



**National Voluntary
Laboratory Accreditation Program**



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

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CALIBRATION LABORATORIES

NVLAP LAB CODE 200127-0

NVLAP Code: 20/A01 ANSI/NCSL Z540-1-1994; Part 1 Compliant

DIMENSIONAL

NVLAP Code: 20/D05
 Length

<i>Range</i>	<i>Best Uncertainty (±) ^{note 1}</i>	<i>Remarks</i>
Reference Block Calibration Brinell Hardness Laboratory Capability ASTM E10, ISO 6506		
0 mm to 7 mm	0.0038 mm	Indentation Measurement
Reference Block Calibration Vickers Hardness Laboratory Capability ASTM E92, ISO 6507		
0 mm to 0.500 mm	0.0009 mm	Indentation Measurement
Reference Block Calibration Vickers Hardness Laboratory Capability ASTM E384, ISO 6507		
0 mm to 0.100 mm	0.0003 mm	Indentation Measurement
1 mm to 0.200 mm	0.00036 mm	Indentation Measurement
Reference Block Calibration Knoop Hardness Laboratory Capability ASTM E384, ISO 4545		
0 mm to 0.100 mm	0.0003 mm	Indentation Measurement
1 mm to 0.200 mm	0.00036 mm	Indentation Measurement

2008-10-01 through 2009-09-30

Effective dates

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CALIBRATION LABORATORIES

NVLAP LAB CODE 200127-0

MECHANICAL

NVLAP Code: 20/M06

Force

Reference Block Calibration Brinell Hardness Laboratory Capability ASTM E10, ISO 6506

<i>Range</i>	<i>Best Uncertainty (±) ^{note 1}</i>	<i>Remarks</i>
62.5 kgf	0.32 kgf	Applied Force
187.5 kgf	0.95 kgf	Applied Force
500 kgf	2.55 kgf	Applied Force
1000 kgf	3.64 kgf	Applied Force
1500 kgf	5.83 kgf	Applied Force
2000 kgf	6.68 kgf	Applied Force
2500 kgf	7.81 kgf	Applied Force
3000 kgf	9.34 kgf	Applied Force

Reference Block Calibration Vickers Hardness Laboratory Capability ASTM E92, ISO 6507

1 kgf	0.003 kgf	Applied Force
2 kgf	0.006 kgf	Applied Force
5 kgf	0.02 kgf	Applied Force
10 kgf	0.05 kgf	Applied Force
20 kgf	0.088 kgf	Applied Force
30 kgf	0.126 kgf	Applied Force
50 kgf	0.218 kgf	Applied Force

Reference Block Calibration Vickers Hardness Laboratory Capability ASTM E384, ISO 6507

10 gf	1 gf	Applied Force
25 gf	1 gf	Applied Force
50 gf	1 gf	Applied Force
100 gf	1 gf	Applied Force
200 gf	1 gf	Applied Force
300 gf	2.1 gf	Applied Force
500 gf	3.1 gf	Applied Force

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Field Calibration Vickers Hardness ASTM E384, ISO 6507

10 gf	1 gf	Applied Force
25 gf	1 gf	Applied Force
50 gf	1 gf	Applied Force
100 gf	1 gf	Applied Force
200 gf	1 gf	Applied Force
300 gf	2.1 gf	Applied Force
500 gf	3.1 gf	Applied Force
1000 gf	5.5 gf	Applied Force

Field Calibration Knoop Hardness ASTM E384, ISO 4545

10 gf	1 gf	Applied Force
25 gf	1 gf	Applied Force
50 gf	1 gf	Applied Force
100 gf	1 gf	Applied Force
200 gf	1 gf	Applied Force
300 gf	2.1 gf	Applied Force
500 gf	3.1 gf	Applied Force
1000 gf	5.5 gf	Applied Force

Rockwell Hardness Testers - ASTM E4, Direct Laboratory and Field Calibration

3 kgf	10 gf	Applied Force
10 kgf	10 gf	Applied Force
15 kgf	10 gf	Applied Force
30 kgf	10 gf	Applied Force
45 kgf	10 gf	Applied Force
60 kgf	30 gf	Applied Force
100 kgf	30 gf	Applied Force
150 kgf	30 gf	Applied Force

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NVLAP Code: 20/M13

Hardness

Calibration of Test Blocks Rockwell ASTM E18, ISO 6508

<i>Hardness Scale and Range</i>	<i>Best Uncertainty (\pm) in Rockwell Points</i> <small>notes 1, 2, 3, 4</small>	<i>Remarks</i>
HRA Steel Scale		
Carbide \geq 86	0.15	
80 to 85	0.15	
70 to 79	0.16	
60 to 69	0.28	
HRB Scale		
\geq 80	0.42	
51 to 79	0.87	
1 to 50	1.36	
HRC Scale		
60 to 70	0.31	
40 to 59	0.32	
20 to 39	0.37	
HRD Scale		
70 to 80	0.17	
50 to 69	0.25	
40 to 49	0.27	
HRE Scale		
\geq 89	0.54	
75 to 88	0.54	
65 to 87	0.54	
HRF Scale		
\geq 87	0.40	
70 to 86	0.40	
40 to 69	0.54	

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HRG Scale

≥ 80	0.30
40 to 79	0.30
1 to 39	0.76

HRH Scale

≥ 90	0.40
80 to 89	0.40
60 to 79	0.68

HRK Scale

≥ 70	0.40
30 to 69	0.40
10 to 29	0.64

HRL Scale

≥ 115	0.35
90 to 114	0.35

HRM Scale

≥ 100	0.56
70 to 99	0.56

HRP Scale

≥ 85	0.65
40 to 84	0.91

HRR Scale

≥ 120	0.23
100 to 119	0.40

HRS Scale

≥ 112	0.19
110 to 111	0.91

HRV Scale

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≥ 104	0.20
80 to 103	0.61

HR15N Scale

90 to 95	0.18
80 to 89	0.18
40 to 79	0.39

HR15T Scale

88 to 100	0.21
80 to 87	0.21
20 to 79	0.37

HR15W Scale

89 to 100	0.53
80 to 88	0.44

HR15X Scale

88 to 100	0.33
80 to 87	0.62

HR15Y Scale

94 to 100	0.63
85 to 93	1.30

HR30N Scale

77 to 85	0.27
60 to 76	0.27
40 to 59	0.55

HR30T Scale

57 to 85	0.39
50 to 56	0.66
20 to 49	0.90

HR30W Scale

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65 to 100 0.76
40 to 64 0.90

HR30X Scale

79 to 100 0.15
60 to 78 0.99

HR30Y Scale

88 to 100 0.37
60 to 87 0.82

HR45N Scale

67 to 75 0.18
50 to 66 0.21
10 to 49 0.43

HR45T Scale

50 to 75 0.40
40 to 49 0.40
1 to 39 0.73

HR45W Scale

49 to 100 0.12
10 to 47 0.29

HR45X Scale

69 to 100 0.34
40 to 68 0.81

HR45Y Scale

82 to 100 0.29
60 to 81 0.94

Field Service Indirect Verification of Hardness Testing Machines Rockwell ASTM E18, ISO 6508

Hardness Scale and Range Best Uncertainty (\pm) in Rockwell Points ^{notes 1, 2, 3, 4} Remarks
HR15N Scale

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90 to 95	0.19
80 to 89	0.19
40 to 79	0.39

HR15T Scale

≥ 88	0.21
80 to 87	0.21
20 to 79	0.37

HR15W Scale

≥ 89	0.67
80 to 88	0.67

HR15X Scale

≥ 88	0.33
80 to 87	0.62

HR15Y Scale

≥ 94	0.63
85 to 93	1.30

HR30N Scale

77 to 85	0.28
60 to 76	0.28
40 to 59	0.55

HRT30T Scale

≥ 57	0.39
50 to 56	0.66
20 to 49	0.90

HR30W Scale

≥ 65	0.76
40 to 64	0.90

HR30X Scale

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≥ 79 0.15
60 to 78 0.99

HR30Y Scale

≥ 88 0.37
60 to 87 0.82

HR45N Scale

67 to 75 0.19
50 to 66 0.22
10 to 49 0.43

HR45T Scale

≥ 50 0.41
40 to 49 0.41
1 to 39 0.73

HR45W Scale

≥ 48 0.13
10 to 47 0.30

HR45X Scale

≥ 69 0.35
40 to 68 0.81

HR45Y Scale

≥ 82 0.30
60 to 81 0.94

HRA Scale

Carbide ≥ 86 0.16
80 to 85 0.16
70 to 79 0.17
60 to 69 0.28

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HRB Scale

≥ 80	0.42
51 to 79	0.87
1 to 50	1.36

HRC Scale

60 to 70	0.32
40 to 59	0.36
20 to 39	0.40

HRD Scale

70 to 80	0.18
50 to 69	0.26
40 to 49	0.27

HRE Scale

≥ 89	0.54
75 to 88	0.54
65 to 87	0.54

HRF Scale

≥ 87	0.40
70 to 86	0.40
40 to 69	0.54

HRG Scale

≥ 80	0.30
40 to 79	0.30
1 to 39	0.76

HRH Scale

≥ 90	0.41
80 to 89	0.41
60 to 79	0.54

HRK Scale

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≥ 70	0.40
30 to 69	0.40
10 to 29	0.64

HRL Scale

≥ 115	0.36
90 to 114	0.36

HRM Scale

≥ 100	0.56
70 to 99	0.56

HRP Scale

≥ 85	0.65
40 to 84	0.91

HRR Scale

≥ 120	0.24
100 to 119	0.41

HRS Scale

≥ 112	0.20
110 to 111	0.95

HRV Scale

≥ 104	0.21
80 to 103	0.61

Brinell Reference Test Blocks: ASTM E10, ISO 6506

<i>Brinell Scale</i>	<i>Range in Brinell Units</i>	<i>Best Uncertainty (±) ^{notes 1, 2, 3, 4}</i>	<i>Remarks</i>
HBW 1/62.5	200 to 400	9.5 HBW	
HBW 1/62.5	400 to 600	25 HBW	
HBW 2.5/187.5	200 to 400	6.2 HBW	
HBW 2.5/187.5	400 to 600	14.5 HBW	

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HBW 10/500	20 to 100	1 HBW
HBW 10/500	400 to 600	1.5 HBW
HBW 5/1000	200 to 400	4 HBW
HBW 5/1000	400 to 600	8 HBW
HBW 10/1000	200 to 400	3.3 HBW
HBW 10/1000	400 to 600	7 HBW
HBW 10/1500	200 to 400	2.7 HBW
HBW 10/1500	400 to 600	6.5 HBW
HBW 10/2000	200 to 400	2.2 HBW
HBW 10/2000	400 to 600	5.2 HBW
HBW 10/2500	200 to 400	2 HBW
HBW 10/2500	400 to 600	4.4 HBW
HBW 10/3000	200 to 400	1.9 HBW
HBW 10/3000	400 to 600	4.9 HBW

Calibrate Vickers Reference Test Blocks: ASTM E92, ISO 6507

<i>Vickers Scale</i>	<i>Range in Vickers Units</i>	<i>Best Uncertainty (±) ^{notes 1, 2, 3, 4}</i>	<i>Remarks</i>
HV 1	200	4.0 HV	
HV 1	400	8.0 HV	
HV 1	700	17.5 HV	
HV 2	200	3.0 HV	
HV 2	400	8.0 HV	
HV 2	700	14.0 HV	
HV 5	200	3.0 HV	
HV 5	400	6.0 HV	
HV 5	700	10.5 HV	
HV 10	200	3.0 HV	

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HV 10	400	6.0 HV
HV 10	700	10.5 HV
HV 20	200	3.0 HV
HV 20	400	6.0 HV
HV 20	700	10.5 HV
HV 30	200	3.0 HV
HV 30	400	4.0 HV
HV 30	700	7.0 HV
HV 50	200	3.0 HV
HV 50	400	4.0 HV
HV 50	700	7.0 HV

Calibrate Vickers Reference Test Blocks: ASTM E384, ISO 6507

<i>Vickers Scale</i>	<i>Range in Vickers Units</i>	<i>Best Uncertainty (±) ^{notes 1, 2, 3, 4}</i>	<i>Remarks</i>
HV 0.01	200	10 HV	
HV 0.01	400	20 HV	
HV 0.01	700	35 HV	
HV 0.025	200	10 HV	
HV 0.025	400	20 HV	
HV 0.025	700	35 HV	
HV 0.05	200	10 HV	
HV 0.05	400	20 HV	
HV 0.05	700	35 HV	
HV 0.01	200	8 HV	
HV 0.01	400	20 HV	
HV 0.01	700	38 HV	
HV 0.2	200	6 HV	
HV 0.2	400	18 HV	

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HV 0.2	700	38 HV
HV 0.3	200	5 HV
HV 0.3	400	14 HV
HV 0.3	700	35 HV
HV 0.5	200	5 HV
HV 0.5	400	12 HV
HV 0.5	700	24 HV
HV 1	200	4 HV
HV 1	400	8 HV
HV 1	700	17 HV

Calibrate Knoop Reference Test Blocks and Indenters: ASTM E384, ISO 4545

<i>Knoop Scale</i>	<i>Range in Knoop Units</i>	<i>Best Uncertainty (\pm)</i> <small>notes 1, 2, 3, 4</small>	<i>Remarks</i>
HK 0.01	200	7 HK	
HK 0.01	400	16 HK	
HK 0.01	700	33 HK	
HK 0.025	200	7 HK	
HK 0.025	400	14 HK	
HK 0.025	700	22 HK	
HK 0.05	200	7 HK	
HK 0.05	400	14 HK	
HK 0.05	700	20 HK	
HK 0.1	200	7 HK	
HK 0.1	400	12 HK	
HK 0.1	700	19 HK	
HK 0.2	200	5 HK	
HK 0.2	400	8 HK	
HK 0.2	700	17 HK	

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HK 0.3	200	5 HK
HK 0.3	400	8 HK
HK 0.3	700	15 HK
HK 0.5	200	5 HK
HK 0.5	400	7 HK
HK 0.5	700	15 HK
HK 1	200	5 HK
HK 1	400	7 HK
HK 1	700	15 HK

Brinell Hardness Testers: ASTM E10, ISO 6506 Indirect-Field Service and Laboratory Calibration

<i>Brinell Scale</i>	<i>Range in Brinell Units</i>	<i>Best Uncertainty (±)</i> <small>notes 1, 2, 3, 4</small>	<i>Remarks</i>
HBW 1/62.5	200 to 400	2 HBW	
HBW 1/62.5	400 to 600	4 HBW	
HBW 2.5/187.5	200 to 400	2 HBW	
HBW 2.5/187.5	400 to 600	4 HBW	
HBW 10/500	20 to 100	2 HBW	
HBW 10/500	100 to 150	4HBW	
HBW 5/1000	200 to 400	2 HBW	
HBW 5/1000	400 to 600	4 HBW	
HBW 10/1000	200 to 400	2 HBW	
HBW 10/1000	400 to 600	7 HBW	
HBW 10/1500	200 to 400	2 HBW	
HBW 10/1500	400 to 600	4 HBW	
HBW 10/2000	200 to 400	2 HBW	
HBW 10/2000	400 to 600	4 HBW	
HBW 10/2500	200 to 400	2 HBW	

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HBW 10/2500	400 to 600	4 HBW
HBW 10/3000	200 to 400	2 HBW
HBW 10/3000	400 to 600	4 HBW

Vickers Hardness Testers: ASTM E92, ISO 6507 Indirect-Field Service and Laboratory Calibration

<i>Vickers Scale</i>	<i>Range in Vickers Units</i>	<i>Best Uncertainty (±) ^{notes 1, 2, 3, 4}</i>	<i>Remarks</i>
HV 1	200	8.7 HV	
HV 1	400	21.4 HV	
HV 1	700	44 HV	
HV 2	200	6.9 HV	
HV 2	400	16.3 HV	
HV 2	700	31 HV	
HV 5	200	3.9 HV	
HV 5	400	11 HV	
HV 5	700	19.7 HV	
HV 10	200	3.1 HV	
HV 10	400	7.7 HV	
HV 10	700	14.9 HV	
HV 20	200	2.5 HV	
HV 20	400	6.2 HV	
HV 20	700	11 HV	
HV 30	200	2 HV	
HV 30	400	4.4 HV	
HV 30	700	9.3 HV	
HV 50	200	1.9 HV	
HV 50	400	3.5 HV	
HV 50	700	6.3 HV	

Vickers Hardness Testers: ASTM E384, ISO 6507 Indirect-Field Service and Laboratory Calibration

<i>Vickers Scale</i>	<i>Range in Vickers Units</i>	<i>Best Uncertainty (±) ^{notes 1, 2, 4}</i>	<i>Remarks</i>
HV 0.01	200	10 HV	

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HV 0.01	400	30 HV
HV 0.01	700	40 HV
HV 0.025	200	9 HV
HV 0.025	400	20 HV
HV 0.025	700	30 HV
HV 0.05	200	8.5 HV
HV 0.05	400	19 HV
HV 0.05	700	27 HV
HV 0.1	200	8 HV
HV 0.1	400	18 HV
HV 0.1	700	25 HV
HV 0.2	200	7 HV
HV 0.2	400	17 HV
HV 0.2	700	20 HV
HV 0.3	200	6 HV
HV 0.3	400	16 HV
HV 0.3	700	19 HV
HV 0.5	200	5 HV
HV 0.5	400	15 HV
HV 0.5	700	17 HV
HV 1	200	5 HV
HV 1	400	10 HV
HV 1	700	15 HV

Knoop Hardness Testers: ASTM E384, ISO 4545 Indirect-Field Service and Laboratory Calibration

<i>Knoop Scale</i>	<i>Range in Knoop Units</i>	<i>Best Uncertainty (±) ^{notes 1, 2, 4}</i>	<i>Remarks</i>
HK 0.01	200	7 HK	
HK 0.01	400	16 HK	
HK 0.01	700	33 HK	
HK 0.025	200	7 HK	
HK 0.025	400	14 HK	

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HK 0.025	700	22 HK
HK 0.05	200	7 HK
HK 0.05	400	14 HK
HK 0.05	700	20 HK
HK 0.1	200	7 HK
HK 0.1	400	12 HK
HK 0.1	700	19 HK
HK 0.2	200	5 HK
HK 0.2	400	8 HK
HK 0.2	700	17 HK
HK 0.3	200	5 HK
HK 0.3	400	8 HK
HK 0.3	700	17 HK
HK 0.5	200	5 HK
HK 0.5	400	7 HK
HK 0.5	700	15 HK
HK 1	200	5 HK
HK 1	400	7 HK
HK 1	700	15 HK

NVLAP Code: 20/M13
Calibration of Durometer Blocks

Hardness Scale and Range	Best Uncertainty (\pm) in Shore ^{note 1}	Remarks
Shore A 0 to 100	7	
Shore D 0 to 100	0.03	

NVLAP Code: 20/M13
Calibration of Durometer Blocks

Hardness Scale and Range	Best Uncertainty (\pm) in N ^{note 1}	Remarks
Shore A 0 to 8.9 N	0.013	
Shore D 0 to 44.5	0.013	
Indenter Tip A	0.075 mm ^{note 6}	

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Indenter Tip D

0.075 mm

1. Represents an expanded uncertainty using a coverage factor, $k = 2$, at an approximate level of confidence of 95 %.
2. The standardized test blocks used for verification are calibrated at the David L. Ellis Company, Inc. Hardness Calibration Laboratory in accordance with ASTM E10, E18, E92, E384, or ISO 4545, 6506, 6507, 6508 using NIST HRC Standard Reference Materials (SRM) 2810, 2811, 2812 and other primary reference standards from other National Metrology Institutes. Some Rockwell scales are traceable to David L. Ellis Co., Inc. hardness levels through laboratory standardizing machines. The standardizing machines are directly verified according to applicable ASTM or ISO procedures using devices that are traceable to NIST either directly or through a NVLAP-accredited laboratory.
3. W on ball scales indicates use of carbide balls, e.g., HRBW. S on ball scales indicates the use of steel balls, e.g., HRBS.
4. Where available, certified materials (NIST (USA), PTB (Germany), and IMGC (Italy)) are used to indirectly verify scales and hardness levels. All other scales and hardness ranges are traceable to directly verified testers with parameters traceable to NIST.
5. The Heidenhain specification indicates that the accuracy is maintained over a temperature range of 10 °C to 40 °C.
6. Tip shape only verified for condition. Indenter extension verified by use of gage blocks.

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