 kΩ > 2 kΩ to 20 kΩ > 20k Ω to 200 kΩ > 200 kΩ to 2 MΩ > 2 MΩ to 20 MΩ > 20 MΩ to 200 MΩ > 200 MΩ to 2 GΩ	18 μΩ/Ω + 4 μΩ 11 μΩ/Ω + 14 μΩ 81 μΩ/Ω + 5.1 μΩ 9 μΩ/Ω + 0.5 mΩ 9 μΩ/Ω + 5 mΩ 37 μΩ/Ω + 50 mΩ 10 μΩ/Ω + 1.0 Ω 33 μΩ/Ω + 0.2 kΩ 0.054 % + 0.01 MΩ 0.15 % + 1 MΩ	Fluke 8508A
DC Current Source	0 μA to 220 μA > 220 μA to 2.2 mA > 2.2 mA to 22 mA > 22 mA to 220 mA > 220 mA to 2.2 A > 2.2 A to 11 A > 11 A to 100 A	40 μA/A + 6 nA 35 μA/A + 7 nA 35 μA/A + 40 nA 45 μA/A + 4 μA 88 μA/A + 12 μA 0.037 % + 0.48 mA 0.032 %	Fluke 5720A  Fluke 5725A Amplifier Valhalla 2555A
DC Current Measure	0 μA to 200 μA > 200 μA to 2 mA > 2 mA to 20 mA > 20 mA to 200 mA > 200 mA to 2 A > 2 A to 20 A > 20 A to 1000 A	13 μA/A + 0.40 nA 13 μA/A + 4.0 nA 15 μA/A + 42 nA 48 μA/A + 0.8 μA 0.019 % + 16 μA 0.053 % + 12 mA 0.010%	Fluke 8508A  L&N/ Rubicon Shunts

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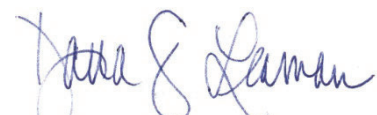
**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)** <sup>Notes 1,2</sup>

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty <sup>Notes 3, 5</sup>	Remarks
DC Current Source/Measure (Calibration of DC Shunts)	10 $\mu\Omega$ to 100 m $\Omega$	0.010 %	Comparison to DC Shunts at Source Current 0.15 A to 1000 A
<b>DC VOLTAGE (20/E06)</b>			
DC Voltage Source	0 mV to 220 mV > 220 mV to 2.2 V > 2.2 V to 11 V > 2.2 V to 22 V > 22 V to 220 V > 220 V to 1100 V	7.5 $\mu\text{V}/\text{V}$ + 0.40 $\mu\text{V}$ 5.1 $\mu\text{V}/\text{V}$ + 0.70 $\mu\text{V}$ 3.7 $\mu\text{V}/\text{V}$ + 2.5 $\mu\text{V}$ 4.0 $\mu\text{V}/\text{V}$ + 4 $\mu\text{V}$ 30.6 $\mu\text{V}/\text{V}$ + 40 $\mu\text{V}$ 221.3 $\mu\text{V}/\text{V}$ + 400 $\mu\text{V}$	Fluke 5720A
DC Voltage Measure	0 V to 200 mV > 200 mV to 2 V > 2 V to 20 V > 20 V to 200 V > 200 V to 1000 V	5.5 $\mu\text{V}/\text{V}$ + 0.5 $\mu\text{V}$ 3.9 $\mu\text{V}/\text{V}$ + 0.2 $\mu\text{V}$ 4.1 $\mu\text{V}/\text{V}$ + 1.0 $\mu\text{V}$ 30.7 $\mu\text{V}/\text{V}$ + 12 $\mu\text{V}$ 221.3 $\mu\text{V}/\text{V}$ + 0.12 mV	Fluke 8508A

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

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty <sup>Notes 3, 5</sup>	Remarks
<b>LF AC VOLTAGE (20/E09)</b>				
LF AC Voltage Source	0 mV to 2.2 mV	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	0.008 % + 4.2 $\mu\text{V}$ 0.02 % + 4.2 $\mu\text{V}$ 0.063 % + 5.1 $\mu\text{V}$ 0.11 % + 10.1 $\mu\text{V}$ 0.14 % + 20 $\mu\text{V}$ 0.27 % + 20 $\mu\text{V}$	Fluke 5720A
	> 2.2 mV to 22 mV	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	0.008% + 12 $\mu\text{V}$ 0.02 % + 12 $\mu\text{V}$ 0.05 % + 13 $\mu\text{V}$ 0.11 % + 15 $\mu\text{V}$ 0.14 % + 23 $\mu\text{V}$ 0.27 % + 23 $\mu\text{V}$	

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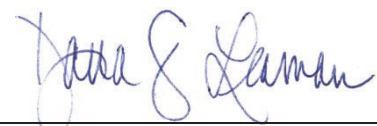
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Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty <sup>Notes 3, 5</sup>	Remarks
	> 22 mV to 220 mV	40 Hz to 20 kHz > 20 kHz to 50 kHz > 50 kHz to 100 kHz > 100 kHz to 300 kHz > 300 kHz to 500 kHz > 500 kHz to 1 MHz	0.008 % + 7.0 μV 0.02 % + 7.0 μV 0.05 % + 17 μV 0.09 % + 20 μV 0.14 % + 25 μV 0.27 % + 45 μV	
	> 220 mV to 2.2 V	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	45 μV/V + 8.1 μV 75 μV/V + 10 μV 0.011 % + 30 μV 0.042 % + 80 μV 0.1 % + 0.20 mV 0.17 % + 0.30 mV	
	> 2.2 V to 22 V	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	73 μV/V + 51 μV 88 μV/V + 0.10 mV 0.011 % + 0.20 mV 0.028 % + 0.60 mV 0.1 % + 2.0 mV 0.15 % + 3.2 mV	
	> 22 V to 220 V	40 Hz to 20 kHz > 20 kHz to 50 kHz > 50 kHz to 100 kHz	0.087 % + 0.61 mV 0.045 % + 1.0 mV 0.072 % + 2.5 mV	
	> 220 V to 1000 V	40 Hz to 1 kHz	.09 % + 3.5 mV	
	220 V to 600 V	40 Hz to 1 kHz > 1 to 20 kHz > 20 to 30 kHz > 30 to 50 kHz > 50 to 100 kHz	0.03 % + 4.2 mV 0.036 % + 6.1 mV 0.068 % + 11.1 mV 0.074 % + 11.1 mV 0.24 % + 45 mV	Fluke 5720A/5725A
	> 600 V to 1100 V	40 Hz to 1 kHz > 1 to 20 kHz > 20 to 30 kHz	0.039 % + 4.2 mV 0.065 % + 6.1 mV 0.087 % + 11.1 mV	



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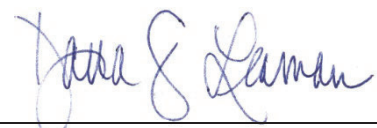
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Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty <sup>Notes 3, 5</sup>	Remarks
LF AC Voltage Measure	0 V to 200 mV	10 Hz to 100 Hz	0.015 % + 4.0 $\mu$ V	Fluke 8508A
		> 100 Hz to 2 kHz	0.012 % + 2.0 $\mu$ V	
		> 2 kHz to 10 kHz	0.014 % + 4.0 $\mu$ V	
		> 10 kHz to 30 kHz	0.034 % + 8.0 $\mu$ V	
		> 30 kHz to 100 kHz	0.077 % + 20 $\mu$ V	
	> 0.2 V to 2 V	10 Hz to 100 Hz	0.012 % + 20 $\mu$ V	
		> 100 Hz to 2 kHz	81 $\mu$ V/V + 20 $\mu$ V	
		> 2 kHz to 10 kHz	0.011 % + 20 $\mu$ V	
		> 10 kHz to 30 kHz	0.022 % + 40 $\mu$ V	
		> 30 kHz to 100 kHz	0.058 % + 0.20 mV	
	> 2 V to 20 V	> 100 kHz to 300 kHz	0.30 % + 2.3 mV	
		> 300 kHz to 1 MHz	1.0 % + 20 mV	
		10 Hz to 100 Hz	0.014 + 0.20 mV	
		> 100 Hz to 2 kHz	0.009 + 0.20 mV	
		> 2 kHz to 10 kHz	0.012 % + 0.20 mV	
	> 20 V to 200 V	> 10 kHz to 30 kHz	0.022 % + 0.40 mV	
		> 30 kHz to 100 kHz	0.058 % + 2.0 mV	
		> 100 kHz to 300 kHz	0.30 % + 20 mV	
		> 300 kHz to 1 MHz	1.0 % + 0.20 V	
		10 Hz to 100 Hz	0.14 % + 2.0 mV	
> 200 V to 1000 V	> 100 Hz to 2 kHz	0.037 % + 2.0 mV		
	> 2 kHz to 10 kHz	0.035 % + 2.0 mV		
	> 10 kHz to 30 kHz	0.043 % + 4.0 mV		
	> 30 kHz to 100 kHz	0.091 % + 20 mV		
	40 kHz to 10 kHz	0.024 % + 1.2 mV		
> 10 kHz to 30 kHz	0.07 % + 1.2 mV			

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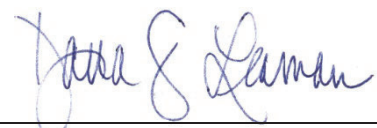
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Measured Parameter or Device Calibrated	Range	Expanded Uncertainty <sup>Notes 3,5</sup>	Remarks
<b>TIME and FREQUENCY</b>			
<b>FREQUENCY DISSEMINATION (20/F01)</b>			
Frequency Measure	1 MHz 5 MHz 10 MHz	1 x 10 <sup>-12</sup> Hz/Hz 1 x 10 <sup>-12</sup> Hz/Hz 1 x 10 <sup>-12</sup> Hz/Hz	NIST FMAS + Fluke 910R
<b>MECHANICAL</b>			
<b>MASS DETERMINATION (20/M08)</b>			
Mass <sup>Note 4</sup>	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 500 mg 200 mg 100 mg 50 mg 20 mg 10 mg 5 mg 2 mg 1 mg	30 mg 27.6 mg 15.9 mg 6.6 mg 2.5 mg 0.86 mg 0.35 mg 0.22 mg 0.12 mg 43 µg 18 µg 12 µg 14 µg 8.4 µg 7.9 µg 3.3 µg 2.5 µg 3.0 µg 2.2 µg 1.9 µg 2.4 µg 4.5 µg 4.2 µg 1.7 µg	Echelon II

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<b>TORQUE (20/M15)</b>			
Torque Measure	5 lb-in to 50 lb-in	0.33 %	TTC 400 Torque Calibrator
	30 lb-in to 400 lb-in	0.26 %	
	80 lb-in to 1000 lb-in	0.22 %	
	20 lbf to 250 lbf	0.25 %	

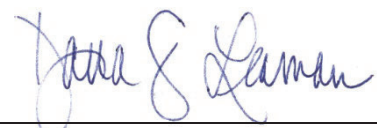
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Measured Parameter or Device Calibrated	Test Load Range	Readability	Expanded Uncertainty <sup>Note 3</sup>	Remarks
<b>CALIBRATION OF WEIGHING INSTRUMENTS (20/M16)</b>				
Balances Field calibrations available <sup>Note 4</sup>	30 kg	1 g	1.3 g	
	20 kg	0.1 g	0.13 g	
	10 kg	0.01 g	12 mg	
	1 kg	1 mg	1.3 mg	
	100 g	0.1 mg	0.13 mg	
	10 g	0.01 mg	0.13 mg	
	1 g	0.001 mg	0.0016 mg	

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty <sup>Notes 3, 5</sup>	Remarks
<b>THERMODYNAMIC</b>			
<b>LABORATORY THERMOMETERS, DIGITAL and ANALOG (20/T03)</b>			
Temperature Measuring Devices <sup>Note 4</sup>	-90 °C to 0 °C	0.0034 °C	Ametek HTC 125A Dry Well w/SPRT and 1594A Super Thermometer
	0 °C to 30 °C	0.0024 °C	7012 Liquid Bath w./SPRT and Super Thermometer
	0 °C to 125 °C	0.0043 °C	Ametek HTC 125A Dry Well w/SPRT and Super Thermometer

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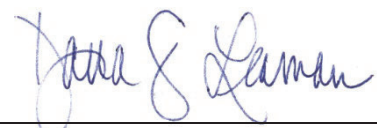
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	126 °C to 420 °C	0.015 °C	9173 Dry Well w/SPRT and Super Thermometer	
	421 °C to 700 °C	0.059 °C	9173 Dry Well w/ 5624 PRT	
	701 °C to 1000 °C	0.22 °C	9112 Tube Furnace w/ 5624 PRT	
<b>LEAK ARTIFACTS (20/T04)</b>				
Leak Artifacts	1.0 X 10 <sup>-4</sup> atm cc/sec to 9.9 X 10 <sup>-4</sup> atm cc/sec	6.4 %	Vacuum Decay Method	
	1.0 X 10 <sup>-5</sup> atm cc/sec to 9.9 X 10 <sup>-5</sup> atm cc/sec	4.2 %		
	1.0 X 10 <sup>-6</sup> atm cc/sec to 9.9 X 10 <sup>-6</sup> atm cc/sec	4.4 %		
	7.0 X 10 <sup>-7</sup> atm cc/sec to 9.9 X 10 <sup>-7</sup> atm cc/sec	4.5 %		
	5.0 X 10 <sup>-7</sup> atm cc/sec to 6.9 X 10 <sup>-7</sup> atm cc/sec	5.3 %		
	3.0 X 10 <sup>-7</sup> atm cc/sec to 4.9 X 10 <sup>-7</sup> atm cc/sec	5.6 %		
<b>PRESSURE (20/T05)</b>				
Hydraulic Deadweight Piston Gauge (Gauge Mode)	208.65 to 3 712.41 psig (1.4 to 25.6 MPa)	0.0062 %		Direct Comparison Oil
	19882.35 to 39 645.51 psig	0.0065%		
	208.65 to 3712.41 psig (1.4 to 25.6 MPa)	0.0045 %	Direct Comparison Nitrogen	
	3712.41 to 15 000 psig (25.6 to 103.5 MPa)	0.0065 %		

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CALIBRATION LABORATORIES

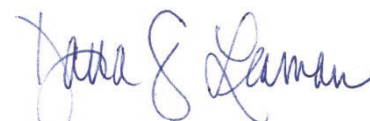
NVLAP LAB CODE 105000-0

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty <sup>Notes 3, 5</sup>	Remarks	
<b>VACUUM and LOW PRESSURE TRANSDUCERS (20/T10)</b>				
Capacitance Diaphragm Gauge	0.001 Torr to 0.004 Torr	(where x is the applied pressure) (0.0035x <sup>-0.949</sup> ) %	Direct Comparison; MKS Baratron, 1 Torr	
	0.004 Torr to 0.01 Torr	0.64 %		
	0.01 Torr to 1.0 Torr	0.43 %	MKS Baratron 10 Torr MKS Baratron, 100 Torr	
	1.0 Torr to 10 Torr	0.090 %		
	10 Torr to 100 Torr	0.29 %	MKS Baratron, 1000 Torr	
	100 Torr to 1000 Torr	0.085 %		
Ionization Gauge	1.0 X 10 <sup>-4</sup> Torr to 1.0 X 10 <sup>-6</sup> Torr	5.9 %	Direct Comparison; Granville-Phillips 370121	
	1.0 X 10 <sup>-6</sup> Torr to 1.0 X 10 <sup>-7</sup> Torr	4.0 %		
	1.0 X 10 <sup>-7</sup> Torr to 1.0 X 10 <sup>-8</sup> Torr	4.3 %		
	1.0 X 10 <sup>-8</sup> Torr to 1.0 X 10 <sup>-9</sup> Torr	5.4 %		
	1.0 X 10 <sup>-4</sup> Torr to 1.0 X 10 <sup>-7</sup> Torr	Greater of (1% or 8.07E-07x)		Direct Comparison; MKS SRG-2CE
	1.0 X 10 <sup>-7</sup> Torr			
<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. 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.5 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:**  $L$  is length in same units as measurand (units shown in Range column).

**Note 8:**  $L$  is length in meters

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