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CALIBRATION AND MEASUREMENT CAPABILITY (CMC)*

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION METHOD OR PROCEDURE, STANDARD EQUIPMENT (OPTIONAL)
Dimensional			
Micrometers[5]	0.0625 in to 60 in	(70 + 7.5L) µin (where L = length in inches)	Direct measurement method Gage blocks, and micrometer standards
Calipers[5]	0 in to 1 in 1 in to 60 in	280 µin 320 µin	Direct measurement method with gage blocks
Mechanical			
Speed(Non-Contact) – Generate[3]	6 rpm to 99.99 rpm 100 rpm to 999.9 rpm 1000 rpm to 99999 rpm	0.011 rpm 0.073 rpm 0.59 rpm	Direct measurement method HP 3325B
Scales and Balances[5] - (Linearity Test Only)	200 mg 1 g to 10 g 10 g 20 g 30 g 40 g 50 g 50 g to 100 g 100 g 100 g to 200 g 200 g 200 g to 300 g 300 g 300 g to 400 g 400 g 400 g to 500 g 500 g 500 g to 800 g 1 kg 1 kg to 2.8 kg	0.070 mg 0.50 mg 0.059 mg 0.12 mg 0.087 mg 0.015 mg 0.14 mg 0.22 mg 0.28 mg 0.50 mg 0.58 mg 0.80 mg 0.86 mg 1.1 mg 0.91 mg 1.1 mg 1.2 mg 2.1 mg 2.9 mg 7.7 mg	Direct measurement method Class 1 and Class 3 Weights

** If information in this CMC is presented in non-SI units, the conversion factors stated in NIST Special Publication 811 "Guide for the Use of the International System of Units (SI)" apply.*

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION METHOD OR PROCEDURE, STANDARD EQUIPMENT (OPTIONAL)
	3 kg 3 kg to 4.8 kg 5 kg 5 kg to 9.8 kg 10 kg 10 kg to 14.8 kg 15 kg	8.8 mg 14 mg 14 mg 28 mg 120 mg 130 mg 130 mg	
	33 lb to 50 lb 50 lb 50 lb to 100 lb 100 lb 100 lb to 150 lb 150 lb 150 lb to 200 lb 200 lb 200 lb to 250 lb 250 lb 250 lb to 300 lb 300 lb 300 lb to 350 lb 350 lb 350 lb to 400 lb 400 lb	0.014 lb 0.0058 lb 0.019 lb 0.011 lb 0.025 lb 0.017 lb 0.031 lb 0.023 lb 0.037 lb 0.029 lb 0.044 lb 0.037 lb 0.050 lb 0.042 lb 0.055 lb 0.048 lb	Direct measurement method Class 7 Weights
Pressure/Vacuum[5] – Generate[3] and Measure[4]	0 inH_20 to 10 inH_20	0.031 inH_2O	Direct measurement method Fluke 700P01 w/719
	-12 psi to 30 psi	0.018 psi	Direct measurement method Fluke 717-30G
	0 psia to 30 psia	0.021 psia	Direct measurement method Fluke 700PA5 w/719
	30 psi to 100 psi	0.044 psi	Direct measurement method Fluke 719-100G
	100 psi to 300 psi	0.12 psi	Direct measurement method Fluke 719 Pro 300G
	300 psi to 1000 psi	0.51 psi	Direct measurement method Fluke 700P08 w/719
	1000 psi to 3000 psi	2.4 psi	Direct measurement method Fluke 700P29
	3000 psi to 5000 psi	4.0 psi	Direct measurement method Fluke 700P30 w/719
	5000 psi to 10 000 psi	8.1 psi	Direct measurement method Fluke 700P31 w/ 719

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION METHOD OR PROCEDURE, STANDARD EQUIPMENT (OPTIONAL)
Force Gauges[5] X1 0.5 lb mass X6 1 lb masses X8 2 lb masses X2 5lb masses X8 10 lb masses	0.5 lbf 1 lbf 2 lbf 5 lbf 10 lbf	0.0041 lbf 0.0042 lbf 0.0042 lbf 0.0046 lbf 0.054 lbf	Direct measurement method Class 7 Weights-CMCs for combinations of masses are summed. Quantity for each mass listed in far left column.
Force[5] – Measure[4]	0 lbf to 10 000 lbf	18 lbf	Direct measurement method Interface 1211NE-10K-B
	0 lbf to 100 000 lbf	240 lbf	Direct measurement method VLC-120
	0 lbf to 225 000 lbf	1.6e3 lbf	Direct measurement method Tetrahedron 300K Load Cell
Hand Torque Tools	 Clockwise Direction 10 lbf·in to 30 lbf·in 30 lbf·in to 100 lbf·in 100 lbf·in to 500 lbf·in 500 lbf·in to 1200 lbf·in 1200 lbf·in to 3120 lbf·in Counter Clockwise Direction 10 lbf·in to 30 lbf·in 30 lbf·in to 100 lbf·in 100 lbf·in to 500 lbf·in 500 lbf·in to 1200 lbf·in 1200 lbf·in to 3120 lbf·in	(X is the applied torque value) 1.8 % 0.013X+1.7 % 0.0021X+1.2 % 0.0005X+0.86 % 0.2 % 2 % 0.014X+1.9 % 0.0017X+1.1 % 0.0007X+1.1 % 0.22 %	Direct measurement method using Larson UTWCS, ISO 6789-1

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION METHOD OR PROCEDURE, STANDARD EQUIPMENT (OPTIONAL)
Thermal			
Simulated Temperature[5] - Thermocouples Generate & Measure			Direct measurement method Fluke 7526A
	600 °C to 800 °C	0.35 °C	
	800 °C to 1550 °C	0.28 °C	
	1550 °C to 1820 °C	0.22 °C	
Type B			
	-250 °C to -200 °C	0.25 °C	
	-200 °C to -100 °C	0.12 °C	
	-100 °C to 0 °C	0.09 °C	
Type E	0 °C to 600 °C	0.08 °C	
	600 °C to 1000 °C	0.10 °C	
	-210 °C to -100 °C	0.14 °C	
	-100 °C to 800 °C	0.09 °C	
	800 °C to 1200 °C	0.10 °C	
Type J			
	-250 °C to -200 °C	0.46 °C	
	-200 °C to -100 °C	0.16 °C	
	-100 °C to 500 °C	0.10 °C	
Type K	500 °C to 800 °C	0.10 °C	
	800 °C to 1372 °C	0.13 °C	
	-250 °C to -200 °C	0.73 °C	
	-200 °C to -100 °C	0.23 °C	
	-100 °C to 0 °C	0.12 °C	
Type N	0 °C to 100 °C	0.11 °C	
	100 °C to 800 °C	0.10 °C	
	800 °C to 1300 °C	0.12 °C	
Type R	-50 °C to -25 °C	0.55 °C	
	-25 °C to 0 °C	0.45 °C	
	0 °C to 100 °C	0.39 °C	
	100 °C to 400 °C	0.28 °C	
	400 °C to 600 °C	0.22 °C	
	600 °C to 1000 °C	0.21 °C	
	1000 °C to 1600 °C	0.19 °C	
	1600 °C to 1767 °C	0.23 °C	
Type S	-50 °C to -25 °C	0.51 °C	
	-25 °C to 0 °C	0.43 °C	
	0 °C to 100 °C	0.38 °C	
	100 °C to 400 °C	0.29 °C	
	400 °C to 600 °C	0.23 °C	
	600 °C to 1000 °C	0.22 °C	
	1000 °C to 1600 °C	0.22 °C	
	1600 °C to 1767 °C	0.26 °C	

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION METHOD OR PROCEDURE, STANDARD EQUIPMENT (OPTIONAL)
Simulated Temperature[5] - Thermocouples Generate & Measure (continued)			Direct measurement method Fluke 7526A
Type T	-250 °C to -200 °C -200 °C to -100 °C -100 °C to 0 °C 0 °C to 200 °C 200 °C to 400 °C	0.35 °C 0.16 °C 0.11 °C 0.09 °C 0.09 °C	
Type U	-200 °C to 0 °C 0 °C to 200 °C 200 °C to 600 °C	0.16 °C 0.10 °C 0.10 °C	
Simulated Temperature[5] RTD Generate & Measure			Direct measurement method Fluke 7526A
Pt 385, 100 Ω	-200 °C to 800 °C	0.05 °C	
Pt 385, 1000 Ω	-200 °C to 0 °C 0 °C to 100 °C 100 °C to 300 °C 300 °C to 400 °C 400 °C to 630 °C	0.014 °C 0.016 °C 0.020 °C 0.022 °C 0.027 °C	
Pt 3926, 100 Ω	-200 °C to 630 °C	0.05 °C	
Pt 3916, 100 Ω	-200 °C to 630 °C	0.05 °C	
Ni 120, 120 Ω	-80 °C to 260 °C	0.02 °C	
Temperature[5] – Generate and Measure[3]	-197 °C to 0.01°C 0.01 °C to 231 °C 231 °C to 419 °C 419 °C to 660 °C	0.019 °C 7.8e-5(t)+0.019°C 7.0e-5(t)+0.037°C 7.5e-5(t)+0.05°C	Comparison measurement method Hart 1502A w/5628
Infrared Temperature[5] – Measure[4]	35 °C to 100 °C 100 °C to 250 °C	1.5 °C 1.5 %	Direct measurement method Fluke 62 MAX+
Relative Humidity – Generate[3]	10 %RH to 95 %RH	0.51 %RH	Direct measurement method Thunder Scientific 1200
Relative Humidity[5] – Measure[4]	0 %RH to 90 %RH 90 %RH to 97 %RH	1.2 %RH 2.0 %RH	Comparison measurement method Vaisala HM70

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION METHOD OR PROCEDURE, STANDARD EQUIPMENT (OPTIONAL)
	Electrical – DC/LF		
DC Voltage[5] – Generate[3]	0 mV to 220 mV 220 mV to 2.2 V 2.2 V to 11 V 11 V to 22 V 22 V to 220 V 220 V to 1000 V	7.0 µV/V + 430 nV 4.7 µV/V + 1.2 µV 3.1 µV/V + 4.7 µV 3.1 µV/V +5.6 µV 4.7 µV/V + 73 µV 6.2 µV/V + 1.2 mV	Direct measurement method Fluke 5720A
DC Voltage –Measure[4]	0 V to 100 mV 0.1 V to 1 V 1V to 10 V 10 V to 100 V 100 V to 1000 V	5.5 µV/V + 240 nV 4.7 µV/V + 190 nV 4.7 µV/V + 840 nV 6.2 µV/V + 30 µV 16 µV/V + 600 µV	Direct measurement method HP 3458A
DC Current[5] Generate[3]	0.1 A to 1 A 10 µA to 100 µA 0.1 mA to 1 mA 1 mA to 10 mA 10 mA to 100 mA	120 µA/A + 10 µA 25 µA/A + 0.8 nA 25 µA/A + 5 nA 25 µA/A + 50 nA 40 µA/A + 0.5 µA	Direct measurement method Fluke 5720A w/HP 3458A
	0.022 A to 0.220 A 0.22 A to 2.2 A	45 µA/A + 0.7 µA 80 µA/A + 12 µA	Direct measurement method Fluke 5720A
	2.2 A to 11 A	360 µA/A + 480 µA	Direct measurement method Fluke 5720A w/5725A
	11 A to 20.5 A	0.1 % + 750 µA	Direct measurement method Fluke 5520A
	20 A to 150 A 150 A to 550 A 550 A to 1000 A	0.26 % + 0.05 A 0.25 % + 0.06 A 0.27 % + 0.06 A	Direct measurement method Fluke 5520A w/50 Turn Coil
DC Current[5] – Measure[4]	0 nA to 100 nA 0.1 µA to 1 µA 1 µA to 10 µA 10 µA to 100 µA 100 µA to 1 mA 1 mA to 10 mA 10 mA to 100 mA 100 mA to 1 A	19 µA/A + 640 pA 20 µA/A + 4.2 nA 20 µA/A + 40 nA 31 µA/A + 390 nA 90 µA/A + 8 µA 20 µA/A + 0.042 µA 31 µA/A + 0.04 µA 90 µA/A + 8 µA	Direct measurement method HP 3458A
	1 A to 30 A	9.6 mA	V/R method HP 3458A w/HP 34330A

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION METHOD OR PROCEDURE, STANDARD EQUIPMENT (OPTIONAL)
	10 A to 100 A	32 mA	V/R method HP 3458A w/LAB100-100
	100 A to 1000 A	930 mA	
DC Resistance[5] – Generate[3]	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	41 µΩ 88 µΩ 160 µΩ 210 µΩ 420 µΩ 950 µΩ 1.8 mΩ 7.9 mΩ 15 mΩ 79 mΩ 150 mΩ 1 Ω 1.9 Ω 18 Ω 36 Ω 360 Ω 860 Ω 9.6e3 Ω	Direct measurement method Fluke 5720A
	0 Ω to 10.9999 Ω 11 Ω to 32.9999 Ω 33 Ω to 109.9999 Ω 110 Ω to 329.9999 Ω 330 Ω to 1.099999 kΩ 1.1 kΩ to 3.299999 kΩ 3.3 kΩ to 10.99999 kΩ 11 kΩ to 32.99999 kΩ 33 kΩ to 109.9999 kΩ 110 kΩ to 329.9999 kΩ 330 kΩ to 1.099999 MΩ 1.1 MΩ to 3.299999 MΩ 3.3 MΩ to 10.99999 MΩ 11 MΩ to 32.99999 MΩ 33 MΩ to 109.9999 MΩ 110 MΩ to 329.9999 MΩ 330 MΩ to 1100 MΩ	3.1 µΩ/Ω + 8.2e-4 Ω 24 µΩ/Ω + 1.2e-3 Ω 22 µΩ/Ω + 1.2e-3 Ω 22 µΩ/Ω + 2.0e-3 Ω 22 µΩ/Ω + 3.9e-3 Ω 22 µΩ/Ω + 2.0e-2 Ω 22 µΩ/Ω + 3.6e-2 Ω 22 µΩ/Ω + 1.3e-1 Ω 22 µΩ/Ω + 3.6e-1 Ω 25 µΩ/Ω + 2.2 Ω 25 µΩ/Ω + 4.7 Ω 27 µΩ/Ω + 77 Ω 110 µΩ/Ω + 130 Ω 200 µΩ/Ω + 2.3 kΩ 390 µΩ/Ω + 15 kΩ 0.24 % + 110 kΩ 1.2 % + 9.7 kΩ	Direct measurement method Fluke 5520A
DC Resistance − Measure[4]	0 Ω to 2 Ω 2 Ω to 20 Ω 20 Ω to 200 Ω 200 Ω to 2 kΩ 2 kΩ to 20 kΩ 20 kΩ to 200 kΩ 200 kΩ to 2 MΩ	17 µΩ/Ω + 4 µΩ 9.5 µΩ/Ω + 14 µΩ 8.0 µΩ/Ω + 50 µΩ 8.0 µΩ/Ω + 500 µΩ 8.0 µΩ/Ω + 5 mΩ 8.0 µΩ/Ω + 50 mΩ 9.0 µΩ/Ω + 1 Ω	Direct measurement method Fluke 8508A (Normal Mode)

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION METHOD OR PROCEDURE, STANDARD EQUIPMENT (OPTIONAL)
DC Resistance − Measure[4] (continued)	2 MΩ to 20 MΩ 20 MΩ to 200 MΩ 200 MΩ to 2 GΩ	20 μΩ/Ω + 100 Ω 120 μΩ/Ω + 10 kΩ 1500 μΩ/Ω + 1 MΩ	
	2 MΩ to 20 MΩ 20 MΩ to 200 MΩ 200 MΩ to 2 GΩ 2 GΩ to 20 GΩ	17 μΩ/Ω + 10 Ω 65 μΩ/Ω + 1 kΩ 180 μΩ/Ω + 100 kΩ 1500 μΩ/Ω +10 MΩ	Direct measurement method Fluke 8508A (High Voltage Mode)
	10 MΩ 100 MΩ 1 GΩ 10 GΩ	0.0050 % 0.0064 % 0.015 % 0.12 %	V / I method HP 3458A; Fluke 5720A
	100 GΩ 1 TΩ	0.29 % 0.57 %	V / I method Keithley 487; Fluke 5720A
DC Power − Generate[3]	 (33 mV to 1020 V) 330 μA to 329.99 mA 330 mA to 2.999 A 3 A to 20.5 A	(% of output in Watts) 0.023 % 0.022 % 0.07 %	Direct measurement method Fluke 5520A
AC Voltage[5] – Generate[3]	0.22mV to 2.2 mV (10 Hz to 20 Hz) (20 Hz to 40 Hz) (40 Hz to 20 kHz) (20 kHz to 50 kHz) (50 kHz to 100 kHz) (100 kHz to 300 kHz) (300 kHz to 500 kHz) (500 kHz to 1 MHz) 2.2 mV to 22 mV (10 Hz to 20 Hz) (20 Hz to 40 Hz) (40 Hz to 20 kHz) (20 kHz to 50 kHz) (50 kHz to 100 kHz) (100 kHz to 300 kHz) (300 kHz to 500 kHz) (500 kHz to 1 MHz)	 240 μV/V + 4 μV 90 μV/V + 4.2 μV 78 μV/V + 4 μV 200 μV/V + 4 μV 470 μV/V + 4.8 μV 1100 μV/V + 9.4 μV 1400 μV/V + 19 μV 2800 μV/V + 20 μV 340 μV/V + 4.2 μV 90 μV/V + 4.2 μV 78 μV/V + 4.3 μV 200 μV/V + 4.3 μV 470 μV/V + 5.7 μV 1100 μV/V + 11 μV 1400 μV/V + 20 μV 2700 μV/V + 36 μV	Direct measurement method Fluke 5720A

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION METHOD OR PROCEDURE, STANDARD EQUIPMENT (OPTIONAL)
AC Voltage[5] – Generate[3] (continued)	22 mV to 220 mV (10 Hz to 20 Hz) (20 Hz to 40 Hz) (40 Hz to 20 kHz) (20 kHz to 50 kHz) (50 kHz to 100 kHz) (100 kHz to 300 kHz) (300 kHz to 500 kHz) (500 kHz to 1 MHz) 220 mV to 2.2 V (10 Hz to 20 Hz) (20 Hz to 40 Hz) (40 Hz to 20 kHz) (20 kHz to 50 kHz) (50 kHz to 100 kHz) (100 kHz to 300 kHz) (300 kHz to 500 kHz) (500 kHz to 1 MHz) 2.2 V to 22 V (10 Hz to 20 Hz) (20 Hz to 40 Hz) (40 Hz to 20 kHz) (20 kHz to 50 kHz) (50 kHz to 100 kHz) (100 kHz to 300 kHz) (300 kHz to 500 kHz) (500 kHz to 1 MHz)	 340 µV/V + 13 µV 86 µV/V + 7.4 µV 78 µV/V + 7.4 µV 200 µV/V + 7.4 µV 470 µV/V + 19 µV 860 µV/V + 28 µV 1400 µV/V + 31 µV 2600 µV/V + 76 µV 240 µV/V + 56 µV 86 µV/V + 40 µV 42 µV/V + 29 µV 70 µV/V + 26 µV 110 µV/V + 60 µV 390 µV/V + 120 µV 940 µV/V + 220 µV 1600 µV/V + 590 µV 340 µV/V + 530 µV 88 µV/V + 400 µV 42 µV/V + 230 µV 70 µV/V + 250 µV 94 µV/V + 480 µV 260 µV/V + 780 µV 940 µV/V + 2.3 mV 1400 µV/V + 7.2 mV	Direct measurement method Fluke 5520A

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION METHOD OR PROCEDURE, STANDARD EQUIPMENT (OPTIONAL)
AC Voltage[5] – Generate[3] (continued)	22 V to 220 V (10 Hz to 20 Hz) (20 Hz to 40 Hz) (40 Hz to 20 kHz) (20 kHz to 50 kHz) (50 kHz to 100 kHz) 220 V to 1100 V (50 Hz to 1 kHz)	 340 µV/V + 5.7 mV 86 µV/V + 4.4 mV 52 µV/V + 2.7 mV 78 µV/V + 0.4 mV 140 µV/V + 6.9 mV 22 µV/V + 25 mV	
	220 V to 1100 V (40 Hz to 1 kHz) (1 kHz to 20 kHz) (20 kHz to 30 kHz)	 70 µV/V + 34 mV 130 µV/V + 28 mV 470 µV/V + 33 mV	Direct measurement method Fluke 5720A w/5725A
AC Voltage[5] – Measure[4]	0 mV to 10 mV (1 Hz to 40 Hz) (40 Hz to 1 kHz) (1 kHz to 20 kHz) (20 kHz to 50 kHz) (50 kHz to 100 kHz) (100 kHz to 300 kHz) 10 mV to 100 mV (1 Hz to 40 Hz) (40 Hz to 1 kHz) (1 kHz to 20 kHz) (20 kHz to 50 kHz) (50 kHz to 100 kHz) (100 kHz to 300 kHz) (300 kHz to 1 MHz) (1 MHz to 2 MHz) 100 mV to 1 V (1 Hz to 40 Hz) (40 Hz to 1 kHz) (1 kHz to 20 kHz) (20 kHz to 50 kHz) (50 kHz to 100 kHz) (100 kHz to 300 kHz) (300 kHz to 1 MHz) (1 MHz to 2 MHz) 1 V to 10 V (1 Hz to 40 Hz)	 0.03 % + 3 µV 0.02 % + 1.1 µV 0.03 % + 1.1 µV 0.1 % + 1.1 µV 0.5 % + 1.1 µV 4 % + 2 µV 0.007 % + 4 µV 0.007 % + 2 µV 0.014 % + 2 µV 0.03 % + 2 µV 0.08 % + 2 µV 0.3 % + 10 µV 1 % + 10 µV 1.5 % + 10 µV 0.007 % + 40 µV 0.007 % + 20 µV 0.014 % + 20 µV 0.03 % + 20 µV 0.08 % + 20 µV 0.3 % + 100 µV 1 % + 100 µV 1.5 % + 100 µV 0.007 % + 400 µV	Direct measurement method HP 3458A

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION METHOD OR PROCEDURE, STANDARD EQUIPMENT (OPTIONAL)
AC Voltage[5] – Measure[4] (continued)	(40 Hz to 1 kHz) (1 kHz to 20 kHz) (20 kHz to 50 kHz) (50 kHz to 100 kHz) (100 kHz to 300 kHz) (300 kHz to 1 MHz) (1 MHz to 2 MHz) 10 V to 100 V (1 Hz to 40 Hz) (40 Hz to 1 kHz) (1 kHz to 20 kHz) (20 kHz to 50 kHz) (50 kHz to 100 kHz) (100 kHz to 300 kHz) (300 kHz to 1 MHz) 100 V to 700 V (1 Hz to 40 Hz) (40 Hz to 1 kHz) (1 kHz to 20 kHz) (20 kHz to 50 kHz) (50 kHz to 100 kHz)	0.007 % + 200 µV 0.014 % + 200 µV 0.03 % + 200 µV 0.08 % + 200 µV 0.3 % + 1 mV 1 % + 1 mV 1.5 % + 1 mV 0.02 % + 4 mV 0.02 % + 2 mV 0.02 % + 2 mV 0.035 % + 2 mV 0.12 % + 2 mV 0.4 % + 10 mV 1.5 % + 10 mV 0.04 % + 28 mV 0.04 % + 14 mV 0.06 % + 14 mV 0.12 % + 14 mV 0.3 % + 14 mV	Direct measurement method HP 3458A
	0 kV to 2 kV (20 Hz to 100 Hz) (100 Hz to 400 Hz) (2 kV to 20 kV) 20 Hz to 100 Hz	 0.07 % + 2 V 0.4 % + 4 V 0.2 % + 20 V	Direct measurement method Vitrek 4620B
AC Voltage − Amplitude Flatness, Measure[4]	1 V to 2 V 1 MHz 2 MHz 10 MHz 20 MHz 30 MHz 50 MHz 100 MHz	 0.086 % 0.092 % 0.092 % 0.17 % 0.2 % 0.47 % 1.8 %	Thermal Transfer method HP 3458A w/Fluke A55
AC Current[5] – Generate[3]	100 µA to 220 µA (10 Hz to 20 Hz) (20 Hz to 40 Hz) (40 Hz to 1 kHz) (1 kHz to 5 kHz) (5 kHz to 10 kHz)	 250 µA/A + 16 nA 160 µA/A + 10 nA 120 µA/A + 8 nA 280 µA/A + 12 nA 1100 µA/A + 65 nA	Direct measurement method Fluke 5720A

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION METHOD OR PROCEDURE, STANDARD EQUIPMENT (OPTIONAL)
AC Current[5] – Generate[3] (continued)	220 µA to 2.2 mA (10 Hz to 20 Hz) (20 Hz to 40 Hz) (40 Hz to 1 kHz) (1 kHz to 5 kHz) (5 kHz to 10 kHz) 2.2 mA to 22 mA (10 Hz to 20 Hz) (20 Hz to 40 Hz) (40 Hz to 1 kHz) (1 kHz to 5 kHz) (5 kHz to 10 kHz) 22 mA to 220 mA (10 Hz to 20 Hz) (20 Hz to 40 Hz) (40 Hz to 1 kHz) 22 mA to 220 mA (1 kHz to 5 kHz) (5 kHz to 10 kHz) 220 mA to 2.2 A (20 Hz to 1 kHz) (1 kHz to 5 kHz) (5 kHz to 10 kHz) 2.2 A to 11 A (40 Hz to 1 kHz) (1 kHz to 5 kHz) (5 kHz to 10 kHz)	 250 µA/A + 40 nA 160 µA/A + 35 nA 120 µA/A + 35 nA 200 µA/A + 110 nA 1100 µA/A + 650 nA 250 µA/A + 400 nA 160 µA/A + 350 nA 120 µA/A + 350 nA 200 µA/A + 550 nA 1100 µA/A + 5 µA 250 µA/A + 4 µA 160 µA/A + 3.5 µA 120 µA/A + 2.5 µA 200 µA/A + 3.5 µA 1100 µA/A + 10 µA 260 µA/A + 35 µA 450 µA/A + 80 µA 7000 µA/A + 160 µA 460 µA/A + 170 µA 950 µA/A + 380 µA 600 µA/A + 750 µA	Direct measurement method Fluke 5720A
	11 A to 20.5 A (45 Hz to 100 Hz) (100 Hz to 1 kHz) (1 kHz to 5 kHz)	 0.12 % + 5 mA 0.15 % + 5 mA 3 % + 5 mA	Direct measurement method Fluke 5520A
	10 A to 1000 A (45 Hz to 440 Hz)	 0.28 % + 0.11 A	Direct-method Fluke 5520A w/50 turn coil
AC Current – Measure[4]	10 µA to 100 µA (10 Hz to 20 Hz) (20 Hz to 45 Hz) (45 Hz to 100Hz) (100 Hz to 1 kHz) 100 µA to 1 mA (10 Hz to 20 Hz) (20 Hz to 45 Hz)	 0.33 % + 24 nA 0.12 % + 24 nA 0.048 % +24 nA 0.048 % + 24 nA 0.33 % + 200 nA 0.12 % + 170 nA	Direct measurement method HP 3458A

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION METHOD OR PROCEDURE, STANDARD EQUIPMENT (OPTIONAL)
	(45 Hz to 100 Hz)	0.048 % + 170 nA	
	(100 Hz to 5 kHz)	0.024 % + 170 nA	
	1 mA to 10 mA		
	(10 Hz to 20 Hz)	0.33 % + 1.7 µA	
	(20 Hz to 45 Hz)	0.12 % + 1.7 µA	
	(45 Hz to 100 Hz)	0.048 % + 1.7 µA	
	(100 Hz to 5 kHz)	0.024 % + 1.7 µA	
	10 mA to 100 mA		
	(10 Hz to 20 Hz)	0.33 % + 17 µA	
	(20 Hz to 45 Hz)	0.12 % + 17 µA	
	(45 Hz to 100 Hz)	0.048 % + 17 µA	
	(100 Hz to 5 kHz)	0.024 % + 17 µA	
	100 mA to 1 A		
	(10 Hz to 20 Hz)	0.33 % + 170 µA	
	(20 Hz to 45 Hz)	0.13 % + 170 µA	
	(45 Hz to 100 Hz)	0.064 % + 170 µA	
	(100 Hz to 5 kHz)	0.078 % + 170 µA	

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION METHOD OR PROCEDURE, STANDARD EQUIPMENT (OPTIONAL)
AC Resistance – Generate[3]	10 Ω (DC to 1 MHz) (1 MHz to 2 MHz) (2 MHz to 3 MHz) (3 MHz to 4 MHz) (4 MHz to 5 MHz) (5 MHz to 10 MHz) (10 MHz to 13 MHz) 100 Ω (DC to 1 MHz) (1 MHz to 2 MHz) (2 MHz to 3 MHz) (3 MHz to 4 MHz) (4 MHz to 5 MHz) (5 MHz to 10 MHz) (10 MHz to 13 MHz) 1 kΩ (DC to 100 kHz) (100 kHz to 1 MHz) (1 MHz to 2 MHz) (2 MHz to 3 MHz) (3 MHz to 4 MHz) (4 MHz to 5 MHz) (5 MHz to 10 MHz) (10 MHz to 13 MHz) 10 kΩ (DC to 100 kHz) (100 kHz to 1 MHz) 100 kΩ (DC to 100 kHz) (100 kHz to 1 MHz)	 0.13 % 0.14 % 0.16 % 0.17 % 0.2 % 0.5 % 0.7 % 0.13 % 0.14 % 0.15 % 0.15 % 0.15 % 0.3 % 0.4 % 0.13 % + 0.2 Ω 0.13 % + 0.2 Ω 0.13 % + 0.2 Ω 0.13 % + 0.2 Ω 0.14 % + 0.2 Ω 0.15 % + 0.2 Ω 0.3 % + 0.2 Ω 0.4 % + 0.2 Ω 0.12 % + 2 Ω 0.13 % + 2 Ω 0.13 % + 20 Ω 0.13 % + 20 Ω	Direct measurement method HP 42030 resistor set
AC Resistance – Measure[4]	1 Ω: 100 Hz 1 kHz 10 kHz 100 kHz 10 Ω: 100 Hz 1 kHz 10 kHz 100 kHz 100 Ω: 100 Hz	 1.7 % 1.5 % 1.5 % 1.5 % 0.31 % 0.20 % 0.22 % 0.22 % 0.092 %	Direct measurement method HP 4284A

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION METHOD OR PROCEDURE, STANDARD EQUIPMENT (OPTIONAL)
AC Resistance – Measure[4] (continued)	1 kHz 10 kHz 100 kHz 1 kΩ: 100 Hz 1 kHz 10 kHz 100 kHz 10 kΩ: 100 Hz 1 kHz 10 kHz 100 kHz 100 kΩ: 100 Hz 1 kHz 10 kHz 100 kHz	0.092 % 0.12 % 0.12 % 0.92 % 0.92 % 0.92 % 0.12 % 0.092 % 0.092 % 0.092 % 0.10 % 0.10 % 0.10 % 0.12 % 0.28 %	Direct measurement method HP 4284A
AC Power – Generate[3] (45 Hz to 1 kHz)	 10 mW (1 V, 10 mA) 100 mW (1 V, 100 mA) 1 W (1 V, 1 A) 10 W (10 V, 1 A) 100 W (100 V, 1 A) 1 kW (100 V, 10 A)	(% of output in Watts) 0.059 % 0.059 % 0.054 % 0.055 % 0.056 % 0.095 %	Direct measurement method Fluke 5520A (PF = 1)
Capacitance – Generate[3]	0.19 nF to 1.0999 nF (10 Hz to 10 kHz) 1.1 nF to 3.2999 nF (10 Hz to 3 kHz) 3.3 nF to 10.9999 nF (10 Hz to 1 kHz) 11 nF to 109.999 nF (10 Hz to 1 kHz) 110 nF to 329.999 nF (10 Hz to 1 kHz) 330 nF to 1.09999 µF (10 Hz to 600 Hz) 1.1 µF to 3.29999 µF (10 Hz to 300 Hz)	0.5 % + 0.01 nF 0.5 % + 0.01 nF 0.25 % + 0.01 nF 0.25 % + 0.1 nF 0.25 % + 0.3 nF 0.25 % + 1 nF 0.25 % + 3 nF	Direct measurement method Fluke 5520A

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION METHOD OR PROCEDURE, STANDARD EQUIPMENT (OPTIONAL)
Capacitance – Generate[3] (continued)	3.3 µF to 10.9999 µF (10 Hz to 150 Hz) 11 µF to 32.9999 µF (10 Hz to 120 Hz) 33 µF to 109.999 µF (10 Hz to 80 Hz) 110 µF to 329.999 µF (0 Hz to 50 Hz) 330 µF to 1.09999 mF (0 Hz to 20 Hz) 1.1 mF to 3.2999 mF (0 Hz to 6 Hz) 3.3 mF to 10.9999 mF (0 Hz to 2 Hz) 11 mF to 32.9999 mF (0 Hz to 0.6 Hz) 33 mF to 110 mF (0 Hz to 0.2 Hz)	0.25 % + 10 nF 0.4 % + 30 nF 0.45 % + 100 nF 0.45 % + 300 nF 0.45 % + 1 µF 0.45 % + 3 µF 0.45 % + 10 µF 0.75 % + 30 µF 1.1 % + 100 µF	Direct measurement method Fluke 5520A
Capacitance – Generate[3] / Measure[4]	1 pF: 100 kHz 10 pF: 10 kHz 100 kHz 100 pF: 1 kHz 10 kHz 100 kHz 1 nF: 100 Hz 1 kHz 10 kHz 100 kHz 10 nF: 100 Hz 1 kHz 10 kHz 100 kHz 100 nF: 100 Hz	 0.50 % 0.39 % 0.29 % 0.38 % 0.13 % 0.10 % 0.38 % 0.12 % 0.092 % 0.12 % 0.12 % 0.092 % 0.092 % 0.12 % 0.092 %	Direct measurement method HP 4284A

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION METHOD OR PROCEDURE, STANDARD EQUIPMENT (OPTIONAL)
Capacitance – Generate[3] / Measure[4] (continued)	1 kHz 10 kHz 100 kHz 1 uF: 100 Hz 1 kHz 10 kHz 100 kHz 10 uF: 100 Hz 1 kHz 10 kHz 100 uF 100 Hz 1 kHz 1 mF: 100 Hz	0.092 % 0.093 % 0.20 % 0.092 % 0.092 % 0.20 % 1.0 % 0.092 % 0.17 % 1.0 % 0.29 % 1.0 % 1.2%	Direct measurement method HP 4284A
Inductance – Generate[3] / Measure[4]	10 uH: 100 kHz 100 uH: 10 kHz 100 kHz 1 mH: 1 kHz 10 kHz 100 kHz 10 mH: 100 Hz 1 kHz 10 kHz 100 kHz 100 mH: 100 Hz 1 kHz 10 kHz 100 kHz 1 H: 100 Hz 1 kHz 10 H: 100 Hz	 0.24 % 0.24 % 0.17 % 0.22 % 0.17 % 0.12 % 0.33 % 0.15 % 0.092 % 0.10 % 0.27 % 0.092 % 0.093 % 0.28 % 0.092 % 0.092 % 0.092 %	Direct measurement method HP 4284A
Oscilloscopes - Voltage Function – DC Signal (50 Ω)	(1 to 2.1) mV (2.1 to 5.56) mV (5.56 to 21) mV (21 to 55.6) mV (55.6 to 210) mV	0.053 % + 25 µV 0.02 % + 25 µV 0.089 % + 25 µV 0.054 % + 25 µV 0.029 % + 25 µV	Direct measurement method Fluke 9500B w/9530

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION METHOD OR PROCEDURE, STANDARD EQUIPMENT (OPTIONAL)
	(210 to 556) mV (0.556 to 2.1) V (2.1 to 5.56) V	0.041 % + 25 µV 0.17 % + 25 µV 0.36 % + 25 µV	Direct measurement method Fluke 9500B w/9530
Oscilloscopes Voltage Function - DC Signal (1 MΩ)	(1 to 2.1) mV (2.1 to 5.56) mV (5.56 to 21) mV (21 to 55.6) mV (55.6 to 210) mV (210 to 556) mV (0.556 to 2.1) V (2.1 to 5.56) V (5.56 to 22.24) V (22.24 to 55.6) V 55.6 to 222.4) V	0.053 % + 25 µV 0.02 % + 25 µV 0.053 % + 25 µV 0.058 % + 25 µV 0.028 % + 25 µV 0.039 % + 25 µV 0.12 % + 25 µV 0.052 % + 25 µV 0.063 % + 25 µV 0.09 % + 25 µV 0.025 % + 25 µV	
Oscilloscopes Square Wave Signal (<10 kHz) (50 Ω)	40 µVp-p to 2.1 mVp-p (2.1 to 5.56) mVp-p (5.56 to 21) mVp-p (21 to 55.6) mVp-p (55.6 to 210) mVp-p (210 to 556) mVp-p (0.556 to 2.1) Vp-p (2.1 to 5.56) Vp-p	0.16 % + 10 µV 0.17 % + 10 µV 0.12 % + 10 µV 0.23 % + 10 µV 0.12 % + 10 µV 0.15 % + 10 µV 0.13 % + 10 µV 0.29 % + 10 µV	
Oscilloscopes - Square Wave Signal (<10 kHz) (1 MΩ)	40 µVp-p to 2.1 mVp-p (2.1 to 5.56) mVp-p (5.56 to 21) mVp-p (21 to 55.6) mVp-p (55.6 to 210) mVp-p (210 to 556) mVp-p (0.556 to 2.1) Vp-p (2.1 to 5.56) Vp-p (5.56 to 22.24) Vp-p (22.24 to 55.6) Vp-p 55.6 to 222.4) Vp-p	0.16 % + 10 µV 0.17 % + 10 µV 0.12 % + 10 µV 0.14 % + 10 µV 0.13 % + 10 µV 0.17 % + 10 µV 0.13 % + 10 µV 0.23 % + 10 µV 0.35 % + 10 µV 0.18 % + 10 µV 0.1 % + 10 µV	
Oscilloscopes - Edge Function - Rise/Fall Time	150 ps (Fast Edge) 500 ps (Edge)	19 ps 44 ps	
Oscilloscopes – Leveled Sine Function - Leveled Sine Amplitude (Single Ref Frequency 50 kHz to 10 MHz)	5 mVp-p to 5 Vp-p(Ampl) 5 mVp-p to 5 Vp-p (0.1 Hz to 300 MHz (300 MHz to 550 MHz)	1.5 % 10 % 10 %	

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION METHOD OR PROCEDURE, STANDARD EQUIPMENT (OPTIONAL)
	(550 MHz to 1.1 GHz) (1.1 to 3.2) GHz	10 % 30 %	
Oscilloscopes – Timing Marker	(10 to 100) ns (0.1 to 1) µs (0.001 to 1) ms (1 to 10) ms (10 to 100) ms (0.1 to 1) s (1 to 10) s (10 to 50) s	68 µs/s 80 µs/s 0.26 µs/s 0.25 µs/s 0.25 µs/s 0.25 µs/s 0.25 µs/s 0.26 µs/s	
Time and Frequency			
Timers/Stop Watches[5]	0.001 s to 99999.999 s	0.001 %	Comparison measurement method VWR 62344-880
Frequency – Generate[3] / Measure[4]	0.1 MHz, 1 MHz, 5 MHz, 10 MHz	(5 x 10^{-12} F) Hz Where F is frequency in Hz	Direct measurement method Fluke 910R
	1 Hz to 26.5 GHz	(1.2 x 10^{-10} F) Hz Where F is frequency in Hz	Direct measurement method HP 3325, Fluke 910R as external time base
RF/Microwave and Electromagnetics			
Power − Measure[3]	(0.0001 GHz to 18 GHz) -20 dBm to -15 dBm -15 dBm to -10 dBm -10 dBm to 10 dBm 10 dBm to 20 dBm	 0.34 dBm 0.15 dBm 0.12 dBm 0.19 dBm	Direct measurement method HP 437B with 8482A
	(18 GHz to 26.5 GHz) -20 dBm to -15 dBm -15 dBm to -10 dBm -10 dBm to 10 dBm 10 dBm to 20 dBm	 0.35 dBm 0.17 dBm 0.14 dBm 0.21 dBm	Direct measurement method HP 437B with 8485A
Chemical/Gas			
pH[6] - Generate[3]	4 pH 7 pH 10 pH	0.035 pH 0.035 pH 0.024 pH	Direct method using Buffer Solutions

[1]The uncertainty covered by the Calibration and Measurement Capability (CMC) is expressed as the expanded uncertainty having a coverage probability of approximately 95 %. It is the smallest measurement uncertainty that a laboratory can achieve within its scope of accreditation when performing calibrations of a best existing device. The measurement uncertainty reported on a calibration certificate may be greater than that provided in the CMC due to the behavior of the calibration item and other factors that may contribute to the uncertainty of a specific calibration.

[2]When uncertainty is stated in relative terms (such as percent, a multiplier expressed as a decimal fraction or in scientific notation), it is in relation to instrument reading or instrument output, as appropriate, unless otherwise indicated.

[3]Capability is suitable for the calibration of measuring devices in the stated ranges.

[4]Capability is suitable for the calibration of devices intended to generate the indicated quantity in the stated ranges.

[5]Also available as site calibration. Note that actual measurement uncertainties achievable at a customer's site can normally be expected to be larger than the uncertainties listed on this Scope of Accreditation.

RDG = reading
BW = bandwidth
p-p = peak to peak
HV = high voltage
VSWR = voltage standing wave ratio