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SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

CALIBRATION

Electromagnetic – DC/Low Frequency

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
² Source DC Voltage	Up to 330mV 330 mV to 3.3 V (3.3 to 33) V (33 to 330) V 330 V to 1.02 kV	70 μ V/V + 3.8 μ V 58 μ V/V + 6.0 μ V 59 μ V/V + 58 μ V 64 μ V/V + 0.58 mV 64 μ V/V + 1.8 mV	Fluke 5500A	
² Source DC Current	Up to 3.3 mA 3.3 mA to 33 mA 33 mA to 330 mA 330 mA to 3.0 A 3.0 A to 11 A	0.16 mA/A + 58 nA 0.12 mA/A + 0.29 μ A 0.12 mA/A + 3.9 μ A 0.35 mA/A + 51 μ A 0.70 mA/A + 0.7 mA	Fluke 5500A	
² Clamp-On Ammeters	11 A to 550 A	5.9 mA/A + 1.5 A	With Coil	
² Source AC Voltage	(1 to 33) mV (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz (33 to 330) mV (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz 330 mV to 3.3 V (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	4.05 mV/V + 6.0 μ V 1.74 mV/V + 6.0 μ V 4.05 mV/V + 6.0 μ V 4.05 mV/V + 6.0 μ V 4.05 mV/V + 6.0 μ V 4.05 mV/V + 6.0 μ V 2.89 mV/V + 29.0 μ V 0.59 mV/V + 11.7 μ V 1.16 mV/V + 11.8 μ V 1.86 mV/V + 23.2 μ V 2.78 mV/V + 99 μ V 8.2 mV/V + 0.23 mV 1.74 mV/V + 145 μ V 0.35 mV/V + 36 μ V 0.93 mV/V + 36 μ V 1.62 mV/V + 0.17 mV 2.78 mV/V + 0.99 mV 5.8 mV/V + 1.91 mV	Fluke 5500A	DOD Midas, OEM and GIDEP Source Procedure

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
² Source (cont.) AC Voltage	(3.3 to 33) V (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (33 to 330) V 45 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz (330 to 1020) V 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	1.74 mV/V + 0.16 mV 0.47 mV/V + 0.38 mV 0.93 mV/V + 0.17 mV 2.20 mV/V + 0.31 mV 2.8 mV/V + 1.1 mV 0.58 mV/V + 3.9 mV 0.93 mV/V + 8.8 mV 1.05 mV/V + 19.1 mV 0.58 mV/V + 47 mV 2.31 mV/V + 58 mV 2.31 mV/V + 0.29 V	Fluke 5500A	DOD Midas, OEM and GIDEP Source Procedure
² Source AC Current	(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 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 (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 (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 330 mA to 2.2 A (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (2.2 to 11 A) (45 to 100 Hz) (100 to 500 Hz) 500 Hz to 1 kHz 1000 A 45 Hz to 1kHz	2.9 mA/A + 0.18 µA 1.5 mA/A + 0.18 µA 1.5 mA/A + 0.29 µA 4.7 mA/A + 0.18 µA 14.5 mA/A + 0.18 µA 2.4 mA/A + 0.35 µA 1.2 mA/A + 0.35 µA 1.2 mA/A + 0.36 µA 2.4 mA/A + 0.36 µA 7.0 mA/A + 0.36 µA 2.4 mA/A + 3.5 µA 1.2 mA/A + 3.5 µA 1.05 mA/A + 3.6 µA 2.32 mA/A + 3.7 µA 7.0 mA/A + 3.6 µA 2.4 mA/A + 19 µA 1.2 mA/A + 19 µA 1.08 mA/A + 22 µA 2.4 mA/A + 36 µA 7.0 mA/A + 40 µA 2.4 mA/A + 0.36 mA 1.16 mA/A + 0.36 mA 8.7 mA/A + 0.4 mA 9 mA/A + 0.6 mA 0.71 mA/A + 0.63 mA 1.2 mA/A + 6.3 mA 3.9 mA/A + 6.4 mA	Fluke 5500A	
² Clamp-On Ammeters		6.7 mA/A + 1.4 A	With Coil	

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
² Source Resistance	Up to 11 Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω 330 Ω 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 330kΩ 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	140 μΩ/Ω + 1.0 mΩ 142 μΩ/Ω + 1.8 mΩ 106 μΩ/Ω + 1.8 mΩ 105 μΩ/Ω + 1.8 mΩ 105 μΩ/Ω + 7.0 mΩ 105 μΩ/Ω + 8.0 mΩ 105 μΩ/Ω + 70 mΩ 105 μΩ/Ω + 0.07 Ω 128 μΩ/Ω + 0.7 Ω 141 μΩ/Ω + 7.5 Ω 175 μΩ/Ω + 63.6 Ω 176 μΩ/Ω + 72 Ω 0.7 mΩ/Ω + 0.78 kΩ 1.16 mΩ/Ω + 1.7 kΩ 5.78 mΩ/Ω + 7.0 kΩ 5.8 mΩ/Ω + 0.2 MΩ	Fluke 5500A	DOD Midas, OEM and GIDEP Source Procedure
² Source AC Power (45 to 65) Hz, 330 mV to 1020 V @PF = 1	(3.3 to 8.999) mA 1 W 5W 9W (9 to 3.999) mA 3.3 W 15 W 33 W (33 to 89.99) mA 9 W 45 W 90 W (90 to 329.99) mA 33 W 150 W 330 W (0.33 to 0.8999) A 90 W 450 W 900 W (0.9 to 2.1999) A 220 W 1000 W 2200 W (2.2 to 4.4999) A 450 W 2000 W 4500 W (4.5 to 11) A 2000 W 5000 W 11000W	1.8 mW/W + 7.1 mW 1.8 mW/W + 7.6 mW 1.8 mW/W + 7.6 mW 1.8 mW/W + 7.1 mW 1.8 mW/W + 7.6 mW 1.8 mW/W + 7.6 mW 1.8 mW/W + 7.1 mW 1.8 mW/W + 7.6 mW 1.8 mW/W + 7.6 mW 1.8 mW/W + 71 mW 1.8 mW/W + 76 mW 1.8 mW/W + 76 mW 1.8 mW/W + 76 mW 1.8 mW/W + 76 mW 1.8 mW/W + 76 mW 1.9 mW/W + 0.76 W 1.9 mW/W + 0.76 W 1.9 mW/W + 0.76 W 1.9 mW/W + 0.71 W 1.9 mW/W + 0.76 W 1.9 mW/W + 0.76 W 1.9 mW/W + 0.76 W 1.9 mW/W + 0.76 W 1.9 mW/W + 0.76 W	Fluke 5500A	

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
² Source DC Power 33 mV to 1020 V	(90 to 329.99) mA 90 W 150 W 330 W (0.90 to 2.1999) A 900 W 1100 W 2200 W (4.5 to 11) A 2000 W 5000 W 10000 W	0.29 mW/W + 58 mW 0.29 mW/W + 76 mW 0.29 mW/W + 76 mW 0.26 mW/W + 0.58 W 0.26 mW/W + 0.76 W 0.26 mW/W + 0.76 W 0.81 mW/W + 0.71 W 0.81 mW/W + 0.76 W 0.81 mW/W + 0.76 W	Fluke 5500A	DOD Midas, OEM and GIDEP Source Procedure
² Source Capacitance (0.33 to 0.4999) 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 330 μF to 1.1 mF	50 Hz to 10 kHz 50 Hz to 10 kHz 50 Hz to 10 kHz 50 Hz to 10 kHz 50 Hz to 10 kHz 50 Hz to 10 kHz 50 Hz to 5 kHz 50 Hz to 2 kHz 50 Hz to 1.5 kHz (50 to 800) Hz (50 to 400) Hz (50 to 200) Hz (50 to 150) Hz	5.9 mF/F + 12 pF 7.4 mF/F + 14 pF 5.9 mF/F + 13 pF 3.0 mF/F + 59 pF 3.0 mF/F + 130 nF 3.0 mF/F + 0.59 nF 3.0 mF/F + 1.4 nF 4.2 mF/F + 6.8 nF 4.1 mF/F + 13 nF 4.7 mF/F + 68 nF 5.9 mF/F + 0.13 μF 8.2 mF/F + 0.68 μF 11.7 mF/F + 0.7 μF	Fluke 5500A	
² Source and Measure Electrical Simulation of Thermocouple Indicating Devices Type K Type T Type J	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C (-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C (-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.44 °C 0.37 °C 0.37 °C 0.35 °C 0.35 °C 0.44 °C 0.35 °C 0.35 °C 0.35 °C 0.35 °C 0.34 °C 0.34 °C 0.34 °C 0.34 °C	Fluke 5500A	

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² Source and Measure Electrical Simulation of Thermocouple Indicating Devices (cont.) Type E Type R,S RTD PT385(100Ω)	(-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C (0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C (-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	0.56 °C 0.51 °C 0.50 °C 0.50 °C 0.50 °C 0.50 °C 0.50 °C 0.49 °C 0.50 °C 0.082 °C 0.082 °C 0.10 °C 0.11 °C 0.12 °C 0.13 °C 0.25 °C	Fluke 5500A	DOD Midas, OEM and GIDEP Source Procedure
² Source AC Voltage Wide Band	35 mV to 5 V <100 kHz to 1MHz 1 MHz to 15MHz	1.5 % + 2.0 mV 2.0 % + 2.0 mV	HP 33120 A Function	
² Source Inductance ≤ 1kHz	(1 to 10) μH (10 to 100) μH 100μH to 1 mH (1 to 10) mH (10 to 100) mH 100 mH to 1H (1 to 10) H	0.29 μH 2.9 μH 28.9 μH 0.29 mH 2.9 mH 29.0 mH 0.29 H	MCP BXL-70	
² Measure DC Voltage	Up to 100 mV 100 mV to 1 V (1 to 10) V (10 to 100) V 100 V to 1 kV (1 to 20) kV (20 to 35) kV (35 to 40) kV	10.5 μV/V + 0.78 μV 9.4 μV/V + 3.60 μV 9.4 μV/V + 8.2 μV 12 μV/V + 58 μV 12 μV/V + 0.59 mV 0.065 kV 0.11 kV 0.11 kV	HP 3458A Opt 002 With Fluke 80K-40 High Voltage Probe	

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² Measure DC Current	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 Up to 75 A	0.04 µA/A + 6.0 pA 0.03 µA/A + 6.0 pA 0.03 µA/A + 6.0 pA 0.02 mA/A + 0.6 nA 0.03 mA/A + 5.8 nA 0.03 mA/A + 58 nA 0.05 mA/A + 0.6 µA 0.13 mA/A + 13 µA 0.04 mA/A + 13 mA	HP 3458A Opt 002 With 2215-10 Yokogawa	DOD Midas, OEM and GIDEP Source Procedure
² Measure AC Voltage	(1 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 mV 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 (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 100 V to 1 kV (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (1 to 40) kV (50 to 60) Hz	0.09 mV/V + 3.6 µV 0.08 mV/V + 1.4 µV 0.09 mV/V + 1.4 µV 0.14 mV/V + 1.4 µV 0.59 mV/V + 1.4 µV 4.62 mV/V + 2.4 µV 0.08 mV/V + 23.2 µV 0.08 mV/V + 23.2 µV 0.08 mV/V + 23.2 µV 0.09 mV/V + 23.2 µV 0.12 mV/V + 23.2 µV 0.36 mV/V + 28.9 µV 1.16 mV/V + 28.9 µV 1.74 mV/V + 28.9 µV 0.03 mV/V + 4.7 µV 0.03 mV/V + 2.4 µV 0.03 mV/V + 2.4 µV 0.05 mV/V + 2.4 µV 0.14 mV/V + 2.4 µV 0.47 mV/V + 11.6 µV 1.74 mV/V + 11.6 µV 0.05 mV/V + 24 mV 0.05 mV/V + 13 mV 0.07 mV/V + 13 mV 0.14 mV/V + 13 mV 0.35 mV/V + 13 mV 0.21 V	HP 3458A Opt 002 With Fluke 80K-40 High Voltage Probe	

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
² Measure AC Current	Up to 100 µA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 1 kHz 100 µA 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 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	0.47 mA/A + 36 nA 0.18 mA/A + 36 nA 0.07 mA/A + 36 nA 0.07 mA/A + 36 nA 0.47 mA/A + 36 µA 0.18 mA/A + 24 µA 0.07 mA/A + 24 µA 0.04 mA/A + 24 µA 0.07 mA/A + 24 µA 0.47 mA/A + 47 µA 0.64 mA/A + 0.17 mA 0.47 mA/A + 0.24 mA 0.19 mA/A + 0.24 mA 0.10 mA/A + 0.24 mA 0.20 mA/A + 0.24 mA 0.35 mA/A + 0.24 mA 1.16 mA/A + 0.47 mA	Agilent 3458A opt 002	DOD Midas, OEM and GIDEP Source Procedure
² Measure Resistance Fixed Points	10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ 1 GΩ	18 µΩ/Ω + 13µΩ 14 µΩ/Ω + 0.7 mΩ 12 µΩ/Ω + 1.2 mΩ 12 µΩ/Ω + 12 mΩ 12 µΩ/Ω + 0.13 Ω 18 µΩ/Ω + 2.6 Ω 58 µΩ/Ω + 0.12 kΩ 0.58 mΩ/Ω + 12 kΩ 5.8 mΩ/Ω + 1.2 MΩ	Agilent 3458A opt 002	
² Source Capacitance 1 pF 10 pF 100 pF 1000 pF 10 nF 100 nF Algorithmic Deviation 1 pF 10 pF 100 pF 1000 pF	1 kHz 1 kHz 1 kHz 1 kHz 1 kHz 1 kHz (1 to 3) MHz (1 to 13) MHz (1 to 13) MHz (1 to 13) MHz	1.2 fF 12 fF 0.12 pF 1.2 pF 5.8 pF 58 pF 1.2 fF 12 fF 0.12 pF 1.2 pF	Hewlett Packard 16380A Set Consisting of 16381A, 16382A, 16383A, and 16384A	

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² Measure DC High Voltage	Up to 1000 V 1000 V to 2000 V 2000 V to 3000 V 3000 V to 4000 V 4000 V to 5000 V 5000 V to 6000 V	4.5 V 8.5 V 13.1 V 17.1 V 21.1 V 25.1 V	Kikusui 149-10A	DOD Midas, OEM and GIDEP Source Procedure
² Measure AC High Voltage	Up to 1000 V 1000 V to 2000 V 2000 V to 3000 V 3000 V to 4000 V 4000 V to 5000 V 5000 V to 6000 V	2.6 V 4.9 V 7.1 V 9.4 V 12.1 V 14.2 V	Kikusui 149-10A	
² Measure Insulation (DC Voltage) 100 V to 5 kV	1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ 1 GΩ 10 GΩ	2.9 Ω 28.8 Ω 0.29 kΩ 2.9 kΩ 28.8 kΩ 0.29 MΩ 5.8 MΩ 57.7 MΩ	3 RLAB HTE39 3 RLAB HTE39 3 RLAB HTE52 3 RLAB HTE39 3 RLAB HTE39 3 RLAB HTE52 3 RLAB HTE52 3 RLAB HTE72 3 RLAB HTE76	
² Source, Measure Laser Power Meter	Up to 1.5 W 1.5 to 2.5 W 2.5 to 10 W 10 to 100 W	18 % 11 % 5 % 4 %	Laser Power Meter	
² Magnetic North and South	Up to 10 G 10 to 500 G 500 to 1000 G 1000 to 15000 G	0.59 G 0.60 G 0.60 G 4.52G	Standard Magnetic	

Electromagnetic – RF / Microwave

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
² Measure Amplitude Modulation Rate: 50 Hz to 10 kHz, 5 % to 99 % 50 Hz to 100 kHz, 20 % to 99 %	150 kHz to 10 MHz 10 MHz to 1.3 GHz	2.0 % + 1 digit 1.0 % + 1 digit	HP 8902A, HP 11722A	DOD Midas, OEM and GIDEP Source Procedure
² Measure RF Tuned Power (0 to 139) dB	150 kHz to 1.3 GHz 100 kHz to 2.6 GHz	0.02 dB + 0.02 dB/10 dB Step 0.02 dB + 0.02 dB/10 dB Step	HP 8902A HP 11722A HP 8591E	
² Measure Frequency Modulation Rate: 20 Hz to 10 kHz Dev:20 Hz to 40 kHz peak Rate: 50 Hz to 200 kHz Dev:250 Hz to 400 kHz peak	250 kHz to 10 MHz 10 MHz to 1.3 GHz	0.23 kHz + 1 digit 1.15 kHz + 1 digit	HP 8902A, HP 11722A	
² Measure Phase Modulation >0.7 rad Dev. >0.6 rad Dev. Rate:200Hz to 10kHz Rate:200Hz to 20kHz	150kHz to10.0MHz 10.0MHz to1.3GHz 150kHz to10.0MHz 10.0MHz to1.3GHz	0.1 % + 0.03 rad 0.1 % + 0.03 rad 4.0 % + 1 digit 3.0 % + 1 digit	HP 8902A HP 8902A, 11722A HP	
² Measure Distortion Rate: 20 Hz to 100 kHz (0.001 to 100) %	20 Hz to 20 kHz (20 to 100) kHz	1.2 dB 2.3 dB	HP 8903B	
² Measure Noise Figure	9kHz to 1.8 GHz	0.42dB	HP 8591E	
² Measure Flatness Rate: 20 % to 80 % Rate: 90 Hz to 10 kHz	10MHz to 1.3GHz	0.07 kHz + 1 digit	HP 8902A, 11722A HP	

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² Source Frequency Level Units Rate: (+13 to -140) dBm	9 kHz to 2.05 GHz	0.06 dBm	IFR 2023B	DOD Midas, OEM and GIDEP Source Procedure
² Source Power 1 mW Reference	Up to 100 Watt	1.2 % + (0.9 res)	HP 8902A, 11722A HP	
² Source Frequency Modulation Rate: DC to 30 kHz Rate: 1kHz to 120 kHz	9 kHz to 2.05 GHz	2.8 kHz	IFR 2023B	
² Source Amplitude Modulation Rate: 9MHz to 2.05GHz, 0 % to 99.9 %	DC to 30 kHz	5 x 10 ⁻¹² Hz	IFR 2023B	
² Source Phase Modulation Rate: 100 Hz to 10 kHz Rate: 0 to 90 rad	9 kHz to 2.05 GHz	0.23 rad	IFR 2023B	
² Source Frequency Modulation Rate: 1 kHz rate Max. Dev. 0.01MHz Max. Dev. 0.04 MHz Max. Dev. 0.08 MHz Max. Dev. 3.20 MHz Max. Dev. 12.80 MHz	9 kHz to 2.05 GHz	5 x 10 ⁻¹² Hz	IFR 2023B	
² Measure Frequency	30 Hz to 5 GHz	5 x 10 ⁻¹² Hz	HP 53131A opt 050	
² Stopwatch/Timers	Up to 3600 s	5 x 10 ⁻¹² Hz	HP 53131A	
² Stroboscopes	(0 to 100000) rpm	0.00007 % of Applied + 0.58 rpm	HP 33120A	
² Measure RPM Non-Contact	(0 to 100000) rpm	0.03 % of Applied + 1.6 rpm	HP 33120A	

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
² Sound Level Meter	94 dB 114 dB	0.20 dB 0.20 dB	CEM SC - 05	DOD Midas, JIS, OEM and GIDEP Source Procedure

Dimensional

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
² Caliper	Up to 150 mm >150 mm to 200 mm >200 mm to 300 mm >300 mm to 400 mm >400 mm to 500 mm >500 mm to 600 mm	6.1 µm 6.4 µm 7.0 µm 7.9 µm 8.8 µm 9.9 µm	Gauge Block Set	DOD Midas, JIS, OEM and GIDEP Source Procedure
² Depth Gauge	Up to 150 mm >150 mm to 200 mm >200 mm to 300 mm >300 mm to 400 mm >400 mm to 500 mm >500 mm to 600 mm	6.1 µm 6.4 µm 7.0 µm 7.9 µm 8.8 µm 9.9 µm	Gauge Block Set	
² Micrometer	Up to 25 mm 25 mm to 50 mm >50 mm to 75 mm >75 mm to 100 mm >100 mm to 125 mm >125 mm to 150 mm >150 mm to 175 mm >175 mm to 225 mm >225 mm to 250 mm >250 mm to 325 mm >325 mm to 350 mm >350 mm to 400 mm >400 mm to 425 mm >425 mm to 475 mm >475 mm to 500 mm	0.73 µm 0.76 µm 0.78 µm 0.80 µm 0.83 µm 0.88 µm 0.93 µm 1.0 µm 1.1 µm 1.2 µm 1.3 µm 1.4 µm 1.5 µm 1.6 µm 1.7 µm	Gauge Block Set	
² Depth Micrometer	Up mm to 25 mm >25 mm to 50 mm >50 mm to 75 mm >75 mm to 100 mm	0.74 µm 0.76 µm 0.83 µm 0.89 µm	Gauge Block Set	

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMEN	METHOD(S)
² Disk Micrometer	Up mm to 25 mm >25 mm to 50 mm >50 mm to 75 mm >75 mm to 100 mm	0.74 µm 0.78 µm 0.83 µm 0.80 µm	Gauge Block Set	DOD Midas, JIS, OEM and GIDEP Source Procedure
² Inside Micrometer	Up mm to 25 mm >25 mm to 50 mm >50 mm to 75 mm >75 mm to 100 mm	0.73 µm 0.76 µm 0.78 µm 0.80 µm	Gauge Block Set	
² Dial Gauge Thickness Gauge	Up to 25 mm >25 mm to 50 mm >50 mm to 75 mm >75 mm to 100 mm	0.65 µm 0.89 µm 1.2 µm 1.5 µm	Gauge Block Set	
² Digital Linear Gauge	Up mm to 25 mm >25 mm to 50 mm >50 mm to 75 mm >75 mm to 100 mm	0.50 µm 0.55 µm 0.63 µm 0.72 µm	Gauge Block Set	
² Caliper Gauge (Internal and External)	Up mm to 25 mm >25 mm to 50 mm >50 mm to 75 mm >75 mm to 100 mm	0.67 µm 0.89 µm 1.2 µm 1.5 µm	Gauge Block Set	
² Height Gauge	Up mm to 150 mm >150 mm to 200 mm >200 mm to 300 mm >300 mm to 600 mm	1.13 µm 1.34 µm 1.81 µm 3.37 µm	Gauge Block Set	
² Precision Height Gauge	Up mm to 150 mm >150 mm to 200 mm >200 mm to 300 mm >300 mm to 600 mm	0.97 µm 1.2 µm 1.7 µm 3.3 µm	Gauge Block Set	
² Surface Plate	≤ 750 mm x 750 mm ≤ 1200 mm x 1200 mm ≤ 2500 mm x 2500 mm ≤ 5000 mm x 5000 mm	0.18 mm 0.19 mm 0.34 mm 1.18 mm	Straightedge and Dial Comparator	
Ruler	Up to 2000 mm	0.027 mm	Visual Measuring Machine	

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Radius Gauge	>0.5 mm to 100 mm	1.5 µm	Visual Measuring Machine	DOD Midas, JIS, OEM and GIDEP Source Procedure
Pitch Gauge	>0.1 mm to 10 mm	0.6 µm	Visual Measuring Machine	
² Working Standard Scale/ Glass Scale	Up mm to 100 mm >100 mm to 300 mm >300 mm to 400 mm >400 mm to 500 mm >500 mm to 600 mm	0.6 µm + (1.77x10 ⁻⁹ x l) 0.7 µm + (1.77x10 ⁻⁹ x l) 0.8 µm + (1.77x10 ⁻⁹ x l) 0.9 µm + (1.77x10 ⁻⁹ x l) 1.0 µm + (1.77x10 ⁻⁹ x l)	Laser Interferometer	
² Caliper Checker	Up mm to 10 mm >10 mm to 50 mm >50 mm to 75 mm >75 mm to 100 mm >100 mm to 150 mm >150 mm to 200 mm >200 mm to 300 mm >300 mm to 400 mm >400 mm to 500 mm >500 mm to 600 mm	0.46 µm 0.49 µm 0.53 µm 0.57 µm 0.73 µm 0.87 µm 1.2 µm 1.5 µm 1.8 µm 2.2 µm	Gauge Block Set	
² Ultrasonic Thickness Gages	Up to 20 mm >20 mm to 25 mm >25 mm to 50 mm >50 mm to 75 mm >75 mm to 100 mm >100 mm to 150 mm	0.64 µm 0.67 µm 0.89 µm 1.16 µm 1.46 µm 2.10 µm	Gauge Block Set	
² Coating Thickness Gauge	24 µm 52 µm 129 µm 256 µm 517 µm	0.70 µm 0.70 µm 0.70 µm 0.70 µm 0.70 µm	Thickness Standard	
Stage Micrometers / Scale Lupe	Up to 30 mm >30 to 100 mm	0.60 µm 0.71 µm	Visual Measuring Machine	
² Shims/Feeler Gages	>0.05 mm to 25 mm	0.0016 mm	Digital Micrometer	

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMEN	METHOD(S)
² Micrometer Standard / Length Gauge	>25 mm to 125 mm >125 mm to 200 mm >200 mm to 400 mm >400 mm to 500 mm	0.65 µm 0.87 µm 1.50 µm 1.83 µm	Gauge Block Set and Dial Comparator	DOD Midas, JIS, OEM and GIDEP Source Procedure
² Length Measuring Machine	Up mm to 25 mm >25 mm to 50 mm >50 mm to 75 mm >75 mm to 100 mm >100 mm to 200 mm >200 mm to 300 mm >200 mm to 300 mm	0.45 µm 0.47 µm 0.49 µm 0.53 µm 0.76 µm 1.00 µm 1.82 µm	Gauge Block Set	
² Industrial Length Measurement Standards (Length Bars, Wires, Cables)	>25 mm to 125 mm >125 mm to 200 mm >200 mm to 400 mm >400 mm to 500 mm >500 mm to 600 mm	0.65 µm 0.87 µm 1.50 µm 1.83 µm 2.18 µm	Gauge Block Set	
Test Sieves	>0.05 mm to 10 mm >10 mm to 25 mm >25 mm to 50 mm	0.60 µm 0.70 µm 1.00 µm	Visual Measuring Machine	
² Measuring Microscopes	X Axis, Y Axis Up to 50 mm >50 to 100 mm >100 to 150 mm >150 to 200 mm	0.60 µm 0.61 µm 0.71 µm 0.81 µm	Standard Scale	
² Profile Projector	X Axis, Y Axis Up to 50 mm >50 to 100 mm >100 to 150 mm >150 to 200 mm	0.76 µm 0.84 µm 0.91 µm 1.00 µm	Standard Scale	
² Can Seam Micrometer	Up to 13 mm	0.73 µm	Gauge Block	
Inclinometer / Protractors	0.1° to 360° Up to 100 mm >100 to 200 mm >200 to 300 mm	49 " 1.5 µm 2.8 µm 4.1 µm	Visual Measuring Machine	

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
² Roughness Testers	Ra 2.95 µm 3.05 µm Rz 2.95 µm 3.05 µm	0.053 µm 0.053 µm 0.45 µm 0.47 µm	Roughness Standard	DOD Midas, JIS, OEM and GIDEP Source Procedure
² Roundness Testers	Up to 1000 µm	0.09 µm	Glass Hemisphere Standard	
² Dial Gauge	Up to 25 mm	0.001 mm	Calibration Tester	
² Dial Test Indicator	Up to 1 mm	0.59 µm	Calibration Tester	
² Air Micrometer	Up to 10 µm >10 to 100 µm >100 to 1000 µm >1000 to 10000 µm	0.0058 µm 0.0059 µm 0.059 µm 0.14 µm	Calibration Tester	
² Plain Plug Gauge, Pin Gauge, Three Wires, T-probe	0.1 mm to 3 mm 3 mm to 5 mm 5 mm to 10 mm 10 mm to 15 mm	0.50 µm 0.51 µm 0.52 µm 0.54 µm	Laser Scan Diameter	
² Universal Length Machine	Up to 25 mm 25 mm to 50 mm 50 mm to 75 mm 75 mm to 100 mm 100 mm to 200 mm 200 mm to 300 mm 300 mm to 600 mm	0.45 µm 0.47 µm 0.49 µm 0.53 µm 0.76 µm 1.0 µm 1.8 µm	Gauge Block	
² Height Master	Up to 15 mm 15mm to 25 mm 25 mm to 50 mm 50 mm to 75 mm 75 mm to 100 mm 100 mm to 150 mm 150 mm to 200 mm 200 mm to 300 mm 300 mm to 600 mm	0.48 µm 0.50 µm 0.55 µm 0.63 µm 0.72 µm 0.97 µm 1.2 µm 1.7 µm 3.3 µm	Gauge Block	

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
² Universal Length Machine	Up to 25 mm 25 mm to 50 mm 50 mm to 75 mm 75 mm to 100 mm 100 mm to 200 mm 200 mm to 300 mm 300 mm to 600 mm 600 mm to 800 mm 800 mm to 1000 mm	0.033 µm 0.066 µm 0.099 µm 0.13 µm 0.27 µm 0.40 µm 0.80 µm 1.1 µm 1.3 µm	Laser Interferometer	DOD Midas, JIS, OEM and GIDEP Source Procedure
² Linear Measurement Axis (X,Y,Z)	Up to 50 mm 50 mm to 100 mm 100 mm to 200 mm 200 mm to 300 mm 300 mm to 400 mm 400 mm to 500 mm 500 mm to 600 mm 600 mm to 700 mm 700 mm to 800 mm 800 mm to 900 mm 900 mm to 1000 mm 1000 mm to 1500 mm 1500 mm to 2000 mm 2000 mm to 2500 mm 2500 mm to 3000 mm 3000 mm to 3500 mm 3500 mm to 4000 mm 4000 mm to 4500 mm 4500 mm to 5000 mm	0.066 µm 0.085 µm 0.14 µm 0.20 µm 0.26 µm 0.32 µm 0.38 µm 0.44 µm 0.50 µm 0.57 µm 0.63 µm 0.94 µm 1.3 µm 1.6 µm 1.9 µm 2.2 µm 2.5 µm 2.8 µm 3.1 µm	Laser Interferometer	
Steel Tape, Textile Tape	Up to 100 mm 100 mm to 200 mm 100 mm to 300 mm 100 mm to 400 mm 100 mm to 500 mm 100 mm to 600 mm 100 mm to 700 mm 100 mm to 800 mm 100 mm to 900 mm 100 mm to 1000 mm 100 mm to 1500 mm 100 mm to 2000 mm 100 mm to 3000 mm 100 mm to 6000 mm 100 mm to 8000 mm 100 mm to 30000 mm 100 mm to 40000 mm 100 mm to 50000 mm	0.0015 mm 0.0027 mm 0.0040 mm 0.0053 mm 0.0067 mm 0.0080 mm 0.0093 mm 0.011 mm 0.012 mm 0.013 mm 0.020 mm 0.027 mm 0.040 mm 0.080 mm 0.11 mm 0.40 mm 0.53 mm 0.66 mm	Visual Measuring Machine	

Chemical

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
² pH Meter	4.0 pH 7.0 pH 10.0 pH	0.25 pH 0.25 pH 0.25 pH	Buffer Solution	DOD Midas, OEM and GIDEP Source Procedure
² Conductivity Meter	84 µS/cm 1.414 mS/cm 12.8 mS/cm	1.52 µS/cm 0.036 mS/cm 0.21 mS/cm	Buffer Solution	
² ORP	240 mV	5.01 mV	Buffer Solution	
² TDS	1382 mg/l	5.006 mg/l	Buffer Solution	

Mechanical

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
² Scales and Balances	Up to 300 g 300 g to 1.2kg 1.2 kg to 2 kg 2 kg to 12 kg 12 kg to 20 kg 20 kg to 300 kg 300 kg to 500 kg	0.45 mg 0.0024 g 0.0031 g 0.020 g 0.029 g 0.0058 kg 0.0059 kg	Weight Set	DOD Midas, OEM and GIDEP Source Procedure
² Universal Testing Machine (Tension and Compression)	Up to 1 kN (1 to 10) kN (10 to 100) kN	0.11% 0.069% 0.14%	Force Transducer	
² Force Gauge & Push Pull	Up to 1 kN (1 to 10) kN (10 to 100) kN	0.11% 0.069% 0.14%	Force Transducer	
² Rockwell Hardness Testing Machine (Direct Measurement)	Force Up to 150 kgf	0.13 %	Force Transducer	

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
² Rockwell Hardness Testing Machine (Indirect Measurement) (Cont.)	31.7 HRC 42.7 HRC 61.7 HRC 82.3 HRA 95.1 HRB	0.41 HRC 0.42 HRC 0.41 HRC 0.72 HRA 0.81 HRB	Test Block	DOD Midas, OEM and GIDEP Source Procedure
² Hardness Durometer	Type A B E O C D DO M FO	0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.16	Force Transducer	
² Hand Torque Tool, Torque Wrench, Torque Driver, Electronic Torque	(0.2 to 1.0) N.m (1.0 to 5.0) N.m (5.0 to 10.0) N.m (10.0 to 150.0) N.m (150.0 to 250.0) N.m (250.0 to 350.0) N.m	0.006 N.m 0.10 N.m 0.12 N.m 0.46 N.m 1.00 N.m 1.40 N.m	Torque Transducer	
² Torque Transducer	(0.2 to 2) N.m (2 to 4) N.m (4 to 6) N.m (6 to 8) N.m (8 to 10) N.m (10 to 20) N.m (20 to 40) N.m (40 to 1500) N.m	0.92% 0.46% 0.31% 0.23% 0.18% 0.10% 0.06% 0.04%	Weight/ Calibration Arm 500mm	
² Pressure Gauge (Pneumatic &Hydraulic), Digital Pressure Gauge, Pressure Transducer, Differential Pressure Gauge, Pressure Transmitter, Manometer, Pressure Switch Vacuum Gauge	(0 to 300) psi (0 to 70000) kPa	0.033 psi 12 kPa	Pressure Calibrator	

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
² Flow Meter (Air Flow)	Up to 20 L/min 20 to 40 L/min 40 to 60 L/min 60 to 80 L/min 80 to 100 L/min	0.0033 L/min 0.0045 L/min 0.0061 L/min 3.0 L/min 8.0 L/min	Digital Pressure Loop Calibrator	DOD Midas, OEM and GIDEP Source Procedure
² Vibration	1m/s ² 2m/s ² 5m/s ² 10m/s ² 50m/s ² 100m/s ² 200 m/s ² 300 m/s ²	0.06 % 0.06 % 0.14 % 0.27 % 1.4 % 2.7 % 5.4 % 8.1 %	3-AXIS G Force Data Logger	
² Mass	1 mg 2 mg 5 mg 10 mg 20 mg 50 mg 100 mg 200 mg 500 mg 1 g 2 g 5 g 10 g 20 g 50 g 100 g 200 g 500 g 1 kg 2 kg 5 kg 10 kg 20 kg	0.013 mg 0.013 mg 0.013 mg 0.013 mg 0.014 mg 0.014 mg 0.015 mg 0.016 mg 0.018 mg 0.12 mg 0.12 mg 0.12 mg 0.12 mg 0.13 mg 0.14 mg 0.20 mg 0.31 mg 0.40 mg 0.71 mg 29 mg 29 mg 29 mg 29 mg	Weight	

Thermodynamic

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
² Thermo-Hygrometer Temperature Humidity	(10 to 40) °C (20 to 85) %RH	0.65 °C 1.8 %RH	Temp/Humidity Standard	DOD Midas, OEM and GIDEP Source Procedure
² Air Temperature Controlled chamber Hot Air Oven	(50) °C (50 to 100) °C (100 to 200) °C	0.45 °C 0.53 °C 0.79 °C	Agilent 34970A	
² Incubator	(10 to 50) °C	0.38 °C	Agilent 34970A	
² Refrigerator	(0 to 10) °C	0.38 °C	Agilent 34970A	
² Freezer	-80 to 0 °C	0.38 °C	Agilent 34970A	
² Dial Thermometer	-25 to 0 °C 0 to 100 °C 100 to 300 °C	0.38°C 0.53°C 0.45°C	Temp Indicator with Thermocouple Standard	
² Thermocouple Sensor Type K, J, E, T, N, R, S	-25 to 0 °C 0 to 100 °C 100 to 300 °C	0.39°C 0.53°C 0.45°C	Temp Indicator with Thermocouple Standard	
² Thermocouple Sensor Type RTD	-25 to 0 °C 0 to 100 °C 100 to 300 °C	0.39°C 0.53°C 0.45°C	Temp Indicator with Thermocouple Standard	
² Digital Thermometer With Sensor Type K, J, E, T, N, R, S	-25 to 0 °C 0 to 100 °C 100 to 300 °C	0.38°C 0.53°C 0.45°C	Temp Indicator with Thermocouple Standard	
² Digital Thermometer With Sensor Type RTD	-25 to 0 °C 0 to 100 °C 100 to 300 °C	0.39°C 0.53°C 0.45°C	Temp Indicator with Thermocouple Standard	

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
² Dry Block / Temp Bath	-25 to 0 °C 0 to 100 °C 100 to 300 °C	0.53°C 0.64°C 0.57°C	Temp Indicator with Thermocouple Standard	DOD Midas, JIS, OEM and GIDEP Source Procedure
² Autoclave	110 °C 121 °C 135°C	0.73 °C 0.73 °C 0.73 °C	Agilent 34970A	
² Liquid in Glass	-25 to 0 °C 0 to 100 °C 100 to 300 °C	0.41°C 0.55°C 0.47°C	Temp Indicator with Thermocouple Standard	
² Temperature & Humidity Chamber	(10 to 40) °C (20 to 85) %RH	0.65 °C 1.8 %RH	Temp/Humidity Standard	

Environment

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
² UV Meter (UVA)	Up to 500 mW/cm ²	2.4 %	UV Meter STD	DOD Midas, OEM and GIDEP Source Procedure
² Gloss Meter 60°	95.5 GU	1.92 GU	Gloss Standard HORIBA	
² Lux Meter	Up to 10 lx 10 to 20 lx 20 to 60 lx 60 to 100 lx 100 to 200 lx 200 to 1000 lx 1000 to 1500 lx 1500 to 2000 lx 2000 to 3000 lx 3000 to 4000 lx 4000 to 5000 lx	0.68 lx 0.58 lx 2.1 lx 3.4 lx 6.8 lx 34 lx 61 lx 68 lx 101 lx 135 lx 168 lx	Digital Light Meter LX-91	
² Velocity	Up to 15 m/s	0.18 m/s	Anemometer	

PARAMETER / EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT	METHOD(S)
² Color Meter Color Reader	White L* a* b* Y x y Black L* a* b* Y x y	0.63 % 0.29% 0.10% 0.04% 0.20% 0.25% 0.62% 0.37% 0.42% 0.04% 0.37% 0.42%	Glossy Tile	DOD Midas, OEM and GIDEP Source Procedure