



PERRY JOHNSON LABORATORY ACCREDITATION, INC.

Certificate of Accreditation

Perry Johnson Laboratory Accreditation, Inc. has assessed the Laboratory of:

Certified Test Equipment, Inc.
708 Cooper Drive, Wylie, TX 75098

(Hereinafter called the Organization) and hereby declares that Organization is accredited in accordance with the recognized International Standard:

ISO/IEC 17025:2017

This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (as outlined by the joint ISO-ILAC-IAF Communiqué dated April 2017):

Acoustic, Chemical, Dimensional, Electrical, Frequency, Mechanical and Optical Calibration
(As detailed in the supplement)

Accreditation claims for such testing and/or calibration services shall only be made from addresses referenced within this certificate. This Accreditation is granted subject to the system rules governing the Accreditation referred to above, and the Organization hereby covenants with the Accreditation body's duty to observe and comply with the said rules.

For PJLA:

Tracy Szerszen
President

Perry Johnson Laboratory
Accreditation, Inc. (PJLA)
755 W. Big Beaver, Suite 1325
Troy, Michigan 48084

Initial Accreditation Date:

April 14, 2004

Issue Date:

September 21, 2022

Expiration Date:

September 30, 2024

Accreditation No.:

59237

Certificate No.:

L22-602

The validity of this certificate is maintained through ongoing assessments based on a continuous accreditation cycle. The validity of this certificate should be confirmed through the PJLA website: www.pjllabs.com



Certificate of Accreditation: Supplement

Certified Test Equipment, Inc.

708 Cooper Drive, Wylie, TX 75098
 Contact Name: John Collinsworth Phone: 972-429-3722

Accreditation is granted to the facility to perform the following calibrations:

Acoustic

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY (\pm)	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
Sound level meters (at the listed frequencies) ^{FO}			GR 1562A 33K3-4-2873-1
125 Hz	114 dB	0.67 dB	
250 Hz	114 dB	0.67 dB	
500 Hz	114 dB	0.67 dB	
1 000 Hz	114 dB	0.67 dB	
2 000 Hz	114 dB	0.67 dB	
1 000 Hz	94 dB	0.58 dB	Cel Inst. CEL-284/2B 33K3-4-3477-1

Chemical

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE (AND SPECIFICATION WHERE APPROPRIATE)	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY (\pm)	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
pH meter/Probe Calibration Fixed Points ^{FO}	4 pH	0.43 % of reading	pH Buffer Solutions & Fluke 743B 33K8-4-1110-1
	7 pH	0.43 % of reading	
	10 pH	0.43 % of reading	
Conductivity Meter Fixed Points Measured at 25 °C ^{FO}	23 μ s/cm	0.65 % of reading	Conductivity Solutions & Fluke 743B 33K8-4-1110-1
	84 μ s/cm	0.65 % of reading	
	447 μ s/cm	0.65 % of reading	
	1 413 μ s/cm	0.65 % of reading	
	2 070 μ s/cm	0.65 % of reading	
	2 764 μ s/cm	0.65 % of reading	
	12 800 μ s/cm	0.65 % of reading	
	80 000 μ s/cm	0.65 % of reading	



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Dimensional

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Micrometers, Outside ^{FO}	0.05 in to 24 in	500 μ in	Gage Block Set 33K6-4-1-1
Micrometers, Depth ^{FO}	0.05 in to 24 in	500 μ in	
Micrometers, Inside ^{FO}	1.5 in to 12 in	500 μ in	
Calipers ^{FO}	0.05 in to 12 in	500 μ in	
	12 in to 48 in	1 000 μ in	
Height Gages ^{FO}	0 in to 18 in	250 μ in	Mitutoyo LH-600E Height master NA17-20MD-26
Height Masters ^{FO}	0 in to 24 in	150 μ in	Gage Block Set 33K6-4-1-1
Thread Ring Gage Pitch Diameter ^{FO}	0-80 to 2-6	250 μ in	Thread setting Standard FED STD H28/20
Thread Plug Gages Pitch Diameter ^{FO}	0-80 to 2-6	1 000 μ in	Optical Comparator Thread Wire Set Fed Std H28/20
Major Diameter ^{FO}	0.04 in to 2 in	1 000 μ in	Super Micrometer 33K6-4-981-1
Minor Diameter ^{FO}			
Dial Indicators ^{FO}	0 in to 2 in	150 μ in	Dial Indicator Calibrator NA17-20MD-29
Test Indicators ^{FO}	0 in to 0.125 in	150 μ in	
Cylindrical Plug Gages Class XXX ^{FO}	0.06 in to 0.825 in	73 μ in	Laser Micrometer MP-I-MA03/REV 1
	0.83 in to 1.51 in	74 μ in	
	1.51 in to 10 in	(65.9 + 8.5L) μ in	Gage Block Set and Comparator 33K6-4-1-1/ NA17-20MD-1
Cylindrical Plug Gages ^{FO}	0.06 in to 0.83 in	89 μ in	Laser Micrometer MP-I-MA03/REV 1
	0.83 in to 1.51 in	95 μ in	Gage Block Set and Comparator 33K6-4-1-1/ NA17-20MD-1
	1.51 in to 10 in	(73.2 + 14.7L) μ in	
Cylindrical Ring Gages ^{FO}	0.06 in to 0.83 in	28 μ in	Gage Block Set and Comparator 33K6-4-1-1/ NA17-20MD-1
	0.83 in to 1.51 in	34 μ in	
	1.51 in to 10 in	(49.7 + 20L) μ in	



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Sine Bars & Plates Parallelism ^{FO}	6 in to 12 in	95 μ m	Gage Block Set and probe 33K6-4-1-1
Gage Blocks – Grade 3 ^{FO}	0.05 in to 4 in	(2.7 + 0.8L) μ m	Comparator and Master Blocks 33K6-4-1-1/ NA17-20MD-1

Electrical

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY (\pm)	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
Equipment to Output AM Modulated Signals (at the listed frequencies) ^{FO}			Boonton 8210 33K3-4-3070-1
50 Hz to 5 kHz	10 % to 90 %	1.5 % of reading	
5 kHz to 7.5 kHz	10 % to 90 %	3 % of reading	
Equipment to Output FM Modulated Signals (at the listed frequencies) ^{FO}			Wavetek 9100 33K8-4-15-1
50 Hz to 5 kHz	10 % to 90 %	0.5 % of reading	
5 kHz to 7.5 kHz	10 % to 90 %	1 % of reading	
Equipment to measure AC Voltage (at the listed frequencies) ^{FO}			
10 Hz to 3 kHz	0.1 mV to 10 mV	0.02 % of setting + 384 V	
3 kHz to 10 kHz	0.1 mV to 10 mV	0.02 % of setting + 512 μ V	
10 kHz to 30 kHz	0.1 mV to 10 mV	0.03 % of setting + 960 μ V	
30 kHz to 50 kHz	0.1 mV to 10 mV	0.05 % of setting + 1.92 mV	
50 kHz to 100 kHz	0.1 mV to 10 mV	0.1 % of setting + 5.12 mV	
Equipment to measure AC Voltage (at the listed frequencies) ^{FO}			
10 Hz to 3 kHz	10 mV to 32 mV	0.02 % of setting + 96 V	
3 kHz to 10 kHz	10 mV to 32 mV	0.02 % of setting + 128 μ V	
10 kHz to 30 kHz	10 mV to 32 mV	0.03 % of setting + 240 μ V	
30 kHz to 50 kHz	10 mV to 32 mV	0.1 % of setting + 480 μ V	
50 Hz to 100 kHz	10 mV to 32 mV	0.1 % of setting + 1.28 mV	



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Equipment to measure AC Voltage (at the listed frequencies) ^{F0}			Wavetek 9100 33K8-4-15-1
10 Hz to 3 kHz	32 mV to 320 mV	0.02 % of setting + 19.2 V	
3 kHz to 10 kHz	32 mV to 320 mV	0.02 % of setting + 25.6 μ V	
10 kHz to 30 kHz	32 mV to 320 mV	0.03 % of setting + 48 μ V	
30 kHz to 50 kHz	32 mV to 320 mV	0.05 % of setting + 96 μ V	
50 kHz to 100 kHz	32 mV to 320 mV	0.1 % of setting + 256 μ V	
Equipment to measure AC Voltage (at the listed frequencies) ^{F0}			
10 Hz to 3 kHz	0.32 V to 3.2 V	0.02 % of setting + 192 V	
3 kHz to 10 kHz	0.32 V to 3.2 V	0.02 % of setting + 256 μ V	
10 kHz to 30 kHz	0.32 V to 3.2 V	0.03 % of setting + 480 μ V	
30 kHz to 50 kHz	0.32 V to 3.2 V	0.1 % of setting + 960 μ V	
50 kHz to 100 kHz	0.32 V to 3.2 V	0.1 % of setting + 2.56 mV	
Equipment to measure AC Voltage (at the listed frequencies) ^{F0}			
10 Hz to 3 kHz	3.2 V to 32 V	0.02 % of setting + 1.92 mV	
3 kHz to 10 kHz	3.2 V to 32 V	0.03 % of setting + 2.56 mV	
10 kHz to 30 kHz	3.2 V to 32 V	0.04 % of setting + 4.8 mV	
30 kHz to 50 kHz	3.2 V to 32 V	0.1 % of setting + 9.6 mV	
50 kHz to 100 kHz	3.2 V to 32 V	0.2 % of setting + 32 mV	
Equipment to measure AC Voltage (at the listed frequencies) ^{F0}			
10 Hz to 3 kHz	32 V to 105 V	0.02 % of setting + 6.3 mV	
3 kHz to 10 kHz	32 V to 105 V	0.03 % of setting + 8.4 mV	
10 kHz to 30 kHz	32 V to 105 V	0.04 % of setting + 15.8 mV	
30 kHz to 50 kHz	32 V to 105 V	0.08 % of setting + 31.5 mV	
50 kHz to 100 kHz	32 V to 105 V	0.18 % of setting + 105 mV	
Equipment to measure AC Voltage (at the listed frequencies) ^{F0}			
40 Hz to 100 Hz	105 V to 320 V	0.03 % of setting + 19.2 mV	
100 Hz to 1 kHz	105 V to 320 V	0.03 % of setting + 19.2 mV	
1 kHz to 3 kHz	105 V to 320 V	0.04 % of setting + 19.2 mV	
3 kHz to 10 kHz	105 V to 320 V	0.04 % of setting + 32 mV	
10 kHz to 20 kHz	105 V to 320 V	0.06 % of setting + 48 mV	
20 kHz to 30 kHz	105 V to 320 V	0.08 % of setting + 64 mV	



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Equipment to measure AC Voltage (at the listed frequencies) ^{FO}			Wavetek 9100 33K8-4-15-1
40 Hz to 100 Hz	320 V to 800 V	0.03 % of setting + 63 mV	
100 Hz to 1 kHz	320 V to 800 V	0.03 % of setting + 63 mV	
1 kHz to 3 kHz	320 V to 800 V	0.04 % of setting + 63 mV	
3 kHz to 10 kHz	320 V to 800 V	0.04 % of setting + 105 mV	
10 kHz to 20 kHz	320 V to 800 V	0.06 % of setting + 158 mV	
20 kHz to 30 kHz	320 V to 800 V	0.08 % of setting + 210 mV	
Equipment to measure AC Voltage (at the listed frequencies) ^{FO}			HP 745A/HP 746A NA17-20AQ-59
40 Hz to 100 Hz	800 V to 1 050 V	0.03 % of setting + 126 mV	
100 Hz to 1 kHz	800 V to 1 050 V	0.03 % of setting + 126 mV	
1 kHz to 3 kHz	800 V to 1 050 V	0.04 % of setting + 126 mV	
3 kHz to 10 kHz	800 V to 1 050 V	0.04 % of setting + 210 mV	
10 kHz to 20 kHz	800 V to 1 050 V	0.06 % of setting + 315 mV	
50 kHz to 110 kHz	800 V to 1 050 V	0.08 % of setting + 50 μ V	Keithley 2001 33K8-4-1053-1
Equipment to output AC Voltage (at the listed frequencies) ^{FO}			
1 Hz to 10 Hz	2 mV to 200 mV	0.05 % of reading + 30 V	
10 Hz to 50 Hz	2 mV to 200 mV	0.02 % of reading + 30 V	
50 Hz to 10 kHz	2 mV to 200 mV	0.02 % of reading + 30 V	
10 kHz to 30 kHz	2 mV to 200 mV	0.02 % of reading + 30 V	
30 kHz to 50 kHz	2 mV to 200 mV	0.03 % of reading + 30 V	
50 kHz to 100 kHz	2 mV to 200 mV	0.38 % of reading + 30 V	
100 kHz to 200 kHz	2 mV to 200 mV	0.15 % of reading + 50 V	
0.2 MHz to 1 MHz	2 mV to 200 mV	1 % of reading + 200 μ V	
1 MHz to 2 MHz	2 mV to 200 mV	2.5 % of reading + 400 μ V	



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Equipment to output AC Voltage (at the listed frequencies) ^{FO}			Keithley 2001 33K8-4-1053-1
1 Hz to 10 Hz	200 mV to 2 V	0.05 % of reading + 300 V	
10 Hz to 50 Hz	200 mV to 2 V	0.02 % of reading + 300 V	
50 Hz to 10 kHz	200 mV to 2 V	0.02 % of reading + 300 V	
10 kHz to 30 kHz	200 mV to 2 V	0.02 % of reading + 300 V	
30 kHz to 50 kHz	200 mV to 2 V	0.03 % of reading + 300 V	
50 kHz to 100 kHz	200 mV to 2 V	0.15 % of reading + 300 V	
100 kHz to 200 kHz	200 mV to 2 V	0.38 % of reading + 500 V	
0.2 MHz to 1 MHz	200 mV to 2 V	1 % of reading + 2 mV	
1 MHz to 2 MHz	200 mV to 2 V	2.5 % of reading + 4 mV	
Equipment to output AC Voltage (at the listed frequencies) ^{FO}			
1 Hz to 10 Hz	2 V to 20 V	0.05 % of reading + 3 mV	
10 Hz to 50 Hz	2 V to 20 V	0.03 % of reading + 3 mV	
50 Hz to 2 kHz	2 V to 20 V	0.02 % of reading + 3 mV	
2 kHz to 10 kHz	2 V to 20 V	0.03 % of reading + 3 mV	
10 kHz to 30 kHz	2 V to 20 V	0.04 % of reading + 3 mV	
30 kHz to 50 kHz	2 V to 20 V	0.05 % of reading + 3 mV	
50 kHz to 100 kHz	2 V to 20 V	0.15 % of reading + 3 mV	
100 kHz to 200 kHz	2 V to 20 V	0.38 % of reading + 5 mV	
0.2 MHz to 1 MHz	2 V to 20 V	2 % of reading + 40 mV	
1 MHz to 2 MHz	2 V to 20 V	3.5 % of reading + 40 mV	
Equipment to output AC Voltage (at the listed frequencies) ^{FO}			
1 Hz to 10 Hz	20 V to 200 V	0.05 % of reading + 30 mV	
10 Hz to 50 Hz	20 V to 200 V	0.03 % of reading + 30 mV	
50 Hz to 2 kHz	20 V to 200 V	0.02 % of reading + 30 mV	
2 kHz to 10 kHz	20 V to 200 V	0.03 % of reading + 30 mV	
10 kHz to 30 kHz	20 V to 200 V	0.04 % of reading + 30 mV	
30 kHz to 50 kHz	20 V to 200 V	0.05 % of reading + 30 mV	
50 kHz to 100 kHz	20 V to 200 V	0.15 % of reading + 30 mV	
100 kHz to 200 kHz	20 V to 200 V	0.38 % of reading + 50 mV	
0.2 MHz to 1 MHz	20 V to 200 V	2 % of reading + 400 mV	



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Equipment to output AC Voltage (at the listed frequencies) ^{FO}			Keithley 2001 33K8-4-1053-1
1 Hz to 10 Hz	200 V to 750 V	0.07 % of reading + 0.112 5 V	
10 Hz to 50 Hz	200 V to 750 V	0.05 % of reading + 0.112 5 V	
50 Hz to 2 kHz	200 V to 750 V	0.04 % of reading + 0.112 5 V	
2 kHz to 10 kHz	200 V to 750 V	0.05 % of reading + 0.112 5 V	
10 kHz to 30 kHz	200 V to 750 V	0.06 % of reading + 0.112 5 V	
30 kHz to 50 kHz	200 V to 750 V	0.08 % of reading + 0.112 5 V	
50 kHz to 100 kHz	200 V to 750 V	0.25 % of reading + 0.112 5 V	
Equipment to Measure AC Current (at the listed frequencies) ^{FO}			Wavetek 9100 33K8-4-15-1
10 Hz to 3 kHz	0.01 μ A to 32 μ A	0.04 % of setting + 900 nA	
3 kHz to 10 kHz	0.01 μ A to 32 μ A	0.05 % of setting + 1.8 μ A	
10 kHz to 20 kHz	0.01 μ A to 32 μ A	0.10 % of setting + 6 μ A	
20 kHz to 30 kHz	0.01 μ A to 32 μ A	0.13 % of setting + 9 μ A	
Equipment to Measure AC Current (at the listed frequencies) ^{FO}			
10 Hz to 3 kHz	32.001 μ A to 320 μ A	0.04 % of setting + 300 nA	
3 kHz to 10 kHz	32.001 μ A to 320 μ A	0.05 % of setting + 600 nA	
10 kHz to 20 kHz	32.001 μ A to 320 μ A	0.10 % of setting + 2 μ A	
20 kHz to 30 kHz	32.001 μ A to 320 μ A	0.13 % of setting + 3 μ A	
Equipment to Measure AC Current (at the listed frequencies) ^{FO}			
10 Hz to 3 kHz	0.320 01 mA to 3.2 mA	0.04 % of setting + 300 nA	
3 kHz to 10 kHz	0.320 01 mA to 3.2 mA	0.05 % of setting + 600 nA	
10 kHz to 20 kHz	0.320 01 mA to 3.2 mA	0.10 % of setting + 2 μ A	
20 kHz to 30 kHz	0.320 01 mA to 3.2 mA	0.13 % of setting + 3 μ A	
Equipment to Measure AC Current (at the listed frequencies) ^{FO}			
10 Hz to 3 kHz	3.200 01 mA to 32 mA	0.04 % of setting + 3.2 μ A	
3 kHz to 10 kHz	3.200 01 mA to 32 mA	0.05 % of setting + 6.4 μ A	
10 kHz to 20 kHz	3.200 01 mA to 32 mA	0.10 % of setting + 12.8 μ A	
20 kHz to 30 kHz	3.200 01 mA to 32 mA	0.13 % of setting + 22.4 μ A	



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Equipment to Measure AC Current (at the listed frequencies) ^{FO}			Wavetek 9100 33K8-4-15-1	
10 Hz to 3 kHz	32.00 1 mA to 320 mA	0.04 % of setting + 32 μ A		
3 kHz to 10 kHz	32.00 1 mA to 320 mA	0.05 % of setting + 48 μ A		
10 kHz to 20 kHz	32.00 1 mA to 320 mA	0.10 % of setting + 64 μ A		
20 kHz to 30 kHz	32.00 1 mA to 320 mA	0.13 % of setting + 96 μ A		
Equipment to Measure AC Current (at the listed frequencies) ^{FO}				
10 Hz to 3 kHz	0.321 A to 3.2 A	0.05 % of setting + 480 μ A		
3 kHz to 10 kHz	0.321 A to 3.2 A	0.13 % of setting + 2.56 mA		
Equipment to Measure AC Current (at the listed frequencies) ^{FO}				
10 Hz to 3 kHz	3.21 A to 10.5 A	0.10 % of setting + 3 mA		
3 kHz to 10 kHz	3.21 A to 10.5 A	0.25 % of setting + 10 mA		
Equipment to Measure AC Current (at the listed frequencies) ^{FO}				
10 Hz to 3 kHz	10.500 1 A to 20 A	0.10 % of setting + 6.9 mA		
3 kHz to 10 kHz	10.500 1 A to 20 A	0.25 % of setting + 23 mA		
Equipment to Output AC Current (at the listed frequencies) ^{FO}				Keithley 2001 33K8-4-1053-1
20 Hz to 50 Hz	0.01 μ A to 200 μ A	0.18 % of reading + 30 nA		
50 Hz to 200 Hz	0.01 μ A to 200 μ A	0.10 % of reading + 30 nA		
200 Hz to 1 kHz	0.01 μ A to 200 μ A	0.20 % of reading + 30 nA		
1 kHz to 10 kHz	0.01 μ A to 200 μ A	0.25 % of reading + 30 nA		
Equipment to Output AC Current (at the listed frequencies) ^{FO}				
20 Hz to 50 Hz	210 μ A to 2 mA	0.15 % of reading + 0.3 μ A		
50 Hz to 200 Hz	210 μ A to 2 mA	0.08 % of reading + 0.3 μ A		
200 Hz to 1 kHz	210 μ A to 2 mA	0.06 % of reading + 0.3 μ A		
1 kHz to 10 kHz	210 μ A to 2 mA	0.06 % of reading + 0.3 μ A		
Equipment to Output AC Current (at the listed frequencies) ^{FO}				
20 Hz to 50 Hz	2.1 mA to 20 mA	0.15 % of reading + 3 μ A		
50 Hz to 200 Hz	2.1 mA to 20 mA	0.08 % of reading + 3 μ A		
200 Hz to 1 kHz	2.1 mA to 20 mA	0.06 % of reading + 3 μ A		
1 kHz to 10 kHz	2.1 mA to 20 mA	0.06 % of reading + 3 μ A		



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Equipment to Output AC Current (at the listed frequencies) ^{FO}			Keithley 2001 33K8-4-1053-1	
20 Hz to 50 Hz	21 mA to 200 mA	0.15 % of reading + 30 μ A		
50 Hz to 200 Hz	21 mA to 200 mA	0.08 % of reading + 30 μ A		
200 Hz to 1 kHz	21 mA to 200 mA	0.06 % of reading + 30 μ A		
1 kHz to 10 kHz	21 mA to 200 mA	0.08 % of reading + 30 μ A		
Equipment to Output AC Current (at the listed frequencies) ^{FO}				
20 Hz to 50 Hz	210 mA to 2 A	0.18 % of reading + 300 μ A		
50 Hz to 200 Hz	210 mA to 2 A	0.10 % of reading + 300 μ A		
200 Hz to 1 kHz	210 mA to 2 A	0.15 % of reading + 300 μ A		
1 kHz to 10 kHz	210 mA to 2 A	0.23 % of reading + 300 μ A		
Equipment to Output AC Current (at the listed frequencies) ^{FO}				Keithley 2001 with Fluke i1010 33K8-4-1053-1/ 33K1-4-785-1
20 Hz to 10 kHz	2 A to 600 A	1.000 6 % of reading + 0.5A		
Resistance in Ohms - Source(4 Wire) ^{FO}	0 Ω to 20 Ω	0.002 6 % of reading + 0 .000 14 Ω		Keithley 2001 33K8-4-1053-1
	21 Ω to 200 Ω	0.001 8 % of reading + 0.001 4 Ω		
	0.21 k Ω to 2 k Ω	0.001 65 % of reading + 0.008 Ω		
	2.1 k Ω to 20 k Ω	0.001 6 % of reading + 0.08 Ω		
	21 k Ω to 200 k Ω	0.003 6 % of reading + 0.9 Ω		
Resistance in Ohms - Source(2 Wire) ^{FO}	210 k Ω to 2 M Ω	0.005 5 % of reading + 9 Ω		
	2.1 M Ω to 20 M Ω	0.03 % of reading + 90 Ω		
	21 M Ω to 200 M Ω	0.5 % of reading + 20 k Ω		
	210 M Ω to 1 G Ω	1 % of reading + 100 k Ω		
Resistance in Ohms - Source(4 Wire) ^{FO}	0. 001 Ω	1.5 x 10 ⁻⁴ % of reading	L&N 4223 33K8-4-183-1 L&N 4210 33K8-4-125-1 L&N 4025B 33K8-4-125-1 L&N 4030B 33K8-4-125-1 ESI SR104 33K8-4-183-1 ESI SR1010-10 33K8-4-125-1 ESI SR1010-100 33K8-4-125-1	
	1 Ω	7.5 x 10 ⁻⁴ % of reading		
	10 Ω	5 x 10 ⁻⁴ % of reading		
	100 Ω	5 x 10 ⁻⁴ % of reading		
	10 k Ω	7 x 10 ⁻⁴ % of reading		
	1 Ω to 100 Ω	2.9 x 10 ⁻³ % of reading		
	10 Ω to 1 k Ω	5.9 x 10 ⁻³ % of reading		



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MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY (\pm)	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
Resistance in Ohms - Source(4 Wire) ^{FO}	100 Ω to 10 k Ω	1.2 x 10 ⁻³ % of reading	ESI SR1010-1k 33K8-4-125-1
	1 k Ω to 100 k Ω	7 x 10 ⁻⁴ % of reading	ESI SR1010-10k 33K8-4-125-1
	10 k Ω to 1 M Ω	8 x 10 ⁻⁴ % of reading	ESI SR1010-100k 33K8-4-125-1
Equipment to Measure Inductance (@ 1 kHz) ^{FO}	500 μ H	0.05 % of reading	GR 1482D QuadTech 1920 LCR 33K8-4-19-1 NA17-20AZ-111
	5 mH	0.05 % of reading	GR 1482G QuadTech 1920 LCR 33K8-4-19-1 NA17-20AZ-111
	50 mH	0.04 % of reading	GR 1482K QuadTech 1920 LCR 33K8-4-19-1 NA17-20AZ-111
	500 mH	0.05 % of reading	GR 1482N QuadTech 1920 LCR 33K8-4-19-1 NA17-20AZ-111
	5 H	0.05 % of reading	GR 1482R QuadTech 1920 LCR 33K8-4-19-1 NA17-20AZ-111
	5 H to 10 H	0.39 % of reading	GR 1490D QuadTech 1920 LCR 33K8-4-130-1 NA17-20AZ-111
Equipment to Output Capacitance ^{FO}	0 pF to 1.2 pF	5 x 10 ⁻³ % of reading + 0.000 1 pF	ESI 707B QuadTech 1920 LCR 33K8-4-8-1 NA17-20AZ-111
	1.21 pF to 120 pF	5 x 10 ⁻³ % of reading + 0.001 pF	
	121 pF to 1 200 pF	5 x 10 ⁻³ % of reading + 0.01 pF	
	1 201 pF to 0.012 μ F	5 x 10 ⁻³ % of reading + 0.1 pF	
	0.012 μ F to 0.12 μ F	5 x 10 ⁻³ % of reading + 1 pF	
	0.12 μ F to 1.2 μ F	0.01 % of reading + 10 pF	
Equipment to Output Capacitance ^{FO}	1 μ F to 1 mF	0.2 % of reading + 0.001 mF	HP 4282A QuadTech 1920 LCR 04282-99001 NA17-20AZ-111
	10 mF	0.5 % of reading + 0.01 mF	
	100 mF	0.75 % of reading + 0.5 mF	
	1 F	1.2 % of reading + 0.01 F	



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Electrical

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Equipment to Measure Capacitance ^{FO}	0.1 pF	0.05 % of reading	GR 1403N QuadTech 1920 LCR 33K8-4-131-1 NA17-20AZ-111
	10 pF	0.05 % of reading	Boonton CS-10 33K8-4-1-4-52
	50 pF	0.05 % of reading	Boonton CS-50 33K8-4-1-4-52
	100 pF	0.05 % of reading	Boonton CS-100 33K8-4-1-4-52
	1 000 pF	0.01 % of reading	GR 1404A 33K8-4-35-1
	0.1 μ F to 10 μ F	0.13 % of reading	GR 1424A TB9-6625-1062-35
Equipment to Measure Optical Power ^{FO}			Ando AQ1336 33K4-4-394-1
1 310 nm	0.1 mW to 9.999 mW	4.9 μ W/cm ²	
1 550 nm	0.1 mW to 9.999 mW	0.02 mW/cm ²	
Equipment to Output Optical Power ^{FO}			Laser Precision AM 4000 w/ AM-420 33K4-395-1
1 310 nm	0.1 mW to 9.999 mW	1.5 % of reading	
1 550 nm	0.1 mW to 9.999 mW	1.5 % of reading	
Equipment to Measure DC Voltage ^{FO}	1 mV to 100 μ V	6 x 10 ⁻³ % of setting + 4.16 μ V	Fluke 335A 33K8-4-323-1
	0.1 V to 10 V	1 x 10 ⁻³ % of setting + 10 μ V	
	11 V to 100 V	1 x 10 ⁻³ % of setting + 20 μ V	
	110 V to 1 000 V	1 x 10 ⁻³ % of setting + 200 μ V	
Equipment to Output DC Voltage ^{FO}	0.01 mV to 200 mV	3.7 x 10 ⁻³ % of reading + 120 μ V	Keithley 2001 33K8-4-1053-1
	210 mV to 2 V	2.5 x 10 ⁻³ % of reading + 400 μ V	
	2.1 V to 20 V	2.4 x 10 ⁻³ % of reading + 8 mV	
	21 V to 200 V	3.8 x 10 ⁻³ % of reading + 63 mV	
	210 V to 1 000 V	4.1 x 10 ⁻³ % of reading + 660 mV	
	1 001 V to 100 000 V	0.1 % of reading + 600 mV	Keithley 2001 & Spellman HVD100 33K8-4-1053-1 33K1-4-1820-1



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Equipment to Measure DC Current ^{FO}	0.01 μ A to 320 μ A	0.01 % of setting + 11 nA	Keithley 2001 33K8-4-1053-1
	0.320 01 mA to 3.2 mA	0.01 % of setting + 83 nA	
	3.200 1 mA to 32 mA	0.01 % of setting + 900 nA	
	32.001 mA to 320 mA	0.01 % of setting + 9.6 μ A	
	0.320 01 A to 3.2 A	0.03 % of setting + 118 μ A	
	3.21 A to 10.5 A	0.03 % of setting + 940 μ A	
	10.51 A to 20 A	0.03 % of setting + 4.5 mA	
Equipment to Output DC Current ^{FO}	0.001 μ A to 200 μ A	0.03 % of reading + 2.5 μ A	Keithley 2001 with L&N 4360 33K8-4-1053-1 33K8-4-225-1
	210 μ A to 2 mA	0.02 % of reading + 2 μ A	
	2.1 mA to 20 mA	0.02 % of reading + 2 μ A	
	21 mA to 200 mA	0.03 % of reading + 2 μ A	
	210 mA to 2 A	0.05 % of reading + 2 μ A	
	2 A to 15 A	0.05 % of reading + 2 μ A	
	15 A to 300 A	0.05 % of reading + 2 μ A	Keithley 2001 with L&N 4363 33K8-4-1053-1 33K8-4-225-1
300 A to 1 000 A	1 % of reading + 0.5 A	Keithley 2001 with Fluke i1010 33K8-4-1053-1 33K1-4-785-1	
Temperature Calibration, Indication and Control Equipment used with Thermocouple Type J ^{FO}	-210 $^{\circ}$ C to -100 $^{\circ}$ C	0.28 $^{\circ}$ C	Wavetek 9100 Electrical Simulation of Thermocouple Output ITS-90 Reference Table NIST Monograph 175
	-100 $^{\circ}$ C to 800 $^{\circ}$ C	0.23 $^{\circ}$ C	
	800 $^{\circ}$ C to 1 000 $^{\circ}$ C	0.24 $^{\circ}$ C	
	1 000 $^{\circ}$ C to 1 200 $^{\circ}$ C	0.26 $^{\circ}$ C	
Temperature Calibration, Indication and Control Equipment used with Thermocouple Type K ^{FO}	-250 $^{\circ}$ C to -200 $^{\circ}$ C	0.58 $^{\circ}$ C	
	-200 $^{\circ}$ C to -100 $^{\circ}$ C	0.30 $^{\circ}$ C	
	-100 $^{\circ}$ C to 100 $^{\circ}$ C	0.23 $^{\circ}$ C	
	100 $^{\circ}$ C to 600 $^{\circ}$ C	0.26 $^{\circ}$ C	
	600 $^{\circ}$ C to 1 372 $^{\circ}$ C	0.30 $^{\circ}$ C	



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Temperature Calibration, Indication and Control Equipment used with Thermocouple Type R ^{FO}	0 °C to 100 °C	0.53 °C	Wavetek 9100 Electrical Simulation of Thermocouple Output ITS-90 Reference Table NIST Monograph 175
	100 °C to 200 °C	0.42 °C	
	200 °C to 1 600 °C	0.37 °C	
	1 600 °C to 1 767 °C	0.31 °C	
Temperature Calibration, Indication and Control Equipment used with Thermocouple Type T ^{FO}	-250 °C to -200 °C	0.60 °C	
	-200 °C to -100 °C	0.30 °C	
	-100 °C to 0.0 °C	0.25 °C	
	0 °C to 400 °C	0.21 °C	
Temperature Calibration, Indication and Control Equipment used with RTD Pt 385 100 Ω ^{FO}	-100 °C to 100 °C	0.10 °C	Wavetek 9100 Electrical Simulation of RTD Output PT385, IPTS-68 AS PER IEC 751
	100 °C to 630 °C	0.20 °C	
	630 °C to 850 °C	0.30 °C	
Equipment to Output RF ^{FO} Power 50 MHz to 26.5 GHz	1 μ W to 100 mW	4.2 %	HP 438A w/ HP 8485A 33K4-4-144-1 ETMS-50250001-1.72.1703-2703



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Mechanical

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Direct Verification of Durometer Hardness Tester Types A, B, C, D ^{FO}			Optical Comparator 20X Mitutoyo 516-422 Grade 2 Gage Block Set NA17-20MD-20 33K6-4-1-1
Extension at Zero Reading	2.46 mm to 2.54 mm	0.02 mm	
Indentor Shape ^{FO}			Optical Comparator 20X NA17-20MD-20
A, B, C, D Indentor Diameter	1.27 mm	0.06 mm	
A, C Indentor Tip Diameter	0.79 mm	0.02 mm	
B, D Indentor Tip Diameter	0.1 mm	0.01 mm	
A, C Indentor Tip Angle	35 °	0.13 °	
B, D Indentor Tip Angle	30 °	0.25 °	
Durometer Indentor Spring ^{FO}			Sartorius QS4000 NA17-20MM-01
Types A, B	0.55 N to 8.05 N	0.04 N	
Types C, D	4.45 N to 44.45 N	0.22 N	
Indirect Verification of Rockwell Hardness Testers HRA ^{FO}	20 HRA to 40 HRA	0.6 HRA	ASTM E 18-8 and Calibrated Rockwell Hardness Test Blocks
	40 HRA to 60 HRA		
	60 HRA to 85 HRA		
Indirect Verification of Rockwell Hardness Testers HRB ^{FO}	40 HRB to 60 HRB	1.5 HRB	
	60 HRB to 80 HRB	1.1 HRB	
	80 HRB to 100 HRB		
Indirect Verification of Rockwell Hardness Testers HRC ^{FO}	25 HRC to 35 HRC	1.1 HRC	
	35 HRC to 55 HRC	0.9 HRC	
	55 HRC to 65 HRC	0.7 HRC	



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Indirect Verification of Rockwell Hardness Testers HRD ^{FO}	40 HRD to 50 HRD	0.6 HRD	ASTM E 18-8 and Calibrated Rockwell Hardness Test Blocks
	50 HRD to 60 HRD		
	60 HRD to 75 HRD		
Indirect Verification of Rockwell Hardness Testers HR15N ^{FO}	70 HR15N to 80 HR15N	0.7 HR15N	ASTM E 18-8 and Calibrated Rockwell Hardness Test Blocks
	80 HR15N to 90 HR15N		
Indirect Verification of Rockwell Hardness Testers HR30N ^{FO}	40 HR30N to 50 HR30N	1.1 HR30N	
	50 HR30N to 60 HR30N		
	60 HR30N to 75 HR30N		
Indirect Verification of Rockwell Hardness Testers HR45N ^{FO}	20 HR45N to 37 HR45N	0.6 HR45N	ASTM E 18-8 and Calibrated Rockwell Hardness Test Blocks
	37 HR45N to 55 HR45N		
	55 HR45N to 70 HR45N		
Indirect Verification of Rockwell Hardness Testers HR15T ^{FO}	60 HR15T to 65 HR15T	0.9 HR15T	ASTM E 18-8 and Calibrated Rockwell Hardness Test Blocks
	65 HR15T to 70 HR15T		
	70 HR15T to 75 HR15T		
Indirect Verification of Rockwell Hardness Testers HR30T ^{FO}	15 HR30T to 40 HR30T	1.5 HR30T	ASTM E 18-8 and Calibrated Rockwell Hardness Test Blocks
	40 HR30T to 65 HR30T		
	65 HR30T to 90 HR30T		
Indirect Verification of Rockwell Hardness Testers HR45T ^{FO}	10 HR45T to 37 HR45T	0.8 HR45T	ASTM E 18-8 and Calibrated Rockwell Hardness Test Blocks
	37 HR45T to 65 HR45T		
	65 HR45T to 90 HR45T		
Torque Watches ^{FO}	0.5 ozf·in to 360 ozf·in	0.5 % of reading	Class 7 Weight Set, Torque Arm 33K6-4-450-1
Torque Drivers & Wrenches ^{FO}	90 lbf·in to 900 lbf·in	1.6 % of reading	Norbar TWA 100/A Skidmore Wilhelm WD NA17-20MU-52
	15 lbf·ft to 150 lbf·ft		
Torque Transducers ^{FO}	0.1 ozf·in to 366 ozf·in	0.57 % of reading	Class 7 Weight Set, Torque Arm 33K6-4-450-1
	0.1 lbf·in to 900 lbf·in	0.51 % of reading	
	2 lbf·ft to 150 lbf·ft		



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Viscometers- Kinematic, Zahn, Shell, Ford, ISO & DIN Cups @ 25 °C ^{FO}	17.57 mm ² /s	0.44 %	Cannon C10 Fluke 743B – Temperature Measurement Robic Stopwatch I010P029 33K8-4-1110-1
	33.69 mm ² /s	0.44 %	Cannon C20 Robic Stopwatch Fluke 743B – Temperature Measurement I010P029 33K8-4-1110-1
	119.1 mm ² /s	0.45 %	Cannon C60 Robic Stopwatch Fluke 743B – Temperature Measurement I010P029 33K8-4-1110-1
	232 mm ² /s	0.45 %	Cannon C100 Robic Stopwatch Fluke 743B – Temperature Measurement I010P029 33K8-4-1110-1
	392 mm ² /s	0.45 %	Cannon C200 Robic Stopwatch Fluke 743B – Temperature Measurement I010P029 33K8-4-1110-1



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Viscometers- Dynamic, Rotary, Thomas Stormer, ICI Cone Plate 15 °C to 45 °C ^{FO}	309.4 mPa•s to 369.1 mPa•s	0.45 % of reading	Cannon S200KU Fluke 743B – Temperature Measurement I010P029 33K8-4-1110-1
	991.6 mPa•s to 1 206 mPa•s	0.47 % of reading	Cannon S600KU Fluke 743B – Temperature Measurement I010P029 33K8-4-1110-1
	71.7 mPa•s to 106.1 mPa•s	0.44 % of reading	Cannon RT100 Fluke 743B – Temperature Measurement I010P029 33K8-4-1110-1
	731.4 mPa•s to 1 090 mPa•s	0.45 % of reading	Cannon RT1000 Fluke 743B – Temperature Measurement I010P029 33K8-4-1110-1
	3 651 mPa•s to 5 419 mPa•s	0.47 % of reading	Cannon RT5000 Fluke 743B – Temperature Measurement I010P029 33K8-4-1110-1
	8 842 mPa•s to 13 150 mPa•s	0.47 % of reading	Cannon RT12500 Fluke 743B – Temperature Measurement I010P029 33K8-4-1110-1



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Vacuum Gages ^{FO}	-28.5 inHg to 0 inHg	0.1 inHg + 0.13 % of reading	Hass A-1 Barometer NA17-20MD-216
Pressure Gages Pneumatic ^{FO}	0.20 psi to 15 psi	0.06 psi	Wallace & Tiernan FA154 33K6-4-557-1
Pressure Gages Hydraulic ^{FO}	15 psi to 100 psi	0.05 psi	Fluke 743B w/700P06 See note 5 33K8-4-1110-1
	100 psi to 500 psi	0.13 % of reading	Mansfield & Green T-1 Dual Range 33K6-4-205-1
	500 psi to 5 000 psi		
	5 000 psi to 10 000 psi	0.67 % of reading	Ashcroft 1305N 33K6-4-205-1
Low Pressure ^{FO}	0.05 H ₂ O to 0.25 H ₂ O	0.5 % of reading	Dwyer 115 33K6-4-557-1
	0.02 H ₂ O to 3 H ₂ O		Dwyer 209 33K6-4-557-1
	0.1 H ₂ O to 40 H ₂ O	0.36 % of reading	Dwyer 477-2 33K6-4-692-1

Mass, Force & Weighing Devices

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY (\pm)	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
Force (Tension & Compression) ^{FO}	0.1 lb to 100 lb	0.25 % of reading	Class 7 Weight Set NA17-20MM-04
	100 lb to 5 000 lb	0.26 % of reading	Transducer Tech. SW-5K 33K6-4-3196-1
Force (Compression) ^{FO}	5 000 lb to 50 000 lb	0.25 % of reading	Transducer Tech. HSW-50K 33K6-4-3196-1
Bench Scales ^{FO}	0.01 g to 200 g	0.97 mg	Class 4 Weight Set NA17-20MM-04
	0.201 kg to 4.99 kg	0.09 g	
	5 kg to 226.8 kg	210 g	
Floor Scales ^{FO}	227 kg to 2 270 kg	500 g	Class 7 Weight Set NA17-20MM-04



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Time and Frequency

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Equipment to Measure Frequency ^{FO}	0.01 Hz to 20 MHz	2.5×10^{-4} % of setting	HP 3325A 33K3-4-192-1
	0.01 GHz to 2 GHz	4.1×10^{-2} % of setting	HP 8642M 33K4-4-377-1
	2 GHz to 26 GHz	5.5×10^{-5} % of setting	HP 8673A 33K4-4-343-1
Equipment to Output Frequency ^{FO}	0.01 Hz to 100 MHz	2.7×10^{-2} % of reading	HP 5334B 33K3-4-451-1
	100 MHz to 40 GHz	1.0×10^{-4} % of reading	EIP 548A 33K4-4-230-1

Thermodynamic

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY (\pm)	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
Temperature Measurement Thermocouple Type E ^{FO}	-150 °C to 0 °C	0.02 % of reading °C + 0.2 °C	Ectron 1100 33K5-4-240-1
	0 °C to 1 000 °C	0.02 % of reading °C + 0.3 °C	
Temperature Measurement Thermocouple Type J ^{FO}	-150 °C to 0 °C	0.02 % of reading °C + 0.2 °C	
	0 °C to 1 200 °C	0.02 % of reading °C + 0.3 °C	
Temperature Measurement Thermocouple Type K ^{FO}	-150 °C to 0 °C	0.02 % of reading °C + 0.2 °C	
	0 °C to 1 372 °C	0.02 % of reading °C + 0.2 °C	
Temperature Measurement Thermocouple Type T ^{FO}	-150 °C to 0 °C	0.02 % of reading °C + 0.2 °C	
	0 °C to 400 °C	0.02 % of reading °C + 0.2 °C	
Equipment to Measure Humidity at 15 °C to 30 °C ^{FO}	11 % RH	1.5 %	Humidity Salt Solutions CP00426
	33 % RH	1.2 %	
	76 % RH		

1. The CMC (Calibration and Measurement Capability) stated for calibrations included on this scope of accreditation represents the smallest measurement uncertainty attainable by the laboratory when performing a more or less routine calibration of a nearly ideal device under nearly ideal conditions. It is typically expressed at a confidence level of 95 % using a coverage factor k (usually equal to 2). The actual measurement uncertainty associated with a specific calibration performed by the laboratory will typically be larger than the CMC for the same calibration since capability and performance of the device being calibrated and the conditions related to the calibration may reasonably be expected to deviate from ideal to some degree.
2. The laboratories range of calibration capability for all disciplines for which they are accredited is the interval from the smallest calibrated standard to the largest calibrated standard used in performing the calibration. The low end of this range must be an attainable value for which the laboratory has or has access to the standard referenced. Verification of an indicated value of zero in the absence of a standard is common practice in the procedure for many calibrations but by its definition it does not constitute calibration of zero capacity.



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3. The presence of a superscript FO means that the laboratory performs calibration of the indicated parameter both at its fixed location and onsite at customer locations. Example: Outside Micrometer^{FO} would mean that the laboratory performs this calibration at its fixed location and onsite at customer locations.
4. Measurement uncertainties obtained for calibrations performed at customer sites can be expected to be larger than the measurement uncertainties obtained at the laboratories fixed location for similar calibrations. This is due to the effects of transportation of the standards and equipment and upon environmental conditions at the customer site which are typically not controlled as closely as at the laboratories fixed location.
5. The term L represents length in inches or millimeters as appropriate to the uncertainty statement.

