



**CALIBRATION LABORATORIES**

**NVLAP LAB CODE 200301-0**

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

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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>	15° to 360°	0.28°	Instron Internal Method with rotary encoder
Rotary Speed Field calibrations only <sup>Note 4</sup>	0.2 rpm to 120 rpm	0.00037 rpm + 0.00066 rpm/rpm	Comparison to time base oscillator
<b>LENGTH and DIAMETER; STEP GAGES (20/D05)</b>			
Alignment Electronics Calibration	Up to 2000 μ-strain	2.5 S, where S is reading in units of μ-strain	Instron Internal Method
Alignment Transducer Verification	Up to 2000 μ-strain	-0.00024 S % + 1.7 %	Instron Internal Method
Alignment of Materials Testing System Field calibrations only <sup>Notes 4, 9</sup>	Up to 2000 μ-strain	0.0082 S % + 0.23 %	ASTM E1012, Nadcap AC7101, AC7122 specimen alignment (used in determination of % bend)

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Strain Field calibrations only <sup>Note 4</sup>	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 + 0.000024L in 0.0008 in + 0.0002L in 0.0083 in 0.017 in	ASTM E83, ISO 9513, ISO 527 or Internal Method Gage length
	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 0 in to 10 in 10 in to 40 in	0.000012 in 0.000015 in 0.00002 in + 0.000071L in 0.000043 in + 0.00014L in 0.000053 in + 0.00021L in 0.000078 in + 0.00022L in 0.00026 in + 0.00015L in 0.000025 in + 0.00017L in	Displacement with linear scales
Specimen Measuring Device (SMD) Field calibrations only <sup>Note 4</sup>			Instron Internal Procedure using gage blocks
Vertical			
Width	Up to 40 mm	0.00069 mm	
Thickness	Up to 15 mm	0.00063 mm	
Parallelism			Instron Internal Procedure using ball gage
Width	Up to 1.3 mm	1.1 µm	
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	

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Material Testing System Crosshead Displacement or Actuator Stroke Field calibrations only <sup>Note 4</sup>	0 in to 10 in 10 in to 40 in	0.00026 in + 0.00015L in 0.000025 in + 0.00017L in	ASTM E2309 or Internal Method with digital linear encoders
Material Testing System Crosshead/Actuator Speed Field calibrations only <sup>Note 4</sup>	Up to 1270 mm/min	0.00046 mm/min + 0.0012v mm/min, where v is measured value	ASTM E2658 or Internal Method with linear encoders and comparison to time base oscillator
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	0.000025 in + 0.00012L 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	0.08 mm 0.0027 mm	12X eye loupe Micrometer calipers

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Linear Displacement	Up to 152 mm	0.018 mm	
Heat Deflection Machines (HDT & VICAT)	Up to 40.2 mm	0.037 mm	Gage blocks
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
Impact Testers			
Field calibrations only <sup>Note 4</sup>			
Radius of Curvature	Up to 3 mm	0.08 mm	12 X eye loupe
Length	Up to 150 mm	0.027 mm	Caliper
Length, falling weight tester	Up to 2 m	2.0 mm	Tapes
Outside Diameter	Up to 30 mm	0.0027 mm	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	0 mV to 300 mV	0.096 mV	HP 3478A
	0 V to 3 V	0.14 mV	
Field calibrations <sup>Note 4</sup>	0.05 V to 1000 V	0.19 %	Multimeter
<b>LF AC VOLTAGE (20/E09)</b>			
AC Voltage			
Field calibrations only <sup>Note 4</sup>	400 V to 1000 V	2.5 % of full scale	Multimeter
	1 kV to 6 kV	1.2 %	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 Hz to 100 MHz	0.94 %	Oscilloscope
<b>STOPWATCHES &amp; TIMERS (20/F05)</b>			
Timers Field calibrations only <sup>Note 4</sup>	0.7 ms to 5 ms >0 s 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	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 g to 500 t (0.01 N to 5 MN) 1 g to 500 t (0.01 N to 5 MN)	0.12 % 0.12 %	ASTM E4 and ISO 7500-1 and internally developed methods Compression Tension
Falling Weight Impact Tester In Lab	1 kN to 25 kN 1 kN to 222 kN	0.7 % of full scale 0.11 %	Interface 9840 and load cell
Rheological Equipment Field calibrations only <sup>Note 4</sup>	0 g to 250 g	0.31 %	Interface 9840 & load cell

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Heat Deflection Equipment Field calibrations only <sup>Note 4</sup>	0 g 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 <sup>Note 4</sup>			
HRA Carbide	93 Rockwell Points 91 Rockwell Points 85 Rockwell Points	0.07 Rockwell Points 0.11 Rockwell Points 0.17 Rockwell Points	ASTM E18 Annex A4 & ISO 6508-3
HRA Steel Scale	83 Rockwell Points 73 Rockwell Points 63 Rockwell Points	0.10 Rockwell Points 0.27 Rockwell Points 0.15 Rockwell Points	
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	
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	0.11 Rockwell Points 0.16 Rockwell Points	

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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>
	80 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 49 Rockwell Points 24 Rockwell Points	0.13 Rockwell Points 0.12 Rockwell Points 0.19 Rockwell Points	
HRPW Scale	108 Rockwell Points 99 Rockwell Points 88 Rockwell Points	0.15 Rockwell Points 0.23 Rockwell Points 0.26 Rockwell Points	

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HRRW Scale	121 Rockwell Points 119 Rockwell Points 116 Rockwell Points	0.12 Rockwell Points 0.12 Rockwell Points 0.12 Rockwell Points	
HRSW Scale	114 Rockwell Points 109 Rockwell Points 106 Rockwell Points	0.12 Rockwell Points 0.15 Rockwell Points 0.16 Rockwell Points	
HR15TW Scale	90 Rockwell Points 83 Rockwell Points 76 Rockwell Points	0.05 Rockwell Points 0.27 Rockwell Points 0.17 Rockwell Points	
HR30TW Scale	70 Rockwell Points 56 Rockwell Points 43 Rockwell Points	0.20 Rockwell Points 0.20 Rockwell Points 0.29 Rockwell Points	
HR45TW Scale	67 Rockwell Points 41 Rockwell Points 23 Rockwell Points	0.10 Rockwell Points 0.33 Rockwell Points 0.21 Rockwell Points	
HRVWW Scale	106 Rockwell Points 98 Rockwell Points 95 Rockwell Points	0.17 Rockwell Points 0.21 Rockwell Points 0.22 Rockwell Points	
HR15WW Scale	94 Rockwell Points 88 Rockwell Points 84 Rockwell Points	0.08 Rockwell Points 0.07 Rockwell Points 0.11 Rockwell Points	
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	

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<b>Measured Parameter or Device Calibrated</b>	<b>Range</b>	<b>Expanded Uncertainty <sup>Notes 3,5,8</sup></b>	<b>Remarks</b>
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	
Brinell, Knoop and Vickers hardness testing machines Field calibrations only <sup>Note 4</sup>			
Brinell Microscope			ASTM E10
Type A Microscope	10X to 100X Magnification	1.6 µm	
Type B Microscope	10X to 100X Magnification	21 µm	
Vickers and Knoop Microscope	30X to 1000X Magnification	0.9 µm	ASTM E384 or E92

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<b>Measured Parameter or Device Calibrated</b>	<b>Range</b>	<b>Expanded Uncertainty <sup>Notes 3,5,8</sup></b>	<b>Remarks</b>
Indirect Verification of Brinell, Knoop and Vickers testing machines Field calibrations only <sup>Note 4</sup> Brinell Hardness Applied Forces of 10 kgf to 3000 kgf; ball diameter of 1 mm to 10 mm 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 Mid Hardness: 183 HBW 10/3000 199 HBW 2.5/187.5 200 HBW 2.5/187.5 200 HBW 10/1500  High Hardness: 315 HBW 10/3000 326 HBW 5/750 462 HBW 10/3000  Vickers Hardness Field calibrations only <sup>Note 4</sup> Applied Forces of 10 gf to 120 kgf Low Hardness: 129 HV/0.1 212 HV/10 217 HV/0.5 255 HV/15 261 HV/100		1.1 HBW 0.98 HBW 1.4 HBW 1.7 HBW 1.9 HBW  2.4 HBW 2.8 HBW 1.6 HBW 1.7 HBW  2.6 HBW 4.0 HBW 5.0 HBW  1.6 HV 1.4 HV 2.4 HV 1.8 HV 1.8 HV	ASTM E10         ASTM E384 or E92

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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>
Mid Hardness: 321 HV/5 388 HV/0.5 395 HV/0.1 441 HV/100  High Hardness: 598 HV/30 611 HV/5 694 HV/0.5 697 HV/100 705 HV/0.2 719 HV/30  Knoop Indentation Hardness Field calibrations only <small>Note 4</small> Applied forces of 10 gf to 1 kgf Low Hardness: 112 HK/0.01 142 HK/0.1 238 HK/0.5  Mid Hardness: 319 HK/0.2 516 HK/1 524 HK/0.1  High Hardness: 637 HK/0.1 700 HK/0.025 741 HK/0.5		3.9 HV 4.2 HV 6.4 HV 2.8 HV  5.8 HV 3.5 HV 5.5 HV 5.5 HV 9.1 HV 3.6 HV  5.2 HK 2.3 HK 3.8 HK  3.5 HK 4.8 HK 5.8 HK  9.5 HK 13 HK 6.2 HK	ASTM E384 or E92

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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	1.3 °C	Type T thermocouple with Fluke 714
	-150 °C to -100 °C	1.2 °C	
	-100 °C to -50 °C	1.1 °C	
	-50 °C to 0 °C	1.1 °C	
Temperature	0 °C to 100 °C	0.7 °C	Type K Thermocouple with Fluke 714
	100 °C to 200 °C	1.2 °C	
	200 °C to 300 °C	2.1 °C	
	300 °C to 400 °C	2.6 °C	
	400 °C to 500 °C	3.2 °C	
	500 °C to 600 °C	3.7 °C	
	600 °C to 700 °C	4.7 °C	
	700 °C to 800 °C	4.8 °C	
	800 °C to 900 °C	5.3 °C	
<b>PRESSURE INDICATORS (20/T05)</b>			
Pressure Indicators Field calibrations only <sup>Note 4</sup>			Pressure Gage and Hydraulic Pump
	0 bar to 300 bar	0.2 bar	
	0 bar to 2000 bar	1.1 bar	
<b>RESISTANCE THERMOMETRY (20/T07)</b>			
Temperature	-75 °C to 0 °C	0.11 °C	PRT 100 and Hart Scientific Black Stack
	0 °C to 400 °C	0.05 °C	
HDT / Vicat Systems	0 °C to 500 °C	0.13 °C	

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<b>TEMPERATURE INDICATORS (20/T08)</b>			
Thermocouple Simulation	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.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:** 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:** Alignment calibration is the only CMC for which Instron is currently NVLAP accredited in the European region.

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