



**SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005
& ANSI/NCSL Z540-1-1994**

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Certificate Number: ACT-1116

CALIBRATION and TESTING

I. Electromagnetic - DC/Low Frequency Calibration

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY (±)]	REFERENCE STANDARD OR EQUIPMENT	METHODS
DC Voltage - Source	Up to 330 mV 330 mV to 3.3 V (3.3 to 33) V (33 to 330) V 330 V to 1.02 kV	20 µV/V + 1 µV 11 µV/V + 2 µV 12 µV/V + 20 µV 18 µV/V + 150 µV 18 µV/V + 1.5 mV	Fluke 5520A	OEM & GIDEP Sourced Procedures
DC Voltage - Measure	Up to 200 mV 200 mV to 2 V (2 to 20) V (20 to 200) V 200 V to 1 kV	1.74 µV 7.35 µV 51.5 µV 705 µV 4.9 mV	Keithley 2002	
DC Current - Source	Up to 330 µA 330 µA to 3.3 mA (3.3 to 33) mA (33 to 330) mA 330 mA to 1.1 A (1.1 to 11) A (11 to 20.5) A	150 µA /A + 20 nA 100 µA /A + 5 nA 100 µA /A + 250 nA 100 µA /A + 2.5 µA 200 µA /A + 40 µA 500 µA /A + 500 µA 1 mA/A + 750 µA	Fluke 5520A	
Clamp-On Ammeters	(20.5 to 205) A (205 to 1 025) A	494 mA 2.46 A	10 Turn Coil 50 Turn Coil	



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DC Current - Measure	Up to 200 μ A 200 μ A to 2 mA (2 to 20) mA (20 to 200) mA 200 mA to 2 A (2 to 10) A (10 to 400) (400 to 2 000) A	500 μ A/A + 25 nA 500 μ A/A + 20 nA 500 μ A/A + 20 nA 525 μ A/A + 20 μ A 1 mA/A + 20 μ A 1.5 mA/A + 80 μ A 3.574 A 7.6 A	Keithley 2002 Fluke 8846A AC/DC Clamp Meter	
AC Voltage - Source	Up to 33 mV (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz (33 to 330) mV (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz 330 mV to 3.3 V (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz (3.3 to 33) V (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (33 to 330) V (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (5 to 10) kHz (10 to 30) kHz	800 μ V /V + 6 μ V 150 μ V /V + 6 μ V 200 μ V /V + 6 μ V 1 mV/V + 6 μ V 3.5 mV/V + 12 μ V 8 mV/V + 50 μ V 300 μ V /V + 8 μ V 145 μ V /V + 8 μ V 160 μ V /V + 8 μ V 350 μ V /V + 8 μ V 800 μ V /V + 32 μ V 2 mV/V + 70 μ V 300 μ V /V + 50 μ V 150 μ V /V + 60 μ V 190 μ V /V + 60 μ V 300 μ V /V + 50 μ V 700 μ V /V + 125 μ V 2.4 mV/V + 600 μ V 300 μ V /V + 650 μ V 150 μ V /V + 600 μ V 240 μ V /V + 600 μ V 350 μ V /V + 600 μ V 900 μ V /V + 1.6 mV 190 μ V /V + 2 mV 200 μ V /V + 6 mV 250 μ V /V + 6 mV 300 μ V /V + 6 mV 200 μ V /V + 50 mV 300 μ V /V + 6 mV 2 mV/V + 50 mV	Fluke 5520A	OEM & GIDEP Sourced Procedures



PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY (\pm)	REFERENCE STANDARD OR EQUIPMENT	METHODS
AC Voltage - Source (cont.)	330 V to 1.02 kV 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	300 $\mu\text{V}/\text{V} + 10 \text{ mV}$ 250 $\mu\text{V}/\text{V} + 10 \text{ mV}$ 300 $\mu\text{V}/\text{V} + 10 \text{ mV}$	Fluke 5520A	
AC Voltage - Measure	Up to 200 mV (20 to 50) Hz (50 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 50) kHz (50 to 100) kHz (100 to 200) kHz 200 kHz to 1 MHz (1 to 2) MHz 200 mV to 2 V (20 to 50) Hz (50 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 50) kHz (50 to 100) kHz (100 to 200) kHz 200 kHz to 1 MHz (1 to 2) MHz (2 to 20) V (20 to 50) Hz (50 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 50) kHz (50 to 100) kHz (100 to 200) kHz 200 kHz to 1 MHz (1 to 2) MHz	2.5 $\text{mV}/\text{V} + 30 \mu\text{V}$ 700 $\mu\text{V}/\text{V} + 30 \mu\text{V}$ 200 $\mu\text{V}/\text{V} + 40 \mu\text{V}$ 200 $\mu\text{V}/\text{V} + 40 \mu\text{V}$ 250 $\mu\text{V}/\text{V} + 40 \mu\text{V}$ 500 $\mu\text{V}/\text{V} + 40 \mu\text{V}$ 3 $\text{mV}/\text{V} + 30 \mu\text{V}$ 7.5 $\text{mV}/\text{V} + 50 \mu\text{V}$ 20 $\text{mV}/\text{V} + 200 \mu\text{V}$ 50 $\text{mV}/\text{V} + 400 \mu\text{V}$ 2.5 $\text{mV}/\text{V} + 300 \mu\text{V}$ 700 $\mu\text{V}/\text{V} + 300 \mu\text{V}$ 200 $\mu\text{V}/\text{V} + 400 \mu\text{V}$ 200 $\mu\text{V}/\text{V} + 400 \mu\text{V}$ 250 $\mu\text{V}/\text{V} + 400 \mu\text{V}$ 500 $\mu\text{V}/\text{V} + 400 \mu\text{V}$ 3 $\text{mV}/\text{V} + 300 \mu\text{V}$ 7.5 $\text{mV}/\text{V} + 500 \mu\text{V}$ 20 $\text{mV}/\text{V} + 2 \text{ mV}$ 50 $\text{mV}/\text{V} + 4 \text{ mV}$ 2.5 $\text{mV}/\text{V} + 3 \text{ mV}$ 700 $\mu\text{V}/\text{V} + 3 \text{ mV}$ 300 $\mu\text{V}/\text{V} + 3 \text{ mV}$ 400 $\mu\text{V}/\text{V} + 3 \text{ mV}$ 500 $\mu\text{V}/\text{V} + 3 \text{ mV}$ 700 $\mu\text{V}/\text{V} + 3 \text{ mV}$ 3 $\text{mV}/\text{V} + 3 \text{ mV}$ 7.5 $\text{mV}/\text{V} + 5 \text{ mV}$ 40 $\text{mV}/\text{V} + 4 \text{ mV}$ 70 $\text{mV}/\text{V} + 4 \text{ mV}$	Keithley 2002	OEM & GIDEP Sourced Procedures



PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY (\pm)	REFERENCE STANDARD OR EQUIPMENT	METHODS
AC Voltage - Measure (cont.)	<p>(20 to 200) V (20 to 50) Hz (50 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 50) kHz (50 to 100) kHz (100 to 200) kHz 200 kHz to 1 MHz</p> <p>(200 to 750) V (20 to 50) Hz (50 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 50) kHz (50 to 100) kHz</p>	<p>2.5 mV/V + 30 mV 700 μV/V + 30 mV 300 μV/V + 30 mV 400 μV/V + 30 mV 500 μV/V + 30 mV 700 μV/V + 30 mV 3 mV/V + 30 mV 7.5 mV/V + 50 mV 40 mV/V + 40 mV</p> <p>2.5 mV/V + 300 mV 1 mV/V + 300 mV 500 μV/V + 300 mV 600 μV/V + 300 mV 800 μV/V + 300 mV 1 mV/V + 300 mV 5 mV/V + 300 mV</p>	Keithley 2002	OEM & GIDEP Sourced Procedures
AC Current - Source	<p>(29 to 330) μA (10 to 20) Hz (20 to 45) Hz 45 Hz to 1kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz</p> <p>330 μA to 3.3 mA (10 to 20) Hz (20 to 45) Hz 45Hz to 1kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz</p> <p>(3.3 to 33) mA (10 to 20) Hz (20 to 45) Hz 45Hz to 1kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz</p>	<p>2 mA/A + 100 nA 1.5 mA/A + 100 nA 1.25 mA/A + 100 nA 3 mA/A + 150 nA 8 mA/A + 200 nA 16. mA/A + 400 nA</p> <p>2 mA/A+ 150 nA 1.25 mA/A + 150 nA 1 mA/A +150 nA 2 mA/A + 200 nA 5 mA/A + 300 nA 10 mA/A + 600 nA</p> <p>1.8 mA/A + 2 μA 900 μA/A + 2 μA 400 μA/A + 2 μA 800 μA/A + 2 μA 2 mA/A + 3 μA 4 mA/A + 4 μA</p>	Fluke 5520A	

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY (\pm)	REFERENCE STANDARD OR EQUIPMENT	METHODS
AC Current - Source (cont.)	(33 to 330) mA (10 to 20) Hz (20 to 45) Hz 45Hz to 1kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz 330 mA to 1.1 A (10 to 45) Hz 45Hz to 1kHz (1 to 5) kHz (5 to 10) kHz (1.1 to 3) A (10 to 45) Hz 45Hz to 1kHz (1 to 5) kHz (5 to 10) kHz (3 to 11) A (45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz (11 to 20.5) A (45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz (20.5 to 205) A (45 to 440) Hz (205 to 1025) A (45 to 440) Hz	1.8 mA/A + 20 μ A 900 μ A/A + 20 μ A 400 μ A/A + 20 μ A 1 mA/A + 50 μ A 2 mA/A + 100 μ A 4 mA/A + 200 μ A 1.8 mA/A + 100 μ A 500 μ A/A + 100 μ A 6 mA/A + 1 mA 25 mA/A + 5 mA 1.8 mA/A + 100 μ A 600 μ A/A + 100 μ A 6 mA/A + 1 mA 25 mA/A + 5 mA 600 μ A/A + 2 mA 1 mA/A + 2 mA 30 mA/A + 2 mA 1.2 mA/A + 5 mA 1.5 mA/A + 5 mA 30 mA/A + 5 mA 502 mA 2.54 A	Fluke 5520A 10 Turn Coil 50 Turn Coil	OEM & GIDEP Sourced Procedures
Resistance - Measure	Up to 20 Ω (20 to 200) Ω 200 Ω to 2 k Ω (2 to 20) k Ω (20 to 200) k Ω 200 k Ω to 2 M Ω (2 to 20) M Ω (20 to 200) M Ω 200 M Ω to 1 G Ω	50 $\mu\Omega/\Omega$ + 120 $\mu\Omega$ 28 $\mu\Omega/\Omega$ + 40 $\mu\Omega$ 18 $\mu\Omega/\Omega$ + 40 $\mu\Omega$ 19 $\mu\Omega/\Omega$ + 400 $\mu\Omega$ 47 $\mu\Omega/\Omega$ + 10 m Ω 90 $\mu\Omega/\Omega$ + 50 m Ω 315 $\mu\Omega/\Omega$ + 600 m Ω 615 $\mu\Omega/\Omega$ + 30 Ω 2.1 m Ω/Ω + 1.5 k Ω	Keithley 2002	
Frequency - Measure	(1.1 to 10) Hz (10 to 100) Hz 100 Hz to 1.1 kHz (1.1 to 10) kHz (10 to 100) kHz 100 kHz to 1.1 MHz (1.1 to 10) MHz (10 to 15) MHz	582 μ Hz 5.81 mHz 58.2 mHz 581 mHz 5.81 Hz 58.2 Hz 577 Hz 586 Hz	Keithley 2002	



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Frequency - Source	0.01 Hz to 600 MHz	2.5 μ Hz/Hz + 5 μ Hz	Fluke 5520A	OEM & GIDEP Sourced Procedures
Resistance - Source	Up to 11 Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω 330 Ω to 1.1 k Ω (1.1 to 3.3) k Ω (3.3 to 11) k Ω (11 to 33) k Ω (33 to 110) k Ω (110 to 330) k Ω 330 k Ω to 1.1 M Ω (1.1 to 3.3) M Ω (3.3 to 11) M Ω (11 to 33) M Ω (33 to 110) M Ω (110 to 330) M Ω 330 M Ω to 1.1 G Ω	40 $\mu\Omega/\Omega$ + 1 m Ω 30 $\mu\Omega/\Omega$ + 1.5 m Ω 28 $\mu\Omega/\Omega$ + 1.4 m Ω 28 $\mu\Omega/\Omega$ + 2 m Ω 28 $\mu\Omega/\Omega$ + 2 m Ω 28 $\mu\Omega/\Omega$ + 20 m Ω 28 $\mu\Omega/\Omega$ + 20 m Ω 28 $\mu\Omega/\Omega$ + 200 m Ω 28 $\mu\Omega/\Omega$ + 200 m Ω 32 $\mu\Omega/\Omega$ + 2 Ω 32 $\mu\Omega/\Omega$ + 2 Ω 60 $\mu\Omega/\Omega$ + 30 Ω 130 $\mu\Omega/\Omega$ + 50 Ω 250 $\mu\Omega/\Omega$ + 2.5 k Ω 500 $\mu\Omega/\Omega$ + 3 k Ω 3 m Ω/Ω + 100 k Ω 15 m Ω/Ω + 500 k Ω	Fluke 5520A	
Electrical Simulation of Thermocouples Type E	(-250 to -100) $^{\circ}$ C (-100 to -25) $^{\circ}$ C (-25 to 350) $^{\circ}$ C (350 to 650) $^{\circ}$ C (650 to 1 000) $^{\circ}$ C	0.5 $^{\circ}$ C 0.16 $^{\circ}$ C 0.14 $^{\circ}$ C 0.16 $^{\circ}$ C 0.21 $^{\circ}$ C	Fluke 5520A	
Type J	(-210 to -100) $^{\circ}$ C (-100 to -30) $^{\circ}$ C (-30 to 150) $^{\circ}$ C (150 to 760) $^{\circ}$ C (760 to 1 200) $^{\circ}$ C	0.27 $^{\circ}$ C 0.16 $^{\circ}$ C 0.14 $^{\circ}$ C 0.17 $^{\circ}$ C 0.23 $^{\circ}$ C		
Type K	(-200 to -100) $^{\circ}$ C (-100 to -25) $^{\circ}$ C (-25 to 120) $^{\circ}$ C (120 to 1 000) $^{\circ}$ C (1 000 to 1 372) $^{\circ}$ C	0.33 $^{\circ}$ C 0.18 $^{\circ}$ C 0.16 $^{\circ}$ C 0.26 $^{\circ}$ C 0.4 $^{\circ}$ C		
Type L	(-200 to -100) $^{\circ}$ C (-100 to 800) $^{\circ}$ C (800 to 900) $^{\circ}$ C	0.37 $^{\circ}$ C 0.26 $^{\circ}$ C 0.17 $^{\circ}$ C		

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Electrical Simulation of Thermocouples (cont.)	Type N	(-200 to 100) °C	0.40 °C	Fluke 5520A	OEM & GIDEP Sourced Procedures
		(-100 to -25) °C	0.22 °C		
		(-25 to 120) °C	0.19 °C		
		(120 to 410) °C	0.18 °C		
		(410 to 1 300) °C	0.27 °C		
	Type R	(0 to 250) °C	0.57 °C		
		(250 to 400) °C	0.35 °C		
		(400 to 1 000) °C	0.33 °C		
		(1 000 to 1 767) °C	0.40 °C		
	Type S	(0 to 250) °C	0.47 °C		
		(250 to 1 000) °C	0.36 °C		
		(1 000 to 1 400) °C	0.37 °C		
		(1 400 to 1 767) °C	0.46 °C		
	Type T	(-250 to -150) °C	0.63 °C		
		(-150 to 0) °C	0.24 °C		
		(0 to 120) °C	0.16 °C		
	(120 to 400) °C	0.14 °C			
Type U	(-200 to 0) °C	0.56 °C			
	(0 to 600) °C	0.27 °C			
Electrical Simulation of RTDs	Pt 385, 100 Ω	(-200 to -80) °C	0.05 °C	Fluke 5520A	OEM & GIDEP Sourced Procedures
		(-80 to 0) °C	0.05 °C		
		(0 to 100) °C	0.07 °C		
		(100 to 300) °C	0.09 °C		
		(300 to 400) °C	0.1 °C		
		(400 to 630) °C	0.12 °C		
		(630 to 800) °C	0.23 °C		
		Pt 3926, 100 Ω	(-200 to -80) °C		
	(-80 to 0) °C		0.05 °C		
	(0 to 100) °C		0.07 °C		
	(100 to 300) °C		0.09 °C		
	(300 to 400) °C		0.1 °C		
	(400 to 630) °C		0.12 °C		



PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY (±)]	REFERENCE STANDARD OR EQUIPMENT	METHODS	
Electrical Simulation of RTDs (cont.)	Pt 3916, 100 Ω	(-200 to -190) °C	0.25 °C	Fluke 5520A	OEM & GIDEP Sourced Procedures
		(-190 to -80) °C	0.04 °C		
		(-80 to 0) °C	0.05 °C		
		(0 to 100) °C	0.06 °C		
		(100 to 260) °C	0.07 °C		
		(260 to 300) °C	0.08 °C		
		(300 to 400) °C	0.09 °C		
		(400 to 600) °C	0.1 °C		
		(600 to 630) °C	0.23 °C		
	Pt 385, 200 Ω	(-200 to -80) °C	0.04 °C		
		(-80 to 0) °C	0.04 °C		
		(0 to 100) °C	0.04 °C		
		(100 to 260) °C	0.05 °C		
		(260 to 300) °C	0.12 °C		
		(300 to 400) °C	0.13 °C		
		(400 to 600) °C	0.14 °C		
	Pt 385, 500 Ω	(-200 to -80) °C	0.04 °C		
		(-80 to 0) °C	0.05 °C		
		(0 to 100) °C	0.05 °C		
		(100 to 260) °C	0.06 °C		
		(260 to 300) °C	0.08 °C		
		(300 to 400) °C	0.08 °C		
		(400 to 600) °C	0.09 °C		
	Pt 385, 1 000 Ω	(-200 to -80) °C	0.03 °C		
		(-80 to 0) °C	0.03 °C		
		(0 to 100) °C	0.04 °C		
		(100 to 260) °C	0.05 °C		
		(260 to 300) °C	0.06 °C		
(300 to 400) °C		0.07 °C			
(400 to 600) °C		0.07 °C			
PtNi 385, 120 Ω (Ni120)	(-80 to 0) °C	0.08 °C			
	(0 to 100) °C	0.08 °C			
	(100 to 260) °C	0.14 °C			
Cu 427, 10 Ω	(-100 to 260) °C	0.3 °C			



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Capacitance - Source	190 pF to 3.3 nF (3.3 to 11) nF (11 to 33) nF (110 to 330) nF 330 nF to 1.1 μ F (1.1 to 3.3) μ F (3.3 to 11) μ F (11 to 33) μ F (33 to 110) μ F (110 to 330) μ F 330 μ F to 1.1 mF (1.1 to 3.3) mF (3.3 to 11) mF (11 to 33) mF (33 to 110) mF	5 mF/F. + 10 pF 2.5 mF/F + 10 pF 2.5 mF/F + 100 pF 2.5 mF/F + 300 pF 2.5 mF/F + 1 nF 2.5 mF/F + 3 nF 2.5 mF/F + 10 nF 4 mF/F + 30 nF 4.5 mF/F + 100 nF 4.5 mF/F + 300 nF 4.5 mF/F + 1 μ F 4.5 mF/F + 30 μ F 4.5 mF/F + 10 μ F 7.5 mF/F + 30 μ F 11 mF/F + 100 μ F	Fluke 5520A	OEM & GIDEP Sourced Procedures

II. Thermodynamic Calibration

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY (\pm)	REFERENCE STANDARD OR EQUIPMENT	METHODS
Humidity*	(0 to 90) %RH	1.1 %RH	HM141 / HMP45	OEM & GIDEP Sourced Procedures

III. Mechanical Calibration

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY (\pm)	REFERENCE STANDARD OR EQUIPMENT	METHODS
Pressure - Source	Up to 200 psi Up to 1 500 psi Up to 15 000 psi	0.025 psi 3.05 psi 30.5 psi	Ametek Calibrator Mansfield & Green Deadweight Tester	OEM & GIDEP Sourced Procedures
Pressure - Measure	Up to 1 000 psi	3 psi	Heise Gauge	

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY (±)]	REFERENCE STANDARD OR EQUIPMENT	METHODS
Weights	Up to 20 g Up to 2 000 g	0.17 mg 0.54 mg	Precision Weights Class 1 Mass Comparator Precision Weights Class 1	OEM & GIDEP Sourced Procedures
Scales and Balances	Up to 20 g	0.03 mg	Class 1 Weights	
Scales	Up to 1 000 lb (1 000 to 2 000) lb (2 000 to 5 000) lb (5 000 to 12 000) lb	1.34 lb 2.47 lb 6.03 lb 14.4 lb	Class F Weights	NIST Handbook 44 and OEM & GIDEP Sourced Procedures
Rockwell Hardness Testers ³	HR15N HR15T HR15W HR15X HR15Y HR30N HR30T HR30W HR30X HR30Y HR45N HR45T HR45W HR45X HR45Y	(Points of Hardness) 40 to 95: 0.19 20 to 79: 0.37 ≥ 80: 0.21 ≥ 80: 0.67 ≥80: 0.33 85 to 93: 1.30 ≥94: 0.63 40 to 59: 0.55 60 to 85: 0.28 20 to 49: 0.90 50 to 56: 0.66 ≥57: 0.39 40 to 64: 0.90 ≥65: 0.76 60 to 78: 0.99 ≥79: 0.15 60 to 87: 0.82 ≥88: 0.37 10 to 49: 0.43 50 to 66: 0.22 67 to 75: 0.19 1 to 39: 0.73 ≥40: 0.41 10 to 47: 0.30 ≥48: 0.13 40 to 68: 0.81 ≥69: 0.35 60 to 81: 0.94 ≥82: 0.35	Hardness Test Blocks	Indirect Verification per ASTM E18

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY (±)]	REFERENCE STANDARD OR EQUIPMENT	METHODS
Rockwell Hardness Testers ³ (cont.)	HRA	60 to 69: 0.28 70 to 79: 0.17 80 to 85: 0.16 Carbide ≥86: 0.16	Hardness Test Blocks	Indirect Verification per ASTM E18
	HRB	1 to 50: 1.36 51 to 79: 0.87 ≥80: 0.42		
	HRC	20 to 39: 0.40 40 to 59: 0.36 60 to 70: 0.32		
	HRD	40 to 49: 0.27 50 to 69: 0.26 70 to 80: 0.18		
	HRE	≥65: 0.54		
	HRF	40 to 69: 0.54 ≥70: 0.40		
	HRG	1 to 39: 0.76 ≥40: 0.30		
	HRH	60 to 79: 0.54 ≥80: 0.41		
	HRK	10 to 29: 0.64 ≥30: 0.40 ≥90: 0.36		
	HRL	≥70: 0.56		
	HRM	40 to 84: 0.91		
	HRP	≥85: 0.65		
	HRR	100 to 119: 0.41 ≥120: 0.24		
	HRS	110 to 111: 0.95 ≥112: 0.20 ≥80: 0.21		
	Vickers Hardness Testers			
HV1		8.7, 21.4, 44		
HV2		6.9, 16.3, 31		
HV5		3.9, 11, 19.7		
HV10		3.1, 7.7, 14.9		
HV20		2.5, 6.2, 11		
HV30		2.0, 4.4, 9.3		
HV50		1.9, 3.5, 6.3		
HV 0.01		N/A, 30, 40		
HV 0.025		9, 20, 30		
HV 0.05		8.5, 19, 27		
HV-0.1		8, 18, 25		
HV 0.2		7, 17, 20		
HV 0.3		6, 16, 19		
HV 0.5		5, 15, 17		



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Brinell Hardness Testers	HBW 1 / 62.5	(HBW) (200 to 400, 400 to 600) 2, 4	Hardness Test Blocks	Indirect Verification per ASTM E18
	HBW 2.5 / 187.5	2, 4		
	HBW 10 / 500	2, 4		
	HBW 5 / 1 000	2, 4		
	HBW 10 / 1 000	2, 7		
	HBW 10 / 1500	2, 4		
	HBW 10 / 2 000	2, 4		
	HBW 10 / 2 500	2, 4		
Knoop Hardness Testers	HBW 10 / 3 000	2, 4		
	HK 0.01	(HK) (200, 400, 700) N/A, 30, 40		
	HK 0.025	9, 20, 30		
	HK 0.05	8.5, 19, 27		
	HK 0.1	8, 18, 25		
	HK 0.2	7, 17, 20		
	HK 0.3	6, 16, 19		
	HK 0.5	5, 15, 17		
HK 1	5, 10, 15			
Torque	(25 to 250) lbf-in (25 to 250) lbf-ft (100 to 1 000) lbf-ft	3.65 % 2.47 % 3.65 %	Norbar Torque Calibrator	ASME B107.14M

IV. Dimensional Calibration

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY (±)]	REFERENCE STANDARD OR EQUIPMENT	METHODS
Gage Blocks*	(0.050 to 1) in (1 to 4) in (4 to 20) in	5.25 µin 9.04 µin 51.8 µin	Grade 0 & 00 Gage Blocks, Gage Block Comparator	ASME B89.1.2M, ASME B89.1.9, GGG-G-15C
Bench Micrometer*	Up to 1 in lead screw	24 µin	Grade 0 Gage Blocks, Probe, Oz. Testers	OEM & GIDEP Sourced Procedures
O.D. Micrometer	Up to 12 in	92.9µin	Grade 0 Gage Blocks	B89.1.13
Height Gage	Up to 12 in	308 µin	Grade 0 Gage Blocks	OEM & GIDEP Sourced Procedures

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY (\pm)	REFERENCE STANDARD OR EQUIPMENT	METHODS
Height Master	Up to 12 in	72.5 μ in	Grade 0 Gage Blocks, Digital Indicator	OEM & GIDEP Sourced Procedures
Plain Plug Gage	Up to 8 in	52.4 μ in	Grade 0 Gage Blocks, P&W Supermicrometer	B89.1.5
Plain Ring Gage	(0.04 to 12) in	79.5 μ in	Grade 0 Gage Blocks, Ring Gage Comparator	B89.1.6M
Threaded Plugs / Rings	(0.06 to 8) in	84.6 μ in	Grade 0 Gage Blocks, P&W Supermicrometer, Thread Wires	B1.1; B1.2; B1.13M; B1.16M; B1.20.3; B1.20.1; B1.20.5; B1.8 B1.5; B18.29.1; B1.15; B1.12; B1.3M
Thread Measuring Wire	(4 to 100) TPI	31.4 μ in	Class X Cylindrical Roll, P&W Supermicrometer	B89.1.17
Micrometer Standard	(1 to 20) in	112 μ in	Grade 0 Gage Blocks, P&W Supermicrometer	B89.1.13
Caliper	Up to 24 in	692 μ in	Grade 0 Gage Blocks	GGG-C-111b
Test Indicator	Up to 0.06 in	62.2 μ in		B89.1.10M
Plunger Indicator	Up to 4 in	601 μ in		B89.1.10M
Optical Comparator Squareness	Up to 18 in	91 μ in	Master Square	OEM/GIDEP NEMP1036
Linearity	Up to 18 in	107 μ in	Optical Magnification Checker Gage Blocks	
Optical Comparator Magnification	10X 20X 31.25X 50X 100X	487 μ in	Glass Scale	OEM/GIDEP NEMP1036
Surface Plates ⁵ Grades AA, A and B flatness	Up to 180 in x 240 in	(25 + 7DL) μ in	Precision Level System	GGG-P-463C OEM
Squares , Steps, Angle Plates	Up to 18 in	62.15 μ in	Squareness Checker	OEM & GIDEP Sourced Procedures

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY (±)]	REFERENCE STANDARD OR EQUIPMENT	METHODS
Angles & Angle Blocks	Up to 90 °	81 µin	Electronic Gage Head, Mu Checker, Sine Bar	OEM & GIDEP Sourced Procedures
Spheres	Up to 1 in	33 µin	Grade 0 Gage Blocks, P&W Supermicrometer	NEMP1027 OEM & GIDEP Sourced Procedures

V. Mechanical Testing

ITEMS, MATERIALS OR PRODUCTS TESTED	SPECIFIC TESTS OR PROPERTIES MEASURED	SPECIFICATION, STANDARD METHOD OR TECHNIQUE USED	*DETECTION LIMIT/ RANGE/ EQUIPMENT
Sintered and Wrought Products	Hardness - Rockwell and Superficial Scales	ASTM E18	Wilson Rockwell Hardness Tester Rockwell Scales A,B,C,E,F,G,H Superficial Scales T,N
Sintered and Wrought Products	Hardness - Brinell	ASTM E10	Newage Dyna Brinell HB500 thru HB3000
Sintered and Wrought Products	Hardness - Portable	ASTM E110	Mitutoyo Portable
Sintered and Wrought Products	Hardness - Leeb, Equotip	ASTM A956	Equotip LD Scale
Sintered and Wrought Products	Microhardness - Vickers	ASTM E92	Mitutoyo MVK Heavy Load Vickers 500 gr thru 5 KG
Sintered and Wrought Products	Microhardness - Knoop & Vickers	ASTM E384 ASTM B933	Buehler Micro Hardness Tester Knoop Scale 10 g to 1000 g Range Vickers Scale 10 g to 1000 g Range

VI. Dimensional Inspection/Measurement

PARAMETER / EQUIPMENT	RANGE	CALIBRATION AND MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY (±)]	REFERENCE STANDARD OR EQUIPMENT	METHODS
3-D Dimensional CMM	X = 25 in Y = 35 in Z = 17 in	272 μin 293 μin 264 μin	B&S Bridge Type CMM	Customer Drawing PC DMIS S/W

Notes:

1. Calibration and Measurement Capabilities (CMC) (Expanded Uncertainties) are based on approximately a 95% confidence interval, using a coverage of $k=2$.
2. This laboratory offers calibration services in its laboratory and calibration and testing services on-site at customer-designated locations. Since on-site conditions are typically more variable than those in the laboratory, larger measurement uncertainties are expected on-site than what is reported on the accredited scope. Contact the laboratory for specific on-site capabilities.
3. The following statement is from the NIST recommended practice guide (Special Publication 960-5, page 60, section 8.3.3, paragraph 2) "Currently, there are no generally agreed upon U.S. or international methods for calculating the measurement uncertainty of a Rockwell hardness machine or the uncertainty in the certified value of standardized test blocks."
4. CMC for Electromagnetic - DC/Low Frequency Calibration do not include possible contributions to uncertainty from a "best available" unit under test.
5. The use of (DL) signifies the Diagonal Length of the surface plate in feet.
6. The following must be added to CMC for this range above 100V input: $10 \mu V/V \times (V_{in}/100V)^2$.
7. Asterisk (*) indicates parameters that are not available for on-site calibration.
8. This scope is part of and must be included with the Certificate of Accreditation No. ACT-1116.



Vice President