



CALIBRATION LABORATORIES

NVLAP LAB CODE 105013-0

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

<p>Troemner, LLC DBA Mettler Toledo, LLC 201 Wolf Drive P.O. Box 87 Thorofare, NJ 08086-0087 Mr. Steve Armstrong Phone: 856-686-4214 Fax: 856-686-1601 E-mail: sarmstrong@troemner.com URL: http://www.troemner.com</p>	<p>Fields of Calibration Dimensional Electromagnetics - DC/Low Frequency Mechanical Thermodynamic</p> <p>This laboratory is compliant to ANSI/NCSL Z540-1-1994; Part 1. ((20/A01)</p>
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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) ^{Notes 1,2}

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty ^{Note 3}	Remarks
DIMENSIONAL			
LENGTH & DIAMETER; STEP GAGES (20/D05)			
Length Indicators	0.05 in to 1 in 2 in 3 in 4 in 6 in 10 in 12 in	86 µin 160 µin 160 µin 180 µin 210 µin 230 µin 250 µin	Comparison to Gage Blocks

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) ^{Notes 1,2}

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty ^{Notes 3, 5}	Remarks
ELECTROMAGNETICS – DC/LOW FREQUENCY				
AC RESISTORS AND CURRENT (20/E02)				
AC Current – Source and Measure	50 µA to 199.9 µA	10 Hz to 20 Hz 20 Hz to 45 Hz 45 Hz to 1 kHz 1 kHz to 5 kHz	750 µA/A + 20 nA 710 µA/A + 20 nA 690 µA/A + 20 nA 450 µA/A + 20 nA	Fluke 8508A with Fluke 5520A as Source

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) ^{Notes 1,2}

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty ^{Notes 3, 5}	Remarks
	200 μ A to 1.99 mA	5 kHz to 10 kHz	460 μ A/A + 20 nA	
		10 kHz to 30 kHz	1300 μ A/A + 20 nA	
	2 mA to 19.99 mA	10 Hz to 20 Hz	730 μ A/A + 0.2 μ A	
		20 Hz to 45 Hz	120 μ A/A + 0.2 μ A	
		45 Hz to 1 kHz	53 μ A/A + 0.2 μ A	
		1 kHz to 5 kHz	83 μ A/A + 0.2 μ A	
		5 kHz to 10 kHz	150 μ A/A + 0.2 μ A	
		10 kHz to 30 kHz	1300 μ A/A + 0.2 μ A	
	20 mA to 199.9 mA	10 Hz to 20 Hz	730 μ A/A + 2 μ A	
		20 Hz to 45 Hz	150 μ A/A + 2 μ A	
		45 Hz to 1 kHz	90 μ A/A + 2 μ A	
		1 kHz to 5 kHz	160 μ A/A + 2 μ A	
		5 kHz to 10 kHz	210 μ A/A + 2 μ A	
		10 kHz to 30 kHz	1300 μ A/A + 2 μ A	
	200 mA to 1.99 A	10 Hz to 20 Hz	690 μ A/A + 20 μ A	
		20 Hz to 45 Hz	140 μ A/A + 20 μ A	
45 Hz to 1 kHz		91 μ A/A + 20 μ A		
1 kHz to 5 kHz		140 μ A/A + 20 μ A		
5 kHz to 10 kHz		200 μ A/A + 20 μ A		
10 kHz to 30 kHz		1200 μ A/A + 20 μ A		
2 A to 20 A	10 Hz to 20 Hz	1200 μ A/A + 0.2 mA		
	20 Hz to 45 Hz	590 μ A/A + 0.2 mA		
	45 Hz to 1 kHz	590 μ A/A + 0.2 mA		
	1 kHz to 5 kHz	600 μ A/A + 0.2 mA		
2 A to 20 A	5 kHz to 10 kHz	1200 μ A/A + 0.2 mA		
	20 Hz to 45 Hz	250 μ A/A + 2 mA		
	45 Hz to 1 kHz	260 μ A/A + 2 mA		
		1 kHz to 5 kHz	1200 μ A/A + 2 mA	

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Measured Parameter or Device Calibrated	Range	Expanded Uncertainty ^{Note 3, 5}	Remarks
DC RESISTANCE AND CURRENT (20/E05)			
DC Current – Source and Measure	10 μ A to 199.9 μ A 200 uA to 1.99 mA 2 mA to 19.99 mA 20 mA to 199.9 mA 200 mA to 1.99 A 2 A to 20 A	22 μ A/A + 0.4 nA 20 μ A/A + 4 nA 20 μ A/A + 40 nA 26 μ A/A + 0.8 μ A 130 μ A/A + 16 μ A 130 μ A/A + 0.4 mA	Fluke 8508A with Fluke 5520A as Source
DC Resistance – Source and Measure	1 Ω to 1.99 Ω 2 Ω to 19.99 Ω 20 Ω to 199.9 Ω 200 Ω to 1.99 k Ω 2 k Ω to 19.99 k Ω 20 k Ω to 199.9 k Ω 200 k Ω to 1.99 M Ω 2 M Ω to 19.99 M Ω 20 M Ω to 199.9 M Ω 200 M Ω to 1 G Ω	140 $\mu\Omega/\Omega$ + 0.2 m Ω 13 $\mu\Omega/\Omega$ + 0.2 m Ω 6.4 $\mu\Omega/\Omega$ + 0.7 m Ω 5.5 $\mu\Omega/\Omega$ + 3 m Ω 6.9 $\mu\Omega/\Omega$ + 5 m Ω 5.1 $\mu\Omega/\Omega$ + 0.2 Ω 11 $\mu\Omega/\Omega$ + 3 Ω 19 $\mu\Omega/\Omega$ + 0.3 k Ω 200 $\mu\Omega/\Omega$ + 1 k Ω 820 $\mu\Omega/\Omega$ + 67 k Ω	Fluke 8508A with Fluke 5520A as Source
Digital Thermometry Indicators - Resistance Function	10 Ω 25 Ω 100 Ω 300 Ω 10 k Ω 1 Ω to 400 Ω 400 Ω to 10 k Ω	1 $\mu\Omega/\Omega$ 1 $\mu\Omega/\Omega$ 1 $\mu\Omega/\Omega$ 1 $\mu\Omega/\Omega$ 5.0 $\mu\Omega/\Omega$ 2.5 $\mu\Omega/\Omega$ 5.0 $\mu\Omega/\Omega$	Readout devices that actually measure resistance.
DC VOLTAGE (20/E06)			

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Measured Parameter or Device Calibrated	Range	Expanded Uncertainty ^{Note 3, 5}	Remarks
DC Voltage – Source and Measure	10 mV to 24.999 mV	66 μ V/V + 1.2 μ V	Fluke 8508A with Fluke 5520A as Source
	25 mV to 199.99 mV	13 μ V/V + 1.2 μ V	
	200 mV to 1.99 V	5.2 μ V/V + 1.7 μ V	
	2 V to 19.99 V	5.2 μ V/V + 4 μ V	
	20 V to 199.99 V	6.8 μ V/V + 40 μ V	
	200 V to 1000 V	5.5 μ V/V + 500 μ V	

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) ^{Notes 1,2}

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty ^{Notes 3, 5}	Remarks
LF AC VOLTAGE (20/E09)				
AC Voltage – Source and Measure	10 mV to 100 mV	75 Hz to 1 kHz	320 μ V/V + 2 μ V	Fluke 8508A with 5520A as Source
	100 mV to 199 mV	10 Hz to 20 Hz	110 μ V/V + 14 μ V	
		20 Hz to 45 Hz	100 μ V/V + 4 μ V	
		45 Hz to 1 kHz	100 μ V/V + 4 μ V	
		1 kHz to 5 kHz	90 μ V/V + 4 μ V	
		5 kHz to 10 kHz	110 μ V/V + 4 μ V	
		10 kHz to 30 kHz	250 μ V/V + 8 μ V	
		30 kHz to 100 kHz	290 μ V/V + 20 μ V	
	200 mV to 1.99 V	10 Hz to 20 Hz	61 μ V/V + 20 μ V	
		20 Hz to 45 Hz	50 μ V/V + 20 μ V	
		45 Hz to 1 kHz	88 μ V/V + 20 μ V	
		1 kHz to 5 kHz	56 μ V/V + 20 μ V	
		5 kHz to 10 kHz	90 μ V/V + 20 μ V	
		10 kHz to 30 kHz	220 μ V/V + 40 μ V	
	2 V to 19.99 V	30 kHz to 100 kHz	320 μ V/V + 200 μ V	
		10 Hz to 20 Hz	140 μ V/V + 20 μ V	
		20 Hz to 45 Hz	120 μ V/V + 20 μ V	
		45 Hz to 1 kHz	120 μ V/V + 20 μ V	
		1 kHz to 5 kHz	120 μ V/V + 20 μ V	
		5 kHz to 10 kHz	160 μ V/V + 20 μ V	

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Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty <small>Notes 3, 5</small>	Remarks
	20 V to 199.99 V	10 kHz to 30 kHz	260 μ V/V + 40 μ V	
		30 kHz to 100 kHz	280 μ V/V + 200 μ V	
		45 Hz to 100 Hz	110 μ V/V + 20 μ V	
		100 Hz to 1 kHz	100 μ V/V + 20 μ V	
		1 kHz to 5 kHz	100 μ V/V + 20 μ V	
		5 kHz to 10 kHz	130 μ V/V + 20 μ V	
		10 kHz to 30 kHz	250 μ V/V + 40 μ V	
	200 V to 1000 V	30 kHz to 100 kHz	280 μ V/V + 200 μ V	
		60 Hz to 250 Hz	62 μ V/V + 200 μ V	
		250 Hz to 2.5 kHz	54 μ V/V + 200 μ V	
		2.5 kHz to 5 kHz	54 μ V/V + 400 μ V	
		5 kHz to 10 kHz	150 μ V/V + 2 mV	

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty <small>Notes 3, 5</small>	Remarks
TIME AND FREQUENCY			
FREQUENCY DISSEMINATION (20/F01)			
Frequency - Generate	0.11 Hz to 1.99 Hz 2 Hz to 4.99 Hz 5 Hz to 9.99 Hz 10 Hz to 49.99 Hz 50 Hz to 199.9 Hz 200 Hz to 2 MHz	7.5 μ Hz 10 μ Hz 18 μ Hz 3.0 μ Hz/Hz 2.6 μ Hz/Hz 2.5 μ Hz/Hz	Fluke 5520A
STOP WATCHES and TIMERS (20/F05)			
Stop Watches and Timers	0 hr to 24 hr	0.064 s	
MECHANICAL			
FLOW RATE (20/M05)			
Gas Flow by Comparison to DH Molbloc N ₂	2 sccm to 30 slpm	0.36 %	Standard conditions 14.7 psia (101 353 Pa) and 70 °F (21.1 °C)

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Measured Parameter or Device Calibrated	Range	Expanded Uncertainty <small>Notes 3, 5</small>	Remarks
H ₂	> 30 slpm to 100 slpm	0.79 %	
Air	6 slpm to 60 slpm	0.62 %	
Ventilation	2 sccm to 30 slpm	0.48 %	
	2 % to 100 % dilution	1.4 %	
MASS (20/M08)			
Metric	50 kg	2.0 mg	Echelon I
	30 kg	1.2 mg	
	25 kg	0.97 mg	
	20 kg	0.76 mg	
	10 kg	0.37 mg	
	5 kg	0.18 mg	
	3 kg	0.11 mg	
	2 kg	72 µg	
	1 kg	35 µg	
	500 g	18 µg	
	300 g	12 µg	
	200 g	7.3 µg	
	100 g	3.8 µg	
	50 g	2.2 µg	
	30 g	2.6 µg	
	20 g	1.3 µg	
	10 g	1.1 µg	
	5 g	0.9 µg	
	3 g	1.4 µg	
	2 g	0.75 µg	
	1 g	0.54 µg	
	500 mg	0.49 µg	
	300 mg	0.72 µg	
	200 mg	0.40 µg	
	100 mg	0.40 µg	
	50 mg	0.23 µg	
	30 mg	0.20 µg	
	20 mg	0.20 µg	
	10 mg	0.20 µg	
	5 mg	0.20 µg	
	3 mg	0.20 µg	

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Measured Parameter or Device Calibrated	Range	Expanded Uncertainty <small>Notes 3, 5</small>	Remarks
Metric <small>Note 7</small>	2 mg	0.20 µg	Echelon I
	1 mg	0.20 µg	
	0.05 mg to 0.5 mg	0.4 µg	
	30 kg	19 mg	
	25 kg	17 mg	
	20 kg	12 mg	
	10 kg	5 mg	
	5 kg	3.1 mg	
	3 kg	2.6 mg	
	2 kg	2.3 mg	
	1 kg	0.47 mg	
	500 g	0.25 mg	
	300 g	0.15 mg	
	200 g	0.11 mg	
	100 g	19 µg	
	50 g	15 µg	
	30 g	12 µg.	
	20 g	11 µg	
	10 g	11 µg	
	5 g	5.0 µg	
	3 g	5.0 µg	
	2 g	5.0 µg	
	1 g	4.1 µg	
	500 mg	2.6 µg	
	300 mg	2.4 µg	
	200 mg	2.1 µg	
	100 mg	2.1 µg	
	50 mg	2.1 µg	
	30 mg	2.1 µg	
	20 mg	2.1 µg	
10 mg	2.1 µg		
5 mg	2.1 µg		
3 mg	2.1 µg		
2 mg	2.1 µg		
1 mg	2.1 µg		

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Measured Parameter or Device Calibrated	Range	Expanded Uncertainty <small>Notes 3, 5</small>	Remarks
Metric	500 kg	1.2 g	Echelon II
	250 kg	0.53 g	
	200 kg	0.46 g	
	100 kg	0.44 g	
	50 kg	0.11 g	
	30 kg	45 mg	
	25 kg	28 mg	
	20 kg	24 mg	
	10 kg	12 mg	
	5 kg	10 mg	
	3 kg	10 mg	
	2 kg	6.6 mg	
	1 kg	0.59 mg	
	500 g	0.48 mg	
	300 g	0.40 mg	
	200 g	0.21 mg	
	100 g	0.11 mg	
	50 g	90 µg	
	30 g	69 µg	
	20 g	52 µg	
	10 g	29 µg	
	5 g	14 µg	
	3 g	8.0 µg	
	2 g	8.0 µg	
	1 g	5.0 µg	
	500 mg	5.0 µg	
	300 mg	4.0 µg	
	200 mg	4.0 µg	
	100 mg	4.0 µg	
	50 mg	4.0 µg	
	30 mg	3.7 µg	
	20 mg	3.7 µg	
	10 mg	3.7 µg	
5 mg	3.7 µg		
3 mg	3.7 µg		

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Measured Parameter or Device Calibrated	Range	Expanded Uncertainty <small>Notes 3, 5</small>	Remarks
Avoirdupois	2 mg	3.7 µg	Echelon II
	1 mg	3.7 µg	
	3000 lb	13 g	
	2500 lb	13 g	
	2000 lb	12 g	
	1000 lb	0.90 g	
	500 lb	0.65 g	
	200 lb	0.58 g	
	100 lb	0.16 g	
	50 lb	68 mg	
	25 lb	16 mg	
	20 lb	6.0 mg	
	10 lb	4.0 mg	
	5 lb	2.0 mg	
	3 lb	2.0 mg	
	2 lb	0.47 mg	
	1 lb	0.38 mg	
	0.5 lb	0.28 mg	
	0.3 lb	0.11 mg	
	0.2 lb	57 µg	
0.1 lb	39 µg		
0.05 lb	39 µg		
0.03 lb	24 µg		
0.02 lb	23 µg		
0.01 lb	22 µg		
0.005 lb	14 µg		
0.003 lb	13 µg		
0.002 lb	11 µg		
0.001 lb	11 µg		
Metric	1000 kg	10 g	Echelon III
	500 kg	1.2 g	
	200 kg	0.46 g	
	100 kg	0.44 g	
	50 kg	0.11 g	
	30 kg	65 mg	

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Measured Parameter or Device Calibrated	Range	Expanded Uncertainty ^{Notes 3, 5}	Remarks
Magnetic Susceptibility (χ) of mass standards or materials used for mass standards.	25 kg	38 mg	Range value is indicating DUT nominal mass. χ is a dimensionless unit ranging from 0 to 1
	20 kg	33 mg	
	10 kg	37 mg	
	5 kg	28 mg	
	3 kg	26 mg	
	2 kg	23 mg	
	1 kg	3.4 mg	
	500 g	2.4 mg	
	300 g	2.3 mg	
	10 kg	4.4 E-04 χ	
	5 kg	3.8 E-04 χ	
	3 kg	3.4 E-04 χ	
	2 kg	3.2 E-04 χ	
	1 kg	3.5 E-04 χ	
	500 g	4.4 E-04 χ	
	300 g	4.9 E-04 χ	
	200 g	5.2 E-04 χ	
	100 g	5.7 E-04 χ	
	50 g	6.3 E-04 χ	
	30 g	6.5 E-04 χ	
20 g	6.7 E-04 χ		
10 g	4.6 E-04 χ		
5 g	6.8 E-04 χ		
3 g	6.8 E-04 χ		
2 g	6.9 E-04 χ		
1 g	6.9 E-04 χ		
VOLUME and DENSITY (20/M12)			
Gravimetric Method ^{Note 4}	0.1 μ l	0.0085 μ l	
	0.2 μ l	0.0057 μ l	
	0.5 μ l	0.0066 μ l	
	1.0 μ l	0.0061 μ l	
	2.0 μ l	0.0068 μ l	

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Measured Parameter or Device Calibrated	Range	Expanded Uncertainty <small>Notes 3, 5</small>	Remarks
	2.5 µl	0.0066 µl	
	5.0 µl	0.019 µl	
	10 µl	0.027 µl	
	20 µl	0.056 µl	
	25 µl	0.092 µl	
	50 µl	0.10 µl	
	100 µl	0.17 µl	
	200 µl	0.29 µl	
	250 µl	0.39 µl	
	500 µl	0.71 µl	
	1000 µl	1.4 µl	
	2.0 ml	2.6 µl	
	2.5 ml	3.3 µl	
	5 ml	10 µl	
	10 ml	13 µl	
	20 ml	45 µl	
	25 ml	76 µl	
	30 ml	78 µl	
	50 ml	92 µl	
	20 ml	7.1 µl	Automated Burette
	10 ml	6.3 µl	
	6 ml	5.8 µl	
	5 ml to 0.1 ml	2.0 µl	

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Measured Parameter or Device Calibrated	Range	Expanded Uncertainty ^{Notes 3, 5}	Remarks
Density in the range of 0.90 g/cm ³ to 8.5 g/cm ³	5 kg 3 kg 2 kg 1 kg 500 g 300 g 200 g 100 g 50 g 30 g 20 g 10 g 5 g 3 g 2 g 1 g	1.2 mg/cm ³ 1.2 mg/cm ³ 1.5 mg/cm ³ 1.2 mg/cm ³ 1.4 mg/cm ³ 3.2 mg/cm ³ 5.3 mg/cm ³ 2.3 mg/cm ³ 3.0 mg/cm ³ 6.7 mg/cm ³ 2.9 mg/cm ³ 3.1 mg/cm ³ 17 mg/cm ³ 15 mg/cm ³ 13 mg/cm ³ 16 mg/cm ³	Range value indicates DUT mass value. Density of water determined using silicon sphere. Water density used in determination of solid density.
SPEED INDICATORS (20/M14)			
Speed	6.6 RPM to 9.9999 RPM 10 RPM to 99.999 RPM 100 RPM to 999.99 RPM 1000 RPM to 9999.9 RPM 10 000 RPM to 24 000 RPM	0.00013 RPM 0.0013 RPM 0.013 RPM 0.13 RPM 1.3 RPM	Fluke 5520A w/ PM6681

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THERMODYNAMIC

HUMIDITY (20/T02)

Generate Relative Humidity	10 % RH to 95 % RH	0.32 % RH	
Dew/Frost Point	-20 °C to 70 °C	0.20 °C	

LABORATORY THERMOMETERS (20/T03)

Liquid in Glass Thermometers			
Total Immersion	- 80 °C to -70 °C	0.25 °C	
	-70 °C to -40 °C	0.05 °C	
	-40 °C to 0 °C	0.05 °C	
	0 °C to 100 °C	0.05 °C	
	100 °C to 156 °C	0.05 °C	
	156 °C to 250 °C	0.10 °C	
	-80 °C to -40 °C	0.53 °C	
Partial Immersion	-80 °C to 0 °C	0.50 °C	
	0 °C to 100 °C	0.10 °C	
	100 °C to 156 °C	0.10 °C	
	156 °C to 250 °C	0.50 °C	
	250 °C to 400 °C	0.50 °C	
Digital Thermometer System	-196 °C	0.006 °C	Comparison Method LNBP
	-80 °C to -70 °C	0.010 °C	
	-70 °C to -40 °C	0.008 °C	Comparison Method
	-40 °C to 0 °C	0.008 °C	
	0 °C to 100 °C	0.007 °C	
	100 °C to 156 °C	0.009 °C	
	156 °C to 250 °C	0.010 °C	

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	250 °C to 450 °C	0.014 °C	
	450 °C to 500 °C	0.020 °C	
	660 °C	0.010 °C	

PRESSURE (20/T05)			
Pneumatic Pressure using Piston Gauge (Absolute Mode) – Direct Pressure Comparison	7 kPa to 350 kPa 350 kPa to 6895 kPa	0.0016 % + 0.33 Pa 0.0022 % + 1.8 Pa	1.015 psia to 51 psia 51 psia to 1000 psia
Pneumatic Pressure using Piston Gauge (Gage Mode) – Direct Pressure Comparison	7 kPa to 350 kPa 350 kPa to 10 342 kPa	0.0016 % + 0.13 Pa 0.0022 % + 01.6 Pa	1.015 psig to 51 psig 51 psig to 1000 psig
Pneumatic Effective Area using Piston Gauge- Direct Pressure Comparison	7 kPa to 350 kPa 350 kPa to 6895 kPa	0.0015 % + 0.13 Pa 0.0025 % + 1.6 Pa	1.015 psig to 51 psig 51 psig to 1000 psig
Pneumatic Effective Area using Piston Gauge (Differential Mode)	-94.5 kPa to 260.6 kPa 260.6 kPa to 6 798 kPa	0.0026 % + 0.33 Pa 0.0031 % + 1.8 Pa	-13.7 psig to 37.8 psig 37.8 psig to 986 psig
Pneumatic Pressure using Low Pressure Precision Transducer	1 Pa to 249 Pa 249 Pa to 1868 Pa 1868 Pa to 3113 Pa 3113 Pa to 7472 Pa	0.11 Pa 0.14 Pa 0.009 % 0.008 %	0.004 inH ₂ O to 1 inH ₂ O 1 inH ₂ O to 7.5 inH ₂ O 7.5 inH ₂ O to 12.5 inH ₂ O 12.5 inH ₂ O to 30 inH ₂ O
Pressure Drop	100 mmH ₂ O to 1500 mmH ₂ O	1.2 %	

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THERMOCOUPLES & PYROMETER INDICATORS (20/T08)			
Electrical Simulation of Thermocouples			Fluke 5520A
Type E	-250 °C to -100 °C	0.50 °C	
	-100 °C to -25 °C	0.16 °C	
	-25 °C to 350 °C	0.14 °C	
	350 °C to 650 °C	0.16 °C	
	650 °C to 1000 °C	0.21 °C	
Type J	-210 °C to -100 °C	0.27 °C	
	-100 °C to -30 °C	0.16 °C	
	-30 °C to 150 °C	0.14 °C	
	150 °C to 760 °C	0.17 °C	
	760 °C to 1200 °C	0.23 °C	
Type K	-200 °C to -100 °C	0.33 °C	
	-100 °C to -25 °C	0.18 °C	
	-25 °C to 120 °C	0.16 °C	
	120 °C to 1000 °C	0.26 °C	
	1000 °C to 1372 °C	0.40 °C	
Type T	-250 °C to -150 °C	0.63 °C	
	-150 °C to 0 °C	0.24 °C	
	0 °C to 120 °C	0.16 °C	
	120 °C to 400 °C	0.14 °C	
Type R	0 °C to 250 °C	0.57 °C	
	250 °C to 400 °C	0.35 °C	
	400 °C to 1000 °C	0.33 °C	
	1000 °C to 1767 °C	0.40 °C	
Type S	0 °C to 250 °C	0.47 °C	
	250 °C to 1000 °C	0.36 °C	
	1000 °C to 1400 °C	0.37 °C	
	1400 °C to 1767 °C	0.46 °C	

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**National Voluntary
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CALIBRATION LABORATORIES

NVLAP LAB CODE 105013-0

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty <small>Notes 3, 5</small>	Remarks
Type N	-200 °C to -100 °C	0.40 °C	
	-100 °C to -25 °C	0.22 °C	
	-25 °C to 120 °C	0.19 °C	
	120 °C to 410 °C	0.18 °C	
	410 °C to 1300 °C	0.27 °C	
Type B	600 °C to 800 °C	0.44 °C	
	800 °C to 1000 °C	0.34 °C	
	1000 °C to 1550 °C	0.30 °C	
	1550 °C to 1820 °C	0.33 °C	
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.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: These capabilities available at the Troemner Boston Annex, 1600 Osgood Street, Suite E216, North Andover, MA 01845

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