

CALIBRATION LABORATORIES

NVLAP LAB CODE 200301-0


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

<p><b>Instron Calibration Laboratory</b>                  825 University Avenue                  Norwood, MA 02062-2643                  Mr. James O'Donovan                  Phone: 781-575-5526 Fax: 781-575-5764                  E-mail: <a href="mailto:james_odonovan@instron.com">james_odonovan@instron.com</a>                  URL: <a href="http://www.instron.com">http://www.instron.com</a></p>	<p><b>Fields of Calibration</b>                  Dimensional                  Electromagnetics – DC/Low Frequency                  Time &amp; Frequency                  Mechanical                  Thermodynamic</p> <p>This laboratory is compliant to ANSI/NC SL Z540-1-1994; Part 1. (NVLAP Code: 20/A01)</p>
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**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) <sup>Notes 1,2</sup>**

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty <sup>Notes 3,5,8</sup>	Remarks
<b>DIMENSIONAL</b>			
<b>ANGULAR (20/D01)</b>			
Rotary Stroke – Clockwise and Counter-Clockwise Field calibrations only <sup>Note 4</sup>	0.5° to 360°	0.16°	Instron Internal Method with rotary encoder
Rotary Speed Field calibrations only <sup>Note 4</sup>	0.1 rpm to 120 rpm	0.00030 rpm + 0.00021 rpm/rpm	Comparison to time base oscillator
<b>LENGTH and DIAMETER; STEP GAGES (20/D05)</b>			
Displacement Measuring Device, in lab	Up to 1100 mm	0.0021 mm + 0.000049L mm	Instron Internal Method using laser interferometer
Length Measurement – Machine Vision System Field calibrations only <sup>Note 4</sup>	Up to 21 mm	-0.00069L mm + 0.017 mm	Instron Internal Procedure Using Length Pins
Calibration Flags, in Barcelona lab only	Up to 40 mm	0.0016 mm + 0.00006L mm	Instron Internal Method - Quick Vision

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

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Alignment Electronics Calibration, in lab	Up to 2000 $\mu$ -strain	2.5 <i>S</i> , where <i>S</i> is reading in units of $\mu$ -strain	Instron Internal Method
Alignment Transducer Verification, in lab	Up to 2000 $\mu$ -strain	-0.00024 <i>S</i> % + 1.7 %	Instron Internal Method
Alignment of Materials Testing System Field calibrations only <sup>Notes 4</sup>	Up to 2000 $\mu$ -strain	0.0082 <i>S</i> % + 0.23 %	ASTM E1012, Nadcap AC7101, AC7122 specimen alignment (used in determination of % bend)
Extensometer Calibration Apparatus, in Barcelona lab only	0.01 mm to 60 mm	0.099 $\mu$ m + 0.13 <i>L</i> $\mu$ m	Instron Internal Method
Strain Field calibrations only <sup>Note 4</sup>			ASTM E83, ISO 9513, ISO 5893, ISO 527 or Internal Method
Gage length	0.1 in to 0.3 in > 0.3 in to 4.0 in > 4 in to 12 in > 12 in to 72 in	0.000074 in + 0.000024 <i>L</i> in 0.0008 in + 0.0002 <i>L</i> in 0.0024 in + 0.000027 <i>L</i> in 0.017 in	Gage bars, rulers or digital calipers
Displacement	0.0002 in to 0.00475 in > 0.00475 in to 0.006 in > 0.006 in to 0.02 in > 0.02 in to 0.25 in > 0.25 in to 1.0 in > 1.0 in to 2.0 in > 2 in to 10 in > 10 in to 40 in	0.000012 in 0.000015 in 0.00002 in + 0.000071 <i>L</i> in 0.000043 in + 0.00014 <i>L</i> in 0.000053 in + 0.00021 <i>L</i> in 0.000078 in + 0.00022 <i>L</i> in 0.00011 in + 0.00016 <i>L</i> in 0.000022 in + 0.00017 <i>L</i> in	Linear displacement scales

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Specimen Measuring Device (SMD) Field calibrations only <sup>Note 4</sup>			
Vertical			
Width	Up to 40 mm	0.00069 mm	Instron Internal Procedure using gage blocks
Thickness	Up to 15 mm	0.00063 mm	
Parallelism			
Width	Up to 1.3 mm	1.1 µm	Instron Internal Procedure using ball gage
Thickness	Up to 1.3 mm	0.95 µm	
Flatness		0.10 µm	Instron Internal Procedure using optical parallels
Horizontal			
Width	Up to 40 mm	0.0012 mm	Instron Internal Procedure using gage blocks
Thickness	Up to 15 mm	0.00067 mm	
Material Testing System Crosshead Displacement or Actuator Stroke Field calibrations only <sup>Note 4</sup>			ASTM E2309 or Internal Method with digital linear encoders with digital linear or wire encoders
	Up to 3.9 in	0.000048 in + 0.00016L in	
	>3.9 in to 10 in	0.00011 in + 0.00016L in	
	> 10 in to 40 in	0.000022 in + 0.00017L in	
	> 40 in to 60 in	0.0002 in + 0.0016L in	
Material Testing System Crosshead/Actuator Speed Field calibrations only <sup>Note 4</sup>			ASTM E2658 or Internal Method with linear encoders and comparison to time base oscillator
	Up to 0.2 mm/min	0.000019 mm/min + 0.00063v mm/min, where v is measured value	
	> 0.2 mm/min to 1270 mm/min	-0.00011 mm/min + 0.0011v mm/min, where v is measured value	
	> 1270 mm/min to 3000 mm/min	-0.27 mm/min + 0.0014 v mm/min, where v is measured value	

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Hardness XY Stage Micrometer Field calibrations only <sup>Note 4</sup>	Up to 1 in	0.00003 in + 0.00018L in	Internal Method, linear encoder
Rheological Testing System Speed Field calibrations only <sup>Note 4</sup>	Up to 600 mm/min 12 mm/s to 15708 mm/s	2.0 % 1.2 %	Caliper and stopwatch Caliper and tachometer
Impact Testing System Speed Field calibrations only <sup>Note 4</sup>	Up to 24 m/s	1.1 %	Caliper and oscilloscope
Linearity of C.O.D. Gauges Field calibrations only <sup>Note 4</sup>	0.01 in to 0.32 in	0.000012 in + 0.00015L in	Displacement ASTM E399
Rheological Equipment Field calibrations only <sup>Note 4</sup>			
Inside Diameter	2 mm to 2.5 mm 8 mm to 10 mm 9.5 mm to 12.7 mm > 12.7 mm to 16 mm > 16 mm to 20 mm	0.004 mm	Holematic Mark II or go/no-go gage  Setting ring and bore gage
Outside Diameter	Up to 3 mm Up to 30 mm Up to 152 mm	0.08 mm 0.0027 mm 0.018 mm	12X eye loupe Micrometer calipers
Linear Displacement	Up to 40.2 mm	0.037 mm	Gage blocks
Heat Deflection Machines (HDT & VICAT) Field calibrations only <sup>Note 4</sup>			
Linear Displacement	Up to 2 mm	0.012 mm	Gage blocks
Outside Diameter	Up to 30 mm	0.0027 mm	Micrometer

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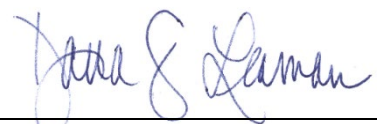
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**CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) <sup>Notes 1,2</sup>**

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Impact Testers Field calibrations only <sup>Note 4</sup> Radius of Curvature Length Length, falling weight tester Outside Diameter	Up to 3 mm Up to 150 mm Up to 2 m Up to 30 mm	0.08 mm 0.027 mm 2.0 mm 0.0027 mm	12 X eye loupe Caliper Tapes Micrometer
<b>ELECTROMAGNETICS – DC/LOW FREQUENCY</b>			
<b>AC RESISTANCE AND CURRENT (20/E02)</b>			
AC Current Field calibrations only <sup>Note 4</sup>	0 A to 10 A	0.3 A	Multimeter
<b>DC VOLTAGE (20/E06)</b>			
DC Voltage – Measure  In lab <sup>Note 9</sup>  Field calibrations <sup>Note 4</sup>  Ratio, in lab at the Barcelona, Spain location only	0 mV to 300 mV 0 V to 3 V  0.05 V to 1000 V  200 $\mu$ V/10 V to 40 mV/10 V	0.096 mV 0.14 mV  0.00058 V + 0.0069v V, where v is the measured value  0.012 %	HP 3478A  Multimeter  Keysight 34470A Digital Multimeter
<b>LF AC VOLTAGE (20/E09)</b>			
AC Voltage Field calibrations only <sup>Note 4</sup>	40 V to 1000 V 1 kV to 6 kV	1.4 % of reading 1.2 %	Multimeter Multimeter with HV probe

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<b>TIME &amp; FREQUENCY</b>			
<b>FREQUENCY DISSEMINATION (20/F01)</b>			
Frequency Measure Field calibrations only <sup>Note 4</sup>	0.5 Hz to 2.0 Hz Up to 100 MHz	1.4 <i>f</i> % + 0.97 %, where <i>f</i> is nominal freq. value 0.94 %	Timer Oscilloscope
<b>STOPWATCHES &amp; TIMERS (20/F05)</b>			
Timers Field calibrations only <sup>Note 4</sup>	0.7 ms to 5 ms Up to 500 s	0.94 % 0.22 s	Oscilloscope Stopwatch
<b>MECHANICAL</b>			
<b>FORCE (20/M06)</b>			
Force <sup>Note 7</sup> In lab <sup>Note 11</sup>	0.1 lbf to 130 000 lbf 130 000 lbf to 240 000 lbf 240 000 lbf to 1 000 000 lbf	0.005 % 0.01 % 0.05 %	ASTM E74, ISO 376, and internally developed methods Primary standard  Secondary standard
Field calibrations <sup>Note 4</sup>	1 gf to 500 000 kgf (0.01 N to 5 MN) 1 gf to 500 000 kgf (0.01 N to 5 MN)	0.12 % 0.12 %	ASTM E4, ISO 7500-1, ISO 7500-2, and internally developed methods  Compression  Tension
Falling Weight Impact Tester, in lab <sup>Note 9</sup>	1 kN to 25 kN 1 kN to 222 kN	0.7 % of full scale 0.11 %	Interface 9840 and load cell
Falling Weight Impact Tester, in field <sup>Note 4</sup>	Up to 3.25 N	9.8 x10 <sup>-5</sup> N + 0.024 % of rdg	Load cell and readout device; Instron internal method

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Rheological Equipment Field calibrations only <small>Note 4</small>	> 3.25 kN to 22 kN	$1.7 \times 10^{-5} \text{ N} + 0.016 \% \text{ of rdg}$	Interface 9840 & load cell
	> 22 kN to 100 kN	$-4.0 \times 10^{-6} \text{ N} \% + 0.82 \% \text{ rdg.}$	
	Up to 250 g	0.31 %	
Heat Deflection Equipment Field calibrations only <small>Note 4</small>	Up to 250 g	0.31 %	Interface 9840 & load cell
<b>HARDNESS (20/M13)</b>			
Hardness Indirect verification of Rockwell Hardness testing machines Field calibrations only <small>Note 4</small>			
HRA Carbide	93 Rockwell Points 91 Rockwell Points 85 Rockwell Points	0.07 Rockwell Points 0.11 Rockwell Points 0.17 Rockwell Points	ASTM B294 Annex A3
HRA Steel Scale	83 Rockwell Points 73 Rockwell Points 63 Rockwell Points	0.10 Rockwell Points 0.27 Rockwell Points 0.15 Rockwell Points	ASTM E18 Annex A4 & ISO 6508-1 & -2
HRBW Scale	95 Rockwell Points 70 Rockwell Points 40 Rockwell Points	0.17 Rockwell Points 0.31 Rockwell Points 0.48 Rockwell Points	
HRC Scale	63 Rockwell Points 45 Rockwell Points 25 Rockwell Points	0.16 Rockwell Points 0.18 Rockwell Points 0.18 Rockwell Points	
HRD Scale	73 Rockwell Points 59 Rockwell Points 43 Rockwell Points	0.05 Rockwell Points 0.13 Rockwell Points 0.14 Rockwell Points	

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HREW Scale	92 Rockwell Points 87 Rockwell Points 81 Rockwell Points	0.11 Rockwell Points 0.24 Rockwell Points 0.14 Rockwell Points	
HRFW Scale	98 Rockwell Points 91 Rockwell Points 80 Rockwell Points	0.11 Rockwell Points 0.16 Rockwell Points 0.13 Rockwell Points	
HRGW Scale	77 Rockwell Points 56 Rockwell Points 23 Rockwell Points	0.18 Rockwell Points 0.28 Rockwell Points 0.45 Rockwell Points	
HRHW Scale	100 Rockwell Points 97 Rockwell Points 91 Rockwell Points	0.16 Rockwell Points 0.22 Rockwell Points 0.16 Rockwell Points	
HRK Scale	91 Rockwell Points 75 Rockwell Points 57 Rockwell Points	0.20 Rockwell Points 0.21 Rockwell Points 0.39 Rockwell Points	
HRLW Scale	124 Rockwell Points 116 Rockwell Points 106 Rockwell Points	0.05 Rockwell Points 0.10 Rockwell Points 0.15 Rockwell Points	
HRM Scale	120 Rockwell Points 105 Rockwell Points 90 Rockwell Points	0.07 Rockwell Points 0.13 Rockwell Points 0.30 Rockwell Points	
HR15N Scale	91 Rockwell Points 83 Rockwell Points 71 Rockwell Points	0.08 Rockwell Points 0.09 Rockwell Points 0.09 Rockwell Points	
HR30N Scale	80 Rockwell Points 64 Rockwell Points 46 Rockwell Points	0.15 Rockwell Points 0.23 Rockwell Points 0.16 Rockwell Points	
HR45N Scale	70 Rockwell Points	0.13 Rockwell Points	

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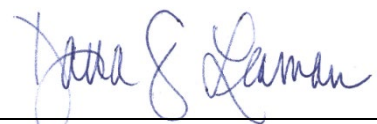
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<b>Measured Parameter or Device Calibrated</b>	<b>Range</b>	<b>Expanded Uncertainty</b> <small>Notes 3,5,8</small>	<b>Remarks</b>
HRPW Scale	49 Rockwell Points	0.12 Rockwell Points	
	24 Rockwell Points	0.19 Rockwell Points	
HRRW Scale	108 Rockwell Points	0.15 Rockwell Points	
	99 Rockwell Points	0.23 Rockwell Points	
	88 Rockwell Points	0.26 Rockwell Points	
HRSW Scale	121 Rockwell Points	0.12 Rockwell Points	
	119 Rockwell Points	0.12 Rockwell Points	
	116 Rockwell Points	0.12 Rockwell Points	
HR15TW Scale	114 Rockwell Points	0.12 Rockwell Points	
	109 Rockwell Points	0.15 Rockwell Points	
	106 Rockwell Points	0.16 Rockwell Points	
HR30TW Scale	90 Rockwell Points	0.05 Rockwell Points	
	83 Rockwell Points	0.27 Rockwell Points	
	76 Rockwell Points	0.17 Rockwell Points	
HR45TW Scale	70 Rockwell Points	0.20 Rockwell Points	
	56 Rockwell Points	0.20 Rockwell Points	
	43 Rockwell Points	0.29 Rockwell Points	
HRVWW Scale	67 Rockwell Points	0.10 Rockwell Points	
	41 Rockwell Points	0.33 Rockwell Points	
	23 Rockwell Points	0.21 Rockwell Points	
HR15WW Scale	106 Rockwell Points	0.17 Rockwell Points	
	98 Rockwell Points	0.21 Rockwell Points	
	95 Rockwell Points	0.22 Rockwell Points	
HR15WW Scale	94 Rockwell Points	0.08 Rockwell Points	
	88 Rockwell Points	0.07 Rockwell Points	
	84 Rockwell Points	0.11 Rockwell Points	

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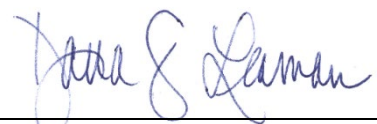
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HR30WW Scale	88 Rockwell Points 75 Rockwell Points 69 Rockwell Points	0.09 Rockwell Points 0.13 Rockwell Points 0.24 Rockwell Points	
HR45WW Scale	82 Rockwell Points 69 Rockwell Points 50 Rockwell Points	0.08 Rockwell Points 0.23 Rockwell Points 0.11 Rockwell Points	
HR15XW Scale	97 Rockwell Points 95 Rockwell Points 90 Rockwell Points	0.08 Rockwell Points 0.08 Rockwell Points 0.10 Rockwell Points	
HR30XW Scale	93 Rockwell Points 88 Rockwell Points 80 Rockwell Points	0.11 Rockwell Points 0.16 Rockwell Points 0.12 Rockwell Points	
HR45XW Scale	90 Rockwell Points 82 Rockwell Points 71 Rockwell Points	0.08 Rockwell Points 0.11 Rockwell Points 0.18 Rockwell Points	
HR15YW Scale	97 Rockwell Points 95 Rockwell Points 92 Rockwell Points	0.12 Rockwell Points 0.15 Rockwell Points 0.10 Rockwell Points	
HR30YW Scale	94 Rockwell Points 91 Rockwell Points 83 Rockwell Points	0.09 Rockwell Points 0.19 Rockwell Points 0.41 Rockwell Points	
HR45YW Scale	91 Rockwell Points 86 Rockwell Points 75 Rockwell Points	0.10 Rockwell Points 0.18 Rockwell Points 0.11 Rockwell Points	

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Brinell, Knoop and Vickers hardness testing machines Field calibrations only <sup>Note 4</sup>			
Brinell Microscope Type A Microscope Type B Microscope	10X to 100X Magnification 10X to 100X Magnification	1.6 µm 21 µm	ASTM E10 & ISO 6506-1 & -2
Vickers and Knoop Microscope Indirect Verification of Brinell, Knoop and Vickers testing machines Field calibrations only <sup>Note 4</sup>	30X to 1000X Magnification	0.9 µm	ASTM E384, E92, or ISO 6507-1 & -2
Brinell Hardness Applied Forces of 10 kgf to 3000 kgf; ball diameter of 1 mm to 10 mm			ASTM E10 & ISO 6506-1 & -2
Low Hardness	94 HBW 10/500 100 HBW 2.5/62.5 111 HBW 10/3000 139 HBW 2.5/62.5 140 HBW 10/1000	1.1 HBW 0.98 HBW 1.4 HBW 1.7 HBW 1.9 HBW	
Mid Hardness	183 HBW 10/3000 199 HBW 2.5/187.5 200 HBW 2.5/187.5 200 HBW 10/1500	2.4 HBW 2.8 HBW 1.6 HBW 1.7 HBW	
High Hardness	315 HBW 10/3000 326 HBW 5/750 462 HBW 10/3000	2.6 HBW 4.0 HBW 5.0 HBW	

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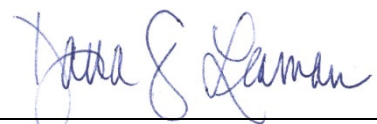
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Vickers Hardness Field calibrations only <small>Note 4</small> Applied Forces of 10 gf to 120 kgf			ASTM E384, E92, or ISO 6507-1 & -2
Low Hardness	129 HV/0.1 212 HV/10 217 HV/0.5 255 HV/15 261 HV/100	1.6 HV 1.4 HV 2.4 HV 1.8 HV 1.8 HV	
Mid Hardness	321 HV/5 388 HV/0.5 395 HV/0.1 441 HV/100	3.9 HV 4.2 HV 6.4 HV 2.8 HV	
High Hardness	598 HV/30 611 HV/5 694 HV/0.5 697 HV/100 705 HV/0.2 719 HV/30	5.8 HV 3.5 HV 5.5 HV 5.5 HV 9.1 HV 3.6 HV	
Knoop Indentation Hardness Field calibrations only <small>Note 4</small> Applied forces of 10 gf to 1 kgf			ASTM E384 or E92
Low Hardness	112 HK/0.01 142 HK/0.1 238 HK/0.5	5.2 HK 2.3 HK 3.8 HK	
Mid Hardness	319 HK/0.2 516 HK/1 524 HK/0.1	3.5 HK 4.8 HK 5.8 HK	

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High Hardness  Direct Verification of Rockwell testing machines Field calibrations only <sup>Note 4</sup>  Testing Time Cycle Indenter Contact Velocity Preliminary Force Dwell Additional Force Application Total Force Dwell Elastic Recovery Dwell	637 HK/0.1 700 HK/0.025 741 HK/0.5           Up to 180 s	9.5 HK 13 HK 6.2 HK            0.000012T s + 0.46 s, where T is time in seconds	ASTM E18 Annex A1 ISO 6508-1 & -2
Test Force Depth Measuring Device Test Machine Level Machine Hysteresis	3 kgf to 150 kgf	0.13 % 0.05 µm 0.0005 in/ft elevation 0.01 Rockwell Points	Instron Internal Method ASTM E18 Annex A1 ISO 6508-1 & -2
Direct Verification of Brinell testing machines & measuring equipment Field calibrations only <sup>Note 4</sup>  Test Force Time Length	From HB 10/3000 to 1/10	0.23 % 0.000012T s + 0.46 s 2.0 µm	ASTM E10 & ISO 6506-1 & -2

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Direct Verification of Vickers testing machines & measuring equipment Field calibrations only <sup>Note 4</sup> Test Force Time Length	Vickers scales: HV 5 to HV 100 HV 0.1 to HV 3	0.23 % 0.0000127 s + 0.46 s 2.0 μm	ASTM E92, ISO 6507-1 & -2
<b>TORQUE (20/M15)</b>			
Torque – Calibration of Torque devices, Clockwise And Counter-Clockwise Field calibrations only <sup>Note 4</sup>	Up to 2 lbf-in Up to 200 lbf-in 1 lbf-in to 110 lbf-in 10 lbf-in to 2213 lbf-in 50 lbf-in to 50000 lbf-in	0.13 % 0.11 % 0.12 % 0.11 % 0.13 %	ASTM E2624 or Internal Method  2 in beam and deadweight 10 in beam and deadweight Torque transducers
<b>IMPACT (20/M17)</b>			
Impact Testing Machines Field calibrations only <sup>Note 4</sup>	(Absorbed energy in Joules)		
Metals	150 J to 900 J	0.40 J	ASTM E23 or ISO 148 including proof testing using certified Specimens
Plastics	0.5 J to 7.5 J 15 J 25 J 50 J	0.015 J 0.030 J 0.042 J 0.081 J	ISO 13802, ASTM D256, ISO 8256, ISO179-1, ISO 180, ISO 7628-2, ISO 9854-1, ASTM D6110, ASTM D1822

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<b>THERMODYNAMIC</b>			
<b>LABORATORY THERMOMETERS, DIGITAL and ANALOG (20/T03)</b>			
In-situ Temperature Measurement Field calibrations only <sup>Note 4</sup>			
Temperature	-200 °C to -150 °C > -150 °C to -100 °C > -100 °C to 0 °C	1.3 °C 1.2 °C 1.1 °C	Type T thermocouple with Fluke 714
Temperature	0 °C to 100 °C > 100 °C to 200 °C > 200 °C to 300 °C > 300 °C to 400 °C > 400 °C to 500 °C > 500 °C to 600 °C > 600 °C to 700 °C > 700 °C to 800 °C > 800 °C to 900 °C	0.7 °C 1.2 °C 2.1 °C 2.6 °C 3.2 °C 3.7 °C 4.2 °C 4.8 °C 5.3 °C	Type K Thermocouple with Fluke 714
<b>PRESSURE INDICATORS (20/T05)</b>			
Pressure Indicators Field calibrations only <sup>Note 4</sup>	0 bar to 300 bar 0 bar to 2000 bar	0.2 bar 1.1 bar	Pressure Gage and Hydraulic Pump
<b>RESISTANCE THERMOMETRY (20/T07)</b>			
Temperature Field calibrations only <sup>Note 4</sup>	-75 °C to 0 °C > 0 °C to 400 °C	0.14 °C 0.05 °C	PRT 100 and Hart Scientific Black Stack
HDT / Vicat Systems	0 °C to 500 °C	0.13 °C	

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

<b>Measured Parameter or Device Calibrated</b>	<b>Range</b>	<b>Expanded Uncertainty</b> <small>Notes 3,5,8</small>	<b>Remarks</b>
<b>TEMPERATURE INDICATORS (20/T08)</b>			
Thermocouple Simulation Field calibrations only <small>Note 4</small>	Type K	1.3 °C	Sensor substitution method using Fluke 714
	Type J	0.9 °C	
	Type B	2.6 °C	
	Type E	0.9 °C	
	Type T	0.9 °C	
	Type R	2.4 °C	
	Type S	2.4 °C	
	Type U	0.9 °C	
	Type L	0.8 °C	
<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:** For ASTM E74 the uncertainties of the measured value are determined by the statistics of the test and the artifact tested but are typically better than  $\pm 0.05$  % for class AA instruments,  $\pm 0.25$  % for class A instruments, and  $\pm 0.1$  % for class A1 instruments.

**Note 8:** Where  $L$  is the measured value, in same units as the range.

**Note 9:** In laboratory calibrations can be performed at Norwood, MA or C/ Argenters 2, Parque Tecnológico del Vallés, Cerdanyola, Barcelona 08290 Spain facilities, unless otherwise noted.

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