

CALIBRATION LABORATORIES

NVLAP LAB CODE 200127-0

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty ^{Note 3}	Remarks
MECHANICAL			
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	

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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	
	40 to 69	0.25	

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty ^{Note 3}	Remarks
HRG Scale	≥ 80	0.23	
	40 to 79	0.17	
HRH Scale	1 to 39	0.76	
	≥ 90	0.35	
HRK Scale	80 to 89	0.41	
	60 to 79	0.71	
HRL Scale	≥ 70	0.34	
	30 to 69	0.47	
HRM Scale	10 to 29	0.54	
	≥ 115	0.17	
	90 to 114	0.24	
	≥ 100	0.41	
	70 to 99	0.52	

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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	
	40 to 79	0.39	
HR15T Scale	88 to 100	0.29	
	80 to 87	0.36	
	20 to 79	0.41	
HR15W Scale	89 to 100	0.42	
	80 to 88	0.24	
HR15X Scale	88 to 100	0.17	
	80 to 87	0.54	
HR15Y Scale	94 to 100	0.20	
	85 to 93	0.44	
HR30N Scale	77 to 85	0.52	
	60 to 76	0.45	
	40 to 59	0.26	

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty ^{Note 3}	Remarks
HR30T Scale	57 to 85	0.19	
	50 to 56	0.62	
	20 to 49	0.55	
HR30W Scale	65 to 100	0.31	
	40 to 64	0.81	
HR30X Scale	79 to 100	0.17	

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	60 to 78	0.95	
HR30Y Scale	88 to 100	0.31	
	60 to 87	0.20	
HR45N Scale	67 to 75	0.17	
	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.
HR15N Scale	90 to 95	0.50	Range and uncertainty given in Rockwell points
	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	.036	
HR15X Scale	≥ 88	0.18	
	80 to 87	0.55	

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Measured Parameter or Device Calibrated	Range	Expanded Uncertainty ^{Note 3}	Remarks
HR15Y Scale	≥ 94	0.22	
	85 to 93	0.45	
HR30N Scale	77 to 85	0.53	
	60 to 76	0.46	
HRT30T Scale	40 to 59	0.28	
	≥ 57	0.21	
	50 to 56	0.63	
	20 to 49	0.56	
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	
HR45T Scale	10 to 49	0.48	
	≥ 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	
	60 to 69	0.29	
HRB Scale	≥ 80	0.38	

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	51 to 79	0.26	
	1 to 50	0.34	

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Measured Parameter or Device Calibrated	Range	Expanded Uncertainty ^{Note 3}	Remarks
HRC Scale	60 to 70	0.32	
	40 to 59	0.34	
	20 to 39	0.38	
HRD Scale	70 to 80	0.22	
	50 to 69	0.26	
	40 to 49	0.25	
HRE Scale	≥ 89	0.50	
	75 to 88	0.50	
	65 to 87	0.37	
HRF Scale	≥ 87	0.45	
	70 to 86	0.65	
	40 to 69	0.27	
HRG Scale	≥ 80	0.25	
	40 to 79	0.20	
	1 to 39	0.77	
HRH Scale	≥ 90	0.36	
	80 to 89	0.42	
	60 to 79	0.72	
HRK Scale	≥ 70	0.35	
	30 to 69	0.48	
	10 to 29	0.55	
HRL Scale	≥ 115	0.19	
	90 to 114	0.26	
HRM Scale	≥ 100	0.42	

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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	

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty <small>Note 3</small>	Remarks
Rockwell Ball Indenters	Ball protrusion 1/16", 1/8", 1/4", 1/2"	0.004 mm	ASTM E18 Conversion to HRC 25 range
	Hardness ball holder Performance 1/16" ball holder	1.2 HV10 (Vickers) 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
Calibrate Reference Test Blocks Brinell ASTM E10, ISO 6506 Brinell Scale			See notes 7, 8, and 10
HBW 1/1	> 0 to 45	0.54 HBW	Range in Brinell units
HBW 1/1	45 to 200	0.54 HBW	

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HBW 1/1.25	> 0 to 200	9.5 HBW	
HBW 1/1.25	200 to 400	9.5 HBW	
HBW 1/2.5	> 0 to 8.0	0.1 HBW	
HBW 1/2.5	8.0 to 54.5	0.1 HBW	
HBW 1/5	> 0 to 15.9	0.1 HBW	
HBW 1/5	15.9 to 109	0.1 HBW	
HBW 1/10	> 0 to 31.8	0.2 HBW	
HBW 1/10	31.8 to 218	0.2 HBW	
HBW 1/30	> 0 to 45	0.3 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 1/62.5	> 0 to 200	0.3 HBW	
HBW 1/62.5	200 to 400	2.2 HBW	
HBW 1/62.5	400 to 600	6.0 HBW	
HBW 2.5/6.25	> 0 to 3.2	0.1 HBW	
HBW 2.5/6.25	3.2 to 21.8	0.1 HBW	

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Measured Parameter or Device Calibrated	Range	Expanded Uncertainty ^{Note 3}	Remarks
HBW 2.5/7.8	> 0 to 4.0	0.1 HBW	
HBW 2.5/7.8	4.0 to 27.2	0.1 HBW	
HBW 2.5/15.625	>0 to 8.0	0.1 HBW	
HBW 2.5/15.625	8.0 to 54.5	0.1 HBW	
HBW 2.5/31.25	> 0 to 15.9	0.1 HBW	
HBW 2.5/31.25	15.9 to 109	0.1 HBW	
HBW 2.5/62.5	> 0 to 31.8	0.2 HBW	
HBW 2.5/62.5	31.8 to 218	0.2 HBW	
HBW 2.5/187.5	> 0 to 45	0.3 HBW	
HBW 2.5/187.5	45 to 200	0.3 HBW	
HBW 2.5/187.5	200 to 400	1.3 HBW	

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HBW 2.5/187.5	400 to 700	2.9 HBW	
HBW 5/25	> 0 to 3/2	0.1 HBW	
HBW 5/25	3/2 to 21.8	0.1 HBW	
HBW 5/31.25	> 0 to 4.0	0.1 HBW	
HBW 5/31.25	4.0 to 27.2	0.1 HBW	
HBW 5/62.5	> 0 to 7.96	0.1 HBW	
HBW 5/62.5	7.96 to 54.5	0.1 HBW	
HBW 5/125	> 0 to 15.9	0.1 HBW	
HBW 5/125	15.9 to 109	0.1 HBW	
HBW 5/250	> 0 to 31.8	0.2 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	> 0 to 3.2	0.1 HBW 0.1	
HBW 10/100	3.2 to 21.8	HBW	
HBW 10/250	> 0 to 8.0	0.1 HBW	
HBW 10/250	8.0 to 54.5	0.1 HBW	
HBW 10/500	> 0 to 100	0.30 HBW	
HBW 10/500	100 to 150	0.30 HBW	
HBW 10/1000	> 0 to 45	0.40 HBW	
HBW 10/1000	45 to 200	0.40 HBW	
HBW 10/1000	200 to 400	1.4 HBW	
HBW 10/1500	> 0 to 45	0.3 HBW	

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty ^{Note 3}	Remarks
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	
HBW 10/2000	> 0 to 45	0.3 HBW	

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HBW 10/2000	45 to 200	0.3 HBW	
HBW 10/2000	200 to 400	1.4 HBW	
HBW 10/2000	400 to 700	3.2 HBW	
HBW 10/2500	> 0 to 45	0.3 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	> 0 to 45	0.3 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			See notes 7, 8, and 10
HV 1	25 to 200	0.2 HV	Range in Vickers units
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	

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Measured Parameter or Device Calibrated	Range	Expanded Uncertainty ^{Note 3}	Remarks
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	
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			See notes 7, 8, and 10

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Vickers Scale 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	

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty ^{Note 3}	Remarks
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	
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	

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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	

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty <small>Note 3</small>	Remarks
Calibrate Reference Test Blocks and Indenters Knoop: ASTM E384, ISO 4545			See notes 7, 8, and 10
Knoop Scale			Range in Knoop units
HK 0.01	25 to 200	0.5 HK	
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	
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	

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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	

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty ^{Note 3}	Remarks
Direct Verification Brinell Hardness Laboratory Capability ASTM E10, ISO 6506	0 mm to 7 mm	0.0038 mm	Indentation Measurement System
Direct Verification 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	

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Direct Verification 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	Indentation Measurement System
Direct Verification Field Calibration ^{Note 4} Brinell Hardness ASTM E10, ISO 6506	0 mm to 7 mm	0.028 mm	
Direct Verification Field Calibration ^{Note 4} Vickers Hardness ASTM E92, ISO 6507, ASTM E384	0 mm to 0.500 mm	0.0014 mm	
Direct Verification Field Calibration ^{Note 4} Vickers Hardness ASTM E384, ISO 6507	0 mm to 0.200 mm	0.001 mm	
Direct Verification Field Calibration ^{Note 4} Knoop Hardness ASTM E384, ISO 4545	0 mm to 0.200 mm	0.001 mm	

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty ^{Note 3}	Remarks
Direct Verification Rockwell Hardness Laboratory and Field Calibrations ^{Note 4}			Direct verification of depth is valid only for United Tru-Blue II testers with a Heidenhain Metro

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ASME E18, ISO 6508	0 mm to 3 mm	0.0003 mm	Gage, over temperature
Direct Verification Brinell Hardness Laboratory Capability ASTM E10, ISO 6506	1 kgf 1.25 kgf 2.5 kgf 5 kgf 6.25 kgf 7.81 kgf 10 kgf 15.62 kgf 25 kgf 30 kgf 31.25 kgf 62.5 kgf 100 kgf 125 kgf 187.5 kgf 250 kgf 500 kgf 750 kgf 1000 kgf 1500 kgf 2000 kgf 2500 kgf 3000 kgf	0.01 kgf 0.01 kgf 0.01 kgf 0.02 kgf 0.02 kgf 0.02 kgf 0.03 kgf 0.04 kgf 0.06 kgf 0.08 kgf 0.16 kgf 0.32 kgf 0.25 kgf 0.31 kgf 0.95 kgf 1.3 kgf 2.6 kgf 0.63 kgf 3.6 kgf 5.8 kgf 6.7 kgf 7.8 kgf 9.3 kgf	Applied Force

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Direct Verification Vickers Hardness Laboratory Capability ASTM E92, ISO 6507, ASTM E384	1 kgf 1.5 kgf 2 kgf 2.5 kgf 3 kgf 5 kgf 10 kgf 20 kgf 30 kgf 50 kgf 100 kgf	0.003 kgf 0.006 kgf 0.006 kgf 0.007 kgf 0.012 kgf 0.02 kgf 0.05 kgf 0.088 kgf 0.13 kgf 0.21 kgf 0.44 kgf	Applied Force
Direct Verification Vickers Hardness Laboratory Capability ASTM E384, ISO 6507	10 gf 25 gf 50 gf 100 gf 200 gf 300 gf 400 gf 500 gf 1000 gf 2000 gf 3000 gf	1 gf 1 gf 1 gf 1 gf 1 gf 2.1 gf 2.1 gf 3.1 gf 5.5 gf 11 gf 16 gf	Applied Force
Direct Verification Knoop Hardness Laboratory Capability ASTM E384, ISO 4545	10 gf 25 gf 50 gf	1 gf 1 gf 1 gf	Applied Force

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	100 gf	1 gf	
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Measured Parameter or Device Calibrated	Range	Expanded Uncertainty ^{Note 3}	Remarks
Direct Verification Field Calibration ^{Note 4} Brinell Hardness ASTM E10, ISO 6506	200 gf	1 gf	Applied Force
	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	
Direct Verification Field Calibration ^{Note 4} Vickers Hardness ASTM E92 ISO 6507, ASTM E384	62.5 kgf	0.6 kgf	
	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	
	3000 kgf	10 kgf	
	1 kgf	0.006 kgf	Applied Force
	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		

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Field Calibration ^{Note 4} Vickers Hardness ASTM E384, ISO 6507	10 gf 25 gf 50 gf	1 gf 1 gf 1 gf	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
Field Calibration ^{Note 4} Knoop Hardness ASTM E384, ISO 4545	100 gf	1 gf	Applied Force
	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	10 gf	1 gf	
	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	
	3 kgf	10 gf	Applied Force
	10 kgf	10 gf	
15 kgf	10 gf		
30 kgf	10 gf		
45 kgf	10 gf		
60 kgf	30 gf		
100 kgf	30 gf		

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Indirect Field Service ^{Note 4} And Laboratory Calibration Brinell Hardness Testers ASTM E10, ISO 6506 Brinell Scale HBW 1/1 HBW 1/1 HBW 1/1.25	150 kgf > 0 to 45 45 to 200 > 0 to 200	30 gf 2 HBW 4 HBW 2 HBW	See notes 7 and 8. Range in Brinell units
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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) ^{Notes 1,2,11}

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty ^{Note 3}	Remarks
HBW 1/1.25	200 to 400	4 HBW	
HBW 1/2.5	> 0 to 8.0	2 HBW	
HBW 1/2.5	8 to 54.5	4 HBW	
HBW 1/5	> 0 to 15.9	2 HBW	
HBW 1/5	15.9 to 109	4 HBW	
HBW 1/10	> 0 to 31.8	2 HBW	
HBW 1/10	31.8 to 218	4 HBW	
HBW 1/30	> 0 to 45	2 HBW	
HBW 1/30	45 to 200	4 HBW	
HBW 1/30	200 to 400	2 HBW	
HBW 1/30	400 to 650	4 HBW	
HBW 1/62.5	200 to 400	2 HBW	
HBW 1/62.5	400 to 600	4 HBW	
HBW 2.5/6.25	> 0 to 3.2	2 HBW	
HBW 2.5/6.25	3.2 to 21.8	4 HBW	
HBW 2.5/7.8	> 0 to 4.0	2 HBW	
HBW 2.5/7.8	4.0 to 27.2	4 HBW	
HBW 2.5/15.625	> 0 to 8.0	2 HBW	
HBW 2.5/15.625	8.0 to 54.5	4 HBW	

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HBW 2.5/31.25	> 0 to 15.9	2 HBW	
HBW 2.5/31.25	15.9 to 109	4 HBW	
HBW 2.5/62.5	> 0 to 31.8	2 HBW	
HBW 2.5/62.5	31.8 to 218	4 HBW	
HBW 2.5/187.5	> 0 to 200	2 HBW	
HBW 2.5/187.5	200 to 400	2 HBW	
HBW 2.5/187.5	400 to 600	4 HBW	
HBW 5/25	> 0 to 3/2	2 HBW	
HBW 5/25	3/2 to 21.8	4 HBW	
HBW 5/31.25	> 0 to 4.0	2 HBW	
HBW 5/31.25	4.0 to 27.2	4 HBW	
HBW 5/62.5	> 0 to 8.0	2 HBW	
HBW 5/62.5	8.0 to 54.5	4 HBW	
HBW 5/125	> 0 to 15.9	2 HBW	
HBW 5/125	15.9 to 109	4 HBW	
HBW 5/250	> 0 to 31.8	2 HBW	

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty ^{Note 3}	Remarks
HBW 5/250	31.8 to 218	4 HBW	
HBW 5/750	> 0 to 45	2 HBW	
HBW 5/750	45 to 200	2 HBW	
HBW 5/750	200 to 400	4 HBW	
HBW 5/750	400 to 600	4 HBW	
HBW 10/100	> 0 to 3/2	2 HBW	
HBW 10/100	3/2 to 21.8	4 HBW	
HBW 10/125	> 0 to 4.0	2 HBW	
HBW 10/125	4.0 to 27.2	4HBW	
HBW 10/250	> 0 to 8.0	2 HBW	
HBW 10/250	8.0 to 54.5	4HBW	
HBW 10/500	> 0 to 20	2 HBW	

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HBW 10/500	20 to 100	2 HBW	
HBW 10/500	100 to 150	4HBW	
HBW 5/1000	> 0 to 200	2 HBW	
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	4 HBW	
HBW 10/1500	> 0 to 200	2 HBW	
HBW 10/1500	200 to 400	2 HBW	
HBW 10/1500	400 to 600	4 HBW	
HBW 10/2000	> 0 to 200	2 HBW	
HBW 10/2000	200 to 400	2 HBW	
HBW 10/2000	400 to 600	4 HBW	
HBW 10/2500	> 0 to 200	2 HBW	
HBW 10/2500	200 to 400	2 HBW	
HBW 10/2500	400 to 600	4 HBW	
HBW 10/3000	> 0 to 200	2 HBW	
HBW 10/3000	200 to 400	2 HBW	
HBW 10/3000	400 to 600	4 HBW	

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty ^{Note 3}	Remarks
Indirect Field Service ^{Note 4} And Laboratory Calibration Vickers Hardness Testers ASTM E92, ISO 6507, ASTM E384			See notes 7 and 8.

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Vickers Scale HV			
1	200	8.7 HV	Range in Vickers units
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	
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 HV			See notes 7 and 8.
0.01	200	10 HV	Range in Vickers units
HV 0.01	400	30 HV	
HV 0.01	700	40 HV	

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty ^{Note 3}	Remarks
HV 0.025	200	9 HV	

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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	
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	

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty ^{Note 3}	Remarks
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	
Calibration of Durometers			
ASTM D2240			
Spring Force Shore			
A	0 N to 8.9 N	0.0002 N	.
Shore D	0 N to 44 N	0.006 N	
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	Tip shape verified for condition only. Indenter extension verified by use

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Calibration of Leeb's Blocks ASTM A956	400 LD to 900 LD	9.3 LD	of gage blocks
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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC)^{Notes 1,2,11}

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty ^{Note 3}	Remarks
TIME & FREQUENCY			
STOPWATCHES AND TIMERS (20/F05)			
Direct Verification Brinell Hardness Laboratory and Field Calibration ^{Note 4} Capability ASTM E10, ISO 6506 Verification of Test Cycle	(0 to 60) s	0.22 s	per ASTM E10 Table A2.2 Digital Stopwatch
Direct Verification Rockwell Hardness Laboratory and Field Calibration ^{Note 4} Capability ASTM E18, ISO 6508 Verification of Test Cycle	(0 to 60) s	0.22 s	Digital Stopwatch
Direct Verification Vickers Hardness Laboratory and Field Calibration ^{Note 4} Capability ASTM E384, E92, ISO 6507 Verification of Test Cycle	(0 to 60) s	0.22 s	Digital Stopwatch

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Direct Verification Knoop Hardness Laboratory and Field Calibration ^{Note 4} Capability ASTM E384, E92, ISO 4545 Verification of Test Cycle	(0 to 60) s	0.22 s	Digital Stopwatch
END			

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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: 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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