SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017
& ANSI/NCSL Z540-1-1994 & ANSI/NCSL Z540-3-2006

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MICRO QUALITY CALIBRATION LLC or
INTERNATIONAL PROCESS SOLUTIONS

CALIBRATION

Valid To: See Table Below Certificate Number: 2348.01

In recognition of the successful completion of the A2LA evaluation (including an assessment of the organization's compliance with A2LA's – R205 Calibration Program Requirements), accreditation is granted to this laboratory at the locations listed above as well as the satellite laboratory location listed below to perform the following calibrations[1, 8]:

I. Acoustical Quantities

Parameter/Range	Frequency	CMC[2, 9] (±)	Comment	Location[10]
Sound Pressure Level – Measuring Equipment	114 dB @ 251.2 Hz	0.26 dB	Sound level calibrator	ATL
	94 dB @ 1 kHz	0.65 dB		HSV
	114 dB @ 1 kHz	0.97 dB		
Up to 150 dB Measure & Measuring Equipment	(19 to 16 000) Hz	0.25 dB	Acoustics calibrator	RFD
	(16 000 to 20 000) Hz	0.32 dB		

II. Chemical Quantities

Parameter/Equipment	Range	CMC[2] (±)	Comment	Location[10]
pH Meters[3]	4 pH	0.025 pH	pH buffer solutions	TPA, RDU, DFW
	7 pH	0.036 pH		
	10 pH	0.069 pH		
	4 pH	0.039 pH		ATL, SFL
	7 pH	0.03 pH		
	10 pH	0.035 pH		

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Parameter/Equipment	Range	CMC[2] (±)	Comment	Location[10]
pH Meters[3] (cont)	4 pH 7 pH 10 pH 4 pH 7 pH 10 pH	0.035 pH 0.025 pH 0.069 pH 0.018 pH 0.017 pH 0.03 pH	pH buffer solutions	RFD, HRT HSV, COS HLR, MEL
Conductivity Meters[3]	2 µS/cm 100 µS/cm 1000 µS/cm 10 000 µS/cm 100 000 µS/cm 150 000 µS/cm 100 µS/cm 1419 µS/cm 10 000 µS/cm 100 µS/cm 1410 µS/cm 10 000 µS/cm 2 µS/cm 10 µS/cm 100 µS/cm 1000 µS/cm 1413 µS/cm 10 000 µS/cm 100 000 µS/cm 2 µS/cm 5 µS/cm 10 µS/cm 100 µS/cm 500 µS/cm 1 000 µS/cm 10 000 µS/cm 100 000 µS/cm 84 µS/cm 1413 µS/cm 10 000 µS/cm	0.2 µS/cm 0.74 µS/cm 3.6 µS/cm 35 µS/cm 350 µS/cm 580 µS/cm 0.74 µS/cm 5.7 µS/cm 35 µS/cm 0.83 µS/cm 5.3 µS/cm 44 µS/cm 0.2 µS/cm 0.17 µS/cm 0.74 µS/cm 3.6 µS/cm 5.7 µS/cm 36 µS/cm 350 µS/cm 0.2 µS/cm 0.2 µS/cm 0.17 µS/cm 0.74 µS/cm 2.3 µS/cm 3.6 µS/cm 36 µS/cm 350 µS/cm 0.83 µS/cm 5.7 µS/cm 35 µS/cm	Conductivity solutions	TPA ATL HSV RFD, HLR, DFW SEL MEL

Parameter/Equipment	Range	CMC[2] (±)	Comment	Location[10]
Conductivity Meters	0.65 µS/cm 10 µS/cm 100 µS/cm 1000 µS/cm 10 000 µS/cm 100 000 µS/cm 10 µS/cm 500 µS/cm 1000 µS/cm	0.33 µS/cm 0.64 µS/cm 2.1 µS/cm 5 µS/cm 44 µS/cm 400 µS/cm 0.17 µS/cm 2.2 µS/cm 3.6 µS/cm	Conductivity solutions	COS RDU

III. Dimensional

Parameter/Equipment	Range	CMC[2, 4] (±)	Comment	Location[10]
Gage Blocks – Length	Up to 10 in Up to 12 in Up to 13 in Up to 13 in Up to 20 in	(3.3 + 2.2L) µin (4 + 2.3L) µin (1.2 + 2.5L) µin (4 + 2.3L) µin (3.2 + 1.2L) µin	Master gage blocks, P&W universal measuring machine	SFL ATL, HSV, HRT RFD HLR, MEL, COS, RDU, DFW TPA
Micrometers[3]	Up to 18 in Up to 40 in Up to 46 in	(26 + 4.7L) µin (27 + 4.6L) µin (9.3 + 7L) µin (29 + 4.4L) µin	Gage blocks (grade 2)	HRT TPA, MEL, COS, RDU, DFW HSV RFD, ATL, HLR, SFL
Micrometer Standards Length Rods	Up to 40 in Up to 40 in Up to 46 in (1 to 10) in Up to 13 in	(1.1 + 5.7L) µin (4.3 + 3.8L) µin (1 + 7.8L) µin (21 + 1.4L) µin (1.2 + 6.9L) µin	Gage blocks (grade 2), P&W universal measuring machine, dial comparator, bench micrometer	RFD TPA HSV, RDU HLR, COS, HRT, MEL, ATL, DFW

Parameter/Equipment	Range	CMC[2, 4] (±)	Comment	Location[10]
Laser Micrometer[3]	(0 to 1.5) in (0 to 1.2) in (0 to 10.5) mm	88 µin 72 µin 0.68 µm	Comparison to pin gages	HRT COS
Calipers[3]	Up to 24 in (24 to 80) in Up to 40 in Up to 46 in Up to 80 in	(284 + 1.6*L*) µin (231 + 3.6*L*) µin (280 + 2*L*) µin (76 + 7*L*) µin (280 + 1.7*L*) µin (280 + 3.4*L*) µin	Gage blocks (grade 2)	HLR TPA, HRT, MEL, COS, RDU, DFW ATL RFD, SFL, RDU HSV
Dial Indicators[3] Resolution: ≥ 50 µin	Up to 10 in	(26 + 3.9*L*) µin	Gage blocks (grade 2)	TPA, ATL, HSV, RFD, HRT, HLR, SFL, MEL, COS, RDU, DFW
< 50 µin	Up to 0.1 in	7 µin 7.7 µin 8.3 µin 9.4 µin 10 µin		RFD TPA ATL, COS, RDU, DFW HLR, SFL HSV, HRT, MEL

Parameter/Equipment	Range	CMC[2, 4] (±)	Comment	Location[10]
Height Gages[3]	Up to 40 in Up to 40 in Up to 46 in Up to 46 in Up to 46 in Up to 46 in Up to 46 in	(110 + 3.3*L*) µin (94 + 2.9*L*) µin (100 + 1.6*L*) µin (78 + 5.3*L*) µin (150 + 2.4*L*) µin (240 + 1.5*L*) µin (100 + 2.9*L*) µin	Gage blocks (grade 2)	TPA RFD, COS, HRT, MEL, RDU, DFW ATL HSV HLR SFL RDU
Protractors[3]	(0 to 360)°	0.008° (29 s) 0.015° (54 s) 0.019 ° (68 s) 0.013° (47 s)	Angle blocks, gage blocks, sine bar	TPA, HSV, RFD HRT MEL ATL, SFL, COS, RDU, HLR, DFW
Rulers[3]	Up to 46 in Up to 72 in	0.009 in 0.009 in	Gage blocks (grade 2)	TPA, ATL, HSV, HLR, SFL, MEL, COS, RDU, HRT, DFW RFD
Radius Gages	(0.016 to 1) in (0.016 to 1) in (0.01 to 1) in (0.01 to 1) in	220 µin 240 µin 290 µin 300 µin	Optical comparator	TPA, ATL, RFD, HLR, MEL, DFW, RDU
Tape Measures[3]	Up to 100 ft Up to 150 ft	(0.00026*F* + 0.026) in (0.00028*F* + 0.024) in	Standard rule	MEL, RFD, SFL, TPA, HLR, COS, RDU, HSV, DFW HRT
Feeler Gage	Up to 1 in Up to 1 in Up to 1 in Up to 1 in	31 µin 36 µin 45 µin 52 µin	Supermicrometer™ C	TPA, ATL, RFD, SFL, COS, RDU, DFW HSV HRT, MEL HLR

Parameter/Equipment	Range	CMC[2, 4] (±)	Comment	Location[10]
Bore Micrometers				
2 Point	Up to 8 in Up to 12 in Up to 12 in	(7 + 2*L*) µin (22 + 3.9*L*) µin (56 + 3.2*L*) µin	Master gage blocks, P&W universal measuring machine	RFD TPA, ATL, HLR, MEL HSV, COS, RDU, DFW
3 Point	Up to 12 in Up to 12 in Up to 8 in Up to 3 in (0.125 to 3.5) in (0.25 to 3.2) in (0.125 to 2) in (0.625 to 3) in	(8.8 + 42*L*) µin (64 + 3.1*L*) µin (42 + 1.4*L*) µin (57 + 2.8*L*) µin (29 + 5.9*L*) µin (23 + 26*L*) µin (15 + 8.8*L*) µin (57 + 14*L*) µin	Master ring	TPA HSV RFD COS, DFW ATL HLR MEL RDU
Cylindrical Gages –				
Plain Rings	Up to 14 in Up to 14 in (0.04 to 14) in (0.02 to 8) in Up to 13 in Up to 10 in Up to 12 in (0.04 to 14) in	(8.1 + 2.9*D*) µin (9.8 + 3*D*) µin (9.6 + 2.1*D*) µin (11 + 2.2*D*) µin (9.3 + 1.5*D*) µin (14 + 2*D*) µin (8.1 + 2.1*D*) µin (11 + 3.2*D*) µin	Master gage blocks, P&W universal measuring machine	TPA HSV RFD HRT, DFW HLR SFL ATL MEL, COS, RDU
Plain Pin, Plugs	Up to 13 in Up to 13 in Up to 13 in Up to 14 in Up to 8 in Up to 13 in Up to 10 in Up to 11 in (0.04 to 14) in (0.04 to 13) in	(6.8 + 3.3*D*) µin (10 + 3.1*D*) µin (11 + 2.5*D*) µin (4.8 + 2.3D)µin (10 + 3*D*) µin (4.2 + 3.4*D*) µin (10 + 2.9*D*) µin (5.2 + 2.1*D*) µin (14 + 2*D*) µin (5.3 + 2.3*D*) µin		RDU COS MEL HLR HRT, DFW RFD HSV SFL ATL TPA
NPT Thread Plugs				
Major Diameter Pitch Diameter	Up to 12 in Up to 12 in	55 µin 120 µin	Bench micrometer, Thread wire set, pipe taper sine block	TPA, RFD, MEL, COS, DFW, RDU
Parallelism & Straightness	(0 to 0.01) in (0 to 4) in	13 µin 110 µin	Gage amplifier, surface plate	RFD, RDU MEL, DFW

Parameter/Equipment	Range	CMC[2, 4] (±)	Comment	Location[10]
Thread Plugs –				
Major Diameter Pitch Diameter	Up to 12 in Up to 12 in	36 µin 92 µin	B & S 599-246-00, thread wire set, gage blocks, Labmaster, Supermicrometer™	TPA
Major Diameter Pitch Diameter	Up to 12 in Up to 12 in	50 µin 97 µin		ATL
Major Diameter Pitch Diameter	Up to 12 in Up to 12 in	40 µin 92 µin		HSV
Major Diameter Pitch Diameter	Up to 12 in Up to 12 in	44 µin 79 µin		RFD
Major Diameter Pitch Diameter	Up to 12 in Up to 12 in	65 µin 110 µin		HLR
Major Diameter Pitch Diameter	Up to 10 in Up to 10 in	43 µin 94 µin		HRT
Major Diameter Pitch Diameter	Up to 12 in Up to 12 in	62 µin 99 µin		MEL
Major Diameter Pitch Diameter	Up to 10 in Up to 10 in	50 µin 97 µin		SFL
Major Diameter Pitch Diameter	Up to 10 in Up to 10 in	44 µin 79 µin		COS, DFW
Major Diameter Pitch Diameter	Up to 10 in Up to 10 in	53 µin 98 µin		RDU
Solid Thread Rings	(0.625 to 12) in	110 µin	Labmaster, measuring machine	RFD
Pitch Diameter	Up to 12 in Up to 12 in Up to 12 in	110 µin 98 µin 120 µin		TPA COS, DFW RDU
Adjustable Thread Rings				
Pitch Diameter (Tactile Fit)	Up to 12 in	(350 + 47*D*) µin	Thread setting plug gages	TPA, ATL, RFD, RDU, MEL, COS, HLR, DFW
Rotary Encoders – Angle [3]	(0 to 360)°	24 arc sec	Rotary encoder	COS

Parameter/Equipment	Range[4]	CMC[2] (±)	Comment	Location[10]
Thread Wires	Up to 0.5*D* Up to 0.5*D*	10 µin 11 µin	Master gage blocks, P&W universal measuring machine	TPA, RFD HSV, COS, RDU, DFW
Surface Plates[3] –				
Local Area Flatness	(-0.001 to 0.001) in (-0.001 to 0.001) in	72 µin 68 µin	Repeat-o-meter Planekator, leveling system	RDU TPA, ATL, HSV, HLR, RFD, HRT, MEL, COS, DFW
Overall Flatness	(12 x 12) in to (6 × 12) ft (12 x 12) in to (6 × 12) ft (12 x 12) in to (6 × 12) ft (12 x 12) in to (6 × 12) ft (12 x 12) in to (6 × 12) ft	110 µin 130 µin 79 µin 66 µin 86 µin		MEL TPA ATL, HLR, HSV, RFD HRT COS, RDU, DFW
Optical Comparators[3] –				
Angle Linearity Magnification	Up to 360 ° Up to 20 in (20 to 40) in 10x to 100x	0.0087 ° 210 µin 450 µin 340 µin	Gage blocks, angle blocks, glass scales, precision balls	TPA
Angle Linearity Magnification	Up to 360 ° Up to 20 in (20 to 40) in 10x to 100x	0.008 7 ° 320 µin 630 µin 420 µin		HSV
Angle Linearity Magnification	Up to 360 ° Up to 20 in (20 to 40) in 10x to 100x	0.042 ° 320 µin 630 µin 420 µin		RFD
Angle Linearity Magnification	Up to 360 ° Up to 20 in (20 to 40) in 10x to 100x	0.016 ° 320 µin 630 µin 430 µin		COS, RDU, DFW
Angle Linearity Magnification	Up to 360 ° Up to 20 in (20 to 40) in (10 to 100) x	0.02 ° 190 µin 350 µin 250 µin		MEL

Parameter/Equipment	Range	CMC[2, 9] (±)	Comment	Location[10]
Roughness – Measure	123 µin Ra 117 µin Ra 116 µin Ra 3 µm Ra	3.2 µin 2.5 µin 2.9 µin 0.06 µm	Mitutoyo SV-3200H4 surface measuring system & roughness specimens	RFD
Roughness Testers[3]	117 µin Ra 370 µin Rmax	1.3 µin	Comparison to roughness specimen	HSV
Coating Thickness Gages[3] Eddy Current & Magnetic Induction	 (0.737 to 100) mils (100 to 243) mils (14 to 202) mils (0.9 to 20) mils (0.48 to 38.9) mils	 26 µin 240 µin 63 µin 62 µin 69 µin	 Coating thickness standards, Foils, Supermicrometers™	 TPA HLR MEL HSV
Ultrasonic Thickness Gauges[3]	Up to 10 in Up to 10 in	110 µin 590 µin	Gage blocks	TPA, HSV MEL
Coating Thickness Shims	(0 to 243) mils (0 to 243) mils	57 µin 69 µin	Supermicrometer™ Model C	TPA, HSV HLR, MEL, DFW, RDU
Crimp Tools[3]	(0.011 to 1) in (0.011 to 0.5) in	150 µin 240 µin	Micrometer, pin gages	TPA, HLR, HSV, HRT, COS, MEL, DFW, RDU
Pi Tapes [3]	Up to 3 in	450 µin	Comparison to plug gages	HRT
Microscopes	Up to 2 in Up to 1 in Up to 25mm	100 µin 100 µin 2.6 µm	Comparison to stage micrometer	HRT, HSV COS

IV. Dimensional Testing[5]

Parameter/Equipment	Range	CMC[2, 4] (±)	Comment	Location[10]
Length	X Axis (0.01 to 10) in Y Axis (0.01 to 6) in	160 µin 120 µin	Optical comparator	TPA, RFD, MEL, RDU
	X Axis (0.01 to 8) in Y Axis (0.01 to 4) in	160 µin 120 µin		ATL
	X Axis (0.01 to 5.0) in Y Axis (0.01 to 3.0) in	340 µin 340 µin		HSV
	X Axis (0.01 to 8) in Y Axis (0.01 to 4) in	180 µin 180 µin		HLR
	(0 to 480) in	(0.8 + 2.6*L*) µin	Laser measurement system	COS
Angle	Up to 360 °	0.006 °	Optical comparator	TPA, RFD, HLR, RDU ATL, MEL
General Inspection				
X Axis	(0 to 33) in (0 to 838) mm	(80 + 3.6*L*) µin (2.1 + 0.003 6*L*) µm	CMM	RFD
Y Axis	(0 to 60) in (0 to 1524) mm	(200 + 0.13*L*) µin (5.1 + 0.000 13*L*) µm		
Z Axis	(0 to 20) in (0 to 508) mm	(200 + 0.13L) µin (5.1 + 0.000 13*L*) µm		

V. Electrical – DC/Low Frequency

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
Phase Angle[3] – Generate	**(-180 to 180) °** (10 to 65) Hz (65 to 500) Hz 500 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	 0.08° 0.19° 0.38° 1.9° 3.8° 7.6°	Fluke 5560A,5522A multiproduct calibrator	TPA, ATL, RFD, HRT, MEL, COS, RDU,HSV, SFL, HLR, DFW
Phase Angle – Generate, 5 V Equal Amplitude 50 mV to 120 V Unequal Amplitude	**(0 to 360)°** 1 Hz to 1 kHz (1 to 6.25) kHz (6.25 to 50) kHz (50 to 200) kHz **(0 to 360)°** 1 Hz to 1 kHz (1 to 6.25) kHz (6.25 to 50) kHz (50 to 200) kHz	 0.005° 0.01° 0.015° 0.04° 0.005° 0.01° 0.015° 0.04°	Clarke-Hess 5600, 5500-2 phase standard	TPA, RFD

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
Phase Angle – Measure 10 mV to 630 V	**(0 to 360)°** 5 Hz to 2 kHz (2 to 5) kHz (5 to 10) kHz (10 to 50) kHz (50 to 100) kHz (100 to 200) kHz	 0.02° 0.03° 0.04° 0.05° 0.1° 0.2°	Clarke-Hess 6000A phase meter	TPA, RFD
Phase Angle – Measure 50 mV to 120 V	**(0 to 360)°** 1 Hz to 1 kHz (1 to 50) kHz (1 to 50) kHz (50 to 200) kHz (5 to 50) kHz (50 to 200) kHz (5 to 50) kHz (50 to 200) kHz	 0.001° 0.002° 0.002° 0.008° 0.002° 0.008° 0.002° 0.008°	 Clarke-Hess 5002A phase bridge Clarke-Hess 5002B phase bridge Clarke-Hess 5002C phase bridge Clarke-Hess 5002D phase bridge	TPA, RFD
DC Current – Generate[3]	(1 to 1.2) nA (1.2 to 12) nA (12 to 120) nA (0.12 to 1.2) µA (1.2 to 10) µA	92 µA/A + 0.007 nA 92 µA/A + 0.007 nA 92 µA/A + 0.01 nA 36 µA/A + 0.1 nA 13 µA/A + 1 nA	Fluke 5730A multifunction calibrator & Fluke 5560A multiproduct calibrator	TPA, RFD, MEL, RDU, COS, DFW, HSV
	(1 to 1.2) nA (1.2 to 12) nA (12 to 120) nA (0.12 to 1.2) µA (1.2 to 10) µA	92 µA/A + 0.007 nA 92 µA/A + 0.007 nA 92 µA/A + 0.01 nA 36 µA/A + 0.1 nA 19 µA/A + 1 nA	Fluke 5720A multifunction calibrator & Fluke 5560A multiproduct calibrator	ATL
	(1 to 1.2) nA (1.2 to 12) nA (12 to 120) nA (0.12 to 1.2) µA (1.2 to 10) µA	93 µA/A + 0.007 nA 92 µA/A + 0.007 nA 92 µA/A + 0.01 nA 36 µA/A + 0.1 nA 15 µA/A + 1 nA	Fluke 5730A multifunction calibrator & Fluke 5522A multiproduct calibrator	HSV

Parameter/Equipment	Range	CMC[2, 7] (±)	Comment	Location[10]
DC Current – Generate[3]	(1 to 1.2) nA (1.2 to 12) nA (12 to 120) nA (0.12 to 1.2) µA (1.2 to 10) µA	99 µA/A + 0.007 nA 99 µA/A + 0.007 nA 99 µA/A + 0.01 nA 36 µA/A + 0.1 nA 19 µA/A + 1 nA	Fluke 5700A multifunction calibrator & Fluke 5560A multiproduct calibrator	HRT
	(1 to 1.2) nA (1.2 to 12) nA (12 to 120) nA (0.12 to 1.2) µA (1.2 to 10) µA	93 µA/A + 0.007 nA 92 µA/A + 0.007 nA 92 µA/A + 0.01 nA 36 µA/A + 0.1 nA 20 µA/A + 1 nA	Fluke 5720A multifunction calibrator & Fluke 5522A multiproduct calibrator	HLR, SFL
	(10 to 220) µA 220 µA to 2.2 mA (2.2 to 22) mA (22 to 100) mA (100 to 220) mA (0.22 to 1) A (1 to 2.2) A	38 µA/A + 5 nA 30 µA/A + 7 nA 30 µA/A + 44 nA 38 µA/A + 0.7 µA 45 µA/A + 0.7 µA 68 µA/A + 12 µA 110 µA/A + 12 µA	Fluke 5720A, 5730A multifunction calibrator	TPA, ATL, HSV, RFD, HLR, SFL, MEL, COS, RDU, DFW
	(10 to 220) µA 220 µA to 2.2 mA (2.2 to 22) mA (22 to 100) mA (100 to 220) mA (0.22 to 1) A (1 to 2.2) A	46 µA/A + 8 nA 46 µA/A + 8 nA 46 µA/A + 82 nA 53 µA/A + 0.9 µA 61 µA/A + 0.9 µA 72 µA/A + 23 µA 110 µA/A + 23 µA	Fluke 5700A multifunction calibrator	HRT
DC Current – Generate[3]	(2.2 to 11) A	270 µA/A + 370 µA	Fluke 5720A, 5730A multifunction calibrator w/5725A transconductance amplifier	HSV, HLR, SFL
	(11 to 20.5) A	760 µA/A + 580 µA	Fluke 5522A multiproduct calibrator	
	(2.2 to 3.1) A (3.1 to 12) A (12 to 30) A	230 µA/A + 120 µA 230 µA/A + 190 µA 760 µA/A + 390 µA	Fluke 5560A multiproduct calibrator	TPA, RFD, MEL, ATL, RDU,COS, HRT, HSV, DFW
	(12 to 20) A (20 to 100) A	76 µA/A + 0.76 mA 76 µA/A + 3.8 mA	Fluke 5560A /52120A amplifier	TPA, RFD

Parameter/Equipment	Range	CMC[2, 7] (±)	Comment	Location[10]
DC Current – Clamp Meters[3]	(1.2 to 200) A (6 to 1000) A	0.21 % of output + 0.008 A 0.21 % of output + 0.024 A	Fluke 5560A multiproduct calibrator w/9100-200 x10/x50 coil	COS, HRT, HSV
	(1.2 to 200) A (6 to 1000) A	0.21 % of output + 0.028 A 0.21 % of output + 0.04 A	Fluke 5522A multiproduct calibrator w/9100-200 x10/x50 coil	SFL, HLR
	(3.1 to 300.2) A	0.65 % of output + 0.014 A	Fluke 5560A multiproduct calibrator w/55xxA x1/x2/x10 coil	RDU
DC Current – Clamp Meters[3] Toroidal-Wound	(0.6 to 600) A (600 to 1000) A	0.19 % of output + 0.04 A 0.20 % of output + 0.04 A	Fluke 5560A multiproduct calibrator w/5500A coil x50	TPA, RFD, MEL, ATL, COS, HSV, DFW, RDU
	(0 to 1025) A	0.2 % of output + 0.05 A	Fluke 5522A multiproduct Calibrator w/5500A coil x50	HSV
DC Current – Clamp Meters Other[3]	(0.6 to 600) A (600 to 1000) A	0.38 % of output + 0.38 A 0.39 % of output + 0.38 A	Fluke 5560A multiproduct calibrator w/5500A coil x50	TPA, RFD, MEL, ATL, COS, HSV, DFW, RDU
	(0 to 1025) A	0.39 % of output + 0.38 A	Fluke 5522A multiproduct calibrator w/5500A coil x50	HSV

Parameter/Equipment	Range	CMC[2, 7] (±)	Comment	Location[10]
DC Current – Measure[3]	(1 to 10) nA (10 to 100) nA (0.1 to 1) µA (1 to 10) µA (10 to 100) µA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA	18 µA/A + 0.15 pA 6.0 µA/A + 1.5 pA 4.8 µA/A + 0.015 nA 4.4 µA/A + 0.015 nA 4.4 µA/A + 0.15 nA 4.4 µA/A + 0.0015 µA 4.4 µA/A + 0.015 µA 9.9 µA/A + 0.15 µA	Agilent 3458A multimeter option 002, Fluke 5450A resistance calibrator	TPA, RFD
	(1 to 10) nA (10 to 100) nA (0.1 to 1) µA (1 to 10) µA	35 µA/A + 0.1 pA 12 µA/A + 1 pA 8.3 µA/A + 0.01 nA 6.9 µA/A + 0.1 nA	Fluke 5730A multifunction calibrator Agilent 3458A option 002 multimeter	MEL, COS RDU, HSV, DFW
	(1 to 10) nA (10 to 100) nA (0.1 to 1) µA (1 to 10) µA	35 µA/A + 0.1 pA 18 µA/A + 1 pA 10 µA/A + 0.01 nA 8.3 µA/A + 0.1 nA	Fluke 5720A multifunction calibrator, Agilent 3458A multimeter option 002	ATL, HLR, SFL
	(1 to 10) nA (10 to 100) nA (0.1 to 1) µA (1 to 10) µA	35 µA/A + 0.12 pA 18 µA/A + 1.2 pA 13 µA/A + 0.01 nA 12 µA/A + 0.12 nA	Fluke 5700A/03 multifunction calibrator Agilent 3458A option 002 multimeter	HRT
	(10 to 100) µA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	13 µA/A + 0.5 nA 13 µA/A + 3 nA 13 µA/A + 0.03 µA 23 µA/A + 0.3 µA 72 µA/A + 6.6 µA	Agilent 3458A multimeter	TPA, MEL, COS, HSV HRT, HLR SFL, RDU
	(0.1 to 20.2) µA (20.2 to 202) µA (0.202 to 2.02) mA (2.02 to 20.2) mA (20.2 to 202) mA (0.202 to 2.02) A (2.02 to 20.2) A (20.2 to 30.2) A	26 µA/A + 0.4 nA 9.9 µA/A + 0.4 nA 9.1 µA/A + 4 nA 14 µA/A + 0.04 µA 56 µA/A + 1.0 µA 130 µA/A + 0.2 mA 230 µA/A + 0.5 mA 540 µA/A + 4.3 mA	Fluke 8588A multimeter	RFD, ATL, DFW
	(0.1 to 20.2) µA (20.2 to 202) µA (0.202 to 2.02) mA (2.02 to 20.2) mA (20.2 to 202) mA (0.202 to 2.02) A	30 µA/A + 0.4 nA 11 µA/A + 0.5 nA 11 µA/A + 5 nA 15 µA/A + 0.05 µA 58 µA/A + 1.5 µA 150 µA/A + 0.2 mA	Fluke 8558A multimeter	RDU

Parameter/Equipment	Range	CMC[2, 6, 7] (±)	Comment	Location[10]
DC Current – Measure[3]	(1 to 10) A (10 to 100) A (100 to 300) A	7.3 µA/A + 3.4 µA 7.3 µA/A + 34 µA 7.3 µA/A + 340 µA	Agilent 3458A multimeter option 002, MI 6311A current divider	TPA
	(1 to 10) A (10 to 100) A	46 µA/A + 90 µA 47 µA/A + 0.09 mA	Agilent 3458A option 002 multimeter standard resistor L&N 4361 current shunt	ATL
	(1 to 10) A (10 to 100) A	45 µA/A + 90 µA 46 µA/A + 0.09 mA		COS, DFW
	(1 to 10) A (10 to 100) A	35 µA/A + 85 µA 44 µA/A + 0.09 mA		RFD
	(1 to 10) A (10 to 100) A	34 µA/A + 90 µA 39 µA/A + 0.09 mA		MEL
	(1 to 3) A (3 to 10) A	760 µA/A + 460 µA 1.1 mA/A + 610 µA	Fluke 8845A multimeter	RDU, HSV, HRT
	(300 to 1 000) A	0.25 % of rdg + 8 mA	Agilent 3458A multimeter option 002, Empro current shunts	TPA
	(10 to 250) A	0.25 % of rdg + 0.02 A		RDU
	(1 to 1000) A	0.25 % of rdg		MEL, COS, DFW
	(1 to 500) A	0.26 % of rdg		SFL
	(1 to 1000) A	0.26 % of rdg		HLR
	(10 to 100) A	0.25 % of rdg		HRT
	(1 to 1000) A	0.25 % of rdg		RFD
	(1 to 500) A	0.27 % of rdg		ATL
	(1 to 600) A	0.27 % of rdg		HSV

Parameter/Equipment	Range	CMC[2, 7] (±)	Comment	Location[10]
DC Voltage – Generate[3]	(0 to 220) mV 220 mV to 2.2 V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V	6.8 µV/V + 0.8 µV 4.6 µV/V + 0.9 µV 3 µV/V + 2.5 µV 3 µV/V + 3.9 µV 4.6 µV/V + 38 µV 6.1 µV/V + 390 µV	Fluke 5720A, 5730A multifunction calibrator	TPA, ATL, HSV, RFD, HLR, SFL, MEL, COS, RDU, DFW
	(0 to 220) mV 220 mV to 2.2 V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1000) V	6.8 µV/V + 0.9 µV 6.1 µV/V + 0.9 µV 6.1 µV/V + 3.2 µV 6.1 µV/V + 6.2 µV 6.8 µV/V + 76 µV 8.4 µV/V + 460 µV	Fluke 5700A multifunction calibrator	HRT
	(0 to 120) mV 120 mV to 1.2 V (1.2 to 12) V (12 to 120) V (120 to 1020) V	9.1 µV/V + 0.9 µV 6.3 µV/V + 1.0 µV 6.1 µV/V + 7.7 µV 8.4 µV/V + 76 µV 8.4 µV/V + 760 µV	Fluke 5560A multiproduct calibrator	COS, HRT, MEL, ATL RDU, TPA, RFD, HSV, DFW
High Voltage –Generate[3]	(1 to 6) kV	2.4 % of output + 10 V	3565D tester high voltage	HLR
DC Voltage – Measure[3]	(0 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 1000) V	3.3 µV/V + 1 µV 2.6 µV/V + 1 µV 2.6 µV/V + 1.5 µV 3.9 µV/V + 20 µV 3.9 µV/V + 66 µV + 12 µV/V x (Vin/1 000) ^2	Agilent 3458A multimeter option 002	TPA, ATL, HSV, RFD, HRT, HLR, MEL, COS, RDU, SFL, DFW
	(0 to 220) mV (0.202 to 2.02) V (2.02 to 20.2) V (20.2 to 202) V (202 to 1000) V	7.3 µV/V + 0.7 µV 2.8 µV/V + 0.8 µV 2.8 µV/V + 0.8 µV 4.2 µV/V + 30 µV 4.3 µV/V + 0.49 mV	Fluke 8588A multimeter	ATL, RFD, DFW
	(0 to 220) mV (0.202 to 2.02) V (2.02 to 20.2) V (20.2 to 202) V (202 to 1000)	6.3 µV/V + 0.7 µV 4 µV/V + 0.8 µV 4 µV/V + 0.8 µV 6.5 µV/V + 30 µV 6.5 µV/V + 99 µV	Fluke 8558A multimeter	RDU
	(1 to 60) kV (12 to 120) kV	0.035 % of rdg 0.018 % of rdg	Ross VD60 HV divider, Agilent 3458A multimeter Ross VD120 HV divider, Agilent 3458A multimeter	TPA

Parameter/Equipment	Range	CMC[2, 6, 7] (±)	Comment	Location[10]
DC High Voltage – Measure[3]	(0 to 1) kV (1 to 10) kV (10 to 70) kV	0.03 % of rdg +0.000032 kV 0.03 % of rdg + 0.000 12 kV + 1.5 µV/V x (Vin/1 000) ^2 0.04% of rdg + 0.001kV + 0.14 µV/V x (Vin/1 000) ^2	Vitrek 4700 Digital HV Meter Vitrek 4700 Digital HV Meter w/HVL-70 High Voltage Probe	DFW
	(1 to 60) kV	0.1 % of rdg	Ross VD60 HV divider, Agilent 34401A multimeter	ATL, HRT, HLR,RDU, MEL, COS
	(1 to 150) kV	0.1 % of rdg	Ross VD150 HV divider, Agilent 34401A multimeter	HSV, RDU
	(1 to 30) kV	0.1 % of rdg	Ross VD30 HV divider, Fluke 89 IV multimeter	HSV
	(1 to 30) kV	0.1 % of rdg	Ross VD30 HV divider, Fluke 287 multimeter	COS
	(0 to 1) kV (1 to 10) kV (1 to 60) kV (1 to 120) kV	0.03 % of rdg + 0.000 032 kV 0.03 % of rdg + 0.000 12 kV + 1.5 µV/V x (Vin/1 000) ^2 0.1 % of rdg 0.1 % of rdg	Vitrek 4700 digital HV meter Ross VD60 HV divider, Agilent 34401A multimeter Ross VD60, VD120 HV divider, Agilent 34401A multimeter	RFD
	(1 to 40) kV	2.3 % of rdg	Fluke 80k-40 HV probe, Agilent 34401A multimeter	SFL

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
DC Voltage – Measure Fixed Points	100 mV 1 V 10 V 100 V 1000 V	3.1 µV/V 0.46 µV/V 0.3 µV/V 0.34 µV/V 0.48 µV/V	Fluke 732B reference standard, 752A voltage divider	TPA
	100 mV 1 V 10 V 100 V 1000 V	3.1 µV/V 0.61 µV/V 0.5 µV/V 0.52 µV/V 0.63 µV/V	Fluke 732A reference standard, 752A voltage divider	RFD
AC Voltage – Generate[3]	**(0.22 to 2.2) mV** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz **(2.2 to 22) mV** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	 230 µV/V + 3.9 µV 88 µV/V + 3.9 µV 76 µV/V + 3.9 µV 190 µV/V + 3.9 µV 460 µV/V + 4.6 µV 990 µV/V + 9.2 µV 1.3 mV/V + 19 µV 2.6 mV/V + 19 µV 230 µV/V + 3.9 µV 88 µV/V + 3.9 µV 76 µV/V + 3.9 µV 190 µV/V + 3.9 µV 460 µV/V + 4.6 µV 990 µV/V + 9.2 µV 1.3 mV/V + 19 µV 2.6 mV/V + 19 µV	Fluke 5720A,5730A multifunction calibrator	TPA, MEL, HSV, RFD, COS, RDU, ATL, SFL, HLR, DFW
	(22 to 220) mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz **220 mV to 2.2 V** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	 230 µV/V + 11.4 µV 88 µV/V + 6.1 µV 53 µV/V + 6.1 µV 110 µV/V + 6.1 µV 300 µV/V + 15 µV 610 µV/V + 19 µV 1.3 mV /V + 23 µV 2.5 mV /V + 46 µV 230 µV/V + 38 µV 84 µV/V + 15 µV 37 µV/V + 8 µV 61 µV/V + 9 µV 76 µV/V + 30 µV 300 µV/V + 76 µV 910 µV /V + 190 µV 1.5 mV/V + 304 µV	Fluke 5730A multifunction calibrator	TPA, MEL, HSV, RFD, COS, RDU, DFW

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
AC Voltage – Generate[3]	**(22 to 220) mV** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz **220 mV to 2.2 V** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	 230 µV/V + 11 µV 88 µV/V + 6.1 µV 76 µV/V + 6.1 µV 190 µV/V + 6.1 µV 460 µV/V + 15 µV 840 µV/V + 19 µV 1.3 mV/V + 23 µV 2.5 mV/V + 46 µV 230 µV/V + 38 µV 84 µV/V + 15 µV 40 µV/V + 8 µV 68 µV/V + 9 µV 99 µV/V + 30 µV 380 µV/V + 76 µV 910 µV/V + 190 µV 1.5 mV/V + 300 µV	Fluke 5720A, multifunction calibrator	ATL, SFL HLR
	(2.2 to 22) V (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz **(22 to 220) V** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	 230 µV/V + 380 µV 84 µV/V + 152 µV 37 µV/V + 54 µV 61 µV/V + 91 µV 76 µV/V + 190 µV 230 µV/V + 610 µV 910 µV/V + 1.9 mV 1.4 mV/V + 3 mV 230 µV/V + 3.8 mV 84 µV/V + 1.5 mV 49 µV/V + 0.6 mV 76 µV/V + 0.9 mV 140 µV/V + 2.3 mV	Fluke 5720A,5730A multifunction calibrator	TPA, MEL, HSV, RFD COS, RDU, ATL, SFL HLR, DFW
	(220 to 750) V 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz **(750 to 1000) V** 40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	 68 µV/V + 3 mV 130 µV/V + 5 mV 460 µV/V + 8 mV 1.8 mV/V + 34 mV 68 µV/V + 3 mV 130 µV/V + 5 mV 460 µV/V + 8 mV	Fluke 5700A,5720A, 5730A multifunction calibrator / Fluke 5725A amplifier	TPA, MEL, HSV, RFD COS, RDU ATL, SFL HLR, HRT, DFW

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
AC Voltage – Generate[3]	**(0.22 to 2.2) mV** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz **(2.2 to 22) mV** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz **(22 to 220) mV** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz **220 mV to 2.2 V** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz **(2.2 to 22) V** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz **(22 to 220) V** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	 460 µV/V + 3.9 µV 180 µV/V + 3.9 µV 91 µV/V + 3.9 µV 310 µV/V + 3.9 µV 720 µV/V + 6.1 µV 990 µV/V + 11 µV 1.4 mV/V + 23 µV 3.7 mV/V + 30 µV 460 µV/V + 4.6 µV 180 µV/V + 4.6 µV 91 µV/V + 4.6 µV 310 µV/V + 4.6 µV 720 µV/V + 6.1 µV 990 µV/V + 11 µV 1.4 mV/V + 23 µV 3.7 mV/V + 30 µV 460 µV/V + 12 µV 180 µV/V + 7.6 µV 84 µV/V + 7.6 µV 270 µV/V + 7.6 µV 690 µV/V + 23 µV 840 µV/V + 23 µV 1.4 mV/V + 30 µV 2.7 mV/V + 76 µV 460 µV/V + 8 µV 140 µV/V + 23 µV 65 µV/V + 5 µV 110 µV/V + 15 µV 210 µV/V + 61 µV 370 µV/V + 110 µV 910 µV /V + 300 µV 1.8 mV/V + 761 µV 460 µV/V + 760 µV 140 µV/V + 230 µV 65 µV/V + 54 µV 110 µV/V + 150 µV 210 µV/V + 300 µV 460 µV/V + 1300 µV 1.1 mV/V + 3800 µV 2.3 mV/V + 6800 µV 457 µV/V + 7.6 mV 137 µV/V + 2.4 mV 68 µV/V + 1.0 mV 190 µV/V + 3.1 mV 457 µV/V + 7.6 mV	Fluke 5700A multifunction calibrator	HRT

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
AC Voltage – Generate[3]	**(1 to 12) mV** (3 to 5) Hz (5 to 10) Hz 10 Hz to 20 KHz (20 to 50) KHz (50 to 100) KHz (100 to 300) KHz (300 to 500) KHz **(12 to 120) mV** (3 to 5) Hz (5 to 10) Hz 10 Hz to 20 KHz (20 to 50) KHz (50 to 100) KHz (100 to 300) KHz (300 to 500) KHz **(0.12 to 1.2) V** (3 to 5) Hz (5 to 10) Hz (10 to 40) Hz 40 Hz to 20 KHz (20 to 50) KHz (50 to 100) KHz (100 to 300) KHz (300 to 500) KHz **(1.2 to 12) V** (3 to 5) Hz (5 to 10) Hz (10 to 40) Hz 40 Hz to 20 KHz (20 to 50) KHz (50 to 100) KHz (100 to 300) KHz (300 to 500) KHz **(12 to 70) V** (3 to 5) Hz (5 to 10) Hz (10 to 40) Hz 40 Hz to 20 KHz (20 to 50) KHz (50 to 100) KHz (100 to 300) KHz **(70 to 120) V** (3 to 5) Hz (5 to 10) Hz (10 to 40) Hz 40 Hz to 20 KHz (20 to 50) KHz (50 to 100) KHz	 0.19 % + 5.3 µV 0.067 % + 5.3 µV 0.011 % + 4.6 µV 0.029 % + 4.6 µV 0.11 % + 11 µV 0.61 % + 23 µV 0.61 % + 23 µV 0.19 % + 5.3 µV 0.067 % + 5.3 µV 0.011 % + 4.6 µV 0.027 % + 6.1 µV 0.061 % + 15 µV 0.15 % + 23 µV 0.15 % + 23 µV 0.19 % + 57 µV 0.067 % + 53 µV 0.011 % + 46 µV 0.011 % + 6 µV 0.023 % + 11 µV 0.053 % + 30 µV 0.15 % + 61 µV 0.15 % + 61 µV 0.19 % + 0.57 mV 0.067 % + 0.57 mV 0.011 % + 0.27 mV 0.011 % + 0.04 mV 0.023 % + 0.04 mV 0.053 % + 0.10 mV 0.15 % + 0.46 mV 0.15 % + 0.46 mV 0.19 % + 5.7 mV 0.067 % + 5.7 mV 0.011 % + 2.7 mV 0.011 % + 0.38 mV 0.023 % + 0.38 mV 0.053 % + 1.0 mV 0.15 % + 15 mV 0.19 % + 5.7 mV 0.067 % + 5.7 mV 0.011 % + 2.7 mV 0.011 % + 0.38 mV 0.023 % + 0.38 mV 0.053 % + 1.0 mV	Fluke 5560A multiproduct calibrator	COS, HRT, MEL, ATL RDU, TPA, RFD, HSV, DFW

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
AC Voltage – Generate[3]	**(120 to 330) V** (3 to 5) Hz (5 to 10) Hz 10 Hz to 20 KHz (20 to 50) KHz (50 to 100) KHz **(330 to 1020) V** (3 to 5) Hz (5 to 10) Hz 10 Hz to 10 KHz	 0.19 % + 57 mV 0.067 % + 57 mV 0.011 % + 6.1 mV 0.023 % + 6.1 mV 0.11 % + 9.5 mV 0.19 % + 57 mV 0.067 % + 57 mV 0.011 % + 61 mV	Fluke 5560A multiproduct calibrator	COS, HRT, MEL, ATL RDU, TPA, RFD, HSV, DFW
AC Voltage – Generate Wideband Absolute[3]	**(0.3 to 1.1) mV** (10 to 30) Hz 30 Hz to 500 kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz **(1.1 to 3.3) mV** (10 to 30) Hz 30 Hz to 500 kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz **(3.3 to 11) mV** (10 to 30) Hz 30 Hz to 500 kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz **(11 to 33) mV** (10 to 30) Hz 30 Hz to 500 kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz	 0.65 % of output + 1.5 µV 0.61 % of output + 1.5 µV 0.63 % of output + 3.8 µV 0.63 % of output + 3.8 µV 0.68 % of output + 3.8 µV 0.76 % of output + 3.8 µV 1.3 % of output + 13 µV 0.58 % of output + 2.3 µV 0.53 % of output + 2.3 µV 0.54 % of output + 4.6 µV 0.54 % of output + 4.6 µV 0.58 % of output + 4.6 µV 0.65 % of output + 4.6 µV 1.3 % of output + 4.6 µV 0.58 % of output + 6.1 µV 0.53 % of output + 6.1 µV 0.54 % of output + 8.4 µV 0.54 % of output + 8.4 µV 0.55 % of output + 8.4 µV 0.61 % of output + 8.4 µV 0.93 % of output + 8.4 µV 0.52 % of output + 12 µV 0.46 % of output + 12 µV 0.47 % of output + 14 µV 0.47 % of output + 14 µV 0.49 % of output + 14 µV 0.55 % of output + 14 µV 0.89 % of output + 14 µV	Fluke 5700A,5720A, 5730A multifunction calibrator	TPA, ATL HSV, RFD, HRT, HLR, SFL, MEL, COS, RDU, DFW

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
AC Voltage – Generate Wideband Absolute[3]	**(33 to 110) mV** (10 to 30) Hz 30 Hz to 500 kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz **(110 to 330) mV** (10 to 30) Hz 30 Hz to 500 kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz **(0.33 to 1.1) V** (10 to 30) Hz 30 Hz to 500 kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz **(1.1 to 3.5) V** (10 to 30) Hz 30 Hz to 500 kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz	 0.52 % of output + 30 µV 0.46 % of output + 30 µV 0.47 % of output + 33 µV 0.47 % of output + 33 µV 0.49 % of output + 33 µV 0.55 % of output + 33 µV 0.89 % of output + 33 µV 0.45 % of output + 0.1 mV 0.38 % of output + 0.1 mV 0.4 % of output + 0.1 mV 0.4 % of output + 0.1 mV 0.42 % of output + 0.1 mV 0.49 % of output + 0.1 mV 0.85 % of output + 0.1 mV 0.45 % of output + 0.3 mV 0.38 % of output + 0.3 mV 0.4 % of output + 0.3 mV 0.4 % of output + 0.3 mV 0.42 % of output + 0.3 mV 0.49 % of output + 0.3 mV 0.85 % of output + 0.3 mV 0.39 % of output + 0.4 mV 0.3 % of output + 0.4 mV 0.32 % of output + 0.4 mV 0.32 % of output + 0.4 mV 0.35 % of output + 0.4 mV 0.44 % of output + 0.4 mV 0.82 % of output + 0.4 mV	Fluke 5700A,5720A, 5730A multifunction calibrator	TPA, ATL, HSV, RFD, HRT, HLR, SFL, MEL, COS, RDU, DFW
AC Voltage – Measure[3]	**Up to 2.2 mV** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz **(2.2 to 7) mV** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	 1.3 mV/V + 1.2 µV 560 µV/V + 1.2 µV 320 µV/V + 1.2 µV 620 µV/V + 1.7 µV 910 µV/V + 2 µV 1.8 mV/V + 3.1 µV 1.8 mV/V + 6.1 µV 2.7 mV/V + 6.1 µV 650 µV/V + 1.2 µV 280 µV/V + 1.2 µV 160 µV/V + 1.2 µV 300 µV/V + 1.7 µV 460 µV/V + 2 µV 910 µV/V + 3.1 µV 990 µV/V + 6.1 µV 1.8 mV/V + 6.1 µV	Fluke 5790B AC/DC transfer standard	TPA, RFD

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
AC Voltage – Measure[3]	**(7 to 22) mV** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz **(22 to 70) mV** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz **(70 to 220) mV** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz **(220 to 700) mV** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz **700 mV to 2.2 V** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kH 500 kHz to 1 MHz	 220 µV/V + 1.2 µV 150 µV/V + 1.2 µV 84 µV/V + 1.2 µV 160 µV/V + 1.7 µV 240 µV/V + 2 µV 620 µV/V + 3.1 µV 680 µV/V + 6.1 µV 1.3 mV/V + 6.1 µV 180 µV/V + 1.3 µV 91 µV/V + 1.3 µV 49 µV/V + 1.3 µV 99 µV/V + 1.7 µV 200 µV/V + 2 µV 390 µV/V + 3.1 µV 510 µV/V + 6.1 µV 840 µV/V + 6.1 µV 160 µV/V + 1.3 µV 65 µV/V + 1.3 µV 29 µV/V + 1.3 µV 53 µV/V + 1.7 µV 120 µV/V + 2 µV 190 µV/V + 3.1 µV 290 µV/V + 6.1 µV 760 µV/V + 6.1 µV 160 µV/V + 1.3 µV 58 µV/V + 1.3 µV 25 µV/V + 1.3 µV 39 µV/V + 1.7 µV 60 µV/V + 2 µV 140 µV/V + 3.1 µV 230 µV/V + 6.1 µV 730 µV/V + 6.1 µV 150 µV/V + 0.7 µV 50 µV/V + 0.7 µV 18 µV/V + 0.7 µV 35 µV/V + 0.7 µV 54 µV/V + 0.7 µV 120 µV/V + 0.7 µV 200 µV/V + 0.7 µV 690 µV/V + 0.7 µV	Fluke 5790B AC/DC transfer standard	TPA, RFD

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
AC Voltage – Measure[3]	**(2.2 to 7) V** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz **(7 to 22) V** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz **(22 to 70) V** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz **(70 to 220) V** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz **(220 to 700) V** 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz **(700 to 1000) V** 40 Hz to 20 kHz (20 to 30) kHz	 150 µV/V + 0.9 µV 51 µV/V + 0.9 µV 18 µV/V + 0.9 µV 37 µV/V + 0.9 µV 62 µV/V + 0.9 µV 150 µV/V + 0.9 µV 300 µV/V + 0.9 µV 910 µV/V + 0.9 µV 150 µV/V + 0.9 µV 51 µV/V + 0.9 µV 21 µV/V + 0.9 µV 37 µV/V + 0.9 µV 62 µV/V + 0.9 µV 150 µV/V + 0.9 µV 300 µV/V + 0.9 µV 910 µV/V + 0.9 µV 150 µV/V + 5.7 µV 52 µV/V + 5.7 µV 24 µV/V + 5.7 µV 43 µV/V + 5.7 µV 72 µV/V + 5.7 µV 150 µV/V + 5.7 µV 150 µV/V + 5.7 µV 52 µV/V + 5.7 µV 24 µV/V + 5.7 µV 53 µV/V + 5.7 µV 75 µV/V + 5.7 µV 31 µV/V + 57 µV 99 µV/V + 57 µV 380 µV/V + 57 µV 29 µV/V + 57 µV 99 µV/V + 57 µV	Fluke 5790B AC/DC transfer standard	TPA, RFD
AC High Voltage – Measure[3]	**60 Hz** (1 to 10) kV (10 to 42) kV	 0.5 % of rdg + 0.002 kV 0.5 % of rdg + 0.02 kV	Ross VD60 HV divider, Agilent 34401A multimeter	TPA, RFD ATL, HRT, HLR,MEL, COS, RDU
	60 Hz (1 to 10) kV (10 to 85) kV	 0.5 % of rdg + 0.002 kV 0.5 % of rdg + 0.02 kV	Ross VD120 HV divider, Agilent 34401A multimeter	TPA, RFD

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
AC High Voltage – Measure[3]	**60Hz** (1 to 28) kV	5.8 % of rdg	Fluke 80k-40 HV probe, Agilent 34401A multimeter	SFL
	60Hz (1 to 5) kV (5 to 21) kV	0.5 % of rdg 0.5 % of rdg	Ross VD30 HV divider, Fluke 287 multimeter	COS
	(0 to 1) kV (30 to 200) Hz (200 to 450) Hz **(1 to 10) kV** (30 to 200) Hz (200 to 450) Hz **(10 to 70) kV** (30 to 100) Hz (100 to 200) Hz (200 to 450) Hz	0.12 % of rdg + 0.000 1 kV 0.12 % of rdg + 0.000 15 kV + 0.14 µV/V x (Vin/1 000) ^2 0.4 % of rdg + 0.000 1 kV 0.4 % of rdg + 0.000 15 kV +0.14 µV/V x (Vin/1 000) ^2 0.12 % of rdg + 0.001 kV 0.6 % of rdg + 0.001 kV 2.5 % of rdg + 0.001 kV + +0.14 µV/V x (Vin/1 000) ^2	Vitrek 4700 Digital HV Meter Vitrek 4700 Digital HV Meter w/HVL-70 High Voltage Probe	DFW
	(0 to 1) kV (30 to 200) Hz (200 to 450) Hz **(1 to 10) kV** (30 to 200) Hz (200 to 450) Hz	0.12 % of rdg + 0.0001 kV 0.12 % of rdg + 0.000 15 kV + 1.5 µV/V x (Vin/1 000) ^2 0.4 % of rdg + 0.0001 kV 0.4 % of rdg + 0.000 15 kV + 1.5 µV/V x (Vin/1 000) ^2	Vitrek 4700 HV meter	RFD
	60 Hz (0 to 5) kV (5 to 21) kV	0.5 % of rdg 0.5 % of rdg	Ross VD30 HV divider, Agilent 34401A multimeter	RDU
	60 Hz (1 to 21) kV	0.5 % of rdg + 0.002 kV	Ross VD30 high voltage divider, Fluke 89 IV multimeter	HSV
	60 Hz (1 to 10) kV (10 to 100) kV	0.5 % of rdg + 0.002 kV 0.5 % of rdg + 0.02 kV	Ross VD150 high voltage divider, HP 34401A multimeter	HSV, RDU

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
AC Voltage – Measure[3]	**(1 to 10) mV**		Agilent 3458A multimeter	TPA, ATL, HSV, RFD, HRT, HLR, MEL, COS, RDU, SFL, DFW
	(1 to 40) Hz	0.02 % of rdg + 2.0 µV		
	40 Hz to 1 kHz	0.013 % of rdg + 0.7 µV		
	(1 to 20) kHz	0.02 % of rdg + 0.7 µV		
	(20 to 50) kHz	0.065 % of rdg + 0.7 µV		
	(50 to 100) kHz	0.33 % of rdg + 0.7 µV		
	100 kHz to 1 MHz	0.78 % of rdg + 3.3 µV		
	(1 to 4) MHz	4.6 % of rdg + 4.6 µV		
	(4 to 8) MHz	13 % of rdg + 5.3 µV		
	(10 to 100) mV			
	(1 to 40) Hz	0.005 % of rdg + 2.6 µV		
	40 Hz to 1 kHz	0.005 % of rdg + 1.3 µV		
	(1 to 20) kHz	0.009 % of rdg + 1.3 µV		
	(20 to 50) kHz	0.02 % of rdg + 1.3 µV		
	(50 to 100) kHz	0.052 % of rdg + 1.3 µV		
	(100 to 300) kHz	0.20 % of rdg + 6.5 µV		
	300 kHz to 1 MHz	0.65 % of rdg + 6.5 µV		
	(1 to 2) MHz	0.98 % of rdg + 46 µV		
	(2 to 4) MHz	2.6 % of rdg + 46 µV		
	(4 to 8) MHz	2.6 % of rdg + 52 µV		
	(8 to 10) MHz	9.8 % of rdg + 65 µV		
	(0.1 to 1) V			
	(1 to 40) Hz	0.005 % of rdg + 26 µV		
	40 Hz to 1 kHz	0.005 % of rdg + 13 µV		
	(1 to 20) kHz	0.009 % of rdg + 13 µV		
	(20 to 50) kHz	0.02 % of rdg + 13 µV		
	(50 to 100) kHz	0.052 % of rdg + 13 µV		
	(100 to 300) kHz	0.2 % of rdg + 65 µV		
	300 kHz to 1 MHz	0.65 % of rdg + 65 µV		
	(1 to 2) MHz	0.98 % of rdg + 0.5 mV		
	(2 to 4) MHz	2.6 % of rdg + 0.5 mV		
	(4 to 8) MHz	2.6 % of rdg + 0.5 mV		
	(8 to 10) MHz	9.8 % of rdg + 0.7 mV		
	(1 to 10) V			
	(1 to 40) Hz	0.005 % of rdg + 0.3 mV		
	40 Hz to 1 kHz	0.005 % of rdg + 0.1 mV		
	(1 to 20) kHz	0.009 % of rdg + 0.1 mV		
	(20 to 50) kHz	0.02 % of rdg + 0.1 mV		
	(50 to 100) kHz	0.052 % of rdg + 0.1 mV		
	(100 to 300) kHz	0.2 % of rdg + 0.7 mV		
	300 kHz to 1 MHz	0.65 % of rdg + 0.7 mV		
	(1 to 2) MHz	0.98 % of rdg + 4.6 mV		
	(2 to 4) MHz	2.6 % of rdg + 4.6 mV		
	(4 to 8) MHz	2.6 % of rdg + 5.2 mV		
	(8 to 10) MHz	9.8 % of rdg + 6.5 mV		

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
AC Voltage – Measure[3]	**(10 to 100) V**		Agilent 3458A multimeter	TPA, ATL, HSV, RFD, HRT, HLR, MEL, COS, RDU, SFL, DFW
	(1 to 40) Hz	0.013 % of rdg + 2.6 mV		
	40 Hz to 1 kHz	0.013 % of rdg + 1.3 mV		
	(1 to 20) kHz	0.013 % of rdg + 1.3 mV		
	(20 to 50) kHz	0.023 % of rdg + 1.3 mV		
	(50 to 100) kHz	0.08 % of rdg + 1.3 mV		
	(100 to 300) kHz	0.26 % of rdg + 6.5 mV		
	300 kHz to 1 MHz	0.98 % of rdg + 6.5 mV		
	(100 to 700) V			
	(1 to 40) Hz	0.026 % of rdg + 26 mV		
	40 Hz to 1 kHz	0.026 % of rdg + 13 mV		
	(1 to 20) kHz	0.039 % of rdg + 13 mV		
	(20 to 50) kHz	0.078 % of rdg + 13 mV		
	(50 to 100) kHz	0.20 % of rdg + 13 mV		
	(1.2 to 12.12) mV		Fluke 8588A multimeter	ATL, RFD, DFW
	(1 to 2 000) Hz	0.028 % of rdg + 1.2 µV		
	(2 to 10) kHz	0.036 % of rdg + 1.2 µV		
	(10 to 30) kHz	0.037 % of rdg + 1.2 µV		
	(30 to 100) kHz	0.30 % of rdg + 0.9 µV		
	(100 to 300) kHz	0.99 % of rdg + 3.9 µV		
	(0.3 to 1) MHz	2 % of rdg + 3.9 µV		
	(12.12 to 121.2) mV			
	(1 to 2 000) Hz	0.009 % of rdg + 0.6 µV		
	(2 to 10) kHz	0.013 % of rdg + 0.6 µV		
	(10 to 30) kHz	0.023 % of rdg + 1.1 µV		
	(30 to 100) kHz	0.052 % of rdg + 5.1 µV		
	(100 to 300) kHz	0.21 % of rdg + 31 µV		
	(0.3 to 1 MHz)	0.99 % of rdg + 0.1 mV		
	(1 to 2) MHz	1.5 % of rdg + 0.5 mV		
	(2 to 4) MHz	4 % of rdg + 1.0 mV		
	(4 to 8) MHz	8.2 % of rdg + 1.0 mV		
	(8 to 10) MHz	16 % of rdg + 1.0 mV		
	(0.1212 to 1.212) V			
	(1 to 2 000) Hz	0.007 % of rdg + 0.006 mV		
	(2 to 10) kHz	0.012 % of rdg + 0.006 mV		
	(10 to 30) kHz	0.023 % of rdg + 0.011 mV		
	(30 to 100) kHz	0.052 % of rdg + 0.05 mV		
	(100 to 300) kHz	0.21 % of rdg + 0.31 mV		
	(0.3 to 1) MHz	0.99 % of rdg + 0.99 mV		
	(1 to 2) MHz	1.5 % of rdg + 4.9 mV		
	(2 to 4) MHz	4 % of rdg + 9.8 mV		
	(4 to 8) MHz	8.1 % of rdg + 9.8 mV		
	(8 to 10) MHz	15 % of rdg + 9.8 mV		

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
AC Voltage – Measure[3]	**(1.212 to 12.12) V** (1 to 2000) Hz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz (1 to 2) MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz **(12.12 to 121.2) V** (1 to 2000) Hz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 200) kHz **(121.2 to 1050) V** (1 to 2000) Hz (2 to 10) kHz (10 to 30) kHz	 0.007 % of rdg + 0.06mV 0.012 % of rdg + 0.06 mV 0.023 % of rdg + 0.11 mV 0.052 % of rdg + 0.52 mV 0.21 % of rdg + 3.1 mV 0.99 % of rdg + 9.9 mV 1.5 % of rdg + 49 mV 4 % of rdg + 98 mV 8.1 % of rdg + 98 mV 15 % of rdg + 98 mV 0.009 % of rdg + 0.6 mV 0.011 % of rdg + 0.6 mV 0.023 % of rdg + 1.1 mV 0.058 % of rdg + 5.1 mV 0.37 % of rdg + 46 mV 0.011 % of rdg + 26 mV 0.011 % of rdg + 26 mV 0.023 % of rdg + 26 mV	Fluke 8588A multimeter	ATL, RFD, DFW
AC Voltage – Measure[3]	**(1.2 to 12.12) mV** (1 to 2000) Hz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (0.3 to 1 MHz) **12.12 to 121.2) mV** (1 to 2000) Hz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (0.3 to 1 MHz) (1 to 2) MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz	 0.06 % of rdg + 2.0 µV 0.045 % of rdg + 2.0 µV 0.046 % of rdg + 2.0 µV 0.42 % of rdg + 2.0 µV 1.6 % of rdg + 5.9 µV 2.5 % of rdg + 5.9 µV 0.011 % of rdg + 1.0 µV 0.015 % of rdg + 1.0 µV 0.025 % of rdg + 2.0 µV 0.057 % of rdg + 20 µV 0.34 % of rdg + 50 µV 1.4 % of rdg + 0.2 mV 1.6 % of rdg + 0.7mV 4.6 % of rdg + 1.2 mV 9.2 % of rdg + 1.2 mV 18 % of rdg + 1.2 mV	Fluke 8558A multimeter	RDU

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
AC Voltage – Measure[3]	**(0.1212 to 1.212) V** (1 to 2000) Hz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (0.3 to 1 MHz) (1 to 2) MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz **(1.212 to 12.12) V** (1 to 2000) Hz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (0.3 to 1 MHz) (1 to 2) MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz **(12.12 to 121.2) V** (1 to 2000) Hz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 200) kHz **(121.2 to 1050) V** (1 to 1000) Hz (2 to 10) kHz (10 to 30) kHz	 0.010 % of rdg + 0.01mV 0.014 % of rdg + 0.01 mV 0.025 % of rdg + 0.02 mV 0.057 % of rdg + 0.20 mV 0.26 % of rdg + 0.5 mV 1.4 % of rdg + 2 mV 1.6 % of rdg + 7 mV 4.6 % of rdg + 12 mV 9.1 % of rdg + 12 mV 18 % of rdg + 12 mV 0.010 % of rdg + 0.1mV 0.014 % of rdg + 0.1 mV 0.025 % of rdg + 0.2 mV 0.057 % of rdg + 2.0 mV 0.26 % of rdg + 5.0 mV 1.38 % of rdg + 20 mV 1.6 % of rdg + 70 mV 4.6 % of rdg + 120 mV 9.1 % of rdg + 120 mV 18 % of rdg + 120 mV 0.011 % of rdg + 1.0mV 0.015 % of rdg + 1.0 mV 0.025 % of rdg + 2.0 mV 0.063 % of rdg + 20 mV 0.43 % of rdg + 100 mV 0.016 % of rdg + 30mV 0.018 % of rdg + 30 mV 0.032 % of rdg + 30 mV	Fluke 8558A multimeter	RDU
AC Voltage – Measure Wideband Flatness Relative to 1 kHz[3]	**(0.6 to 2.2) mV** (10 to 30) Hz 30 Hz to 120 kHz 120 kHz 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz **(2.2 to 7) mV** (10 to 30) Hz 30 Hz to 120 kHz 120 kHz 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	 0.08 % of rdg + 0.1 µV 0.04 % of rdg + 0.1 µV 0.05 % of rdg + 0.8 µV 0.13 % of rdg + 0.8 µV 0.23 % of rdg + 0.8 µV 0.53 % of rdg + 1.6 µV 0.08 % of rdg + 0.1 µV 0.04 % of rdg + 0.1 µV 0.05 % of rdg + 0.8 µV 0.08 % of rdg + 0.8 µV 0.13 % of rdg + 0.8 µV 0.28 % of rdg + 0.8 µV	Fluke 5790B AC/DC transfer standard	TPA, RFD

Parameter/Range	Frequency	CMC[2, 6, 7] (±)	Comment	Location[10]
AC Voltage – Measure Wideband Flatness Relative to 1 kHz[3]	**(7 to 22) mV** (10 to 30) Hz 30 Hz to 120 kHz 120 kHz 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz **(22 to 70) mV** (10 to 30) Hz (30 Hz to 2 MHz) (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz **(70 to 220) mV** (10 to 30) Hz 30 Hz to 500 kHz 500 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz **(220 to 700) mV** (10 to 30) Hz 30 Hz to 500 kHz 500 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30 MHz) **(0.7 to 2) V** (10 to 30) Hz 30 Hz to 500 kHz 500 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz **(2.2 to 7) V** (10 to 30) Hz 30 Hz to 500 kHz 500 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	 0.08 % of rdg + 0.1 µV 0.04 % of rdg + 0.1 µV 0.05 % of rdg + 0.1 µV 0.08 % of rdg + 0.1 µV 0.13 % of rdg + 0.1 µV 0.28 % of rdg + 0.1 µV 0.08 % of rdg + 0.6 µV 0.04 % of rdg + 0.6 µV 0.08 % of rdg + 0.6 µV 0.11 % of rdg + 0.6 µV 0.27 % of rdg + 0.6 µV 0.08 % of rdg 0.03 % of rdg 0.04 % of rdg 0.08 % of rdg 0.11 % of rdg 0.27 % of rdg 0.08 % of rdg 0.02 % of rdg 0.04 % of rdg 0.08 % of rdg 0.11 % of rdg 0.27 % of rdg 0.08 % of rdg 0.02 % of rdg 0.04 % of rdg 0.08 % of rdg 0.11 % of rdg 0.27 % of rdg 0.08 % of rdg 0.02 % of rdg 0.04 % of rdg 0.08 % of rdg 0.11 % of rdg 0.27 % of rdg	Fluke 5790B AC/DC transfer standard	TPA, RFD

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
AC Current – Generate [3]	**(9 to 220) µA** (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz **(0.22 to 2.2) mA** (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz **(2.2 to 22) mA** (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz **(22 to 220) mA** (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	 230 µA/A + 15 nA 150 µA/A + 10 nA 91 µA/A + 8 nA 270 µA/A + 12 nA 990 µA/A + 61 nA 230 µA/A + 39 nA 150 µA/A + 31 nA 91 µA/A + 31 nA 180 µA/A + 99 nA 990 µA/A + 610 nA 230 µA/A + 390 nA 150 µA/A + 310 nA 91 µA/A + 310 nA 180 µA/A + 540 nA 990 µA/A + 4.6 µA 230 µA/A + 4 µA 150 µA/A + 3 µA 91 µA/A + 2 µA 180 µA/A + 3 µA 990 µA/A + 9 µA	Fluke 5730A multifunction calibrator	TPA, HSV, RFD, MEL, COS, RDU, DFW
	(9 to 220) µA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz **(0.22 to 2.2) mA** (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz **(2.2 to 22) mA** (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (5 to 10) kHz	 220 µA/A + 15 nA 150 µA/A + 10 nA 110 µA/A + 8 nA 270 µA/A + 12 nA 990 µA/A + 61 nA 230 µA/A + 39 nA 150 µA/A + 31 nA 110 µA/A + 31 nA 180 µA/A + 99 nA 990 µA/A + 610 nA 230 µA/A + 390 nA 150 µA/A + 310 nA 110 µA/A + 310 nA 180 µA/A + 540 nA 990 µA/A + 4.6 µA	Fluke 5720A multifunction calibrator	ATL, SFL HLR

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
AC Current – Generate [3]	**(22 to 220) mA** (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	 230 µA/A + 4 µA 150 µA/A + 3 µA 110 µA/A + 2 µA 180 µA/A + 3 µA 990 µA/A + 9 µA	Fluke 5720A multifunction calibrator	ATL, SFL HLR
	(9 to 220) µA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz **(0.22 to 2.2) mA** (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz **(2.2 to 22) mA** (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz **(22 to 220) mA** (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	 610 µA/A + 23 nA 320 µA/A + 19 nA 120 µA/A + 15 nA 530 µA/A + 38 nA 1400 µA/A + 760 nA 610 µA/A + 39 nA 320 µA/A + 31 nA 120 µA/A + 31 nA 530 µA/A + 380 nA 1400 µA/A + 760 nA 610 µA/A + 390 nA 320 µA/A + 310 nA 120 µA/A + 310 nA 530 µA/A + 3.8 µA 1400 µA/A + 7.6 µA 610 µA/A + 4 µA 320 µA/A + 3 µA 140 µA/A + 3 µA 530 µA/A + 38 µA 1400 µA/A + 76 µA	Fluke 5700A multifunction calibrator	HRT
	(0.22 to 1.2) A (3 to 45) Hz 45 to 1000 Hz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz **(1.2 to 3.1) A** (3 to 45) Hz 45 to 1000 Hz (1 to 5) kHz (5 to 10) kHz **(3.1 to 12) A** (3 to 45) Hz 45 to 1000 Hz (1 to 5) kHz (5 to 10) kHz	 0.019 % of output + 0.08 mA 0.019 % of output + 0.04 mA 0.019 % of output + 0.06 mA 0.19 % of output + 0.23 mA 0.38 % of output + 0.23 mA 0.029 % of output + 0.4 mA 0.023 % of output + 0.27 mA 0.029 % of output + 0.27 mA 0.19 % of output + 0.40 mA 0.029 % of output + 0.8 mA 0.023 % of output + 0.4 mA 0.029 % of output + 0.6 mA 0.19 % of output + 0.8 mA	Fluke 5560A multiproduct calibrator	COS, HRT, MEL, ATL RDU, TPA, RFD, HSV, DFW

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
AC Current – Generate [3]	**(12 to 30.2) A** (3 to 45) Hz 45 to 1000 Hz (1 to 5) kHz	0.076 % of output + 7.7 mA 0.053 % of output + 6.2 mA 0.038 % of output + 6.2 mA	Fluke 5560A multiproduct calibrator	COS, HRT, MEL, ATL RDU, TPA, RFD, HSV, DFW
	(30.2 to 120) A (10 to 65) Hz (65 to 300) Hz 300 Hz to 1 kHz (1 to 3) kHz (3 to 6) kHz (6 to 10) kHz	160 µA/A + 19 mA 250 µA/A + 28 mA 770 µA/A + 92 mA 0.23 % of output + 230 mA 0.76 % of output + 410 mA 3 % of output + 690 mA	Fluke 5560A multiproduct calibrator, 52120A transconductance amplifier	TPA, RFD
	(0.22 to 2.2) A 20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz **(2.2 to 11) A** 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	230 µA/A + 31 µA 380 µA/A + 76 µA 6.1 mA/A + 150 µA 350 µA /A + 141 µA 720 µA /A + 300 µA 2.7 mA /A + 570 µA	Fluke 5720A, 5730A multifunction calibrator	SFL, HLR, HSV
	(11 to 20.5) A 45 Hz to 100 Hz 100 Hz to 1 kHz (1 to 5) kHz	0.09 % of output + 5 mA 0.11 % of output + 5 mA 2.3 % of output + 5 mA	Fluke 5522A multiproduct calibrator	
AC Current – Generate Clamp Meters[3]	**(3.1 to 300.2) A** (3 to 440) Hz	0.65 % of output + 0.077 A	Fluke 5560A, w/55xxA x1/2/10 coil	RDU
	(3.3 to 30) A (10 to 100) Hz (100 to 440) Hz **(30 to 200) A** 10 to 100 Hz (100 to 440) Hz	0.22 % of output + 0.028 A 0.3 % of output + 0.07 A 0.22 % of output + 0.032 A 0.79 % of output + 0.08 A	Fluke 5522A multiproduct, w/9100-200 x10 coil	HLR, SFL
	(6 to 150) A (10 to 100) Hz (100 to 440) Hz **(150 to 1 000) A** (10 to 100) Hz (100 to 440) Hz	0.22 % of output + 0.029 A 0.3 % of output + 0.08 A 0.22 % of output + 0.81 A 0.79 % of output + 0.2 A	Fluke 5522A multiproduct, w/9100-200 x50 coil	

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
AC Current – Generate Clamp Meters[3]	**(1.2 to 30) A** (10 to 440) Hz **(30 to 120) A** (10 to 440) Hz **(120 to 200) A** 10 to 440 Hz	0.2 % of output + 0.005 A 0.20 % of output + 0.008 A 0.21 % of output + 0.076 A	Fluke 5560A multiproduct calibrator / 9100-200 x10 coil	HRT, COS, HSV, RDU
	(6 to 150) A (10 to 100) Hz **(150 to 600) A** (10 to 100) Hz **(600 to 1000) A** (10 to 100) Hz	0.2 % of output + 0.02 A 0.2 % of output + 0.04 A 0.21 % of output + 0.31 A	Fluke 5560A multiproduct calibrator / 9100-200 x50 coil	
AC Current Clamps – Toroidal-Wound[3]	**(0.6 to 600) A** (45 to 65) Hz **(600 to 1000) A** (45 to 65) Hz **(0.6 to 155) A** (65 to 440) Hz	0.21 % of output + 71 mA 0.22 % of output + 0.311 A 0.6 % of output + 77 mA	Fluke 5560A multiproduct calibrator /x50 coil	TPA, RFD MEL, ATL, COS, DFW, HSV
AC Current Clamps – Other[3]	**(0.6 to 600) A** (45 to 65) Hz **(600 to 1000) A** (45 to 65) Hz **(0.6 to 155) A** (65 to 440) Hz	0.43 % of output + 0.53 A 0.43 % of output + 0.61 A 0.76 % of output + 0.69 A		
AC Current – Generate [3] Clamps – Toroidal-Wound	**(16.5 to 150) A** (45 to 65) Hz **(150 to 1 000) A** (45 to 65) Hz **(16.5 to 150) A** (65 to 440) Hz	0.22 % of output + 69 mA 0.23 % of output + 0.2 A 0.64 % of output + 0.085 A	Fluke 5522A multiproduct calibrator, 5500A/coil x50	HSV
AC Current – Generate [3] Clamps – Other	**(16.5 to 1025) A** (45 to 65) Hz **(16.5 to 150) A** (65 to 440) Hz	0.44 % of output + 0.57 A 0.79 % of output + 0.69 A		

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
AC Current Clamps – Rogowski[3]	**(10 to 100) A** (10 to 1000) Hz (1 to 3) kHz **(100 to 1000) A** (10 to 1000) Hz (1 to 3) kHz **(1000 to 6000) A** (10 to 1000) Hz **(1000 to 3500) A** (1 to 3) kHz	0.53 % of output + 0.011 A 0.61 % of output + 0.015 A 0.53 % of output + 0.11 A 0.61 % of output + 0.15 A 0.53 % of output + 0.68 A 0.61 % of output + 0.95 A	Fluke 5560A multiproduct calibrator, Fluke 52120A transconductance amplifier, coil 6KA current coil	TPA, RFD
AC Current – Measure [3]	**(2 to 200) µA** 10 Hz to 10 kHz **200 µA to 2 mA** 10 Hz to 10 kHz	0.047 % of rdg + 0.018 µA 0.028 % of rdg + 0.18 µA	Fluke 8508A multimeter	TPA
	(0.19 to 1) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz **(1 to 10) mA** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz **(10 to 50) mA** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz **(50 to 500) mA** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz **(0.5 to 2) A** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz	200 µA/A 200 µA/A 170 µA/A 280 µA/A 160 µA/A 70 µA/A 40 µA/A 65 µA/A 170 µA/A 69 µA/A 39 µA/A 66 µA/A 170 µA/A 70 µA/A 40 µA/A 72 µA/A 170 µA/A 77 µA/A 62 µA/A 110 µA/A	Agilent 3458A multimeter/ Fluke A40 current shunts	TPA

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
AC Current – Measure[3]	**(2 to 10) A** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz	 180 µA/A 94 µA/A 79 µA/A 130 µA/A	Fluke 5790B AC/DC transfer standard / Fluke A40 current shunts	TPA
	(10 to 20) A (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz	 310 µA/A 310 µA/A 270 µA/A 380 µA/A	Agilent 3458A multimeter / Fluke Y5020 current shunt	TPA, RFD, ATL
	(1 to 10) A (10 to 1000) Hz **(10 to 100) A** (10 to 1000) Hz **(100 to 300) A** (10 to 1000) Hz	 50 µA/A + 130 µA 50 µA/A + 1.3 mA 50 µA/A + 13 mA	Agilent 3458A multimeter, MI 6311A current divider	TPA
	(0.22 to 10) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz **(10 to 50) mA** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz **(50 to 100) mA** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz **(100 to 250) mA** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz	 190 µA/A + 0.002 µA 90 µA/A + 0.002 µA 44 µA/A + 0.002 µA 76 µA/A + 0.002 µA 190 µA/A 87 µA/A 42 µA/A 71 µA/A 190 µA/A 88 µA/A 45 µA/A 77 µA/A 190 µA/A 91 µA/A 42 µA/A 82 µA/A	Fluke 5790A AC/DC transfer standard / Holt HCS-1 current shunts	RFD

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
AC Current – Measure [3]	**(250 to 500) mA** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz **(0.5 to 1) A** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz **(1 to 2.5) A** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz **(2.5 to 5) A** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz **(5 to 10) A** (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz	 190 µA/A 91 µA/A 42 µA/A 82 µA/A 190 µA/A 92 µA/A 59 µA/A 120 µA/A 200 µA/A 110 µA/A 78 µA/A 130 µA/A 200 µA/A 110 µA/A 85 µA/A 180 µA/A 210 µA/A 130 µA/A 100 µA/A 150 µA/A	Fluke 5790A AC/DC transfer standard / Holt HCS-1 current shunts	RFD
	(5 to 100) µA (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz **(0.1 to 1) mA** (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz **(1 to 10) mA** (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.26 % of rdg + 0.02 µA 0.1 % of rdg + 0.02 µA 0.04 % of rdg + 0.02 µA 0.26 % of rdg + 0.13 µA 0.1 % of rdg + 0.13 µA 0.04 % of rdg + 0.13 µA 0.02 % of rdg + 0.13 µA 0.26 % of rdg + 1.3 µA 0.1 % of rdg + 1.3 µA 0.04 % of rdg + 1.3 µA 0.02 % of rdg + 1.3 µA	Agilent 3458A multimeter	TPA, MEL ATL, RFD HSV, COS HRT, RDU SFL, HLR, DFW

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
AC Current – Measure [3]	**(10 to 100) mA** (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz **(0.1 to 1) A** (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	 0.26 % of rdg + 13 µA 0.1 % of rdg + 13 µA 0.04 % of rdg + 13 µA 0.02 % of rdg + 13 µA 0.26 % of rdg + 0.13 mA 0.1 % of rdg + 0.13 mA 0.05 % of rdg + 0.13 mA 0.07 % of rdg + 0.13 mA	Agilent 3458A multimeter	TPA, MEL ATL, RFD HSV, COS HRT, RDU SFL, HLR, DFW
	(2.02 to 20.2) µA (1 to 2000) Hz (2 to 10) kHz (10 to 30) kHz **(0.202 to 2.02) mA** (1 to 2000) Hz (2 to 10) kHz (10 to 30) kHz **2.02 to 20.2) mA** (1 to 2000) Hz (2 to 10) kHz (10 to 30) kHz **(20.2 to 202) mA** (1 to 2000) Hz (2 to 10) kHz (10 to 30) kHz	 0.20 % of rdg + 2.5 nA 0.20 % of rdg + 2.5 nA 0.20 % of rdg + 2.5 nA 0.027 % of rdg + 49 nA 0.052 % of rdg + 49 nA 0.073 % of rdg + 49 nA 0.027 % of rdg + 0.49 µA 0.052 % of rdg + 0.49 µA 0.073 % of rdg + 0.49 µA 0.027 % of rdg + 4.9 µA 0.051 % of rdg + 4.9 µA 0.073 % of rdg + 4.9 µA	8588A multimeter	RFD, ATL, DFW
	(0.202 to 2.02) A (1 to 2000) Hz (2 to 10) kHz (10 to 30) kHz **(2.02 to 20.2) A** (10 to 2000) Hz (2 to 10) kHz **(20.2 to 30.2) A** (10 to 2000) Hz (2 to 10) kHz	 0.029 % of rdg + 98 µA 0.054 % of rdg + 98 µA 0.078 % of rdg + 98 µA 0.082 % of rdg + 0.49 mA 0.082 % of rdg + 0.49 mA 0.082 % of rdg + 12 mA 0.122 % of rdg + 12 mA	8588A multimeter	RFD, ATL, DFW

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
AC Current – Measure [3]	**(2.02 to 20.2) µA** (1 to 2000) Hz (2 to 10) kHz (10 to 30) kHz **(20.2 to 202) µA** (1 to 2000) Hz (2 to 10) kHz (10 to 30) kHz **(0.202 to 2.02) mA** (1 to 2000) Hz (2 to 10) kHz (10 to 30) kHz **(2.02 to 20.2) mA** (1 to 2000) Hz (2 to 10) kHz (10 to 30) kHz **(20.2 to 202) mA** (1 to 2 000) Hz (2 to 10) kHz (10 to 30) kHz **(0.202 to 2.02) A** (1 to 2000) Hz (2 to 10) kHz (10 to 30) kHz	 0.38 % of rdg + 2.9 nA 0.38 % of rdg + 2.9 nA 0.38 % of rdg + 2.9 nA 0.044 % of rdg + 9.8 nA 0.087 % of rdg + 9.8 nA 0.11 % of rdg + 9.8 nA 0.044 % of rdg + 98 nA 0.087 % of rdg + 98 nA 0.11 % of rdg + 98 nA 0.044 % of rdg + 0.98 µA 0.087 % of rdg + 0.98 µA 0.11 % of rdg + 0.98 µA 0.044 % of rdg + 9.8 µA 0.087 % of rdg + 9.8 µA 0.11 % of rdg + 9.8 µA 0.044 % of rdg + 148 µA 0.076 % of rdg + 148 µA 0.12 % of rdg + 148 µA	Fluke 8558A multimeter	RDU
	(1 to 3) A (3 to 5) Hz (5 to 10) Hz 10 Hz to 5 kHz	 0.72 % of rdg + 1.2 mA 0.23 % of rdg + 1.2 mA 0.1 % of rdg + 1.2 mA	Agilent 34401A multimeter	MEL, ATL, SFL, HSV
	(1 to 3) A (3 to 5) Hz (5 to 10) Hz 10 Hz to 5 kHz (5 to 10) kHz **(3 to 10) A** (3 to 5) Hz (5 to 10) Hz 10 Hz to 5 kHz (5 to 10) kHz	 0.84 % of rdg + 1.4 mA 0.27 % of rdg + 1.4 mA 0.11 % of rdg + 1.4 mA 0.27 % of rdg + 16 mA 0.84 % of rdg + 4.6 mA 0.27 % of rdg + 4.6 mA 0.11 % of rdg + 4.6 mA 0.27 % of rdg + 53 mA	Fluke 8845A,8846A multimeter	RFD, HLR RDU, HRT TPA, COS, HSV, DFW

Parameter/Range	Frequency	CMC[2, 6, 7] (±)	Comment	Location[10]
AC Current – Measure[3]	**(3 to 30) A** 40 Hz to 1 kHz (1 to 5) kHz	0.3 % of rdg + 0.07 A 5 % of rdg + 0.14 A	Agilent 3458A multimeter, Keysight 34330A current shunt	ATL, HSV RFD, HLR SFL, MEL, RDU
	(10 to 100) A (50 to 1000) Hz **(100 to 600) A** (50 to 1000) Hz	2 % of rdg + 0.02 A 2 % of rdg + 0.2 A	Fluke 80i-600 clamp meter / Agilent 3458A multimeter	ATL
	(10 to 2 000) A 55 to 65 Hz **(2 000 to 6 000) A** 55 to 65 Hz	1.5 % of rdg + 0.5A 1 % of rdg + 3.9 A	PEM CWT600B Rogowski coil / Agilent 34401A multimeter	ATL, TPA, RDU
	(10 to 1 000) A (10 to 100) Hz (100 to 500) Hz	1.5 % of rdg + 0.9 A 1.9 % of rdg + 6.6 A	Fluke 376 clamp meter	TPA, MEL RFD, HRT, HSV, DFW
AC Current – Measure[3]	**(200 to 600) A** (10 to 500) Hz **(600 to 2 500) A** (10 to 500) Hz	2.3 % of rdg + 0.9 A 2.3 % of rdg + 6.6 A	Fluke 376 clamp meter i2500 flex probe	TPA, MEL HRT, HSV
	(30 to 600) A (10 to 100) Hz (100 to 400) Hz	1.5 % of rdg + 1.1 A 4.6 % of rdg + 1.1 A	Fluke 336 clamp meter	SFL
Resistance – Generate, Fixed Points[3]	1 mΩ 10 mΩ 100 mΩ	10 μΩ/Ω 6.6 μΩ/Ω 25.3 μΩ/Ω	LN 422x resistance standards	TPA, RFD
	100 μΩ 1 mΩ 10 mΩ 100 mΩ 1 Ω 10 Ω	0.053 % 0.039 % 0.016 % 0.014 % 0.009 % 0.008 %	Burster 1240 series resistance standards	HSV

Parameter/Equipment	Range	CMC[2, 7] (±)	Comment	Location[10]
Resistance – Generate[3] Fixed Points	1 mΩ 10 mΩ 100 mΩ	100 μΩ/Ω 100 μΩ/Ω 100 μΩ/Ω	Standard resistors	MEL
	1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ 1 GΩ	1 μΩ/Ω 2 μΩ/Ω 0.44 μΩ/Ω 0.67 μΩ/Ω 0.86 μΩ/Ω 1.2 μΩ/Ω 2 μΩ/Ω 2.5 μΩ/Ω 19 μΩ/Ω 84 μΩ/Ω	Fluke 742A, IET SRL resistance standards	TPA
	1 Ω 10 kΩ	2.6 μΩ/Ω 0.93 μΩ/Ω	Fluke 742A resistance standards	RFD
	100 V 100 kΩ **(100 to 1000) V** 1 MΩ 10 MΩ 100 MΩ 1 GΩ 10 GΩ	1 % of output 1 % of output 1 % of output 1 % of output 1 % of output 1.2 % of output	TMI RB resistance standard	TPA, HSV MEL, HLR HRT, SFL, COS, DFW, RDU
	(100 to 1000) V 100 GΩ	3.2 % of output		TPA, MEL HSV, DFW
	(1, 1.9) Ω (10, 19) Ω (100, 190) Ω (1, 1.9) kΩ (10, 19) kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	84 μΩ/Ω + 0.1 μΩ 21 μΩ/Ω + 1 μΩ 9.1 μΩ/Ω + 6 μΩ 6.1 μΩ/Ω + 60 μΩ 6.1 μΩ/Ω + 0.6 mΩ 7.6 μΩ/Ω + 6 mΩ 9.1 μΩ/Ω + 6 mΩ 11 μΩ/Ω + 60 mΩ 16 μΩ/Ω + 60 mΩ 35 μΩ/Ω + 0.6 Ω 42 μΩ/Ω + 0.6 Ω 91 μΩ/Ω + 6 Ω	Fluke 5730A multifunction calibrator	COS, HSV MEL, RDU RFD, TPA, DFW

Parameter/Equipment	Range	CMC[2, 7] (±)	Comment	Location[10]
Resistance – Generate[3] Fixed Points	(1, 1.9) Ω (10, 19) Ω (100, 190) Ω (1, 1.9) kΩ (10, 19) kΩ (100, 190) kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	84 μΩ/Ω + 0.1 μΩ 21 μΩ/Ω + 1 μΩ 9.1 μΩ/Ω + 6 μΩ 7.6 μΩ/Ω + 60 μΩ 7.6 μΩ/Ω + 0.6 mΩ 9.9 μΩ/Ω + 6 mΩ 18 μΩ/Ω + 60 mΩ 18 μΩ/Ω + 60 mΩ 35 μΩ/Ω + 0.6 Ω 42 μΩ/Ω + 0.6 Ω 91 μΩ/Ω + 6 Ω	Fluke 5720A multifunction calibrator	HLR, SFL, ATL
	(1, 1.9) Ω (10, 19) Ω (100, 190) Ω (1, 1.9) kΩ (10, 19) kΩ (100, 190) kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	84 μΩ/Ω + 0.1 μΩ 25 μΩ/Ω + 1 μΩ 15 μΩ/Ω + 6 μΩ 11 μΩ/Ω + 60 μΩ 11 μΩ/Ω + 0.6 mΩ 12 μΩ/Ω + 6 mΩ 18 μΩ/Ω + 60 mΩ 18 μΩ/Ω + 60 mΩ 35 μΩ/Ω + 0.6 Ω 42 μΩ/Ω + 0.6 Ω 99 μΩ/Ω + 6 Ω	Fluke 5700A multifunction calibrator	HRT
	1 Ω 1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 kΩ 1.9 kΩ 10 kΩ 19 kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	13 μΩ/Ω + 0.6 μΩ 8.7 μΩ/Ω + 0.6 μΩ 5.6 μΩ/Ω + 6 μΩ 6.7 μΩ/Ω + 6 μΩ 4.7 μΩ/Ω + 60 μΩ 4.5 μΩ/Ω + 60 μΩ 1.2 μΩ/Ω + 0.6 mΩ 1.1 μΩ/Ω + 0.6 mΩ 3 μΩ/Ω + 0.6 mΩ 2 μΩ/Ω + 6 mΩ 1.9 μΩ/Ω + 60 mΩ 1.7 μΩ/Ω + 60 mΩ 3.4 μΩ/Ω + 0.6 Ω 2.8 μΩ/Ω + 0.6 Ω 7.3 μΩ/Ω + 6 Ω 11 μΩ/Ω + 6 Ω 49 μΩ/Ω + 60 Ω	Fluke 5450A resistance calibrator	RFD

Parameter/Equipment	Range	CMC[2, 7] (±)	Comment	Location[10]
Resistance – Fixed Points[3]	(0.01, 0.1, 1.0) Ω	34 µΩ/Ω	Leeds & Northrup resistor set	ATL
	1 mΩ 10 mΩ 100 mΩ 1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ	0.033 % of Output 0.019 % of Output 0.029 % of Output 0.014 % of Output 0.013 % of Output 0.013 % of Output 0.013 % of Output 0.013 % of Output 0.013 % of Output	Keysight 42030A resistor set fixed	COS
Resistance – Generate[3]	Up to 12 Ω (12 to 120) Ω (0.12 to 1.20) kΩ (1.2 to 12.0) kΩ (12 to 120) kΩ (0.12 to 1.2) MΩ (1.2 to 12) MΩ (12 to 120) MΩ (120 to 1200) MΩ	19 µΩ/Ω + 0.001 Ω 19 µΩ/Ω + 0.001 Ω 19 µΩ/Ω + 0.002 Ω 19 µΩ/Ω + 0.02 Ω 19 µΩ/Ω + 0.2 Ω 19 µΩ/Ω + 2 Ω 27 µΩ/Ω + 24 Ω 330 µΩ/Ω + 2 kΩ 3 mΩ/Ω + 76 Ω	Fluke 5560A multiproduct calibrator	COS, HRT MEL, ATL RDU, RFD TPA, HSV, DFW
	(0 to 11) Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω (0.33 to 1.1) kΩ (1.1 to 3.3) kΩ (3.3 to 11) kΩ (11 to 33) kΩ (33 to 110) kΩ (110 to 330) kΩ 0.33 kΩ to 1.1 MΩ (1.1 to 3.3) MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ 330 MΩ to 1.1 GΩ	30 µΩ/Ω + 0.001 Ω 23 µΩ/Ω + 0.001 Ω 21 µΩ/Ω + 0.001 Ω 21 µΩ/Ω + 0.002 Ω 21 µΩ/Ω + 0.002 Ω 21 µΩ/Ω + 0.02 Ω 21 µΩ/Ω + 0.02 Ω 21 µΩ/Ω + 0.2 Ω 21 µΩ/Ω + 0.2 Ω 24 µΩ/Ω + 2 Ω 24 µΩ/Ω + 2 Ω 46 µΩ/Ω + 23 Ω 99 µΩ/Ω + 38 Ω 190 µΩ/Ω + 1.9 k Ω 380 µΩ/Ω + 2.3 k Ω 0.23 % of setting + 76 k Ω 1.1 % of rdg + 380 k Ω	Fluke 5522A multiproduct calibrator	SFL, HLR HSV

Parameter/Equipment	Range	CMC[2, 7] (±)	Comment	Location[10]
Resistance – Measure[3] Fixed Points	(1, 1.9) Ω (10, 19) Ω (100, 190) Ω (1, 1.9) kΩ (10, 19) kΩ (100, 190) kΩ (1, 1.9) MΩ (10, 19) MΩ 100 MΩ 1 GΩ	4.8 μΩ/Ω 2.6 μΩ/Ω 0.7 μΩ/Ω 0.9 μΩ/Ω 1 μΩ/Ω 1.3 μΩ/Ω 2.3 μΩ/Ω 2.9 μΩ/Ω 22 μΩ/Ω 120 μΩ/Ω	Fluke 8508A multimeter, Fluke 742A, IET SRL resistance standards	TPA
Resistance – Measure[3]	Up to 2 Ω (2 to 20) Ω (20 to 200) Ω 200 Ω to 2 kΩ (2 to 20) kΩ (20 to 200) kΩ 200 kΩ to 2 MΩ (2 to 20) MΩ (20 to 200) MΩ 200 MΩ to 2 GΩ (2 to 20) GΩ	15 μΩ/Ω + 3.8 μΩ 8.8 μΩ/Ω + 14 μΩ 7.2 μΩ/Ω + 46 μΩ 7.2 μΩ/Ω + 457 μΩ 7.2 μΩ/Ω + 4.6 mΩ 7.2 μΩ/Ω + 46 mΩ 8 μΩ/Ω + 0.9 Ω 15 μΩ/Ω + 9 Ω 57 μΩ/Ω + 0.9 kΩ 150 μΩ/Ω + 91 kΩ 510 μΩ/Ω + 9.1 MΩ	Fluke 8508A multimeter	TPA
	Up to 2.02 Ω (2.02 to 20.2) Ω (20.2 to 202) Ω (0.202 to 2.02) kΩ (2.02 to 20.2) kΩ (20.2 to 202) kΩ (0.202 to 2.02) MΩ (2.02 to 20.2) MΩ (20.2 to 202) MΩ (0.202 to 2.02) GΩ (2.02 to 20.2) GΩ	16 μΩ/Ω + 4 μΩ 9.6 μΩ/Ω + 14 μΩ 9.0 μΩ/Ω + 48 μΩ 8.9 μΩ/Ω + 0.46 mΩ 9 μΩ/Ω + 4.6 mΩ 9.1 μΩ/Ω + 46 mΩ 10 μΩ/Ω + 1 Ω 17 μΩ/Ω + 9.8 Ω 67 μΩ/Ω + 0.98 kΩ 0.23 mΩ/Ω + 98 kΩ 1.3 mΩ/Ω + 9.8 MΩ	Fluke 8588A multimeter	RFD, ATL, DFW
	Up to 2.02 Ω 2.02 to 20.2 Ω (20.2 to 202) Ω (0.202 to 2.02) kΩ (2.02 to 20.2) kΩ (20.2 to 202) kΩ (0.202 to 2.02) MΩ (2.02 to 20.2) MΩ (20.2 to 202) MΩ (0.202 to 2.02) GΩ (2.02 to 20.2) GΩ	21 μΩ/Ω + 4.4 μΩ 15 μΩ/Ω + 20 μΩ 12 μΩ/Ω + 53 μΩ 12 μΩ/Ω + 0.53 mΩ 12 μΩ/Ω + 5.3 mΩ 12 μΩ/Ω + 53 mΩ 13 μΩ/Ω + 1.0 Ω 17 μΩ/Ω + 9.8 Ω 67 μΩ/Ω + 0.98 kΩ 230 μΩ/Ω + 98 kΩ 1.3 mΩ/Ω + 9.8 MΩ	Fluke 8558A multimeter	RDU

Parameter/Equipment	Range	CMC[2, 7] (±)	Comment	Location[10]
Resistance – Measure[3]	Up to 12 Ω (10 to 120) Ω (0.1 to 1.2) kΩ (1 to 12) kΩ (10 to 120) kΩ (0.1 to 1.2) MΩ (1 to 12) MΩ (10 to 120) MΩ (0.1 to 1.2) GΩ	9.8 μΩ/Ω + 38 μΩ 7.8 μΩ/Ω + 0.3 mΩ 6.5 μΩ/Ω + 0.4 mΩ 6.5 μΩ/Ω + 3.8 mΩ 6.5 μΩ/Ω + 38 mΩ 9.8 μΩ/Ω + 1.5 Ω 33 μΩ/Ω + 100 Ω 330 μΩ/Ω + 1 kΩ 0.33 % of rdg + 70 kΩ	Agilent 3458A multimeter	TPA, ATL, HSV, RFD, HLR, SFL, MEL, COS, RDU, HRT, DFW
	100 V 100 kΩ **(100, 1000) V** 1 MΩ 10 MΩ 100 MΩ 1 GΩ 10 GΩ **(500, 1000) V** 100 GΩ **1000 V** 1 TΩ 10 TΩ	 0.53 % of rdg 0.5 % of rdg 0.5 % of rdg 0.5 % of rdg 0.5 % of rdg 0.52 % of rdg 0.59 % of rdg 0.7 % of rdg 2.5 % of rdg	Quadtech 1865 megohmeter	TPA
	50 Hz (1 to 10) Ω (10 to 100) Ω (100 to 1000) Ω (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ **100/120 Hz** (1 to 10) Ω (10 to 100) Ω (100 to 1000) Ω (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ **1000 Hz** (1 to 10) Ω (10 to 100) Ω (100 to 1000) Ω (1 to 10) kΩ (10 to 100) kΩ	 0.17 % of rdg + 0.003 Ω 0.062 % of rdg + 0.006 Ω 0.051 % of rdg + 0.06 Ω 0.05 % of rdg + 0.0006 kΩ 0.054 % of rdg + 0.006 kΩ 0.09 % of rdg + 0.00006 MΩ 0.45 % of rdg + 0.0006 MΩ 0.13 % of rdg + 0.003 Ω 0.049 % of rdg + 0.006 Ω 0.041 % of rdg + 0.06 Ω 0.04 % of rdg + 0.0006 kΩ 0.043 % of rdg + 0.006 kΩ 0.07 % of rdg + 0.000 06 MΩ 0.34 % of rdg + 0.0006 MΩ 0.05 % of rdg + 0.003 Ω 0.02 % of rdg + 0.006 Ω 0.02 % of rdg + 0.06 Ω 0.02 % of rdg + 0.000 6 kΩ 0.02 % of rdg + 0.006 kΩ	IET 1693 RLC meter	TPA, RFD COS

Parameter/Equipment	Range	CMC[2, 7] (±)	Comment	Location[10]
Resistance – Measure [3]	**1000 Hz** (0.1 to 1) MΩ (1 to 10) MΩ **10 kHz** (1 to 10) Ω (10 to 100) Ω (100 to 1000) Ω (1 to 10) kΩ (10 to 25.6) kΩ (25.6 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ **100 kHz** (1 to 10) Ω (10 to 100) Ω (100 to 1000) Ω (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ	 0.03 % of rdg + 0.000 06 MΩ 0.12 % of rdg + 0.0006 MΩ 0.17 % of rdg + 0.003 Ω 0.062 % of rdg + 0.006 Ω 0.051 % of rdg + 0.06 Ω 0.05 % of rdg + 0.0006 kΩ 0.051 % of rdg + 0.006 kΩ 0.19 % of rdg + 0.006 kΩ 0.33 % of rdg + 0.000 06 MΩ 1.8 % of rdg + 0.0006 MΩ 0.77 % of rdg + 0.003 Ω 0.26 % of rdg + 0.006 Ω 0.21 % of rdg + 0.06 Ω 0.23 % of rdg + 0.0006 kΩ 0.52 % of rdg + 0.006 kΩ 3.4 % of rdg + 0.000 06 MΩ	IET 1693 LCR meter	TPA.RFD COS
Capacitance – Generate[3]	(0.2 to 1.2) nF (1.2 to 12.0) nF (12 to 120.0) nF (0.12 to 1.2) µF (1.2 to 12.0) µF (12 to 120.0) µF (0.12 to 1.2) mF (1.2 to 12.0) mF (12 to 120.0) mF	0.09 % of output + 1.5 pF 0.09 % of output + 0.004 nF 0.10 % of output + 0.023 nF 0.10 % of output + 0.23 nF 0.10 % of output + 2.3 nF 0.11 % of output + 19 nF 0.19 % of output + 190 nF 0.19 % of output + 2.3 µF 0.38 % of output + 23 µF	Fluke 5560A multiproduct calibrator	COS, HRT MEL, ATL RDU, RFD TPA, HSV, DFW
	(220 to 400) pF (0.4 to 3.2999) nF (3.3 to 10.9999) nF (11 to 32.9999) nF (33 to 109.999) nF (110 to 329.999) nF (0.33 to 1.099 99) µF (1.1 to 3.299 99) µF	0.38 % of output + 7.6 pF 0.38 % of output + 0.01 nF 0.19 % of output + 0.01 nF 0.19 % of output + 0.08 nF 0.19 % of output + 0.08 nF 0.19 % of output + 0.23 nF 0.19 % of output + 0.76 nF 0.19 % of output + 2.3 nF	Fluke 5522A multiproduct calibrator	HSV, SFL HLR

Parameter/Equipment	Range	CMC[2, 7] (±)	Comment	Location[10]
Capacitance – Generate[3]	(3.3 to 10.999 9) µF (11 to 32.999 9) µF (33 to 109.999) µF (110 to 329.999) µF (0.33 to 1.099 99) mF (1.1 to 3.299 99) mF (3.3 to 10.9999) mF (11 to 32.9999) mF (33 to 110) mF	0.19 % of output + 7.6 nF 0.3 % of output + 23 nF 0.34 % of output + 76 nF 0.34 % of output + 230 nF 0.34 % of output + 0.76 µF 0.34 % of output + 2.3 µF 0.34 % of output + 7.6 µF 0.57 % of output + 23 µF 0.84 % of output + 76 µF	Fluke 5522A multiproduct calibrator	HSV, SFL HLR
Capacitance – Generate[3] Fixed Points	**1 pF** 1 kHz 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	 0.028 % of output 0.028 % of output 0.034 % of output 0.047 % of output 0.069 % of output 0.096 % of output 0.31 % of output 0.5 % of output	Agilent 16381A capacitor fixed	TPA, ATL
	10 pF 1 kHz 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	 0.019 % of output 0.019 % of output 0.019 % of output 0.019 % of output 0.019 % of output 0.019 % of output 0.022 % of output 0.024 % of output	Agilent 16382A capacitor fixed	
	100 pF 1 kHz 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	 0.017 % of output 0.017 % of output 0.018 % of output 0.018 % of output 0.02 % of output 0.024 % of output 0.053 % of output 0.083 % of output	Agilent 16383A standard air capacitor	

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
Capacitance – Generate [3] Fixed Points	**1000 pF** 1 kHz 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	 0.018 % of output 0.019 % of output 0.024 % of output 0.035 % of output 0.051 % of output 0.069 % of output 0.22 % of output 0.32 % of output	Agilent 16384A standard air capacitor	TPA, ATL
	1 pF 10 pF 100 pF 1 000 pF	0.17 % of rdg 0.17 % of rdg 0.17 % of rdg 0.17 % of rdg	Agilent 16380A capacitor set	RFD
	1 pF 1 kHz 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	 0.038 % of output 0.038 % of output 0.044 % of output 0.055 % of output 0.073 % of output 0.096 % of output 0.25 % of output 0.37 % of output	Agilent 16381A capacitor fixed	
	10 pF 1 kHz 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	 0.035 % of output 0.035 % of output 0.035 % of output 0.035 % of output 0.035 % of output 0.035 % of output 0.036 % of output 0.038 % of output	Agilent 16382A capacitor fixed	
	100 pF 1 kHz 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	 0.035 % of output 0.035 % of output 0.035 % of output 0.035 % of output 0.035 % of output 0.037 % of output 0.048 % of output 0.06 % of output	Agilent 16383A capacitor fixed	

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
Capacitance – Generate [3] Fixed Points	**1000 pF** 1 kHz 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	0.035 % of output 0.035 % of output 0.037 % of output 0.044 % of output 0.056 % of output 0.071 % of output 0.19 % of output 0.28 % of output	Agilent 16384A capacitor fixed	RFD
	0.01 µF 0.12 kHz 1 kHz 10 kHz 100 kHz	0.02 % of output 0.02 % of output 0.02 % of output 0.02 % of output	Agilent 16385A capacitor fixed	
	0.1 µF 0.12 kHz 1 kHz 10 kHz 100 kHz	0.02 % of output 0.02 % of output 0.02 % of output 0.02 % of output	Agilent 16386A capacitor fixed	
	1 µF 0.12 kHz 1 kHz 10 kHz 100 kHz	0.021 % of output 0.02 % of output 0.02 % of output 0.021 % of output	Agilent 16387A capacitor fixed	
	1 pF 1 kHz 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	0.038 % of output 0.038 % of output 0.044 % of output 0.055 % of output 0.073 % of output 0.096 % of output 0.25 % of output 0.37 % of output	Agilent 16381A capacitor fixed	COS

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
Capacitance – Generate [3] Fixed Points	**10 pF** 1 kHz 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	 0.035 % of output 0.035 % of output 0.035 % of output 0.035 % of output 0.035 % of output 0.035 % of output 0.036 % of output 0.038 % of output	Agilent 16382A capacitor fixed	COS
	1000 pF 1 kHz 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	 0.035 % of output 0.035 % of output 0.037 % of output 0.044 % of output 0.056 % of output 0.071 % of output 0.19 % of output 0.28 % of output	Agilent 16384A, capacitor fixed	
	100 & 120 Hz 10 µF 100 µF 1000 µF 10 mF 100 mF 1 F **1 kHz** 10 µF 100 µF 1000 µF 10 mF	 0.35 % of output 0.35 % of output 0.35 % of output 0.35 % of output 0.36 % of output 0.43 % of output 0.35 % of output 0.35 % of output 0.36 % of output 0.4 % of output	Agilent 16385A, 16386A, 16387A, GR 1417 capacitance standard	
Capacitance – Generate 1 kHz	1 pF to 1.111 11 µF	0.05 % of output + 0.5 pF	GR 1413 decade capacitor	MEL, COS
Inductance – Generate[3]	(13 to 120.0) µH (0.12 to 1.2) mH (1.2 to 12.0) mH (12 to 120.0) mH (0.12 to 1.2) H (1.2 to 12.0) H (12 to 120.0) H	0.15 % of output + 0.15 µH 0.09 % of output + 0.76 µH 0.09 % of output + 7.6 µH 0.09 % of output + 76 µH 0.11 % of output + 0.76 mH 0.15 % of output + 7.6 mH 0.19 % of output + 76 mH	Fluke 5560A multiproduct calibrator	COS, HRT MEL, ATL RDU, RFD, DFW, HSV

Parameter/Equipment	Range	CMC[2, 7] (±)	Comment	Location[10]
Inductance – Generate [3] Fixed Point	**100 µH** 10 kHz	0.25µH	GR 1482-B standard inductor	RFD
	100 mH 100 Hz	0.047 mH	GR 1482-L standard inductor	RFD, RDU
	500 µH 1 kHz	0.35 µH	GR 1482-D tandard inductor	ATL
	20 mH 1 kHz	0.008 mH	GR 1482-J standard Inductor	
	200 mH 100 Hz	0.11 mH	GR 1482-M standard inductor	
	2 H 100 Hz	0.8 mH	GR 1482-Q standard inductor	
	50 mH 100 Hz 1 kHz	0.028 mH 0.021 mH	GR 1482-K standard inductor	TPA
	100 mH 100 Hz 1 kHz	0.069 mH 0.063 mH	GR 1481-G standard inductor	
	200 mH 100 Hz 1 kHz	0.09 mH 0.06 mH	GR 1482-M standard inductor	
	500 mH 100 Hz 1 kHz	0.23 mH 0.15 mH	GR 1482-N standard inductor	
	5 H 100 Hz 1 kHz	0.021 H 0.021 H	GR 1482-R standard inductor	

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
Inductance – Generate[3] Fixed Point	**1000 Hz** 5 mH	0.0018 mH	GR 1482-G standard inductor	COS
	(100 to 1000) Hz 100 mH	0.13mH	GR LSB-100mH standard inductor	
	1kHz (1 to 10) mH (1 to 100) mH (100 to 1 000) mH (1 to 10) H	2 % of output 1 % of output 0.5 % of output 0.25 % of output	Bundy Electronics BEC-700-032 decade inductor	MEL
Capacitance – Measure[3]	**50 Hz** (50 to 100) pF (100 to 400) pF (400 to 1000) pF (1 to 10) nF (10 to 100) nF (100 to 1000) nF (0.1 to 1) µF (1 to 10) µF (10 to 100) µF (100 to 1000) µF **100 Hz** (20 to 100) pF (100 to 400) pF (400 to 1000) pF (1 to 10) nF (10 to 100) nF (100 to 1000) nF (0.1 to 1) µF (10 to 100) µF (100 to 1 000) µF **120 Hz** (20 to 100) pF (100 to 400) pF (400 to 1000) pF (1 to 10) nF (10 to 100) nF (100 to 1000) nF (0.1 to 1) µF (1 to 10) µF (10 to 100) µF (100 to 1000) µF	2.6 % of rdg + 0.015 pF 1.3 % of rdg + 0.06 pF 0.37 % of rdg + 0.06 pF 0.18 % of rdg + 0.0006 nF 0.063 % of rdg + 0.006 nF 0.051 % of rdg + 0.06 nF 0.051 % of rdg + 0.000 06 µF 0.05 % of rdg + 0.0006 µF 0.054 % of rdg + 0.006 µF 0.09 % of rdg + 0.06 µF 2.4 % of rdg + 0.015 pF 0.52 % of rdg + 0.06 pF 0.16 % of rdg + 0.06 pF 0.088 % of rdg + 0.0006 nF 0.045 % of rdg + 0.006 nF 0.041 % of rdg + 0.06 nF 0.041 % of rdg + 0.000 06 µF 0.046 % of rdg + 0.006 µF 0.1 % of rdg + 0.06 µF 2 % of rdg + 0.015 pF 0.44 % of rdg + 0.06 pF 0.14 % of rdg + 0.06 pF 0.08 % of rdg + 0.0006 nF 0.044 % of rdg + 0.006 nF 0.04 % of rdg + 0.06 nF 0.04 % of rdg + 0.000 06 µF 0.041 % of rdg + 0.0006 µF 0.047 % of rdg + 0.006 µF 0.11 % of rdg + 0.06 µF	IET 1693 LCR meter	TPA, RFD COS

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
Capacitance – Measure[3]	**1000 Hz** (1 to 10) pF (10 to 20) pF (20 to 100) pF (100 to 400) pF (400 to 1000) pF (1 to 10) nF (10 to 100) nF (100 to 1 000) nF (0.1 to 1) µF (1 to 10) µF (10 to 100) µF (100 to 1000) µF **10 kHz** (20 to 100) pF (100 to 622) pF (622 to 1000) pF (1 to 10) nF (10 to 100) nF (100 to 1 000) nF (0.1 to 1) µF (1 to 10) µF (10 to 100) µF (100 to 500) µF **100 kHz** (20 to 100) pF (100 to 400) pF (400 to 1000) pF (1 to 10) nF (10 to 100) nF (100 to 1000) nF (0.1 to 1) µF (1 to 10) µF	 1.6 % of rdg + 0.014 pF 0.18 % of rdg + 0.015 pF 0.1 % of rdg + 0.015 pF 0.036 % of rdg + 0.06 pF 0.024 % of rdg + 0.06 pF 0.022 % of rdg + 0.0006 nF 0.02 % of rdg + 0.006 nF 0.02 % of rdg + 0.06 nF 0.02 % of rdg + 0.000 06 µF 0.022 % of rdg + 0.0006 µF 0.04 % of rdg + 0.006 µF 0.22 % of rdg + 0.06 µF 0.3 % of rdg + 0.015 pF 0.2 % of rdg + 0.06 pF 0.051 % of rdg + 0.06 pF 0.051 % of rdg + 0.0006 nF 0.051 % of rdg + 0.006 nF 0.058 % of rdg + 0.06 nF 0.058 % of rdg + 0.000 06 µF 0.13 % of rdg + 0.0006 µF 0.85 % of rdg + 0.006 µF 4.1 % of rdg + 0.06 µF 0.49 % of rdg + 0.015 pF 0.26 % of rdg + 0.06 pF 0.21 % of rdg + 0.06 pF 0.21 % of rdg + 0.0006 nF 0.24 % of rdg + 0.006 nF 0.58 % of rdg + 0.06 nF 0.58 % of rdg + 0.000 06 µF 4 % of rdg + 0.0006 µF	IET 1693 LCR meter	TPA, RFD COS

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
Capacitance – Measure[3]	**100 Hz /120 Hz** (16 to 400) pF (0.4 to 1) nF (1 to 100) nF (0.1 to 1) µF (1 to 100) µF (0.1 to 1) mF **1000 Hz** (16 to 400) pF (0.4 to 1) nF (1 to 100) nF (0.1 to 1) µF (1 to 100) µF (0.1 to 1) mF **10 kHz** (16 to 400) pF (0.4 to 1) nF (1 to 100) nF (0.1 to 1) µF (1 to 100) µF (0.1 to 1) mF **20 kHz** (16 to 400) pF (0.4 to 1) nF (1 to 100) nF (0.1 to 1) µF (1 to 100) µF **100 kHz** (16 to 400) pF (0.4 to 1) nF (1 to 100) nF (0.1 to 1) µF (1 to 10) µF	 2 % of rdg + 0.3 pF 0.17 % of rdg 0.13 % of rdg 0.12 % of rdg 0.18 % of rdg 0.20 % of rdg 0.43 % of rdg + 0.3 pF 0.1 % of rdg 0.08 % of rdg 0.07 % of rdg 0.13 % of rdg 0.45 % of rdg 0.56 % of rdg + 0.3 pF 0.15 % of rdg 0.12 % of rdg 0.17 % of rdg 0.69 % of rdg 3.5 % of rdg 1.2 % of rdg + 0.3 pF 0.62 % of rdg 0.62 % of rdg 0.43 % of rdg 1.7 % of rdg 1.6 % of rdg + 0.3 pF 1 % of rdg 0.98 % of rdg 1.4 % of rdg 4.1 % of rdg	Agilent 4263B LCR meter	SFL, HSV

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
Capacitance – Measure[3]	**(10 to 100) nF** (20 to 100) Hz (100 to 1000) Hz (1 to 10) kHz (10 to 100) kHz (0.1 to 1) MHz (1 to 2) MHz **(100 to 1000) nF** (20 to 100) Hz (100 to 1000) Hz (1 to 10) kHz (10 to 100) kHz (0.1 to 1) MHz (1 to 2) MHz **(1 to 10) µF** (20 to 100) Hz (100 to 1000) Hz (1 to 10) kHz (10 to 100) kHz (0.1 to 1) MHz (1 to 2) MHz **(10 to 100) µF** (20 to 100) Hz (100 to 1000) Hz (1 to 10) kHz (10 to 100) kHz **(100 to 1000) µF** (20 to 100) Hz (100 to 1000) Hz (1 to 10) kHz **(1 to 10) mF** (20 to 100) Hz (100 to 1000) Hz **(10 to 100) mF** (20 to 100) Hz	 0.3 % of rdg 0.1 % of rdg 0.1 % of rdg 0.1 % of rdg 0.3 % of rdg 1 % of rdg 0.3 % of rdg 0.1 % of rdg 0.3 % of rdg 0.3 % of rdg 1 % of rdg 1 % of rdg 0.3 % of rdg 0.12 % of rdg 0.3 % of rdg 0.7 % of rdg 5 % of rdg 7 % of rdg 0.3 % of rdg 0.3 % of rdg 0.7 % of rdg 5 % of rdg 0.3 % of rdg 1 % of rdg 5 % of rdg 1.2 % of rdg 10 % of rdg 10 % of rdg	Agilent E4980A LCR meter	MEL, TPA RDU

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
Inductance – Measure [3]	**100 Hz**		IET 1693 LCR meter	TPA, RFD COS
	(40 to 100) µH	3.8 % of rdg + 0.006 µH		
	(0.1 to 0.4) mH	1.6 % of rdg + 0.000 06 mH		
	(0.4 to 1) mH	0.42 % of rdg + 0.000 06 mH		
	(1 to 10) mH	0.19 % of rdg + 0.0006 mH		
	(10 to 100) mH	0.056 % of rdg + 0.006 mH		
	(0.1 to 1) H	0.042 % of rdg + 0.000 06 H		
	(1 to 10) H	0.041 % of rdg + 0.0006 H		
	(10 to 100) H	0.042 % of rdg + 0.006 H		
	1 000 Hz			
	(4 to 10) µH	1.3 % of rdg + 0.003 µH		
	(10 to 40) µH	0.53 % of rdg + 0.006 µH		
	(40 to 100) µH	0.15 % of rdg + 0.006 µH		
	(0.1 to 0.4) mH	0.071 % of rdg + 0.000 06 mH		
	(0.4 to 1) mH	0.033 % of rdg + 0.000 06 mH		
	(1 to 10) mH	0.025 % of rdg + 0.0006 mH		
	(10 to 100) mH	0.021 % of rdg + 0.006 mH		
	(0.1 to 1) H	0.02 % of rdg + 0.000 06 H		
	(1 to 10) H	0.021 % of rdg + 0.0006 H		
	(10 to 100) H	0.026 % of rdg + 0.006 H		
	10 kHz			
	(1 to 4) µH	2.1 % of rdg + 0.003 µH		
	(4 to 10) µH	0.56 % of rdg + 0.003 µH		
	(10 to 40) µH	0.25 % of rdg + 0.006 µH		
	(40 to 100) µH	0.1 % of rdg + 0.006 µH		
	(0.1 to 0.4) mH	0.071 % of rdg + 0.000 06 mH		
	(0.4 to 1) mH	0.056 % of rdg + 0.000 06 mH		
	(1 to 10) mH	0.052 % of rdg + 0.0006 mH		
	(10 to 100) mH	0.051 % of rdg + 0.006 mH		
	(0.1 to 0.407) H	0.051 % of rdg + 0.000 06 mH		
	(0.407 to 1) H	0.18 % of rdg + 0.000 06 H		
	(1 to 10) H	0.27 % of rdg + 0.0006 H		
	(10 to 100) H	1.2 % of rdg + 0.006 H		
	100 kHz			
	(1 to 4) µH	1.2 % of rdg + 0.003 µH		
	(4 to 10) µH	0.44 % of rdg + 0.003 µH		
	(10 to 40) µH	0.3 % of rdg + 0.006 µH		
	(40 to 100) µH	0.23 % of rdg + 0.006 µH		
	(0.1 to 0.4) mH	0.21 % of rdg + 0.000 06 mH		
	(0.4 to 1) mH	0.21 % of rdg + 0.000 06 mH		
	(1 to 10) mH	0.22 % of rdg + 0.0006 mH		
	(10 to 100) mH	0.39 % of rdg + 0.006 mH		
	(0.1 to 1) H	2.1 % of rdg + 0.000 06 H		

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
Inductance – Measure[3]	**100 Hz /120 Hz**		Agilent 4263B LCR meter	SFL, HSV
	(4 to 10) µH	3.4 % of rdg + 0.03 µH		
	(10 to 40) µH	1.5 % of rdg + 0.03 µH		
	(40 to 100) µH	0.57 % of rdg + 0.03 µH		
	(0.1 to 0.4) mH	0.4 % of rdg		
	(0.4 to 1) mH	0.32 % of rdg		
	(1 to 10) mH	0.28 % of rdg		
	(10 to 100) mH	0.23 % of rdg		
	(0.1 to 1) H	0.18 % of rdg		
	(1 to 10) H	0.22 % of rdg		
	1000 Hz			
	(1 to 4) µH	1.0 % of rdg + 0.03 µH		
	(4 to 10) µH	0.46 % of rdg + 0.03 µH		
	(10 to 40) µH	0.49 % of rdg + 0.03 µH		
	(40 to 100) µH	0.35 % of rdg + 0.03 µH		
	(0.1to 0.4) mH	0.30 % of rdg		
	(0.4 to 1) mH	0.11 % of rdg		
	(1 to 10) mH	0.12 % of rdg		
	(10 to 100) mH	0.10 % of rdg		
	(0.1 to 1) H	0.10 % of rdg		
	(1 to 10) H	0.12 % of rdg		
	10 kHz			
	(1 to 4) µH	0.62 % of rdg + 0.03 µH		
	(4 to 10) µH	0.40 % of rdg + 0.03 µH		
	(10 to 40) µH	0.32 % of rdg + 0.03 µH		
	(40 to 100) µH	0.18 % of rdg + 0.03 µH		
	(0.1 to 0.4) mH	0.20 % of rdg		
	(0.4 to 1) mH	0.14 % of rdg		
	(1 to 10) mH	0.17 % of rdg		
	(10 to 100) mH	0.20 % of rdg		
	(0.1 to 1) H	0.20 % of rdg		
	(1 to 10) H	0.44 % of rdg		
	20 kHz			
	(1 to 4) µH	1.3 % of rdg + 0.03 µH		
	(4 to 10) µH	0.68 % of rdg + 0.03 µH		
	(10 to 40) µH	0.63 % of rdg + 0.03 µH		
	(40 to 100) µH	0.53 % of rdg + 0.03 µH		
	(0.1 to 0.4) mH	0.49 % of rdg		
	(0.4 to 1) mH	0.48 % of rdg		
	(1 to 10) mH	0.65 % of rdg		
	(10 to 100) mH	0.66 % of rdg		
	(0.1 to 1) H	1.2 % of rdg		
	(1 to 10) H	3.3 % of rdg		

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
Inductance – Measure [3]	**100 kHz** (1 to 4) µH (4 to 10) µH (10 to 40) µH (40 to 100) µH (0.1 to 0.4) mH (0.4 to 1) mH (1 to 10) mH (10 to 100) mH (0.1 to 1) H	 1.8 % of rdg + 0.03 µH 0.86 % of rdg + 0.03 µH 1.20 % of rdg + 0.03 µH 0.68 % of rdg + 0.03 µH 0.90 % of rdg 1.1 % of rdg 1.3 % of rdg 1.4 % of rdg 6.3 % of rdg	Agilent 4263B LCR meter	SFL, HSV
	(100 to 1000) nH (10 to 100) kHz (0.1 to 1) MHz (1 to 2) MHz **(1 to 10) µH** (2 to 10) kHz (10 to 100) kHz (0.1 to 1) MHz (1 to 2) MHz **(10 to 100) µH** (250 to 1000) Hz (1 to 2) kHz (2 to 10) kHz (10 to 100) kHz (0.1 to 1) MHz (1 to 2) MHz **(100 to 1000) µH** (50 to 100) Hz (100 to 250) Hz (250 to 1000) Hz **(100 to 1000) µH** (1 to 2) kHz (2 to 10) kHz (10 to 100) kHz (0.1 to 1) MHz (1 to 2) MHz	 10 % of rdg 1 % of rdg 1 % of rdg 10 % of rdg 1 % of rdg 0.3 % of rdg 1 % of rdg 10 % of rdg 10 % of rdg 1 % of rdg 0.3 % of rdg 0.3 % of rdg 1 % of rdg 10 % of rdg 10 % of rdg 1 % of rdg 1 % of rdg 0.3 % of rdg 0.3 % of rdg 0.3 % of rdg 1 % of rdg	Agilent E4980A LCR meter	MEL, TPA RDU

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
Inductance – Measure[3]	**(1 to 10) mH** (20 to 50) Hz (50 to 100) Hz (100 to 250) Hz (250 to 1000) Hz (1 to 2) kHz (2 to 10) kHz (10 to 100) kHz (0.1 to 1) MHz (1 to 2) MHz **(10 to 100) mH** (20 to 50) Hz (50 to 100) Hz (100 to 250) Hz (250 to 1000) Hz (1 to 2) kHz (2 to 10) kHz (10 to 100) kHz (0.1 to 1) MHz (1 to 2) MHz **(100 to 1000) mH** (20 to 50) Hz (50 to 100) Hz (100 to 250) Hz (250 to 1000) Hz (1 to 2) kHz (2 to 10) kHz (10 to 100) kHz (0.1 to 1) MHz **(1 to 10) H** (20 to 50) Hz (50 to 100) Hz (100 to 250) Hz (250 to 1000) Hz (1 to 2) kHz (2 to 10) kHz (10 to 100) kHz	 10 % of rdg 1 % of rdg 1 % of rdg 0.3 % of rdg 0.3 % of rdg 0.3 % of rdg 0.1 % of rdg 0.3 % of rdg 1 % of rdg 1 % of rdg 0.3 % of rdg 0.3 % of rdg 0.3 % of rdg 0.3 % of rdg 0.1 % of rdg 0.1 % of rdg 1 % of rdg 10 % of rdg 0.3 % of rdg 0.3 % of rdg 0.1 % of rdg 0.1 % of rdg 0.1 % of rdg 0.1 % of rdg 0.3 % of rdg 10 % of rdg 0.3 % of rdg 0.3 % of rdg 0.1 % of rdg 0.1 % of rdg 0.1 % of rdg 0.3 % of rdg 1 % of rdg	Agilent E4980A LCR meter	MEL, TPA RDU

Parameter/Equipment	Range	CMC[2, 7] (±)	Comment	Location[10]
Oscilloscopes Calibration[3] – Generate			Fluke 5820A oscilloscope calibrator w/ GHz option	COS, MEL ATL, TPA HSV, HRT SFL, HLR
Voltage DC – 50Ω	(1 to 24.999) mV (25 to 109.99) mV 110 mV to 2.1999 V (2.2 to 6.6) V	0.19 % of Output + 31 µV 0.19 % of Output + 36 µV 0.19 % of Output + 87 µV 0.19 % of Output + 0.6 mV		
DC – 1MΩ	(1 to 24.999) mV (25 to 109.99) mV 110 mV to 2.1999 V (2.2 to 10.999) V (11 to 130) V	0.019 % of rdg + 20 µV 0.019 % of rdg + 25 µV 0.019 % of rdg + 76 µV 0.019 % of rdg + 0.6 mV 0.019 % of rdg + 6.0 mV		
Square Wave 10 Hz to 10 kHz – 50 Ω	(1 to 24.999) mVpp (25 to 109.99) mVpp (110mV to 2.1999) Vpp (2.2 to 6.6) Vpp	0.19 % of Output + 31 µV 0.19 % of Output + 36 µV 0.19 % of Output + 87 µV 0.19 % of Output + 0.6 mV		
Square Wave 10 Hz to 1 kHz – 1 MΩ	(1 to 24.999) mV (25 to 109.99) mV (110mV to 2.1999) V (2.2 to 10.999) V (11 to 130) V	0.038 % of rdg + 4 µV 0.038 % of rdg + 9 µV 0.038 % of rdg + 60 µV 0.038 % of rdg + 0.6 mV 0.038 % of rdg + 6.0 mV		
Square Wave (1 to 10) kHz – 1 MΩ	(1 to 24.999) mV (25 to 109.99) mV (110mV to 2.1999) V (2.2 to 10.999) V (11 to 130) V	0.19 % of rdg + 31 µV 0.19 % of rdg + 36 µV 0.19 % of rdg + 87 µV 0.19 % of rdg + 0.6 mV 0.19 % of rdg + 6.0 mV		
Leveled Sine Flatness[3]	**3 dB Bandwidth**			
50 kHz to 10 MHz Reference	(5 to 50) mVpp 50 kHz to 100 MHz (100 to 300) MHz (300 to 500) MHz (500 to 600) MHz (600 to 1600) MHz (1600 to 2100) MHz	 0.34 dB 0.36 dB 0.42 dB 0.46 dB 0.5 dB 0.56 dB		
	50 mV to 3.5 Vpp 50 kHz to 100 MHz (100 to 300) MHz (300 to 500) MHz (500 to 600) MHz (600 to 1600) MHz (1600 to 2100) MHz	 0.24 dB 0.24 dB 0.32 dB 0.34 dB 0.4 dB 0.44 dB		

Parameter/Equipment	Range	CMC[2, 7] (±)	Comment	Location[10]
Leveled Sine Flatness[3] 50 kHz to 10 MHz Reference	**(3.5 to 5) Vpp** 50 kHz to 100 MHz (100 to 300) MHz (300 to 500) MHz (500 to 600) MHz	 0.24 dB 0.24 dB 0.32 dB 0.34 dB	Fluke 5820A oscilloscope calibrator w/ GHz option	COS, MEL ATL, TPA HSV, HRT SFL, HLR
Oscilloscope Calibration Generate[3] Leveled Sine Flatness	**3 dB Bandwidth** **50 mV to 3.5 Vpp** (1100 to 4000) MHz (4000 to 8000) MHz (8000 to 18 000) MHz	 0.25 dB 0.35 dB 0.46 dB	Agilent EPM series power meter w/E9304A H18 power sensor	COS, MEL ATL, TPA HSV, HRT SFL, HLR RFD, RDU, DFW
Oscilloscope Calibration – Generate[3] Time Marker	 500 ps to 20 ms 50 ms to 5 s	 0.25 µs/s 1.9 µs/s + 3.8 µHz	Fluke 5820A oscilloscope calibrator w/ GHz option	COS, MEL ATL, TPA HSV, HRT SFL , HLR
Oscilloscope Calibration – Measure[3] Resistance Leakage	 (40 to 60) Ω 500 kΩ to 1.5 MΩ (0 to 5.99) V	 0.08 % of rdg 0.08 % of rdg 0.038 % of rdg + 1.3 mV		
Oscilloscopes Calibration[3] – Generate Voltage DC – 50 Ω DC – 1 MΩ Square Wave 10 Hz to 10 kHz – 1 MΩ	 1 mV to 5 V 1 mV to 200 V 1 mV to 200 Vpp	 0.025 % of output + 25uV 0.025 % of output + 25uV 0.1 % of output + 10uV	Fluke 9500B w/ 9510 active head	COS, MEL ATL, TPA HSV, RFD
Oscilloscopes Calibration[3] – Generate Time Marker	 9 ns to 55 s	 0.25 µs/s		
Oscilloscopes Calibration[3] – Measure Input Impedance Resistance	 (10 to 40) Ω (40 to 90) Ω (90 to 150) Ω (50 to 800) KΩ (0.8 to 1.2) MΩ (1.2 to 12) MΩ	 0.5 % of rdg 0.1 % of rdg 0.5 % of rdg 0.5 % of rdg 0.1 % of rdg 0.5 % of rdg		

Parameter/Equipment	Range	CMC[2, 7] (±)	Comment	Location[10]
Oscilloscopes Calibration[3] – Generate Leveled Sine Flatness 50 kHz to 10 MHz Ref	**(5mV to 5Vpp)** 0.1 Hz to 300 MHz (300 to 550) MHz **(5 mV to 3Vpp)** (550 to 1100) MHz	 0.18 dB 0.22 dB 0.3 dB	Fluke 9500B w/ 9510 active head	COS, MEL ATL, TPA HSV, RFD
Oscilloscopes Calibration[3] – Generate Voltage DC – 50 Ω DC – 1 MΩ Square Wave 10 Hz to 10 kHz 50Ω 50Ω 1MΩ 1MΩ	 1 mV to 5 V 1 mV to 200 V 40 µV to 1 mVpp 1 mV to 5 Vpp 40 µV to 1 mVpp 1 mV to 200 Vpp	 0.025 % of output + 25uV 0.010 % of output + 10uV 1.0 % of output + 10uV 0.10 % of output + 10uV 1.0 % of output + 10uV 0.10 % of output + 10uV	Fluke 9500C w/9540C active head	RDU, ATL, DFW, HSV
Oscilloscopes Calibration[3] – Generate Leveled Sine Flatness 50 kHz Reference	**(5mV to 5Vpp)** (0.1 Hz to 100) MHz (100 to 500) MHz (500 to 1100) MHz (1100 to 2020) MHz **(5 mV to 3Vpp)** (2020 to 3200) MHz **(5 mV to 2Vpp)** (3200 to 4200) MHz	 0.18 dB 0.24 dB 0.28 dB 0.34 dB 0.42 dB 0.52 dB		
Oscilloscopes Calibration[3] – Generate Time Marker	 240 pS ns to 55 s	 0.15 µs/s		
Oscilloscopes Calibration[3] – Measure Input Impedance Resistance	(10 to 40) Ω (40 to 90) Ω (0.09 to 800) KΩ (0.8 to 1.2) MΩ (1.2 to 12) MΩ	0.5 % of rdg 0.1 % of rdg 0.5 % of rdg 0.1 % of rdg 0.5 % of rdg		

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
AC Power – Generate[3] (12 to 120) mV Power Factor = 1	**(1.2 to 12) mA** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz **(12 to 120) mA** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz **(0.12 to 1.2) A** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz **(1.2 to 3.1) A** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz **(3.1 to 12) A** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz **(12 to 30.2) A** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz	 0.022 % of Output + 0.1 µW 0.022 % of Output + 0.1 µW 0.022 % of Output + 0.1 µW 0.12 % of Output + 0.1 µW 0.022 % of Output + 1.1 µW 0.016 % of Output + 0.7 µW 0.022 % of Output + 0.9 µW 0.12 % of Output + 1.1 µW 0.022 % of Output + 11 µW 0.022 % of Output + 7.2 µW 0.022 % of Output + 9.2 µW 0.19 % of Output + 28 µW 0.03 % of Output + 48 µW 0.025 % of Output + 31 µW 0.03 % of Output + 31 µW 0.19 % of Output + 48 µW 0.03 % of Output + 110 µW 0.025 % of Output + 72 µW 0.03 % of Output + 92 µW 0.19 % of Output + 110 µW 0.077 % of Output + 0.92 mW 0.054 % of Output + 0.74 mW 0.38 % of Output + 0.74 mW	Fluke 5560A multiproduct calibrator	COS, HRT MEL, ATL RDU, RFD TPA, HSV, DFW
AC Power – Generate [3] (0.12 to 1.2) V Power Factor = 1	**(1.2 to 12) mA** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz **(12 to 120) mA** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz **(0.12 to 1.2) A** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz	 0.022 % of Output + 0.9 µW 0.022 % of Output + 0.9 µW 0.022 % of Output + 0.9 µW 0.12 % of Output + 0.9 µW 0.022 % of Output + 9.2 µW 0.016 % of Output + 4.7 µW 0.022 % of Output + 7.4 µW 0.12 % of Output + 9.2 µW 0.022 % of Output + 92 µW 0.022 % of Output + 47 µW 0.022 % of Output + 74 µW 0.19 % of Output + 0.27 mW		

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
AC Power – Generate[3] (0.12 to 1.2) V Power Factor = 1	**(1.2 to 3.1) A** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz **(3.1 to 12) A** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz **(12 to 30.2) A** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz	 0.03 % of Output + 0.46 mW 0.025 % of Output + 0.27 mW 0.03 % of Output + 0.27 mW 0.19 % of Output + 0.46 mW 0.03 % of Output + 0.92 mW 0.025 % of Output + 0.47 mW 0.030 % of Output + 0.74 mW 0.19 % of Output + 0.92 mW 0.077 % of Output + 9.1 mW 0.054 % of Output + 7.3 mW 0.38 % of Output + 7.3 mW	Fluke 5560A multiproduct calibrator	COS, HRT MEL, ATL RDU, RFD TPA, HSV, DFW
AC Power – Generate[3] (1.2 to 12) V Power Factor = 1	**(1.2 to 12) mA** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz **(12 to 120) mA** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz **(0.12 to 1.2) A** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz **(1.2 to 3.1) A** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz **(3.1 to 12) A** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz **(12 to 30.2) A** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz	 0.022 % of Output + 9.2 µW 0.022 % of Output + 9.2 µW 0.022 % of Output + 9.2 µW 0.12 % of Output + 9.2 µW 0.022 % of Output + 92 µW 0.016 % of Output + 46 µW 0.022 % of Output + 74 µW 0.12 % of Output + 92 µW 0.022 % of Output + 0.92 mW 0.022 % of Output + 0.46 mW 0.022 % of Output + 0.74 mW 0.19 % of Output + 2.7 mW 0.03 % of Output + 4.6 mW 0.025 % of Output + 2.7 mW 0.03 % of Output + 2.7 mW 0.19 % of Output + 4.6 mW 0.03 % of Output + 9.2 mW 0.025 % of Output + 4.6 mW 0.03 % of Output + 7.4 mW 0.19 % of Output + 9.2 mW 0.077 % of Output + 91 mW 0.054 % of Output + 73 mW 0.38 % of Output + 73 mW		

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
AC Power – Generate [3] (12 to 120) V Power Factor = 1	**(1.2 to 12) mA** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz **(12 to 120) mA** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz **(0.12 to 1.2) A** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz **(1.2 to 3.1) A** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz **(3.1 to 12) A** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz **(12 to 30.2) A** (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz	 0.022 % of Output + 92 µW 0.022 % of Output + 92 µW 0.022 % of Output + 92 µW 0.12 % of Output + 92 µW 0.022 % of Output + 0.92 mW 0.016 % of Output + 0.46 mW 0.022 % of Output + 0.74 mW 0.12 % of Output + 0.92 mW 0.022 % of Output + 9.2 mW 0.022 % of Output + 4.6 mW 0.022 % of Output + 7.4 mW 0.19 % of Output + 27 mW 0.03 % of Output + 46 mW 0.025 % of Output + 27 mW 0.03 % of Output + 27 mW 0.19 % of Output + 46 mW 0.03 % of Output + 92 mW 0.025 % of Output + 46 mW 0.03 % of Output + 74 mW 0.19 % of Output + 92 mW 0.077 % of Output + 0.91 W 0.054 % of Output + 0.73 W 0.38 % of Output + 0.73 W	Fluke 5560A multiproduct calibrator	COS, HRT MEL, ATL RDU, RFD TPA, HSV, DFW
AC Power – Generate [3] (120 to 330) V Power Factor = 1	**(1.2 to 12) mA** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz **(12 to 120) mA** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz **(0.12 to 1.2) A** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz	 0.022 % of Output + 0.26 mW 0.022 % of Output + 0.26 mW 0.022 % of Output + 0.26 mW 0.12 % of Output + 0.26 mW 0.022 % of Output + 2.6 mW 0.016 % of Output + 1.5 mW 0.022 % of Output + 2.1 mW 0.12 % of Output + 2.6 mW 0.022 % of Output + 26 mW 0.022 % of Output + 15 mW 0.022 % of Output + 21 mW 0.19 % of Output + 76 mW		

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
AC Power – Generate[3] (120 to 330) V Power Factor = 1	**(1.2 to 3.1) A** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz **(3.1 to 12) A** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz **(12 to 30.2) A** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz	 0.03 % of Output + 0.13 W 0.025 % of Output + 0.08 W 0.030 % of Output + 0.08 W 0.19 % of Output + 0.13 W 0.03 % of Output + 0.26 W 0.025 % of Output + 0.15 W 0.03 % of Output + 0.21 W 0.19 % of Output + 0.26 W 0.077 % of Output + 2.5 W 0.054 % of Output + 2.0 W 0.38 % of Output + 2.0 W	Fluke 5560A multiproduct calibrator	COS, HRT MEL, ATL RDU, RFD TPA, HSV, DFW
AC Power – Generate [3] (330 to 1020) V Power Factor = 1	**(1.2 to 12) mA** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz **(12 to 120) mA** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz **(0.12 to 1.2) A** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz **(1.2 to 3.1) A** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz **(3.1 to 12) A** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz **(12 to 30.2) A** (10 to 40) Hz (40 to 1000) Hz (1 to 5) kHz	 0.022 % of Output + 1.1 mW 0.022 % of Output + 1.1 mW 0.022 % of Output + 1.1 mW 0.12 % of Output + 1.1 mW 0.022 % of Output + 11 mW 0.016 % of Output + 8.3 mW 0.022 % of Output + 9.6 mW 0.12 % of Output + 11 mW 0.022 % of Output + 110 mW 0.022 % of Output + 83 mW 0.022 % of Output + 96 mW 0.19 % of Output + 240 mW 0.03 % of Output + 0.43 W 0.025 % of Output + 0.30 W 0.03 % of Output + 0.30 W 0.19 % of Output + 0.43 W 0.03 % of Output + 1.1 W 0.025 % of Output + 0.8 W 0.03 % of Output + 1.0 W 0.19 % of Output + 1.1 W 0.077 % of Output + 8.0 W 0.054 % of Output + 6.5 W 0.38 % of Output + 6.5 W		

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
AC Power – Generate [3] (33 to 329.999) mV Power Factor = 1	**(3.3 to 32.999 9) mA** (20 to 45) Hz (45 to 1000 Hz **(33 to 329.999) mA** (20 to 45) Hz (45 to 1000) Hz **(0.33 to 1.099 99) A** (10 to 45) Hz (45 to 1000) Hz **(1.1 to 2.999 99) A** (10 to 45) Hz (45 to 1000) Hz **(3 to 10.9999) A** (45 to 100) Hz (100 to 1000) Hz **(11 to 20.5) A** (45 to 100) Hz (100 to 1000) Hz	 0.072 % of Output + 0.5 µW 0.032 % of Output + 0.5 µW 0.072 % of Output + 5.4 µW 0.032 % of Output + 5.4 µW 0.14 % of Output + 26 µW 0.04 % of Output + 26 µW 0.14 % of Output + 31 µW 0.044 % of Output + 31 µW 0.047 % of Output + 0.5 mW 0.077 % of Output + 0.5 mW 0.092 % of Output + 1.3 mW 0.12 % of Output + 1.3 mW	Fluke 5522A multiproduct	SFL, HLR HSV
AC Power – Generate [3] (0.33 to 3.299 99) V Power Factor = 1	**(3.3 to 32.9999) mA** (20 to 45) Hz (45 to 1000) Hz **(33 to 329.999) mA** (20 to 45) Hz (45 to 1000) Hz **(0.33 to 1.09999) A** (10 to 45) Hz (45 to 1000) Hz **(1.1 to 2.999 99) A** (10 to 45) Hz (45 to 1000) Hz **(3 to 10.999 9) A** (45 to 100) Hz (100 to 1000) Hz **(11 to 20.5) A** (45 to 100) Hz (100 to 1000) Hz	 0.072 % of Output + 5.2 µW 0.033 % of Output + 5.2 µW 0.072 % of Output + 52 µW 0.033 % of Output + 52 µW 0.14 % of Output + 26 µW 0.04 % of Output + 26 µW 0.14 % of Output + 0.28 mW 0.047 % of Output + 0.29 mW 0.047 % of Output + 5.1 mW 0.077 % of Output + 5.1 mW 0.092 % of Output + 13 mW 0.12 % of Output + 13 mW		

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
AC Power – Generate [3] (3.3 to 32.999 9) V Power Factor = 1	**(3.3 to 32.999 9) mA** (20 to 45) Hz (45 to 1000) Hz **(33 to 329.999) mA** (20 to 45) Hz (45 to 1000) Hz **(0.33 to 1.099 99) A** (10 to 45) Hz (45 to 1000) Hz **(1.1 to 2.999 99) A** (10 to 45) Hz (45 to 1000) Hz **(3 to 10.9999) A** (45 to 100) Hz (100 to 1000) Hz **(11 to 20.5) A** (45 to 100) Hz (100 to 1000) Hz	 0.072 % of Output + 53 µW 0.033 % of Output + 53 µW 0.072 % of Output + 0.5 mW 0.033 % of Output + 0.5 mW 0.14 % of Output + 2.6 mW 0.04 % of Output + 2.6 mW 0.14 % of Output + 2.9 mW 0.047 % of Output + 2.9 mW 0.047 % of Output + 51 mW 0.077 % of Output + 51 mW 0.092 % of Output + 0.13 W 0.12 % of Output + 0.13 W	Fluke 5522A multiproduct calibrator	SFL, HLR HSV
AC Power – Generate [3] (33 to 329.999) V Power Factor = 1	**(3.3 to 32.999 9) mA** (45 to 1000) Hz **(33 to 329.999) mA** (45 to 1000) Hz **(0.33 to 1.099 99) A** (45 to 1000) Hz **(1.1 to 2.999 99) A** (45 to 1000) Hz **(3 to 10.9999) A** (45 to 100) Hz (100 to 1000) Hz **(11 to 20.5) A** (45 to 100) Hz (100 to 1000) Hz	 0.034 % of Output + 0.5 mW 0.034 % of Output + 5.1 mW 0.041 % of Output + 25 mW 0.048 % of Output + 26 mW 0.048 % of Output + 0.5 W 0.077 % of Output + 0.5 W 0.092 % of Output + 1.3 W 0.12 % of Output + 1.3 W		

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
AC Power – Generate[3] (330 to 1 020) V Power Factor = 1	**(3.3 to 32.999 9) mA** (45 to 1000) Hz **(33 to 329.999) mA** (45 to 1000) Hz **(0.33 to 1.099 99) A** (45 to 1000) Hz **(1.1 to 2.999 99) A** (45 to 1000) Hz **(3 to 10.999 9) A** (45 to 100) Hz (100 to 1000) Hz **(11 to 20.5) A** (45 to 100) Hz (100 to 1000) Hz	 0.036 % of Output + 1.6 mW 0.036 % of Output + 16 mW 0.043 % of Output + 78 mW 0.049 % of Output + 81 mW 0.051 % of Output + 1.6 W 0.078 % of Output + 1.6 W 0.094 % of Output + 3.9 W 0.12 % of Output + 3.9W	Fluke 5522A multiproduct calibrator	SFL, HLR HSV
Electrical Calibration of Thermocouple Indicators[3]	**Type B** (600 to 800) °C (800 to 1 550) °C (1 550 °C to 1 820) °C **Type BP** (0 to 200) °C (200 to 600) °C (600 to 800) °C (800 to 1600) °C (1600 to 2000) °C (2000 to 2500) °C **Type C** (0 to 1000) °C (1000 to 1800) °C (1800 to 2000) °C (2000 to 2316) °C **Type D** (0 to 150) °C (150 to 650) °C (650 to 1000) °C (1000 to 1800) °C (1800 to 2315) °C **Type E** (-250 to -200) °C (-200 to -100) °C (-100 to 0) °C (0 to 600) °C (600 to 1000) °C	 0.27 °C 0.21 °C 0.17 °C 0.14 °C 0.12 °C 0.13 °C 0.18 °C 0.21 °C 0.3 °C 0.12 °C 0.18 °C 0.20 °C 0.27 °C 0.19 °C 0.16 °C 0.2 °C 0.33 °C 0.59 °C 0.19 °C 0.09 °C 0.07 °C 0.06 °C 0.08 °C	Fluke 7526A process calibrator	COS, MEL RDU, RFD TPA, SFL HSV, HLR, DFW

Parameter/Equipment	Range	CMC[2] (±)	Comment	Location[10]
Electrical Calibration of Thermocouple Indicators[3]	**Type J** (-210 to -100) °C (-100 to 800) °C (800 to 1200) °C **Type K** (-250 to -200) °C (-200 to -100) °C (-100 to 800) °C (800 to 1372) °C **Type XK** (-250 to -100) °C (-100 to 0) °C (0 to 600) °C (600 to 800) °C **Type L** (-200 to -100) °C (-100 to 900) °C **Type N** (-250 to -200) °C (-200 to -100) °C (-100 to 0) °C (0 to 100) °C (100 to 800) °C (800 to 1300) °C **Type R** (-50 to -25) °C (-25 to 0) °C (0 to 100) °C (100 to 400) °C (400 to 600) °C (600 to 1000) °C (1000 to 1600) °C (1600 to 1767) °C **Type S** (-50 to -25) °C (-25 to 0) °C (0 to 100) °C (100 to 400) °C (400 to 600) °C (600 to 1600) °C (1600 to 1767) °C **Type T** (-250 to -200) °C (-200 to -100) °C (-100 to 0) °C (0 to 400) °C **Type U** (-200 to 0) °C (0 to 600) °C	 0.11 °C 0.07 °C 0.08 °C 0.35 °C 0.12 °C 0.08 °C 0.1 °C 0.08 °C 0.07 °C 0.06 °C 0.07 °C 0.08 °C 0.07 °C 0.56 °C 0.18 °C 0.09 °C 0.08 °C 0.08 °C 0.09 °C 0.42 °C 0.34 °C 0.3 °C 0.21 °C 0.17 °C 0.16 °C 0.14 °C 0.18 °C 0.39 °C 0.33 °C 0.29 °C 0.22 °C 0.18 °C 0.17 °C 0.20 °C 0.27 °C 0.12 °C 0.08 °C 0.07 °C 0.13 °C 0.08 °C	Fluke 7526A process calibrator	COS, MEL RDU, RFD TPA, SFL HSV, HLR, DFW

Parameter/Equipment	Range	CMC[2] (±)	Comment	Location[10]
Electrical Calibration of RTD Indicating Devices[3]	**Pt 100 (385)** (-200 to 800) °C **Pt 100 (3916)** (-200 to 630) °C **Pt 100 (3926)** (-200 to 630) °C **Pt 200 (385)** (-200 to 400) °C (400 to 630) °C **Pt 500 (385)** (-200 to 630) °C **Pt 1 000 (385)** (-200 to 630) °C **Cu 10 (427)** (-100 to 260) °C **Ni 120 (672)** (-80 to 260) °C	0.04 °C 0.04 °C 0.04 °C 0.30 °C 0.38 °C 0.13 °C 0.07 °C 0.29 °C 0.29 °C	Fluke 7526A process calibrator	COS, MEL RDU, RFD TPA, SFL HSV, HLR, DFW

Parameter/Equipment	Range	CMC[2] (±)	Comment	Location[10]
Electrical Calibration of Thermocouple Indicating Devices[3]	**Type B** (600 to 800) °C (800 to 1000) °C (1000 to 1550) °C (1550 to 1820) °C **Type C** (0 to 150) °C (150 to 650) °C (650 to 1000) °C (1000 to 1800) °C (1800 to 2315) °C **Type D** (0 to 150) °C (150 to 650) °C (650 to 1000) °C (1000 to 1800) °C (1800 to 2315) °C **Type E** (-250 to -150) °C (-150 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C **Type G** (0 to 150) °C (150 to 650) °C (650 to 1000) °C (1000 to 1800) °C (1800 to 2315) °C **Type J** (-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C **Type K** (-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C **Type L** (-200 to -100) °C (-100 to 800) °C (800 to 900) °C	 0.33 °C 0.26 °C 0.23 °C 0.25 °C 0.19 °C 0.16 °C 0.2 °C 0.34 °C 0.60 °C 0.19 °C 0.16 °C 0.2 °C 0.33 °C 0.59 °C 0.3 °C 0.11 °C 0.08 °C 0.12 °C 0.16 °C 0.38 °C 0.25 °C 0.2 °C 0.33 °C 0.59 °C 0.18 °C 0.1 °C 0.08 °C 0.11 °C 0.15 °C 0.21 °C 0.1 °C 0.08 °C 0.16 °C 0.27 °C 0.24 °C 0.15 °C 0.08 °C	Fluke 5560A multiproduct calibrator	HRT, ATL, TPA, HSV, RFD, MEL, COS, RDU, DFW

Parameter/Equipment	Range	CMC[2] (±)	Comment	Location[10]
Electrical Calibration of Thermocouple Indicating Devices [3]	**Type N** (-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1300) °C **Type R** (0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C **Type S** (0 to 250) °C (250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C **Type T** (-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C **Type U** (-200 to 0) °C (0 to 600) °C **Type BP** (0 to 1000) °C (1000 to 2000) °C (2000 to 2500) °C **Type XK** (-200 to 300) °C (300 to 800) °C	 0.25 °C 0.11 °C 0.09 °C 0.08 °C 0.15 °C 0.39 °C 0.22 °C 0.21 °C 0.26 °C 0.32 °C 0.24 °C 0.24 °C 0.31 °C 0.46 °C 0.16 °C 0.1 °C 0.08 °C 0.3 °C 0.08 °C 0.3 °C 0.46 °C 0.61 °C 0.15 °C 0.23 °C	Fluke 5560A multiproduct calibrator	HRT, ATL, TPA, HSV, RFD, MEL, COS, RDU, DFW
Electrical Calibration of RTD Indicators [3]	**Cu 10 (427)** (-80 to 260) °C **Cu 50 (428)** (-180 to 200) °C **Cu 100 (428)** (-180 to -40) °C (-40 to 200) °C **Ni 120 (672)** (-80 to 0) °C (0 to 100) °C (100 to 260) °C	 0.23 °C 0.3 °C 0.3 °C 0.49 °C 0.06 °C 0.06 °C 0.11 °C	Fluke 5560A multiproduct calibrator	HRT, ATL, TPA, HSV, RFD, MEL, COS, RDU, DFW

Parameter/Equipment	Range	CMC[2] (±)	Comment	Location[10]
Electrical Calibration of RTD Indicators[3]	**Pt 100 (385)** (-200 to-80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C **Pt 100 (3916)** (-200 to -190) °C (-190 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C **Pt 100 (3926)** (-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C **Pt 200 (385)** (-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C **Pt 500 (385)** (-200 to-80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C **Pt 1000 (385)** (-200 to-80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	 0.04 °C 0.04 °C 0.05 °C 0.07 °C 0.08 °C 0.09 °C 0.18 °C 0.19 °C 0.03 °C 0.04 °C 0.05 °C 0.05 °C 0.06 °C 0.07 °C 0.08 °C 0.18 °C 0.04 °C 0.04 °C 0.05 °C 0.07 °C 0.08 °C 0.09 °C 0.03 °C 0.03 °C 0.03 °C 0.04 °C 0.09 °C 0.1 °C 0.11 °C 0.12 °C 0.03 °C 0.04 °C 0.04 °C 0.05 °C 0.06 °C 0.06 °C 0.07 °C 0.08 °C 0.02 °C 0.02 °C 0.03 °C 0.04 °C 0.05 °C 0.05 °C 0.05 °C 0.18 °C	Fluke 5560A multiproduct calibrator	HRT, ATL, TPA, HSV, RFD, MEL, COS, RDU, DFW

VI. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
RF Flatness – Measure[3]	**9 kHz to 2 000MHz** (20 to -10) dBm (-10 to -30) dBm (-30 to -40) dBm (-40 to -42) dBm **(2 to 14) GHz** (20 to -10) dBm (-10 to -30) dBm (-30 to -40) dBm (-40 to -42) dBm **(14 to 18) GHz** (20 to -10) dBm (-10 to -30) dBm (-30 to -40) dBm (-40 to -42) dBm	 0.1 dB 0.1 dB 0.11 dB 0.12 dB 0.10 dB 0.09 dB 0.1 dB 0.11 dB 0.11 dB 0.12 dB 0.12 dB 0.13 dB	Agilent EPM series power meter w/E9304A H18 power sensor	COS, MEL RDU, RFD TPA, SFL HSV, HLR HRT, ATL, DFW
RF Power – Measure[3]	**9 kHz to 14 000 MHz** (20 to 0) dB (0 to -40) dB (-40 to -50) dB (-50 to -55) dB **(14 000 to 18 000) MHz** (20 to 0) dB (0 to -40) dB (-40 to -50) dB (-50 to -55) dB	 0.13 dB 0.15 dB 0.34 dB 0.93 dB 0.12 dB 0.16 dB 0.35 dB 0.93 dB		

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
RF Power – Measure[3]	**(10 to 100) MHz** (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB **(100 to 2 000) MHz** (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB **(2 000 to 12 400) MHz** (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB **(12 400 to 18 000) MHz** (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB **(18 000 to 26 500) MHz** (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB	 0.07 dB 0.06 dB 0.06 dB 0.06 dB 0.11 dB 0.07 dB 0.07 dB 0.06 dB 0.07 dB 0.11 dB 0.08 dB 0.08 dB 0.08 dB 0.08 dB 0.12 dB 0.09 dB 0.08 dB 0.08 dB 0.09 dB 0.12 dB 0.12 dB 0.12 dB 0.12 dB 0.12 dB 0.15 dB	Agilent EPM series power meter RF power Keysight N8485A power	RFD, ATL
	(50 to 100) MHz (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB **(100 to 6000) MHz** (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB	 0.08 dB 0.07 dB 0.07 dB 0.07 dB 0.11 dB 0.08 dB 0.07 dB 0.07 dB 0.08 dB 0.11 dB	Agilent EPM series power meter N8487A power sensor	MEL, RFD TPA, HSV COS, RDU

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
RF Power – Measure[3]	**(6000 to 12 400) MHz** (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB **(12 400 to 18 000) MHz** (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB **(18 000 to 26 500) MHz** (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB **(26 5000 to 33 000) MHz** (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB **(33 000 to 40 000) MHz** (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB **(40 000 to 50 000) MHz** (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB	 0.08 dB 0.08 dB 0.08 dB 0.08 dB 0.12 dB 0.09 dB 0.09 dB 0.08 dB 0.09 dB 0.12 dB 0.11 dB 0.11 dB 0.10 dB 0.11 dB 0.14 dB 0.12 dB 0.12 dB 0.12 dB 0.12 dB 0.15 dB 0.13 dB 0.13 dB 0.12 dB 0.13 dB 0.15 dB 0.19 dB 0.18 dB 0.18 dB 0.19 dB 0.2 dB	Agilent EPM series power meter N8487A power sensor	MEL, RFD TPA, HSV COS, RDU

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
RF Power – Measure[3]	**(100 to 2000) MHz** (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB **(2000 to 12 400) MHz** (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB **(12 400 to 18 000) MHz** (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB **(18 000 to 26 500) MHz** (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB **(26 5000 to 40 000) MHz** (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB **(40 000 to 50 000) MHz** (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB	 0.14 dB 0.06 dB 0.07 dB 0.08 dB 0.15 dB 0.15 dB 0.07 dB 0.07 dB 0.08 dB 0.15 dB 0.15 dB 0.08 dB 0.08 dB 0.09 dB 0.15 dB 0.16 dB 0.1 dB 0.1 dB 0.11 dB 0.16 dB 0.17 dB 0.12 dB 0.12 dB 0.13 dB 0.18 dB 0.22 dB 0.19 dB 0.19 dB 0.19 dB 0.23 dB	Agilent EPM series power meter 8487A power sensor	ATL

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
RF Power – Measure[3]	**(50 to 26 500) MHz** (20 to 10) dB (10 to -50) dB (-50 to -60) dB (-60 to -65) dB	 0.25 dB 0.22 dB 0.37 dB 0.94 dB	Agilent EPM series power meter w/E4413A power sensor	MEL, TPA, COS
	100 kHz to 30 MHz (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -115) dB (-115 to -120) dB (-120 to -125) dB	 0.13 dB 0.13 dB 0.15 dB 0.2 dB 0.26 dB 0.39 dB 0.59 dB	Agilent N5531S measuring receiver N1912A w/E9304A power sensor	COS, MEL RDU, RFD TPA, SFL HSV, HLR HRT, ATL, DFW
	(30 to 2000) MHz (30 to 20) dB (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -115) dB (-115 to -120) dB (-120 to -125) dB **(2000 to 3050) MHz** (30 to 20) dB (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -115) dB (-115 to -120) dB (-120 to -125) dB **(3050 to 6600) MHz** (30 to 20) dB (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -115) dB (-115 to -120) dB (-120 to -125) dB	 0.36 dB 0.20 dB 0.22 dB 0.23 dB 0.25 dB 0.27 dB 0.33 dB 0.46 dB 0.42 dB 0.30 dB 0.31 dB 0.32 dB 0.34 dB 0.35 dB 0.40 dB 0.51 dB 0.42 dB 0.30 dB 0.31 dB 0.32 dB 0.34 dB 0.38 dB 0.48 dB 0.64 dB	Agilent N5531S measuring receiver w/N5532A Opt 526 power sensor	SFL, HLR, HRT

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
RF Power – Measure[3]	**(6600 to 13 200) MHz** (30 to 20) dB (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -100) dB (-100 to -105) dB (-105 to -110) dB (-110 to -115) dB (-115 to -120) dB **(13 200 to 18 000) MHz** (30 to 20) dB (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -90) dB (-90 to -95) dB (-95 to -100) dB (-100 to -105) dB (-105 to -110) dB **(18 000 to 19 200) MHz** (30 to 20) dB (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -90) dB (-90 to -95) dB (-95 to -100) dB (-100 to -105) Db (-105 to -110) dB **19 200 to 26 500) MHz** (30 to 20) dB (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -90) dB (-90 to -95) dB (-95 to -100) dB (-100 to -105) dB (-105 to -110) dB	 0.42 dB 0.30 dB 0.31 dB 0.32 dB 0.34 dB 0.37 dB 0.45 dB 0.60 dB 0.82 dB 0.42 dB 0.30 dB 0.31 dB 0.32 dB 0.33 dB 0.35 dB 0.41 dB 0.53 dB 0.72 dB 0.48 dB 0.38 dB 0.39 dB 0.40 dB 0.41 dB 0.42 dB 0.47 dB 0.58 dB 0.75 dB 0.48 dB 0.38 dB 0.39 dB 0.4 dB 0.43 dB 0.50 dB 0.63 dB 0.84 dB 1.1 dB	Agilent N5531S measuring receiver w/N5532A Opt 526 power sensor	SFL, HLR, HRT

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
RF Power – Measure[3]	**(30 to 2000) MHz** (30 to 20) dB (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -115) dB (-115 to -120) dB (-120 to -125) dB **(2000 to 3050) MHz** (30 to 20) dB (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -115) dB (-115 to -120) dB (-120 to -125) dB **(3050 to 6600) MHz** (30 to 20) dB (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -115) dB (-115 to -120) dB **(6600 to 13 200) MHz** (30 to 20) dB (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -115) dB (-115 to -120) dB **(13 200 to 18 000) MHz** (30 to 20) dB (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -90) dB (-90 to -95) dB (-95 to -100) dB (-100 to -105) dB (-105 to -110) dB (-110 to -115) dB (-115 to -120) dB	 0.36 dB 0.20 dB 0.22 dB 0.23 dB 0.25 dB 0.27 dB 0.33 dB 0.70 dB 0.37 dB 0.21 dB 0.23 dB 0.24 dB 0.26 dB 0.28 dB 0.34 dB 0.70 dB 0.37 dB 0.21 dB 0.23 dB 0.24 dB 0.29 dB 0.38 dB 0.53 dB 0.37 dB 0.21 dB 0.23 dB 0.24 dB 0.34 dB 0.46 dB 0.65 dB 0.37 dB 0.21 dB 0.23 dB 0.24 dB 0.26 dB 0.26 dB 0.26 dB 0.29 dB 0.38 dB 0.53 dB 0.75 dB	Agilent N5531S measuring receiver w/N5532A Opt 550 power sensor	MEL, RFD TPA, HSV COS, RDU ATL, DFW

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
RF Power – Measure[3]	**(18 000 to 19 200) MHz** (30 to 20) dB (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -90) dB (-90 to -95) dB (-95 to -100) dB (-100 to -105) dB (-105 to -110) dB (-110 to -115) dB (-115 to -120) dB **(19 200 to 26 500) MHz** (30 to 20) dB (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -90) dB (-90 to -95) dB (-95 to -100) dB (-100 to -105) dB (-105 to -110) dB (-110 to -115) dB (-115 to -120) dB **(26 500 to 31 150) MHz** (30 to 20) dB (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to - 90) dB (-90 to -95) dB (-95 to -100) dB (-100 to -105) dB (-105 to -110) dB (-110 to -115) dB (**31 150 to 41 000) MHz** (30 to 20) dB (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -90) dB (-90 to -95) dB (-95 to -100) dB (-100 to -105) dB (-105 to -110) dB	 0.39 dB 0.25 dB 0.24 dB 0.25 dB 0.27 dB 0.27 dB 0.27 dB 0.30 dB 0.38 dB 0.53 dB 0.75 dB 0.39 dB 0.25 dB 0.24 dB 0.25 dB 0.28 dB 0.33 dB 0.43 dB 0.61 dB 0.85 dB 1.20 dB 1.50 dB 0.42 dB 0.30 dB 0.34 dB 0.34 dB 0.36 dB 0.39 dB 0.46 dB 0.61 dB 0.82 dB 1.1 dB 0.42 dB 0.30 dB 0.34 dB 0.35 dB 0.48 dB 0.64 dB 0.87 dB 1.2 dB 1.5 dB	Agilent N5531S measuring receiver w/N5532A Opt 550 power sensor	MEL, RFD TPA, HSV COS, RDU ATL, DFW

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
RF Power – Measure[3]	**(41 000 to 45 000) MHz** (30 to 20) dB (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -90) dB (-90 to -95) dB (-95 to -100) dB (-100 to -105) dB **(45 000 to 50 000) MHz** (30 to 20) dB (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -90) dB	 0.42 dB 0.30 dB 0.34 dB 0.38 dB 0.68 dB 0.93 dB 1.2 dB 1.6 dB 0.42 dB 0.30 dB 0.34 dB 0.67 dB 1.4 dB	Agilent N5531S measuring receiver w/N5532A Opt 550 power sensor	MEL, RFD TPA, HSV COS, RDU ATL, DFW
	(10 to 100) MHz (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB (-25 to -30) dB (-30 to -35) dB **(100 to 2400) MHz** (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB (-25 to -30) dB (-30 to -35) dB **(2400 to 12 400) MHz** (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB **(2400 to 12 400) MHz** (-20 to -25) dB (-25 to -30) dB (-30 to -35) dB	 0.09 dB 0.08 dB 0.08 dB 0.09 dB 0.12 dB 0.29 dB 0.82 dB 0.10 dB 0.10 dB 0.09 dB 0.10 dB 0.13 dB 0.29 dB 0.83 dB 0.10 dB 0.10 dB 0.09 dB 0.10 dB 0.13 dB 0.29 dB 0.83 dB	Agilent EPM series power meter N8488A power sensor	COS, DFW

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
RF Power – Measure[3]	**(12 400 to 18 000) MHz** (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB (-25 to -30) dB (-30 to -35) dB **(18 000 to 26 500) MHz** (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB (-25 to -30) dB (-30 to -35) dB **(26 500 to 40 000) MHz** (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB (-25 to -30) dB (-30 to -35) dB **(40 000 to 67 000) MHz** (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB (-25 to -30) dB (-30 to -35) dB **(67 000 to 70 000) MHz** (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB (-25 to -30) dB (-30 to -35) dB	 0.10 dB 0.10 dB 0.10 dB 0.10 dB 0.13 dB 0.29 dB 0.83 dB 0.12 dB 0.12 dB 0.12 dB 0.12 dB 0.15 dB 0.30 dB 0.83 dB 0.15 dB 0.15 dB 0.15 dB 0.15 dB 0.17 dB 0.31 dB 0.83 dB 0.22 dB 0.22 dB 0.22 dB 0.22 dB 0.24 dB 0.35 dB 0.85 dB 0.25 dB 0.25 dB 0.25 dB 0.25 dB 0.26 dB 0.37 dB 0.85 dB	Agilent EPM series power meter N8488A power sensor	COS, DFW

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
RF Power – Measure[3]	**100 kHz to 2000 MHz** (5 to 10) dB (10 to 20) dB (20 to 30) dB (30 to 35) dB (35 to 44) dB **(2000 to 4200) MHz** (5 to 10) dB (10 to 20) dB (20 to 30) dB (30 to 35) dB (35 to 44) dB	 0.15 dB 0.08 dB 0.07 dB 0.07 dB 0.18 dB 0.15 dB 0.08 dB 0.07 dB 0.07 dB 0.18 dB	Agilent EPM series power meter RF power/ HP 8482A power sensor	TPA
RF Power – Generate[3]	**10 Hz to 100 kHz** (24 to -48) dBm **100 kHz to 9.99 MHz** (24 to -48) dBm (-48 to -74) dBm (-74 to -94) dBm **(10 to 128) MHz** (24 to -48) dBm (-48 to -84) dBm (-84 to -94) dBm (-94 to -124) dBm **(128 to 300) MHz** (20 to -48) dBm (-48 to -74) dBm (-74 to -84) dBm (-84 to -94) dBm (-94 to -124) dBm **(300 to 1400) MHz** (20 to -48) dBm (-48 to -74) dBm (-74 to -84) dBm (-84 to -94) dBm (-94 to -124) dBm **(1.4 to 3.0) GHz** (14 to -48) dBm (-48 to -74) dBm (-74 to -94) dBm (-94 to -124) dBm	 0.06 dB 0.07 dB 0.16 dB 0.39 dB 0.07 dB 0.09 dB 0.24 dB 0.54 dB 0.08 dB 0.09 dB 0.24 dB 0.39 dB 1.2 dB 0.16 dB 0.31 dB 0.39 dB 0.77 dB 1.2 dB 0.24 dB 0.39 dB 0.77 dB 1.2 dB	Fluke 9640A-LPNX RF reference source	TPA, RFD

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
RF Power Generate[3]	**10 to 30 MHz** (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -120) dB	 0.23 dB 0.25 dB 0.27 dB 0.43 dB	Agilent N5531S measuring receiver N1912A w/E9304A power sensor, 83630B signal generator	SFL, HRT HLR, RDU
RF Power – Generate[3]	**(30 to 2000) MHz** (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -120) dB **(2000 to 3050) MHz** (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -120) dB **(3050 to 6600) MHz** (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -120) dB **(6600 to 13 200) MHz** (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -120) dB **(13 200 to 18 000) MHz** (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -120) dB **(18 000 to 19 200) MHz** (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -120) dB	 0.26 dB 0.28 dB 0.29 dB 0.3 dB 0.37 dB 0.37 dB 0.38 dB 0.38 dB 0.4 dB 0.52 dB 0.37 dB 0.38 dB 0.38 dB 0.4 dB 0.52 dB 0.37 dB 0.38 dB 0.38 dB 0.49 dB 0.84 dB 0.37 dB 0.38 dB 0.38 dB 0.75 dB 1.3 dB 0.49 dB 0.5 dB 0.5 dB 0.81 dB 1.4 dB	Agilent N5531S measuring receiver w/N5532A Opt 526 power sensor, 83630B signal generator	SFL, HRT HLR

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
RF Power – Generate[3]	**(19 200 to 26 500) MHz** (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -120) dB	 0.49 dB 0.5 dB 0.5 dB 1.2 dB 1.9 dB	Agilent N5531S measuring receiver w/N5532A Opt 526 power sensor, 83630B signal generator	SFL, HRT HLR
RF Power – Generate[3]	**(30 to 2000) MHz** (0 to -58) dB (-58 to -78) dB (-78 to -110) dB **(2000 to 3050) MHz** (0 to -58) dB (-58 to -78) dB (-78 to -110) dB **(3050 to 6600) MHz** (0 to -58) dB (-58 to -78) dB (-78 to -110) dB **(6600 to 13 200) MHz** (0 to -58) dB (-58 to -78) dB (-78 to -110) dB **(13 200 to 18 000) MHz** (0 to -58) dB (-58 to -78) dB (-78 to -110) dB **(18 000 to 19 200) MHz** (0 to -58) dB (-58 to -78) dB (-78 to -110) dB **(19 200 to 26 500) MHz** (0 to -58) dB (-58 to -78) dB (-78 to -110) dB **(26 500 to 31 150) MHz** (-3 to -58) dB (-58 to -78) dB (-78 to -110) dB **(31 150 to 41 000) MHz** (-6 to -58) dB (-58 to -78) dB (-78 to -100) dB	 0.3 dB 0.31 dB 0.32 dB 0.35 dB 0.36 dB 0.37 dB 0.35 dB 0.36 dB 0.39 dB 0.35 dB 0.36 dB 0.42 dB 0.35 dB 0.36 dB 0.46 dB 0.41 dB 0.42 dB 0.5 dB 0.41 dB 0.42 dB 0.9 dB 0.63 dB 0.64 dB 0.96 dB 0.83 dB 0.84 dB 1.1 dB	Agilent N5531S measuring receiver w/N5532A Opt 550 power sensor, 83650B signal generator	RDU

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
RF Power – Generate[3]	**(41 000 to 45 000) MHz** (-6 to -58) dB (-58 to -78) dB (-78 to -100) dB **(45 000 to 50 000) MHz** (-6 to -58) dB (-58 to -78) dB (-78 to -90) dB	 0.83 dB 0.85 dB 1.4 dB 0.83 dB 1.0 dB 1.5 dB	Agilent N5531S measuring receiver w/N5532A Opt 550 power sensor, 83650B signal generator	RDU
RF Power – Generate[3]	**(0.25 to 30) MHz** (10 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -120) dB	 0.23 dB 0.23 dB 0.25 dB 0.27 dB 0.43 dB	Agilent N5531S Measuring Receiver N1912A w/E9304A Power Sensor, E8257D Signal Generator	MEL, TPA RFD, HSV ATL, COS SFL, DFW
	(30 to 2000) MHz (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB **(2000 to 3050) MHz** (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB **(3050 to 6600) MHz** (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB **(6600 to 13 200) MHz** (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB **(13 200 to 18 000) MHz** (15 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB	 0.29 dB 0.30 dB 0.31 dB 0.32 dB 0.34 dB 0.35 dB 0.36 dB 0.37 dB 0.34 dB 0.35 dB 0.36 dB 0.37 dB 0.34 dB 0.35 dB 0.36 dB 0.42 dB 0.34 dB 0.35 dB 0.36 dB 0.46 dB		MEL, TPA RFD, HSV ATL, COS, DFW

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
RF Power – Generate[3]	**(18 000 to 19 200) MHz** (15 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB **(19 200 to 26 500) MHz** (15 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB **(26 500 to 31 150) MHz** (15 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB **(31 150 to 41 000) MHz** (10 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -100) dB **(41 000 to 45 000) MHz** (10 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -100) dB **(45 000 to 50 000) MHz** (10 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -90) dB	 0.41 dB 0.41 dB 0.42 dB 0.5 dB 0.41 dB 0.41 dB 0.42 dB 0.9 dB 0.62 dB 0.63 dB 0.64 dB 0.96 dB 0.82 dB 0.83 dB 0.84 dB 1.1 dB 0.82 dB 0.83 dB 0.85 dB 1.4 dB 0.82 dB 0.83 dB 1.0 dB 1.5 dB	Agilent N5531S measuring receiver w/N5532A Opt 550 power sensor, E8257D signal generator	MEL, TPA RFD, HSV ATL, COS, DFW
	(50 000 to 65 000) MHz (0 to -20) dB (-20 to -25) dB (-25 to -30) dB (-30 to -35) dB **(65 000 to 67 000) MHz** (-2 to -20) dB (-20 to -25) dB (-25 to -30) dB (-30 to -35) dB	 0.86 dB 0.86 dB 0.89 dB 1.2 dB 0.88 dB 0.88 dB 0.91 dB 1.2 dB	Agilent EPM series power meter N8488A power sensor, E8257D Op 567 signal generator	COS, DFW

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
Thermal Noise – Measure, ENR[3]	**5 dB, 15 dB, or 21 dB** 0.1 GHz 1 GHz 2 GHz 3 GHz 4 GHz 5 GHz 6 GHz 7 GHz 8 GHz 9 GHz 10 GHz 11 GHz 12 GHz 13 GHz 14 GHz 15 GHz 16 GHz 17 GHz 18 GHz 19 GHz 20 GHz 21 GHz 22 GHz 23 GHz 24 GHz 25 GHz 26 GHz 26.5 GHz	 0.21 dB 0.21 dB 0.22 dB 0.23 dB 0.24 dB 0.25 dB 0.26 dB 0.27 dB 0.28 dB 0.29 dB 0.30 dB 0.31 dB 0.32 dB 0.33 dB 0.34 dB 0.35 dB 0.36 dB 0.37 dB 0.38 dB 0.39 dB 0.40 dB 0.41 dB 0.42 dB 0.43 dB 0.44 dB 0.45 dB 0.46 dB 0.47 dB	Agilent 346C noise source – option H13	TPA
RF Attenuation – Measure[3]	**(30 to 3050) MHz** (0 to 10) dB (10 to 20) dB (20 to 30) dB (30 to 40) dB (40 to 50) dB (50 to 60) dB (60 to 70) dB (70 to 80) dB (80 to 90) dB (90 to 100) dB (100 to 110) dB (110 to 120) dB	 0.02 dB 0.025 dB 0.03 dB 0.035 dB 0.04 dB 0.076 dB 0.081 dB 0.12 dB 0.12 dB 0.13 dB 0.13 dB 0.26 dB	Agilent N5531S measuring receiver w/N5532A Opt 526 power sensor	SFL, HRT HLR

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
RF Attenuation – Measure[3]	**(3050 to 6600) MHz** (0 to 10) dB (10 to 20) dB (20 to 30) dB (30 to 40) dB (40 to 50) dB (50 to 60) dB (60 to 70) dB (70 to 80) dB (80 to 90) dB (90 to 100) dB (100 to 110) dB (110 to 120) dB **(6600 to 13 200) MHz** (0 to 10) dB (10 to 20) dB (20 to 30) dB (30 to 40) dB (40 to 50) dB (50 to 60) dB (60 to 70) dB (70 to 80) dB (80 to 90) dB (90 to 100) dB (100 to 110) dB (110 to 120) dB **(13 200 to 19 200) MHz** (0 to 10) dB (10 to 20) dB (20 to 30) dB (30 to 40) dB (40 to 50) dB (50 to 60) dB (60 to 70) dB (70 to 80) dB (80 to 90) dB (90 to 100) dB (100 to 110) dB **(19 200 to 26 500) MHz** (0 to 10) dB (10 to 20) dB (20 to 30) dB (30 to 40) dB (40 to 50) dB (50 to 60) dB (60 to 70) dB (70 to 80) dB (80 to 90) dB (90 to 100) dB (100 to 110) dB	 0.02 dB 0.025 dB 0.03 dB 0.035 dB 0.04 dB 0.076 dB 0.081 dB 0.12 dB 0.12 dB 0.13 dB 0.15 dB 0.37 dB 0.02 dB 0.025 dB 0.03 dB 0.035 dB 0.04 dB 0.076 dB 0.081 dB 0.12 dB 0.12 dB 0.14 dB 0.34 dB 0.77 dB 0.02 dB 0.025 dB 0.03 dB 0.035 dB 0.04 dB 0.076 dB 0.081 dB 0.12 dB 0.12 dB 0.27 dB 0.66 dB 0.02 dB 0.025 dB 0.03 dB 0.035 dB 0.04 dB 0.076 dB 0.081 dB 0.12 dB 0.2 dB 0.5 dB 1.1 dB	Agilent N5531S measuring receiver w/N5532A Opt 526 power sensor	SFL, HRT HLR

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
RF Attenuation – Measure[3]	**(30 to 3050) MHz** (0 to 10) dB (10 to 20) dB (20 to 30) dB (30 to 40) dB (40 to 50) dB (50 to 60) dB (60 to 70) dB (70 to 80) dB (80 to 90) dB (90 to 100) dB (100 to 110) dB **(3050 to 6600) MHz** (0 to 10) dB (10 to 20) dB (20 to 30) dB (30 to 40) dB (40 to 50) dB (50 to 60) dB (60 to 70) dB (70 to 80) dB (80 to 90) dB (90 to 100) dB (100 to 110) dB **(6600 to 13 200) MHz** (0 to 10) dB (10 to 20) dB (20 to 30) dB (30 to 40) dB (40 to 50) dB (50 to 60) dB (60 to 70) dB (70 to 80) dB (80 to 90) dB (90 to 100) dB (100 to 110) dB **(13 200 to 19 200) MHz** (0 to 10) dB (10 to 20) dB (20 to 30) dB (30 to 40) dB (40 to 50) dB (50 to 60) dB (60 to 70) dB (70 to 80) dB (80 to 90) dB (90 to 100) dB (100 to 110) dB	 0.02 dB 0.025 dB 0.03 dB 0.035 dB 0.04 dB 0.076 dB 0.081 dB 0.12 dB 0.12 dB 0.13 dB 0.13 dB 0.02 dB 0.025 dB 0.03 dB 0.035 dB 0.04 dB 0.076 dB 0.081 dB 0.12 dB 0.12 dB 0.13 dB 0.19 dB 0.02 dB 0.025 dB 0.03 dB 0.035 dB 0.04 dB 0.076 dB 0.081 dB 0.12 dB 0.12 dB 0.13 dB 0.25 dB 0.02 dB 0.025 dB 0.03 dB 0.035 dB 0.04 dB 0.076 dB 0.081 dB 0.12 dB 0.12 dB 0.13 dB 0.31 dB	Agilent N5531S measuring receiver w/N5532B Opt 550 power sensor	MEL, RFD TPA, HSV COS, RDU, DFW

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
RF Attenuation – Measure[3]	**(19 200 to 26 500) MHz**		Agilent N5531S measuring receiver w/N5532B Opt 550 power sensor	MEL, RFD TPA, HSV COS, RDU, DFW
	(0 to 10) dB	0.02 dB		
	(10 to 20) dB	0.025 dB		
	(20 to 30) dB	0.03 dB		
	(30 to 40) dB	0.035 dB		
	(40 to 50) dB	0.04 dB		
	(50 to 60) dB	0.076 dB		
	(60 to 70) dB	0.081 dB		
	(70 to 80) dB	0.12 dB		
	(80 to 90) dB	0.14 dB		
	(90 to 100) dB	0.36 dB		
	(100 to 110) dB	0.82 dB		
	(26 500 to 31 150) MHz			
	(0 to 10) dB	0.02 dB		
	(10 to 20) dB	0.025 dB		
	(20 to 30) dB	0.03 dB		
	(30 to 40) dB	0.035 dB		
	(40 to 50) dB	0.04 dB		
	(50 to 60) dB	0.076 dB		
	(60 to 70) dB	0.081 dB		
	(70 to 80) dB	0.12 dB		
	(80 to 90) dB	0.13 dB		
	(90 to 100) dB	0.33 dB		
	(100 to 110) dB	0.77 dB		
	(31 150 to 41 000) MHz			
	(0 to 10) dB	0.02 dB		
	(10 to 20) dB	0.025 dB		
	(20 to 30) dB	0.03 dB		
	(30 to 40) dB	0.035 dB		
	(40 to 50) dB	0.04 dB		
	(50 to 60) dB	0.076 dB		
	(60 to 70) dB	0.081 dB		
	(70 to 80) dB	0.14 dB		
	(80 to 90) dB	0.36 dB		
	(41 000 to 45 000) MHz			
	(0 to 10) dB	0.02 dB		
	(10 to 20) dB	0.025 dB		
	(20 to 30) dB	0.03 dB		
	(30 to 40) dB	0.035 dB		
	(40 to 50) dB	0.04 dB		
	(50 to 60) dB	0.076 dB		
	(60 to 70) dB	0.11 dB		
	(70 to 80) dB	0.24 dB		
	(80 to 90) dB	0.6 dB		
	(45 000 to 50 000) MHz			
	(0 to 10) dB	0.02 dB		
	(10 to 20) dB	0.025 dB		
	(20 to 30) dB	0.03 dB		
	(30 to 40) dB	0.035 dB		
	(40 to 50) dB	0.04 dB		
	(50 to 60) dB	0.11 dB		
	(60 to 70) dB	0.29 dB		
	(70 to 80) dB	0.7 dB		
	(80 to 90) dB	1.4 dB		

Parameter/Range	Frequency	CMC[2] (±)	Comment	Location[10]
RF Power – Power Sensor (Cal Factor) M is the mismatch Uncertainty	**Type-N (50 Ω)** 0.1 MHz 0.3 MHz 0.5 MHz 1 MHz 3 MHz 5 MHz 10 MHz 30 MHz 50 MHz 100 MHz 300 MHz 500 MHz 1000 MHz 1500 MHz 2000 MHz 2500 MHz 3000 MHz 3500 MHz 3700 MHz 4000 MHz 4200 MHz 5000 MHz 6000 MHz	 1.2 % of rdg + M 1 % of rdg + M 1 % of rdg + M 1 % of rdg + M 1 % of rdg + M 1 % of rdg + M 0.97 % of rdg + M 0.95 % of rdg + M 0.85 % of rdg + M 0.85 % of rdg + M 0.89 % of rdg + M 0.89 % of rdg + M 0.89 % of rdg + M 0.89 % of rdg + M 0.89 % of rdg + M 0.88 % of rdg + M 0.88 % of rdg + M 0.9 % of rdg + M 0.9 % of rdg + M 0.92 % of rdg + M 0.93 % of rdg + M 0.93 % of rdg + M 0.93 % of rdg + M	Agilent EPM series power meter w/Keysight N8482A H84 power sensor	RFD
	Type-N (50 Ω) 0.1 MHz 0.3 MHz 0.5 MHz 1 MHz 3 MHz 5 MHz 10 MHz 30 MHz 50 MHz 100 MHz 300 MHz 500 MHz 1000 MHz 1500 MHz 2000 MHz 2500 MHz 3000 MHz 3500 MHz 3700 MHz 4000 MHz 4200 MHz	 1.1 % of rdg + M 0.94 % of rdg + M 0.93 % of rdg + M 0.93 % of rdg + M 0.9 % of rdg + M 0.9 % of rdg + M 0.89 % of rdg + M 0.89 % of rdg + M 0.91 % of rdg + M 0.89 % of rdg + M 0.94 % of rdg + M 0.94 % of rdg + M 0.96 % of rdg + M 0.96 % of rdg + M 0.96 % of rdg + M 1.1 % of rdg + M 1.2 % of rdg + M 1.2 % of rdg + M 1.2 % of rdg + M 1.4 % of rdg + M 1.4 % of rdg + M	Agilent EPM series power meter w/Keysight 8482A H84 power sensor	TPA

Parameter/Range	Frequency	CMC[2] (±)	Comment	Location[10]
RF Power – Power Sensor (Cal Factor) M is the mismatch Uncertainty	**Type-N (50 Ω)** 10 MHz 30 MHz 50 MHz 100 MHz 300 MHz 500 MHz 800 MHz 1000 MHz 1200 MHz 1500 MHz 2000 MHz 3000 MHz 4000 MHz 5000 MHz 6000 MHz 7000 MHz 8000 MHz 9000 MHz 10 000 MHz 11 000 MHz 12 000 MHz 12 400 MHz 13 000 MHz 14 000 MHz 15 000 MHz 16 000 MHz 17 000 MHz 18 000 MHz	 1.3 % of rdg + M 1.3 % of rdg + M 1.2 % of rdg + M 1.2 % of rdg + M 1.2 % of rdg + M 1.2 % of rdg + M 1.2 % of rdg + M 1.2 % of rdg + M 1.2 % of rdg + M 1.2 % of rdg + M 1.2 % of rdg + M 1.2 % of rdg + M 1.2 % of rdg + M 1.3 % of rdg + M 1.3 % of rdg + M 1.3 % of rdg + M 1.3 % of rdg + M 1.4 % of rdg + M 1.4 % of rdg + M 1.4 % of rdg + M 1.4 % of rdg + M 1.5 % of rdg + M 1.5 % of rdg + M 1.5 % of rdg + M 1.6 % of rdg + M 1.6 % of rdg + M 1.6 % of rdg + M	Agilent EPM series power meter w/Keysight N8481A H84 power sensor	RFD
	Type-N (50 Ω) 100 MHz 500 MHz 1000 MHz 2000 MHz 3000 MHz 4000 MHz 5000 MHz 6000 MHz 7000 MHz 8000 MHz 9000 MHz 10 000 MHz 11 000 MHz 12 000 MHz 13 000 MHz 14 000 MHz 15 000 MHz 16 000 MHz 17 000 MHz 18 000 MHz	 1.2 % of rdg + M 1.2 % of rdg + M 1.2 % of rdg + M 1.2 % of rdg + M 1.3 % of rdg + M 1.3 % of rdg + M 1.4 % of rdg + M 1.4 % of rdg + M 1.4 % of rdg + M 1.4 % of rdg + M 1.5 % of rdg + M 1.5 % of rdg + M 1.5 % of rdg + M 1.5 % of rdg + M 1.7 % of rdg + M 1.7 % of rdg + M 1.7 % of rdg + M 1.8 % of rdg + M 1.8 % of rdg + M 1.9 % of rdg + M	Agilent EPM series power meter w/Keysight 8481A H84 power sensor	TPA

Parameter/Range	Frequency	CMC[2] (±)	Comment	Location[10]
RF Power – Power Sensor (Cal Factor) M is the mismatch Uncertainty	**3.5 mm (50Ω)** 50 MHz 100 MHz 300 MHz 500 MHz 1000 MHz 1500 MHz 2000 MHz 3000 MHz 4000 MHz 5000 MHz 6000 MHz 7000 MHz 8000 MHz 9000 MHz 10 000 MHz 11 000 MHz 12 000 MHz 12 400 MHz 13 000 MHz 14 000 MHz 15 000 MHz 16 000 MHz 17 000 MHz 18 000 MHz 19 000 MHz 20 000 MHz 21 000 MHz 22 000 MHz 23 000 MHz 24 000 MHz 25 000 MHz 26 000 MHz 26 500 MHz	 .3 % of rdg + M 1.2 % of rdg + M 1.2 % of rdg + M 1.3 % of rdg + M 1.3 % of rdg + M 1.3 % of rdg + M 1.2 % of rdg + M 1.3 % of rdg + M 1.3 % of rdg + M 1.3 % of rdg + M 1.4 % of rdg + M 1.4 % of rdg + M 1.5 % of rdg + M 1.6 % of rdg + M 1.6 % of rdg + M 1.5 % of rdg + M 1.5 % of rdg + M 1.6 % of rdg + M 1.6 % of rdg + M 1.9 % of rdg + M 1.7 % of rdg + M 1.6 % of rdg + M 1.8 % of rdg + M 1.7 % of rdg + M 2 % of rdg + M 2.2 % of rdg + M 2.1 % of rdg + M 2.5 % of rdg + M 2.7 % of rdg + M 2.3 % of rdg + M 2 % of rdg + M 2 % of rdg + M 2.3 % of rdg + M	Agilent EPM series power meter power w/Keysight 8485A H84 power sensor	TPA
	2.4 mm (50 Ω) 50 MHz 100 MHz 300 MHz 500 MHz 1000 MHz 2000 MHz 3000 MHz 4000 MHz 5000 MHz 6000 MHz 7000 MHz 8000 MHz 9000 MHz	 1.1 % of rdg + M 1.1 % of rdg + M 1.1 % of rdg + M 1.2 % of rdg + M 1.2 % of rdg + M 1.2 % of rdg + M 1.2 % of rdg + M 1.2 % of rdg + M 1.3 % of rdg + M 1.3 % of rdg + M 1.3 % of rdg + M 1.4 % of rdg + M 1.5 % of rdg + M	Agilent EPM series power meter w/Keysight N8487A H84 power sensor	

Parameter/Range	Frequency	CMC[2] (±)	Comment	Location[10]
RF Power – Power Sensor (Cal Factor) M is the mismatch Uncertainty	**2.4 mm (50 Ω)** 10 000 MHz 11 000 MHz 12 000 MHz 13 000 MHz 14 000 MHz 15 000 MHz 16 000 MHz 17 000 MHz 18 000 MHz 19 000 MHz 20 000 MHz 21 000 MHz 22 000 MHz 23 000 MHz 24 000 MHz 25 000 MHz 26 000 MHz 27 000 MHz 28 000 MHz 29 000 MHz 30 000 MHz 31 000 MHz 32 000 MHz 33 000 MHz 34 000 MHz 34 500 MHz 35 000 MHz 36 000 MHz 37 000 MHz 38 000 MHz 39 000 MHz 40 000 MHz 41 000 MHz 42 000 MHz 43 000 MHz 44 000 MHz 45 000 MHz 46 000 MHz 47 000 MHz 48 000 MHz 49 000 MHz 50 000 MHz	1.5 % of rdg + M 1.5 % of rdg + M 1.5 % of rdg + M 1.5 % of rdg + M 1.6 % of rdg + M 1.6 % of rdg + M 1.7 % of rdg + M 1.7 % of rdg + M 1.7 % of rdg + M 1.9 % of rdg + M 1.9 % of rdg + M 1.9 % of rdg + M 1.9 % of rdg + M 1.9 % of rdg + M 1.9 % of rdg + M 1.9 % of rdg + M 1.9 % of rdg + M 2.4 % of rdg + M 2.4 % of rdg + M 2.4 % of rdg + M 2.4 % of rdg + M 2.4 % of rdg + M 2.4 % of rdg + M 2.5 % of rdg + M 2.5 % of rdg + M 2.5 % of rdg + M 2.6 % of rdg + M 2.6 % of rdg + M 2.6 % of rdg + M 2.9 % of rdg + M 3.0 % of rdg + M 3.2 % of rdg + M 3.2 % of rdg + M 3.2 % of rdg + M 3.2 % of rdg + M 3.2 % of rdg + M 3.2 % of rdg + M 3.3 % of rdg + M 3.4 % of rdg + M 3.4 % of rdg + M	Agilent EPM series power meter w/Keysight N8487A H84 power sensor	TPA

Parameter/Equipment	Range	CMC[2, 7] (±)	Comment	Location[10]
RF Power – Measure[3] 50 MHz	1.0 mW	0.32 % of rdg	HP 432A PM w/478A Opt H76 thermistor mount	TPA, COS, HSV, DFW
Attenuation Generate @ 30 MHz	10 dB 20 dB 30 dB 40 dB 50 dB	5.6 mdB 7.6 mdB 6.4 mdB 7.4 mdB 8.6 mdB	HP 11812A calibration kit	TPA, RFD
Phase Noise[3] Offset Frequency	**5 MHz < f ≤ 18 GHz** ≤ 100 kHz 100 kHz to 40 MHz	 2.3 dB 4.6 dB	HP 3048A phase noise system w/866xA RF source	MEL, COS TPA
Total Harmonic Distortion (THD)	**(0 to 65) dB** **20 Hz to 20 kHz** (0 to 40) dB (40 to 50) dB (50 to 60) dB (60 to 65) dB **(20 to 50) kHz** (0 to 40) dB (40 to 50) dB (50 to 60) dB **(50 to 100) kHz** (0 to 40) dB (40 to 50) Db	 1.0 dB 1.0 dB 1.3 dB 1.7 dB 2.0 dB 2.1 dB 3.0 dB 2.0 dB 2.4 dB	HP 8903B audio analyzer	COS, HSV MEL, ATL RDU, RFD TPA, SFL HLR, HRT, DFW

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
Harmonics Measure[3]	**(-80 to -10) dB** **2nd through 5th Harmonic** 1 kHz to 600 MHz (600 to 1 320) MHz (1 320 to 2 200) MHz (2 200 to 3 000) MHz (3 000 to 4 400) MHz (4 400 to 5 300) MHz **2nd through 4th Harmonic** (5 300 to 6 625) MHz **2nd through 3rd Harmonic** (6 625 to 8 833) MHz **2nd Harmonic** (8 833 to 13 250) MHz	 0.37 dB 1.1 dB 1.4 dB 1.4 dB 1.7 dB 1.9 dB 2.1 dB 2.1 dB 2.1 dB	Agilent E4440A Measuring Receiver	HLR, HRT SFL
	(-10 to -80) dB **2nd through 5th Harmonic** 1kHz to 600MHz (600 to 1 320) MHz (1 320 to 2 200) MHz (2 200 to 3 000) MHz (3 000 to 4 400) MHz (4 400 to 5 300) MHz (5 300 to 10 000) MHz **2nd through 4th Harmonic** (10 000 to 12 500) MHz **2nd through 3rd Harmonic** (12 500 to 16 667) MHz **2nd Harmonic** (16 667 to 25 000) MHz	 0.37 dB 1.1 dB 1.4 dB 1.4 dB 1.7 dB 1.9 dB 2.1 dB 2.1 dB 2.1 dB 2.3 dB	Agilent E4448A Measuring Receiver	COS, HSV MEL, ATL RDU, RFD TPA, DFW
Amplitude Modulation – Measure[3]	**100 kHz to 10 MHz** **Rate 50 Hz to 10 kHz** (5 to 99) % Depth **10 MHz to 3 GHz** **Rate 50 Hz to 100 kHz** (5 to 20) % Depth (20 to 99) % Depth **(3 to 26.5) GHz** **Rate 50 Hz to 100 kHz** (5 to 20) % Depth (20 to 99) % Depth	 0.75 % of rdg + 0.3 digits 2.5 % of rdg + 0.4 digits 0.5 % of rdg + 0.4 digits 4.5 % of rdg + 0.4 digits 1.5 % of rdg + 0.4 digits	Agilent N5531S measuring receiver	COS, HSV MEL, ATL RDU, RFD TPA, SFL HLR, HRT, DFW

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
Amplitude Modulation – Measure[3]	**(26.5 to 31.15) GHz** **Rate 50 Hz to 100 kHz** (5 to 20) % Depth (20 to 99) % Depth **(31.15 to 50) GHz** **Rate 50 Hz to 100 kHz** (5 to 20) % Depth (20 to 99) % Depth	 6.8 % of rdg + 0.4 digits 1.9 % of rdg + 0.4 digits 26 % of rdg + 0.4 digits 6 % of rdg + 0.4 digits	Agilent N5531S measuring receiver Agilent N5531S measuring Receiver	COS, HSV MEL, ATL RDU, RFD TPA, DFW
AM Distortion –Measure[3] Rate 20 Hz to 1 kHz	**(0.1 to 10) MHz** **AM Depth > 1%** (0 to -20) dB (-20 to -30) dB **AM Depth > 3%** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB **10 MHz to 26.5 GHz** **AM Depth > 1%** (0 to -20) dB (-20 to -30) dB **AM Depth > 3%** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB	 1.2 dB 2.2 dB 1.0 dB 1.3 dB 2.4 dB 1.3 dB 2.5 dB 1.1 dB 1.4 dB 3.0 dB		COS, HSV MEL, ATL RDU, RFD TPA, SFL HLR, HRT, DFW
	(26.5 MHz to 50.0 GHz) **AM Depth > 3 %** (0 to -20) dB **AM Depth > 5%** (0 to -20) dB (-20 to -30) dB	 1.8 dB 1.5 dB 3.5 dB		COS, HSV MEL, ATL RDU, RFD TPA, DFW

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
Frequency Modulation – Measure[3] β = deviation / rate	**250 kHz to 10 MHz** Rates 20 Hz to 10 kHz Peak Dev 200 Hz to 40 kHz **10 MHz to 6.6 GHz** Rates 50 Hz to 200 kHz Peak Dev 250 Hz to 400 kHz **(6.6 to 13.2) GHz** Rates 50 Hz to 200 kHz Peak Dev 250 Hz to 400 kHz **(13.2 to 26.5) GHz** Rates 50 Hz to 200 kHz Peak Dev 250 Hz to 400 kHz	 β > 0.2 - 1.5 % of rdg + 2 Hz β > 1.2 - 1 % of rdg + 2 Hz β > 0.20 - 1.5 % of rdg + 2 Hz β > 0.45 - 1 % of rdg + 2 Hz β > 0.2 - 2.5 % of rdg + 4 Hz β > 8.0 - 1 % of rdg + 4 Hz β > 0.2 - 3.8 % of rdg + 9 Hz β > 16 - 1 % of rdg + 9 Hz	Agilent N5531S measuring receiver	COS, HSV MEL, ATL RDU, RFD TPA, SFL HLR, HRT, DFW
	(26.5 to 31.15) GHz Rates 50 Hz to 200 kHz Peak Dev 250 Hz to 400 kHz **(31.15 to 50) GHz** Rates 50 Hz to 200 kHz Peak Dev 250 Hz to 400 kHz	 β > 0.2 - 3.8 % of rdg + 9 Hz β > 16 - 1 % of rdg + 9 Hz β > 0.2 – 8.5 % of rdg + 17 Hz β > 16 - 1 % of rdg + 17 Hz		COS, HSV MEL, ATL RDU, RFD TPA, DFW
FM Distortion – Measure[3] Rate 20 Hz to 1 kHz	**(1 to 6 600) MHz** **Dev 500 Hz to 2 kHz** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB **Dev > 2 kHz** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB **(6.6 to 13.2) GHz** **Dev > 2.3 kHz** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB **Dev > 4.5 K kHz** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB **(13.2 to 26.5) GHz** **Dev > 2.7 kHz** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB	 0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB 0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB 0.26 dB 0.79 dB 2.3 dB		COS, HSV MEL, ATL RDU, RFD TPA, SFL HLR, HRT, DFW

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
FM Distortion – Measure[3] Rate 20 Hz to 1 kHz	**(13.2 to 26.5) GHz** **Dev > 6.0 kHz** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB	 0.09 dB 0.27 dB 0.83 dB 2.4 dB	Agilent N5531S measuring receiver	COS, HSV MEL, ATL RDU, RFD TPA, SFL HLR, HRT, DFW
	(26.5 to 31.15) GHz **Dev > 2.7 kHz** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB **Dev > 6.0 kHz** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB **(31.15 to 50.0) GHz** **Dev > 4 kHz** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB **Dev > 12 kHz** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB	 0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB 0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB		COS, HSV MEL, ATL RDU, RFD TPA, DFW
Phase Modulation – Measure[3]	**100 kHz to 6.6 GHz** Deviations > 0.3 rad Deviations > 0.7 rad **(6.6 to 13.2) GHz** Deviations > 0.6 rad Deviations > 2.0 rad **(13.2 to 26.5) GHz** Deviations: > 1.2 rad Deviations > 4.0 rad	 3 % of rdg + 0.002 rad 1 % of rdg + 0.002 rad 3 % of rdg + 0.005 rad 1 % of rdg + 0.005 rad 3 % of rdg + 0.009 rad 1 % of rdg + 0.009 rad		COS, HSV MEL, ATL RDU, RFD TPA, SFL HLR, HRT, DFW
	(26.5 to 31.15) GHz Deviations: > 1.3 rad Deviations > 4.0 rad **(31.15 to 50) GHz** Deviations: > 2.4 rad Deviations > 8.0 rad	 3 % of rdg + 0.009 rad 1 % of rdg + 0.009 rad 3 % of rdg + 0.018 rad 1 % of rdg + 0.018 rad		COS, HSV MEL, ATL RDU, RFD TPA, DFW

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
PM Distortion – Measure[3]	**(1 to 6 600) MHz** **Rate (20 to 500) Hz** **Dev > 0.8 rad** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB **Dev > 2.5 rad** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB **Rate (500 to 1 000) Hz** **Dev > 0.4 rad** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB **Dev > 1.0 rad** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB **(6.6 to 13.2) GHz** **Rate (20 to 500) Hz** **Dev > 1.8 rad** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB **Dev > 5.5 rad** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB **Rate (500 to 1000) Hz** **Dev > 0.8 rad** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB **Dev > 2.5 rad** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB	 0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB 0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB 0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB 0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB	Agilent N5531S measuring receiver	COS, HSV MEL, ATL RDU, RFD TPA, SFL HLR, HRT, DFW

Parameter/Range	Frequency	CMC[2, 7] (±)	Comment	Location[10]
PM Distortion – Measure[3]	**(13.2 to 26.5) GHz** **Rate (20 to 500) Hz** **Dev > 3.5 rad** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB **Dev > 10.0 rad** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB **Rate (500 to 1000) Hz** **Dev > 1.2 rad** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB **Dev > 4.0 rad** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB	 0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB 0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB	Agilent N5531S measuring receiver	COS, HSV MEL, ATL RDU, RFD TPA, SFL HLR, HRT, DFW
	(26.5 to 31.15) GHz **Rate (20 to 500) Hz** **Dev > 3.5 rad** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB **Dev > 10.0 rad** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB **Rate (500 to 1 000) Hz** **Dev > 1.2 rad** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB **Dev > 4.0 rad** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB	 0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB 0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB		MEL, RFD TPA, HSV COS, RDU, DFW

Parameter/Range	Frequency	CMC[2] (±)	Comment	Location[10]
PM Distortion – Measure[3]	**(31.15 to 50.0) GHz** **Rate 20 to 500 Hz** **Dev > 7.5 rad** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB **Dev > 19.0 rad** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB **(31.15 to 50.0) GHz** **Rate (500 to 1 000) Hz** **Dev > 3.0 rad** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB **Dev > 8.0 rad** (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB	 0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB 0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB	Agilent N5531S measuring receiver	MEL, RFD TPA, HSV COS, RDU, DFW
Return Loss (VSWR) 5 Hz to 45 MHz 45 MHz to 50 GHz	 (0 to 40) dB (0 to 40) dB	 1.1 dB 0.41 dB	HP 8751A, HP 85107B network analyzers	
ISN – Relative Amplitude (dB) Insertion Loss Impedance Magnitude (Ω) Impedance Phase (°)	 **(0 to 120) dB** 150 kHz to 80 MHz **(0 to 1) kΩ** 150 kHz to 80 MHz **(-180 to 180)°** 150 kHz to 80 MHz	 0.59 dB 2 % of rdg 1.8°	CISPR 22, CISPR 32, CISPR 16-1-2 HP 8751A network analyzer & HP 87512A transmission/reflection test set, 85032B calibration kit	TPA

Parameter/Range	Frequency	CMC[2] (±)	Comment	Location[10]
CDN's & Adapters – (50 to 150) Ω Relative Amplitude (dB) Adapter Insertion Loss Relative Amplitude (dB) Coupling Factor Impedance Magnitude (Ω) Relative Amplitude (dB) Voltage Division Factor	**(0 to 120) dB** 10 kHz to 230 MHz **(0 to 120) dB** 10 kHz to 230 MHz **(0 to 1) kΩ** 10 kHz to 230 MHz **(0 to 120) dB** 10 kHz to 230 MHz	 1.3 dB 1.3 dB 2 % rdg 0.59 dB	IEC/EN 61000-4-6 CISPR 16-1-2 HP 8751A network analyzer & HP 87512A transmission/reflection test set, 85032B calibration kit	TPA
LISN – Relative Amplitude (dB) Insertion Loss Impedance Magnitude (Ω) Impedance – Phase (°) Relative Amplitude (dB) Isolation	**(0 to 120) dB** 9 kHz to 100 MHz (100 to 300) MHz (300 to 500) MHz **(0 to 1) kΩ Ω** 9 kHz to 500 MHz **(-180 to 180)°** 9 kHz to 500 MHz **(0 to 120) dB** 9 kHz to 100 MHz (100 to 300) MHz (300 to 500) MHz	 0.59 dB 1.3 dB 1.8 dB 2 % of rdg 1.8° 0.59 dB 1.3 dB 1.8 dB	ANSI C63.4, CISPR 25, CISPR 16-1-2 HP 8751A network analyzer & HP 87512A transmission/reflection test set, 85032B calibration kit	
Current Probes & Bulk Current Injection Probes Insertion Loss & Transfer Impedance Relative Amplitude (dB)	**(0 to 120) dB** 20 Hz to 100 MHz (100 to 300) MHz (300 to 500) MHz	 0.59 dB 1.3 dB 1.8 dB	CISPR 16-1-2 IEC/EN 61000-4-6 HP 8751A network analyzer & HP 87512A transmission/reflection test set, 85032B calibration kit	
EFT/Burst Generator – Voltage (+/-) Risetime Impulse Duration Burst Duration Burst Period	 10 V to 8 kV 5 ns +/- 30 % 50 ns +/- 30 % 15 ms +/- 20 % 300 ms +/- 20 %	 2.6 % of rdg 0.003 % of rdg 0.003 % of rdg 0.003 % of rdg 0.003 % of rdg	IEC/EN 61000-4-4 Tektronix TDS784C oscilloscope, EFT attenuator set	COS

Parameter/Equipment	Range	CMC[2] (±)	Comment	Location[10]
Surge Generator – Front Time (+/-) Risetime Open/Short Circuit (+/-) Time to Half Value (+/-) Open Circuit Voltage (+/-) Short Circuit Voltage (+/-) Ring Wave Voltage Ring Wave Risetime	 (0.1 to 50) µs (0.1 to 50) µs (20 to 1 500) µs 10 V to 8 kV (0.125 to 3) kA 1 kV +/- 10 % 1.5 µs +/- 0.5 µs	 0.008 % of rdg 0.008 % of rdg 0.008 % of rdg 2.9 % of rdg 2.9 % of rdg 2.9 % of rdg 0.008 % of rdg	IEC/EN 61000-4-5 IEC/EN 61000-4-8 IEC/EN 61000-4-9 IEC/EN 61000-4-10 IEC/EN 61000-4-11 IEC/EN 61000-4-12 Tektronix TDS784C Oscilloscope, Tektronix P5210 high voltage probe Pearson 411 current probe	COS
Source Errors for CISPR Bands A, B, C & D for Impulse Spectral Amplitude Absolute Amplitude Pulse Response & Relative Ratio	**Band A (0 to 120) dB** (10 to 150) kHz **Band B (0 to 120) dB** (0.15 to 30) MHz	0.82 dB 0.82 dB	IGUU 2918 pulse generator CISPR 16-1-1 signal generator, Agilent 33250A waveform generator	
Source Errors for CISPR Bands A, B, C & D for Impulse Spectral Amplitude Absolute Amplitude Pulse Response & Relative Ratio	**Band C & D** (0 to 120) dB (30 to 1 000) MHz (0 to 120) dB **Band E** (1 to 18) GHz	1.5 dB 0.77 dB	IGUU 2918 pulse generator CISPR 16-1-1 signal generator, Agilent 33250A waveform generator	
Source Errors for Sinewave output for CISPR Checks (at 60 dBµV) Absolute Amplitude	**60 dBµV** Band A through D Band E	0.58 dB 0.58 dB	CISPR 16-1-1 Agilent E8257D signal generator, Agilent 33250A waveform generator	
QuasiPeak to Peak & Average Detector Response Relative Amplitude Ratio	**(-60 to 60) dB** Band A through D	1.3 dB	IGUU 2918 pulse generator	
Return Loss (VSWR) 30 kHz to 6 GHz 6 GHz to 18 GHz	 (0 to 80) dB (0 to 50) dB	 2.4 dB 0.32 dB	Agilent 8753ES network analyzers, Wiltron 87A50 VSWR bridge	
ESD Simulators Contact Voltage (Positive & Negative) Risetime Peak Current 30 ns Current 60 ns Current	 (0 to 20) kV (20 to 30) kV (0 to 5) ns (0 to 60) A (0 to 60) A (0 to 60) A	 1.2 % of rdg + 2V 1.2 % of rdg + 20V 31.5 ps 2.1 % of rdg 2.9 % of rdg 6.3 % of rdg	IEC 61000-4-2 ISO 10605 MIL STD 331 ESVM Agilent 54855A oscilloscope, IEC ESD target	

VII. Mechanical

Parameter/Equipment	Range	CMC[2] (±)	Comment	Location[10]
Accelerometers –				
(7 < 10) Hz (10 < 30) Hz (30 < 2000) Hz (2 to 10) kHz	(0.01 to 10) g	2 % of rdg 1.5 % of rdg 1 % of rdg 2.5 % of rdg	Accelerometer calibrator	TPA
(5 < 10) Hz (10 < 30) Hz (30 < 2000) Hz (2 to 10) kHz	(0.01 to 10) g	4 % of rdg 3 % of rdg 1.5 % of rdg 4 % of rdg	Portable vibration calibrator	ATL, HRT, HLR, SFL, MEL, COS, DFW, RDU
(7 to 100) Hz (100 to 2 500) Hz (2.5 to 10) kHz	(1.01 to 10) g	1.5 % of rdg 1.2 % of rdg 2.5 % of rdg	Accelerometer calibrator	HSV
Accelerometers –				
(7 < 10) Hz (10 < 100) Hz (100 to 920) Hz (> 920 to 5000) Hz (> 5 to 10) kHz	(0.2 to 1) g	1.7 % of rdg 1.2 % of rdg 1 % of rdg 1.4 % of rdg 1.9 % of rdg	Accelerometer calibrator	RFD
Scales & Balances[3]	1 mg to 5000 g (0.001 to 100) lb	(0.049 + 0.003X) mg (3.2 E^{-6} + 3.1 E^{-6}W) lb	Class 1 weights	TPA, RFD
	Up to 1 000 lb	(0.000 2 + 0.000 12W) lb	Class F weights	
	1 g to 40 kg	(0.042 + 0.0045X) mg	Class 1 weights	ATL
	Up to 1100 lb Up to 500 kg	(0.0003 + 0.000 12W) lb (0.13 + 0.00012X) g	Class F weights	
	1 mg to 600 g 1 mg to 22 Kg	(0.014 + 0.001 5X) mg (0.04 + 0.003 1X) mg	Class 0 weights Class 1 weights	HSV
	10 mg to 40 kg (0.022 to 2000) lb	(7.7 + 0.12X) mg (0.000 04 + 0.000 12W) lb	Class F weights	
	1 mg to 220 g	(0.048 + 0.003 1X) mg	ASTM E617 Class 1 weights	HRT
	Up to 1000 lb Up to 454 kg	(0.000 12W) lb (0.000 12X) g	NIST Class F weights	
	500 mg to 15 kg	(1 + 0.0042X) mg	Class 1 & 2 weights	HLR
	Up to 28 kg	(8.5 + 0.12X) mg	Class F & 2 weights	
	Up to 1 600 lb	(0.005 + 0.000 13W) lb	Class F weights	

Parameter/Equipment	Range	CMC[2] (±)	Comment	Location[10]
Scales & Balances[3] (continued)	0.01 g to 10 kg Up to 400 lb Up to 181 kg	(0.15 + 0.003*X*) mg (0.000 12*W*) lb (0.000 12*X*) g	Class 1 weights Class F weights	SFL, DFW SFL
	(1 to 400) g	(0.001 5X + 0.019) mg	Class 0 weights	MEL
	(1 to 1000) g (1000 to 40 000) g	(0.0031*X* + 0.04) mg (0.003 3*X*) mg	Class 1 weights	
	(1 to 9100) g	(0.12*X* + 9.3) mg	Class F weights	
	(0.002 to 1000) lb	(0.000 12*W* + 0.000 04) lb		
	1 mg to 420 g	(0.021 + 0.003 4*X*) mg	Class 1 weights	COS, DFW
	Up to 100 kg Up to 1000 lb	(0.0017 + 0.000 12*X*) g (0.0021 + 0.000 12*W*) lb	Class F weights	
	500 g to 41 kg	(0.015 + 0.024*X*) mg	Class 1 Weights	COS
	1 g to 11 kg (0.001 to 75) lb	(0.16 + 0.003 *X*) mg (0.000 004 7 *W*) lb	Class 6 Weights	RDU
	1 g to 11 kg (0.001 to 531) lb	(0.75 + 0.12 *X*) mg (0.000 12 *W*) lb		
Banding Tools	Up to 180 lbf	1.2 lbf	Glenair Bandmaster calibration fixture	MEL, COS

Parameter/Equipment	Range	CMC[2,4] (±)	Comment	Location[10]
Force				
Tension & Compression	(0.5 to 750) lbf	0.09 % of rdg	Class F weights[3]	TPA
		The greater of:		
	(20 to 1000) lbf	0.012 % of rdg or 0.023 lbf	Morehouse press with load cells	
	(200 to 10 000) lbf	0.012 % of rdg or 0.24 lbf		
	(10 000 to 25 000) lbf	0.012 % of rdg or 0.5 lbf		
	(25 000 to 50 000) lbf	0.012 % of rdg or 0.77 lbf		
		The greater of:		
	(5 to 300) lbf	0.012 % of rdg or 0.006 lbf	Morehouse press with load cells	RDU
	(40 to 2000) lbf	0.012 % of rdg or 0.48 lbf		
	10 mgf to 540 lbf	0.061 % of rdg	Class 1 & Class F weights[3]	ATL
	(0.01 to 500) lbf	0.063 % of rdg	Class F weights[3]	RFD
	(50 to 2000) lbf	0.068 % of rdg	Morehouse press with load cells	
	(200 to 10 000) lbf	0.044 % of rdg		
	(500 to 25 000) lbf	0.087 % of rdg		
	Up to 10 kgf	(6.1 + 0.002 9*X*) mg	Class 1 weights[3]	SFL
	(0.1 to 300) lbf	0.086 % of rdg	Class F weights[3]	
	(0.5 to 500) lbf	0.06 % of rdg	Class F weights[3]	MEL
	(0.5 to 500) lbf	0.02 % of rdg	Class F weights[3]	COS, RDU, DFW
	(200 to 25 000) lbf	0.017 % of rdg	Morehouse load [3]cells	COS
	(0.5 to 500) lbf	(0.000 06 + 0.000 12*W*) lbf	Class F weights[3]	HRT
	220 gf to 23 kgf	(0.03 + 0.000 12*M*) g		
Tension	(1000 to 50 000) lbf	0.021 % of rdg	Morehouse load cells	HSV
	(10 to 200) mgf	0.45 mgf	Class F weights[3]	
	(0.2 to 1) gf	1.2 mgf		
	(1 to 10) gf	0.037 % of rdg		
	(10 to 500) gf	0.024 % of rdg		
	(1 to 540) lbf	0.017 % of rdg		
Compression	(200 to 10 000) lbf	0.014 % of rdg		
	(500 to 25 000) lbf	0.018 % of rdg	Morehouse load cells	
	(1000 to 50 000) lbf	0.034 % of rdg		
Force Gages, Load Cells & Dynamometers				
Tension/Compression	10 g to 10 kg	0.024 % of rdg	Class F weights[3]	HLR
	(0.5 to 500) lb	0.031 % of rdg		

Parameter/Equipment	Range	CMC[2, 9] (±)	Comment	Location[10]
Pressure – Generate[3]	(0 to 24) inH_2O	0.001 5 inH_2O	Dwyer 1425-25 hook gage	TPA
	(60 to 110) kPa (8.7 to 16) psia	0.027 kPa 0.004 psi	ADT783 pressure controller ADT151-BP	
	(-15 to 15) psi (> 15 to 30) psi	0.0018 psi 0.012 % of rdg	ADT783 pressure controller ADT151-01RD-CP30M	
	(-15 to 150) psi (> 150 to 300) psi	0.0018 psi 0.012 % of rdg	ADT783 pressure controller ADT151-01RD-CP300M	
	(-15 to 500) psi (> 500 to 1000) psi	0.059 psi 0.012 % of rdg	ADT783 pressure controller with ADT151-01RD-CP1KM	
	(10 to 16 000) psi	0.019 % of rdg	Fluke P3125-PSI dead weight tester	
	(16 000 to 40 000) psi	25 psi	Additel ADT672-10-GP40K Pressure Calibrator	
	(0 to 30) inH_2O	The greater of 0.0073 % of rdg or 0.000 55 inH_2O	Ruska 7250LP	ATL
	(0 to 23) psia (0 to 30) inHg	0.005 psi 0.01 inHg	Paroscientific 760-23A	
	(-15 to 300) psig (-15 to 1000) psig	0.07 psi 0.24 psi	Additel ADT761A-1K	
	(10 to 16 000) psi	The greater of 0.019 % of rdg or 0.0075 psi	Fluke P3125-PSI deadweight tester	
	(10 to 16 000) psi	0.019 % of rdg	Dead weight Fluke P3125	RFD
	(-14.75 to 1015) psig (0.75 to 1015) psia	0.002 % of rdg	Fluke PG7601 piston gauge, PC-7100/7600-1 PC-7200-2 & PC-7300-5 piston-cylinder	ATL
	(60 to 13 000) psig (72 to 13 000) psia	0.0035 % of rdg		
	(145 to 29 000) psig (160 to 29 000) psia	0.0035 % of rdg		
	(0 to 12) inH_2O	0.0025 inH_2O	Dwyer 1425-25 hook gage	HLR

Parameter/Equipment	Range	CMC[2, 9] (±)	Comment	Location[10]
Pressure – Generate[3] (cont)			*Whichever is greater	
	(10 to 500) psi (200 to 10 000) psi	0.008 % of rdg 0.01 % of rdg	Fluke P3224-PSI	MEL
	(0.2 to 1000) psi	0.0022 % of rdg	Ruska 2468A deadweight tester	SFL
	Up to 2900 psig Up to 10 000 psig	0.37 psi 1.3 psi	ADT 762	COS
	(0.01 to 17.4) psia	*0.00073 psi or 0.0084 % rdg	Fluke 6270A pressure controller & modules PM500-A120K	COS, DFW
	(-15 to 15) psi	0.00088 psi	PM500-BG100K	
	(0 to 30) psi	*0.0012 psi or 0.0083 % rdg	PM500-G200K	
	(0 to 100) psi	*0.0043 psi or 0.0083 % rdg	PM500-G700K	
	(-15 to 600) psi	*0.025 psi or 0.0084 % rdg	PM500-BG4M	
	(-15 to 1500) psi	*0.062 psi or 0.0084 % rdg	PM500-BG10M	
	(0 to 6000) psi (0 to 15 000) psi	0.72 psi 2 psi	ADT793 w/ ADT151-01-GP15K	RDU
	(60 to 110) kPa (8.7 to 16) psia	0.027 kPa 0.004 psi	ADT783 w/ ADT151-BP	
	(-15 to 15) psi (> 15 to 100) psi	0.005 9 psi 0.012 % of rdg	ADT783 w/ ADT151-CP100M-PSI	
	(-15 to 150) psi (> 150 to 300) psi	0.018 psi 0.012 % of rdg	ADT783 w/ ADT151-CP300M-PSI	
	(-15 to 500) psi (> 500 to 1000) psi	0.059 psi 0.012 % of rdg	ADT783 w/ ADT151-CP1KM-PSI	
	(-15 to 1800) psi (> 1800 to 3600) psi	0.059 psi 0.012 % of rdg	ADT783 pressure controller w/ ADT151-CP3.6KM-PSI	

Parameter/Equipment	Range	CMC[2, 9] (±)	Comment	Location[10]
Pressure – Measure[3]	(-150 to 150) inH_2O	0.07 inH_2O	Additel ADT686-DP150,	ATL
	(0 to 30) psig	0.007 psi	Additel ADT686-GP30	
	(0 to 50) psia	0.029 psi	Additel ADT681-05-AP50	
	(0 to 150) psia	0.093 psi	Additel ADT681-05-AP150	
	(0 to 5000) psig	1.2 psi	Additel ADT686-GP5K,	
	(0 to 10 000) psig	2.3 psi	Additel ADT686-GP10K	
	(0 to 30) psia	0.018 psi	Fluke 700GA5	HSV
	(0 to 61) inHg	0.037 inHg		
	(-15 to 15) psi	0.007 psi	Additel 681-GP15	
	(0 to 30) psi	0.009 psi	Additel 681-GP30	
	(-15 to 100) psi	0.027 psi	Additel 681- GP100	
	(0 to 300) psi	0.08 psi	Additel 681- GP300	
	(0 to 1000) psi	0.24 psi	Additel 681- GP1K	
	(0 to 3000) psi	0.7 psi	Additel 681- GP3K	
	(0 to 10 000) psi	2.5 psi	Additel 681- GP10K	
	(-150 to 150) inH_2O	0.094 inH_2O	Additel 681-DP150	
	(-20 to 20) inH_2O	0.013 inH_2O	Additel 681-DP20	
	(-1 to 1) inH_2O	0.001 5 inH_2O	ADT681-05-DP1-inH_2O	RFD
	(-5 to 5) inH_2O	0.008 inH_2O	ADT681-05-DP5-inH_2O	
	(-50 to 50) inH_2O	0.061 inH_2O	ADT681-05-DP50-inH_2O	
	(-15 to 0) psi	0.008 9 psi	Fluke 2700G-BG100K	
	(0 to 15) psi	0.004 psi	Fluke 2700G-BG100K	
	(0 to 30) psi	0.007 8 psi	Additel ADT681-GP30	
	(0 to 100) psi	0.028 psi	Fluke 2700G-BG700K	
	(0 to 300) psi	0.064 psi	Fluke 2700G-BG2M	
	(0 to 1000) psi	0.23 psi	Fluke 2700G-BG7M	
	(0 to 3000) psi	0.97 psi	Additel ADT681-GP3K	
	(0 to 10 000) psi	3.3 psi	Additel ADT681-GP10K	
	(-1 to 1) inH_2O	0.004 inH_2O	Additel ADT155-DPI-760	HRT
	(-15 to 100) psig	0.027 psi	ADT681-02-GP100-PSI	
	Up to 500 psig	0.12 psi	ADT681-02-GP500-PSI	
	Up to 1000 psig	0.26 psi	ADT681-02-GP1K-PSI	
	Up to 10 000 psig	2.5 psi	ADT681-02-GP10K-PSI	
			Additel 681	HLR
	(0 to 15) psi	0.004 psi	ADT681-02-GP15-PSI	
	(-15 to 100) psi	0.03 psi	ADT681-02-CP100-PSI	
	(0 to 150) psi	0.039 psi	ADT681-02-GP150-PSI	
	(0 to 500) psi	1.2 psi	ADT681-02-GP500-PSI	
	(0 to 10 000) psi	2.3 psi	ADT681-02-GP10K-PS	

Parameter/Equipment	Range	CMC[2, 9] (±)	Comment	Location[10]
Pressure – Measure[3] (cont)	(-1 to 1) inH_2O	0.0017 inH_2O	Additel ADT681-05-DP1	MEL
	(-50 to 50) inH_2O	0.058 inH_2O	Additel ADT681-05-DP50	
	(-30 to 0) inHg	0.022 inHg	Additel ADT681-02-CP30	
	(-15 to 30) psi	0.011 psi	Additel ADT681-02-CP30	
	(0 to 100) psi	0.032 psi	Additel ADT681-02-GP100	
	(0 to 300) psi	0.07 psi	Additel ADT681-02-GP300	
	(0 to 500) psi	0.12 psi	Additel ADT681-02-GP500	
	(0 to 1000) psi	0.3 psi	Additel ADT681-02-GP1K	
	(0 to 3000) psi	0.9 psi	Additel ADT681-02-GP3K	
	(0 to 5000) psi	1.5 psi	Additel ADT681-02-GP5K	
	(0 to 15 000) psi	8.7 psi	Additel ADT681-05-GP15K	
	(-15 to 100) psi	0.082 psi	Fluke 74x w/700PD6 pressure module	SFL
	(0 to 500) psi	0.31 psi	Fluke 700G07	
			Additel 681	
	(-150 to 150) inH_2O	0.07 inH_2O	ADT681-02-DP150	
	(0 to 15) psi	0.004 psi	ADT681-02-GP15	
	(0 to 100) psi	0.02 psi	ADT681-05-GP100	
	(0 to 1000) psi	0.6 psi	ADT681-02-GP1K	
	(0 to 10 000) psi	5.9 psi	ADT681-02-GP10K	
	(-150 to 150) inH_20	0.07 inH_20	ADT681-02-DP150	COS
	Up to 30 psia	0.035 psi	ADT681-10AP30	
	(-30 to 0) inHg	0.023 inHg	ADT681-02-CP30	
	(-15 to 30) psig	0.011 psi	ADT681-02-CP30	
	Up to 100 psig	0.025 psi	ADT681-02-GP100	
	(-15 to 300) psig	0.077 psi	ADT681-02-CP300	
	Up to 1000 psig	0.25 psi	ADT681-02-GP1K	
	Up to 5000 psig	1.5 psi	ADT681-02-GP5K	
	Up to 10 000 psig	3.1 psi	ADT681-02-GP10K	
	Up to 15 000 psig	3.6 psi	ADT681-05-GP15K	
			Additel 681	DFW
	(-150 to 150) inH20	0.07 inH20	ADT681A-02-DP150	
	(-30 to 0) inHg	0.023 inHg	ADT681-02-CP30	
	(-15 to 30) psig	0.011 psi	ADT681-02-CP30	
	Up to 100 psig	0.025 psi	ADT681-02-GP100	
	(-15 to 300) psig	0.077 psi	ADT681-02-CP300	
	Up to 1000 psig	0.25 psi	ADT681-02-GP1K	
	Up to 5000 psig	1.5 psi	ADT681-02-GP5K	
	Up to 10 000 psig	3.1 psi	ADT681-02-GP10K	
	Up to 15 000 psig	3.6 psi	ADT681-05-GP15K	
	(-1 to 1) inH20	0.002 inH20	ADT681A-05-DP1	
	(-20 to 20) inH20	0.07 inH20	ADT681A-05-DP20	
	Up to 100 psig	0.025 psi	ADT681A-02-GP100	
	(-15 to 300) psig	0.07 psi	ADT681A-02-CP300	
	Up to 1000 psig	0.25 psi	ADT681A-02-GP1K	
	Up to 10000 psig	2.4 psi	ADT681A-02-GP10K	

Parameter/Equipment	Range	CMC[2] (±)	Comment	Location[10]
Rotary Torque - Angle [3]	(0 to 360)°	24 arc sec	Rotary encoder	COS
Vacuum Gages	(100 to 1000) torr (10 to 100) torr (1 to 10) torr (10 to 100) mtorr	0.084 % rdg + 0.25 torr 0.093 % rdg + 0.025 torr 0.094 % rdg + 0.0025 torr 0.29 % rdg + 0.025mtorr	MKS 960A vacuum transducers	ATL
Pipette	(10 to 100) µL (100 to 1000) µL (1 to 10) mL	(0.58 + 0.004*V*) µL (0.6 + 0.001*V*) µL (2.6 + 0.0012*V*) µL	Mass balance	TPA, RDU, COS, DFW
Torque Tools[3]	(10 to 100) ozf-in 64 ozf-in to 1000 lbf-ft	0.6 % of rdg 0.32 % of rdg	CDI 1001 torque tester CDI 5000 ST torque analyzer	TPA, RFD, HRT, HLR, SFL, MEL, COS
	(5 to 50) ozf-in 64 ozf-in to 600 lbf-ft	0.32 % of rdg 0.32 % of rdg		RDU
	(4 to 1000) lbf·in (25 to 1000) lbf·ft	0.4 % of rdg 0.49 % of rdg	CDI torque system	ATL, DFW
	(10 to 100) ozf·in (5 to 1000) lbf·in (25 to 250) lbf·ft (250 to 2000) lbf·ft	0.59 % of rdg 0.35 % of rdg 0.35 % of rdg 0.6 % of rdg		HSV
	(0.5 to 2.5) ozf-in (2 to 10) ozf-in (6 to 43) ozf-in (30 to 215) ozf-in	0.18 % of rdg 0.18 % of rdg 0.18 % of rdg 0.18 % of rdg	Waters torque analyzer	RFD, COS
	(1 to 10) ozf·in	0.63 % of rdg	AWS QCMIO-10	MEL
Torque Analyzers	1 lbf-in to 1000 lbf-ft	0.075 % of rdg	Torque arm/ Class F weights	TPA
	1 ozf·in to 250 lbf·ft	0.11 % of rdg		ATL
	(5 to 80) ozf·in (5 to 600) lbf·in (50 to 2000) lbf·ft	0.16 % of rdg 0.15 % of rdg 0.14 % of rdg		HSV
	0.4 ozf-in to 1000 lbf·ft	0.065 % of rdg		RFD
	5 lbf-in to 1000 lbf-ft	0.06 % of rdg		HLR

Parameter/Equipment	Range	CMC[2] (±)	Comment	Location[10]
Torque Analyzers	(1 to 20) ozf-in (20 to 100) ozf-in (4 to 150) lbf-in (12.5 to 250) lbf-ft	0.25 % of rdg 0.12 % of rdg 0.04 % of rdg 0.16 % of rdg	Torque arm/ Class F weights	MEL
	Up to 200 ozf-in (4 to 150) lbf-in (12.5 to 1000) lbf-ft	0.1 % of rdg 0.064 % of rdg 0.036 % of rdg		COS, RDU, DFW
	Up to 80 ozf-in (4 to 150) lbf-in (12.5 to 600) lbf-ft	0.14 % of rdg 0.047 % of rdg 0.031 % of rdg		RDU
Rockwell Hardness Testers[3]	HBRW (< 60) HRBW (≥ 60 to < 80) HRBW (≥ 80) HRBW	 3 HRBW 3 HRBW 1.3 HRBW	Indirect verification per ASTM E18	TPA
	HRC (< 35) HRC (≥ 35 to < 60) HRC (≥ 60) HRC	 1.3 HRC 1.2 HRC 0.7 HRC		
	HREW (< 84) HREW (≥ 84 to < 93) HREW (≥ 93) HREW	 1.3 HREW 1.3 HREW 1.3 HREW		
	HR15TW (< 81) HR15TW (≥ 81 to < 87) HR15TW (> 87) HR15TW	 1.8 HR15TW 1.3 HR15TW 1.3 HR15TW		
	HRA (20 to 69) HRA (70 to 79) HRA (80 to 86) HRA	 0.62 HRA 0.52 HRA 0.33 HRA		ATL
	HRBW (0 to 59) HRBW (60 to 79) HRBW (80 to 100) HRBW	 0.9 HRBW 0.62 HRBW 0.42 HRBW		
	HRC (20 to 39) HRC (40 to 59) HRC (60 to 70) HRC	 0.36 HRC 0.33 HRC 0.21 HRC	Indirect verification per ASTM E18	

Parameter/Equipment	Range	CMC[2] (±)	Comment	Location[10]
Rockwell Hardness Testers[3] (cont)	HRBW (< 60) HRBW (≥ 60 to < 80) HRBW (≥ 80) HRBW HRC (< 35) HRC (≥ 35 to < 60) HRC (≥ 60) HRC HR15TW (< 81) HR15TW (≥ 81 to < 87) HR15TW (> 87) HR15TW HRBW (< 60) HRBW (≥ 60 to < 80) HRBW HRC (≥ 35 to < 60) HRC (≥ 60) HRC HA < 70 HA > 80 HA HRA (20 to 65) HRA (70 to 78) HRA (80 to 84) HRA HRBW (40 to 59) HRBW (60 to 79) HRBW (80 to 100) HRBW HRC (20 to 30) HRC (35 to 55) HRC (56 to 65) HRC HRBW (0 to 59) HRBW (60 to 79) HRBW (80 to 100) HRBW HRC (20 to 39) HRC (40 to 59) HRC (60 to 70) HRC	 3 HRBW 3 HRBW 1.4 HRBW 1.3 HRC 1.3 HRC 0.73 HRC 1.8 HR15TW 1.3 HR15TW 1.3 HR15TW 3.1 HRBW 3 HRBW 1.2 HRC 0.7 HRC 1.4 HRA 0.7 HRA 0.53 HRA 0.36 HRA 0.29 HRA 0.57 HRBW 0.62 HRBW 0.4 HRBW 0.42 HRC 0.26 HRC 0.23 HRC 0.82 HRBW 0.8 HRBW 0.55 HRBW 0.47 HRC 0.45 HRC 0.39 HRC	Indirect verification per ASTM E18	RFD HSV HLR MEL

Parameter/Equipment	Range	CMC[2] (±)	Comment	Location[10]
Rockwell Hardness Testers[3] (cont)	HRA (20 to 65) HRA (70 to 78) HRA (80 to 84) HRA HRBW < 60 HRBW (≥ 60 to < 80) HRBW ≥ 80 HRBW HRC < 35 HRC (≥ 35 to < 60) HRC ≥ 60 HRC HRBW < 60 HRBW (≥ 60 to < 80) HRBW ≥ 80 HRBW HRC < 35 HRC (≥ 35 to < 60) HRC ≥ 60 HRC HRA < 70 HRA (≥ 70 to < 80) HRA ≥ 80 HRA	 0.45 HRA 0.39 HRA 0.32 HRA 0.8 HRBW 0.85 HRBW 0.69 HRBW 0.58 HRC 0.54 HRC 0.39 HRC 3 HRBW 3 HRBW 1.3 HRBW 1.3 HRC 1.2 HRC 0.7 HRC 1.3 HRA 1.2 HRA 0.7 HRA	Indirect verification per ASTM E18	MEL RDU COS
Durometers Scale (Force) Accuracy Types A, B, E, O,C, D, DO Type M Types OO, OOO Types CF & SL Indenter Geometry Length Diameter Angle Types A, B, C, D, DO, O Type M Types O, OO Indenter Geometry Length Diameter Angle	 (0 to 100) duros 0.1 in 0.05 in (30 to 35) ° (0 to 100) duros 0.1 in 0.05 in (30 to 35) °	 0.06 duros 0.07 duros 0.08 duros 0.06 duros 130 µin 130 µin 0.085 ° 0.06 duros 0.07 duros 0.08 duros 130 µin 130 µin 0.12°	Direct verification Master balance Optical comparator Master balance Optical comparator	RFD TPA, RDU

Parameter/Equipment	Range	CMC[2] (±)	Comment	Location[10]
Durometers Scale (Force) Accuracy				
Types A, B, C, D, DO, O Type M, Types OO, OOO	(0 to 100) duros	0.06 duros 0.09 duros 0.07 duros	Master balance	ATL, HLR
Indenter Geometry Length Diameter Angle	 0.1 in 0.05 in (30 to 35) °	 180 µin 180 µin 0.006°	Optical comparator	
Types A, B, C, D, DO, E, O	(0 to 100) duros	0.06 duros	Master balance	HSV
Indenter Geometry Length Diameter Angle	 0.1 in 0.05 in (30 to 35) °	 140 µin 140 µin 0.13°	Optical comparator	
Mass – Fixed Points	(1, 2, 5, 10) mg (20, 50, 100, 500) mg (1, 2, 5) g 10 g 20 g 50 g 100 g 200 g 500 g 1 kg 5 kg (0.001, 0.002) lb (0.005, 0.01, 0.02) lb 0.05 lb 0.1 lb 0.2 lb (0.5, 1, 2) lb 5 lb 10 lb 25 lb 50 lb (1,2,5) g 10 g 20 g 50 g 100 g 200 g 500 g 1 kg 2 kg	0.027 mg 0.027 mg 0.08 mg 0.13 mg 0.11 mg 0.22 mg 0.36 mg 0.64 mg 29 mg 30 mg 31 mg 0.18 mg 0.19 mg 0.24 mg 0.29 mg 0.39 mg 27 mg 28 mg 28 mg 0.23 g 0.23 g 0.07 mg 0.15 mg 0.19 mg 0.23 mg 0.45 mg 0.99 mg 6.5 mg 10 mg 14 mg	ASTM E617 Class 1 weights ASTM E617 Class 1 weights	TPA ATL

Parameter/Equipment	Range	CMC[2] (±)	Comment	Location[10]
Mass – Fixed Points (cont)	5 kg 10 kg 20 kg	31 mg 82 mg 114 mg	ASTM E617 Class 4 weights	ATL
	200 g 500 g 1 kg 5 kg	0.73 mg 29 mg 30 mg 30 mg	ASTM E617 Class 1 weights	RFD
	(1, 2, 3, 5, 10) mg (20, 30, 50, 100) mg (200, 300, 500) mg (1, 2, 3, 5) g (10, 20, 30) g 50 g 100 g 200 g	0.013 mg 0.013 mg 0.013 mg 0.049 mg 0.068 mg 0.072 mg 0.23 mg 0.38 mg		COS
	500 g (1, 2, 3) kg (5, 10, 20) kg	5.8 mg 58 mg 58 mg		
	(0.001, 0.002) lb (0.005, 0.01, 0.02) lb 0.05 lb 0.1 lb 0.2 lb (0.5, 1, 2) lb (5, 10) lb 50 lb	0.13 mg 0.14 mg 0.2 mg 0.3 mg 0.34 mg 27 mg 28 mg 150 mg	ASTM E617; Class 1 weights,	RDU
	(1, 2, 5) g 10 g 20g 50 g 100 g 200 g 500 g (1, 2, 5) kg 10 kg	0.14 mg 0.19 mg 0.18 mg 0.25 mg 0.45 mg 0.65 mg 29 mg 31 mg 150 mg		

Parameter/Equipment	Range	CMC[2] (±)	Comment	Location[10]
Mass – (cont)				
Arvoirdupois	(1, 2, 3, 5, 10, 20, 30) mg	1.8 µg	ASTM E617;	HLR
	(50, 100, 200) mg	1.8 µg	Class 0 weights,	
	300 mg	2 µg	OIML Class E2	
	500 mg	1.8 µg	weights precision	
	(1, 2, 5) g	5.2 µg	mass comparators,	
	10 g	8.2 µg	balances	
	20 g	10 µg		
	50 g	21 µg		
	100 g	41 µg		
	200 g	61 µg		
	500 g	0.16 mg		
	1 kg	0.31 mg		
	2 kg	0.61 mg		
	5 kg	2.1 mg		
	10 kg	3.1 mg		
	20 kg	8.1 mg		
	25 kg	8.1 mg		
			ASTM E617	
	(0.001, 0.002) lb	2.5 µg	Class 1 weights	
	0.005 lb	6.1 µg		
	0.01 lb	6.2 µg	Precision mass	
	0.02 lb	7.3 µg	Comparators	
	0.05 lb	15 µg	Balances	
	0.1 lb	20 µg		
	0.2 lb	38 µg		
	(0.5, 1) lb	0.25 mg		
	2 lb	0.33 mg		
	5 lb	1.2 mg		
	10 lb	2.1 mg		
	20 lb	4.1 mg		
	25 lb	4.2 mg		
	50 lb	14 mg		
Class F				
	(5 to 225) g	1.2 mg	Master balances	ATL
	(1 to 10) lb	0.034 g		
	(220 to 50) lb	0.33 g		
	(0.5 to 10) lb	0.03 g, (0.000 066) lb		HSV
	(10 to 50) lb	0.27 g, (0.000 6) lb		
	(1 to 220) g	0.42 mg		MEL
	(220 to 6400) g	36 mg		
	(6 to 34) kg	0.31 g		
	(1 to 200) g	0.69 mg	Precision balance	RFD
	(200 to 2 500) g	0.026 g		
	(1 to 34) kg	0.25 g		

Parameter/Equipment	Range	CMC[2] (±)	Comment	Location[10]
Mass – Fixed Points Avoirdupois	 5 lb 10 lb 20 lb 25 lb 50 lb 100 lb 500 lb 1000 lb	 467 mg 468 mg 475 mg 487 mg 523 mg 1.04 g 4.53 g 9.1 g	ASTM E617 Class 3 & 4 weights	DFW
Gloss Meters	(20, 60, 85)° (0 to 100) GU	0.71 GU	Gloss standards	HLR

VIII. Fluid Quantities

Parameter/Equipment	Range	CMC[2] (±)	Comment	Location[10]
Gas Flow	(1 to 10 000) sccm (10 to 1000) slpm (1 to 50 000) sccm (15 to 100) slpm	0.2 % of rdg 0.26 % of rdg 0.2 % of reading 0.31 % of reading	Molbloc flow standards	TPA DFW

IX. Thermodynamics

Parameter/Equipment	Range	CMC[2, 9] (±)	Comment	Location[10]
Relative Humidity – Generate	(10 to 95) %RH	0.5 % RH	Thunder Scientific 2500 humidity chamber	COS, RDU, TPA, RFD, HRT, HLR, SFL, MEL, ATL, DFW

Parameter/Equipment	Range	CMC[2, 9] (±)	Comment	Location[10]
Relative Humidity Measure[3]	(0 to 90) %RH (90 to 100) %RH	1.2 % RH 2 % RH	Vaisala MI70/HMP76 humidity indicator & probe	COS, RDU, TPA, RFD, SFL, ATL
	(0 to 90) %RH	1.6 % RH	Vaisala M170/HMP75 humidity indicator & probe	HRT, MEL
	(0 to 90) % RH	1.2 % RH	Vaisala HM170/ HMP77B humidity indicator & probe	HSV
	(10 to 90) %RH	1.3 % RH	Comparison to Vaisala MI70 Indicator & HMP77B Probe	HLR
	(9 to 85) %RH	2.1 % RH	Vaisala HM46 humidity indicator & probe	DFW
Temperature – Measure[3]	(-196 to 230) °C (-321 to 446) °F (230 to 420) °C (446 to 788) °F (420 to 660) °C (788 to 1220) °F	0.023 °C 0.042 °F 0.04 °C 0.072 °F 0.056 °C 0.1 °F	Hart 1502A indicator with 5616 & 5609 PRT	TPA
	(800 to 1550) °C	2 °C	Type B thermocouple	
	(-196 to 230) °C (230 to 420) °C	0.03 °C 0.041 °C	Hart 1502 indicator with Fluke 5615 PRT	ATL
	(-200 to 420) °C	0.036 °C	Hart 1502A indicator with Burnes Engineering 12005 PRT	RFD
	(-196 to 200) °C (200 to 400) °C (400 to 660) °C	0.018 °C 0.03 °C 0.043 °C	PRT w/ Additel reference thermometer readout	HSV
	(-196 to 0.01) °C (0.01 to 660) °C	0.0043 °C (0.0043 + 0.000 001T) °C	Fluke 5699 SPRT & Fluke 1594A Super-Thermometer	RDU
	(-196 to 200) °C (200 to 420) °C	0.045 °C 0.59 °C	Hart 1502 Indicator, ASL T100 PRT	HLR
	(-200 to 300) ˚C	0.031 °C	Hart 1502 indicator with 5622 PRT	SFL
	(-196 to 232) °C (-321 to 450) °F (232 to 420) °C (450 to 788) °F	0.018 °C 0.032 °F 0.025 °C 0.044 °F	Comparison to Hart 1502A indicator with 5615 PRT	MEL

Parameter/Equipment	Range	CMC[2, 9] (±)	Comment	Location[10]
Temperature Measure[3] (cont)	(-200 to 400) °C (400 to 660) °C	0.024 °C 0.069 °C	Secondary PRT	COS
	(-196 to 0) °C (0 to 230) °C (230 to 420) °C (420 to 660) °C	0.015 °C 0.021 °C 0.029 °C 0.052 °C	Comparison to Hart 1502A indicator with 5615 PRT	HRT
	(-197 to 230) °C (230 to 420) °C (420 to 660) °C	0.015 °C 0.023 °C 0.035 °C	Secondary PRT w/ Additel reference thermometer readout	RDU, DFW
Temperature – Measuring Equipment[3]	(-40 to 160) °C (160 to 420) °C	0.056 °C 0.067 °C	Hart 1502 indicator with Fluke 5615 PRT & Additel dry well	ATL
	(420 to 660) °C	0.31 °C	Additel dry well	
	(-40 to 155) °C (155 to 660) °C	0.037 °C 0.14 °C	PRT w/ Additel reference thermometer readout & dry block	HSV
	(-25 to 350) °C	0.087 °C	Hart 1502A indicator with Burnes Engineering 12005 PRT & dry block	RFD
	(-25 to 140) ˚C (140 to 300) ˚C	0.13 °C 0.42 °C	Hart 1502 indicator with 5622 PRT & dry block	SFL
	(-25 to 140) °C	0.08°C	Hart 1502A w/ 5615 PRT Fluke 9103 dry block	MEL
	(140 to 375) °C	0.19 °C	Fluke 9100S dry block	
	(-5 to 125) °C	0.051°C	Hart 1502A w/ 5615 PRT Fluke 7102 microbath	
	(-40 to 660) °C	0.18 °C	Dry well calibrators	COS, DFW
	(-40 to 160) °C (33 to 700) °C	0.13 °C (0.21 + 0.00042T) °C		RDU
Temperature – Source	(-196 to 300) °C (> 300 to 500) °C	0.014 °C 0.02 °C	Fluke 5699 SPRT, Fluke 1594ASuperthermometer & temperature baths	RDU
Temperature – Source Fix Point	0.01 °C	0.0026 °C	Triple point of water	RDU

Parameter/Equipment	Range	CMC[2] (±)	Comment	Location[10]
Temperature Uniformity Surveys[3]			Datalogger & thermocouples	
Type J	(100 to 900) °F	1.8 °F		TPA
Type K	(100 to 1000) °F (1000 to 2000) °F (2000 to 2200) °F	2 °F 2.1 °F 2.7 °F		TPA, HSV, COS
Type T	(32 to 400) °F	1.6 °F		HSV
Infrared (IR) Thermometry[3]	(20 to 100) °C (100 to 300) °C (300 to 420) °C (420 to 500) °C	1.5 °C 4.3 °C 6 °C 7.7 °C	Fluke 9132 infrared calibrator λ = (8 to 14) µm, Ɛ = 0.95	TPA, ATL, HSV, RFD, HLR, SFL, MEL, COS, RDU, HRT, DFW

X. Time & Frequency

Parameter/Equipment	Range	CMC[2, 9] (±)	Comment	Location[10]
Frequency – Generate[3]	10 MHz	1 x 1^{e-9} Hz/Hz	HP Z3801A GPS receiver	HSV, HLR HRT
		1 x 1^{e-12} Hz/Hz	HP 58503A, Z3805A GPS receiver	TPA, MEL RFD, COS SFL, ATL RDU, DFW
	(1 to 10) Hz (10 to 100) Hz (100 to 1000) Hz (1 to 10) kHz (10 to 100) kHz (0.1 to 1) MHz (1 to 10) MHz	1 x 1^{e-9} Hz/Hz + 0.57 µHz 1 x 1^{e-9} Hz/Hz + 5.7 µHz 1 x 1^{e-9} Hz/Hz + 57 µHz 1 x 1^{e-9} Hz/Hz + 0.57 mHz 1 x 1^{e-9} Hz/Hz + 5.7 mHz 1 x 1^{e-9} Hz/Hz + 57 mHz 1 x 1^{e-9} Hz/Hz + 0.57 Hz	Agilent 33250A function generator / HP Z3801A GPS receiver	HSV, HLR HRT
		1 x 1^{e-12} Hz/Hz + 0.57 µHz 1 x 1^{e-12} Hz/Hz + 5.7 µHz 1 x 1^{e-12} Hz/Hz + 57 µHz 1 x 1^{e-12} Hz/Hz + 0.57 mHz 1 x 1^{e-12} Hz/Hz + 5.7 mHz 1 x 1^{e-12} Hz/Hz + 57 mHz 1 x 1^{e-12} Hz/Hz + 0.57 Hz	Agilent 33250A function generator / HP 58503A,Z3805A GPS receiver	TPA, MEL RFD, COS SFL, ATL RDU, DFW

Parameter/Equipment	Range	CMC[2, 9] (±)	Comment	Location[10]
Frequency – Generate[3]	(10 to 20 000) MHz	1 x 1^{e-12} Hz/Hz + 0.57 mHz	Agilent E8257D Opt 520 / HP 58503A GPS receiver	SFL
	(10 to 26 500) MHz	1 x 1^{e-12} Hz/Hz + 0.57 Hz	HP 83630B Opt 008 / HP 58503A GPS receiver	
		1 x 1^{e-9} Hz/Hz + 0.57 kHz	HP 83630B / HP Z3801A GPS receiver	HLR, HRT
	(10 to 50 000) MHz	1 x 1^{e-12} Hz/Hz + 0.57 mHz	Agilent 83650B Opt 008 / HP 58503A GPS receiver	RDU
		1 x 1^{e-9} Hz/Hz + 0.57mHz	Agilent E8257D Opt 550 / HP Z3801A GPS receiver	HSV
		1 x 1^{e-12} Hz/Hz + 0.57mHz	Agilent E8257D Opt 550 / HP 58503A GPS receiver	TPA, COS, MEL, ATL, RFD, DFW
	(50 000 to 67 000) MHz	1 x 1^{e-12} Hz/Hz + 0.57mHz	Agilent E8257D Opt 567 / HP 58503A GPS receiver	COS, DFW
Frequency – Measure[3]	(1 to 10) Hz (10 to 100) Hz (100 to 1000) Hz (1 to 10) kHz (10 to 100) kHz (100 to 200) kHz (0.2 to 3000) MHz	5.2 x 1^{e-9} Hz/Hz 2.5 x 1^{e-9} Hz/Hz 1.6 x 1^{e-9} Hz/Hz 1.3 x 1^{e-9} Hz/Hz 1.2 x 1^{e-9} Hz/Hz 1. x 1^{e-9} Hz/Hz 1.21 x 1^{e-9} Hz/Hz	Agilent 53131A Opt 030 frequency counter / HP Z3801A GPS receiver	HLR, HRT, HSV
		4.2 x 1^{e-9} Hz/Hz 1.5 x 1^{e-9} Hz/Hz 0.6 x 1^{e-9} Hz/Hz 0.33 x 1^{e-9} Hz/Hz 0.24 x 1^{e-9} Hz/Hz 0.21 x 1^{e-9} Hz/Hz 0.21 x 1^{e-9} Hz/Hz	Agilent 53131A Opt 030 frequency counter / HP 58503A,Z3805A GPS receiver	SFL, RDU, ATL, DFW

Parameter/Equipment	Range	CMC[2, 9] (±)	Comment	Location[10]
Frequency – Measure[3]	(1 to 10) Hz (10 to 100) Hz (100 to 1000) Hz (1 to 10) kHz (10 to 100) kHz (100 to 200) kHz (0.2 to 3000) MHz	1.82 x 1^{e-9} Hz/Hz 0.59 x 1^{e-9} Hz/Hz 0.20 x 1^{e-9} Hz/Hz 74 x 1^{e-12} Hz/Hz 35 x 1^{e-12} Hz/Hz 23 x 1^{e-12} Hz/Hz 20 x 1^{e-12} Hz/Hz	Agilent 53132A Opt 030 frequency counter / HP 58503A GPS receiver	TPA, MEL RFD, COS
	(10 to 26 500) MHz	1 x 1^{e-9} Hz/Hz + 0.1 Hz	Agilent E4440A spectrum analyzer / HP Z3801A GPS receiver	HRT, HLR
		1 x 1^{e-12} Hz/Hz + 0.1 Hz	Agilent E4440A spectrum analyzer / HP 58503A GPS receiver	SFL
	(500 to 46 000) MHz	1 x 1^{e-9} Hz/Hz + 1.0 Hz	Agilent 5352B frequency counter / HP Z3801A GPS receiver	HSV
		1 x 1^{e-12} Hz/Hz + 1.6 Hz	Agilent 53152A frequency counter / HP 58503A GPS receiver	TPA
	(10 to 50 000) MHz	1 x 1^{e-9} Hz/Hz + 0.1 Hz	Agilent E4448A spectrum analyzer / HP Z3801A GPS receiver	HSV
		1 x 1^{e-12} Hz/Hz + 0.1 Hz	Agilent E4448A spectrum analyzer / HP 58503A,Z3805A GPS receiver	TPA, RFD, MEL, COS, RDU, ATL, DFW
Time – Generate	1 pps	1 x 1^{e-12} s/s + 750 ps	HP 58503A GPS receiver	TPA, MEL RFD, COS SFL, ATL, RDU, DFW

Parameter/Equipment	Range	CMC[2,4] (±)	Comment	Location[10]
Timer - Stopwatch[3]	10 s to 24 hr	34 ms	Totalize method with counter	SFL, HLR COS, RDU HRT, ATL, RFD, DFW
Type I (digital) Timers[3]	(0 to19.99) sec/day (0 to 599) sec/month	0.031 sec/day 1.1 sec/month	Helmut Klein Timometer 4500	TPA, RFD MEL, HSV
Type II (mechanical) Timers[3]	(0 to 320) sec/day	0.6 sec/day		
Tachometers – RPM[3] Measuring Equipment	Up to 100 000 RPM	0.001 % of rdg + 0.6*R*	Comparison to HP 3325B, 33250A signal generator & LED	HRT, RDU HLR, TPA SFL, RFD ATL, MEL COS, HSV, DFW

[1] This laboratory offers commercial calibration service and field calibration service.

[2] Calibration and Measurement Capability Uncertainty (CMC) is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards or nearly ideal measuring equipment. CMCs represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of $k = 2$. The actual measurement uncertainty of a specific calibration performed by the laboratory may be greater than the CMC due to the behavior of the customer's device and to influences from the circumstances of the specific calibration.

[3] Field calibration service is available for this calibration. Please note the actual measurement uncertainties achievable on a customer's site can normally be expected to be larger than the CMC found on the A2LA Scope. Allowance must be made for aspects such as the environment at the place of calibration and for other possible adverse effects such as those caused by transportation of the calibration equipment. The usual allowance for the actual uncertainty introduced by the item being calibrated, (e.g., resolution) must also be considered and this, on its own, could result in the actual measurement uncertainty achievable on a customer's site being larger than the CMC.

[4] In the statement of CMC, *L* is the numerical value of the nominal length of the device measured in inches. *R* is the resolution of the unit under test. *D* is the numerical value of the nominal diameter of the device measured in inches, *M* represents mismatch, *X* is mass in gram and *W* is mass in pounds and *F* is length in feet.

[5] This laboratory meets R205 – *Specific Requirements: Calibration Laboratory Accreditation Program* for the types of dimensional tests listed above and is considered equivalent to that of a calibration.

[6] In the statement of CMC, percentages are of rdg unless otherwise noted.

[7] The stated measured values are determined using the indicated instrument (see Comments). This capability is suitable for the calibration of the devices intended to measure or generate the measured value in the ranges indicated. CMC's are expressed as either a specific value that covers the full range or as a percentage or fraction of the rdg plus a fixed floor specification.

[8] This scope meets A2LA's *P112 Flexible Scope Policy*.

[9] The type of instrument or material being calibrated is defined by the parameter. This indicates the laboratory is capable of calibrating instruments that measure or generate the values in the ranges indicated for the listed measurement parameter.

[10] The locations of the laboratories that can perform the calibrations are given by a three-letter code with valid to dates given in the table below:

[11] The name and contact information under each laboratory's address "below" represents the point-of-contact for that respective laboratory

[12] Due to its corporate scope nature all certificates are issued and shown under 2348.01, but locations perform their work individually.

[10, 11, 12] **Location**	**Initials**	**Cert#**	**Expiration**
12530 Telecom Drive, Temple Terrace, FL 33637 Wally Gynn - 813-978-3054 - wally.gynn@tmicalibration.com	TPA	2348.02	September 30, 2027
117 Jetplex Circle Suite C4, Madison, AL 35758 Donny Prax - 256-772-4115 - donny.prax@tmicalibration.com	HSV	2348.03	September 30, 2027
3248 Forest View Road, Rockford, IL 61109 Brian Schickowski - 779-774-3877 - brian.schickowski@tmicalibration.com	RFD	2348.04	September 30, 2027
425 Hayden Station Suite B, Windsor, CT 06095 Jesse Revis - 860-219-0046 - jesse.revis@tmicalibration.com	HRT	2348.05	September 30, 2027
3000 Northwoods Parkway Suite 270, Peachtree Corners, GA 30071 Milt Mosher - 888-497-1448 - milt.mosher@tmicalibration.com	ATL	2348.06	September 30, 2026
4613 Northwest Parkway, Hilliard, OH 43026 Matt Ayres - 614-850-9940 - matt.ayres@tmicalibration.com	HLR	2348.07	September 30, 2026
2100 Park Central Blvd. North Suite 300, Pompano Beach, FL 33064 Wesley Gonzalez - 954-252-2223 - wesley.gonzalez@tmicalibration.com	SFL	2348.08	September 30, 2026
3060 Venture Lane Suite 106, Melbourne, FL 32934 Schuyler Cournoyer - 321-242-0890 - schuyler.cournoyer@tmicalibration.com	MEL	2348.09	September 30, 2026
1355 Garden of the Gods Road, Suite 100, Colorado Springs, CO 80907 Glenn Curtis - 719-424-7068 - glenn.r.curtis@tmicalibration.com	COS	2348.11	September 30, 2027
2200 Gateway Centre Blvd. #208, Morrisville, NC 27560 Taylor Floyd - 919-234-1291 - taylor.floyd@tmicalibration.com	RDU	2348.12	February 29, 2028
1801 Royal Lane, Suite 100, Dallas, TX 75229 Kyle Huitt – 469-779-0107 – kyle.huitt@tmicalibration.com	DFW	2348.13	September 30, 2027

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SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017
& ANSI/NCSL Z540-1-1994 & ANSI/NCSL Z540-3-2006

MICRO QUALITY CALIBRATION LLC
9168 De Soto Ave
Chatsworth, CA 91311-4408
Jeff Breidigan Phone: 818 701 4969 ext 241
Click here to access the satellite location

CALIBRATION

Valid To: November 30, 2026 Certificate Number: 2348.01

In recognition of the successful completion of the A2LA evaluation process (including an assessment of the organization's compliance with A2LA's – R205 Calibration Program Requirements), accreditation is granted to this laboratory at the location listed above to perform the following calibrations [i, 10]:

I. Acoustical

Parameter/Equipment	Frequency	CMC[2] (±)	Comments
Sound Level Meters[3]–			
94 dB	31.5 Hz to 12.5 kHz 16 kHz	0.31 dB 0.32 dB	Bruel & Kjaer 4226
104 dB	31.5 Hz to 12.5 kHz 16 kHz	0.30 dB 0.34 dB	
114 dB	31.5 Hz to 12.5 kHz 16 kHz	0.30 dB 0.57 dB	

II. Chemical

Parameter/Equipment	Range	CMC[2, 8] (±)	Comments
pH – Measuring Equipment[3]	4.00 pH 7.00 pH 10.00 pH	0.012 pH 0.012 pH 0.012 pH	Buffer solutions

Parameter/Equipment	Range	CMC[2, 5, 8] (±)	Comments
Conductivity – Measuring Equipment[3]	10 µS/cm 100 µS/cm 1410 µS/cm 10 000 µS/cm	0.65 µS/cm 2.2 µS/cm 6 µS/cm 41 µS/cm	Laboratory standard conductivity solution
Aerosol Particle Counters	(0.3 to 10) µm	2.9 %	TSI electrostatic classifier 3082 TSI condensation particle counter 3772

III. Dimensional

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Gage Blocks	Up to 4 in (> 4 to 20) in	(2.9 + 0.7*L*) µin (3.1 + 1.3*L*) µin	Electronic comparator, master steel gage blocks
Caliper[3]	Up to 20 in (> 20 to 40) in	(4.8*L* + 0.6*R*) µin (370 + 6*L*) µin	Gage blocks
Micrometer[3]	Up to 12 in (> 12 to 36) in	(4.8*L* + 0.6*R*) µin (43 + 8.8*L*) µin	Gage blocks
Bench Micrometers	Up to 20 in	(12 + 1.3*L*) µin	Gage blocks
Dial, Digital, & Test Indicator[3]	Up to 4 in	(4.8*L* + 0.6*R*) µin	Gage blocks
Height Gages[3]	Up to 40 in	(4.8*L* + 0.6*R*) µin	Gage blocks
Optical Flats	(1 to 8) in	6.2 µin	Standard optical flat

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Measuring Microscopes[3]	Up to 12 in	(95 + 3.0*L*) µin	Glass scale
Cylindrical Gages –			
Plug & Pin Gages	Up to 1 in (> 1 to 4) in (> 4 to 16) in	(6.8 + 0.7*D*) µin (5.4 + 2.2*D*) µin (10 + 1.7*D*) µin	Universal measuring standard-Supra-500
Plain Ring Gages	Up to 1 in (> 1 to 4) in (> 4 to 16) in	(13 + 0.9*D*) µin (13 + 1.2*D*) µin (12 + 2.2*D*) µin	Universal measuring standard-Supra-500 w/ID probes
Thread Wires	(4 to 20) TPI (> 20 to 80) TPI	17 µin 12 µin	Supermicrometer™ Universal measuring standard-Supra-500
Thread Plug Gage			
Pitch Diameter	(4 to 20) TPI (> 20 to 80) TPI	(28 + 1.5*D*) µin (24 + 0.5*D*) µin	Supermicrometer™ Universal measuring standard-Supra-500 w/ thread wires
Major Diameter	Up to 16 in	(11 + 1.5*D*) µin	Universal measuring standard-Supra-500
Thread Plug Gage –			
Minor Lead Angle	(4 to 80) TPI	(95 + 5.4*D*) µin (31 + 2.6*D*) µin 0.054°	Quest thread view machine MicroScanner™
Major Minor Pitch Flank Angle	Up to 6 in	(80 + 4.5*L*) µin (84 + 3.8*L*) µin (50 + 5.5*L*) µin 0° 6” 32’	
Thread Ring Gage –	(80 to 4.5) TPI	(67 + 0.5*D*) µin	Universal measuring standard-Supra-500 w/ probe MicroScanner™
Major Minor Pitch Flank Angle	Up to 6 in	(83 + 4.2*L*) µin (81 + 4.9*L*) µin (51 + 7.7*L*) µin 0° 6” 32’ 3’	

Parameter/Equipment	Range	CMC[2, 6] (±)	Comments
Surface Plate[3] –			
Flatness	(18 x 18) in	13 µin	Autocollimator, repeat-o-meter
Repeatability	(36 x 72) in	28 µin	
Optical Comparator[3] –			
X Axis	Up to 12 in	(46 + 4*L*) µin	Gage blocks, angle blocks
Y Axis	Up to 12 in	(47 + 3*L*) µin	
Angle	Up to 360°	2.5 min	
Angle Blocks[3]	Up to 45°	2.1 arc sec	Sine plate, gage blocks & electronic indicator
Crimping Tools[3]	Up to 1 in diameter	200 µin	Pin gages, optical comparator & pull tester
Precision Levels[3]	(2 to 15) in	150 µin	Gage blocks
Protractors/Clinometer[3]	Up to 180°	1.3 arc sec + 0.6*R*	Sine plate w/ angle blocks
Surface Roughness Specimens	Up to 400 µin	0.62 µin	SurfTest w/ reference specimen
Profilometers	Up to 400 µin	0.55 µin	Surface roughness specimen
Rotary Table	(1 to 360) °	4.1 arc sec	Renishaw laser
Steel Rules & Tapes – Steel Rules Measuring Tapes	Up to 72 in Up to 1200 in (in 40 in segments)	0.0027 in (6600 + 16*L*) µin	Kudale TSCU

IV. Dimensional Testing[1]

Parameter/Range	Range	CMC[2, 6] (±)	Comments
Length – 1D[9]	Up to 40 in Up to 110 in	5.2 µin/in (12 + 0.8*L*) µin	Gage blocks, CMM, Supra 500, etc Renishaw laser

V. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
DC Voltage – Generate[3]	10 V Up to 220 mV 220 mV to 2.2V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V	0.52 µV/V 7.5 µV/V + 0.39 µV 4.6 µV/V + 0.62 µV 3.1 µV/V + 2.3 µV 3.2 µV/V + 3.9 µV 4.7 µV/V + 39 µV 6.2 µV/V + 0.39 mV	Fluke 732B Fluke 5730A
DC Voltage – Measure[3] High Voltage	Up to 100 mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1000) V (1000 to 10 000) V (10 000 to 70 000) V	5.7 µV/V + 0.2 µV 2.8 µV/V + 0.3 µV 2.8 µV/V + 0.5 µV 4.1 µV/V + 30 µV 4.3 µV/V + 0.5 mV 0.042 % + 0.6R 0.048 % + 0.6R	FLUKE 8588A Vitrek 4700/HLV-70
DC Current – Generate[3]	20 nA to 220 µA 220 µA to 2.2 mA (2.2 to 22) mA (22 to 220) mA 220 mA to 2.2 A (2.2 to 11) A (11 to 20) A (20 to 700) A (20.5 to 120) A	39 µA/A + 5.4 nA 31 µA/A + 6.2 nA 32 µA/A + 40 nA 46 µA/A + 0.70 µA 85 µA/A + 12 µA 0.28 mA/A + 0.37 mA 1.1 mA/A + 0.75 mA 1.5 mA/A + 0.52 A 0.8 mA/A + 5.3 mA	Fluke 5730A, Fluke 5730A, Fluke 5725A Fluke 5522A Keysight 6680A HP 3458A, current shunts Fluke 5730A, 52120A

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
DC Current – Clamp Meters	(16.5 to 150) A (150 to 1000) A (1 to 5) kA	0.51 % + 0.15 A 0.52 % + 0.54 A 0.6 % + 1 A	Fluke 5522A w/ Fluke 5500 coils Fluke 5730A/52120A/ 6KA coil
DC Current – Measure[3]	(10 to 20) pA (20 to 200) pA (0.2 to 2) nA (2 to 20) nA (20 to 100) nA 100 nA to 1 µA (1 to 10) µA (10 to 100) µA 100 µA to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1A (1 to 10) A (10 to 30) A (30 to 100) A (100 to 700) A	1.2 % + 3.5 fA 1.2 % + 6 fA 0.27 % + 0.32 pA 0.24 % + 0.6 pA 0.018 % + 60 pA 35 µA/A + 60 pA 27 µA/A + 0.14 nA 31 µA/A + 1 nA 29 µA/A + 7 nA 30 µA/A + 70 nA 48 µA/A + 0.7 µA 0.014 % + 13 µA 0.028 % + 0.43 mA 0.07 % + 4.4 mA 0.026 % 0.038 %	Keithley 6517A HP 3458A, option 002 Fluke 8588A HP 3458A, current shunts
Resistance – Generate	(0 to 10.9999) Ω (11 to 32.9999) Ω (33 to 109.9999) Ω (110 to 329.9999) Ω (0.33 to 1.099 999) kΩ (1.1 to 3.299 999) kΩ (3.3 to 10.999 99) kΩ (11 to 32.999 99) kΩ (33 to 109.9999) kΩ (110 to 329.9999) kΩ (0.33 to 1.099 999) MΩ (1.1 to 3.299 999) MΩ (3.3 to 10.999 99) MΩ (11 to 32.999 99) MΩ (33 to 109.9999) MΩ (110 to 330) MΩ (330 to 1100) MΩ	32 µΩ/Ω + 0.8 mΩ 24 µΩ/Ω + 1.2 mΩ 22 µΩ/Ω + 1.1 mΩ 23 µΩ/Ω + 1.6 mΩ 22 µΩ/Ω + 1.6 mΩ 22 µΩ/Ω + 16 mΩ 22 µΩ/Ω + 16 mΩ 22 µΩ/Ω + 0.16 Ω 22 µΩ/Ω + 0.16 Ω 26 µΩ/Ω + 5.4 Ω 25 µΩ/Ω + 5.4 Ω 47 µΩ/Ω + 39 Ω 0.1 mΩ/Ω + 54 Ω 0.22 mΩ/Ω + 2.1 kΩ 0.39 mΩ/Ω + 2.5 kΩ 2.3 mΩ/Ω + 79 kΩ 12 mΩ/Ω + 0.39 MΩ	Fluke 5522A
Fixed Points	1 Ω 10 kΩ 19 kΩ	10 µΩ/Ω 5 µΩ/Ω 5.2 µΩ/Ω	Fluke 742A

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Resistance – Generate (cont)			
Fixed Points	0 Ω 1 Ω 1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 kΩ 1.9 kΩ 10 kΩ 19 kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	39 µΩ 85 µΩ/Ω 85 µΩ/Ω 21 µΩ/Ω 21 µΩ/Ω 9.3 µΩ/Ω 9.5 µΩ/Ω 6.3 µΩ/Ω 6.2 µΩ/Ω 6.3 µΩ/Ω 6.3 µΩ/Ω 7.8 µΩ/Ω 10 µΩ/Ω 12 µΩ/Ω 17 µΩ/Ω 36 µΩ/Ω 44 µΩ/Ω 98 µΩ/Ω	Fluke 5730A
High Resistance – Generate, Fixed Points[3]	1 MΩ 10 MΩ 100 MΩ 1 GΩ 10 GΩ 100 GΩ 1 TΩ 10 TΩ	11 µΩ/Ω 16 µΩ/Ω 26 µΩ/Ω 46 µΩ/Ω 0.1 mΩ/Ω 0.14 mΩ/Ω 4 mΩ/Ω 12 mΩ/Ω	Ohm-Labs high resistors
Resistance – Measure[3]	(0 to 2) Ω (2 to 20) Ω (20 to 200) Ω 200 Ω to 2 kΩ (2 to 20) kΩ (20 to 200) kΩ 200 kΩ to 2 MΩ (2 to 20) MΩ (20 to 200) MΩ 200 MΩ to 2 GΩ (2 to 20) GΩ (0.1 to 2) GΩ (2 to 20) GΩ (20 to 200) GΩ (0.2 to 2) TΩ (2 to 10) TΩ	12 µΩ/Ω + 4 µΩ 8.2 µΩ/Ω + 14 µΩ 7.2 µΩ/Ω + 0.05 mΩ 7.2 µΩ/Ω + 0.5 mΩ 7.2 µΩ/Ω + 5 mΩ 8.9 µΩ/Ω + 1 Ω 17 µΩ/Ω + 10 Ω 68 µΩ/Ω + 1 kΩ 0.02 µΩ/Ω + 0.1 MΩ 0.0053 % + 10 MΩ 0.27 % + 20 kΩ 0.27 % + 0.2 MΩ 0.44 % + 2 MΩ 0.44 % + 20 MΩ 1.3 % + 0.2 GΩ	Fluke 8588A *High voltage mode Keithley 6517A

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Electrical Simulation of Thermocouple[3] –			
Type J	(-210 to 1200) °C	0.13 °C	Fluke 5522A w/ zero reference junction & SPRT
Type K	(-200 to 1372) °C	0.13 °C	
Type T	(-250 to 400) °C	0.13 °C	
Type N	(-200 to 1300) °C	0.14 °C	
Type E	(-250 to 1000) °C	0.14 °C	
Type B	(600 to 1820) °C	0.15 °C	
Type S	(0 to 1767) °C	0.15 °C	
Type R	(0 to 1767) °C	0.15 °C	
Capacitance – Measure[3]	(0.1 to 1) nF	0.12 % + 0.1 pF	Fluke 8588A
	(1 to 10) nF	0.066 % + 2 pF	
	(10 to 100) nF	0.041 % + 10 pF	
	(0.1 to 1) µF	0.042 % + 0.1 nF	
	(1 to 10) µF	0.044 % + 1 nF	
	(10 to 100) µF	0.062 % + 10 nF	
	(0.1 to 1) mF	0.063 % + 0.1µF	
	(1 to 10) mF	0.075 % + 1 µF	
	(10 to 100) mF	0.074 % + 10 µF	
Capacitance – Generate[3]	(0.22 to 0.4) nF	0.45 % + 8 pF	Fluke 5522A
	(0.40 to 1.1) nF	0.39 % + 8 pF	
	(1.1 to 3.3) nF	0.46 % + 8 pF	
	(3.3 to 11) nF	0.2 % + 8 pF	
	(11 to 33) nF	0.2 % + 80 pF	
	(33 to 110) nF	0.2 % + 80 pF	
	(0.11 to 0.33) µF	0.2 % + 0.24 nF	
	(0.33 to 1.1) µF	0.2 % + 0.8 nF	
	(1.1 to 3.3) µF	0.2 % + 2.4 nF	
	(3.3 to 11) µF	0.2 % + 8 nF	
	(11 to 33) µF	0.31 % + 24 nF	
	(33 to 110) µF	0.35 % + 80 nF	
	(0.11 to 0.33) mF	0.35 % + 0.24 µF	
	(0.33 to 1.1) mF	0.35 % + 0.8 µF	
	(1.1 to 3.3) mF	0.35 % + 2.4 µF	
	(3.3 to 11) mF	0.35 % + 8 µF	
	(11 to 33) mF	0.58 % + 24 µF	
	(33 to 110) mF	0.85 % + 80 µF	

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
Capacitance Generate[3]			
Fixed Point:			
1 pF	1 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	0.037 % 0.027 % 0.044 % 0.065 % 0.089 % 0.25 % 0.37 %	Agilent 16380A
10 pF	1 kHz to 1 MHz 2 MHz/3 MHz 4 MHz/5 MHz 10 MHz 13 MHz	0.011 % 0.011 % 0.012 % 0.016 % 0.019 %	
100 pF	1 kHz to 1 MHz 2 MHz/3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	0.011 % 0.012 % 0.014 % 0.017 % 0.035 % 0.050 %	
1000 pF	1 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	0.012 % 0.015 % 0.030 % 0.046 % 0.063 % 0.19 % 0.28 %	
10 nF	(100/120) Hz (1/10/100) kHz	0.014 % 0.014 %	Agilent 16380C
100 nF	(100/120) Hz (1/10/100) kHz	0.014 % 0.014 %	
1000 nF	(100/120) Hz/1 kHz 10 kHz 100 kHz	0.014 % 0.021 % 0.70 %	

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
AC Voltage – Generate[3]			
300 µV to 2.2 mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1.0) MHz	0.25 mV/V + 4.0 µV 90 µV/V + 4.0 µV 90 µV/V + 4.0 µV 0.20 mV/V + 4.0 µV 0.50 mV/V + 5.0 µV 1.0 mV/V + 10 µV 1.4 mV/V + 20 µV 2.7 mV/V + 20 µV	Fluke 5730A, Fluke 5725A
(2.2 to 22) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1.0) MHz	0.24 mV/V + 4.0 µV 90 µV/V + 4.0 µV 80 µV/V + 4.0 µV 0.20 mV/V + 4.0 µV 0.47 mV/V + 4.0 µV 1.0 mV/V + 10 µV 1.4 mV/V + 20 µV 1.4 mV/V + 20 µV	
(22 to 220) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1.0) MHz	0.24 mV/V + 12 µV 90 µV/V + 6.2 µV 54 µV/V + 6.2 µV 0.12 mV/V + 6.2 µV 0.31 mV/V + 16 µV 0.62 mV/V + 20 µV 1.4 mV/V + 24 µV 2.7 mV/V + 47 µV	
220 mV to 2.2 V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1.0) MHz	0.24 mV/V + 40 µV 85 µV/V + 16 µV 37 µV/V + 8 µV 62 µV/V + 10 µV 77 µV/V + 31 µV 0.31 mV/V + 80 µV 0.93 mV/V + 0.2 µV 1.6 mV/V + 0.31 µV	
(2.2 to 22) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1.0) MHz	0.24 mV/V + 0.4 mV 85 µV/V + 0.16 mV 38 µV/V + 54 µV 62 µV/V + 93 µV 77 µV/V + 0.2 mV 0.24 mV/V + 0.62 mV 0.93 mV/V + 2 mV 1.4 mV/V + 3.1 mV	
(22 to 220) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	0.24 mV/V + 4 mV 0.85 mV/V + 1.5 mV 51 µV/V + 0.5 mV 80 µV/V + 1 mV 0.15 mV/V + 2.4 mV	

Parameter/Range	Frequency	CMC[2, 4, 6] (±)	Comments
AC Voltage – Generate[3] (cont)			
(220 to 750) V	40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	72 µV/V + 3.1 mV 0.13 mV/V + 4.7 mV 0.47 mV/V + 8.5 mV 0.2 % + 35 mV	Fluke 5730A, Fluke 5725A
(750 to 1100) V	40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	70 µV/V + 3.1 mV 0.13mV/V + 4.7 mV 0.47mV/V + 8.5 mV	
AC Voltage – Measure[3]			
Up to 10 mV	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (300 to 1000) kHz	0.026 % + 1.1 µV 0.034 % + 1.1 µV 0.035 % + 1.1 µV 0.03 % + 0.8 µV 1 % + 4 µV 2.1 % + 3.8 µV	Fluke 8588A
(10 to 100) mV	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (300 to 1000) kHz	0.007 % + 0.5 µV 0.012 % + 0.5 µV 0.024 % + 1 µV 0.055 % + 5 µV 0.23 % + 31 µV 1.2 % + 0.1 mV	
100 mV to 1 V	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (300 to 1000) kHz	0.0073 % + 5 µV 0.012 % + 5 µV 0.022 % + 0.01 mV 0.053 % + 0.05 mV 0.21 % + 0.3 mV 1 % + 1 mV	
(1 to 10) V	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (300 to 1000) kHz	0.0066 % + 0.05 mV 0.012 % + 0.05 mV 0.022 % + 0.1 mV 0.052 % + 0.5 mV 0.21 % + 3.1 mV 1.1 % + 10 mV	

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
AC Voltage – Measure[3] (cont)			
(10 to 100) V	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (300 to 1000) kHz	0.007 % + 0.5 mV 0.0091 % + 0.5 mV 0.022 % + 1 mV 0.052 % + 5 mV 0.35 % + 47 mV 1.1 % + 0.5 V	Fluke 8588A
(100 to 1000) V	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz	0.0094 % + 25 mV 0.0093 % + 25 mV 0.023 % + 25 mV 0.054 % + 0.1 V	Fluke 8588A
High Voltage:			
(1000 to 10 000) V	60 Hz	0.18 % + 0.6R	Vitrek 4700/HLV- 70
(10 000 to 50 000) V	60 Hz	0.14 % + 0.6R	
2.2 mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1.0) MHz	1.4 mV/V + 1 µV 0.58 mV/V + 1 µV 0.33 mV/V + 1 µV 0.62 mV/V + 1.6 µV 0.93 mV/V + 2 µV 1.8 mV/V + 3.1 µV 1.9 mV/V + 6.2 µV 2.7 mV/V + 6.2 µV	Fluke 5790B
(2.2 to 7) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1.0) MHz	0.66 mV/V + 1 µV 0.29 mV/V + 1 µV 0.17 mV/V + 1 µV 0.32 mV/V + 1.5 µV 0.48 mV/V + 2 µV 0.93 mV/V + 3.1 µV 1 mV/V + 6.2 µV 1.8 mV/V + 6.2 µV	
(7 to 22) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1.0) MHz	0.24 mV/V + 1 µV 0.15 mV/V + 1 µV 85 µV/V + 1 µV 0.17 mV/V + 1.6 µV 0.25 mV/V + 2 µV 0.63 mV/V + 3.1 µV 0.7 mV/V + 6.2 µV 1.4 mV/V + 6.2 µV	
(22 to 70) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1.0) MHz	0.19 mV/V + 1.2 µV 93 µV/V + 1.2 µV 51 µV/V + 1.2 µV 0.17 mV/V + 1.5 µV 0.25 mV/V + 2 µV 0.63 mV/V + 3.1 µV 0.52 mV/V + 6.2 µV 0.86 mV/V + 6.2 µV	

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
AC Voltage – Measure[3] (cont)			
(70 to 220) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1.0) MHz	0.18 mV/V + 1.2 µV 66 µV/V + 1.2 µV 30 µV/V + 1.2 µV 54 µV/V + 1.6 µV 0.13 mV/V + 2 µV 0.2 mV/V + 3.1 µV 0.3 mV/V + 6.2 µV 0.78 mV/V + 6.2 µV	Fluke 5790B
(220 to 700) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1.0) MHz	0.17 mV/V + 1.2 µV 60 µV/V + 1.2 µV 26 µV/V + 1.2 µV 40 µV/V + 1.5 µV 62 µV/V + 2 µV 0.14 mV/V + 3.1 µV 0.24 mV/V + 6.2 µV 0.75 mV/V + 6.2 µV	
700 mV to 2.2 V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1.0) MHz	0.16 mV/V 52 µV/V 20 µV/V 36 µV/V 55 µV/V 0.13 mV/V 0.2 mV/V 0.7 mV/V	
(2.2 to 7) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1.0) MHz	0.16 mV/V 52 µV/V 19 µV/V 38 µV/V 64 µV/V 0.15 mV/V 0.32 mV/V 0.94 mV/V	
(7 to 22) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1.0) MHz	0.16 mV/V 52 µV/V 21 µV/V 37 µV/V 64 µV/V 0.15 mV/V 0.31 mV/V 0.95 mV/V	

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
AC Voltage – Measure[3] (cont)			
(22 to 70) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1.0) MHz	0.16 mV/V 54 µV/V 26 µV/V 44 µV/V 74 µV/V 0.16 mV/V 1.4 mV/V 1.4 mV/V	Fluke 5790B
(70 to 220) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz	0.16 mV/V 55 µV/V 25 µV/V 55 µV/V 80 µV/V 1.4 mV/V 1.4 mV/V	
(220 to 700) V	(15 to 50) Hz 50 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	1.6 mV/V 80 µV/V 32 µV/V 0.11 mV/V 0.4 mV/V	
(700 to 1000) V	(15 to 50) Hz 50 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	1.4 mV/V 80 µV/V 30 µV/V 1.4 mV/V 1.4 mV/V	
AC Voltage Flatness Measure[3]			
2.2 mV	30 Hz 120 kHz 2 MHz 10 MHz 20 MHz 30 MHz 50 MHz	0.08 % 0.04 % 0.06 % + 0.8 µV 0.14 % + 0.8 µV 0.24 % + 0.8 µV 0.54 % + 1.6 µV 0.8 % + 1.6 µV	Fluke 5790B
(2.2 to 7) mV	30 Hz 120 kHz 2 MHz 10 MHz 20 MHz 30 MHz 50 MHz	0.08 % 0.04 % 0.06 % + 0.8 µV 0.08 % + 0.8 µV 0.14 % + 0.8 µV 0.3 % + 0.8 µV 0.4 % + 0.8 µV	

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
AC Voltage Flatness Measure[3] (cont)			
(7 to 22) mV	30 Hz 120 kHz 2 MHz 10 MHz 20 MHz 30 MHz 50 MHz	0.08 % 0.04 % 0.054 % 0.08 % 0.14 % 0.29 % 0.47 %	Fluke 5790B
(22 to 70) mV	30 Hz 2 MHz 10 MHz 20 MHz 30 MHz 50 MHz	0.08 % 0.04 % 0.08 % 0.12 % 0.27 % 0.47 %	
(70 to 220) mV	30 Hz 500kHz 2 MHz 10 MHz 20 MHz 30 MHz 50 MHz	0.08 % 0.04 % 0.04 % 0.08 % 0.12 % 0.27 % 0.47 %	
(220 to 700) mV	30 Hz 500kHz 2 MHz 10 MHz 20 MHz 30 MHz 50 MHz	0.08 % 0.03 % 0.04 % 0.08 % 0.12 % 0.27 % 0.47 %	
700 mV to 2.2 V	30 Hz 500kHz 2 MHz 10 MHz 20 MHz 30 MHz 50 MHz	0.08 % 0.03 % 0.04 % 0.08 % 0.12 % 0.27 % 0.47 %	
(2.2 to 7) V	30 Hz 500kHz 2 MHz 10 MHz 20 MHz 30 MHz 50 MHz	0.08 % 0.03 % 0.04 % 0.08 % 0.12 % 0.27 % 0.47 %	

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
AC Current – Generate[3]			
(29 to 330) µA	(10 to 30) kHz	1.3 % + 0.31 µA	Fluke 5522A
(0.33 to 3.3) mA	(10 to 30) kHz	0.77 % + 0.47 µA	
(3.3 to 33) mA	(10 to 30) kHz	0.31 % + 3.1 µA	
(33 to 330) mA	(10 to 30) kHz	0.31 % + 0.16 mA	
(0.33 to 1.1) A	(10 to 45) Hz	0.14 % + 77 µA	
(1.1 to 3) A	(10 to 45) Hz	0.14 % + 77 µA	
(3 to 20.5) A	(45 to 100) Hz	0.093 % + 5 mA	
	100 Hz to 1kHz	0.12 % + 5 mA	
	(1 to 5) kHz	2.4 % + 5 mA	
Up to 220 µA	(10 to 20) Hz	0.024 % + 16 nA	Fluke5730A/5725A
	(20 to 40) Hz	0.016 % + 10 nA	
	40 Hz to 1 kHz	0.01 % + 8 nA	
	(1 to 5) kHz	0.028 % + 12 nA	
	(5 to 10) kHz	0.1 % + 62 nA	
220 µA to 2.2 mA	(10 to 20) Hz	0.024 % + 39 nA	
	(20 to 40) Hz	0.016 % + 31 nA	
	40 Hz to 1 kHz	0.01 % + 31 nA	
	(1 to 5) kHz	0.019 % + 0.1 µA	
	(5 to 10) kHz	0.1 % + 0.62 µA	
(2.2 to 22) mA	(10 to 20) Hz	0.024 % + 0.39 µA	
	(20 to 40) Hz	0.016 % + 0.31 µA	
	40 Hz to 1 kHz	0.01 % + 0.31 µA	
	(1 to 5) kHz	0.019 % + 0.54 µA	
	(5 to 10) kHz	0.1 % + 4.7 µA	
(22 to 220) mA	(10 to 20) Hz	0.024 % + 3.8 µA	
	(20 to 40) Hz	0.016 % + 3.1 µA	
	40 Hz to 1 kHz	0.01 % + 2.4 µA	
	(1 to 5) kHz	0.019 % + 3.1 µA	
	(5 to 10) kHz	0.1 % + 9.3 µA	
220 mA to 2.2 A	20 Hz to 1 kHz	0.024 % + 31 µA	
	(1 to 5) kHz	0.039 % + 77 µA	
	(5 to 10) kHz	0.62 % + 0.16 mA	
(2.2 to 11) A	20 Hz to 1 kHz	0.036 % + 0.14 mA	
	(1 to 5) kHz	0.078 % + 0.3 mA	
	(5 to 10) kHz	0.28 % + 0.6 mA	
Up to 120 A	(10 to 65) Hz	0.026 % + 29 mA	Fluke 5730A /52120A
	(65 to 300) Hz	0.024 % + 46 mA	
	(0.3 to 1) kHz	0.077 % + 0.13 mA	

Parameter/Range	Frequency	CMC[2, 4] (±)	Comments
Clamp On Meters			
(16.5 to 150) A	(45 to 65) Hz (65 to 400) Hz	0.31 % + 0.03 A 0.86 % + 0.032 A	Fluke 5522A w/5500 coil
(150 to 1025) A	(45 to 5) Hz (65 to 400) Hz	0.34 % + 0.19 A 1.2 % + 0.35 A	
(1000 to 6000) A	(10 to 1000) Hz	0.58 % + 1 A	Fluke 5730A/ 52120A/6KA coil
AC Current – Measure			
Up to 20 µA	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz	0.2 % + 2.5 nA 0.20 % + 2.5 nA 0.23 % + 2.5 nA	Fluke 8588A
(20 to 200) µA	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz	0.026 % + 5 nA 0.051 % + 5 nA 0.072 % + 5 nA 0.45 % + 10 nA	
200 µA to 2 mA	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz	0.026 % + 50 nA 0.051 % + 50 nA 0.072 % + 50 nA 0.45 % + 0.1 µA	
(2 to 20) mA	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz	0.026 % + 0.5 µA 0.051 % + 0.5 µA 0.072 % + 0.5 µA 0.46 % + 1 µA	
(20 to 200) mA	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz	0.026 % + 5 µA 0.05 % + 5 µA 0.07 % + 5 µA	
200 mA to 2 A	1 Hz to 2 kHz 2 to 10) kHz (10 to 30) kHz	0.026 % + 0.1 mA 0.051 % + 0.1 mA 0.084 % + 0.1 mA	
(2 to 20) A	10 Hz to 2 kHz (2 to 10) kHz	0.08 % + 0.5 mA 0.08 % + 0.5 mA	
(20 to 30) A	10 Hz to 2 kHz (2 to 5) kHz	0.08 % + 12 mA 0.12 % + 12 mA	

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
AC Current – Measure (cont)			
Up to 1 mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 10) kHz (10 to 30) kHz (30 to 50) kHz (50 to 100) kHz	0.017 % 0.0075 % 0.006 % 0.0078 % 0.0083 % 0.016 % 0.017 %	Fluke 8588A
(1 to 10) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	0.016 % 0.0058 % 0.0033 % 0.0044 % 0.0069 %	
(10 to 200) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	0.016 % 0.0058 % 0.0033 % 0.0044 % 0.006 %	Fluke 5790B/A40B
(0.2 to 2) A	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 10) kHz (10 to 30) kHz (30 to 50) kHz (50 to 100) kHz	0.016 % 0.0058 % 0.0035 % 0.0038 % 0.0085 % 0.0068 % 0.008 %	
(2 to 20) A	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz (20 to 30) kHz (30 to 100) kHz	0.017 % 0.0068 % 0.0048 % 0.0057 % 0.0079 % 0.0085 % 0.013 %	
(20 to 100) A	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz (20 to 30) kHz (30 to 50) kHz (50 to 100) kHz	0.018 % 0.0085 % 0.0069 % 0.0095 % 0.011 % 0.011 % 0.018 % 0.019 %	

Parameter/Equipment	Range	CMC[2, 4, 5] (±)	Comments
Oscilloscopes[3] –			
Amplitude DC Signal:			
Into 50 Ω Load	(-6.6 to 6.6) V	0.25 % + 40 µV	Fluke 5522A/SC1100
Into 1 MΩ Load	(-130 to 130) V	0.050 % + 40 µV	
Rise Time	< 300 ps	+0 ps/-100 ps	
Leveled Sine Wave Flatness, Relative to 50 kHz, 5 mV(p-p) to 5.5 V(p-p)	50 Hz to 100 MHz (100 to 300) MHz (300 to 600) MHz 600 MHz to 1.1 GHz	1.5 % + 100 µV 2.0 % + 100 µV 4.0 % + 100 µV 5.0 % + 100 µV	
Time Marker Into 50 Ω Load	(5 to 50) ms 20 ms to 2 ns	(25 + 1000t) parts in 10^6 2.5 parts in 10^6	t is time in seconds Fluke 9500B/9530
Bandwidth	(0.1 to 300) MHz (300 to 550) MHz 550 MHz to 1.1 GHz 1.1 GHz to 3.2 GHz	2 % 2.7 % 3.3 % 4.1 %	
Time Marker	9.0091 ns to 83 µs 83 µs to 55 s	0.22 µs/s 2.4 µs/s	
Voltage:			
DC Into 1 MΩ	± 1 mV to 200 V	0.024 % + 20 µV	
DC Into 50 Ω	± 1 mV to 5 V	0.024 % + 20 µV	
Squarewave Into 1 MΩ	40 µV + 200 Vp-p	0.08 % + 8 µV	
Squarewave Into 50 Ω	40 µV + 5 Vp-p	0.08 % + 8 µV	
Risetime	10 Hz to 2 MHz	22 ps	
Tachometers[3]	(6 to 99 999) RPM	0.004 %	Frequency standard w/ LED
Phase – Measure (0 to 360)[3]	5 Hz to 2 kHz (2 to 5) kHz (5 to 10) kHz (10 to 50) kHz	0.03° 0.04° 0.05° 0.06°	Clark Hess 6000A

VI. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC[2, 4, 5] (±)	Comments
Power Sensor – Calibration Factors (-30 to 20) dBm (-30 to 20) dBm	 0.1 MHz to 4.2 GHz 50 MHz to 26.5 GHz	 2.8 % CF 3.5 % CF	Agilent power sensors 8482A & 8485A CF is calibration factor
Amplitude Modulation[3] – Carrier: (0.15 to 10) MHz Depth: Up to 99 % Carrier: 10 MHz to 1.3 GHz Depth: Up to 99 %	 (20 to 50) Hz 50 Hz to 10 kHz (20 to 50) Hz 50 Hz to 50 kHz (50 to 100) kHz	 3.8 % 2.7 % 3.8 % 1.6 % 3.8 %	 HP 8902A measuring receiver w/ 11722A power sensor
Frequency Modulation[3] – Carrier: 250 kHz to 10 MHz Dev: Up to 40 kHz Carrier: 10 MHz to 1.3 GHz Dev: Up to 400 kHz	 20 Hz to 10 kHz (20 to 50) Hz 50 Hz to 100 kHz (100 to 200) kHz	 2.9 % 5.9 % 1.3 % 5.9 %	 HP 8902A measuring receiver w/ 11722A power sensor
Phase Modulation[3] – Carrier: 150 kHz to 10 MHz Carrier: 10 MHz to 1.3 GHz	 200 Hz to 10 kHz 200 Hz to 20 kHz	 4.8 % 3.7 %	HP 8902A measuring receiver w/ 11722A power sensor
Absolute Power – Measure[3] (0 to -10) dBm (-10 to -20) dBm (-20 to -30) dBm (-30 to -40) dBm (-40 to -50) dBm (-50 to -60) dBm (-60 to -70) dBm (-70 to -80) dBm (-80 to -90) dBm (-90 to -100) dBm (-100 to -110) dBm (-110 to -120) dBm	 10 MHz to 26.5 GHz	 0.08 dB 0.10 dB 0.12 dB 0.13 dB 0.15 dB 0.17 dB 0.20 dB 0.23 dB 0.28 dB 0.33 dB 0.39 dB 0.43 dB	 HP 8902A measuring receiver w/ 11722A & 11792A power sensors

VII. Fluid Quantities

Parameter/Equipment	Range[7]	CMC[2, 5, 8] (±)	Comments
Flow – Gas[3]	(0.5 to 5) sccm (5 to 50) sccm (0.05 to 0.5) lpm (0.5 to 5) lpm (3 to 30) lpm (30 to 100) lpm (100 to 2500) lpm	1.2 % Rdg 1.2 % Rdg 0.28 % Rdg 0.26 % Rdg 0.42 % Rdg 0.65 % Rdg 1.2 % Rdg	DH instruments flow meter calibrator Molbox1 Alicat MCR2500SLM
Flow – Liquid[3]	(0.02 to 3) gpm (0.5 to 60.0) gpm (1.5 to 160) gpm (0.1 to 10) gpm (10 to 400) gpm	0.11 % Rdg 0.09 % Rdg 0.09 % Rdg 0.067 % Rdg 0.079 % Rdg	Flow technology turbine meter Compuflow test stand

VIII. Magnetic Quantities

Parameter/Equipment	Range[7]	CMC[2, 5, 8] (±)	Comments
Gauss Meter[3]	(1 to 200) Gauss	0.88 %	Helmholtz coil, zero gauss chamber

IX. Optical Quantities

Parameter/Equipment	Range[7]	CMC[2, 5, 8] (±)	Comments
Illuminance – Light Meters	(5 to 200) fc (200 to 2000) fc	2.8 % 3.1 %	Hoffman light source w/ PCS 600 light meter
Optical Wavelength – Measure	(700 to 1650) nm	0.000 48 %	Keysight 86120A
Optical Absolute Power – Measure	-20 dBm @ 850 nm -20 dBm @ 1550 nm	0.091 dBm 0.090 dBm	Agilent 81624A

Parameter/Equipment	Range	CMC[2, 8] (±)	Comments
Optical Power Linearity – Measure			
850 nm	0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm	0.022 dBm 0.024 dBm 0.023 dBm 0.024 dBm 0.024 dBm 0.029 dBm	Agilent 81624A
1310 nm	0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm	0.023 dBm 0.024 dBm 0.025 dBm 0.025 dBm 0.027 dBm 0.030 dBm	
1550 nm	0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm	0.022 dBm 0.025 dBm 0.023 dBm 0.024 dBm 0.024 dBm 0.030 dBm	

X. Mechanical

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Pressure Gauges & Transducer /Vacuum[3]			
Vacuum	Up to 1 Torr (1 to 1000) Torr	0.0008 Torr 0.26 Torr	INFICON CDGsci DH Instrument PPC3
Pneumatic	(0 to 17) psia Up to 600 psig Up to 3000 psig Up to 6000 psig Up to 10 000 psig	0.002 % Rdg + 0.001 psia 0.010 % Rdg + 0.001 psig 0.010 % Rdg + 0.01 psig 0.011 % Rdg + 0.1 psig 0.021 % Rdg + 0.1 psig	Mensor CPC 8000 DH Instruments pressure calibrator, PPCH-G Ruska Model 2450-701
Hydraulic	(5 to 40 000) psig (725 to 72 500) psi	0.030 % Rdg 0.030 % Rdg	DH-Budenberg 5306

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Torque Analyzers[3]	(1 to 10) ozf·in (10 to 100) ozf·in (4 to 50) lbf·in (30 to 400) lbf·in (80 to 1000) lbf·in (20 to 250) lbf·ft (200 to 2000) lbf·ft	0.16 % Rdg 0.12 % Rdg 0.065 % Rdg 0.025 % Rdg 0.026 % Rdg 0.017 % Rdg 0.086 % Rdg	Torque arms w/ Class F weights
Torque Tools[3]	(1 to 10) ozf·in (10 to 100) ozf·in (4 to 50) lbf·in (30 to 400) lbf·in (80 to 1000) lbf·in (20 to 250) lbf·ft (200 to 2000) lbf·ft	0.11 % Rdg 0.01 % Rdg 0.19 % Rdg 0.51 % Rdg 0.34 % Rdg 0.34 % Rdg 0.36 % Rdg	Mountz MTX10Z AWS: QC10-100 CDI torque, force & tension calibration system, Model: 200-400-02
Air Velocity Instruments	(25 to 350) fpm (350 to 1000) fpm (1000 to 9000) fpm	2.6 % Rdg 2.4 % Rdg 1.3 % Rdg	Omega WT4401-D Pitot tube
Fume Hood Anemometer Air Volume Flow	 (25 to 500) fpm (200 to 400) cfm	 4.9 % Rdg 9 cfm	 Testo anemometer Testo flow hood systems
Force Gages & Transducers[3]	Up to 1 lbf (1 to 100) lbf (1 to 1000) lbf (350 to 1000) lbf (1000 to 30 000) lbf (30 000 to 100 000) lbf	0.064 % Rdg 0.049 % Rdg 0.037 % Rdg 0.12 % Rdg 0.026 % Rdg + 1.5 lbf 0.028 % Rdg	Dead weights Morehouse force machine w/ load cell
Durometer Calibrator – A Scale D Scale	 (56.08 to 820.87) g (0 to 4.53) kg	 2.6 g 0.012 kg	 25 lbf load cell

Parameter/Equipment	Range	CMC[2, 8] (±)	Comments
Pipettes	≤ 1 µL ≤ 10 µL ≤ 100 µL ≤ 1000 µL ≤ 5 mL ≤ 10 mL	0.007 µL 0.008 µL 0.017 µL 0.040 µL 0.045 µL 0.66 µL	Sartorius CC111, Sartorius WZA 225-CW mass comparator
Volumetric – Measure	Up to 5 *L*	0.094 m*L*/*L*	Sartorius mass comparator
Durometers – Type A, B, O Type C, D, DO Indentor Geometry: Length Diameter Angle Radius	 (0 to 100) DUROS (0 to 100) DUROS Up to 0.2 in Up to 1 in (0 to 90)° Up to 1 in	 0.52 DUROS 0.46 DUROS 0.58 m·in 0.41 m·in 0.049° 0.18 m·in	 REX-1 durometer calibrator Optical comparator
Indirect Verification of Rockwell Hardness Testers[3]	HRA: Low Mid High HRBW: Low Mid High HRC: Low Mid High HR15N: Low Mid High	 0.31 HRA 0.22 HRA 0.19 HRA 0.60 HRBW 0.50 HRBW 0.68 HRBW 0.56 HRC 0.46 HRC 0.40 HRC 0.54 HR15N 0.47 HR15N 0.61 HR15N	ASTM E18

Parameter/Equipment	Range	CMC[2, 5] (±)	Comments
Indirect Verification of Rockwell Hardness Testers[3] (cont)	HR15TW: Low Mid High HR30N: Low Mid High HR30TW: Low Mid High HR45N: Low Mid High HR45TW: Low Mid High	 0.29 HR15TW 0.29 HR15TW 0.47 HR15TW 0.35 HR30N 0.52 HR30N 0.57 HR30N 0.40 HR30TW 0.38 HR30TW 0.34 HR30TW 0.56 HR45N 0.35 HR45N 0.29 HR45N 0.89 HR45TW 0.62 HR45TW 0.61 HR45TW	ASTM E18
Direct Verification of Rockwell Hardness Testers Verification of Test Force Verification of Depth Measuring Device	 (15 to 150) kgf (0 to 260) µm	 0.08 % + 0.01 kgf 0.17 µm	 Load cell Digital indicator system
Accelerometers – Vibration: Sensitivity/Frequency Response Shock: Linearity Dynamic Pressure: Linearity	 (0.5 to 10) Hz (5 to 10 000) Hz (10 000 to 15 000) Hz Up to 10 000 g Up to 15 000 psi	 1.7 % Rdg 1.9 % Rdg 2.2 % Rdg 2.3 % Rdg 3.1 % Rdg	 Modal shop 9155w/ PCB accelerometers

Parameter/Equipment	Range	CMC[2, 6, 8] (±)	Comments
Balances[3]	Up to 310 g Up to 4100 g Up to 15 kg	0.3 mg + 0.6*R* 48 mg + 0.6*R* 0.52 g + 0.6*R*	Class 1 master weights
Scales[3]	Up to 100 lb Up to 1000 lb Up to 7200 lb	7.7 g + 0.6*R* 0.12 kg + 0.6*R* 0.051 % + 0.6*R*	Class 4 master weights Standard weights
Mass – Measure	30 kg 25 kg 20 kg 10 kg 5 kg 3 kg 2 kg 1 kg 500g 300 g 200 g 100 g 50 g 30 g 20 g 10 g 5 g 3 g 2 g 1 g 500 mg 300 mg 200 mg 100 mg 50 mg 30 mg 20 mg 10 mg 5 mg 3 mg 2 mg 1 mg	15 mg 13 mg 10 mg 5.5 mg 2.5 mg 4.9 mg 2.3 mg 1.6 mg 0.57 mg 0.36 mg 0.19 mg 0.19 mg 73 µg 64 µg 9.3 µg 6.1 µg 4.6 µg 4.2 µg 4.6 µg 4.6 µg 3.3 µg 3.2 µg 2.9 µg 2.9 µg 2.5 µg 3.0 µg 2.5 µg 2.5 µg 2.5 µg 2.9 µg 2.5 µg 2.5 µg	Double substitution
Mass – Measure (Avoirdupois)	1 lb 5 lb 10 lb 25 lb 50 lb 500 lb 1000 lb	5.3 µlb (2.4 mg) 5.3 µlb (2.4 mg) 2.1 µlb (9.5 mg) 11 µlb (4.8 mg) 33 µlb (15 mg) 0.026 lb (12 g) 0.068 lb (31 g)	Double substitution Load cell

XI. Thermodynamics

Parameter/Equipment	Range	CMC[2, 5, 6, 8] (±)	Comments
Temperature – Measure & Measuring Equipment	(-196 to -80) °C (-80 to 100) °C (100 to 660) °C (400 to 1600) °C	0.034 °C 0.021 °C 0.039 °C 0.27 % + 0.6*R*	Fluke 1560 w/SPRT, TempSens cal-sys -196/-80 & Fluke 7380 Type R TC w/ Tempsens cal-sys 1700
Infrared / Pyrometers[3]	(50 to 500) °C (150 to 1200) °C (-30 to 150) °C	1.4 °C + 0.6*R* 0.48 % + 0.6*R* 0.8 °C	Fluke 9132 ε = 0.95 (8 to 14) µm IsoTech Pegasus R970 ε = 0.995 (9 to 14) µm Fluke 9133 ε = 0.95 (8 to 14) µm
Humidity – Measuring Equipment, (10 to 30) °C	(5 to 15) % RH (5 to 25) % RH (25 to 35) % RH (35 to 50) % RH (50 to 65) % RH (65 to 80) % RH (80 to 95) % RH	0.40 % RH 0.49 % RH 0.52 % RH 0.59 % RH 0.62 % RH 0.66 % RH 0.83 % RH	Rotronic HC2-SH & GEO 2000
Temperature – Measuring Equipment, Fixed Point	Triple Point of Water Liquid Nitrogen	8.3 mK 7.5 mK	Pond Engineering TPW
Humidity – Measure[3]			
(-50 to 90) °C	Frost Point Dew Point	1.1 °C 0.14 °C	Chilled mirror
(10 to 30) °C	(5 to 15) % RH (5 to 25) % RH (25 to 35) % RH	0.20 % RH 0.36 % RH 0.40 % RH	Rotronic HC2-SH
(10 to 30) °C	(35 to 50) % RH (50 to 65) % RH (65 to 80) % RH (80 to 95) % RH	0.47 % RH 0.51 % RH 0.56 % RH 0.77 % RH	Rotronic HC2-SH

Parameter/Equipment	Range	CMC[2] (±)	Comments
Dew Point	(100 to -65) °C	0.35 °C	Edge tech 1500
Environmental Chambers, Ovens, Furnaces, Freezers, Temperature Baths & Dry Wells	(-80 to 1000) °C	2.0 ° C	Type K TCs & Vaisala RH probe

XII. Time & Frequency

Parameter/Equipment	Range	CMC[2, 8] (±)	Comments
Frequency –Measuring Equipment	10 MHz Reference Signal	2.0 parts in 10^{10} Hz	Datum 9390-6000 w/ GPS
Frequency – Measure	1 MHz to 40 GHz	9.3 parts in 10^{9} Hz 1.4 part in 10^{7} Hz	10 MHz signal from Datum 9390-6000 w/GPS to: 53131 counter 53152A counter
Stopwatches	Up to 24 hrs	0.048 s/day	Timometer 4500

SATELLITE

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I. Acoustical

Parameter/Equipment	Range	CMC[2] (±)	Comments
Sound Level Meters 3 – 125 Hz to 4000 Hz	114 dB 104 dB 94 dB 84 dB 74 dB	0.26 dB 0.38 dB 0.39 dB 0.48 dB 0.86 dB	IET Labs 1986 omnical sound level calibrator

II. Chemical

Parameter/Equipment	Range	CMC[2, 8] (±)	Comments
Conductivity – Liquid Measuring Equipment[3]	84 µS/cm 1413 µS/cm 12 880 µS/cm	0.8 µs/cm 4.0 µs/cm 50 µs/cm	Laboratory standard conductivity solution
Conductivity – Metal Measuring Equipment[3]	9.33 %IACS 14.92 %IACS 25.80 %IACS 32.56 %IACS 44.92 %IACS 59.42 %IACS 100.97 %IACS	0.2 % IACS 0.35 % IACS 0.31 % IACS 0.38 % IACS 0.37 % IACS 0.47 % IACS 1.5 % IACS	Metal conductivity standards
Metal Conductivity Standards	Up to 102 %IACS	0.013 % + 0.2 % IACS	Conductivity meter
pH – Measuring Equipment[3]	4 pH 7 pH 10 pH	0.01 pH 0.01 pH 0.01 pH	Buffer solutions

III. Dimensional

Parameter/Equipment	Range	CMC[2, 8] (±)	Comments
Angle Blocks	Up to 90°	0.0015°	Angle blocks
Angle Gages	Up to 120°	0.0058°	Video measuring system
Bore Gages/Intramics	(0.150 to 1.000) in (3.810 to 25.400) mm (1.000 to 2.000) in (25.4025 to 50.800) mm (2.000 to 3.000) in (50.8025 to 76.200) mm (3.000 to 4.000) in (76.2025 to 101.600) mm (4.000 to 5.000) in (101.6025 to 127.000) mm (5.000 to 6.000) in (127.0025 to 152.40) mm (6.000 to 7.000) in (152.4025 to 177.800) mm	(4.2 + 1.4*D*) µin (110 + 1.4*D*) nm (3.5 + 2.1*D*) µin (89 + 2.1D) nm (3.1 + 2.3*D*) µin (79 + 2.3*D*) nm (4 + 2*D*) µin (100 + 2.0*D*) nm (12 + 6*D*) µin (300 + 6.0*D*) nm (8 + 2*D*) µin (200 + 2.0*D*) nm (8 + 2*D*) µin (200 + 2.0*D*) nm	Lab Master, gage blocks, cylindrical rings
Calipers[3]	Up to 6 in Up to 150 mm (6.0005 to 12) in (150.001 to 300) mm (12.0005 to 18) in (300.001 to 450) mm (18.0005 to 24) in (450.001 to 600) mm (24.0005 to 36) in (600.001 to 900) mm (36.0005 to 48) in (900.001 to 1200) mm (48.0005 to 60) in (1200.001 to 1500) mm (60.005 to 72) in 1500.001 to 1830) mm	(3.7 + 3.6*L*) µin (94 + 3.6*L*) nm (3 + 4*L*) µin (76 + 4*L*) nm (5 + 4.5*L*) µin (4.5*L* nm) + 0.13 µm (20 + 5*L*) µin (5.0*L* nm) + 0.51 µm (15 + 4.6*L*) µin (4.6*L* nm) + 0.38 µm (11 + 4.2*L*) µin (4.2*L* nm) + 0.28 µm (70 + 2.5*L*) µin (2.5 nm) + 1.8 µm (270 + 7.5*L*) µin (7.5*L* nm) + 6.9 µm	Gage blocks

Parameter/Equipment	Range	CMC[2, 8] (±)	Comments
Chamfer & Countersink Gages	Up to 3 in Up to 76.2 mm	(170 + 110*D*) µin 4.3 µm + 110*D* nm	Chamfer rings
Coating Thickness	Up to 0.060 in thick	0.022 + 0.0035*L* mils	Comparison to master films
Concentricity Gage	Up to 0.050 in	8 µin	LVDT with amplifier master cylinder
Crimpers	Up to 12 in Up to 304.8 mm (0.011 to 0.060) in (0.061 to 0.250) in (0.251 to 0.500) in	(80 + 3.2*L*) µin (2.03 + 3.25*L*) µm (140 + 200*L*) µin (140 + 160*L*) µin (130 + 80*L*) µin	Video measuring system Pin gages
Depth Measuring Instruments, Gages & Micrometers[3]	Up to 6 in Up to 150.0 mm (6.000 to 12) in (150.001 to 300) mm (12.000 to 18) in (300.001 to 450) mm (18.000 to 24) in (450.001 to 600) mm	(12 + 1.3*L*) µin (1.30*L* nm) + 0.30 µm (20 + 2.5*L*) µin (2.5*L* nm) + 0.51 µm (14 + 5*L*) µin (5*L* nm) + 0.36 µm (15 + 4.8*L*) µin (4.8*L* nm) + 0.38 µm	Gage blocks, surface plate
Flatness[3] – Anvils, Spindles, Gage Stands & Gage Blocks	Up to 3 in diameter Up to 76.2 mm diameter	2.8 µin 0.071 µm	Comparison to master optical flat under monochromatic light source
Gage Block – Length	(0.01 to 0.21) in (0.031 25 to 4) in 2 in 3 in 4 in (5 to 20) in (125 to 500) mm	4.7 µin (2.5 + 1.7*L*) µin 5.7 µin 7.2 µin 8.9 µin (8.8 + 1.2*L*) µin (1.2*L* nm) + 0.22 µm	Gage blocks, gage block comparator Lab Master 175

Parameter/Equipment	Range	CMC[2, 8] (±)	Comments
Gage Block – Parallelism	Up to 4 in Up to 100 mm (5 to 20) in (125 to 500) mm	2.7 µin 0.069 µm 1.6 µin 0.04 µm	Gage block Comparator Lab Master 175
Glass Scale / Stage Micrometer	Up to 12 in Up to 304.8 mm	(80 + 3.2*L*) µin (2.0 + 3.2*L*) nm	Video measuring system
Height Gages[3] – Dial, Digital & Vernier	 Up to 12 in Up to 300 mm (12.000 to 18) in (300.001 to 450) mm (18.000 to 24) in (450.001 to 600) mm (24.000 to 36) in (600.001 to 900) mm (36.000 to 48) in (900.001 to 1200) mm (48.000 to 60) in (1200.001 to 1500) mm	 (17 + 3*L*) µin (3*L* nm) + 0.43 µm (35 + 3.5*L*) µin (3.5*L* nm) + 0.86 µm (21 + 6.3*L*) µin (6.3*L* nm) + 0.53 µm (41 + 3.3*L*) µin (3.3*L* nm) + 1.0 µm (30 + 5*L*) µin (5.0*L* nm) + 0.76 µm (60 + 2.5*L*) µin (2.5*L* nm) + 1.5 µm	Gage blocks surface plate
High Accuracy Height Gages	Up to 12 in Up to 300 mm (12.000 1 to 18) in (300.001 to 450) mm (18.000 1 to 24) in 450.000 1 to 609.6) mm	(23 + 1.7*L*) µin (0.17*L* nm) + 0.58 µm (8 + 2*L*) µin (2.0*L* nm) + 0.20 µm (14 + 1.8*L*) µin (1.8*L* nm) + 0.36 µm	Gage blocks Surface plate
Indicators[3] – Digital, Dial, Bore gages with Removable Indicator	 Up to 4 in Up to 101.6 mm	 (6.8 + 2.6*L*) µin (170 + 2.6*L*) nm	Gage blocks

Parameter/Equipment	Range	CMC[2, 8] (±)	Comments
Indicators Test[3] –	Up to 0.05 in Up to 1.25 mm	15 µin 0.38 µm	Calibration tester, gage blocks
Cylindrical Gages, Protusion Gages & Washer Rings			LMU-175, gage blocks
Inside measurements	(0.040 to 0.125) in (1.015 to 3.175) mm	4.4 µin 0.11 µm	
	(0.125 to 0.250) in (3.175 to 6.350) mm	4.5 µin 0.14 µm	
	(0.250 to 1.000) in (6.350 to 25.400) mm	5.2 µin 0.13 µm	
	(1.000 to 2.000) in (50.8025 to 76.2000) mm	5.5 µin 0.14 µm	
	(2.0001 to 3.0000) in (50.8025 to 76.2000) mm	5.5 µin 0.14 µm	
	(30 001 to 4.0000) in (76.2025 to 101.6000) mm	5.5 µin 0.14 µm	
	(4.0001 to 5.0000) in (101.6025 to 127.0000) mm	6.2 µin 0.16 µm	
	(5.0001 to 6.0000) in (127.0025 to 152.4000) mm	6.6 µin 0.17 µm	
	(6.0001 to 7.0000) in (152.4025 to 177.8000) mm	8.8 µin 0.22 µm	
	(7.0001 to 8.0000) in (1 778 025 to 2 032 000) mm	9.2 µin 0.23 µm	
	(8.0001 to 9.0000) in (203.2025 to 228.6000) mm	9.2 µin 0.23 µm	
	(9.0001 to 10.0000) in (228.6025 to 254.0000) mm	9.2 µin 0.23 µm	
	(10.0001 to 11.0000) in (254.0025 to 279.4000) mm	10 µin 0.25 µm	
	(11.0001 to 12.0000) in (279.4025 to 304.8000) mm	13 µin 0.33 µm	

Parameter/Equipment	Range	CMC[2, 8] (±)	Comments
Inside / Outside Measurement			Video measuring system
Non-Contact	Up to 12 in Up to 304.8 mm	(80 + 3.2*L*) µin (2.03 + 3.2*L*) µm	
Inspection Fixtures			
Parallelism	Up to 72 in Up to 1825 mm	(37 + 0.4*L*) µin (0.94 + 0.4*L*) nm	Surface plate, LVDT with amplifier
Perpendicularity / Squareness	Up to 24 in Up to 455 mm	(37 + 66*L*) µin (0.94 + 5.5*L*) nm	Surface plate, granite square, LVDT with amplifier
V-Groove Parallelism	Up to 12 in Up to 305 mm	(37 + 7*L*) µin (0.94 + 7*L*) nm	Surface plate, master cylinders, LVDT
Laser Micrometer[3]	(0.05 to 1.00) in (1.27 to 25.4) mm	(4.1 + 31*L*) µin (100 + 31*L*) nm	Master cylinders
Step Height Parallelism	Up to 5000 µin	8.5 µin	LVDT w/ amplifier
Levels	Up to 18 in Up to 455 mm	(6.4 + 5.6*L*) µin (160 + 5.6*L*) nm	Gage blocks & surface plate
Micrometers[3]			
Inside	Up to 6 in Up to 150 mm (6.0001 to 12) in (150.001 to 300) mm (12.0001 to 32) in (300.001 to 800) mm (32.001 to 60) in (800.001 to 1525) mm	(7.4 + 2.6*L*) µin (190 + 2.6*L*) nm (13 + 3.2*L*) µin (3.2*L* nm) + 0.33 µm (21 + 2.8*L*) µin (2.8*L* nm) + 0.53 µm (27 + 2.9*L*) µin (2.9*L* nm) + 0.69 µm	Gage blocks

Parameter/Equipment	Range	CMC[2, 8] (±)	Comments
Micrometers[3] (cont)			Gage blocks
Outside	Up to 6 in Up to 150 mm (6.0001 to 12) in (150.001 to 300) mm (12.0001 to 18) in (300.001 to 450) mm (18.0001 to 24) in (450.001 to 600) mm (24.0001 to 30) in (600.001 to 750) mm (30.0001 to 36) in (750.001 to 900) mm (36.0001 to 42) in (900.001 to 1050) mm (42.0001 to 48) in (1050.001 to 1200) mm (48.0001 to 54) in (1200.001 to 1375) mm (54.0001 to 60) in (1375.001 to 1525) mm	(18 + 0.26*L*) µin (460 + 0.26*L*) nm (19 + 1*L*) µin (480 + 1.0*L*) nm (28 + 0.67*L*) µin (710 + 0.67*L*) nm (20 + 3.3*L*) µin (3.3*L* nm) + 0.51 µm (52 + 0.17*L*) µin (0.17*L* nm) + 1.3 µm (49 + 2.5*L*) µin 2.5*L* nm + 1.2 µm (97 + 3.5*L*) µin (3.5*L* nm) + 2.5 µm (89 + 2.8*L*) µin (2.8*L* nm) + 2.3 µm (76 + 2.2*L*) µin (2.2*L* nm) + 1.8 µm (110 + 2.7*L*) µin (2.70*L* nm) + 2.8 µm	
Length/Height – Ranged - Caliper Checkers - Check Master - Depth Mic Master - Height Master - Mic Master - Micrometer Standards - Rise Blocks - Standard Reference Bars	Up to 6 in Up to 155 mm (6.0001 to 12) in (150.001 to 300) mm (12.0001 to 18) in (300.001 to 450) mm (18.0001 to 24) in (450.001 to 600) mm (24.0001 to 36) in (600.001 to 900) mm (36.0001 to 48) in (900.001 to 1200) mm (48.0001 to 60) in (1200.001 to 1500) mm	(12 + 0.2*L*) µin (0.20*L* nm) + 0.30 µm (12 + 0.33*L*) µin (0.33*L* nm) + 0.30 µm (17 + 0.33*L*) µin (0.33*L* nm) + 0.43 µm (14 + 0.67*L*) µin (0.67*L* nm) + 0.36 µm (19 + 0.58*L*) µin (0.58*L* nm) + 0.48 µm (21 + 0.17*L*) µin (0.17*L* nm) + 0.53 µm (22 + 0.17*L*) µin (0.17*L* nm) + 0.56 µm	Surface plate, gage blocks & LVDT with amplifier
Mu-Checker/Gage Amplifier & Probe[3]	Up to 0.05 in Up to 1.25 mm	5 µin 120 nm	Gage blocks

Parameter/Equipment	Range	CMC[2, 8] (±)	Comments
Microscope[3]			
Linearity			
X	Up to 4 in	(8.8 + 1.5*L*) µin	Gage blocks
Y	Up to 101.6 mm	(220 + 1.5*L*) nm	
Angle	(0 to 90) °	0.012°	Angle blocks
Optical Comparator[3] – Stage Movement			
Angularity			
X	(0.5 to 12) in (12.7 mm to 304.8 mm)	(37 + 12*L*) µin (940 + 12*L*) nm	Gage blocks
Y			
Squareness			
X	0° to 360° (12 in of X axis travel maximum, Y axis travel maximum less than 12 in)	0.0013°	True square
Y			
Magnification			
X	10X, 20X, 31.25X, 50X, 62.5X, 100X	0.08 %	Gage blocks, glass scales
Y			
Optical Flats	Up to 3 in diameter Up to 76.2 mm diameter	2.8 µin 0.071 µm	Comparison to master optical flat
Optical Parallels			Comparison to master optical flat
Flatness	Up to 3 in diameter Up to 76.2 mm dia	2.8 µin 0.071 µm	
Parallelism	Up to 3 in diameter Up to 76.2 mm dia	0.75 µin 0.019 µm	
Protractors[3]	Up to 90°	0.023°	Master angle blocks
Radius Length	Up to 6 in Up to 152.4 mm	(80 + 3.2*L*) µin (3.2*L* nm) + 2.0 µm	Video measuring system

Parameter/Equipment	Range	CMC[2, 8] (±)	Comments
Outside Measurements Cylindrical Plug Gages, Deltronic Pin Gages, Discs, Master Cylinders, Spheres (Diameter)	Up to 1.0000 in Up to 25.4000 mm (1.0001 to 2.0000) in (25.4025 to 50.8000) mm (2.0001 to 3.0000) in (50.8025 to 76.2000) mm (3.0001 to 4.0000) in (76.2025 to 101.6000) mm (4.0001 to 5.0000) in (101.6025 to 127.0000) mm (5.0001 to 6.0000) in (127.0025 to 152.4000) mm (6.0001 to 7.0000) in (152.4025 to 177.8000) mm (7.0001 to 8.0000) in (177.8025 to 203.2000) mm (8.0001 to 9.0000) in (203.2025 to 228.6000) mm (9.0001 to 10.0000) in (228.6025 to 254.0000) mm	6.0 µin 0.15 µm 6.3 µin 0.16 µm 6.3 µin 0.16 µm 6.3 µin 0.16 µm 6.9 µin 0.18 µm 7.2 µin 0.18 µm 9.5 µin 0.24 µm 9.5 µin 0.24 µm 9.5 µin 0.24 µm 9.5 µin 0.24 µm	LMU-175, gage blocks
Rulers & Tape	Up to 12 in Up to 304.8 mm (12 to 300) in (304.0 to 365.7) mm	(80 + 3.2*L*) µin (3.2*L* nm) + 2.0 µm (1100 + 8.3*L*) µin (8.3*L* nm) + 28 µm	Video measuring system Gage blocks

Parameter/Equipment	Range	CMC[2, 8] (±)	Comments
Sine Bars/Plates	Up to 5 in Up to 127 mm	(23 + 20*L*) µin (20*L* nm) + 0.58 µm	Squares, angle blocks LVDT w/ amplifier, gage blocks
Surface Plates[3]			
Flatness	Up to 12 in Up to 300 mm	20 µin 0.51 µm	LVDT with amplifier
	(12 to 120) in (300 to 3050) mm	21 µin 0.54 µm	Auto collimator
Repeatability	0.002 in 0.05 mm	25 µin 0.64 µm	Repeat O Meter
Surface Roughness - Profilometer	118.6 µin Ra 2.96 µm Ra	1 µin 0.03 µm	Roughness specimen
	40 µin Ra 1.02 µm Ra	2.5 µin 0.064 µm	
	20 µin Ra 0.508 µm Ra	1.2 µin 0.031 µm	
	15.9 µin Ra 0.378 µm Ra	1 µin 0.03 µm	
Surface Roughness Patch / Specimens	(2 to 500) µin Ra (0.0508 to 127) µm Ra	9.2 nin/µin + 0.92 µin 0.23 nm/µm + 0.023 µm	Profilometer w/ specimens
Tapered Thread Plug			
Major Diameter	Up to 6 in Up to 150 mm	(100 + 1.3*D*) µin (1.3*D* nm) + 2.6 µm	Lab Master 175, thread wires
Pitch Diameter	Up to 6 in Up to 150 mm	(110 + 1.3*D*) µin (1.3*D* nm) + 2.8 µm	
Tapered Thread Ring - Thickness / Step Height	Up to 6 in Up to 150 mm	(3.1 + 1.3*D*) µin (1.3*D* nm) + 0.13 µm	Gage blocks, master taper plugs, Lab Master

Parameter/Equipment	Range	CMC[2, 8] (±)	Comments
Thread Plug Major Diameter Pitch Diameter (127 to 4) TPI (0.35 to 2.50) mm	 Up to 10 in Up to 254 mm Up to 10 in Up to 254 mm	 (5.6 + 1.2*D*) µin (1.2*D* nm) + 0.14 µm (29 + 1.2*D*) µin (1.2*D* nm) + 0.74 µm	Lab Master 175, gage blocks, thread wires
Thread Rings Pitch Diameter Taper	 Up to 4.5000 in Up to 115.000 mm Up to 6 in Up to 150 mm	 (29 + 1.3*D*) µin (1.3*D* nm) + 0.74 µm (110 + 1.3*D*) µin (1.3*D* nm) + 2.8 µm	 Setting plug gages Gage blocks, master taper plugs, Lab Master 175
Thread & Gear Wires	Up to 1.0000 in Dia Up to 25.400 mm Dia	7.9 µin 0.22 µm	Lab Master 175, gage blocks, master cylinders
Video Measuring System Keyence[3]	Up to 12 in	(6.6 + 16*L*) µin	Master cylinders

IV. Electrical – DC/Low Frequency

Parameter/Equipment	Frequency	CMC[2, 4] (±)	Comments
AC Current – Generate[3]			
Up to 220 µA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	700 µA/A + 25 nA 350 µA/A + 20 nA 140 µA/A + 16 nA 600 µA/A + 40 nA 1.6 mA/A + 80 nA	Fluke 5700A, Fluke 5725A
220 µA to 2.02 mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	700 µA/A + 40 nA 350 µA/A + 35 nA 140 µA/A + 35 nA 600 µA/A + 400 nA 1.6 mA/A + 800 nA	
(2.2 to 22) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	700 µA/A + 400 nA 350 µA/A + 350 nA 140 µA/A + 350 nA 600 µA/A + 4 µA 1.6 mA/A + 8 µA	
(22 to 220) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	700 µA/A + 4 µA 350 µA/A + 3.5 µA 140 µA/A + 3.5 µA 600 µA/A + 40 µA 1.6 mA/A + 80 µA	
220 mA to 2.2 A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	650 µA/A + 35 µA 750 µA/A + 80 µA 8.5 mA/A + 160 µA	
(2.2 to 11) A	40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	460 µA/A + 170 µA 950 µA/A + 380 µA 3.6 mA/A + 760 µA	
(29 to 330) µA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.44 nA/A + 160 nA 0.22 nA/A + 98 nA 0.16 nA/A + 49 nA 1.1 nA/A + 18 nA 0.99 nA/A + 43 nA 9.5 nA/A + 220 nA	Fluke 5522A
330 µA to 3.3 mA	10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	3.4 µA/A + 0.31 µA 2.5 µA/A + 0.27 µA 0.14 µA/A + 54 nA 0.14 µA/A + 46 nA 0.77 µA/A + 140 nA 0.44 µA/A + 1.1 µA	

Parameter/Equipment	Frequency	CMC[2, 4] (□)	Comments
AC Current – Generate[3] (cont)			Fluke 5522A
(3.3 to 33) mA	10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.81 µA/A + 2.3 µA 0.3 µA/A + 4 µA 90 nA/A + 330 nA 90 nA/A + 330 nA 210 nA/A + 1 µA 74 nA/A + 9.8 µA	
(33 to 330) mA	10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.71 µA/A + 27 µA 47 nA/A + 48 µA 98 nA/A + 2.8 µA 160 nA/A + 0.82 µA 190 nA/A + 9.7 µA 0.44 µA/A + 66 µA	
(330 mA to 1.1 A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.79 mA/A + 0.45 mA 61 µA/A + 54 µA 1.6 mA/A + 0.45 mA 5.1 mA/A + 0.017 mA	
(1.1 to 3) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	37 µA/A + 0.65 mA 270 µA/A + 180 µA 0.57 mA/A + 0.51 mA 6.2 mA/A + 5.5 mA	
(3 to 11) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.17 mA/A + 3.5 mA 0.29 mA/A + 0.16 mA 22 mA/A + 72 mA	
(11 to 20.5) A	(45 to 100) Hz 100 to 1 kHz (1 to 5) kHz	0.64 mA/A + 4.2 mA 0.82 mA/A + 6.4 mA 29 mA/A + 310 mA	
Clamp Meters (20 to 150) A (150 to 1050) A	 (50 to 400) Hz (50 to 400) Hz	 0.057 % + 0.14 A 0.026 % + 0.45 A	Fluke 5522A/ with 5500A COIL
AC Current – Measure[3]			
Up to 100 µA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	4 mA/A + 30 nA 1.5 mA/A + 30 nA 600 µA/A + 30 nA 600 µA/A + 30 nA	Keysight 3458A, option 002

Parameter/Equipment	Frequency	CMC[2, 4] (□)	Comments
AC Current – Measure[3]			Keysight 3458A, option 002
100 µA to 1 mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	4 mA/A + 200 nA 1.5 mA/A + 200 nA 600 µA/A + 200 nA 300 µA/A + 200 nA 600 µA/A + 200 nA 4 mA/A + 400 nA 5.5 mA/A + 1.5 µA	
(1 to 10) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	4 mA/A + 2 µA 1.5 mA/A + 2 µA 600 µA/A + 2 µA 300 µA/A + 2 µA 600 µA/A + 2 µA 4 mA/A + 4 µA 5.5 mA/A + 15 µA	
(10 to 100) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	4 mA/A + 20 µA 1.5 mA/A + 20 µA 600 µA/A + 20 µA 300 µA/A + 20 µA 600 µA/A + 20 µA 4 mA/A + 40 µA 5.5 mA/A + 150 µA	
100 mA to 1 A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz	4 mA/A + 200 µA 1.6 mA/A + 200 µA 800 µA/A + 200 µA 1 mA/A + 200 µA 3 mA/A + 200 µA 10 mA/A + 400 µA	
(1 to 3) A	3 Hz to 5 kHz (5 to 10) kHz	20 µA/A + 0.1 mA 0.9 mA/A + 0.2 mA	Keysight 34465A
(3 to 10) A	33 Hz to 5 kHz (5 to 10) kHz	0.43 mA/A + 0.72 mA 0.2 mA/A + 1.6 mA	
(1 to 50) A	10 Hz to 1 kHz	0.59 mA/A + 2 mA	Keysight 34465A current shunt
(1 to 100) A	10 Hz to 1 kHz	0.42 mA/A + 0.27 mA	

Parameter/Equipment	Frequency	CMC[2, 4] (□)	Comments
AC Voltage – Generate[3]			Fluke 5700A with 5725A
Up to 2.2 mV	(10 to 20) Hz	550 µV/V + 4.5 µV	
	(20 to 40) Hz	210 µV/V + 4.5 µV	
	40 Hz to 20 kHz	105 µV/V + 4.5 µV	
	(20 to 50) kHz	370 µV/V + 4.5 µV	
	(50 to 100) kHz	850 µV/V + 7 µV	
	(100 to 300) kHz	1.1 mV/V + 13 µV	
	(300 to 500) kHz	1.7 mV/V + 25 µV	
	(500 to 1000) kHz	3.4 mV/V + 25 µV	
(2.2 to 22) mV	10 to 20) Hz	550 µV/V + 5 µV	
	(20 to 40) Hz	210 µV/V + 5 µV	
	40 Hz to 20 kHz	105 µV/V + 5 µV	
	(20 to 50) kHz	370 µV/V + 5 µV	
	(50 to 100) kHz	850 µV/V + 7 µV	
	(100 to 300) kHz	1.1 mV/V + 12 µV	
	(300 to 500) kHz	1.7 mV/V + 25 µV	
	(500 to 1000) kHz	3.4 mV/V + 25 µV	
(22 to 220) mV	(10 to 20) Hz	550 µV/V + 13 µV	
	(20 to 40) Hz	210 µV/V + 8 µV	
	40 Hz to 20 kHz	105 µV/V + 8 µV	
	(20 to 50) kHz	370 µV/V + 8 µV	
	(50 to 100) kHz	850 µV/V + 25 µV	
	(100 to 300) kHz	1.1 mV/V + 25 µV	
	(300 to 500) kHz	1.7 mV/V + 35 µV	
	(500 to 1000) kHz	3.4 mV/V + 80 µV	
220 mV to 2.2 V	(10 to 20) Hz	500 µV/V + 80 µV	
	(20 to 40) Hz	160 µV/V + 25 µV	
	40 Hz to 20 kHz	75 µV/V + 6 µV	
	(20 to 50) kHz	120 µV/V + 16 µV	
	(50 to 100) kHz	250 µV/V + 70 µV	
	(100 to 300) kHz	430 µV/V + 130 µV	
	(300 to 500) kHz	1.05 mV/V + 350 µV	
	(500 to 1000) kHz	2.2 mV/V + 850 µV	
(2.2 to 22) V	(10 to 20) Hz	500 µV/V + 800 µV	
	(20 to 40) Hz	160 µV/V + 250 µV	
	40 Hz to 20 kHz	75 µV/V + 60 µV	
	(20 to 50) kHz	120 µV/V + 160 µV	
	(50 to 100) kHz	250 µV/V + 350 µV	
	(100 to 300) kHz	500 µV/V + 1.5 mV	
	(300 to 500) kHz	1.25 mV/V + 4.3 mV	
	(500 to 1000) kHz	2.7 mV/V + 85 mV	

Parameter/Equipment	Frequency	CMC[2, 4]	Comments
AC Voltage – Generate[3] (cont)			
(22 to 220) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (500 to 1000) kHz	500 µV/V + 8 mV 160 µV/V + 2.5 mV 80 µV/V + 0.8 mV 220 µV/V + 3.5 mV 500 µV/V + 8 mV 1.5 mV/V + 90 mV 4.7 mV/V + 90 mV 11.5 mV/V + 190 mV	Fluke 5700A with 5725A
(220 to 750) V	30 to 50) kHz (50 to 100) kHz	600 µV/V + 11 mV 2.3 mV/V + 45 mV	
(220 to 1100) V	(15 to 50) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	400 µV/V + 16 mV 90 µV/V + 4 mV 165 µV/V + 6 mV 600 µV/V + 11 mV	
(33 to 330) V	45 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	160 µV/V + 0.82 mV 140 µV/V + 3.9 mV 230 µV/V + 0.91 mV 350 µV/V + 27 mV 1.1 mV/V + 30 mV	Fluke 5522A
(330 to 1020) V	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	66 µV/V + 11 mV 67 µV/V + 3.1 mV 91 µV/V + 6 mV	
AC Voltage – Measure[3]			Keysight 3458A
Up to 10 mV	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 100 kHz to 1 MHz	300 µV/V + 3 µV 200 µV/V + 1.1 µV 300 µV/V + 1.1 µV 1 mV/V + 1.1 µV 5 mV/V + 1.1 µV 40 mV/V + 2 µV 12 mV/V + 5 µV	AC Band ≤ 2 MHz
Up to 10 mV	(1 to 4) MHz (4 to 8) MHz	70 mV/V + 7 µV 200 mV/V + 8 µV	AC Band > 2 MHz

Parameter/Equipment	Frequency	CMC[2, 4]	Comments
AC Voltage – Measure[3] (cont)			
(10 to 100) mV	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz 100 kHz to 1 MHz (1 to 4) MHz (4 to 8) MHz (8 to 10) MHz	70 µV/V + 4 µV 70 µV/V + 2 µV 140 µV/V + 2 µV 300 µV/V + 2 µV 800 µV/V + 2 µV 3 mV/V + 10 µV 10 mV/V + 10 µV 15 mV/V + 10 µV 20 mV/V + 50 µV 40 mV/V + 70 µV 40 mV/V + 80 µV 150 mV/V + 100 µV	Keysight 3458A AC Band ≤ 2 MHz Keysight 3458A AC Band > 2 MHz
100 mV to 1 V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz 100kHz to 1 MHz (1 to 4) MHz (4 to 8) MHz (8 to 10) MHz	70 µV/V + 40 µV 70 µV/V + 20 µV 140 µV/V + 20 µV 300 µV/V + 20 µV 800 µV/V + 20 µV 3 mV/V + 100 µV 10 mV/V + 100 µV 15 mV/V + 100 µV 20 mV/V + 500 µV 40 mV/V + 700 µV 40 mV/V + 800 µV 150 mV/V + 1mV	Keysight 3458A AC Band ≤ 2 MHz Keysight 3458A AC Band > 2 MHz
(1 to 10) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz 300 kHz to 1 MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz	70 µV/V + 400 µV 70 µV/V + 200 µV 140 µV/V + 200 µV 300 µV/V + 200 µV 800 µV/V + 200 µV 3 mV/V + 1 mV 10 mV/V + 1 mV 15 mV/V + 1 mV 20 mV/V + 5 mV 40 mV/V + 7 mV 40 mV/V + 8 mV 150 mV/V + 10 mV	Keysight 3458A AC Band ≤ 2 MHz Keysight 3458A AC Band > 2 MHz
(10 to 100) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	200 µV/V + 4 mV 200 µV/V + 2 mV 200 µV/V + 2 mV 350 µV/V + 2 mV 1.2 mV/V + 2 mV 4 mV/V + 10 mV 15 mV/V + 10 mV	Keysight 3458A AC Band ≤ 2 MHz
(100 to 1000) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	400 µV/V + 40 mV 400 µV/V + 20 mV 600 µV/V + 20 mV 1.2 mV/V + 20 mV 3 mV/V + 20 mV	

Parameter/Equipment	Frequency	CMC[2, 4]	Comments
AC Voltage – Measure[3] (cont)			
(100 to 1000) V	50 Hz to 400 Hz	820 µV/V + 480 mV	Vitrek 4700
(1000 to 50 000) V	50 Hz to 400 Hz	0.72 mV/V + 170 mV	Vitrek HVL-70
Capacitance – Generate[3]			Fluke 5522A
(220 to 399.9) pF	10 Hz to 10 kHz	0.12 % + 1.6 pF	
(0.4 to 1.0999) nF	10 Hz to 10 kHz	0.19 pF/F + 2.2 pF	
(1.1 to 3.2999) nF	10 Hz to 3 kHz	2.8 pF/F + 7.6 pF	
(3.3 to 10.9999) nF	10 Hz to 1 kHz	1.3 pF/F + 11 pF	
(11 to 32.9999) nF	10 Hz to 1 kHz	1.3 pF/F + 7.6 pF	
(33 to 109.999) nF	10 Hz to 1 kHz	1.8 pF/F + 6 pF	
(110 to 329.999) nF	10 Hz to 1 kHz	1.3 pF/F + 50 pF	
(0.33 to 1.099 99) µF	(10 to 600) Hz	1.8 nF/F + 0.04 nF	
(1.1 to 3.299 99) µF	(10 to 300) Hz	1.4 nF/F + 0.6 nF	
(3.3 to 10.9999) µF	(10 to 150) Hz	2.1 nF/F + 4.7 nF	
(11 to 32.9999) µF	(10 to 120) Hz	3 nF/F + 26 nF	
(33 to 109.999) µF	(10 to 80) Hz	2.8 nF/F + 86 nF	
(110 to 329.999) µF	(0 to 50) Hz	1.7 nF/F + 10 nF	
(0.33 to 1.0999) mF	(0 to 20) Hz	1.7 µF/F + 0.38 µF	
(1.1 to 3.299 99) mF	(0 to 6) Hz	1.8 µF/F + 0.52 µF	
(3.3 to 10.9999) mF	(0 to 2) Hz	2.1 µF/F + 0.87 µF	
(11 to 32.9999) mF	(0 to 0.6) Hz	5.3 µF/F + 49 µF	
(33 to 110) mF	(0 to 0.2) Hz	1.9 µF/F + 130 µF	
Capacitance – Measure[3]			
1 pF to 1 mF	20 Hz to 300 kHz	0.11 % Rdg + 3.6 fF	Keysight E4980AL

Parameter/Equipment	Range	CMC[2, 4]	Comments
DC Current – Generate[3]	Up to 220 µA	50 µA/A + 8 nA	Fluke 5700A w/ 5725A
	220 µA to 2.2 mA	50 µA/A + 8 nA	
	(2.2 to 22) mA	50 µA/A + 80 nA	
	(22 to 220) mA	60 µA/A + 0.8 µA	
	220 mA to 2.2 A	80 µA/A + 25 µA	
	(2.2 to 11) A	360 µA/A + 480 µA	

Parameter/Equipment	Range	CMC[2, 4]	Comments
DC Current – Generate[3] (cont)	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 3) A (3 to 11) A (11 to 20.5) A	32 pA/A + 2.4 nA 47 nA/A + 24 nA 40 nA/A + 190 nA 35 nA/A + 1.4 µA 20 µA/A + 22 µA 66 µA/A + 34 µA 90 µA/A + 220 µA 270 µA/A + 1.2 mA	Fluke 5522A
Clamp Meters	(20 to 150) A (150 to 1050) A	0.26 % + 40 mA 0.25 % + 100 mA	Fluke 5522A/ with 5500A COIL
DC Current – Measure[3]	Up to 100 nA 100 nA to 1 µA (1 to 10) µA (10 to 100) µA 100 µA to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A	30 µA/A + 40 pA 20 µA/A + 40 pA 20 µA/A + 100 pA 20 µA/A + 800 pA 20 µA/A + 5 nA 20 µA/A + 50 nA 35 µA/A + 500 nA 110 µA/A + 10 µA	Keysight 3458A option 2
	(1 to 50) A (1 to 100) A (1 to 500) A	0.59 mA/A + 60 mA 0.42 mA/A + 42 mA 0.28 mA/A + 28 mA	Keysight 3458A current shunts
	(1 to 3) A (3 to 10) A	390 µA/A + 190 µA 240 µA/A + 1.4 mA	Keysight 34465A
	(1 to 50) A (1 to 100) A (1 to 500) A	0.59 mA/A + 62 mA 0.42 mA/A + 45 mA 0.28 mA/A + 31 mA	Keysight 34465A current Shunts
DC Voltage – Generate[3]	Up to 220 mV 220 mV to 2.2 V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V	8 µV/V + 0.6 µV 7 µV/V + 1 µV 7 µV/V + 3.5 µV 7 µV/V + 6.5 µV 8 µV/V + 80 µV 9 µV/V + 500 µV	Fluke 5700A
	Up to 330 mV 330 mV to 3.3 V (3.3 to 33) V (33 to 330) V (330 V to 1020) V	5.8 µV/V + 1.2 µV 4.5 µV/V + 5.3 µV 4.5 µV/V + 61 µV 3.3 µV/V + 720 µV 2.8 µV/V + 4.4 mV	Fluke 5522A

Parameter/Equipment	Range	CMC[2, 4]	Comments
DC Voltage – Measure[3]	Up to 100 mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 1000) V (100 to 10 000) V (1000 to 70 000)	5 µV/V + 300 nV 4 µV/V + 300 nV 4 µV/V + 500 nV 6 µV/V + 30 µV 6 µV/V + 100 µV 160 µV/V + 55 mV 0.22 mV/V + 5.7 V	Keysight 3458A, option 002 Vitrek 4700, Vitrek HVL-70
Inductance – Generate[3]	100 mH	0.13 mH	Standard Inductor
Oscilloscopes[3]			Fluke 5522A/SC1100
AC Square Wave Signal			
Into 1 MΩ	1.0 mVpp to 130 Vpp	0.1 % of output + 40 µV	
Into 50 Ω	1.0 mVpp to 6.6 Vpp	0.25 % of output + 40 µV	
AC Square Wave Frequency	10 Hz to 10 kHz	2.5 µHz/Hz	
DC Signal			
Into 1 MΩ	Up to ±130 V	0.05 % of output + 40 µV	
Into 50 Ω	Up to ±6.6 V	0.25 % of output + 40 µV	
Edge – Aberrations	Within 2 ns from 50 % of Rising Edge	<(3 % of output + 2 mV)	
	(2 to 5) ns	<(2 % of output + 2 mV)	
	(5 to 15) ns	<(1 % of output + 2 mV)	
	After 15 ns	<(0.5 % of output + 2 mV)	
Edge - Amplitude Range	5 mVpp to 2.5 Vpp	2 % of Output + 200 µV	
Edge - Frequency Range	1 kHz to 10 MHz	2.5 µHz/Hz	
Edge - Rise Time	24 ps to 350 ps	23 ps	
Level Sine Wave – Amplitude			
(5 mV to 5.5 V)	50 kHz Reference	2.0 % of output + 0.3 mV	
	50 kHz to 100 MHz	3.5 % of output + 0.3 mV	
	(100 to 300) MHz	4.0 % of output + 0.3 mV	
	(300 to 600) MHz	6.0 % of output + 0.3 mV	
(5 mV to 3.5 V)	(600 to 1100) MHz	7.0 % of output + 0.3 mV	

Parameter/Equipment	Range	CMC[2, 4]	Comments
Oscilloscopes[3] (cont)			Fluke 5522A/SC1100
Level Sine Wave – Flatness			
(5 mV to 5.5 V)	50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz	1.5 % + 100 µV 2 % + 100 µV 4 % + 100 µV	
(5 mV to 3.5 V)	600 to 1100) MHz	5 % + 100 µV	
Frequency Range	50 kHz to 1100 MHz	2.5 µHz/Hz	
Time Marker	(1 to 5) ns 10 ns (20 to 50) ns 100 ns to 20 ms 50 ms to 5 s	1.2 ps 12 ps 12 ps 460 ps/s + 46 ps 42 µs/s + 108 ns	
Resistance – Generate[3] Fixed Points 4-Wire	0.001 Ω 0.01 Ω 0.1 Ω 1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ	30 µΩ 33 µΩ 36 µΩ 75 µΩ 87 µΩ 550 µΩ 3.7 mΩ 90 mΩ 620 mΩ 9.9 Ω 310 Ω	Standard resistors & Keysight 3458A, option 002
Fixed Points	0 Ω 1 Ω 1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 kΩ 1.9 kΩ 10 kΩ 19 kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	50 µΩ 95 µΩ/Ω 95 µΩ/Ω 28 µΩ/Ω 27 µΩ/Ω 17 µΩ/Ω 17 µΩ/Ω 13 µΩ/Ω 13 µΩ/Ω 12 µΩ/Ω 12 µΩ/Ω 14 µΩ/Ω 14 µΩ/Ω 20 µΩ/Ω 21 µΩ/Ω 40 µΩ/Ω 47 µΩ/Ω 110 µΩ/Ω	Fluke 5700A

Parameter/Equipment	Range	CMC[2, 4]	Comments
Resistance – Generate[3] (cont)			
(1 to 10) kΩ Decade	1 kΩ 2 kΩ 3 kΩ 4 kΩ 5 kΩ 6 kΩ 7 kΩ 8 kΩ 9 kΩ 10 kΩ	150 mΩ 270 mΩ 400 mΩ 510 mΩ 660 mΩ 800 mΩ 930 mΩ 1 Ω 1 Ω 1 Ω	IET HRRS-F-9-1k-5kV-WT high voltage resistors
(10 to 100) kΩ Decade	10 kΩ 20 kΩ 30 kΩ 40 kΩ 50 kΩ 60 kΩ 70 kΩ 80 kΩ 90 kΩ 100 kΩ	46 mΩ 1.5 Ω 2.9 Ω 3.9 Ω 3.1 Ω 4.4 Ω 5.4 Ω 6.4 Ω 7.5 Ω 7.2 Ω	
(100 to 1000) kΩ Decade	100 kΩ 200 kΩ 300 kΩ 400 kΩ 500 kΩ 600 kΩ 700 kΩ 800 kΩ 900 kΩ 1000 kΩ	1.9 Ω 91 Ω 90 Ω 91 Ω 85 Ω 86 Ω 75 Ω 79 Ω 78 Ω 74 Ω	
(1 to 10) MΩ Decade	1 MΩ 2 MΩ 3 MΩ 4 MΩ 5 MΩ 6 MΩ 7 MΩ 8 MΩ 9 MΩ 10 MΩ	190 Ω 140 Ω 180 Ω 230 Ω 310 Ω 340 Ω 420 Ω 500 Ω 530 Ω 590 Ω	

Parameter/Equipment	Range	CMC[2, 4]	Comments
Resistance – Generate[3] (cont)			IET HRRS-F-9-1k-5kV-WT high voltage resistors
(10 to 100) MΩ Decade	10 MΩ 20 MΩ 30 MΩ 40 MΩ 50 MΩ 60 MΩ 70 MΩ 80 MΩ 90 MΩ 100 MΩ	2.4 kΩ 17 kΩ 34 kΩ 57 kΩ 80 kΩ 100 kΩ 130 kΩ 120 kΩ 130 kΩ 78 kΩ	
(100 to 1000) MΩ Decade	100 MΩ 200 MΩ 300 MΩ 400 MΩ 500 MΩ 600 MΩ 700 MΩ 800 MΩ 900 MΩ 1000 MΩ	37 kΩ 80 kΩ 290 kΩ 480 kΩ 600 kΩ 910 kΩ 1.1 MΩ 1.3 MΩ 1.6 MΩ 1.8 MΩ	
(1 to 10) GΩ Decade	1 GΩ 2 GΩ 3 GΩ 4 GΩ 5 GΩ 6 GΩ 7 GΩ 8 GΩ 9 GΩ 10 GΩ	0.72 MΩ 1 MΩ 1.7 MΩ 4 MΩ 6.4 MΩ 8.7 MΩ 21 MΩ 22 MΩ 28 MΩ 35 MΩ	
(10 to 100) GΩ Decade	10 GΩ 20 GΩ 30 GΩ 40 GΩ 50 GΩ 60 GΩ 70 GΩ 80 GΩ 90 GΩ 100 GΩ	60 MΩ 140 MΩ 290 MΩ 510 MΩ 750 MΩ 990 MΩ 1.4 GΩ 1.9 GΩ 2.1 GΩ 1.3 GΩ	

Parameter/Equipment	Range	CMC[2, 4]	Comments
Resistance – Generate[3] (cont)			
(100 to 1000 GΩ) Decade	100 GΩ 200 GΩ 300 GΩ 400 GΩ 500 GΩ 600 GΩ 700 GΩ 800 GΩ 900 GΩ 1000 GΩ	1.2 GΩ 2.4 GΩ 3.5 GΩ 7.2 GΩ 8.2 GΩ 9.7 GΩ 12 GΩ 16 GΩ 18 GΩ 20 GΩ	IET HRRS-F-9-1k-5kV-WT high voltage resistors
Variable Points	Up to 11 Ω (10 to 33) Ω (33 to 110) Ω (110 to 330) Ω 330 to 1.1 kΩ (1.1 to 3.3) kΩ (3.3 to 11) kΩ (11 to 33) kΩ (33 to 110) kΩ (110 to 330) kΩ 330 kΩ to 1.1 MΩ (1.1 to 3.3) MΩ (3.3 to 11) MΩ (1 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ (330 to 1100) MΩ	18 µΩ/Ω + 270 µΩ 32 µΩ/Ω + 340 µΩ 9.2 µΩ/Ω + 1.1 mΩ 11 µΩ/Ω + 110 µΩ 15 µΩ/Ω + 0.45 mΩ 29 µΩ/Ω + 17 mΩ 5.3 µΩ/Ω + 120 mΩ 10 µΩ/Ω + 31 mΩ 9.3 µΩ/Ω + 180 mΩ 30 µΩ/Ω + 12 Ω 1.3 µΩ/Ω + 14 Ω 23 µΩ/Ω + 51 Ω 100 µΩ/Ω + 150 Ω 100 µΩ/Ω + 10 Ω 150 µΩ/Ω + 4.7 kΩ 860 µΩ/Ω + 79 kΩ 8.2 mΩ/Ω + 2.6 MΩ	Fluke 5522A
Resistance – Measure[3]	Up to 10 Ω (10 to 100) Ω 100 Ω to 1 kΩ (1 to 10) kΩ (10 to 100) kΩ (100 to 1) MΩ (1 to 10) MΩ (10 to 100) MΩ 100 MΩ to 1 GΩ	15 µΩ/Ω + 50 µΩ 12 µΩ/Ω + 500 µΩ 10 µΩ/Ω + 500 µΩ 10 µΩ/Ω + 5 mΩ 10 µΩ/Ω + 50 mΩ 10 µΩ/Ω + 2 Ω 50 µΩ/Ω + 100 Ω 500 µΩ/Ω + 1 kΩ 0.5 % + 10 kΩ	Keysight 3458A option 002

Parameter/Equipment	Range	CMC[2, 4]	Comments
Electrical Calibration of Thermocouples – Generate			Ectron 1140A SPRT with readout & ice bath
Type E	(-175 to 950) °C (-283 to 1742) °F	0.077 °C 0.138 °F	
Type K	(-200 to 1200) °C (-328 to 2192) °F	0.096 °C 0.172 °F	
Type J	(-105 to 1100) °C (-157 to 2012) °F	0.101 °C 0.181 °F	
Type N	(-175 to 1000) °C (-283 to 1832) °F	0.133 °C 0.239 °F	
Type T	(-135 to 300) °C (-211 to 572) °F	0.188 °C 0.338 °F	
Electrical Calibration of Thermocouples – Measure			Ectron 1140A SPRT with readout & ice bath
Type E	(-175 to 950) °C (-283 to 1742) °F	0.052 °C 0.093 °F	
Type K	(-200 to 1200) °C (-328 to 2192) °F	0.099 °C 0.178 °F	
Type J	(-105 to 1100) °C (-157 to 2012) °F	0.068 °C 0.122 °F	
Type N	(-175 to 1000) °C (-283 to 1832) °F	0.129 °C 0.233 °F	
Type T	(-135 to 300) °C (-211 to 572) °F	0.115 °C 0.207 °F	

Parameter/Equipment	Range	CMC[2, 4]	Comments
Temperature Calibrations Electrical Indication & Control[3]			Ectron 1140A
Type B	(250 to 350) °C (350 to 445) °C (450 to 580) °C (580 to 750) °C (750 to 1000) °C (1000 to 1820) °C	0.95 °C 0.74 °C 0.58 °C 0.45 °C 0.37 °C 0.29 °C	
Type C	(0 to 250) °C (250 to 1000 °C (1000 to 1500) °C (1500 to 1800) °C (1800 to 2000) °C (2000 to 2250) °C (2250 to 2315) °C	0.20 °C 0.16 °C 0.18 °C 0.21 °C 0.23 °C 0.29 °C 0.32 °C	
Type E	(-270 to -245) °C (-245 to -195) °C (-195 to -155) °C (-155 to -90) °C (-90 to 15) °C (15 to 890) °C (890 to 1000) °C	1.20 °C 0.18 °C 0.10 °C 0.08 °C 0.07 °C 0.06 °C 0.07 °C	
Type J	(-210 to -180) °C (-180 to -120) °C (-120 to -50) °C (-50 to 990) °C (990 to 1200) °C	0.12 °C 0.10 °C 0.08 °C 0.07 °C 0.07 °C	
Type K	(-270 to -255) °C (-255 to -195) °C (-195 to -115) °C (-115 to -55) °C (-55 to 1000) °C (1000 to 1372) °C	2.20 °C 0.70 °C 0.12 °C 0.09 °C 0.07 °C 0.08 °C	
Type N	(-270 to -260) °C (-260 to -200) °C (-200 to -140) °C (-140 to -70) °C (-70 to 25) °C (25to 160) °C (160 to 1300) °C	5 °C 1 °C 0.23 °C 0.15 °C 0.12 °C 0.10 °C 0.09 °C	

Parameter/Equipment	Range	CMC[2, 4]	Comments
Temperature Calibrations Electrical Indication & Control[3] (cont)			Ectron 1140A
Type R	(-50 to -30) °C (-30 to 45) °C (45 to 160) °C (160 to 380) °C (380 to 775) °C (775 to 1768) °C	0.65 °C 0.55 °C 0.40 °C 0.30 °C 0.26 °C 0.22 °C	
Type S	(-50 to -30) °C (-30 to 45) °C (45 to 105) °C (105 to 310) °C (310 to 615) °C (615 to 1768) °C	0.62 °C 0.56 °C 0.40 °C 0.33 °C 0.29 °C 0.26 °C	
Type T	(-270 to -255) °C (-255 to -240) °C (-240 to -210) °C (-210 to -150) °C (-150 to -40) °C (-40 to 100) °C (100 to 400) °C	1.80 °C 0.49 °C 0.30 °C 0.18 °C 0.12 °C 0.08 °C 0.07 °C	
Type L	(-200 to -100) °C (-100 to 800) °C (800 to 900) °C	0.37 °C 0.26 °C 0.17 °C	
Type U	(-200 to 0) °C (0 to 600) °C	0.56 °C 0.27 °C	
Electrical Calibration of RTD			Fluke 5522A
Pt 385, 100 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C	0.05 °C 0.05 °C 0.07 °C 0.09 °C 0.10 °C 0.12 °C 0.23 °C	

Parameter/Equipment	Range	CMC[2, 4]	Comments
Electrical Calibration of RTD (cont)			Fluke 5522A
Pt 3916, 100 Ω	(-200 to -190) °C (-190 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.25 °C 0.04 °C 0.05 °C 0.06 °C 0.07 °C 0.08 °C 0.09 °C 0.10 °C 0.23 °C	
Pt 3926, 100 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C	0.05 °C 0.05 °C 0.07 °C 0.09 °C 0.10 °C 0.12 °C	
Pt 385, 200 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.04 °C 0.04 °C 0.04 °C 0.05 °C 0.12 °C 0.13 °C 0.14 °C 0.16 °C	
Pt 385, 500 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.04 °C 0.05 °C 0.05 °C 0.06 °C 0.08 °C 0.08 °C 0.09 °C 0.11 °C	
Pt 385, 1000 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 TO 630) °c	0.03 °C 0.03 °C 0.04 °C 0.05 °C 0.06 °C 0.07 °C 0.07 °C 0.23 °C	
PtNi, 120 Ω	(-80 to 0) °C (0 to 100) °C (100 to 260) °C	0.08 °C 0.08 °C 0.14 °C	
Cu 42 710 Ω	(-120 to 260) °C	0.30 °C	

Parameter/Equipment	Range	CMC[2, 4]	Comments
Welders[3] –			Keysight 34465A Current Shunt
AC Voltage 10 Hz to 20 kHz	Up to 750 V	0.43 mV/V + 330 mV	
AC Current 10 Hz to 20 kHz	Up to 100 A	0.42 mA/A + 24 mA	
DC Voltage	Up to 1000 V	6.7 µV/V + 14 mV	
DC Current	Up to 500 A	0.28 mA/A + 31 mA	
Wrist Strap/Footwear & Workstation Monitors[3]	675 kΩ 825 kΩ 8.5 MΩ 11.5 MΩ 35 MΩ 40 MΩ 80 MΩ 120 MΩ	5.6 kΩ 2.2 kΩ 2.2 kΩ 22 kΩ 140 kΩ 140 kΩ 610 kΩ 1.9 MΩ	Calibration Unit Desco 07010 & Charleswater 99090

V. Mechanical

Parameter/Equipment	Range	CMC[2, 5, 8]	Comments
Durometers –			Weight scale ASTM D2240
Types: A, B, O	Up to 750 gf	0.016 % + 0.17 gf	
Types: C, D	Up to 4100 gf	0.003 % + 0.3 gf	
Types: CF	Up to 10 000 gf	0.023 % + 0.39 gf	
Types: OO, OOO	Up to 2610 gf	0.01 % + 0.18 gf	
Types: M	Up to 2610 gf	0.01 % + 0.18 gf	
Indenter Length	Up to 1 in	(80 + 3.2*L*) µin	Video Measuring System ASTM D2240
Force[3] – Measuring & Sourcing Devices	Up to 10 gf (10 to 100) gf (100 to 500) gf	0.29 mgf/gf + 2.7 mgf 0.027 mgf/gf + 5.3 mgf 0.018 mgf/gf + 10 mgf	Class 3 standard weights
	(1 to 10) lbf (10 to 50) lbf	0.038 % + 0.013 ozf 0.0058 % + 0.064 ozf	NIST Class F weights
	Up to 300 lbf Up to 1000 lbf Up to 5000 lbf Up to 15 000 lbf	0.0015 % + 0.0018 lbf 0.0016 % + 0.0059 lbf 0.0014 % + 0.015 lbf 0.05 %	Load cell with indicator

Parameter/Equipment	Range	CMC[2]	Comments
Indirect Verification of Rockwell Hardness Testers[3]	(170 to 960) HLD	9.7 HLD	Leeb Hardness Test Blocks ASTM A956
	HRA		Rockwell hardness Test blocks ASTM E18
	(20 to 70)	0.55 HRA	
	(70.01 to 79)	0.48 HRA	
	(79.01 to 84)	0.41 HRA	
	HRB		
	(40 to 60)	1.58 HRB	
	(60.01 to 88)	1.05 HRB	
	(88.01 to 100)	1.05 HRB	
	HRC		
	(20 to 35)	0.77 HRC	
	(35.01 to 60)	0.53 HRC	
	(60.01 to 71)	0.43 HRC	
	HRE		
	(70 to 84)	1.01 HRE	
	(84.01 to 93)	1.02 HRE	
	(93.01 to 150)	1.00 HRE	
	HR15N		
	(70 to 78)	0.63 HR15N	
	(78.01 to 90)	0.61 HR15N	
	(90.01 to 92)	0.61 HR15N	
	HRN30		
	(40 to 55)	1.01 HR30N	
	(55.01 to 77)	0.75 HR30N	
	(77.01 to 82)	0.62 HR30N	
	HRN45N		
	(20 to 37)	1.04 HR45N	
	(37.01 to 66)	1.01 HR45N	
	(66.01 to 72)	0.65 HR45N	
	HR15T		
	(74 to 79)	1.02 HR15T	
	(79.01 to 85)	1.02 HR15T	
	(85.01 to 93)	1.07 HR15T	
	HR30T		
	(42 to 57)	1.03 HR30T	
	(57.01 to 70)	1.02 HR30T	
	(70.01 to 87)	1.05 HR30T	
	HR45T		
	(13 to 33)	1.02 HR45T	
	(33.01 to 53)	1.05 HR45T	
	(53.01 to 73)	1.01 HR45T	

Parameter/Equipment	Range	CMC[2]	Comments
Indirect Verification of Microindentation Hardness Knoop	(100 to 1000) HK	(17 + 0.008*X*) HK	ASTM E92
Indirect Verification of Microindentation Vickers[3]	(100 to 1000) HV	(12 + 0.012*X*) HV	ASTM E92
Indirect Verification of Hardness Brinell 10mm ball	**HBW** 500kg 1000 kg 3000 kg (0 to 170) 3000 kg (174 to 395) 3000 kg (396 to 561)	 1.5 HBW 1.2 HBW 1.5 HBW 4.9 HBW 7.4 HBW	Brinell test blocks ASTM E10
Mass –	1 mg to 5 g	3 µg/g + 5.2 µg	Direct reading method Sartorius MC 5
	(1 to 220) g	1.4 µg/g + 11 µg	Comparison Mmthod Mettler Toledo XP205
	(200 to 10 000) g (10 000 to 34 000) g	5.6 µg/g + 2 mg 100 µg/g + 80 mg	Comparison method A&D, MC-10K
Fixed	10 g 20 g 30 g 50 g 100 g 200 g	41 µg 56 µg 52 µg 84 µg 200 µg 320 µg	Comparison method Mettler Toledo XP205
	300 g 500 g 1 kg 2 kg 4 kg 5 kg 10 kg	8.6 mg 8.6 mg 8.8 mg 15 mg 17 mg 17 mg 66 mg	Comparison method A&D, MC-10K
	20 kg	650 mg	Comparison method Mettler Toledo PM-34K

Parameter/Equipment	Range	CMC[2, 5, 8]	Comments
Pressure Measuring & Sourcing Devices[3]	(- 60 to 60) inH_2O Up to 300 psi	0.0025 % + 0.000 48 inH_2O) 0.0051 % + 0.0007 psi	Ruska 7252i
	(0.2 to 25) psi Up to 1000 psi	0.0011 % of rdg + 0.000 01 psi 0.0017 % of rdg + 0.000 06 psi	Ruska 2465
	(8 to 17) psia (14.5 to 1014) psia Up to 1000 psi Up to 10 000 psi	0.003 % + 0.000 02 psia 0.011 % + 0.011 psia 0.0021 % + 0.018 psi 0.0029 % + 0.32 psi	Mensor CPG2500 with CPR2550
	(100 to 3000) psi	0.0036 % of rdg + 0.000 02 psi	Ruska 2470
	(90 to 40 000) psi	0.0055 % of Rdg	DH-Budenberg CPB3800HP
	(-10 to 10) inH_2O	0.0053 % + 0.017 in.H_2O	Fluke 700G01
	(-15 to 30) psi (-30 to 60) inHg	0.001 % + 0.0057 psi 0.001 % + 0.012 inHg	Additel ADT681
	Up to 100 psi	0.0012 % + 0.027 psi	Additel ADT681
	(-12 to 300) psi (-24.4 to 610 inHg	0.0031 % + 0.044 psi 0.0031 % + 0.09 inHg	Fluke 2700G
	(-15 to 500) psi (-30 to 1018) inHg	0.027 % + 0.043 psi 0.027 % + 0.088 inHg	Omega DPG4000
	Up to 1000 psi Up to 3000 psi Up to 5000 psi Up to 10 000 psi	0.0024 % + 0.15 psi 0.009 % + 0.23 psi 0.002 % + 0.91 psi 0.017 % + 0.36 psi	Additel ADT681 Fluke 2700G Additel ADT681 Fluke 2700G
	Up to 30 000 psi	0.0035 % + 2.8 psi	Addittel ADT681
Transducers, Tester & Analyzer	Up to 10 lbf·in (5 to 100) lbf·in (100 to 3000) lbf·in (200 to 2000) lbf·ft	0.016 % Rdg + 0.0018 lbf·in 0.01 % Rdg + 0.0049 lbf·in 0.01 % Rdg + 0.011 lbf·in 0.031 % Rdg + 0.039 lbf·ft	Torque wheel arm 2.5, 5, 10 & 40 in with weights

Parameter/Equipment	Range	CMC[2, 5, 8]	Comments
Scales[3] –			
Analytical & Precision	1 mg 10 mg 20 mg 50 mg 100 mg 200 mg 500 mg 1 g 2 g 3 g 5 g 10 g 20 g 30 g 50 g 100 g 200 g 300 g 500 g 1 kg 2 kg 4 kg 5 kg 10 kg 20 kg	2.9 µg 17 µg 4.4 µg 8.3 µg 3.4 µg 3.9 µg 4.3 µg 7 µg 6.1 µg 7.1 µg 8.1 µg 14 µg 18 µg 46 µg 27 µg 63 µg 0.19 mg 0.16 mg 0.3 mg 0.57 mg 1 mg 2.2 mg 2.7 mg 5.3 mg 10 mg	Ultra & Class 1 standard weight
Floor & Bench Scales	(0.001 to 1) lb (1 to 10) lb (10 to 50) lb (50 to 100) lb (100 to 200) lb (200 to 500) lb (500 to 1000) lb (1000 to 1500) lb (1500 to 2000) lb	$(1.90 \times 10^{-6} + 1.50 \times 10^{-4}$ Wt) lb $(1.40 \times 10^{-4} + 8.90 \times 10^{-6}$ Wt) lb $(8.50 \times 10^{-4} + 1.50 \times 10^{-5}$ Wt) lb $(2.00 \times 10^{-4} + 1.80 \times 10^{-5}$ Wt) lb $(6.00 \times 10^{-4} + 2.50 \times 10^{-5}$ Wt) lb $(1.00 \times 10^{-2} + 1.30 \times 10^{-4}$ Wt) lb $(1.10 \times 10^{-2} + 3.60 \times 10^{-5}$ Wt) lb $(3.30 \times 10^{-2} + 1.40 \times 10^{-5}$ Wt) lb $(1.00 \times 10^{-2} + 2.00 \times 10^{-5}$ Wt) lb	NIST Class F weights
Torque Tools[3] –	(2 to 20) ozf·in (10 to 100) ozf·in (2 to 20) lbf-in (24 to 240) lbf·in (20 to 200) lbf·ft (100 to 1000) lbf·ft (200 to 2000) lbf·ft	00.022 % Rdg + 0.0056 ozf·in 0.026 % Rdg + 0.022 ozf·in 0.022 % Rdg + 0.0039 lbf·in 0.013 % Rdg + 0.029 lbf·in 0.013 % Rdg + 0.029 lbf·ft 0.15 % Rdg + 0.1 lbf·ft 0.35 % Rdg + 0.02 lbf·ft	AKO TSD6500 with transducers AWS QCMF-2000

VI. Thermodynamics

Parameter/Equipment	Range	CMC[2,5,8]	Comments
Humidity Generate –			RH Systems CGS-240 , humidity generator
at 0 °C	10 % RH (10 to 30) % RH (30 to 50) % RH (50 to 70) % RH (70 to 95) % RH	0.03 % RH 0.08 % RH 0.13 % RH 0.19 % RH 0.25 % RH	By primary realization in accordance to RISP-5
at 25 °C	10 % RH (10 to 30) % RH (30 to 50) % RH (50 to 70) % RH (70 to 95) % RH	0.02 % RH 0.06 % RH 0.10 % RH 0.14 % RH 0.19 % RH	
at 50 °C	10 % RH (10 to 30) % RH (30 to 50) % RH (50 to 70) % RH (70 to 95) % RH	0.02 % RH 0.05 % RH 0.08 % RH 0.12 % RH 0.16 % RH	
at 70 °C	10 % RH (10 to 30) % RH (30 to 50) % RH (50 to 70) % RH (70 to 95) % RH	0.02 % RH 0.05 % RH 0.07 % RH 0.10 % RH 0.14 % RH	
Temperature Generate	(0 to 70) °C (32 to 158) °F	0.018 °C 0.032 °F	RH Systems CGS-240 humidity generator
Infrared Temperature Measuring Instruments	(-15 to 120) °C (35 to 500) °C (50 to 749) °C (601 to 1100) °C (1101 to 1200) °C	0.13 % Rdg + 0.85 °C 0.25 % Rdg + 0.33 °C 2.8 °C 4.9 °C 0.7 °C	Fluke 4180 ε = 0.95 Fluke 4181 ε = 0.95 IR-564 IR-300
Ovens, Autoclaves, Freezers, Refrigerators, Environmental Chambers, Liquid Baths[3]	(-87.2 to 1204.4) °C		Thermocouples
Type K	TUS	1.2 °C	AMS 2750
Type N	TUS	1.3 °C	customer
Type K	SAT	1.4 °C	specific
Type N	SAT	1.2 °C	specifications

Parameter/Equipment	Range	CMC[2, 5, 8]	Comments
Oven/Chamber Temperature Uniformity Measure[3]	(32 to 1800) °F	0.073 % Rdg + 0.59 °F	Fluke 1586A Type K thermocouple, AMS2750
	(32 to 1400) °F	0.11 % Rdg + 0.26 °F	Fluke 1586A Type J thermocouple
Temperature – Measuring Equipment, Resistance Thermometers Fixed Point Calibrations			
Liquid Nitrogen	-196 °C	6.2 mK	Triple, melting, & freezing point cells with MicroK thermometry bridge
Mercury	-38.8344 °C	1.4 mK	
Triple Point Water	0.010 °C	0.5 mK	
Gallium	29.7646 °C	0.9 mK	
Indium	156.5985 °C	2.1 mK	
Tin	231.928 °C	2.3 mK	
Zinc	419.527 °C	2.3 mK	
Aluminum	660.323 °C	6.0 mK	
Comparison	-196 °C	0.012 °C	Calibration baths and furnaces, SPRT, Super thermometer
	(-80 to 0) °C	0.009 °C	
	(0 to 150) °C	0.017 °C	
	(150 to 300) °C	0.032 °C	
	(300 to 550) °C	0.06 °C	
	(550 to 1100) °C	0.9 °C	Type S Thermocouple
Thermocouple Probes & Wire Types E, J, K, N, T	(-80 to 0) °C	0.16 °C	Temperature Baths, Ectron 1140A Fluke 1594A w/SPRT & field metrology well
	(0 to 150) °C	0.12 °C	
	(25 to 250) °C	0.11 °C	
	(50 to 660) °C	0.015 % + 0.13 °C	

VII. Time & Frequency

Parameter/Equipment	Range	CMC[2, 5, 8]	Comments
Frequency – Measuring Equipment[3]	1 µHz to 30 MHz	56 nHz/Hz + 0.055 µHz	Keysight 33519B
	0.1 Hz to 225 MHz	50 pHz/Hz + 1.2 mHz	Agilent 53181A Counter
	100 MHz to 3 GHz	340 pHz/Hz + 19 mHz	

Parameter/Equipment	Range	CMC[2, 5, 8]	Comments
Stop Watches/ Timer[3]	Up to 24 hr Up to 86 400 s Up to 86 400 s	0.063 s / 24 hr 0.08 s 0.001 s/hr + 0.47 s	Timometer 4500 Photo totalize method Direct comparison
Tachometer –			
Contact	(10 to 50 000) RPM	0.000 12 % + 0.021 RPM	Ideal Aerosmith
Non - Contact	Up to 99 999 RPM	0.001 % + 0.003 RPM	Generator with LED

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017
& ANSI/NCSL Z540-1-1994

INTERNATIONAL PROCESS SOLUTIONS
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Thomas Main Phone: 650-595-7890

CALIBRATION

Valid To: March 31, 2027 Certificate Number: 2348.01

In recognition of the successful completion of the A2LA evaluation (including an assessment of the organization's compliance with A2LA's – R205 Calibration Program Requirements), accreditation is granted to this laboratory at the locations listed above as well as the satellite laboratory location listed below to perform the following calibrations[1, 2, 8, 10]:

I. Dimensional

Parameter/Equipment	Range	CMC[2, 9] (±)	Comment
Outside Diameter (Pin and Plug Gages)	(0.01 to 0.25) in (0.25 to 1) in	30 µin 78 µin	Comparison to PlugGage using Mitutoyo LSM-6100 laser scan micrometer Measurement heads

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2] (±)	Comment
DC Voltage – Source [2]	(0 to 3 299 999) mV (0.33 to 3 299 999) V (3.3 to 3 299 999) V (33 to 3 299 999) V (330 to 1020) V	63.6 µV/V + 5.8 µV 53.8 µV/V + 27 µV 54.7 µV/V + 0.24 mV 69 µV/V + 3.4 mV 71.1 µV/V + 11 mV	Comparison to Fluke 5502A multiproduct calibrator

Parameter/Range	Frequency	CMC[2] (±)	Comment
DC Voltage – Measure	(10 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V 100 V to 1 kV	23 µV/V + 0.3 µV 5.6 µV/V + 0.4 µV 5.6 µV/V + 0.8 µV 8.5 µV/V + 45 µV 9.9 µV/V + 1.7 mV	Comparison to Fluke 8558A, 8.5 digit multimeter
AC Voltage – Source (Sine)			
(1 to 32.999) 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	1.5 mV/V + 31 µV 1 mV/V + 25 µV 1.6 mV/V + 25 µV 2.1 mV/V + 30 µV 3.7 mV/V + 45 µV 11 mV/V + 94 µV	Comparison to Fluke 5502A, multiproduct calibrator
(33 to 329.999) 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	0.4 mV/V + 97 µV 0.31 mV/V + 35 µV 0.8 mV/V + 35 µV 1.1 mV/V + 63 µV 2.6 mV/V + 0.21 mV 5.5 mV/V + 0.45 mV	
(0.33 to 3.29999) 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	0.4 mV/V + 0.8 mV 0.31 mV/V + 0.21 mV 0.77 mV/V + 0.2 mV 1.1 mV/V + 0.23 mV 2.6 mV/V + 0.49 mV 5.4 mV/V + 2.3 mV	
(3.3 to 32.9999) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.4 mV/V + 8 mV 0.31 mV/V + 2 mV 0.77 mV/V + 2 mV 1.1 mV/V + 2.6 mV 2.6 mV/V + 5.4 mV	
(33 to 329.999) V	45 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz (20 to 50) kHz	0.53 mV/V + 21 mV 0.88 mV/V + 27 mV 1 mV/V + 27 mV 1.2 mV/V + 55 mV 2.7 mV/V + 0.13 V	
(330 to 1020) V	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.39 mV/V + 0.26 V 0.88 mV/V + 68 mV 1 mV/V + 73 mV	

Parameter/Range	Frequency	CMC[2] (±)	Comment
AC Voltage – Measure			
(1 to 10) mV	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.86 mV/V + 2.6 µV 0.64 mV/V + 2.6 µV 0.65 mV/V + 2.6 µV 6.3 mV/V + 2.6 µV 24 mV/V + 7.7 µV 38 mV/V + 7.7 µV	Comparison to Fluke 8558A, 8.5 digit multimeter
(10 to 100) mV	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz	0.14 mV/V + 1.3 µV 0.19 mV/V + 1.3 µV 0.35 mV/V + 2.6 µV 0.85 mV/V + 26 µV 4.5 mV/V + 65 µV 21 mV/V + 0.26 mV 24 mV/V + 0.9 mV 69 mV/V + 1.5 mV 0.14 mV/V + 1.6 mV 0.26 mV/V + 1.6 mV	
(0.1 to 1) V	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz	0.14 mV/V + 13 µV 0.2 mV/V + 13 µV 0.35 mV/V + 26 µV 0.85 mV/V + 0.26 mV 3.9 mV/V + 0.65 mV 21 mV/V + 2.6 mV 24 mV/V + 9 mV 70 mV/V + 16 mV 0.14 V/V + 16 mV 0.26 V/V + 16 mV	
(1 to 10) V	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz	0.14 mV/V + 0.13 mV 0.19 mV/V + 0.13 mV 0.35 mV/V + 0.26 mV 0.85 mV/V + 2.6 mV 3.9 mV/V + 6.5 mV 21 mV/V + 26 mV 24 mV/V + 90 mV 69 mV/V + 0.16 V 0.13 V/V + 0.16 V 0.26 V/V + 0.16 V	
(10 to 100) V	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.13 mV/V + 1.3 mV 0.19 mV/V + 1.3 mV 0.35 mV/V + 2.6 mV 0.85 mV/V + 26 mV 6.3 mV/V + 0.13 V 23 mV/V + 0.9 V	
(100 to 1000) V	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz	0.21 mV/V + 39 mV 0.24 mV/V + 39 mV 0.47 mV/V + 39 mV 0.85 mV/V + 0.26 V	

Parameter/Equipment	Range	CMC[2] (±)	Comment
Resistance – Source (Simulation)	Up to 10.999 Ω (11 to 32.999) Ω (33 to 109.999) Ω (110 to 329.999) Ω (0.33 to 1.1) kΩ (1.1 to 3.3) kΩ (3.3 to 11) kΩ (11 to 33) kΩ (33 to 110) kΩ (110 to 330) kΩ (0.33 to 1.1) MΩ (1.1 to 3.3) MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ (0.33 to 1.1) GΩ	58 µΩ/Ω + 2.7 mΩ 70 µΩ/Ω + 5.2 mΩ 90 µΩ/Ω + 3.4 mΩ 96 µΩ/Ω + 5.3 mΩ 88 µΩ/Ω + 22 mΩ 93 µΩ/Ω + 41 mΩ 89 µΩ/Ω + 0.22 Ω 78 µΩ/Ω + 0.6 Ω 0.11 mΩ/Ω +2.2 Ω 0.13 mΩ/Ω + 6.6 Ω 0.16 mΩ/Ω + 20 Ω 0.13 mΩ/Ω + 22 Ω 0.67 mΩ/Ω + 0.4 kΩ 1.1 mΩ/Ω + 6.1 kΩ 5.2 mΩ/Ω + 7.6 kΩ 5.5 mΩ/Ω + 0.24 MΩ 7.5 mΩ/Ω + 19 MΩ	Comparison to Fluke 5502A multiproduct calibrator Millivolt/Resistance simulation using Fluke 5502A, multiproduct calibrator
Resistance – Measure (4-wire Configuration)	Up to 1 Ω (1 to 10) Ω (10 to 100) Ω (0.1 to 1) kΩ (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ (10 to 100) MΩ (0.1 to 1) GΩ	26 µΩ/Ω + 6.3 µΩ 19 µΩ/Ω + 31 µΩ 14 µΩ/Ω + 0.12 mΩ 14 µΩ/Ω + 1.2 mΩ 14 µΩ/Ω + 12 mΩ 13 µΩ/Ω + 0.12 Ω 17 µΩ/Ω + 2.4 Ω 29 µΩ/Ω + 0.2 kΩ 74 µΩ/Ω + 20 kΩ 0.8 mΩ/Ω + 1.9 MΩ	Comparison to Fluke 8558A, 8.5 digit multimeter
DC Current – Source	(0 to 329.999) µA (0 to 3.299 99) mA (0 to 32.9999) mA (0 to 329.999) mA (0 to 2.999 99) A (0 to 20.5) A	0.16 mA/A + 28 nA 0.14 mA/A + 0.11 µA 0.1 mA/A + 0.86 µA 0.9 mA/A + 14 µA 0.13 mA/A + 2.1 mA 1 mA/A + 4.6 mA	Comparison to Fluke 5502A, multiproduct calibrator
DC Current – Measure	(0.001 to 10) µA (10 to 100) µA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	48 µA/A + 0.52 nA 16 µA/A + 0.6 nA 16 µA/A + 6 nA 16 µA/A + 60 nA 53 µA/A + 1.9 µA 0.18 mA/A + 0.19 mA	Comparison to Fluke 8558A, 8.5 digit multimeter

Parameter/Range	Frequency	CMC[2] (±)	Comment
AC Current – Source			Comparison to Fluke 5502A, multiproduct calibrator
(29 to 329.99) µA	(10 to 20) Hz	2 mA/A + 0.22 µA	
	(20 to 45) Hz	1.6 mA/A + 0.13 µA	
	45 Hz to 1 kHz	1.4 mA/A + 0.12 µA	
	(1 to 5) kHz	3.4 mA/A + 0.18 µA	
	(5 to 10) kHz	9.2 mA/A + 0.23 µA	
	(10 to 30) kHz	18.3 mA/A + 0.49 µA	
(0.33 to 3.299 99) mA	(10 to 20) Hz	2.3 mA/A + 0.27 µA	
	(20 to 45) Hz	1.4 mA/A + 0.3 µA	
	45 Hz to 1 kHz	1.2 mA/A + 0.16 µA	
	(1 to 5) kHz	2.3 mA/A + 0.21 µA	
	(5 to 10) kHz	3.91 mA/A + 8.1 µA	
	(10 to 30) kHz	7.4 mA/A + 19 µA	
(3.3 to 32.999 9) mA	(10 to 20) Hz	1.8 mA/A + 14 µA	
	(20 to 45) Hz	1 mA/A + 3.5 µA	
	45 Hz to 1 kHz	0.42 mA/A + 3.5 µA	
	(1 to 5) kHz	0.93 mA/A + 2.1 µA	
	(5 to 10) kHz	2.3 mA/A + 5.4 µA	
	(10 to 30) kHz	4.6 mA/A + 6.6 µA	
(33 to 329.999) mA	(10 to 20) Hz	1.8 mA/A + 0.11 mA	
	(20 to 45) Hz	1 mA/A + 35 µA	
	45 Hz to 1 kHz	0.46 mA/A + 22 µA	
	(1 to 5) kHz	1.1 mA/A + 70 µA	
	(5 to 10) kHz	2.3 mA/A + 0.12 mA	
	(10 to 30) kHz	4.5 mA/A + 0.26 mA	
(0.33 to 1.099 99) A	(10 to 45) Hz	2.1 µA/A + 0.11 mA	
	45 Hz to 1 kHz	0.4 µA/A + 0.34 mA	
	(1 to 5) kHz	6.8 mA/A + 1.2 mA	
	(5 to 10) kHz	29 mA/A + 5.2 mA	
(1.1 to 2.999 99) A	(10 to 45) Hz	2 mA/A + 0.25 mA	
	45 Hz to 1 kHz	0.61 mA/A + 0.4 mA	
	(1 to 5) kHz	6.9 mA/A + 1.2 mA	
	(5 to 10) kHz	29 mA/A + 5.3 mA	
(3 to 11) A	(45 to 100) Hz	0.46 mA/A + 5.4 mA	
	100 Hz to 1 kHz	0.97 mA/A + 4.3 mA	
	(1 to 5) kHz	35 mA/A + 4 mA	
(11 to 20.5) A	(45 to 100) Hz	0.63 mA/A + 30 mA	
	100 Hz to 1 kHz	1.6 mA/A + 7.3 mA	
	(1 to 5) kHz	34 mA/A + 25 mA	

Parameter/Range	Frequency	CMC[2] (±)	Comment
AC Current – Measure			
(10 to 100) µA	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz	6 mA/A + 13 nA 1 mA/A + 13 nA 1.4 mA/A + 13 nA 7.8 mA/A + 19 nA	Comparison to Fluke 8558A, 8.5 digit multimeter
(0.1 to 1) mA	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz	0.7 mA/A + 0.13 µA 1.1 mA/A + 0.13 µA 1.5 mA/A + 0.13 µA 7.8 mA/A + 0.19 µA	
(1 to 10) mA	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz	0.6 mA/A + 1.3 µA 1 mA/A + 1.3 µA 1.3 mA/A + 1.3 µA 7.8 mA/A + 1.9 µA	
(10 to 100) mA	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz	0.58 mA/A + 13 µA 1 mA/A + 13 µA 1.3 mA/A + 13 µA	
(0.1 to 1) A	1 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz	0.75 mA/A + 0.19 mA 1.3 mA/A + 0.19 mA 1.5 mA/A + 0.19 mA	
DC Voltage – Measure [3]	(-1 to 1) V (1 to 25) V (25 to 60) V	0.21 mV/V + 6 µV 0.22 mV/V + 60 µV 0.23 mV/V + 52 µV	Comparison to Beamex MC2, documenting process calibrator
DC Voltage – Source [3]	(-3 to 0.25) V (0.25 to 12) V	0.15 mA/A + 12 µV 0.22 mV/V + 85 µV	Comparison to Beamex MC2, documenting process calibrator

Parameter/Equipment	Range	CMC[2] (±)	Comment
Capacitance – Source	(220 to 399.9) pF (0.4 to 1.0999) nF (1.1 to 3.2999) nF (3.3 to 10.999) nF (11 to 32.999) nF (33 to 109.99) nF (110 to 329.99) nF (0.33 to 1.0999) µF (1.1 to 3.2999) µF (3.3 to 10.999) µF (11 to 32.999) µF (33 to 109.99) µF (110 to 329.99) µF (0.33 to 1.0999) mF (1.1 to 3.2999) mF (3.3 to 10.999) mF (11 to 32.999) mF (33 to 110) mF	3.3 mF/F + 14 pF 3.8 mF/F + 14 pF 3.5 mF/F + 20 pF 2.1 mF/F + 22 pF 2.2 mF/F + 0.14 nF 2.1 mF/F + 0.22 nF 2.1 mF/F + 0.67 nF 2.1 mF/F + 2.2 nF 2 mF/F + 7 nF 1.9 mF/F + 26 nF 3.5 mF/F + 78 nF 3.7 mF/F + 0.32 µF 3.9 mF/F + 0.89 µF 4.7 mF/F + 1.8 µF 4.7 mF/F + 5.2 µ 4.4 mF/F + 21 µF 7.7 mF/F + 71 µF 12 mF/F + 0.17 mF	Comparison to Fluke 5502A, multiproduct calibrator
Electrical Simulation of Thermocouple Indicating Devices – Source [2]			Comparison to Fluke 5502A, multiproduct calibrator
Type J	(-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.32 °C 0.19 °C 0.17 °C 0.27 °C 0.32 °C	
Type K	(-210 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.39 °C 0.22 °C 0.19 °C 0.35 °C 0.5 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.73 °C 0.28 °C 0.19 °C 0.16 °C	
DC Current – Measure [3]	(-100 to 100) Ma	0.19 mA/A + 2 µV	Comparison to Beamex MC2, documenting process calibrator

Parameter/Equipment	Range	CMC[2] (±)	Comment
DC Current – Source [3]	(-100 to 100) mA	0.15 mA/A + 3 µA	Comparison to Beamex MC2, documenting process calibrator
Resistance – Measure [3]	Up to 250 Ω (0.25 to 4) kΩ	0.21 µΩ/Ω + 4 mΩ 0.23 µΩ/Ω + 4 mΩ	Comparison to Beamex MC2, documenting process calibrator
Resistance – Source [3] (Simulation)	Up to 2650 Ω (2650 to 4000) Ω	0.4 mΩ/Ω + 20 mΩ 0.46 mΩ/Ω + 3 mΩ	Comparison to Beamex MC2, documenting process calibrator
Electrical Simulation of RTD Indicating Devices – Source/Measure [3]	(-200 to 200) °C (200 to 600) °C (600 to 800) °C	0.18 °C 0.29 °C 0.53 °C	Comparison to Beamex MC2, documenting process calibrator

III. Mechanical

Parameter/Equipment	Range	CMC[2] (±)	Comment
Pressure – Measure [3]	(-14.5 to 300) psig	0.18 psi	Comparison to Beamex MC2, documenting process calibrator, Beamex IPM20C pressure module with pressure sources
Pressure Sources (Gages, Transducers, etc.)	Up to 9.999 kPa (10 to 15) kPa Up to 59.999 kPa (60 to 100) kPa (-100 to 250) kPa (70 to 699) kPa 700 kPa to 2 MPa	1 Pa 0.11 Pa/kPa 5.8 kPa 0.11 Pa/kPa 30 Pa 180 Pa 87 Pa/MPa + 130 Pa	Comparison to Fluke 6270A, pressure controller; Fluke PM600 A2M/BG15k, Fluke PM500 G100k/BG250k pressure modules
Pipettes [3]	(1 to 10) µL (10 to 100) µL (100 to 1000) µL	0.09 µL 0.12 µL 1.8 µL	Comparison to balance using gravimetric method per ISO 8655-2:2000/2022 ISO 8655-6:2000/2022 & ISO 20461:2023

IV. Thermodynamics

Parameter/Equipment	Range	CMC[2] (±)	Comment
Temperature – Source	(50 to 650) °C	0.076 % rdg + 0.0079 °C	Comparison to Fluke 5628 PRT, Fluke 1560, black stack thermometer, Fluke 9144 metrology well
Temperature – Measure	(-196 to 0) °C (0 to 300) °C	0.0009 % rdg + 0.027 °C 0.007 % rdg + 0.027 °C	Comparison to Intelligent RTD temperature probe w/ bath/dry wells. The actual value from the reference probe will be utilized at the setpoint.
Relative Humidity – Generate			Comparison to Thunder Scientific 2500 RH/temp chamber
@ 10 °C	10 % RH 30 % RH 50 % RH 70 % RH 80 % RH	0.08 % RH 0.21 % RH 0.32 % RH 0.43 % RH 0.54 % RH	
@ 21.11 °C	10 % RH 30 % RH 50 % RH 70 % RH 80 % RH	0.08 % RH 0.26 % RH 0.30 % RH 0.40 % RH 0.49 % RH	
@ 70 °C	10 % RH 30 % RH 50 % RH 70 % RH 80 % RH	0.07 % RH 0.23 % RH 0.23 % RH 0.29 % RH 0.35 % RH	

V. Time & Frequency

Parameter/Equipment	Range	CMC[2] (±)	Comment
Frequency – Measure [2]	(1 to 10) Hz 10 Hz to 1 kHz (1 to 10) kHz (10 to 100) kHz 100 kHz to 1 MHz (1 to 100) MHz (10 to 100) MHz	2.6 µHz/Hz 1 mHz/kHz 1 mHz/kHz 1 mHz/kHz 1 Hz/MHz 1 Hz/MHz 1 Hz/MHz	Comparison to Fluke 8558A, 8.5 digit multimeter
Frequency – Measure [3]	(5 to 50) Hz (50 to 500) Hz 500 Hz to 5 kHz (5 to 50) kHz	0.11 mHz/Hz + 1 mHz 0.12 mHz/Hz + 0.22 mHz 0.12 mHz/Hz + 0.35 mHz 0.12 mHz/Hz + 3 mHz	Comparison to Beamex MC2, documenting process calibrator

[1] This laboratory offers commercial calibration service and field calibration service, where noted.

[2] Calibration and Measurement Capability Uncertainty (CMC) is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards or nearly ideal measuring equipment. CMCs represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of $k = 2$. The actual measurement uncertainty of a specific calibration performed by the laboratory may be greater than the CMC due to the behavior of the customer's device and to influences from the circumstances of the specific calibration.

[3] Field calibration service is available for these calibrations. Please note the actual measurement uncertainties achievable on a customer's site can normally be expected to be larger than the CMC found on the A2LA Scope. Allowance must be made for aspects such as the environment at the place of calibration and for other possible adverse effects such as those caused by transportation of the calibration equipment. The usual allowance for the actual uncertainty introduced by the item being calibrated, (e.g., resolution) must also be considered and this, on its own, could result in the actual measurement uncertainty achievable on a customer's site being larger than the CMC.

[4] The stated measured values are determined using the indicated instrument (see Comments). This capability is suitable for the calibration of the devices intended to measure or generate the measured value in the ranges indicated. CMCs are expressed as either a specific value that covers the full range or as a percent or fraction of the reading plus a fixed floor specification.

[5] In the statement of CMC, percentages are to be read as percent of reading, unless noted otherwise.

[6] In the statement of CMC, L is the numerical value of the nominal length of the device measured in inches, R is the numerical value of the resolution of the device under test in microinches, D is the numerical value of the nominal diameter of the device measured in inches.

[7] This scope meets A2LA's *P112 Flexible Scope Policy*.

[8] The type of instrument or material being calibrated is defined by the parameter. This indicates the laboratory is capable of calibrating instruments that measure or generate the values in the ranges indicated for the listed measurement parameter.

[9] This laboratory meets *R205 – Specific Requirements: Calibration Laboratory Accreditation Program* for the types of dimensional tests listed above and is considered equivalent to that of a calibration.

[10] Due to its corporate scope nature all certificates are issued and shown under 2348.01, but locations perform their work individually.

Accredited Laboratory

A2LA has accredited

TECHNICAL MAINTENANCE, INC.

for technical competence in the field of

Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and the requirements of ANSI/NCSL Z540.3-2006 and R205 – Specific Requirements: Calibration Laboratory Accreditation Program. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 5th of September, 2025.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 2348.01
Valid to *see scope of accreditation*

For the calibrations to which this accreditation applies, please refer to the laboratory's Calibration Scope of Accreditation.

Accredited Laboratory

A2LA has accredited

MICRO QUALITY CALIBRATION, INC.

Chatsworth, CA

for technical competence in the field of

Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and the requirements of ANSI/NCSL Z540.3-2006 and R205 – Specific Requirements: Calibration Laboratory Accreditation Program. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 30th day of January 2023.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 2348.01
Valid to November 30, 2026
Revised January 6, 2026

For the calibrations to which this accreditation applies, please refer to the laboratory's Calibration Scope of Accreditation.

Accredited Laboratory

A2LA has accredited

INTERNATIONAL PROCESS SOLUTIONS

for technical competence in the field of

Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and R205 – Specific Requirements: Calibration Laboratory Accreditation Program. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 2nd of February 2026.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 2348.01
Valid to *see scope of accreditation*

For the calibrations to which this accreditation applies, please refer to the laboratory's Calibration Scope of Accreditation.