



CALIBRATION LABORATORIES

NVLAP LAB CODE 200127-0

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

| | |
|---|---|
| <p>David L. Ellis Co., Incorporated 310 Old High Street, P.O. Box 592 Acton, MA 01720-0010 Mr. Robert A. Ellis Phone: 978-897-1795 Fax: 978-897-0844 E-mail: sales@hardness-testblocks.com URL: http://www.hardness-testblocks.com</p> | <p>Fields of Calibration Dimensional Mechanical</p> <p>This laboratory is compliant to ANSI/NCSL Z540-1-1994; Part 1. (NVLAP Code: 20/A01)</p> |
|---|---|

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)^{Notes 1,2,11}

| Measured Parameter or Device Calibrated | Range | Expanded Uncertainty ^{Note 3} | Remarks |
|---|--------------------------------------|--|-------------------------|
| DIMENSIONAL | | | |
| Length & Diameter; Step Gages (20/D05) | | | |
| 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 E384, E92, ISO 6507 | 0 mm to 0.100 mm 1 mm to 0.200 mm | 0.0003 mm 0.00036 mm | |
| Reference Block Calibration Knoop Hardness Laboratory Capability ASTM E384, ISO 4545 | 0 mm to 0.100 mm 1 mm to 0.200 mm | 0.0003 mm 0.00036 mm | |
| Indenters Brinell Hardness Laboratory Capability ASTM E10, ISO 6506 | 1 mm to 10 mm | 0.00025 mm | |
| Length of Indenter Vickers, Knoop, Brinell Reference Block Calibration Vickers Hardness Laboratory | >0 mm to 3.0 mm | 0.025 mm | |
| | | | Grade 10 Ball |

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| Measured Parameter or Device Calibrated | Range | Expanded Uncertainty^{Note 3} | Remarks |
|--|------------------------------|--|-------------------------|
| Capability ASTM E92, ISO 6507, ASTM E384 | 136° | 5 minutes | UKAS Vickers |
| Reference Block Calibration | 130° | 5 minutes | UKAS Knoop |
| Vickers Hardness Laboratory | 172° | 5 minutes | |
| Capability ASTM E384, ISO 4545 | | | |
| Field Calibration ^{Note 4} Brinell Hardness ASTM E10, ISO 6506 | 0 mm to 7 mm | 0.028 mm | Indentation Measurement |
| Field Calibration ^{Note 4} Vickers Hardness ASTM E92, ISO 6507, ASTM E384 | 0 mm to 0.500 mm | 0.0014 mm | |
| Field Calibration ^{Note 4} Vickers Hardness ASTM E384, ISO 6507 | 0 mm to 0.200 mm | 0.001 mm | |
| Field Calibration ^{Note 4} Knoop Hardness ASTM E384, ISO 4545 | 0 mm to 0.200 mm | 0.001 mm | |
| Rockwell Hardness Testers Direct Laboratory And Field Calibrations ^{Note 4} ASME E18, ISO 6508 | 0 mm to 3 mm | 0.0003 mm | |
| | | | |
| MECHANICAL | | | |
| FORCE (20/M06) | | | |
| Reference Block Calibration Brinell Hardness Laboratory Capability ASTM E10, ISO 6506 | 1 kgf 1.25 kgf 2.5 kgf | 0.01 kgf 0.01 kgf 0.01 kgf | Applied Force |

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)^{Notes 1,2,11}

| Measured Parameter or Device Calibrated | Range | Expanded Uncertainty ^{Note 3} | Remarks |
|---|-----------|--|---------------|
| Reference Block Calibration Vickers Hardness Laboratory Capability ASTM E92, ISO 6507, ASTM E384 | 5 kgf | 0.02 kgf | Applied Force |
| | 6.25 kgf | 0.02 kgf | |
| | 7.81 kgf | 0.02 kgf | |
| | 10 kgf | 0.03 kgf | |
| | 15.62 kgf | 0.04 kgf | |
| | 25 kgf | 0.06 kgf | |
| | 30 kgf | 0.08 kgf | |
| | 31.25 kgf | 0.16 kgf | |
| | 62.5 kgf | 0.32 kgf | |
| | 100 kgf | 0.25 kgf | |
| | 125 kgf | 0.31 kgf | |
| | 187.5 kgf | 0.95 kgf | |
| | 250 kgf | 1.3 kgf | |
| | 500 kgf | 2.6 kgf | |
| | 750 kgf | 0.63 kgf | |
| | 1000 kgf | 3.6 kgf | |
| | 1500 kgf | 5.8 kgf | |
| | 2000 kgf | 6.7 kgf | |
| | 2500 kgf | 7.8 kgf | |
| | 3000 kgf | 9.3 kgf | |
| | 1 kgf | 0.003 kgf | |
| | 1.5 kgf | 0.006 kgf | |
| | 2 kgf | 0.006 kgf | |
| | 2.5 kgf | 0.007 kgf | |
| | 3 kgf | 0.012 kgf | |
| | 5 kgf | 0.02 kgf | |
| | 10 kgf | 0.05 kgf | |
| 20 kgf | 0.088 kgf | | |
| 30 kgf | 0.13 kgf | | |
| 50 kgf | 0.21 kgf | | |
| 100 kgf | 0.44 kgf | | |

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| Measured Parameter or Device Calibrated | Range | Expanded Uncertainty ^{Note 3} | Remarks |
|--|-----------|--|---------------|
| Reference Block Calibration Vickers Hardness Laboratory Capability ASTM E384, ISO 6507 | 10 gf | 1 gf | Applied Force |
| | 25 gf | 1 gf | |
| | 50 gf | 1 gf | |
| | 100 gf | 1 gf | |
| | 200 gf | 1 gf | |
| | 300 gf | 2.1 gf | |
| | 400 gf | 2.1 gf | |
| | 500 gf | 3.1 gf | |
| | 1000 gf | 5.5 gf | |
| | 2000 gf | 11 gf | |
| 3000 gf | 16 gf | | |
| Reference Block Calibration Knoop Hardness Laboratory Capability ASTM E384, ISO 4545 | 10 gf | 1 gf | Applied Force |
| | 25 gf | 1 gf | |
| | 50 gf | 1 gf | |
| | 100 gf | 1 gf | |
| | 200 gf | 1 gf | |
| | 300 gf | 2.1 gf | |
| | 400 gf | 2.1 gf | |
| | 500 gf | 3.1 gf | |
| | 1000 gf | 5.5 gf | |
| | 2000 gf | 11 gf | |
| 3000 gf | 16 gf | | |
| Field Calibration ^{Note 4} Brinell Hardness ASTM E10, ISO 6506 | 62.5 kgf | 0.6 kgf | Applied Force |
| | 187.5 kgf | 1.9 kgf | |
| | 500 kgf | 5.0 kgf | |
| | 1000 kgf | 5.8 kgf | |
| | 1500 kgf | 7.4 kgf | |
| | 2000 kgf | 8.1 kgf | |
| | 2500 kgf | 9.5 kgf | |

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)^{Notes 1,2,11}

| Measured Parameter or Device Calibrated | Range | Expanded Uncertainty ^{Note 3} | Remarks | |
|---|----------|--|---------------|---------------|
| Field Calibration ^{Note 4} Vickers Hardness ASTM E92 ISO 6507, ASTM E384 | 3000 kgf | 10 kgf | Applied Force | |
| | 1 kgf | 0.006 kgf | | |
| | 2 kgf | 0.012 kgf | | |
| | 5 kgf | 0.030 kgf | | |
| | 10 kgf | 0.060 kgf | | |
| | 20 kgf | 0.12 kgf | | |
| | 30 kgf | 0.18 kgf | | |
| | 50 kgf | 0.30 kgf | | |
| Field Calibration ^{Note 4} Vickers Hardness ASTM E384, ISO 6507 | 10 gf | 1 gf | | Applied Force |
| | 25 gf | 1 gf | | |
| | 50 gf | 1 gf | | |
| | 100 gf | 1 gf | | |
| | 200 gf | 1 gf | | |
| | 300 gf | 2.1 gf | | |
| | 500 gf | 3.1 gf | | |
| | 1000 gf | 5.5 gf | | |
| Field Calibration ^{Note 4} Knoop Hardness ASTM E384, ISO 4545 | 10 gf | 1 gf | Applied Force | |
| | 25 gf | 1 gf | | |
| | 50 gf | 1 gf | | |
| | 100 gf | 1 gf | | |
| | 200 gf | 1 gf | | |
| | 300 gf | 2.1 gf | | |
| | 500 gf | 3.1 gf | | |
| | 1000 gf | 5.5 gf | | |
| Rockwell Hardness Testers - Direct Laboratory & Field Calibration ^{Note 4} ASTM E4 | 3 kgf | 10 gf | Applied Force | |
| | 10 kgf | 10 gf | | |
| | 15 kgf | 10 gf | | |
| | 30 kgf | 10 gf | | |
| | 45 kgf | 10 gf | | |

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| Measured Parameter or Device Calibrated | Range | Expanded Uncertainty ^{Note 3} | Remarks |
|---|------------------------------|--|--------------------------------------|
| | 60 kgf 100 kgf 150 kgf | 30 gf 30 gf 30 gf | |
| HARDNESS (20/M13) | | | |
| Calibration of Test Blocks Rockwell ASTM E18, ISO 6508 | | | See notes 7, 8, and 9 |
| HRA Scale | ≥ 86 | 0.17 | Uncertainty given in Rockwell points |
| | 80 to 85 | 0.17 | |
| | 70 to 79 | 0.29 | |
| HRB Scale | 60 to 69 | 0.28 | |
| | ≥ 80 | 0.37 | |
| | 51 to 79 | 0.24 | |
| HRC Scale | 1 to 50 | 0.33 | |
| | 60 to 70 | 0.31 | |
| | 40 to 59 | 0.32 | |
| HRD Scale | 20 to 39 | 0.37 | |
| | 70 to 80 | 0.17 | |
| | 50 to 69 | 0.26 | |
| HRE Scale | 40 to 49 | 0.24 | |
| | ≥ 89 | 0.48 | |
| | 75 to 88 | 0.48 | |
| HRF Scale | 65 to 87 | 0.36 | |
| | ≥ 87 | 0.44 | |
| | 70 to 86 | 0.45 | |
| HRG Scale | 40 to 69 | 0.25 | |
| | ≥ 80 | 0.23 | |
| | 40 to 79 | 0.17 | |
| HRH Scale | 1 to 39 | 0.76 | |
| | ≥ 90 | 0.35 | |
| | 80 to 89 | 0.41 | |
| HRK Scale | 60 to 79 | 0.71 | |
| | ≥ 70 | 0.34 | |
| | 30 to 69 | 0.47 | |
| | 10 to 29 | 0.54 | |

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| Measured Parameter or Device Calibrated | Range | Expanded Uncertainty^{Note 3} | Remarks |
|--|--------------|--|--|
| HRL Scale | ≥ 115 | 0.17 | See notes 7, 8, and 9 Uncertainty given in Rockwell points |
| | 90 to 114 | 0.24 | |
| HRM Scale | ≥ 100 | 0.41 | |
| | 70 to 99 | 0.52 | |
| HRP Scale | ≥ 85 | 0.34 | |
| | 40 to 84 | 0.50 | |
| HRR Scale | ≥ 120 | 0.22 | |
| | 100 to 119 | 0.33 | |
| HRS Scale | ≥ 112 | 0.17 | |
| | 110 to 111 | 0.78 | |
| HRV Scale | ≥ 104 | 0.25 | |
| | 80 to 103 | 0.21 | |
| HR15N Scale | 90 to 95 | 0.50 | |
| | 80 to 89 | 0.40 | |
| HR15T Scale | 40 to 79 | 0.39 | |
| | 88 to 100 | 0.29 | |
| HR15W Scale | 80 to 87 | 0.36 | |
| | 20 to 79 | 0.41 | |
| HR15X Scale | 89 to 100 | 0.42 | |
| | 80 to 88 | 0.24 | |
| HR15Y Scale | 88 to 100 | 0.17 | |
| | 80 to 87 | 0.54 | |
| HR30N Scale | 94 to 100 | 0.20 | |
| | 85 to 93 | 0.44 | |
| HR30T Scale | 77 to 85 | 0.52 | |
| | 60 to 76 | 0.45 | |
| HR30W Scale | 40 to 59 | 0.26 | |
| | 57 to 85 | 0.19 | |
| HR30X Scale | 50 to 56 | 0.62 | |
| | 20 to 49 | 0.55 | |
| HR30Y Scale | 65 to 100 | 0.31 | |
| | 40 to 64 | 0.81 | |
| | 79 to 100 | 0.17 | |
| | 60 to 78 | 0.95 | |
| | 88 to 100 | 0.31 | |
| | 60 to 87 | 0.20 | |

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| Measured Parameter or Device Calibrated | Range | Expanded Uncertainty^{Note 3} | Remarks | |
|---|--------------|--|-----------------------|---|
| HR45N Scale | 67 to 75 | 0.17 | See notes 7, 8, and 9 | |
| | 50 to 66 | 0.21 | | |
| | 10 to 49 | 0.47 | | |
| HR45T Scale | 50 to 75 | 0.37 | | |
| | 40 to 49 | 0.38 | | |
| | 1 to 39 | 0.68 | | |
| HR45W Scale | 49 to 100 | 0.28 | | |
| | 10 to 47 | 0.75 | | |
| HR45X Scale | 69 to 100 | 0.17 | | |
| | 40 to 68 | 0.74 | | |
| HR45Y Scale | 82 to 100 | 0.22 | | |
| | 60 to 81 | 0.62 | | |
| Field Service ^{Note 4} Indirect Verification of Hardness Testing Machines Rockwell ASTM E18, ISO 6508 | | | | See notes 7 and 8. Range and uncertainty given in Rockwell points |
| HR15N Scale | 90 to 95 | 0.50 | | |
| | 80 to 89 | 0.41 | | |
| | 40 to 79 | 0.40 | | |
| HR15T Scale | ≥ 88 | 0.42 | | |
| | 80 to 87 | 0.51 | | |
| | 20 to 79 | 0.60 | | |
| HR15W Scale | ≥ 89 | 0.61 | | |
| | 80 to 88 | .0.36 | | |
| HR15X Scale | ≥ 88 | 0.18 | | |
| | 80 to 87 | 0.55 | | |
| HR15Y Scale | ≥ 94 | 0.22 | | |
| | 85 to 93 | 0.45 | | |
| HR30N Scale | 77 to 85 | 0.53 | | |
| | 60 to 76 | 0.46 | | |
| | 40 to 59 | 0.28 | | |
| HRT30T Scale | ≥ 57 | 0.21 | | |
| | 50 to 56 | 0.63 | | |
| | 20 to 49 | 0.56 | | |

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| Measured Parameter or Device Calibrated | Range | Expanded Uncertainty^{Note 3} | Remarks |
|--|--------------|--|----------------|
| HR30W Scale | ≥ 65 | 0.33 | |
| | 40 to 64 | 0.82 | |
| HR30X Scale | ≥ 79 | 0.19 | |
| | 60 to 78 | 0.95 | |
| HR30Y Scale | ≥ 88 | 0.33 | |
| | 60 to 87 | 0.22 | |
| HR45N Scale | 67 to 75 | 0.19 | |
| | 50 to 66 | 0.23 | |
| | 10 to 49 | 0.48 | |
| HR45T Scale | ≥ 50 | 0.38 | |
| | 40 to 49 | 0.39 | |
| | 1 to 39 | 0.69 | |
| HR45W Scale | ≥ 48 | 0.30 | |
| | 10 to 47 | 0.76 | |
| HR45X Scale | ≥ 69 | 0.18 | |
| | 40 to 68 | 0.75 | |
| HR45Y Scale | ≥ 82 | 0.24 | |
| | 60 to 81 | 0.63 | |
| HRA Scale | ≥ 86 | 0.18 | |
| | 80 to 85 | 0.18 | |
| | 70 to 79 | 0.23 | |
| HRB Scale | 60 to 69 | 0.29 | |
| | ≥ 80 | 0.38 | |
| | 51 to 79 | 0.26 | |
| HRC Scale | 1 to 50 | 0.34 | |
| | 60 to 70 | 0.32 | |
| | 40 to 59 | 0.34 | |
| HRD Scale | 20 to 39 | 0.38 | |
| | 70 to 80 | 0.22 | |
| | 50 to 69 | 0.26 | |
| HRE Scale | 40 to 49 | 0.25 | |
| | ≥ 89 | 0.50 | |
| | 75 to 88 | 0.50 | |
| HRF Scale | 65 to 87 | 0.37 | |
| | ≥ 87 | 0.45 | |
| | 70 to 86 | 0.65 | |

John S. Laman

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| Measured Parameter or Device Calibrated | Range | Expanded Uncertainty ^{Note 3} | Remarks |
|---|-------------------------------|--|----------------------------|
| HRG Scale | 40 to 69 | 0.27 | |
| | ≥ 80 | 0.25 | |
| HRH Scale | 40 to 79 | 0.20 | |
| | 1 to 39 | 0.77 | |
| | ≥ 90 | 0.36 | |
| HRK Scale | 80 to 89 | 0.42 | |
| | 60 to 79 | 0.72 | |
| | ≥ 70 | 0.35 | |
| HRL Scale | 30 to 69 | 0.48 | |
| | 10 to 29 | 0.55 | |
| | ≥ 115 | 0.19 | |
| HRM Scale | 90 to 114 | 0.26 | |
| | ≥ 100 | 0.42 | |
| HRP Scale | 70 to 99 | 0.53 | |
| | ≥ 85 | 0.35 | |
| HRR Scale | 40 to 84 | 0.51 | |
| | ≥ 120 | 0.24 | |
| HRS Scale | 100 to 119 | 0.34 | |
| | ≥ 112 | 0.18 | |
| HRV Scale | 110 to 111 | 0.77 | |
| | ≥ 104 | 0.21 | |
| | 80 to 103 | 0.61 | |
| Rockwell Ball Indenters | Ball protrusion | 0.004 mm | ASTM E18 |
| | 1/16", 1/8", 1/4", 1/2" | | |
| | Hardness ball holder | 1.2 HV10 (Vickers) | Conversion to HRC 25 range |
| | Performance 1/16" ball holder | 0.25 HRBW | ASTM E18 |
| | Performance 1/8" ball holder | 0.30 HREW | ASTM E18 |
| | Performance 1/4" ball holder | 0.31 HRLW | ASTM E18 |
| Performance 1/2" ball holder | 0.20 HRRW | ASTM E18 | |

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| Measured Parameter or Device Calibrated | Range | Expanded Uncertainty^{Note 3} | Remarks |
|--|--------------|--|------------------------|
| Calibrate Reference Test Blocks | | | See notes 7, 8, and 10 |
| Brinell ASTM E10, ISO 6506 | | | |
| Brinell Scale | | | |
| HBW 1/1 | 45 to 200 | 0.54 HBW | Range in Brinell units |
| HBW 1/1.25 | 200 to 400 | 9.5 HBW | |
| HBW 1/2.5 | 8.0 to 54.5 | 0.1 HBW | |
| HBW 1/5 | 15.9 to 109 | 0.1 HBW | |
| HBW 1/10 | 31.8 to 218 | 0.2 HBW | |
| HBW 1/30 | 45 to 200 | 0.3 HBW | |
| HBW 1/30 | 200 to 400 | 2.2 HBW | |
| HBW 1/30 | 400 to 650 | 6.0 HBW | |
| HBW 2.5/6.25 | 3.2 to 21.8 | 0.1 HBW | |
| HBW 2.5/7.8 | 4.0 to 27.2 | 0.1 HBW | |
| HBW 2.5/15.625 | 8.0 to 54.5 | 0.1 HBW | |
| HBW 2.5/31.25 | 15.9 to 109 | 0.1 HBW | |
| HBW 2.5/62.5 | 31.8 to 218 | 0.2 HBW | |
| HBW 2.5/187.5 | 45 to 200 | 0.3 HBW | |
| HBW 2.5/187.5 | 200 to 400 | 1.3 HBW | |
| HBW 2.5/187.5 | 400 to 700 | 2.9 HBW | |
| HBW 5/25 | 3/2 to 21.8 | 0.1 HBW | |
| HBW 5/31.25 | 4.0 to 27.2 | 0.1 HBW | |
| HBW 5/62.5 | 7.96 to 54.5 | 0.1 HBW | |
| HBW 5/125 | 15.9 to 109 | 0.1 HBW | |
| HBW 5/250 | 31.8 to 218 | 0.2 HBW | |
| HBW 5/750 | 45 to 200 | 0.30 HBW | |
| HBW 5/750 | 200 to 400 | 1.8 HBW | |
| HBW 5/750 | 400 to 600 | 4.6 HBW | |
| HBW 10/100 | 3.2 to 21.8 | 0.1 HBW | |
| HBW 10/125 | 4.0 to 27.2 | 0.1 HBW | |
| HBW 10/250 | 8.0 to 54.5 | 0.1 HBW | |
| HBW 10/500 | 100 to 150 | 0.30 HBW | |
| HBW 10/1000 | 45 to 200 | 0.40 HBW | |
| HBW 10/1000 | 200 to 400 | 1.4 HBW | |
| HBW 10/1500 | 45 to 200 | 0.3 HBW | |
| HBW 10/1500 | 200 to 400 | 1.5 HBW | |
| HBW 10/1500 | 400 to 700 | 3.5 HBW | |

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|--|--------------|--|--|
| HBW 10/2000 | 45 to 200 | 0.3 HBW | See notes 7, 8, and 10 Range in Vickers units |
| HBW 10/2000 | 200 to 400 | 1.4 HBW | |
| HBW 10/2000 | 400 to 700 | 3.2 HBW | |
| HBW 10/2500 | 45 to 200 | 0.3 HBW | |
| HBW 10/2500 | 200 to 400 | 1.3 HBW | |
| HBW 10/2500 | 400 to 700 | 3.0 HBW | |
| HBW 10/3000 | 45 to 200 | 0.3 HBW | |
| HBW 10/3000 | 200 to 400 | 1.3 HBW | |
| HBW 10/3000 | 400 to 700 | 2.9 HBW | |
| Vickers: ASTM E92, ASTM E384 | | | |
| HV 1 | 200 to 400 | 1.5 HV | |
| HV 1 | 400 to 700 | 3.6 HV | |
| HV 1 | 700 to 2 300 | 7.7 HV | |
| HV 1.5 | 25 to 200 | 0.1 HV | |
| HV 1.5 | 200 to 400 | 1.4 HV | |
| HV 1.5 | 400 to 700 | 3.2 HV | |
| HV 1.5 | 700 to 2 300 | 6.7 HV | |
| HV 2 | 25 to 200 | 0.1 HV | |
| HV 2 | 200 to 400 | 1.3 HV | |
| HV 2 | 400 to 700 | 3.0 HV | |
| HV 2 | 700 to 2 300 | 6.1 HV | |
| HV 2.5 | 25 to 200 | 0.1 HV | |
| HV 2.5 | 200 to 400 | 1.3 HV | |
| HV 2.5 | 400 to 700 | 2.9 HV | |
| HV 2.5 | 700 to 2300 | 5.7 HV | |
| HV 3 | 25 to 200 | 0.1 HV | |
| HV 3 | 200 to 400 | 1.3 HV | |
| HV 3 | 400 to 700 | 2.8 HV | |
| HV 3 | 700 to 2300 | 5.5 HV | |
| HV 5 | 25 to 200 | 0.1 HV | |
| HV 5 | 200 to 400 | 1.2 HV | |
| HV 5 | 400 to 700 | 2.6 HV | |
| HV 5 | 700 to 2300 | 5.0 HV | |
| HV 10 | 25 to 200 | 0.1 HV | |

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| Measured Parameter or Device Calibrated | Range | Expanded Uncertainty^{Note 3} | Remarks |
|--|--------------|--|------------------------|
| HV 10 | 200 to 400 | 1.2 HV | |
| HV 10 | 400 to 700 | 2.5 HV | |
| HV 10 | 700 to 2300 | 4.5 HV | |
| HV 20 | 25 to 200 | 0.1 HV | |
| HV 20 | 200 to 400 | 1.2 HV | |
| HV 20 | 400 to 700 | 2.4 HV | |
| HV 20 | 700 to 2300 | 4.3 HV | |
| HV 30 | 25 to 200 | 0.1 HV | |
| HV 30 | 200 to 400 | 1.2 HV | |
| HV 30 | 400 to 700 | 2.3 HV | |
| HV 30 | 700 to 2300 | 4.2 HV | |
| HV 50 | 25 to 200 | 0.1 HV | |
| HV 50 | 200 to 400 | 1.2 HV | |
| HV 50 | 400 to 700 | 2.3 HV | |
| HV 50 | 700 to 2300 | 4.0 HV | |
| HV 100 | 25 to 200 | 0.1 HV | |
| HV 100 | 200 to 400 | 1.1 HV | |
| HV 100 | 400 to 700 | 2.3 HV | |
| HV 100 | 700 to 2300 | 4.0 HV | |
| Calibrate Reference Test Blocks Vickers: ASTM E384, ISO 6507 Vickers Scale | | | See notes 7, 8, and 10 |
| HV 0.01 | 25 to 200 | 0.5 HV | Range in Vickers units |
| HV 0.01 | 200 to 400 | 10 HV | |
| HV 0.01 | 400 to 700 | 28 HV | |
| HV 0.01 | 700 to 2300 | 64 HV | |
| HV 0.025 | 25 to 200 | 0.3 HV | |
| HV 0.025 | 200 to 400 | 6.4 HV | |
| HV 0.025 | 400 to 700 | 18 HV | |
| HV 0.025 | 700 to 2300 | 41 HV | |
| HV 0.05 | 25 to 200 | 0.2 HV | |
| HV 0.05 | 200 to 400 | 4.6 HV | |
| HV 0.05 | 400 to 700 | 13 HV | |
| HV 0.05 | 700 to 2300 | 29 HV | |
| HV 0.1 | 25 to 200 | 0.2 HV | |

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)^{Notes 1,2,11}

| Measured Parameter or Device Calibrated | Range | Expanded Uncertainty^{Note 3} | Remarks |
|--|--------------|--|------------------------|
| HV 0.1 | 200 to 400 | 3.3 HV | |
| HV 0.1 | 400 to 700 | 9.2 HV | |
| HV 0.1 | 700 to 2300 | 21 HV | |
| HV 0.2 | 25 to 200 | 0.2 HV | |
| HV 0.2 | 200 to 400 | 2.5 HV | |
| HV 0.2 | 400 to 700 | 6.7 HV | |
| HV 0.2 | 700 to 2300 | 15 HV | |
| HV 0.3 | 25 to 200 | 0.2 HV | |
| HV 0.3 | 200 to 400 | 2.2 HV | |
| HV 0.3 | 400 to 700 | 5.6 HV | |
| HV 0.3 | 700 to 2300 | 13 HV | |
| HV 0.4 | 25 to 200 | 0.2 HV | |
| HV 0.4 | 200 to 400 | 1.9 HV | |
| HV 0.4 | 400 to 700 | 5.0 HV | |
| HV 0.4 | 700 to 2300 | 11 HV | |
| HV 0.5 | 25 to 200 | 0.2 HV | |
| HV 0.5 | 200 to 400 | 1.8 HV | |
| HV 0.5 | 400 to 700 | 4.6 HV | |
| HV 0.5 | 700 to 2300 | 10 HV | |
| HV 1 | 25 to 200 | 0.2 HV | |
| HV 1 | 200 to 400 | 1.5 HV | |
| HV 1 | 400 to 700 | 3.6 HV | |
| HV 1 | 700 to 2300 | 7.7 HV | |
| Calibrate Reference Test Blocks and Indenters Knoop: ASTM E384, ISO 4545 Knoop Scale | | | See notes 7, 8, and 10 |
| HK 0.01 | 25 to 200 | 0.5 HK | Range in Knoop units |
| HK 0.01 | 200 to 400 | 4.9 HK | |
| HK 0.01 | 400 to 700 | 12 HK | |
| HK 0.01 | 700 to 2300 | 24 HK | |
| HK 0.025 | 25 to 200 | 0.5 HK | |
| HK 0.025 | 200 to 400 | 4.2 HK | |
| HK 0.025 | 400 to 700 | 9.4 HK | |
| HK 0.025 | 700 to 2300 | 18 HK | |

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| Measured Parameter or Device Calibrated | Range | Expanded Uncertainty^{Note 3} | Remarks |
|---|--------------|--|------------------------|
| HK 0.05 | 25 to 200 | 0.5 HK | |
| HK 0.05 | 200 to 400 | 3.9 HK | |
| HK 0.05 | 400 to 700 | 8.5 HK | |
| HK 0.05 | 700 to 2300 | 16 HK | |
| HK 0.1 | 25 to 200 | 0.5 HK | |
| HK 0.1 | 200 to 400 | 3.8 HK | |
| HK 0.1 | 400 to 700 | 8.0 HK | |
| HK 0.1 | 700 to 2300 | 15 HK | |
| HK 0.2 | 25 to 200 | 0.5 HK | |
| HK 0.2 | 200 to 400 | 3.8 HK | |
| HK 0.2 | 400 to 700 | 7.7 HK | |
| HK 0.2 | 700 to 2300 | 14 HK | |
| HK 0.3 | 25 to 200 | 0.5 HK | |
| HK 0.3 | 200 to 400 | 3.7 HK | |
| HK 0.3 | 400 to 700 | 7.6 HK | |
| HK 0.3 | 700 to 2300 | 13 HK | |
| HK 0.5 | 25 to 200 | 0.5 HK | |
| HK 0.5 | 200 to 400 | 3.7 HK | |
| HK 0.5 | 400 to 700 | 7.6 HK | |
| HK 0.5 | 700 to 2300 | 13 HK | |
| HK 1 | 25 to 200 | 0.5 HK | |
| HK 1 | 200 to 400 | 3.7 HK | |
| HK 1 | 400 to 700 | 7.5 HK | |
| HK 1 | 700 to 2300 | 13 HK | |
| Indirect Field Service ^{Note 4} And Laboratory Calibration Brinell Hardness Testers ASTM E10, ISO 6506 Brinell Scale | | | See notes 7 and 8. |
| HBW 1/62.5 | 200 to 400 | 2 HBW | Range in Brinell units |
| 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 | |

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| Measured Parameter or Device Calibrated | Range | Expanded Uncertainty^{Note 3} | Remarks |
|---|--------------|--|--|
| HBW 5/1000 | 200 to 400 | 2 HBW | See notes 7 and 8. Range in Vickers units |
| HBW 5/1000 | 400 to 600 | 4 HBW | |
| HBW 10/1000 | 200 to 400 | 2 HBW | |
| HBW 10/1000 | 400 to 600 | 4 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 | |
| HBW 10/2500 | 400 to 600 | 4 HBW | |
| HBW 10/3000 | 200 to 400 | 2 HBW | |
| HBW 10/3000 | 400 to 600 | 4 HBW | |
| Indirect Field Service ^{Note 4} And Laboratory Calibration Vickers Hardness Testers ASTM E92, ISO 6507, ASTM E384 Vickers Scale | | | |
| HV 1 | 200 | 8.7 HV | |
| HV 1 | 400 | 21 HV | |
| HV 1 | 700 | 44 HV | |
| HV 2 | 200 | 6.9 HV | |
| HV 2 | 400 | 16 HV | |
| HV 2 | 700 | 31 HV | |
| HV 5 | 200 | 3.9 HV | |
| HV 5 | 400 | 11 HV | |
| HV 5 | 700 | 20 HV | |
| HV 10 | 200 | 3.1 HV | |
| HV 10 | 400 | 7.7 HV | |
| HV 10 | 700 | 15 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 | |

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)^{Notes 1,2,11}

| Measured Parameter or Device Calibrated | Range | Expanded Uncertainty^{Note 3} | Remarks |
|--|--------------|--|------------------------|
| HV 30 | 700 | 9.3 HV | |
| HV 50 | 200 | 1.9 HV | |
| HV 50 | 400 | 3.5 HV | |
| HV 50 | 700 | 6.3 HV | |
| Indirect Field Service ^{Note 4} And Laboratory Calibration Vickers Hardness Testers ASTM E384, ISO 6507 Vickers Scale | | | See notes 7 and 8. |
| HV 0.01 | 200 | 10 HV | Range in Vickers units |
| 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 | |

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| Measured Parameter or Device Calibrated | Range | Expanded Uncertainty^{Note 3} | Remarks |
|--|--------------|--|----------------------------------|
| Indirect Field Service ^{Note 4} And Laboratory Calibration Knoop Hardness Testers ASTM E384, ISO 4545 Knoop Scale | | | See notes 7 and 8. |
| HK 0.01 | 200 | 7 HK | Range in Knoop units |
| 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 | |
| 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 | |
| Calibration of Durometer Blocks ASTM D2240 Hardness scale | | | |
| Shore A | 0 to 100 | 0.8 | Uncertainty given in Shore units |
| Shore D | 0 to 100 | 0.8 | |

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| Measured Parameter or Device Calibrated | Range | Expanded Uncertainty^{Note 3} | Remarks |
|---|-----------------------------|--|---|
| Calibration of Durometers ASTM D2240 Spring Force Shore A Shore D | 0 N to 8.9 N 0 N to 44 N | 0.0002 N 0.006 N | Tip shape verified for condition only. Indenter extension verified by use of gage blocks. |
| Indenter Extension | 0 mm to 6.35 mm | 0.005 mm | |
| Calibration of Leeb's Testers ASTM A956 | 400 LD to 900 LD | 8.5 LD | |
| Calibration of Leeb's Blocks ASTM A956 | 400 LD to 900 LD | 9.3 LD | |
| 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.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: Uncertainty 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.

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Note 7: 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. These 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.

Note 8: 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.

Note 9: The best uncertainty is shown at the highest part of the range and increases as Rockwell value decreases. The uncertainty of the lowest value in the range is equal to the uncertainty listed in the next lower range. Best uncertainty remains the same for all values higher than the ranges shown in each scale.

Note 10: The best uncertainty is shown for the lowest value in the range. The uncertainty increases in a non-linear manner to a value which equals the uncertainty of the next range. The highest value of uncertainty for the upper value is 2 to 3 times higher than value shown depending on type. Please contact the lab for a better estimation of uncertainty for these higher values.

Note 11: Calibrations for Rockwell hardness are performed at either David L. Ellis's Acton facility or their Maynard facility. Other calibrations are performed at Maynard only. Location of specific calibration will be noted on calibration certificate.

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