Issue date: 11 October 2023
Valid Until: 14 September 2028

NO: SAMM 088

LABORATORY LOCATION/ CENTRAL OFFICE:	SIRIM Calibration Sdn Bhd, Shah Alam Lot 12, 18 & 20 Jalan Beremban 15/12 Seksyen 15 40200 Shah Alam, Selangor , 40200, SELANGOR MALAYSIA
ACCREDITED SINCE :	14 SEPTEMBER 1995
FIELD(S) OF CALIBRATION:	ELECTRICAL HEAT & TEMPERATURE DIMENSIONAL MASS FORCE TORQUE PRESSURE VOLUME DENSITY ACOUSTIC & VIBRATION

This laboratory has demonstrated its technical competence to operate in accordance with MS ISO/IEC 17025:2017 (ISO/IEC 17025:2017).

This laboratory's fulfillment of the requirements of ISO/IEC 17025 means the laboratory meets both the technical competence requirements and management system requirements that are necessary for it to consistently deliver technically valid test results and calibrations. The management system requirements in ISO/IEC 17025 are written in language relevant to laboratory operations and operate generally in accordance with the principles of ISO 9001 (see Joint ISO-ILAC-IAF Communiqué dated April 2017).

*** The uncertainty covered by the CMC is expressed as the expanded uncertainty corresponding to a coverage probability of approximately 95 % and have a coverage factor of k=2 unless stated otherwise.**

CENTRAL LOCATION	SIRIM Calibration Sdn Bhd, Shah Alam Lot 12, 18 & 20 Jalan Beremban 15/12 Seksyen 15 40200 Shah Alam, Selangor , 40200, Selangor
FIELD(S) OF CALIBRATION :	ELECTRICAL, HEAT & TEMPERATURE, DIMENSIONAL, MASS, FORCE, TORQUE, PRESSURE, VOLUME, DENSITY, ACOUSTIC & VIBRATION

SCOPE OF CALIBRATION : ELECTRICAL

Instrument Calibrated/Measurement Parameter	**Range**	**Calibration and Measurement Capability Expressed as an Uncertainty (±)***	**Remarks**
Measuring Instrument Dc Voltage	± 220 mV Range ± (0 mV to 220 mV) ± 2.2 V Range ± (0 V to 2.2 V) ± 11 V Range ± (0 V to 11 V) ± 22 V Range ± (0 V to 22 V) ± 220 V Range ± (0 V to 220 V) ± 1100 V Range ± (100 V to 1100 V)	7.5 µV/V + 0.4 µV 5 µV/V + 0.7 µV 3.5 µV/V + 2.5 µV 3.5 µV/V + 4 µV 5 µV/V + 40 µV 6.5 µV/V + 0.4 mV	Fluke 5730A
Measuring Instrument Ac Voltage	2.2 mV to 220 V (See Matrix A)	(See Matrix A)	Fluke 5730A
	1100 V Range (110 V to 1100 V) 15 Hz to 50 Hz 50 Hz to 1 kHz	360 µV/V + 20 mV 85 µV/V + 4 mV	Fluke 5730A

Instrument Calibrated/Measurement Parameter	**Range**	**Calibration and Measurement Capability Expressed as an Uncertainty (±)***	**Remarks**
	800 V to 1050 V 1 kHz to 3 kHz 3 kHz to 10 kHz 10 kHz to 20 kHz	0.8 mV/V + 0.13 V 0.8 mV/V + 0.21 V 1.2 mV/V + 0.32 V	Wavetek 9100
Measuring Instrument Dc Current	± 220 µA Range ± (0 µA to 220 µA) ± 2.2 mA Range ± (0 mA to 2.2 mA) ± 22 mA Range ± (0 mA to 22 mA) ± 220 mA Range ± (0 mA to 220 mA) ± 2.2 A Range ± (0 A to 2.2 A)	40 µA/A + 6 nA 35 µA/A + 7 nA 35 µA/A + 40 nA 45 µA/A + 0.7 µA 80 µA/A + 12 µA	Fluke 5730A
	± 3.2 A Range ± (0.32 A to 3.2 A) ± 10.5 A Range ± (3.2 A to 10.5 A) ± 20 A Range ± (10.5 A to 20 A)	0.6 mA/A + 0.12 mA 0.55 mA/A + 0.94 mA 0.55 mA/A + 4.5 mA	Wavetek 9100
Measuring Instrument Ac Current	9 µA to 2.2 A (See Matrix B)	(See Matrix B)	Fluke 5730A

Instrument Calibrated/Measurement Parameter	**Range**	**Calibration and Measurement Capability Expressed as an Uncertainty (±)***	**Remarks**
	0.32 A to 3.2 A 10 Hz to 3 kHz 3 kHz to 10 kHz 3.2 A to 10.5 A 10 Hz to 3 kHz 3 kHz to 10 kHz 10.5 A to 20 A 10 Hz to 3 kHz 3 kHz to 10 kHz	1 mA/A + 0.48 mA 2.5 mA/A + 2.6 mA 2 mA/A + 3 mA 5 mA/A + 10 mA 2 mA/A + 6.9 mA 5 mA/A + 23 mA	Wavetek 9100
Measuring Instrument Resistance Fixed Value	1 mΩ 10 mΩ 100 mΩ 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	0.2 mΩ/Ω 0.1 mΩ/Ω 0.02 mΩ/Ω 5 μΩ/Ω 95 μΩ/Ω 5 μΩ/Ω 23 μΩ/Ω 5 μΩ/Ω 10 μΩ/Ω 5 μΩ/Ω 6.5 μΩ/Ω 5 μΩ/Ω 6.5 μΩ/Ω 5 μΩ/Ω 8.5 μΩ/Ω 5 μΩ/Ω 18 μΩ/Ω 5 μΩ/Ω 47 μΩ/Ω	Fluke 5730A & Fluke 742A Series Resistance Standard
	100 MΩ 1 GΩ 10 GΩ 100 GΩ 1 TΩ	0.1 mΩ/Ω 5 μΩ/Ω 0.02 Ω/Ω 0.05 Ω/Ω 0.05 Ω/Ω	Fluke 5730A & Takeda Riken TR45 Series Standard Resistor

Instrument Calibrated/Measurement Parameter	**Range**	**Calibration and Measurement Capability Expressed as an Uncertainty (±)***	**Remarks**
Residual Current	3 mA to 3A At Time interval up to 5 s At Time interval <190 ms	0.14 mA/A 0.3 mA/A	For RCD Tester Calibrator (using Transmille 3200)
Capacitance Fixed Value	(See Matrix C)	(See Matrix C)	Wavetek 9100
	20z to 1 MHz 1 pF, 10 pF, 100 pF, 1000 pF, 0.01 µF, 0.1 µF and 1.0 µF	1 mF/F	HP 1600A series
Inductance Fixed Value	100 µH @ 1 kHz (1, 10, 100) mH @ 1 kHz 1H @ 1 kHz	2.5 mH/H 1 mH/H 1 mH/H	Ando RS-100 series
Power/ Energy (dc)	1 kW to 20 kW 0.1 W to 1 kW	0.7 mW/W 0.22 mW/W	Fluke 5522A
Power / Energy (ac), (45 Hz To 65 Hz At Pf=1)	10 kW to 20 kW 1 W to 10 kW 0.1 W to 1 W	1 mW/W 0.9 mW/W 1 mW/W	Fluke 5522A
High Voltage Meter Dc Voltage Ac Voltage @ (50/60) Hz	0.5 kV to 10 kV	0.35 mV/V + 0.07 V 1 mV/V + 0.2 V	Vitrek (4700 & HVP 35) and TOS 5101
Clamp Meter Dc Current 10 -“ Turn Coil	± 3.2 A to 32 A ± 32 A to 105 A ± 105 A to 200 A	0.06 mA/A + 1.18 mA 0.55 mA/A + 9.4 mA 0.55 mA/A + 45 mA	Wavetek 9100 c/w Current Coil
Clamp Meter Dc Current 50 -“ Turn Coil	± 16 A to 160 A ± 160 A to 525 A ± 525 A to 1000 A	0.6 mA/A + 5.9 mA 0.55 mA/A + 47 mA 0.55 mA/A + 0.23 A	Wavetek 9100 c/w Current Coil
Clamp Meter 50 - Turn Coil	16 A to 160 A 10 Hz to 100 Hz 160 A to 1000 A 10 Hz to 100 Hz	2 mA/A + 28 mA 2.1 mA/A + 0.45 A	Wavetek 9100 c/w Current Coil

Instrument Calibrated/Measurement Parameter	**Range**	**Calibration and Measurement Capability Expressed as an Uncertainty (±)***	**Remarks**
Ac Current 10 -“ Turn Coil	3.2 A to 32 A 10 Hz to 100 Hz 100 Hz to 440 Hz 32 A to 200 A 10 Hz to 100 Hz 100 Hz to 440 Hz	2 mA/A + 5.5 mA 7.8 mA/A + 27 mA 2.1 mA/A + 90 mA 6.7 mA/A + 0.25 A	Wavetek 9100 c/w Current Coil
Insulation Tester	(1 kΩ to 10 kΩ) @ 10 V	26 µΩ/Ω + 0.6 Ω	Biddle 726349
	(10 kΩ to 100 kΩ) @ 50 V (0.1 MΩ to 1 MΩ) @ 150 V (1 MΩ to 10 MΩ) @ 300 V (10 MΩ to 100 MΩ) @ 500 V (0.1 GΩ to 1 GΩ) @ 1000 V (1 GΩ to 10 GΩ) @ 5000 V (10 GΩ to 100 GΩ) @ 5000 V (100 GΩ to 600 GΩ) @ 5000	16 µΩ/Ω + 0.47 Ω 34 µΩ/Ω + 0.68 kΩ 5.1 µΩ/Ω + 0.67 kΩ 73 µΩ/Ω + 5.5 kΩ 73 µΩ/Ω + 55 kΩ 0.28 mΩ/Ω + 0.7 MΩ 4.1 mΩ/Ω + 0.43 MΩ 4.3 mΩ/Ω + 4.1 MΩ	IET HRRS-Q-9-10k
Oscilloscope Vertical Deflection Dc Signal	0 V to ± 6.6 V (50 Ω Load) 0 V to ± 130 V (1 MΩ Load)	2.5 mV/V+ 0.04 mV 0.5 mV/V + 0.04 mV	Fluke 5500A SC600
Vertical Deflection	± 1 mVp-p to ± 6.6 Vp-p (50 Ω Load)	2.5 mVp-p/Vp-p + 0.04mVp-p	Fluke 5500A SC600
Square Wave Signal	± 1 mVp-p to ± 130 Vp-p (1 MΩ Load)	1 mVp-p/Vp-p + 0.04 mVp-p	Fluke 5500A SC600
Horizontal Deflection Time Markers (50 ï•— Load)	2 ns/div to 20 ms/div 50 ms/div to 5 s/div	2.5 µs/s (25+(Output x 1000)) µs/s	Fluke 5500A SC600
Rise Time	≤ 300 ps	+0 ns / -0.1 ns	Fluke 5500A SC600

Instrument Calibrated/Measurement Parameter	**Range**	**Calibration and Measurement Capability Expressed as an Uncertainty (±)***	**Remarks**
Bandwidth Frequency	50 kHz to 600 MHz	2.5 µHz/Hz	Fluke 5500A SC600
	600 MHz to 40 GHz (+11 dBm to –135 dBm)	7 nHz/Hz	Agilent E8257D Reference to SPIRENT STR 4500
Bandwidth Amplitude	50 kHz to 600 MHz	0.03 Vp-p	Fluke 5500A SC600
	600 MHz to 40 GHz (+11 dBm to –135 dBm)	0.92 dBm	Agilent E8257D
Time & Frequency 1. Measuring Instrument Time	1 s to 24 Hrs	0.06 µs/s + 0.021 s	Agilent 33250A & Universal Counter HP 53132A
	20 ms to 5 s	0.7 ms	For RCD Tester Calibrator (using Transmille 3200)
Time & Frequency Residual Current Duration	10 ms to 5 s	0.4 ms	For RCD Tester Calibrator (using Transmille 3200)
Time & Frequency Rpm Measuring Instruments (non Contact)	(60 to 5999) rpm (6000 to 29999) rpm (30000 to 59999) rpm (60000 to 99999) rpm	13 µrpm/rpm + 9.3 mrpm 31 µrpm/rpm - 66 mrpm 0.36 prpm/rpm + 0.72 rpm 0.62 prpm/rpm + 0.72 rpm	In-House method, ESF/0303
Time & Frequency 2.generating Instrument Rpm Non-contact Measurement	10 to 29 rpm 30 to 59 rpm 60 to 99 rpm 100 to 299 rpm 300 to 599 rpm 600 to 999 rpm 1000 to 2999 rpm 3000 to 5999 rpm 6000 to 9999 rpm 10000 to 29999 rpm 30000 to 59999 rpm 60000 to 99999 rpm	0.014 rpm 0.036 rpm 0.07 rpm 0.14 rpm 0.37 rpm 0.7 rpm 1.4 rpm 3.6 rpm 7 rpm 14 rpm 36 rpm 70 rpm	In-House method, ESF/0303
Time & Frequency Contact Measurement	20 to 29 rpm 30 to 59 rpm 60 to 99 rpm 100 to 299 rpm 300 to 599 rpm 600 to 999 rpm 1000 to 2999 rpm 3000 to 5999 rpm 6000 to 9999 rpm 10000 to 12999 rpm 13000 to 25999 rpm 26000 to 29999 rpm	0.011 rpm 0.016 rpm 0.029 rpm 0.07 rpm 0.16 rpm 0.29 rpm 0.7 rpm 1.6 rpm 2.9 rpm 7 rpm 8 rpm 14 rpm	In-House method, ESF/0303

Instrument Calibrated/Measurement Parameter	**Range**	**Calibration and Measurement Capability Expressed as an Uncertainty (±)***	**Remarks**
Sourcing/generating Instrument Dc Voltage	± 100 mV Range ± (100 µV to 120 mV) ±1 V Range ± (100 mV to 1.2 V) ± 10 V Range ± (1 V to 12 V) ±100 V Range ± (10 V to 120 V) ±1000 V Range ± (100 V to 1050 V)	5 µV/V + 0.3 µV 4 µV/V + 0.3 µV 4 µV/V + 0.5 µV 6 µV/V + 0.03 mV 6 µV/V + 0.1 mV	HP 3458A Opt. 002
	200 mV 2 V 20 V 200 V 1000 V	2.7 µV/V + 0.5 µV 2.7 µV/V + 0.2 µV 2.7 µV/V + 0.2 µV 4.0 µV/V + 0.2 µV 4.0 µV/V + 0.2 µV	Fluke 8508A with Guildline 7520 & Fluke 732B
Ac Voltage	2.2 mV to 1000V (See Matrix D)	(See Matrix D)	Fluke 5790A
	10 mV to 700V (See Matrix E)	(See Matrix E)	HP 3458A Opt. 002
	(0 kV to 9.99 kV) @ 50/60 Hz (10 kV to <20 kV) @ 50/60 Hz (20 kV to 28 kV) @ 50/60 Hz	1.2 mV/V + 0.1 V 1 mV/V + 0.2 V 1 mV/V + 0.2 V	Vitrek 4700 with (HVL-100, HVL-70 & HVP-35)

Instrument Calibrated/Measurement Parameter	**Range**	**Calibration and Measurement Capability Expressed as an Uncertainty (±)***	**Remarks**
Dc Current	200 µA 2 mA 20 mA 200 mA 2 A 10 A	6.5 µA/A + 2.0 µA 6.5 µA/A + 2.0 µA 8.0 µA/A + 2.0 µA 33.0 µA/A + 4.0 µA 170.0 µA/A + 8.0 µA 380.0 µA/A + 20.0 µA	Fluke 8508A with Guildline 7520 & Fluke A40B Series
	± (1 nA to 100 nA) ± (100 nA 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)	30 µA/A + 0.04 nA 20 µA/A + 0.04 nA 20 µA/A + 0.1 nA 20 µA/A + 0.8 nA 20 µA/A + 5 nA 20 µA/A + 0.05 µA 35 µA/A + 0.5 µA 0.11 mA/A + 0.01 mA	HP 3458A Opt. 002
	± (1 pA to 20 pA) ± (20 pA to 200 pA) ± (200 pA to 2 nA)	26 mA/A 26 mA/A 10 mA/A	Agilent 4339B
	± (1 A to 10 A) ± (10 A to 100 A)	5.1 mA 0.05 A	HP 3458A & Guildline 9211A

Instrument Calibrated/Measurement Parameter	**Range**	**Calibration and Measurement Capability Expressed as an Uncertainty (±)***	**Remarks**
Resistance	0 Ω to 10 Ω 10 Ω to 100 Ω 0.1 kΩ to 1 kΩ 1 kΩ to 10 kΩ 10 kΩ to 100 kΩ 0.1 MΩ to 1 MΩ 1 MΩ to 10 MΩ 10 MΩ to 100 MΩ 100 MΩ to 1 GΩ 1 GΩ to 2 GΩ 2 GΩ to 20 GΩ 20 GΩ to 200 GΩ 0.2 TΩ to 2 TΩ 2 TΩ to 20 TΩ 20 TΩ to 200 TΩ	15 µΩ/Ω + 0.05 mΩ 12 µΩ/Ω + 0.5 mΩ 10 µΩ/Ω + 0.5 mΩ 10 µΩ/Ω + 5 mΩ 10 µΩ/Ω + 0.05 Ω 15 µΩ/Ω + 2 Ω 50 µΩ/Ω + 0.1 kΩ 0.5 mΩ/Ω + 1 kΩ 5 mΩ/Ω + 0.01 MΩ 2.3 mΩ/Ω + 0.01 MΩ 2.3 mΩ/Ω + 0.1 MΩ 3.5 mΩ/Ω + 1 MΩ 3.5 mΩ/Ω + 0.01 GΩ 10 mΩ/Ω + 0.1 GΩ 12 mΩ/Ω + 1 GΩ	HP 3458A Opt 002 & Keithley 6517 / Agilent 4339A
	0 Ω to 2 Ω, 20 MΩ 100 MΩ	8 µΩ/Ω 10 µΩ/Ω 31 µΩ/Ω	Fluke 8508A with Guildline 7520 & Fluke A40B Series
High Voltage Tester Dc Voltage	0 kV to 9.99 kV 10 kV to <20 kV 20 kV to 35 kV >35 kV to 40 kV	0.3 mV/V + 0.03 V 0.35 mV/V + 0.07 V 0.35 mV/V + 0.07 V 0.4 mV/V + 0.2 V	Vitrek 4700 with (HVL-100, HVL-70 & HVP-35)
1. Measuring Instrument Frequency	1 µHz to 80 MHz (10 mVpp to 10 Vpp) 250 kHz to 40 GHz (+11 dBm to –135dBm)	0.23 nHz/Hz + 0.67 mHz 5.2 nHz/Hz + 46 µHz	(Agilent 33250A or Agilent E8257D) Reference to Pendulum 6689
1. Measuring Instrument Amplitude	10 mVp-p to 10 Vp-p (1 µHz to 80 MHz, Into 50 Ω)	10 mVpp/Vpp + 1 mVpp	Agilent 33250A
	+11 dBm to –135dBm (250 kHz to 40 GHz)	0.92 dBm	Agilent E8257D
1. Measuring Instrument Flatness	Sine Wave Relative to 1 kHz (Auto range on)	0.4 dBm	Agilent 33250A
2. Generating Instrument Frequency	1 Hz to 5 GHz	0.32 nHz/Hz	HP53132A Reference to Pendulum 6689
Amplitude/ Level	-20 dBm to +30 dBm (100 kHz to 2.6 GHz)	0.04 dBm	HP 8902 with 11722A
Rf Amplitude/ Level	-36 dB to +20 dB (9 kHz to 6 GHz)	38 mdBm/dBm + 5.3 mdBm	Agilent E4419B with E9304A

Instrument Calibrated/Measurement Parameter	**Range**	**Calibration and Measurement Capability Expressed as an Uncertainty (±)***	**Remarks**
Tuned Rf Level	-127 dB to 0 dB (2.5 MHz to 1.3 GHz)	0.07 dBm	HP 8902 with 11722A
Modulation Related Signal: Amplitude Modulation (am) Am Depth: 5% To 99%	Carrier Frequency 150 kHz to 10 MHz Modulation Frequency 50 Hz to 10 kHz Carrier Frequency 150 kHz to 1300 MHz Modulation Frequency 20 Hz to 10 kHz Carrier Frequency 10 MHz to 1300 MHz Modulation Frequency 50 Hz to 100 kHz	0.17% 0.19% 0.13%	HP 8902 with 11722A
Frequency Modulation (fm) Fm Deviation: ? 40 Khz Peak	Carrier Frequency 150 kHz to 10 MHz Modulation Frequency 20 Hz to 10 kHz	0.13 kHz	HP 8902 with 11722A
Fm Deviation: ? 400 Khz Peak	Carrier Frequency 10 MHz to 1300 MHz Modulation Frequency 50 Hz to 100 kHz Carrier Frequency 10 MHz to 1300 MHz Modulation Frequency 100 kHz to 200 kHz	0.03 kHz 0.32 kHz	HP 8902 with 11722A
Phase Modulation (Ï†m) Ï†m Deviation: ? 40 Radians Peak	Carrier Frequency 150 kHz to 10 MHz Modulation Frequency 200 Hz to 10 kHz	0.15 Radians	HP 8902 with 11722A
Ï†m Deviation: ? 400 Radians Peak	Carrier Frequency 10 MHz to 1.3 GHz Modulation Frequency 200 Hz to 20 kHz	0.14 Radians	HP 8902 with 11722A
Distortion Related Signal: Audio Distortion (-99 To 0) Db	Fundamental Frequency 20 Hz to 20 kHz Fundamental Frequency 20 kHz to 100 kHz	1 dB 2 dB	HP 8903B
Generating Instrument Ac Current	5 µA to 1 A (See Matrix F)	(See Matrix F)	HP 3458A

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Instrument Calibrated/Measurement Parameter	**Range**	**Calibration and Measurement Capability Expressed as an Uncertainty (±)***	**Remarks**
	200 µA to 10 A (See Matrix G)	(See Matrix G)	Fluke 8508A with Guildline 7520 & Fluke A40B Series
	1 A to 50 A 50 Hz/ 60 Hz	0.5 mA/A	HP 3458A & Zenith H007098
Generating Instrument Capacitance	1 pF to 1 mF @ (10 Hz to 1 MHz)	0.5 mF/F	HP 4284A
Generating Instrument Inductance	1 µH to 10 H @ (10 Hz to 1 MHz)	0.5 mH/H	HP 4284A
Generating Instrument High Voltage Tester Dc Voltage	0 kV to 9.99 kV 10 kV to <20 kV 20 kV to 35 kV >35 kV to 40 kV	0.3 mV/V + 0.03 V 0.35 mV/V + 0.07 V 0.35 mV/V + 0.07 V 0.4 mV/V + 0.2 V	Vitrek 4700 with (HVL-100, HVL-70 & HVP-35)
Generating Instrument Ac Voltage	(0 kV to 9.99 kV) @ 50/60 Hz (10 kV to <20 kV) @ 50/60 Hz (20 kV to 28 kV) @ 50/60 Hz	1.2 mV/V + 0.1 V 1 mV/V + 0.2 V 1 mV/V + 0.2 V	Vitrek 4700 with (HVL-100, HVL-70 & HVP-35)

SCOPE OF CALIBRATION : HEAT & TEMPERATURE

Instrument Calibrated/Measurement Parameter	**Range**	**Calibration and Measurement Capability Expressed as an Uncertainty (±)***	**Remarks**
Liquid In-glass Thermometer (partial Immersion)	0 ºC to 200 ºC	2 ºC	Comparison method using SPRT / PRT in liquid bath.
Liquid In-glass Thermometer (total Immersion)	- 80 ºC to 0 ºC 0 ºC to 80 ºC 80 ºC to 250 ºC 250 ºC to 500 ºC	0.05 ºC 0.03 ºC 0.05 ºC 0.10 ºC	Comparison method using SPRT / PRT in liquid bath.
Platinum Resistance Thermometer	- 80 ºC to 600 ºC 600 ºC to 950 ºC	0.05 ºC 0.5 ºC	Comparison method using SPRT / PRT in liquid bath/dry block
Thermocouple	- 80 ºC to 600 ºC 600 ºC to 950 ºC	0.1 ºC 0.3 ºC	Comparison method using SPRT/ PRT/ Standard Thermocouple Type R liquid bath/dry block
Psychrometer Thermohygrograph Thermohygrometer	10 ºC to 50 ºC 35 % to 95 %RH	0.5 ºC 3.0 %RH	Comparison method using: 1) PT100 sensor for wet and dry bulb based on BS1339-1: 2002 in climatic chamber 2) Temperature Humidity Meter in Climatic Chamber.
Temperature Switch	- 50 ºC to 10 ºC 10 ºC to 100 ºC 100 ºC to 600 ºC	1 º C 2 º C 3 º C	Comparison method using SPRT/ PRT/ Thermocouple Type R in liquid bath/dry block
Mechanical Thermometer	- 80 ºC to 100 ºC 100 ºC to 200 ºC 200 ºC to 600 ºC	0.1 ºC 0.6 ºC 1.5 ºC	Comparison method using SPRT/ PRT/ Thermocouple Type R in liquid bath/dry block
Temperature Calibrator (dry Block)	- 30 ºC to 600 ºC 600 ºC to 950 ºC	0.11 ºC 0.63 ºC	EA-10 /13 (EAL Guideline for calibration of Dry block Calibrator)
Temperature Indicating Instruments K - Type	- 200 ºC to 0 ºC 0 ºC to 1300 ºC	0.4 ºC 0.4 ºC	Calibration by Electrical simulation using Temperature Calibrator
Temperature Indicating Instruments J - Type	- 200 ºC to 0 ºC 0 ºC to 1100 ºC	0.3 ºC 0.3 ºC	Calibration by Electrical simulation using Temperature Calibrator

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Instrument Calibrated/Measurement Parameter	**Range**	**Calibration and Measurement Capability Expressed as an Uncertainty (±)***	**Remarks**
Temperature Indicating Instruments T - Type	- 200 ºC to 0 ºC 0 ºC to 400 ºC	0.5 ºC 0.4 ºC	Calibration by Electrical simulation using Temperature Calibrator
Temperature Indicating Instruments E - Type	- 200 ºC to 0 ºC 0 ºC to 900 ºC	0.4 ºC 0.3 ºC	Calibration by Electrical simulation using Temperature Calibrator
Temperature Indicating Instruments R - Type	0 ºC to 1000 ºC 1000 ºC to 1700 ºC	1.3 ºC 1.1 ºC	Calibration by Electrical simulation using Temperature Calibrator
Temperature Indicating Instruments S - Type	0 ºC to 1000 ºC 1000 ºC to 1700 ºC	1.3 ºC 1.2 ºC	Calibration by Electrical simulation using Temperature Calibrator
Temperature Indicating Instruments Pt 100	- 200 ºC to 0 ºC 0 ºC to 800 ºC	0.2 ºC 0.5 ºC	Calibration by Electrical simulation using Temperature Calibrator

SCOPE OF CALIBRATION : DIMENSIONAL

Instrument Calibrated/Measurement Parameter	**Range**	**Calibration and Measurement Capability Expressed as an Uncertainty (±)***	**Remarks**
Gauge Block (imperial Units)	0.05 inch to 4 inch	(0.004 + 1.0 L) µinch L in inch	Gauge block
Bevel Protractor	0 to 360 degrees: Graduation 5 min. Graduation 1 deg	3 minute 0.5 degree	Angle block
Snap Gauge / Caliper Gauge	Up to 200 mm	5 µm	Uni. Measuring M/c
Micrometer 25 Mm Travels For Frame Sizes 25 Mm, 50 Mm, 75 Mm And 100mm	0.001 mm to 100 mm	2 µm	Gauge Block
Caliper	0.01 mm to 300 mm 300 mm to 600 mm 600 mm to 1000 mm	7 µm 9 µm 12 µm	Gauge Block Caliper Checker
Height Gauge	0.01 mm to 600 mm	10 µm	Caliper Checker
Caliper Checker	20 mm to 300 mm 301 mm to 600 mm	3 µm 9 µm	Long Gauge block
Calibration Tester	0 mm to 25 mm	2 µm	Dig.Length Indicator /Gauge Block
Dial / Digital Test Indicator	0.001 mm to 100 mm	2 µm	Dial gauge testing machine
Dial / Digital Gauge	0.001 mm to 100 mm	2 µm	Dial gauge testing machine
Dial / Digital Thickness Gauge	0.01 mm to 50 mm	5 µm	Gauge Block
Depth Micro-checker	0 mm to 300 mm	6 µm	Gauge Block / Pre. Height Gauge
Feeler Gauge	0.005 mm to 2.0 mm	3 µm	Dig.Length Indicator
Glass Scale	up to 200 mm 200 mm to 300 mm	3.8 µm 5.6 µm	Uni. Measuring M/c
Grind Gauge/fine Gauge	0.001 mm to 0.15 mm	2 µm	Dig. Length Indicator
Height Master	0.001 mm to 600 mm	6 µm	Pre. Height Gauge / Gauge Block
Ruler	0.1 mm to 2000 mm	0.1mm	Linear scale
Mu-checker	0.1 mm to 2000 µm	2 µm	Gauge Block
Precision Height Gauge	0.001 mm to 600 mm	4 µm	Gauge Block
Straight Edge	0 mm to 600 mm	1.5 µm	Dig.Length Indicator / Straight edge
Tape	0 m to 100 m	(0.33 + 0.019 L) mm L is length in unit meter	Linear scale

Instrument Calibrated/Measurement Parameter	**Range**	**Calibration and Measurement Capability Expressed as an Uncertainty (±)***	**Remarks**
Thickness Foil	0.001 mm to 2.0 mm	3 µm	Dig.Length Indicator
Setting/standard Rod	25 mm to 100 mm 100 mm to 600 mm	(0.15 + 0.0064 L) (0.11 + 0.008 L) L is length in unit mm	Universal Length Machine and Gauge Block
Plain Pin Or Plug Gauge (diameter Only)	0.2 mm to 50 mm	0.5 µm	Universal Length Machine
Plain Ring Gauge (diameter Only)	1 mm to 100 mm 100 mm to 200 mm	(0.007 L+ 0.11) µm (0.0064 L+ 0.41) µm L is diameter in unit mm	Universal Length Machine and Gauge Block
Thread Plug Gauge (simple Pitch Diameter)	2 mm to 50 mm	2 µm	Universal Length Machine (In-house Method)
Length Machine (for In-house Equipment Only)	0 mm to 1 m 0 mm to 10 m	0.1 mm 0.4 mm	Standard Scale
Universal Measuring Microscope (individual Linear Axis Onlyfor In-house Equipment Only)	0 mm to 200 mm	2.5 µm	Standard Scale
Digital Length Indicator	0 to 25 mm	0.4 µm	Gauge Block
Gauge Block	0.5 mm to 100 mm 100 mm to 250 mm	(0.1 + 1.0 L) µm L in m	Reference Equipment: Gauge block

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SCOPE OF CALIBRATION : MASS

Instrument Calibrated/Measurement Parameter	**Range**	**Calibration and Measurement Capability Expressed as an Uncertainty (±)***	**Remarks**
Standard Weights Class E2, F1, F2, M1, M2 & M3	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	0.002 mg 0.002 mg 0.003 mg 0.003 mg 0.003 mg 0.004 mg 0.005 mg 0.006 mg 0.008 mg 0.010 mg 0.012 mg 0.016 mg 0.020 mg 0.026 mg 0.04 mg 0.05 mg 0.10 mg 0.26 mg 0.51 mg 1.3 mg 3.0 mg 16 mg 100 mg	With general reference to OIML R111. Mass comparison using: ABBA weighing scheme for weights of OIML classes E2 and F1; and AB, AB weighing scheme for weights of OIML classes F2 and below
Weight Blocks	1 mg to 10 g Above 10 g to 50 g Above 50 g to 100 g Above 100 g to 200 g Above 200 g to 500 g Above 500 g to 1 kg Above 1 kg to 2 kg Above 2 kg to 5 kg Above 5 kg to 10 kg Above 10 kg to 20 kg Above 20 kg to 30 kg Above 30 kg to 60 kg Above 60 kg to 100 kg Above 100 kg to 200 kg Above 200 kg to 500 kg	2 mg 3 mg 5 mg 9 mg 0.02 g 0.05 g 0.09 g 0.2 g 0.5 g 0.9 g 1.3 g 2.6 g 0.02 kg 0.02 kg 0.04 kg	Mass comparison using AB, AB weighing scheme
Spring /hanging Scale	up to 5 kg up to 20 kg up to 50 kg up to 100 kg	16 g 31 g 62 g 0.13 kg	Using calibrated standard weights of OIML classes FI

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SCOPE OF CALIBRATION : FORCE

Instrument Calibrated/Measurement Parameter	**Range**	**Calibration and Measurement Capability Expressed as an Uncertainty (±)***	**Remarks**
Proving Rings/load Cells	(0 – 5000) N (5001-10000) N (10.1 – 50) KN (50.1 – 100) KN (100.1 – 300) KN	2.2 N 1.0 N 0.12 KN 0.20 KN 1.7 KN	Calibrated by using Load Cell with reference to ISO 376: 2011
Push-pull/ Force Gauge	1 gf to 5 kgf 5 kgf to 20 kgf 20 kgf to 50 kgf 50 kgf to 100 kgf	16 gf 31 gf 62 gf 124 gf	ASTM E74-18 Using Standard Weight Class F1 & F2
Gramme/ Dial Tension Gauge	1 gf to 50 gf 50 gf to 500 gf 500 gf to 2000 g	1 gf to 50 gf 50 gf to 500 gf 500 gf to 2000 g	ASTM E74-18 Using Standard Weight Class F1 & F2

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SCOPE OF CALIBRATION : TORQUE

Instrument Calibrated/Measurement Parameter	**Range**	**Calibration and Measurement Capability Expressed as an Uncertainty (±)***	**Remarks**
Torque Wrench	0 N.m to 2 N.m 2.1 N.m to 100 N.m 101 N.m to 500 N.m	0.07 N.m 0.3 N.m 2 N.m	Comparison with torque transducers with general reference to BS EN ISO 6789-1:2017 Transducer 2 N.m Transducer 100 N.m Transducer 1000 N.m
Torque Meter And Analyser	0 N.m to 2 N.m 3 N.m to 50 N.m 51 N.m to 100 N.m 101 N.m to 500 N.m	0.1% of reading 0.1% of reading 0.1% of reading 0.1% of reading	With general reference to BS 7882: 2017

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SCOPE OF CALIBRATION : PRESSURE

Instrument Calibrated/Measurement Parameter	**Range**	**Calibration and Measurement Capability Expressed as an Uncertainty (±)***	**Remarks**
Pressure Measuring Device (gas Medium)	1 psi to 100 psi 101 psi to 1600 psi	0.02 % of pressure 0.02 % of pressure	Comparison with Dead Weight Tester with reference to BS EN 837- 1: 1998 and 837-2, 837-3: 1998 ADWT ADWT
Pressure Measuring Device (oil And Water Medium)	10 psi to 800 psi 801 psi to 16000 psi	0.02 % of pressure 0.02 % of pressure	DWT DWT
	16 001 psi to 40000 psi	0.02 % of pressure	With reference to BS EN 837-1: 1998 BS EN 837-3: 1998
Vacuum Gauge	Ambient to -0.9 bar (Gauge mode) 0.1 bar (Absolute mode)	0.1 % of pressure	Mercury Manometer Multifunction Calibrator
Low Pressure Measuring Devices Mercury Manometer	0 to 1500 mm Hg	0.02 % of pressure	Digital Manometer Reference Pressure Balance
Deadweight Tester	10 psi to 40 000 psi	0.02 % of pressure	Cross float method with reference to OIML R110 1994(E) NCSL RISP-4 2000 EAL G26/EA-4/17 JULY 1997 Pressure Balance

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SCOPE OF CALIBRATION : VOLUME

Instrument Calibrated/Measurement Parameter	**Range**	**Calibration and Measurement Capability Expressed as an Uncertainty (±)***	**Remarks**
Bulb Pipette	1 ml to 5 ml 5 ml to 100 ml	0.008 ml 0.03 ml	Cal. Procedure No TCP 0002 REV2.0 Ref: ISO 4787
Graduated Pipette	1 ml to 5 ml 5 ml to 100 ml	0.008 ml 0.03 ml	Cal. Procedure No TCP 0002 REV2.0 Ref: ISO 4787
Measuring Cylinder	5 ml to 100 ml 100 ml to 500 ml 500 ml to 1000 ml 1000 ml to 2000 ml	0.05 ml 0.5 ml 2.0 ml 3.0 ml	Cal. Procedure No TCP 0001 REV2.0 Ref: ISO 4787
Burette	1 ml to 50 ml	0.05 ml	Cal. Procedure No TCP 0003 REV2.0 Ref: ISO 4787
Beaker & Flasks	5 ml to 100 ml 100 ml to 1000 ml 1000 ml to 2000 m	1.0 ml 3.0 ml 5.0 ml	Cal. Procedure No TCP 0004 REV2.0 Ref: ISO 4787
Piston-operated Volumetric Apparatus	10 ml to 20 ml 20 ml to 50 ml 50 ml to 100 ml 100 ml to 200 ml 200 ml to 500 ml 500 ml to 1000 ml 1000 ml to 5000 ml 5000 ml to 10000 ml 10000 ml	0.03 ml 0.09 ml 0.15 ml 0.4 ml 0.8 ml 1.8 ml 3.5 ml 20 ml 40 ml	No.TCP/0005 REV.0.0 Based on ISO 8655- 6:2002

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SCOPE OF CALIBRATION : DENSITY

Instrument Calibrated/Measurement Parameter	**Range**	**Calibration and Measurement Capability Expressed as an Uncertainty (±)***	**Remarks**
Density Hydrometer	0.600 g/ml to 0.650 g/ml 0.650 g/ml to 0.700 g/ml 0.700 g/ml to 0.750 g/ml 0.750 g/ml to 0.800 g/ml 0.800 g/ml to 0.850 g/ml 0.850 g/ml to 0.900 g/ml 0.900 g/ml to 0.950 g/ml 0.950 g/ml to 1.000 g/ml 1.000 g/ml to 1.050 g/ml 1.050 g/ml to 1.100 g/ml 1.100 g/ml to 1.150 g/ml 1.150 g/ml to 1.200 g/ml 1.200 g/ml to 1.250 g/ml 1.250 g/ml to 1.300 g/ml 1.300 g/ml to 1.350 g/ml 1.350 g/ml to 1.400 g/ml 1.400 g/ml to 1.450 g/ml 1.450 g/ml to 1.500 g/m	0.001 g/ml (resolution 0.0005 g/ml)	Comparison Method with reference to BS 718:1991
Temperature Specific Gravity Hydrometer	0.6 to 0.65 0.65 to 0.7 0.7 to 0.75 0.75 to 0.8 0.8 to 0.85 0.85 to 0.9 0.9 to 0.95 0.95 to 1 1 to 1.1 1.1 to 1.2 1.2 to 1.3 1.3 to 1.4 1.4 to 1.5	0.001 (resolution 0.0005)	Cal. Procedure No. MDL 0002 with reference to BS 718:1991

SCOPE OF CALIBRATION : ACOUSTIC & VIBRATION

Instrument Calibrated/Measurement Parameter	**Range**	**Calibration and Measurement Capability Expressed as an Uncertainty (±)***	**Remarks**
Measuring Instrument Sound Level Meter	Nominal SPL 94 dB, 104 dB & 114 dB Reference 94 dB re 20 µPa at 1 kHz	0.98 mdB/dB - 0.13 dB 0.21 dB 0.13 dB	Generating using Bruel & Kjaer 4226
	31.5 Hz to 16000 Hz 124 dB (at 250Hz)	0.98 mdB/dB - 0.13 dB 0.21 dB 0.13 dB	Generating using Bruel & Kjaer 4228
	(54 to 134) dB (31.5 to 12500) Hz	0.98 mdB/dB - 0.13 dB 0.21 dB 0.13 dB	Electrical Signal Injection from function generator Agilent 33250A
Sourcing/generating Instrument Sound Calibrator	Nominal SPL 94dB, 104 dB & 114 dB Reference 94 dB re 20 µPa at 1 kHz 31.5 Hz to 16000 Hz	0.11 dB 0.21 dB	Comparison with reference Calibrator Bruel & Kjaer 4226 and 4231, Agilent 34401A
	124 dB (at 250Hz)	0.11 dB 0.21 dB	Comparison with reference Calibrator Bruel & Kjaer 4228 and Agilent 34401A

SITE LOCATION (HQ)	1. CATEGORY 1
FIELD(S) OF CALIBRATION :	ACOUSTIC & VIBRATION,DIMENSIONAL,ELECTRICAL,ELECTRICAL ((RF)),FORCE,HEAT & TEMPERATURE,MASS,PRESSURE

SCOPE OF CALIBRATION : ELECTRICAL

Material / Product Tested	**Type Of Test / Properties Measured / Range Of Measurement**	**Standard Test Methods / Equipment / Techniques**	**Remarks**
Measuring Instrument Dc Voltage	± 220 mV Range ± (0 mV to 220 mV)	9 µV/V + 0.8 µV	Fluke 5700A
	± 2.2 V Range ±(0 V to 2.2 V)	8 µV/V + 1.2 µV	Fluke 5700A

Material / Product Tested	**Type Of Test / Properties Measured / Range Of Measurement**	**Standard Test Methods / Equipment / Techniques**	**Remarks**
	+11 V Range ± (0 V to 11 V)	8 µV/V + 4 µV	Fluke 5700A
	± 22 V Range ± (0 V to 22 V)	8 µV/V + 8 µV	Fluke 5700A
	±220 V Range ±(0 V to 220 V)	9 µV/V + 0.1 mV	Fluke 5700A
	± 1100 V Range ± (100 V to 1100 V)	11 µV/V + 0.6 mV	Fluke 5700A
Measuring Instrument Ac Voltage	2.2 mV to 220 V (See Matrix A) 1100 V Range (110 V to 1100 V) 50 Hz to 1 kHz	(See Matrix A) 90 µV/V + 4 mV	Fluke 5700A
	800 V to 1050 V 1 kHz to 3 kHz 3 kHz to 10 kHz 10 kHz to 20 kHz	0.8 mV/V + 0.13 V 0.8 mV/V + 0.21 V 1.2 mV/V + 0.32 V	Wavetek 9100
Measuring Instrument Dc Current	± 220 µA Range ± (0 mA to 220 µA) ± 2.2 mA Range ± (0 mA to 2.2 mA) ± 22 mA Range ± (0 mA to 22 mA) ± 220 mA Range ± (0 mA to 220 mA) ± 2.2 A Range ± (0 A to 2.2 A)	60 µA/A + 10 nA 60 µA/A + 10 nA 60 µA/A + 0.1 µA 70 µA/A + 1 µA 95 µA/A + 30 µA	Fluke 5700A

Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques	Remarks
	± 3.2 A Range ± (0.32 A to 3.2 A) ± 10.5 A Range ± (3.2 A to 10.5 A) ± 20 A Range ± (10.5 A to 20 A)	0.6 mA/A + 0.12 mA 0.55 mA/A + 0.94 mA 0.55 mA/A + 4.5 mA	Wavetek 9100
Measuring Instrument Ac Current	9 µA to 2.2 A (See Matrix B)	(See Matrix B)	Fluke 5700A
	<u>0.32 A to 3.2 A</u> 10 Hz to 3 kHz 3 kHz to 10 kHz <u>3.2 A to 10.5 A</u> 10 Hz to 3 kHz 3 kHz to 10 kHz <u>10.5 A to 20 A</u> 10 Hz to 3 kHz 3 kHz to 10 kHz	1 mA/A + 0.48 mA 2.5 mA/A + 2.6 mA 2 mA/A + 3 mA 5 mA/A + 10 mA 2 mA/A + 6.9 mA 5 mA/A + 23 mA	Wavetek 9100

Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques	Remarks
Measuring Instrument Resistance Fixed Value	1 mΩ 10 mΩ 100 mΩ 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	0.2 mΩ/Ω 0.1 mΩ/Ω 0.02 mΩ/Ω 5 µΩ/Ω 0.11 mΩ/Ω 5 µΩ/Ω 31 µΩ/Ω 5 µΩ/Ω 0.02 mΩ/Ω 5 µΩ/Ω 15 µΩ/Ω 5 µΩ/Ω 14 µΩ/Ω 5 µΩ/Ω 15 µΩ/Ω 5 µΩ/Ω 24 µΩ/Ω 5 µΩ/Ω 0.05 mΩ/Ω	Fluke 5700A & Fluke 742A Series
	100 MΩ 1 GΩ 10 GΩ 100 GΩ 1 TΩ	0.13 mΩ/Ω 5 µΩ/Ω 0.02 Ω/Ω 0.05 Ω/Ω 0.05 Ω/Ω	Fluke 5700A & Takeda Riken TR45 Standard Resistor
Measuring Instrument Insulation Tester	(1 kΩ to 10 kΩ) @ 10 V	26 µΩ/Ω + 0.6 Ω	Biddle726349

Material / Product Tested	**Type Of Test / Properties Measured / Range Of Measurement**	**Standard Test Methods / Equipment / Techniques**	**Remarks**
	(10 kΩ to 100 kΩ) @ 50 V (0.1 MΩ to 1 MΩ) @ 150 V (1 MΩ to 10 MΩ) @ 300 V (10 MΩ to 100 MΩ) @ 500 V (0.1 GΩ to 1 GΩ) @ 1 kV (1 GΩ to 10 GΩ) @ 5 kV (10 GΩ to 100 GΩ) @ 5 kV (100 GΩ to 600 GΩ) @ 5 kV	16 µΩ/Ω + 0.47 Ω 34 µΩ/Ω + 0.68 kΩ 5.1µΩ/Ω + 0.67 kΩ 73 µΩ/Ω + 5.5 kΩ 73 µΩ/Ω + 55 kΩ 0.28 mΩ/Ω + 0.7 MΩ 4.1 mΩ/Ω + 0.43 MΩ 4.3 mΩ/Ω + 4.1 MΩ	IET HRRS-Q-9-10k
Residual Current	3 mA to 3A At Time interval up to 5 s At Time interval <190 ms	0.14 mA/A 0.3 mA/A	For RCD Tester Calibrator (using Transmille 3200)
Capacitance	(See Matrix C)	(See Matrix C)	Wavetek 9100
Fixed Value	20Hz to 1MHz 1 pF, 10 pF, 100 pF, 1000 pF, 0.02 µF, 0.1 µF and 1.0 µF	1 mF/F	HP 1600A series
Inductance Fixed Value	100 µH @ 1 kHz (1, 10, 100) mH @ 1 kHz 1H @ 1 kHz	2.5 mH/H 1 mH/H 1 mH/H	Ando RS-100 series
Power/ Energy (dc)	1 kW to 20 kW 0.1 W to 1 kW	0.7 mW/W 0.22 mW/W	Fluke 5522A
Power/ Energy (ac), (45 Hz To 65 Hz At Pf=1)	10 kW to 20 kW 1 W to 10 kW 0.1 W to 1 W	1mW/W 0.9 mW/W 1 mW/W	Fluke 5522A
High Voltage Meter Dc Voltage Ac Voltage @ (50/60) Hz	0.5 kV to 10 kV	0.35 mV/V + 0.07 V 1 mV/V + 0.2 V	Vitrek (4700 & HVP 35) and TOS 5101
Clamp Meter Dc Current Dc Current 10 -“ Turn Coil	± 3.2 A to 32 A ± 32 A to 105 A ± 105 A to 200 A	0.06 mA/A + 1.18 mA 0.55 mA/A + 9.4 mA 0.55 mA/A + 45 mA	Wavetek 9100 c/w Current Coil
Clamp Meter Dc Current Dc Current 50 -“ Turn Coil	± 16 A to 160 A ± 160 A to 525 A ± 525 A to 1000 A	0.6 mA/A + 5.9 mA 0.55 mA/A + 47 mA 0.55 mA/A + 0.23 A	Wavetek 9100 c/w Current Coil

Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques	Remarks
Clamp Meter 50 -“ Turn Coil	16 A to 160 A 10 Hz to 100 Hz 160 A to 1000 A 10 Hz to 100 Hz	2 mA/A + 28 mA 2.1 mA/A + 0.45 A	Wavetek 9100 c/w Current Coil
Ac Current 10 -“ Turn Coil	3.2 A to 32 A 10 Hz to 100 Hz 100 Hz to 440 Hz 32 A to 200 A 10 Hz to 100 Hz 100 Hz to 440 Hz	2 mA/A + 5.5 mA 7.8 mA/A + 27 mA 2.1 mA/A + 90 mA 6.7 mA/A + 0.25 A	Wavetek 9100 c/w Current Coil
Oscilloscope Vertical Deflection Dc Signal	0 V to ± 6.6 V (50 Ω Load) 0 V to ± 130 V (1 MΩ Load)	2.5 mV/V+ 0.04 mV 0.5 mV/V + 0.04 mV	Fluke 5500A SC600
Oscilloscope Vertical Deflection	± 1 mVp-p to ± 6.6 Vp-p (50 Ω Load)	2.5 mVp-p/Vp-p + 0.04mVp-p	Fluke 5500A SC600
Oscilloscope Square Wave Signa	± 1 mVp-p to ± 130 Vp-p (1 MΩ Load)	1 mVp-p/Vp-p + 0.04 mVp-p	Fluke 5500A SC600
Horizontal Deflection Time Markers (50 ï•— Load)	2 ns/div to 20 ms/div 50 ms/div to 5 s/div	2.5 µs/s (25+(Output x 1000)) µs/s	Fluke 5500A SC600
Risetime	≤ 300 ps	+0 ns / -0.1 ns	Fluke 5500A SC600
Bandwidth Frequency	50 kHz to 600 MHz	2.5 µHz/Hz	Fluke 5500A SC600
	600 MHz to 40 GHz (+11 dBm to –135 dBm)	7 nHz/Hz	Agilent E8257D Reference to SPIRENT STR4500
Bandwidth Amplitude	50 kHz to 600 MHz	0.03 Vp-p	Fluke 5500A SC600
	600 MHz to 40 GHz (+11 dBm to –135 dBm)	0.92 dBm	Agilent E8257D
Time & Frequency 1. Measuring Instrument Time	1 s to 24 Hrs	0.06 µs/s + 0.021 s	Agilent 33250A & Universal Counter HP 53132A
	20 ms to 5 s	0.7 ms	For RCD Tester Calibrator (using Transmille 3200)
Time & Frequency Residual Current Duration	10 ms to 5 s	0.4 ms	For RCD Tester Calibrator (using Transmille 3200)

Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques	Remarks
Time & Frequency Rpm Measuring Instruments (non Contact)	(60 to 5999) rpm (6000 to 29999) rpm (30000 to 59999) rpm (60000 to 99999) rpm	13 µrpm/rpm + 9.3 mrpm 31 µrpm/rpm - 66 mrpm 0.36 prpm/rpm + 0.72 rpm 0.62 prpm/rpm + 0.72 rpm	In-House method, ESF/0303
Time & Frequency 2.generating Instrument Continue Rpm (non-contact Type)	10 to 29 rpm 30 to 59 rpm 60 to 99 rpm 100 to 299 rpm 300 to 599 rpm 600 to 999 rpm 1000 to 2999 rpm 3000 to 5999 rpm 6000 to 9999 rpm 10000 to 29999 rpm 30000 to 59999 rpm 60000 to 99999 rpm	0.014 rpm 0.036 rpm 0.07 rpm 0.14 rpm 0.37 rpm 0.7 rpm 1.4 rpm 3.6 rpm 7 rpm 14 rpm 36 rpm 70 rpm	In-House method, ESF/0303.
Time & Frequency Rpm (contact Type)	20 to 29 rpm 30 to 59 rpm 60 to 99 rpm 100 to 299 rpm 300 to 599 rpm 600 to 999 rpm 1000 to 2999 rpm 3000 to 5999 rpm 6000 to 9999 rpm 10000 to 12999 rpm 13000 to 25999 rpm 26000 to 29999 rpm	0.011 rpm 0.016 rpm 0.029 rpm 0.07 rpm 0.16 rpm 0.29 rpm 0.7 rpm 1.6 rpm 2.9 rpm 7 rpm 8 rpm 14 rpm	In-House method, ESF/0303
2. Generating Instrument Continue Ac Current	1 A to 50 A 50 Hz/ 60 Hz	0.5 mA/A	HP 3458A & Zenith H007098
	50 A to 1000 A 50 Hz/ 60 Hz 40 Hz to 1 kHz	15 mA/A + 2 A 0.03 A/A + 4 A	Kyoritsu 2003

Material / Product Tested	**Type Of Test / Properties Measured / Range Of Measurement**	**Standard Test Methods / Equipment / Techniques**	**Remarks**
2. Generating Instrument Continue Dc Current	± (1 nA to 100 nA) ± (100 nA 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)	30 µA/A + 0.04 nA 20 µA/A + 0.04 nA 20 µA/A + 0.1 nA 20 µA/A + 0.8 nA 20 µA/A + 5 nA 20 µA/A + 0.05 µA 35 µA/A + 0.5 µA 0.11 mA/A + 0.01 mA	HP 3458A
	± (1 A to 10 A) ± (10 A to 100 A)	5.1 mA 0.05 A	HP 3458A & Guideline 9211A
	± (100 A to 1000 A)	15 mA/A + 2A	Kyoritsu 2003
2. Generating Instrument Continue Capacitance	1 pF to 1 mF @ (10 Hz to 1 MHz)	0.5 mF/F	HP 4284A
2. Generating Instrument Continue Inductance	1 µH to 10 H @ (10 Hz to 1 MHz)	0.5 mH/H	HP 4284A
2. Generating Instrument Continue Resistance	0 Ω to 10 Ω 10 Ω to 100 Ω 0.1 kΩ to 1 kΩ 1 kΩ to 10 kΩ 10 kΩ to 100 kΩ 0.1 MΩ to 1 MΩ 1 MΩ to 10 MΩ 10 MΩ to 100 MΩ 100 MΩ to 1 GΩ	15 µΩ/Ω + 0.05 mΩ 12 µΩ/Ω + 0.05 mΩ 10 µΩ/Ω + 0.05 mΩ 10 µΩ/Ω + 5 mΩ 10 µΩ/Ω + 0.05 Ω 15 µΩ/Ω + 2 Ω 50 µΩ/Ω + 0.1 kΩ 0.5 mΩ/Ω + 1 kΩ 5 mΩ/Ω + 0.01 MΩ	HP 3458A
High Voltage Tester Dc Voltage	0 kV to 9.9 kV 10 kV to <20 kV 20 kV to 35 kV >35 kV to 40 kV	0.3 mV/V + 0.03 V 0.35 mV/V + 0.07 V 0.35 mV/V + 0.07 V 0.4 mV/V + 0.2 V	Vitrek 4700 with (HVL-100, HVL-70 & HVP-35)

Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques	Remarks
High Voltage Tester Ac Voltage	(0 kV to 9.99 kV) @ 50/60Hz (10 kV to 20 kV) @ 50/60 Hz (20 kV to 28 kV) @ 50/60 Hz	1.2 mV/V + 0.1 V 1 mV/V + 0.2 V 1 mV/V + 0.2 V	Vitrek 4700 with (HVL-100, HVL-70 & HVP-35)

SCOPE OF CALIBRATION : DIMENSIONAL

Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques	Remarks
Profile Projector (error Of Indication Of Linear Scale X-y)	1 mm to 200 mm 201 mm to 300 mm	5 µm 7 µm	Glass Scale
Surface Table/plate	2500 mm x 1600 mm	4 µm	Levelnic / Plankator

SCOPE OF CALIBRATION : MASS

Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques	Remarks
Analytical Balance	up to 50 g up to 100 g up to 200 g	0.13 mg 0.15 mg 0.2 mg	OIML class E2 Reference Weights
Balance / Scale (triple Beam, Single Beam Spring, Top Pan, Mechanical & Electronic)	up to 1000 g up to 2000 g up to 5000 g up to 10000 g up to 20 kg up to 50 kg up to 100 kg up to 200 kg up to 500 kg	2 mg 0.02 g 0.02 g 0.2 g 0.2 g 2 g 13 g 0.03 kg 0.1 kg	OIML classes F1/F2/M2 Reference Weights
Electrical And Mechanical Platform Balance	up to 1000 kg up to 2000 kg	0.27 kg 0.66 kg	OIML class M2 Reference Weights

SCOPE OF CALIBRATION : FORCE

Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques	Remarks
Universal Testing Machine / Compression Mode	(0 -5000) N (5001 – 10000) N (10.1 – 50) KN (50.1 – 100) KN (100.1 – 600) KN (600.1 – 900) KN (900.1 – 1800) KN	2.2 N 1.0 N 0.12 KN 0.20 KN 0.12 KN 2.51 KN 2.58 KN	Calibrated by using load cell with reference to BS EN ISO 7500- 1:2018
Charpy / Izod Impact Tester	1 Joule to 300 Joules	1 % of reading	BS 131-7: 1998

SCOPE OF CALIBRATION : PRESSURE

Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques	Remarks
Pressure Measuring Device (oil Medium)	0 psi to 100 psi 0 psi to 1000 psi 0 psi to 10 000 psi 0 psi to 12 000 psi 0 psi to 16 000 psi	0.3 % of pressure 0.4 % of pressure 0.5 % of pressure 0.6 % of pressure 0.6 % of pressure	Calibrate with reference to BS EN 837-1: 1998 BS EN 837-3: 1998 DWT Digital Test Gauge
Vacuum Measuring Devices	Ambient to -0.9 bar (Gauge mode) 0.1 bar (Absolute mode)	1.0 % of pressure	Calibrate by using Pressure Calibrator with reference to BS EN 837-1: 1998 BS EN 837-3: 1998
Pressure Gauge	0 bar to 20 bar	0.5 % of pressure	Calibrate by using Pressure Calibrator with reference to BS EN 837-1: 1998 BS EN 837-3: 1998

SCOPE OF CALIBRATION : ACOUSTIC & VIBRATION

Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques	Remarks
Measuring Instrument Sound Level Meter	Nominal SPL 94 dB, 104 dB & 114 dB Reference 94 dB re 20 µPa at 1 kHz 31.5 Hz to 16000 Hz	0.98 mdB/dB - 0.13 dB	Generating using Bruel & Kjaer 4226

Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques	Remarks
	124 dB (at 250Hz)	0.21 dB	Generating using Bruel & Kjaer 4228
	(54 to 134) dB (31.5 to 12500) Hz	0.13 dB	Electrical Signal Injection from function generator Agilent 33250A
Sourcing/generating Instrument Sound Calibrator	Nominal SPL 94dB, 104 dB & 114 dB Reference 94 dB re 20 µPa at 1 kHz 31.5 Hz to 1600 Hz	0.11 dB	Comparison with reference Calibrator Bruel & Kjaer 4226 and 4231, Agilent 34401A
	124 dB (at 250Hz)	0.21 dB	Comparison with reference Calibrator Bruel & Kjaer 4228 and Agilent 34401A

SCOPE OF CALIBRATION : ELECTRICAL ((RF))

Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques	Remarks
Signal Generator Frequency	1 Hz to 5 GHz	0.32 nHz/Hz	HP53132A Reference to Pendulum 6689
Signal Generator Amplitude/ Level	-20 dBm to +30 dBm (100 kHz to 2.6 GHz)	0.04 dBm	HP 8902 with 11722A
	-36 dB to +20 dB 9 kHz to 6 GHz)	38 mdBm/dBm + 5.3 mdBm	Agilent E4418B with E9304A
Signal Generator Tuned Rf Level	-127 dB to 0 dB (2.5 MHz to 1.3 GHz)	0.07 dBm	HP 8902 with 11722A
Measuring Instrument Frequency	1 µHz to 80 MHz (10 mVpp to 10 Vpp) 250 kHz to 40 GHz (+11 dBm to –135dBm)	0.23 nHz/Hz + 0.67 mHz 5.2 nHz/Hz + 46 µHz	(Agilent 33250A or Agilent E8257D) Reference to Pendulum 6689
Measuring Instrument Amplitude	10 mVp-p to 10 Vp-p (1 µHz to 80 MHz, Into 50 Ω)	10 mVpp/Vpp + 1 mVpp	Agilent 33250A

Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques	Remarks
	+11 dBm to –135dBm (250 kHz to 40 GHz)	0.92 dBm	Agilent E8257D
Measuring Instrument Flatness	Sine Wave Relative to 1 kHz (Auto range on)	0.4 dBm	Agilent 33250A

SCOPE OF CALIBRATION : HEAT & TEMPERATURE

Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques	Remarks
Humidity Chamber	20 % to 95 %RH	2.0 % of RH	TLAS-G-20 BS 1339-1 :2002
Temperature Controlled Enclosure	- 60 ºC to 200 ºC 200 ºC to 400 ºC 400 ºC to 950 ºC	0.8 ºC 1.2 ºC 2 ºC	TLAS-G-20
Temperature Indicating Instruments K - Type	- 200 ºC to 0 ºC 0 ºC to 1300 ºC	0.4 ºC 0.4 ºC	Calibration by Electrical simulation using Temperature Calibrator
Temperature Indicating Instruments J - Type	- 200 ºC to 0 ºC 0 ºC to 1100 ºC	0.3 ºC 0.3 ºC	Calibration by Electrical simulation using Temperature Calibrator
Temperature Indicating Instruments T - Type	- 200 ºC to 0 ºC 0 ºC to 400 ºC	0.5 ºC 0.4 ºC	Calibration by Electrical simulation using Temperature Calibrator
Temperature Indicating Instruments E - Type	- 200 ºC to 0 ºC 0 ºC to 900 ºC	0.4 ºC 0.3 ºC	Calibration by Electrical simulation using Temperature Calibrator
Temperature Indicating Instruments R -“ Type	0 ºC to 1000 ºC 1000 ºC to 1700 ºC	1.3 ºC 1.1 ºC	Calibration by Electrical simulation using Temperature Calibrator
Temperature Indicating Instruments S - Type	0 ºC to 1000 ºC 1000 ºC to 1700 ºC	1.3 ºC 1.2 ºC	Calibration by Electrical simulation using Temperature Calibrator

Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques	Remarks
Temperature Indicating Instruments Pt 100	- 200 ºC to 0 ºC 0 ºC to 800 ºC	0.2 ºC 0.5 ºC	Calibration by Electrical simulation using Temperature Calibrator
Temperature Sensor With Indicator -pt100	0 ºC to 300 ºC 301 ºC to 600 ºC	0.15 ºC 0.26 ºC	Calibration by comparison method using: 1-Pt100 / Type R Thermocouple as reference standards 2-Dry Block Calibrator
Temperature Sensor With Indicator -thermocouple	0 ºC to 300 ºC 301 ºC to 600 ºC 601 ºC to 950 ºC	0.15 ºC 0.26 ºC 1.1 ºC	Calibration by comparison method using: 1-Pt100 / Type R Thermocouple as reference standards 2-Dry Block Calibrator

BRANCH LOCATION	1. SIRIM CALIBRATION SDN. BHD. BANGUNAN SIRIM BERHAD, JALAN PINTASAN KUANTAN–KUALA TERENGGANU, KAWASAN PERINDUSTRIAN GEBENG,MALAYSIA
FIELD(S) OF CALIBRATION :	ELECTRICAL,PRESSURE

SCOPE OF CALIBRATION: ELECTRICAL

Items, Materials or Products Inspected	Type and Range of Inspection	Inspection Methods and Procedures	Remarks
Measuring Instrument (a) Dc Voltage (±)	0 mV to 330 mV 0 V to 3.3 V 0 V to 33 V 30 V to 330 V 100 V to 1020 V	22 mV/V + 1.8 mV 11 mV/V + 9.9 mV 12 mV/V + 96 mV 23 mV/V + 0.98 mV 23 mV/V + 5.4 mV	Generate using calibrator model Fluke 5522 A

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Items, Materials or Products Inspected	Type and Range of Inspection	Inspection Methods and Procedures	Remarks
Measuring Instrument (b) Resistance	0 Ω to 11 Ω 11 Ω to 33 Ω 33 Ω to 110 Ω 110 Ω to 330 Ω 330 Ω to 1.1 kΩ 1.1 kΩ to 3.3 kΩ 3.3 kΩ to 11 kΩ 11 kΩ to 33 kΩ 33 kΩ to 110 kΩ 110 kΩ to 330 kΩ 330 kΩ to 1.1 MΩ 1.1 MΩ to 3.3 MΩ 3.3 MΩ to 11 MΩ 11 MΩ to 33 MΩ 33 MΩ to 110 MΩ 110 MΩ to 330 MΩ 330 MΩ to 1100 MΩ	47 μΩ/Ω + 1.2 mΩ 35 μΩ/Ω + 1.7 mΩ 33 μΩ/Ω + 1.6 mΩ 32 μΩ/Ω + 2.3 mΩ 13 μΩ/Ω + 54 mΩ 11 μΩ/Ω + 0.55 Ω 32 μΩ/Ω + 28 mΩ 29 μΩ/Ω + 0.41 Ω 32 μΩ/Ω + 0.3 Ω 37 μΩ/Ω + 2.4 Ω 36 μΩ/Ω + 3.7 Ω 69 μΩ/Ω + 35 Ω 0.15 mΩ/Ω + 61 Ω 0.29 mΩ/Ω + 2.8 kΩ 0.59 mΩ/Ω + 4.6 kΩ 3.5 mΩ/Ω + 0.11 MΩ 17 mΩ/Ω + 5.7 MΩ	Generate using calibrator model Fluke 5522 A
	0.100 Ω to 0.110 Ω 0.110 Ω to 0.200 Ω 0.100 Ω to 1.100 Ω 1.100 Ω to 10.100 Ω 10.100 Ω to 100.100 Ω 100.100 Ω to 1000.100 Ω	0.12 mΩ/Ω + 2.3 mΩ 0.12 mΩ/Ω + 2.3 mΩ 0.12 mΩ/Ω + 2.3 mΩ 0.12 mΩ/Ω + 2.3 mΩ 0.12 mΩ/Ω + 2.3 mΩ 0.12 mΩ/Ω + 2.3 mΩ	Generate using Yokogawa 279301
Measuring Instrument (c) Capacitance	220 pF to 400 pF 0.4 nF to 1.1 nF 1.1 nF to 3.3 nF 3.3 nF to 11 nF 11 nF to 33 nF 33 nF to 110 nF 110 nF to 330 nF 0.33 μF to 1.1 μF 1.1 μF to 3.3 μF 3.3 μF to 11 μF 11 μF to 33 μF 33 μF to 110 μF 110 μF to 330 μF 0.33 mF to 1.1 mF 1.1 mF to 3.3 mF 3.3 mF to 11 mF 11 mF to 33 mF 33 mF to 110 mF	5.7 μF/F + 12 pF 5.5 mF/F + 13 pF 5.8 mF/F + 12 pF 2.9 mF/F + 12 pF 3.4 mF/F + 6.8 pF 2.9 mF/F + 20 pF 2.9 mF/F + 58 pF 2.9 mF/F + 1.2 nF 2.9 mF/F + 3.5 nF 2.9 mF/F + 12 nF 4.5 mF/F + 38 nF 5.2 mF/F + 0.13 μF 5.1 mF/F + 0.35 μF 5.2 mF/F + 1.2 μF 5.2 mF/F + 3.4 μF 5.7 mF/F + 17 μF 8.5 mF/F + 35 μF 13 mF/F + 0.12 mF	Generate using calibrator model Fluke 5522 A

Items, Materials or Products Inspected	Type and Range of Inspection	Inspection Methods and Procedures	Remarks
Measuring Instrument (d) Ac Voltage (see Matrix A)	0 mV to 1020 V See Matrix A	See Matrix A	Generate using calibrator model Fluke 5522 A
Measuring Instrument (e) Dc Current (±)	0 µA to 330 µA 0 mA to 3.3 mA 0 mA to 33 mA 0 mA to 330 mA 0 A to 1.1 A 1.1 A to 3 A 0 A to 11 A 11 A to 20.5 A	0.18 mA/A + 23 nA 0.12 mA/A + 58 nA 0.12 mA/A + 0.32 µA 0.12 mA/A + 3.0 µA 0.23 mA/A + 50 µA 0.43 mA/A + 57 µA 0.55 mA/A + 0.91 mA 1.2 mA/A + 1.1 mA	Generate using calibrator model Fluke 5522 A
Measuring Instrument (f) Ac Current (see Matrix B)	See Matrix B	See Matrix B	Generate using calibrator model Fluke 5522 A
Measuring Instrument (a) Frequency	1 µHz to 20 MHz	2.3 µHz/Hz + 2.1 µHz	Generate using Agilent 33220A Function / Arbitrary Waveform Generator
	250 kHz to 2 GHz	2 µHz/Hz + 0.3 Hz	Generate using Agilent E44318 ESG-D Series Signal Generator
Measuring Instrument (b) Time Base Input	10 MHz	1 µHz/Hz	Generate using Agilent E44318 ESG-D Series Signal Generator (Rear Time Base Output)
Measuring Instrument (c) Amplitude	10 mVpp to 10 Vpp (1 µHz to 20 MHz, Into 50 Ω)	12 mVpp/Vpp + 1.1 mVpp	Generate using Agilent 33220A Function/ Arbitrary Waveform Generator
	20 mVpp to 20 Vpp (1 µHz to 20 MHz, Into open circuit)	11 mVpp/Vpp + 9.5 mVpp	Generate using Agilent 33220A Function/ Arbitrary Waveform Generator
	+7 to –120 dBm (250 kHz to 2 GHz)	-0.02 dBm/dBm + 0.06 dBm	Generate using Agilent E44318 ESG-D Series Signal Generator
Measuring Instrument (d) Modulation Am Depth Calibration Factor Fm Deviation Calibration Factor	33.33 % nominal 340 kHz peak nominal	0.06 % 0.08 kHz	Generate using HP 8901A (Calibration Output)

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Items, Materials or Products Inspected	Type and Range of Inspection	Inspection Methods and Procedures	Remarks
1. Generating Instruments (a) Dc Voltage	± 100 mV Range ± (100 µV to 120 mV) ± 1 V Range ± (0.1 V to 1.2 V) ± 10 V Range ± (1 V to 12 V) ± 100 V Range ± (10 V to 120 V) ± 1000 V Range ± (100 V to 1050 V)	4.4 µV/V + 0.7 µV 3.6 µV/V + 1.9 µV 4.7 µV/V + 2.6 µV 6.1 µV/V + 0.16 mV 6.1 µV/V + 1.5 mV	Measure using 8 1/2 Digit Multimeter Keysight 3458A Opt. 002
1. Generating Instruments (b) Dc Current	± 100 nA Range, ± (1 nA to 120 nA) ± 1 µA Range ± (0.1 µA to 1.2 µA) ± 10 µA Range, ± (1 µA to 12 µA) ± 100 µA Range, ± (10 µA to 120 µA) ± 1 mA Range, ± (0.1 mA to 1.2mA) ± 10 mA Range ± (1 mA to 12 mA) ± 100 mA Range, ± (10 mA to 120 mA) ± 1 A Range, ± (0.1 A to 1.05 A)	34 µA/A + 47 pA 24 µA/A + 47 pA 25 µA/A + 0.12 nA 19 µA/A + 2.1 nA 22 µA/A + 11 nA 22 µA/A + 0.11 µA 41 µA/A + 1.2 µA 0.12 mA/A + 23 µA	Measure using 8 1/2 Digit Multimeter Keysight 3458A Opt. 002
	± 3 A Range, ± (1 A to 3 A)	0.14 mA/A + 69 µA	Measure using 6 1/2 Digit Multimeter HP 34401A
1. Generating Instruments (c) Resistance, (four-wire Ohms And Two-wire Ohms.)	0 Ω to 12 Ω 10 Ω to 120 Ω 0.1 kΩ to 1.2 kΩ 1 kΩ to 12 kΩ 10 kΩ to 120 kΩ 0.1 MΩ to 1.2 MΩ 1 MΩ to 12 MΩ 10 MΩ to 120 MΩ 0.1 GΩ to 1.2 GΩ	3.3 µΩ/Ω + 76 mΩ 0.32 µΩ/Ω + 0.56 mΩ 0.78 µΩ/Ω + 0.55 mΩ 0.79 µΩ/Ω + 5.5 mΩ 8.4 µΩ/Ω + 0.45 Ω 1.2 µΩ/Ω + 1.2 Ω 5.1 µΩ/Ω + 21 Ω 0.54 mΩ/Ω + 4.5 mΩ 57 mΩ/Ω + 12 kΩ	Measure using 8 ½ Digit Multimeter Keysight 3458A Opt. 002
1. Generating Instruments (d) Ac Voltage	10 mV to 700V (See Matrix C)	(See Matrix C)	Measure using 8 1/2 Digit Multimeter Keysight 3458A Opt. 002
1. Generating Instruments (e) Ac Current	5 µA to 1 A (See Matrix D)	(See Matrix D)	Measure using 8 1/2 Digit Multimeter Keysight 3458A Opt. 002

Items, Materials or Products Inspected	Type and Range of Inspection	Inspection Methods and Procedures	Remarks
Clamp Meter Dc Current Via Current Coil	10 A to 16.5 A 16.5 A to 150 A 150 A to 1025 A	2.8 mA/A + 4.2 mA 4.3 mA/A - 54 mA 2.9 mA/A + 37 mA	Generate using Calibrator Fluke 5522A
Ac Current Via Current Coil	(45 Hz to 65 Hz) 10 A to 16.5 A 16.5 A to 150 A 150 A to 1025 A	2.7 mA/A + 19 mA 3.1 mA/A + 43 mA 3.1 mA/A + 0.23 A	Generate using Calibrator Fluke 5522A
	(65 Hz to 440 Hz) 10 A to 16.5 A 16.5 A to 150 A 150 A to 1025 A	8.8 mA/A + 9.6 mA 9.0 mA/A + 31 mA 8.9 mA/A + 0.17 A	Generate using Calibrator Fluke 5522A
Power Meters Dc Power Energy	0.1 W to 1 kW 1 kW to 20 kW	0.25 mW/W + 0.18 mW 0.80 mW/W - 1.7 mW	Generate using Fluke 5522A
Ac Power Energy	(45 Hz to 65 Hz, PF=1) 0.1 W to 1 W 1 W to 10 kW 10 kW to 20 kW	0.2 mW/W + 23 mW 1.2 mW/W + 7.2 mW 1.2 mW/W + 31 mW	Generate using Fluke 5522A
Oscilloscope Vertical Deflection Dc Signal	0 V to ± 6.6 V (50 Ω Load) 0 V to ± 130 V (1 MΩ Load)	2.8 mV/V + 0.48 mV 0.56 mV/V + 0.48 mV	Generating using calibrator model Fluke 5500A SC600
Vertical Deflection Square Wave Signal	± 1 mVp-p to ± 6.6 Vp-p (50 Ω Load) ± 1 mVp-p to ± 130 Vp-p (1 MΩ Load)	2.8 mVp-p/Vp-p + 0.48 mVpp 1.2 mVp-p/Vp-p + 0.47 mVpp	Generating using calibrator model Fluke 5500A SC600
Horizontal Deflection Time Markers (50 ï•— Load)	2 ns/div to 20 ms/div 50 ms/div to 5 s/div	73 ps/s + 12 ns 5.5 ms/s + 0.39 ms	Generating using calibrator model Fluke 5500A SC600
Risetime	1 kHz to 10 MHz 10 mV to 2.5 V	7.9 ns/s + 7.2 ps	Generating using calibrator model Fluke 5500A SC600
Bandwidth Frequency	50 kHz to 600 MHz (5 mV to 5.5 V	2 mHz/Hz + 1.4 MHz	Generating using calibrator model Fluke 5500A SC600
	250 kHz – 2 GHz (+7 to –120 dBm)	2 nHz/Hz + 1.4 MHz	Generate using Agilent E4431B ESG-D Series Signal Generator

Items, Materials or Products Inspected	Type and Range of Inspection	Inspection Methods and Procedures	Remarks
Bandwidth Amplitude	5 mV to 5.5 V (50 kHz to 600 MHz)	0.41 mVp-p/Vp-p + 0.34 Vp-p	Generating using calibrator model Fluke 5500A SC600
	+7 to –120 dBm (250 kHz – 2 GHz)	0.26 Vp-p	Generating using Agilent E4431B ESG-D Series Signal Generator
Insulation Testers	(1.0 kΩ to 10.0 kΩ) @ 10.0 V (10.0 kΩ to 100.0 kΩ) @ 50.0 V (0.1 MΩ to 1.0 MΩ) @ 150.0 V (1.0 MΩ to 10.0 MΩ) @ 300.0 V (10.0 MΩ to 100.0 MΩ) @ 500.0 V (0.1 GΩ to 1.0 GΩ) @ 1000.0 V (1.0 GΩ to 10.0 GΩ) @ 5000.0 V (10.0 GΩ to 100.0 GΩ) @ 5000.0V (100.0 GΩ to 500.0 GΩ) @ 5000.0V	1.2 mΩ/Ω + 0.14 Ω 1.2 mΩ/Ω + 1.4 Ω 0.94 mΩ/Ω + 0.49 kΩ 1.2 mΩ/Ω + 0.14 kΩ 1.3 mΩ/Ω + 0.38 kΩ 13 mΩ/Ω - 0.20 MΩ 1.5 mΩ/Ω - 1.9 MΩ 29 mΩ/Ω - 0.43 GΩ 40 mΩ/Ω - 0.36 GΩ	Tinsley 4720

Items, Materials or Products Inspected	Type and Range of Inspection	Inspection Methods and Procedures	Remarks
2. Generating Instruments (a) Frequency Or Period	0.01 Hz to 225 MHz 6 ns to 100 s 150 kHz to 650 MHz 650 MHz to 1300 MHz	5.8 µHz/Hz + 0.15 mHz 5.8 µs/s - 69 ps 14 µHz/Hz + 36 µHz 14 µHz/Hz + 35 µHz	Measure using Fluke PM 6680B Timer Counter Analyzer
2. Generating Instruments (b) Amplitude/ Level	0.1 W to 1 W (150 kHz to 60 MHz) 0.01 W to 0.1 W (150 kHz to 60 MHz) 1 mW to 10 mW (150 kHz to 60 MHz) 0.1 W to 1 W (650 MHz to 1300 MHz) 0.01 W to 0.1 W (650 MHz to 1300 MHz) 1 mW to 10 mW (650 MHz to 1300 MHz)	0.35 nW/W + 2.2 mW 35 pW/W + 2.2 mW 3.3 pW/W + 2.2 mW 0.30 nW/W + 2.6 mW 30 pW/W + 2.6 mW 2.2 pW/W + 2.6 mW	Measure using HP 8901A
2. Generating Instruments (c) Modulation Related Signal: Amplitude Modulation (am) Am Depth: 1 % To 99 %	Carrier Frequency 150 kHz to 10 MHz Modulation Frequency 50 Hz to 10 kHz	0.024 %/% + 0.011 %	Measure using HP 8901A
	Carrier Frequency 150 kHz to 10 MHz Modulation Frequency 20 Hz to 10 kHz	0.036 %/% + 0.011 %	Measure using HP 8901A
	Carrier Frequency 10 MHz to 1300 MHz Modulation Frequency 50 Hz to 50 kHz	0.024 %/% + 0.011 %	Measure using HP 8901A
	Carrier Frequency 10 MHz to 1300 MHz Modulation Frequency 20 Hz to 100 kHz	0.036 %/% + 0.011 %	Measure using HP 8901A

Items, Materials or Products Inspected	Type and Range of Inspection	Inspection Methods and Procedures	Remarks
2. Generating Instruments Frequency Modulation (fm) Fm Deviation: ? 40 Khz Peak	Carrier Frequency 150 kHz to 10 MHz Modulation Frequency 20 Hz to 10 kHz	0.036 %/% + 0.011 %	Measure using HP 8901A
	Carrier Frequency 10 MHz to 1300 MHz Modulation Frequency 20 Hz to 200 kHz	0.057 kHz/kHz + 0.021 kHz	Measure using HP 8901A
2. Generating Instruments Frequency Modulation (fm) Fm Deviation: ? 400 Khz Peak	Carrier Frequency 10 MHz to 1300 MHz Modulation Frequency 50 Hz to 100 kHz	0.012 kHz/kHz + 0.12 kHz	Measure using HP 8901A
2. Generating Instruments Phase Modulation (Ï†m) Ï†m Deviation: ? 400 Radians Peak	Carrier Frequency 10 kHz to 1300 MHz Modulation Frequency 200 Hz to 20 kHz	0.034 Radians/Radians + 0.12 Radians	Measure using HP 8901A
2. Generating Instruments Phase Modulation (Ï†m) Ï†m Deviation: ? 40 Radians Peak	Carrier Frequency 10 kHz to 1300 MHz Modulation Frequency 200 Hz to 20 kHz	0.034 Radians/Radians + 0.012 Radians	Measure using HP 8901A
2. Generating Instruments Phase Modulation (Ï†m) Ï†m Deviation: ? 4 Radians Peak	Carrier Frequency 10 kHz to 1300 MHz Modulation Frequency 200 Hz to 8 kHz	0.034 Radians/Radians + 0.0013 Radians	Measure using HP 8901A
Time & Frequency 1. Measuring Instruments A) Time	1 s to 24 Hrs	0.83 ps/s + 29 ms	Agilent 33220A & Fluke PM 6680B Timer Counter Analyzer
Time & Frequency B) Rpm (non-contact)	60 rpm to 999.99 rpm 1000.0 rpm to 9999.9 rpm 10000 rpm to 99999 rpm	17 µrpm/rpm + 8.4 mrpm 17 µrpm/rpm + 84 mrpm 17 µrpm/rpm + 0.84 rpm	In-House method, ESF/0303

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SCOPE OF CALIBRATION: PRESSURE

Items, Materials or Products Inspected	**Type and Range of Inspection**	**Inspection Methods and Procedures**	**Remarks**
Pressure Measuring Device (hydraulic Of Oil Medium)	10 psi to 500 psi 500 psi to 10000 psi	0.021% of pressure 0.025% of pressure	Hydraulic Dead Weight Tester
Pressure Vacuum Gauge	-12 psi to 0 psi	0.01 psi	Digital Pressure Indicator