

Schedule


Issue date: 01 July 2025
Valid Until: -



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LABORATORY LOCATION/ CENTRAL OFFICE:	Trescal (Malaysia) Sdn. Bhd., Shah Alam Lot 148, No 2A, Jalan U1/19 HICOM-Glenmarie Industrial Park , 40150, SELANGOR MALAYSIA
	
ACCREDITED SINCE :	01 JULY 2025
FIELD(S) OF TESTING:	MECHANICAL ((VALVE TESTING))
FIELD(S) OF CALIBRATION:	HEAT & TEMPERATURE MASS FORCE TORQUE HARDNESS PRESSURE VOLUME FLOW VISCOSITY DENSITY OPTICAL & PHOTOMETRIC DIMENSIONAL ELECTRICAL
SITE:	
1 . SITE LABORATORY(HQ) :	CATEGORY I
FIELD(S) OF TESTING :	MECHANICAL ((VALVE TESTING))
FIELD(S) OF CALIBRATION:	DIMENSIONAL,ELECTRICAL,FORCE,HEAT & TEMPERATURE,MASS,PRESSURE,TORQUE,VOLUME

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:	Trescal (Malaysia) Sdn. Bhd., Shah Alam Lot 148, No 2A, Jalan U1/19 HICOM-Glenmarie Industrial Park , 40150, Selangor
FIELD(S) OF TESTING :	MECHANICAL,

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SCOPE OF TESTING : MECHANICAL ((VALVE TESTING))

Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques
A. Pressure Relief Valves	1. "As Received" Pop Pressure Test 2. Seat Leakage Test	1. API 576 Clause 6.2.9: 2017 2. API 527 Section 2,4 & 5: 2020
B. Control Valves	1. Shell Test 2. Pressure Closure Test (Seat Leakage Test) 3. Packing Test 4. Rated Valve Travel Test 5. Dead Band Test	1. API 598: 2016 Clause 6.3, ASME B 16.34 Section 7.1 & IEC 60534-4: 2006 Section 5.4 2. API 598: 2016 Clause 6.4, 6.5 ASME B 16.34 Section 7.2 & EC 60534-4: 2006 Section 5.5 3. IEC 60534-4: 2006 Section 5.6 4. IEC 60534-4: 2006 Section 5.7 5. IEC 60534-4: 2006 Section 5.8
C. Isolation Valves 1. Parallel Slide Valve 2. Gate Valve 3. Globe Valve 4. Check Valve 5. Plug Valve 6. Butterfly Valve 7. Ball Valve	1. Shell Test 2. Pressure Closure Test (Seat Leakage Test) 3. Back Seat Test	1. API 598: 2016 Clause 6.3 & ASME B 16.34 Section 7.1 2. API 598: 2016 Clause 6.4, 6.5 & ASME B 16.34 Section 7.2 3. API 598: 2016 Clause 6.2

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SITE LOCATION (HQ)	1. CATEGORY I
FIELD(S) OF TESTING :	MECHANICAL ((VALVE TESTING))

SCOPE OF TESTING : MECHANICAL ((VALVE TESTING))

Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques
A. Pressure Relief Valves	1. "As Received" Pop Pressure Test 2. Seat Leakage Test	1. API 576 Clause 6.2.9: 2017 2. API 527 Section 2,4 & 5: 2020
B. Control Valves	1. Shell Test 2. Pressure Closure Test (Seat Leakage Test) 3. Packing Test 4. Rated Valve Travel Test 5. Dead Band Test	1. API 598: 2016 Clause 6.3, ASME B 16.34 Section 7.1 & EC 60534-4: 2006 Section 5.4 2. API 598: 2016 Clause 6.4, 6.5 ASME B 16.34 Section 7.2 & EC 60534-4: 2006 Section 5.5 3. IEC 60534-4: 2006 Section 5.6 4. IEC 60534-4: 2006 Section 5.7 5. IEC 60534-4: 2006 Section 5.8
C. Isolation Valves 1. Parallel Slide Valve 2. Gate Valve 3. Globe Valve 4. Check Valve 5. Plug Valve 6. Butterfly Valve 7. Ball Valve	1. Shell Test 2. Pressure Closure Test (Seat Leakage Test) 3. Back Seat Test	1. API 598: 2016 Clause 6.3 & ASME B 16.34 Section 7.1 2. API 598: 2016 Clause 6.4 & 6.5 ASME B 16.34 Section 7.2 3. API 598: 2016 Clause 6.2

CENTRAL LOCATION	Trescal (Malaysia) Sdn. Bhd., Shah Alam Lot 148, No 2A, Jalan U1/19 HICOM-Glenmarie Industrial Park , 40150, Selangor
FIELD(S) OF CALIBRATION :	HEAT & TEMPERATURE, MASS, FORCE, TORQUE, HARDNESS, PRESSURE, VOLUME, FLOW, VISCOSITY, DENSITY, OPTICAL & PHOTOMETRIC, DIMENSIONAL, ELECTRICAL

SCOPE OF CALIBRATION : HEAT & TEMPERATURE

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
1. Temperature Sensor	-196 °C	0.3 °C	Comparison with Pt 100 in liquid nitrogen storage container
	-80 °C to -40 °C	0.05 °C	Comparison with Pt 100 and thermocouple in liquid bath and temperature block calibrator
	-40 °C to 30 °C	0.02 °C	
	30 °C to 250 °C	0.023 °C	
	250 °C to 400 °C	0.16 °C	
	400 °C to 600 °C	0.21 °C	
	600 °C to 800 °C	1.4 °C	
	800 °C to 1000 °C	1.6 °C	
2. Temperature Sensor With Indicator	1000 °C to 1300 °C	2.5 °C	
	-196 °C	0.3 °C	Comparison with Pt 100 in liquid nitrogen storage container
	-80 °C to -40 °C	0.05 °C	Comparison with Pt 100 and thermocouple in liquid bath and temperature block calibrator
	-40 °C to 30 °C	0.02 °C	
	30 °C to 250 °C	0.023 °C	
	250 °C to 400 °C	0.16 °C	
	400 °C to 600 °C	0.21 °C	
	600 °C to 800 °C	1.4 °C	
800 °C to 1000 °C	1.6 °C		
3. Temperature Recorders / Indicators (by Electrical Simulation) A) Type T	-270 °C to -100 °C	0.5 °C	By electrical simulation using calibrator and reference table ITS 90
	-100 °C to 400 °C	0.1 °C	
3. Temperature Recorders / Indicators (by Electrical Simulation) B) Type E	250 °C to -100 °C	0.5 °C	By electrical simulation using calibrator and reference table ITS 90
	-100 °C to 1000 °C	0.1 °C	
3. Temperature Recorders / Indicators (by Electrical Simulation) C) Type K	-270 °C to -100 °C	1.1 °C	By electrical simulation using calibrator and reference table ITS 90
	-100 °C to 1370 °C	0.1 °C	

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
3. Temperature Recorders / Indicators (by Electrical Simulation) D) Type R	-50 ° C to 500 ° C 500 ° C to 1760 ° C	0.3 ° C 0.1 ° C	By electrical simulation using calibrator and reference table ITS 90
3. Temperature Recorders / Indicators (by Electrical Simulation) E) Type J	-210 ° C to 1200 ° C	0.1 ° C	By electrical simulation using calibrator and reference table ITS 90
3. Temperature Recorders / Indicators (by Electrical Simulation) F) Type S	-50 ° C to 500 ° C 500 ° C to 1760 ° C	0.3 ° C 0.1 ° C	By electrical simulation using calibrator and reference table ITS 90
3. Temperature Recorders / Indicators (by Electrical Simulation) G) Type B	200 ° C to 500 ° C 500 ° C to 1800 ° C	1.0 ° C 0.2 ° C	By electrical simulation using calibrator and reference table ITS 90
3. Temperature Recorders / Indicators (by Electrical Simulation) H) Type N	-200 ° C to -100 ° C -100 ° C to 1300 ° C	1.0 ° C 0.1 ° C	By electrical simulation using calibrator and reference table ITS 90
3. Temperature Recorders / Indicators (by Electrical Simulation) I) Pt 100	-200 ° C to 850 ° C	0.1 ° C	By electrical simulation using calibrator and reference table ITS 90
4. Temperature Calibrator (i) Simulation A) Type T	-270 ° C to -100 ° C -100 ° C to 400 ° C	0.6 ° C 0.1 ° C	By electrical measurement using multimeter and reference table ITS 90
4. Temperature Calibrator (i) Simulation B) Type E	-270 ° C to -100 ° C -100 ° C to 1000 ° C	0.6 ° C 0.1 ° C	By electrical measurement using multimeter and reference table ITS 90
4. Temperature Calibrator (i) Simulation C) Type K	-270 ° C to -100 ° C -100 ° C to 1370 ° C	1.1 ° C 0.1 ° C	By electrical measurement using multimeter and reference table ITS 90
4. Temperature Calibrator (i) Simulation D) Type R	-50 ° C to 500 ° C 500 ° C to 1760 ° C	0.3 ° C 0.1 ° C	By electrical measurement using multimeter and reference table ITS 90
4. Temperature Calibrator (i) Simulation E) Type J	-210 ° C to 1200 ° C	0.1 ° C	By electrical measurement using multimeter and reference table ITS 90

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
4. Temperature Calibrator (i) Simulation F) Type S	-50 ° C to 500 ° C 500 ° C to 1760 ° C	0.3 ° C 0.2 ° C	By electrical measurement using multimeter and reference table ITS 90
4. Temperature Calibrator (i) Simulation G) Type B	100 ° C to 500 ° C 500 ° C to 1800 ° C	1.1 ° C 0.3 ° C	By electrical measurement using multimeter and reference table ITS 90
4. Temperature Calibrator (i) Simulation H) Type N	-200 ° C to -100 ° C -100 ° C to 1300 ° C	1.1 ° C 0.1 ° C	By electrical measurement using multimeter and reference table ITS 90
4. Temperature Calibrator (i) Simulation I) Pt 100	-200 ° C to 850 ° C	0.1 ° C	By electrical measurement using multimeter and reference table ITS 90
4. Temperature Calibrator (ii) Measurement A) Type T	-270 ° C to -100 ° C -100 ° C to 400 ° C	0.5 ° C 0.1 ° C	By electrical simulation using calibrator and reference table ITS 90
4. Temperature Calibrator (ii) Measurement B) Type E	-250 ° C to -100 ° C -100 ° C to 1000 ° C	0.6 ° C 0.1 ° C	By electrical simulation using calibrator and reference table ITS 90
4. Temperature Calibrator (ii) Measurement C) Type K	-270 ° C to -100 ° C -100 ° C to 1370 ° C	1.1 ° C 0.1 ° C	By electrical simulation using calibrator and reference table ITS 90
4. Temperature Calibrator (ii) Measurement D) Type R	-50 ° C to 500 ° C 500 ° C to 1760 ° C	0.3 ° C 0.1 ° C	By electrical simulation using calibrator and reference table ITS 90
4. Temperature Calibrator (ii) Measurement E) Type J	-210 ° C to 1200 ° C	0.1 ° C	By electrical simulation using calibrator and reference table ITS 90
4. Temperature Calibrator (ii) Measurement F) Type S	-50 ° C to 500 ° C 500 ° C to 1760 ° C	0.3 ° C 0.1 ° C	By electrical simulation using calibrator and reference table ITS 90
4. Temperature Calibrator (ii) Measurement G) Type B	200 ° C to 500 ° C 500 ° C to 1800 ° C	1.1 ° C 0.3 ° C	By electrical simulation using calibrator and reference table ITS 90

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
4. Temperature Calibrator (ii) Measurement H) Type N	-200 ° C to -100 ° C	1.0 ° C	By electrical simulation using calibrator and reference table ITS 90
	-100 ° C to 1300 ° C	0.1 ° C	
4. Temperature Calibrator (ii) Measurement I) Pt 100	-200 ° C to 850 ° C	0.1 ° C	By electrical simulation using calibrator and reference table ITS 90
5. Liquid-in-glass Thermometer A) (total Immersion)	-40 ° C to -30 ° C	0.08 ° C	Comparison with Pt100 in liquid bath and temperature block calibrator
	-30 ° C to 30 ° C	0.045 ° C	
	30 ° C to 200 ° C	0.035 ° C	
	200 ° C to 400 ° C	0.15 ° C	
5. Liquid-in-glass Thermometer B) (partial Immersion)	-40 ° C to -30 ° C	0.08 ° C	Comparison with Pt100 in liquid bath and temperature block calibrator
	-30 ° C to 30 ° C	0.045 ° C	
	30 ° C to 200 ° C	0.035 ° C	
	200 ° C to 400 ° C	0.15 ° C	
Temperature & Humidity Indicator Or Recorder	-70 ° C to 5 ° C	0.3 ° C	Comparison with Pt100 sensor in chamber and humidity calibrator
	5 ° C to 50 ° C	0.1 ° C	
Temperature & Humidity Indicator Or Recorder	50 ° C to 80 ° C	0.3 ° C	Comparison with thermohygrometer and wet & dry bulb in chamber and humidity calibrator
	Relative humidity at 25 ° C	1.4 %rh	
	5 %rh to 50 %rh	1.6 %rh	
	50 % rh to 70 %rh	1.8 %rh	
	70 %rh to 95 %rh	2.2 %rh	
Temperature Block Calibrator	-40 ° C to 400 ° C	0.015 ° C	Calibration using PRT sensor and thermocouple R/S
	400 ° C to 600 ° C	0.02 ° C	
	600 ° C to 1300 ° C	2.8 ° C	
Radiation Thermometer	50 ° C to 100 ° C	0.6 ° C	Comparison with Pt100, thermocouple and radiation thermometer
	100 ° C to 200 ° C	1.0 ° C	
	200 ° C to 400 ° C	1.5 ° C	
	400 ° C to 1200 ° C	3.3 ° C	
Temperature & Humidity Sensor (probe Type)	Relative Humidity at 25 ° C	0.6 %rh	Comparison with Humidity Standard Solution with reference to ASTM E104
	5 %rh	0.6 %rh	
	10 %rh	0.6 %rh	
	20 %rh	0.8 %rh	
	35 %rh	0.8 %rh	
	50 %rh	1.3 %rh	
	80 %rh	1.3 %rh	
	95 %rh	1.3 %rh	

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
Infrared Ear Thermometer	35 °C to 42 °C	0.07 °C	Comparison with PRT in liquid bathblackbody with reference to ASTM E1965

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
Standard Weight / Dead Weight	1 mg	0.003 mg	Calibration by comparison with standard weight of same nominal value
	2 mg	0.003 mg	Calibration by comparison with standard weight of same nominal value
	5 mg	0.003 mg	Calibration by comparison with standard weight of same nominal value
	10 mg	0.003 mg	Calibration by comparison with standard weight of same nominal value
	20 mg	0.005 mg	Calibration by comparison with standard weight of same nominal value
	50 mg	0.005 mg	Calibration by comparison with standard weight of same nominal value
	100 mg	0.005 mg	Calibration by comparison with standard weight of same nominal value
	200 mg	0.006 mg	Calibration by comparison with standard weight of same nominal value
	500 mg	0.006 mg	Calibration by comparison with standard weight of same nominal value
	1 g	0.008 mg	Calibration by comparison with standard weight of same nominal value

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
	2 g	0.009 mg	Calibration by comparison with standard weight of same nominal value
	5 g	0.009 mg	Calibration by comparison with standard weight of same nominal value
	10 g	0.015 mg	Calibration by comparison with standard weight of same nominal value
	20 g	0.015 mg	Calibration by comparison with standard weight of same nominal value
	50 g	0.05 mg	Calibration by comparison with standard weight of same nominal value
	100 g	0.08 mg	Calibration by comparison with standard weight of same nominal value
	200 g	0.09 mg	Calibration by comparison with standard weight of same nominal value
	500 g	0.3 mg	Calibration by comparison with standard weight of same nominal value
	1 kg	0.6 mg	Calibration by comparison with standard weight of same nominal value
	2 kg	1 mg	Calibration by comparison with standard weight of same nominal value
	5 kg	5 mg	Calibration by comparison with standard weight of same nominal value

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
	10 kg	15 mg	Calibration by comparison with standard weight of same nominal value
	20 kg	0.02 g	Calibration by comparison with standard weight of same nominal value
	25 kg	0.2 g	Calibration by comparison with standard weight of same nominal value
	30 kg	0.2 g	Calibration by comparison with standard weight of same nominal value

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SCOPE OF CALIBRATION : FORCE

Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
Force Measurement Device (compression & Tension)	0 N to 5 N	0.001 N	Calibrated by using standard weights generally based on ISO 376:2011
	5 N to 1 kN	0.03 N	Calibrated by using dead weights generally based on ISO 376:2011
	1 kN to 10 kN	6.1 N	Calibrated by using load cell generally based on ISO 376:2011
	10 kN to 50 kN	7.6 N	Calibrated by using load cell generally based on ISO 376:2011
	50 kN to 100 kN	78 N	Calibrated by using load cell generally based on ISO 376:2011
Force Measurement Device (tension)	100 kN to 300 kN	410 N	Calibrated by using load cell generally based on ISO 376:2011
Force Measurement Device (compression)	100 kN to 500 kN	0.3 kN	Calibrated by using load cell generally based on ISO 376:2011

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SCOPE OF CALIBRATION : TORQUE

Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
Torque Measuring Device	0 N.m to 1 N.m	0.49 % of reading	Calibrated using torque calibrators based on BS7882:2017
	1 N.m to 2 N.m	0.39 % of reading	Calibrated using torque calibrators based on BS7882:2017
	2 N.m to 10 N.m	0.31 % of reading	Calibrated using torque calibrators based on BS7882:2017
	10 N.m to 30 N.m	0.40 % of reading	Calibrated using torque calibrators based on BS7882:2017
	30 N.m to 150 N.m	0.26 % of reading	Calibrated using torque calibrators based on BS7882:2017
	150 N.m to 400 N.m	0.16 % of reading	Calibrated using torque calibrators based on BS7882:2017
	400 N.m to 1500 N.m	0.12 % of reading	Calibrated using torque calibrators based on BS7882:2017
Hand Torque Tools	0 N.m to <0.12 N.m	3.6 % of reading	Calibrated using torque calibrators based on ISO 6789-2: 2017
	0.12 N.m to <0.2 N.m	1.7 % of reading	Calibrated using torque calibrators based on ISO 6789-2: 2017
	0.2 N.m to <2 N.m	1.5 % of reading	Calibrated using torque calibrators based on ISO 6789-2: 2017

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
	2 N.m to <10 N.m	1.0 % of reading	Calibrated using torque calibrators based on ISO 6789-2: 2017
	10 N.m to <150 N.m	0.8 % of reading	Calibrated using torque calibrators based on ISO 6789-2: 2017
	150 N.m to <400 N.m	0.3 % of reading	Calibrated using torque calibrators based on ISO 6789-2: 2017
	400 N.m to 1500 N.m	0.3 % of reading	Calibrated using torque calibrators based on ISO 6789-2: 2017

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SCOPE OF CALIBRATION : HARDNESS

Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
Durometer (type A, B, C, D, E, O, Do, Oo)	0 to 100 shore hardness index	0.5 shore hardness index	Calibrated using balance, block gauges and profile projector with refer ASTM D2240:15e1 Measurements of spring force, indenter travel and indenter extension excluding indenter cone angle.

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SCOPE OF CALIBRATION : PRESSURE

Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
Pressure Measuring Device Pneumatic	0 kPa to 100 kPa 1 kgf/cm ² to 30 kgf/cm ²	0.0082 kPa	Calibrated by using dead weight tester and pressure Meter with reference as AS1349 (1986)
	Hydraulic	0 kgf/cm ² to 60 kgf/cm ²	0.012% of reading
	60 kgf/cm ² to 1200 kgf/cm ²	0.015% of reading	Calibrated by using dead weight tester and Pressure Meter with reference to with reference to AS1349 (1986)
	1200 kgf/cm ² to 2812 kgf/cm ²	0.011 % of reading	Calibrated by using dead weight tester and Pressure Meter with reference to with reference to AS1349 (1986)
	2812 kgf/cm ² to 4218 kgf/cm ²	14 kgf/cm ²	Calibrated by using dead weight tester and High Pressure Transducer with reference to with reference to AS1349 (1986)
Vacuum Absolute Pressure Measuring Device	-95 kPa to 0 kPa	0.011 kPa	Comparison with test gauge with reference to AS1349 (1986)
	0 kPa abs to 210 kPa abs 210 kPa abs to 700 kPa abs	0.070 kPa abs 0.13 kPa abs	Comparison with test gauge with reference to AS1349 (1986)
Manometer	0 Pa to 500 Pa	0.21 Pa	Comparison with pressure meter with reference to AS1349 (1986)

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
	500 Pa to 1000 Pa	0.50 Pa	Comparison with pressure meter with reference to AS1349 (1986)
	1000 Pa to 3000 Pa	1.5 Pa	Comparison with pressure meter with reference to AS1349 (1986)
	3000 Pa to 5000 Pa	2.9 Pa	Comparison with pressure meter with reference to AS1349 (1986)
	5000 Pa to 7000 Pa	4.2 Pa	Comparison with pressure meter with reference to AS1349 (1986)

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SCOPE OF CALIBRATION : VOLUME

Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks	
1. Pova Pipette	0.1 μ l to 2.5 μ l	0.020 μ l	Calibrated by gravimetric method with refer to AS2162.2 & ISO 8655-6:2022	
	2.5 μ l to 20 μ l	0.025 μ l	Calibrated by gravimetric method with refer to AS2162.2 & ISO 8655-6:2022	
	20 μ l to 100 μ l	0.1 μ l	Calibrated by gravimetric method with refer to AS2162.2 & ISO 8655-6:2022	
	100 μ l to 300 μ l	0.2 μ l	Calibrated by gravimetric method with refer to AS2162.2 & ISO 8655-6:2022	
	300 μ l to 1000 μ l	0.7 μ l	Calibrated by gravimetric method with refer to AS2162.2 & ISO 8655-6:2022	
	1000 μ l to 5000 μ l	3.5 μ l	Calibrated by gravimetric method with refer to AS2162.2 & ISO 8655-6:2022	
	5000 μ l to 10000 μ l	7.1 μ l	Calibrated by gravimetric method with refer to AS2162.2 & ISO 8655-6:2022	
2. Graduated & One Mark Pipette	Graduated 1 ml 5 ml 10 ml to 25 ml	0.015 ml 0.02 ml 0.03 ml	Calibrated by gravimetric method with refer to AS2162.1	
	One Mark 0.5 ml to 1 ml 2 ml to 10 ml 25 ml 50 ml	0.01 ml 0.01 ml 0.015 ml 0.02 ml	Calibrated by gravimetric method with refer to AS2162.1	
	3. Burette	10 ml	0.013 ml	Calibrated by gravimetric method with refer to AS2162.1
		25 ml	0.02 ml	
		50 ml	0.03 ml	
		100 ml	0.06 ml	

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
4. Measuring Cylinder	10 ml 25 ml 50 ml to 100 ml 250 ml 500 ml 1000 ml 2000 ml	0.05 ml 0.13 ml 0.24 ml 0.50 ml 1.2 ml 2.4 ml 2.6 ml	Calibrated by gravimetric method with refer to AS2162.1
5. One Mark Volumetric Flask	1 ml	0.014 ml	Calibrated by gravimetric method with refer to AS2162.1
	5 ml	0.014 ml	Calibrated by gravimetric method with refer to AS2162.1
	10 ml	0.02 ml	Calibrated by gravimetric method with refer to AS2162.1
	20 ml	0.02 ml	Calibrated by gravimetric method with refer to AS2162.1
	25 ml	0.02 ml	Calibrated by gravimetric method with refer to AS2162.1
	50 ml	0.03 ml	Calibrated by gravimetric method with refer to AS2162.1
	100 ml	0.05 ml	Calibrated by gravimetric method with refer to AS2162.1
	250 ml	0.12 ml	Calibrated by gravimetric method with refer to AS2162.1
	500 ml	0.22 ml	Calibrated by gravimetric method with refer to AS2162.1
	1000 ml	0.45 ml	Calibrated by gravimetric method with refer to AS2162.1
6. Dispenser / Digital Burette	1 ml to 5 ml	0.006 ml	Calibrated by gravimetric method with reference to AS 2162.2
	5 ml to 10 ml	0.007 ml	
	10 ml to 25 ml	0.011 ml	
	25 ml to 50 ml	0.019 ml	
	50 ml to 100 ml	0.58 ml	

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
7. Test Measure And Provers -“ Gravimetric Method	5 L and 10 L 20 L 50 L 100 L 200 L	0.002 L 0.004 L 0.018 L 0.018 L 0.022 L	Calibrated by gravimetric method using balance based on NIST IR 7383 SOP 14 and NIST Handbook 105-3 (2010)
7. Test Measure And Provers -“ Volumetric Method	5 L and 10 L 20 L 50 L 100 L 200 L	0.002 L 0.004 L 0.008 L 0.009 L 0.016 L	Calibrated by volumetric method using standard test measures based on NIST IR 7383 SOP 19 and NIST Handbook 105-3 (2010)
8. Conductivity Meter	1, 10 μ S/cm 84 μ S/cm 1413 μ S/cm 12.88 mS/cm 111.8 mS/cm	0.36 μ S/cm 1.0 μ S/cm 5.4 μ S/cm 0.06 mS/cm 0.43 mS/cm	Calibrated by using standard solution with reference to ASTM D 1125-14
9. Ph Meter	4.01 pH, 7.01 pH & 10.01 pH	0.01 pH	Calibrated by using standard solution with reference to JIS K 0102:2016
10. Volumetric Instruments (beakers, Pitchers And Volumetric Containers)	Up to 500 ml 1000 ml 2000 ml 5000 ml 10000 ml 20000 ml	4.2 ml 5.4 ml 9.6 ml 16 ml 27 ml 37 ml	Calibrated by gravimetric method with general reference to ISO 4787:2021
11. Air Entrainment Meter	Range: Up to 8 L 0 % to 2 % 2 % to 5 % 5 % to 10 % 10 % to 20 %	0.05 % 0.06 % 0.15 % 0.2 %	Calibrated by gravimetric method with reference to BS EN 12350-7:2019

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SCOPE OF CALIBRATION : FLOW

Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
Gas Flow Mass Flow Meter (fluid : Air)	0 cm ³ /min to 20 cm ³ /min 20 cm ³ /min to 200 cm ³ /min 200 cm ³ /min to 1 L/min 200 cm ³ /min to 1 L/min 0 L/min to 50 L/min 50 L/min to 300 L/min	0.44 % of reading 0.74 % of reading 0.43 % of reading 0.81 % of reading 0.71 % of reading 0.56 % of reading	Calibrated by using mass flow meter based on National Measurement System, TUV NEL and manufacturer manual
Volumetric Flow Meter (fluid : Air)	0 cm ³ /min to 20 cm ³ /min 20 cm ³ /min to 200cm ³ /min 200 cm ³ /min to 1 L/min 1 L/min to 10 L/min 10 L/min to 50 L/min 50 L/min to 300 L/min	0.48 % of reading 0.77 % of reading 0.47 % of reading 0.84 % of reading 0.74 % of reading 0.60 % of reading	Calibrated by using mass flow meter based on National Measurement System, TUV NEL and manufacturer manual
Variable Area Flow Meter (fluid : Air)	0 cm ³ /min to 20 cm ³ /min 20 cm ³ /min to 200cm ³ /min 200 cm ³ /min to 1 L/min 1 L/min to 10 L/min 10 L/min to 50 L/min 50 L/min to 300 L/min	0.6 % of full scale 0.9 % of full scale 0.6 % of full scale 0.9 % of full scale 0.8 % of full scale 0.7 % of full scale	Calibrated by using mass flow meter based on National Measurement System, TUV NEL and manufacturer manual

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SCOPE OF CALIBRATION : VISCOSITY

Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
Zahn Cup	Cup No. 2 (20 mm ² /s to 250 mm ² /s) Cup No. 3 (100 mm ² /s to 800 mm ² /s) Cup No. 4 (200 mm ² /s to 1200 mm ² /s)	1.1 mm ² /s 2.3 mm ² /s 2.8 mm ² /s	Calibrated by using viscosity standard oil with reference to ASTM D4212-16
Ford Cup	Cup No. 3 (49 mm ² /s to 220 mm ² /s) Cup No. 4 (70 mm ² /s to 370 mm ² /s) Cup No. 5 (200 mm ² /s to 1200 mm ² /s)	1.1 mm ² /s 1.2 mm ² /s 4.5 mm ² /s	Calibrated by using viscosity standard oil with reference to ASTM 1200-10 (reapproved 2018)
Rotational Viscometer	7.6 mPa.s to 55.00 mPa.s 101.0 mPa.s to 393.0 mPa.s 11000 mPa.s to 40000 mPa.s	1 % of reading	Calibrated by using standard oil by manufacturer's calibration procedure

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SCOPE OF CALIBRATION : DENSITY

Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
Density Hydrometer	0.600 g/mL to 1.850 g/mL	0.0006 g/mL	Calibrated by using standard density hydrometer based on BS 718:1991

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SCOPE OF CALIBRATION : OPTICAL & PHOTOMETRIC

Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
Refractometer Sucrose Mass Fraction	0 %Brix to 50 %Brix	0.24 %Brix	Calibrated by using sucrose powder & weighing balance with reference to OIML R 108 & OIML R 124
Refractometer Refractive Index	1.333 nD to 1.420 nD	0.006 nD	Calibrated by using sucrose powder & weighing balance with reference to OIML R 108 & OIML R 124

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SCOPE OF CALIBRATION : DIMENSIONAL

Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
1. Precision Caliper (internal, External & Depth Measurement)	0 mm to 300 mm 300 mm to 600 mm 600 mm to 1000 mm	6 μ m 12 μ m 13 μ m	Calibrated by using Caliper Checker and Gauge Block with reference to JIS B 7507:2022 or BS EN ISO 13385-1:2019
2. Internal Micrometer	0 mm to 175 mm 175 mm to 375 mm 375 mm to 550 mm 550 mm to 675 mm 675 mm to 825 mm 825 mm to 900 mm	2 μ m 3 μ m 4 μ m 5 μ m 6 μ m 7 μ m	Calibrated by using Gauge Block, Height Setting Micrometer, Dial Test Indicator, Universal Horizontal Measuring Machine with reference to JIS B 7502:2016 or BS 959:2008
3. External Micrometer	0 mm to 25 mm 25 mm to 75 mm 75 mm to 150 mm 150 mm to 250 mm 250 mm to 325 mm 325 mm to 425 mm 425 mm to 500 mm 500 mm to 575 mm 575 mm to 600 mm	0.4 μ m 1.2 μ m 1.5 μ m 2.0 μ m 2.5 μ m 3.0 μ m 3.5 μ m 4.0 μ m 4.5 μ m	Calibrated by using Gauge Block and Optical Parallel with reference to JIS B 7502:2016 or ISO 3611:2023
4. Dial Gauge	0 mm to 10 mm 10 mm to 50 mm 50 mm to 100 mm	0.5 μ m 1.0 μ m 1.5 μ m	Calibrated by using Precision Indicator Tester, Micrometer Head, Dial Gauge Calibrator, Calibration Tester with reference to JIS B 7503:2017 or DIN 879-1:1999 or ASME B89.1.10M-2001
5. Ruler	0 mm to 1000 mm 1000 mm to 2000 mm	0.1 mm 0.2 mm	Calibrated by using Linear Scale Comparator with reference to JIS B 7516:2005

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
6. Feeler Gauge	0 mm to 3 mm	0.5 μ m	Calibrated by using Linear Displacement Transducer, Universal Horizontal Measuring Machine with reference to JIS B 7524:2008 or BS 957:2008
7. Thickness Gauge	0 mm to 20 mm	1.0 μ m	Calibrated by using Gauge Block, Balance with reference to ISO 13102:2012, JIS B 7503:2017
8. Precision Level / Spirit Level	0.02 mm/m 0.05 mm/m 0.1 mm/m	0.01 mm/m 0.01 mm/m 0.02 mm/m	Calibrated by using Sine Bar and Gauge Block with reference to JIS B 7510:1993
9. Gauge Block	0 mm to 10 mm 10 mm 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 250 mm 0 in to 0.5 in 0.5 in to 1 in 1 in to 2 in 2 in to 3 in 3 in to 4 in	0.09 μ m 0.10 μ m 0.13 μ m 0.17 μ m 0.21 μ m 0.26 μ m 0.33 μ m 0.39 μ m 5.0 μ in 5.3 μ in 6.3 μ in 7.7 μ in 9.4 μ in	Calibrated by using gauge block and gauge block comparator with reference to JIS B 7506:2004, BS 4311:2007
10.depth Gauge	0 mm to 100 mm 100 mm to 300 mm	2.0 μ m 3.0 μ m	Calibrated by using Depth Gauge Checker, Gauge Block with reference to JIS B 7518:2018 or ISO 13385-2:2020
11.depth Micrometer	0 mm to 100 mm 100 mm to 300 mm	2.0 μ m 3.0 μ m	Calibrated by using Depth Gauge Checker, Gauge Block with reference to JIS B 7544:1994 or BS 6468:2008

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
12.height Gauge	0 mm to 300 mm 300 mm to 600 mm 600 mm to 1000 mm	6.0 μ m 8.0 μ m 10.0 μ m	Calibrated by using Caliper Checker, Gauge Block and Granite Surface Plate with reference to JIS B 7517:2018 or BS EN ISO 13225:2012
13.micrometer Head & Calibration Tester For Dial Gauge And Dial Test Indicator	0 mm to 25 mm 25 mm to 50 mm	0.4 μ m 0.8 μ m	Calibrated by using Gauge Block, Linear Displacement Transducer and Optical Flat with reference to JIS B 7502:2016
14.measuring Tape	0 m to 2 m 2 m to 5 m 5 m to 10 m 10 m to 20 m 20 m to 50 m 50 m to 100 m	0.2 mm 0.3 mm 0.6 mm 1.2 mm 3.2 mm 6.3 mm	Calibrated by using Linear Scale Comparator with reference to JIS B 7512:2018, JIS B 7522:2016
15.dial Test Indicator	0 mm to 0.5 mm 0.5 mm to 5 mm	0.5 μ m 1.0 μ m	Calibrated by using Precision Indicator Tester, Calibration Tester with reference to JIS B 7533:2015 or ASME B89.1.10M-2001
16.snap Micrometer - Micrometer Range	0 mm to 75 mm 75 mm to 100 mm 100 mm to 125 mm	1.5 μ m 1.6 μ m 1.8 μ m	Calibrated by using Gauge Block with reference to JIS B 7520:1981
16.snap Micrometer - Indicator Range	0 mm to \pm 0.08 mm \pm 0.15 mm	0.7 μ m 3.2 μ m	Calibrated by using Gauge Block with reference to JIS B 7520:1981
17.setting Rod	25 mm to 75 mm 100 mm to 150 mm 175 mm to 200 mm 225 mm to 250 mm 275 mm to 300 mm 325 mm to 375 mm 400 mm to 425 mm 450 mm to 475 mm 500 mm to 525 mm 550 mm to 600 mm	1.0 μ m 1.5 μ m 2.0 μ m 2.5 μ m 3.0 μ m 3.5 μ m 4.0 μ m 4.5 μ m 5.0 μ m 5.6 μ m	Calibrated by using Linear Displacement Transducer and Gauge Block with reference to JIS B 7420:1997

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
18.non-metallic Thickness Foil	0 mm to 2.5 mm	0.3 μ m	Calibrated by using Linear Displacement Transducer with reference to BS EN ISO 2178:2016
19.glass Scale	0 mm to 200 mm 200 mm to 400 mm 400 mm to 1000 mm	0.01 mm 0.05 mm 0.09 mm	Calibrated by using Profile Projector, Standard Scale, Linear Scale with reference to JIS B 7541:2001
20.test Sieve	0.032 mm to 125 mm	2.0 μ m	Calibrated by using Profile Projector, Caliper with reference to BS ISO 3310-1:2016, BS ISO 3310-2:2013
21.plain Plug / Pin Gauge (diameter Only)	0 mm to 25 mm 25 mm to 50 mm 50 mm to 100 mm 100 mm to 150 mm	0.7 μ m 1.1 μ m 1.5 μ m 1.9 μ m	Calibrated by using Laser Scan Micrometer or Universal Horizontal Measuring Machine with reference to JIS B 7420:1997, BS 969:2008
22.parallel Thread Plug Gauge (major Diameter And Pitch Diameter)	2 mm to 38 mm 38 mm to 100 mm	1.2 μ m 3.0 μ m	Calibrated by using Universal Horizontal Measuring Machine, 3-wire pin set, Micrometer with reference to JIS B 0261:2020 or ANSI/ASME B1.2-1983 or ISO 1502-1996
23.thread Ring Gauge (minor Diameter And Pitch Diameter)	2 mm to 38 mm	Minor Diameter : 2.8 μ m Pitch Diameter : 1.2 μ m	Calibrated by using Universal Horizontal Measuring Machine, 3-wire pin set, Micrometer with reference to JIS B 0261:2004 or ANSI/ASME B1.2-1983 or ISO 1502-1996

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
	38 mm to 100 mm	Minor Diameter : 3.0 μ m Pitch Diameter : 3.0 μ m	Calibrated by using Universal Horizontal Measuring Machine with reference to ANSI/ASME B1.2-1983 or ISO 1502-1996
24.square	0 mm to 75 mm 75 mm to 150 mm 150 mm to 300 mm 300 mm to 400 mm	6.0 μ m 8.0 μ m 11 μ m 12 μ m	Calibrated by using Square Tester, Dial Tester Indicator, Parallel Bar and Granite Tri-Square with reference to JIS 7526:1995
25.angle	0 ° to 180 ° (Degree)	3 minutes	Calibrated by using Angle Blocks, Beveled Protractor, Sine Bar, Gauge Blocks and Dial Test Indicator with reference to JIS B 0405:1991
26.dial Bore Tester / Gauge	18 mm to 100 mm (Resolution 0.001 mm) 18 mm to 100 mm (Resolution 0.01 mm)	0.001 mm 0.003 mm	Calibrated by using Micrometer Head, Gauge Block and Ring Gauge with reference to JIS B 7515:1982
27.microindicator	\pm 25 μ m (Resolution: 0.5 μ m) \pm 50 μ m to 100 μ m (Resolution: 1 μ m) Above 100 μ m (Resolution: 2 μ m)	0.2 μ m 0.8 μ m 1.5 μ m	Calibrated by using Gauge blocks, Precision Indicator Tester, Calibration Tester with reference to JIS B 7519:1994
28.coating Thickness Gauge	0 mm to 2.766 mm	0.7 μ m	Calibrated by using Thickness Foil
29.linear Height	0 mm to 200 mm 200 mm to 400 mm 400 mm to 600 mm	1.0 μ m 2.0 μ m 2.4 μ m	Calibrated by using Gauge Block with reference to BS EN ISO 13225:2012

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
30.ultrasonic Thickness Gauge	0 mm to 10 mm 10 mm to 100 mm 100 mm to 600 mm	0.002 mm 0.011 mm 0.02 mm	Calibrated by using Gauge Block, Step Wedge, Standard Block with reference to ASTM E797/E797M-21
31.vee Block	150 mm x 150 mm x 65 mm	20 μ m	Calibrated by using Dial Test Indicator and Granite Surface Plate with reference to JIS B 7540:1972
32.three Point Internal Micrometer	0 mm to 50 mm 50 mm to 100 mm	1.8 μ m 2.3 μ m	Calibrated by using Ring Gauge with reference to DIN 863-4:1999
33.digital Indicator	0 mm to 25 mm 25 mm to 50 mm 50 mm to 100 mm	0.4 μ m 0.6 μ m 1.0 μ m	Calibrated by using Micrometer Head, Gauge Block, Calibration Tester, Precision Indicator Tester, Dial Gauge Calibrator with reference to ISO 13102:2012
34.electrical Comparator / Precision Indicator Checker	0 mm to 2 mm	0.18 μ m	Calibrated by using Gauge Block, Calibration Tester, Micrometer Head with reference to JIS B 7536:1982
35.plain Ring Gauge (diameter Only)	2 mm to 50 mm 50 mm to 100 mm 100 mm to 150 mm	1.4 μ m 1.5 μ m 1.6 μ m	Calibrated by Contact Method using Universal Horizontal Measuring Machine with Master Ring Gauge
36.height Setting Micrometer & Riser Block	0 mm to 300 mm 300 mm to 600 mm	1 μ m 2 μ m	Calibrated by using Gauge Block with reference to ISO 7863:1984
37.caliper Checker	0 mm to 360 mm 360 mm to 670 mm	2.1 μ m 4 μ m	Calibrated by using Gauge Block

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
38.taper Thread Plug Gauge (pitch Diameter At Basic Length, Step Length)	1/16 in to 2 in	0.0002 in	Calibrated by using Universal Horizontal Measuring Machine and Gauge Block with reference to ASME B1.20.5-1991
39.geometric Measurements (jig, Fixture, Machined Part And Workpiece) I) Length (contact Method)	0 mm to 11 mm 11 mm to 100 mm 100 mm to 200 mm 200 mm to 300 mm 300 mm to 400 mm 400 mm to 600 mm 600 mm to 1000 mm	0.55 μ m 1.5 μ m 2.0 μ m 3.0 μ m 3.5 μ m 5.0 μ m 15.0 μ m	Calibrated by using Micrometer, Linear Height Gauge, Linear Displacement Transducer, Ruler, Caliper, Height Setting Micrometer
39.geometric Measurements (jig, Fixture, Machined Part And Workpiece) Ii) Length (non-contact Method)	0 mm to 100 mm	2.5 μ m	Calibrated by using Profile Projector, Vision Measuring Machine
39.geometric Measurements (jig, Fixture, Machined Part And Workpiece) Iii) Diameter (contact Method)	0 mm to 25 mm 25 mm to 100 mm 100 mm to 200 mm 200 mm to 300 mm	0.6 μ m 1.5 μ m 2.0 μ m 2.5 μ m	Calibrated by using Linear Height Gauge, Micrometer, Linear Displacement Transducer, Caliper
39.geometric Measurements (jig, Fixture, Machined Part And Workpiece) Iv) Diameter, Radius (non-contact Method)	0 mm to 25 mm 25 mm to 100 mm	0.7 μ m 2.5 μ m	Calibrated by using Laser Scan Micrometer, Profile Projector, Vision Measuring Machine
39.geometric Measurements (jig, Fixture, Machined Part And Workpiece) V) Angle	0 ° to 360 °	0.09 °	Calibrated by using Protractor, Angle Block, Dial Test Indicator
39.geometric Measurements (jig, Fixture, Machined Part And Workpiece) Vi) Straightness & Parallelism	0 mm to 1000 mm	2.0 μ m	Calibrated by using Dial Test Indicator & Granite Surface Plate

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SCOPE OF CALIBRATION : ELECTRICAL

Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
Time & Frequency 1. Tachometer - Non Contact	30 rpm to 99 rpm 100 rpm to 999 rpm 1000 rpm to 4999 rpm 5000 rpm to 9999 rpm 10000 rpm to 49999rpm 50000 rpm to 99999 rpm	0.0073 rpm 0.010 rpm 0.062 rpm 0.072 rpm 0.62 rpm 0.72 rpm	Using light pulses synchronized to frequencies that correspond to the stated rpm values
Time & Frequency - Contact	60 rpm to 1000 rpm 1000 rpm to 1500 rpm 1500 rpm to 6000 rpm	1.5 rpm 2 rpm 3.2 rpm	Calibrated by using tachometer calibrator
	1 rpm to 99 rpm 100 rpm to 999 rpm 1000 rpm to 4999 rpm 5000 rpm to 9999 rpm	0.2 rpm 1.1 rpm 4.3 rpm 8.3 rpm	By comparison with Optical Tachometer
Time & Frequency 2. Stopwatch And Timer	0 s to 30 s 30 s to 60 s 60 s to 300 s 300 s to 600 s 600 s to 900 s 1800 s to 3600 s 3600 s to 7200 s 7200 s to 10800 s	0.012 s 0.012 s 0.012 s 0.012 s 0.012 s 0.012 s 0.012 s 0.012 s	By Comparison with a reference stopwatch
	1 s to 99999 s	4 μ s/s	Calibrated by using Universal Counter
Measuring Instrument 1.dc Voltage	(0 to 220) mV (0.0 to 2.2) V (0 to 11) V (0 to 22) V (0 to 220) V (0 to 1100) V	9.7 μ V/V 5.4 μ V/V 3.8 μ V/V 4.0 μ V/V 5.3 μ V/V 7.1 μ V/V	Calibrated using Multifunction Calibrator
Measuring Instrument 2.dc Current	(0 to 220) μ A (0.0 to 2.2) mA (0 to 22) mA (0 to 220) mA (0.0 to 2.2) A (2.9to 2.9) A (2.9 to 10.9) (10.9 to 20.0) A	0.068 mA/A 0.039 mA/A 0.037 mA/A 0.049 mA/A 0.081 mA/A 0.31 mA/A 0.43 mA/A 0.81 mA/A	Calibrated using Multifunction Calibrator

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
Measuring Instrument 3.dc Current Via Current Coils	(3.2 to 32) A (32 to 105) A (105 to 200) A (200 to 525) A (525 to 1000) A	2.1 mA/A 2.3 mA/A 2.6 mA/A 2.6 mA/A 2.6 mA/A	Calibrated using Multifunction Calibrator & Current Coil
Measuring Instrument 4.ac Voltage	(0.0 to 220) V	(See Matrix A)	Calibrated using Multifunction Calibrator
	(220 to 1100) V	(See Matrix B)	Calibrated using Multifunction Calibrator
Measuring Instrument 5.ac Current	(0 to 20) A	(See Matrix C)	Calibrated using Multifunction Calibrator
Measuring Instrument 6.ac Current Via Current Coils	(3.2 to 1000) A	(See Matrix D)	Calibrated using Multifunction Calibrator & Current Coil
Measuring Instrument 7.wideband Ac Voltage (frequency From 30 Hz To 500 KHz Into 50 \bar{I} % Termination)	(0.3 to 1.1) mV (1.1 to 3) mV (3 to 11) mV (11 to 33) mV (33 to 110) mV (110 to 330) mV (0.33 to 1.1) V (1.1 to 3.5) V	9.9 mV/V 8.0 mV/V 7.7 mV/V 6.5 mV/V 6.4 mV/V 5.3 mV/V 5.4 mV/V 4.1 mV/V	Calibrated using Multifunction Calibrator
Measuring Instrument 8.wideband Ac Voltage Amplitude Flatness At 1 KHz Reference Into 50 \bar{I} % Termination	0.3 mV to 3.5 V	(See Matrix E)	Calibrated using Multifunction Calibrator

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
Measuring Instrument 9.resistance	0 ?	40 μ ?	Calibrated using Multifunction Calibrator (Standard Value)
	1 ?	95 μ ?	
	1.9 ?	95 μ ?	
	10 ?	46 μ ?	
	19 ?	79 μ ?	
	100 ?	300 μ ?	
	190 ?	570 μ ?	
	1 k?	0.25 m?	
	1.9 k?	0.48 m?	
	10 k?	2.5 m?	
	19 k?	4.8 m?	
	100 k?	250 m?	
	190 k?	480 m?	
	1 M?	4.0 ?	
	1.9 M?	7.6 ?	
	10 M?	10 ?	
	19 M?	19 ?	
	100 M?	25 k?	
	1 ?	8 μ ?	Calibrated using Standard Resistance
	10 ?	11 μ ?	
	10 k?	7 m?	
	(0.0 to 10.9) ?	0.041 m?/?	Calibrated using Multifunction Calibrator
	(11 to 32.9) ?	0.031 m?/?	
	(33 to 109.9) ?	0.028 m?/?	
	(0.11 to 1.09) k?	0.028 m?/?	
	(1.1 to 10.9) k?	0.029 m?/?	
	(11 to 109) k?	0.029 m?/?	
	(0.11 to 1.09) M?	0.033 m?/?	
	(1.1 to 3.29) M?	0.062 m?/?	
	(3.3 to 10.9) M?	0.13 m?/?	
	(11 to 32.9) M?	0.27 m?/?	
	(33 to 109.9) M?	0.54 m?/?	
	(110 to 330) M?	4.8 m?/?	
(330 to 1100) M?	18 m?/?		

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks	
Measuring Instrument Resistance (continued)	(0.01 to 0.1) ?	23 m?/?	Calibrated using Decade Resistance Box	
	(0.1 to 1) ?	5.8 m?/?		
	(1 to 10) ?	0.58 m?/?		
	(10 to 100) ?	0.58 m?/?		
	(100 to 1000) ?	0.58 m?/?		
	(1 to 10) k?	0.58 m?/?		
	(10 to 100) k?	0.58 m?/?		
	(0.1 to 1) M?	0.58 m?/?		
	(1 to 10) M?	2.3 m?/?		
	(10 to 100) M?	2.3 m?/?		
	(100 to 1000) M?	23 m?/?		
	(1 to 10) G?	58 m?/?		
	(10 to 100) G?	58 m?/?		
(100 to 1000) G?	58 m?/?			
Measuring Instrument 10. Capacitance	Stim Repetition Rate ?350 Hz	5.4 mF/F 3.0 mF/F	Calibrated using Multifunction Calibrator	
	(0.5 to 4.0) nF	2.7 mF/F		
	(4.0 to 40.0) nF	3.5 mF/F		
	(40.0 to 400.0) nF	4.3 mF/F		
	(0.4 to 4.0) μ F	4.3 mF/F		
	(4.0 to 40.0) μ F	4.4 mF/F		
	(40.0 to 400.0) μ F	8.9 mF/F		
	(0.4 to 4.0) mF			
	(4.0 to 40.0) mF			
	Stim Repetition Rate 350 Hz to 1.5 kHz	11 mF/F		Calibrated using Multifunction Calibrator
	(0.5 to 4.0) nF	5.9 mF/F		
	(4.0 to 40.0) nF	5.3 mF/F		
	(40.0 to 400.0) nF	6.9 mF/F		
	(0.4 to 4.0) μ F	8.4 mF/F		
(4.0 to 40.0) μ F	8.4 mF/F			
(40.0 to 400.0) μ F	8.5 mF/F			
(0.4 to 4.0) mF	18 mF/F			
(4.0 to 40.0) mF				

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
Measuring Instrument Capacitance (continued)	at 1 kHz (0.19 to 0.4) nF (0.4 to 1.1) nF (1.1 to 3.3) nF (3.3 to 11) nF (11 to 33) nF (33 to 110) nF (0.11 to 0.33) μ F (0.33 to 1.1) μ F (1.1 to 3.3) μ F (3.3 to 11) μ F (11 to 33) μ F (33 to 110) μ F (110 to 330) μ F (0.33 to 1.1) mF (1.1 to 3.3) mF (3.3 to 11) mF (11 to 33) mF (33 to 110) mF	35 mF/F 16 mF/F 9.4 mF/F 4.0 mF/F 6.4 mF/F 4.0 mF/F 4.1 mF/F 4.1 mF/F 4.1 mF/F 4.1 mF/F 5.8 mF/F 6.4 mF/F 6.2 mF/F 6.3 mF/F 6.2 mF/F 6.2 mF/F 9.7 mF/F 15 mF/F	Calibrated using Multifunction Calibrator
	1 pF to 1 μ F 1 μ F to 10 μ F	0.61 mF/F 12 mF/F	Calibrated using Decade Capacitance box
	Fixed Value 10 μ F 100 μ F 1000 μ F	0.50 mF/F 0.70 mF/F 5.1 mF/F	Calibrated using Standard Capacitance
Measuring Instrument 11. Inductance	(10 to 100) μ H (100 to 1000) μ H (1 to 10) mH (10 to 100) mH (100 to 1000) mH (1 to 10) H	23 mH/H 23 mH/H 23 mH/H 23 mH/H 23 mH/H 23 mH/H	Calibrated using Decade Inductance Box
	Fixed Value 100 μ H 1 mH 10 mH 100 mH	12 mH/H 1.2 mH/H 1.2 mH/H 1.2 mH/H	Calibrated using Standard Inductance
Measuring Instrument 12. Frequency	(0.01 to 12) kHz (12 to 100) kHz (0.1 to 2) MHz	0.0057 mHz/Hz 0.0057 mHz/Hz 0.0050 mHz/Hz	Calibrated using Multifunction Calibrator
Measuring Instrument 13. Dc Power	(40 to 200) mW (0.22 to 720) W (720 to 11000) W	0.71 mW/W 0.47 mW/W 1 mW/W	Calibrated using Multifunction Calibrator
Measuring Instrument 14. Ac Power	(45 to 65 Hz) (0.04 to 3.3) W (3.3 to 11000) W	3.1 mW/W 1.9 mW/W	Calibrated using Multifunction Calibrator

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
Measuring Instrument 15. Power Factor	0 to 1	0.003	Calibrated using Multifunction Calibrator
Measuring Instrument Frequency - Accuracy	1 μ Hz to 0.5 Hz 0.5 Hz to 600 MHz 600 MHz to 1050 MHz 10 GHz to 2 GHz	5 μ Hz/Hz 2.9 μ Hz/Hz 2.9 μ Hz/Hz 0.12 μ Hz/Hz	Calibrated using Function Generator, Multifunction Calibrator, Oscilloscope Calibrator
Measuring Instrument Frequency - Amplitude	(0.01 to 5.00) Vpp 1 μ Hz to 100 kHz 100 kHz to 20 MHz 20 MHz to 30.2 MHz (5 to 10) Vpp 1 μ Hz to 100 kHz 100 kHz to 20 MHz 20 MHz to 30.2 MHz	40 mV/V 40 mV/V 40 mV/V 58 mV/V 92 mV/V 210 mV/V	Calibrated using Function Generator
Measuring Instrument 17. Earth Tester	0.01 ? to 0.1 ? 0.1 ? to 100 ? 100 ? to 1 M ?	2.3 m?/? 0.14 m?/? 2.3 m?/?	Calibrated using Decade Resistance Box
Measuring Instrument 18. Insulation Tester / High Voltage Insulation Tester (up To 5 Kv)	(1 to 100) M? (0.1 to 1) G? (1 to 10) G? (0.01 to 1) T? (1 to 10) T?	1.2 m?/? 2.3 m?/? 5.8 m?/? 19 m?/? 35 m?/?	Calibrated using Decade Resistance Box
16. Oscilloscope Vertical Amplitude A. Acv Square (vp-p) 1 M $\dot{\text{i}}$ % Load 50 $\dot{\text{i}}$ % Load B.dc Signal 1 M $\dot{\text{i}}$ % Load 50 $\dot{\text{i}}$ % Load	10 Hz to 10 kHz 1 mVp-p to 130 Vp-p	2.9 mV/V	Calibrated using Multifunction Calibrator
	100 μ V to 5 V	2.9 mV/V	Calibrated using Multifunction Calibrator
	0 V to 130 V 4.44 mV to 2.78V	0.58 mV/V 2.9 mV/V	Calibrated using Multifunction Calibrator
16. Oscilloscope Time Base	1 ns 2 ns to 5 s 5 s to 15 s	0.029 ms/s 1.2 ms/s 0.12 μ s/s	Calibrated using Multifunction Calibrator, Oscilloscope Calibrator

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
16. Oscilloscope Rise Time	2 ns (Nominal) Edge function 25 mVp-p, 1 MHz into 50 Ω	0.2 ns	Calibrated using Multifunction Calibrator
16. Oscilloscope Edge Function Output Period Rise Time 50 μ % Load 1 M Ω % Load Fall Time 50 μ % Load 1 M Ω % Load	100 ns to 100 ms 10 μ s to 10 ms	29 μ s/s 29 μ s/s	Calibrated using Multifunction Calibrator
	100 ns to 10 ms 100 ns to 10 ms	29 μ s/s 29 μ s/s	Calibrated using Multifunction Calibrator
16. Oscilloscope Bandwidth -“ Amplitude Flatness At 50 Khz Reference	5 mV to 5.5 V 50 kHz to 100 MHz 100 MHz to 300 MHz	19 mV/V 25 mV/V	Calibrated using Multifunction Calibrator, Oscilloscope Calibrator
	5 mV to 3.5 V 300 MHz to 1050 MHz	59 mV/V	Calibrated using Multifunction Calibrator, Oscilloscope Calibrator
	424 mVp-p to 1.131Vp-p 1 GHz to 2 GHz	230 mV/V	Calibrated using Multifunction Calibrator, Oscilloscope Calibrator
Sourcing/generating Instrument 19. Dc Voltage	(0 to 100) mV (0 to 1) V (0 to 10) V (0 to 100) V (0 to 1000) V	14 μ V/V 6.5 μ V/V 5.5 μ V/V 8.3 μ V/V 8.6 μ V/V	Calibrated using Digital Multimeter
Sourcing/generating Instrument 20. Dc High Voltage	1 kV to 10 kV 10 kV to 40 kV	0.97 mV/V 23 mV/V	Calibrated using Digital Multimeter and High Voltage Meter
Sourcing/generating Instrument 21. Dc Current	(0 to 100) μ A (0 to 1) mA (0 to 10) mA (0 to 100) mA (0 to 1) A (0 to 2) A	33 μ A/A 30 μ A/A 29 μ A/A 46 μ A/A 160 μ A/A 890 μ A/A	Calibrated using Digital Multimeter
	(0 to 10) A	2.4 mA/A	Calibrated using Digital Multimeter

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
Sourcing/generating Instrument 22. Dc Current Via Current Shunt	(0.1 to 1) mA	140 μ A/A	Calibrated using Digital Multimeter and Current Shunt
	(1 to 10) mA	14 μ A/A	
	(10 to 100) mA	2.9 μ A/A	
	(0.1 to 1) mA	140 μ A/A	
	(1 to 10) mA	14 μ A/A	
	(10 to 100) mA	2.9 μ A/A	
	(0.1 to 1) A	140 μ A/A	
	(1 to 2) A	68 μ A/A	
	(2 to 5) A	29 μ A/A	
	(5 to 10) A	16 μ A/A	
	(10 to 15) A	12 μ A/A	
	(15 to 20) A	10 μ A/A	
(20 to 25) A	50 μ A/A		
(25 to 30) A	50 μ A/A		
	(10 to 100) A	2.6 mA/A	Calibrated using Digital Multimeter and Current Shunt
Sourcing/generating Instrument 23. Ac Voltage	(0 to 700) V	(See Matrix F)	Calibrated using Digital Multimeter
	700 V to 1000 V	14 mV/V	Calibrated using Digital Multimeter
	(45 to 1000) Hz (1 to 10) kHz	14 mV/V	
Sourcing/generating Instrument 24. Ac High Voltage	50 Hz & 60 Hz (1 to 10) kV (10 to 40) kV	12 mV/V 62 mV/V	Calibrated using Digital Multimeter and High Voltage Meter
Sourcing/generating Instrument 25. Ac Current	10 μ A to 10 A	(See Matrix G)	Calibrated using Digital Multimeter
Sourcing/generating Instrument 26. Ac Current Via Current Shunt	10 A to 100 A 45 Hz to 65 Hz	3.1 mA/A	Calibrated using Digital Multimeter and Current Shunt
Sourcing/generating Instrument 27. Resistance	(0 to 10) ?	0.036 m-,,!/?	Calibrated using Digital Multimeter
	(10 to 100) ?	0.023 m?/?	
	(0.1 to 1) k?	0.016 m?/?	
	(1 to 10) k?	0.016 m?/?	
	(10 to 100) k?	0.018 m?/?	
	(0.1 to 1) M?	0.030 m?/?	
	(1 to 10) M?	0.084 m?/?	
	(10 to 100) M?	0.6 m?/?	
(0.1 to 1) G?	5.9 m?/?		
Sourcing/generating Instrument 28. Frequency (100 Mv To 750 V)	1 Hz to 40 Hz	0.60 mHz/Hz	Calibrated using Digital Multimeter
	40 Hz to 100 MHz	0.12 mHz/Hz	

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
Sourcing/generating Instrument 29. Capacitance	(1 to 10) nF (10 to 100) nF (100 to 1000) nF (1 to 10) μ F (10 to 100) μ F (100 to 1000) μ F (1 to 10) mF (10 to 50) mF	24 mF/F 12 mF/F 12 mF/F 12 mF/F 12 mF/F 17 mF/F 17 mF/F 37 mF/F	Calibrated using Digital Multimeter
Rf Measuring Equipment 30. Rf Power Sensor Calibration Factor	Power Level 1.00 mW, Ref = 50 MHz 50 MHz to 1GHz 2 GHz to 5 GHz 6 GHz to 10 GHz 11 GHz to 18 GHz	1.6 % 1.7 % 1.9 % 2.6 %	Calibration Factor Type-N 50 ?, Direct Comparison Method using N432A, 8478B, 11667A, NRVS & NRV-Z51
Rf Measuring Equipment 31. Rf Measuring A) Frequency	0.1 Hz to 18 GHz	2.0×10^{-12}	Generated using Frequency Generator DS345, HP8665A, 68369B ext ref. to EC1S-SO with GPS disciplined
Rf Measuring Equipment B) Rf Power (50 μ %)	-30 dBm to 20 dBm DC to 30 MHz 30 MHz to 6 GHz 6 GHz to 8 GHz 8 GHz to 12.4 GHz 12.4 GHz to 15 GHz 15 GHz to 16 GHz 16 GHz to 18 GHz	0.10 dB 0.08 dB 0.09 dB 0.10 dB 0.12 dB 0.13 dB 0.14 dB	Characterized using 68369B, NRVS and NRV-Z52
Rf Measuring Equipment 32. Rf Power Meter	Power Level -25 dBm (3.1623 μ W) -20 dBm (10 μ W) -15 dBm (31.6228 μ W) -10 dBm (100 μ W) -5 dBm (316.2278 μ W) 0 dBm (1 mW) 5 dBm (3.1623 mW) 10 dBm (10 mW) 15 dBm (31.6228 mW) 20 dBm (100 mW)	0.020 μ W 0.017 μ W 0.026 μ W 0.02 μ W 0.04 μ W 0.0001 mW 0.0006 mW 0.002 mW 0.007 mW 0.030 mW	Generation using Agilent 11683A- H01 range calibrator, Fluke 5720A calibrator
Rf Measuring Equipment Reference Output	1 mW @ 50 MHz	0.004 mW	Agilent N432A,HP 478A-H75 and HP3458A-002

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
Generating Equipment 33. Rf Generating A) Frequency	0.1 Hz to 18 GHz	2.0×10^{-12}	Measurement using CNT-90 ext ref to EC1S-SO with GPS disciplined
Generating Equipment B) Rf Power (50 I‰)	-30 dBm to 20 dBm DC to 30 MHz 30 MHz to 6 GHz 6 GHz to 8 GHz 8 GHz to 12.4 GHz 12.4 GHz to 15 GHz 15 GHz to 16 GHz 16 GHz to 18 GHz	0.09 dB 0.07 dB 0.08 dB 0.09 dB 0.11 dB 0.12 dB 0.14 dB	Measurement using NRVS and NRV-Z52
Generating Equipment C) Frequency Modulation Accuracy/deviation	-18 to 30 dBm		N5531S fc = Carrier Frequency fm = Modulation Rate ?f = Peak Deviation ? = ?f/fm
	fc: 250 kHz to 10 MHz fm: 20 Hz to 10 kHz ?f = 200 Hz to 40 kHz ? > 0.2 ? > 1.2	0.015 Hz/Hz 0.010 Hz/Hz	
	fc: 10 MHz to 6.6 GHz fm: 50 Hz to 200 kHz ?f = 250 Hz to 400 kHz ? > 0.2 ? > 0.45	0.015 Hz/Hz 0.010 Hz/Hz	N5531S fc = Carrier Frequency fm = Modulation Rate ?f = Peak Deviation ? = ?f/fm
	fc: 6.6 GHz to 13.2 GHz fm: 50 Hz to 200 kHz ?f = 250 Hz to 400 kHz ? > 0.2 ? > 8	0.025 Hz/Hz 0.010 Hz/Hz	N5531S fc = Carrier Frequency fm = Modulation Rate ?f = Peak Deviation ? = ?f/fm
	fc: 13.2 GHz to 26.5 GHz fm: 50 Hz to 200 kHz ?f = 250 Hz to 400 kHz ? > 0.2 ? > 16	0.038 Hz/Hz 0.010 Hz/Hz	N5531S fc = Carrier Frequency fm = Modulation Rate ?f = Peak Deviation ? = ?f/fm
Generating Equipment D) Amplitude Modulation Depth	-18 to 30 dBm fc: 100 kHz to 10 MHz fm: 50 Hz to 10 kHz Depth: 5% to 99%	0.0075%/%	N5531S fc = Carrier Frequency fm = Modulation Rate

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
	fc: 10 MHz to 3 GHz fm: 50 Hz to 100 kHz Depth: 20% to 99% Depth: 5% to 20%	0.005%/ % 0.025%/ %	N5531S fc = Carrier Frequency fm = Modulation Rate
	fc: 3 GHz to 26.5 GHz fm: 50 Hz to 100 kHz Depth: 20% to 99% Depth: 5% to 20%	0.015%/ % 0.045%/ %	N5531S fc = Carrier Frequency fm = Modulation Rate
Generating Equipment E) Phase Modulation Accuracy/deviation	-18 to 30 dBm fc: 100 kHz to 6.6 GHz ??: 0.7 rad ??: 0.3 rad	0.01 rad/rad 0.03 rad/rad	N5531S fc = Carrier Frequency ?? = Phase Deviation
	fc: 6.6 GHz to 13.2 GHz ??: 2.0 rad ??: 0.6 rad	0.01 rad/rad 0.03 rad/rad	N5531S fc = Carrier Frequency ?? = Phase Deviation
	fc: 13.2 GHz to 26.5 GHz ??: 4.0 rad ??: 1.2 rad	0.01 rad/rad 0.03 rad/rad	N5531S fc = Carrier Frequency ?? = Phase Deviation
Generating Equipment F) Frequency Modulation Distortion	fm: 20Hz to 1 kHz fc: 1 MHz to 6.6 GHz ?f = 500 Hz to 2.0 kHz ?f ? 2.0 kHz	0.12 %/ % + 0.3% 0.12 %/ % + 0.1%	N5531S fc = Carrier Frequency fm = Modulation Rate ?f = Deviation
	fc: 6.6 GHz to 13.2 GHz ?f ? 2.3 kHz ?f ? 4.5 kHz	0.12 %/ % + 0.3% 0.12 %/ % + 0.1%	N5531S fc = Carrier Frequency fm = Modulation Rate ?f = Deviation
	fc: 13.2 GHz to 26.5 GHz ?f ? 2.7 kHz ?f ? 6.0 kHz	0.12 %/ % + 0.3% 0.12 %/ % + 0.1%	N5531S fc = Carrier Frequency fm = Modulation Rate ?f = Deviation
Generating Equipment G) Amplitude Modulation Distortion	0.01% to 100% fm: 20 Hz to 1 kHz		N5531S fc = Carrier Frequency fm = Modulation Rate
	fc: 100 kHz to 10 MHz Depth > 1% Depth > 3%	0.12 %/ % + 0.8% 0.12 %/ % + 0.3%	
	fc: 10 MHz to 26.5 GHz Depth > 1% Depth > 3%	0.12 %/ % + 1.0% 0.12 %/ % + 0.4%	N5531S fc = Carrier Frequency fm = Modulation Rate

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Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (\pm)*	Remarks
Generating Equipment H) Phase Modulation Distortion	-18 to 30 dBm fc: 100 kHz to 6.6 GHz fm: 20 Hz to 500 Hz ?? > 0.8 rad ?? > 2.5 rad	0.0012 %/% + 0.3% 0.0012 %/% + 0.1%	N5531S fc = Carrier Frequency fm = Modulation Rate ?? = Phase Deviation
	fc: 1 MHz to 6.6 GHz fm: 500 Hz to 1 kHz ?? > 0.4 rad ?? > 1.0 rad	0.0012 %/% + 0.3% 0.0012 %/% + 0.1%	N5531S fc = Carrier Frequency fm = Modulation Rate ?? = Phase Deviation
	fc: 6.6 GHz to 13.2 GHz fm: 20 Hz to 500 Hz ?? > 1.8 rad ?? > 5.5 rad	0.0012 %/% + 0.3% 0.0012 %/% + 0.1%	N5531S fc = Carrier Frequency fm = Modulation Rate
	fc: 6.6 GHz to 13.2 GHz fm: 500 Hz to 1 kHz ?? > 0.8 rad ?? > 2.5 rad	0.0012 %/% + 0.3% 0.0012 %/% + 0.1%	N5531S fc = Carrier Frequency fm = Modulation Rate
	fc: 13.2 GHz to 26.5 GHz fm: 20 Hz to 500 Hz ?? > 3.5 rad ?? > 10.0 rad	0.0012 %/% + 0.3% 0.0012 %/% + 0.1%	N5531S fc = Carrier Frequency fm = Modulation Rate
	fc: 13.2 GHz to 26.5 GHz fm: 500 Hz to 1 kHz ?? > 1.2 rad ?? > 4.0 rad	0.0012 %/% + 0.3% 0.0012 %/% + 0.1%	N5531S fc = Carrier Frequency fm = Modulation Rate
	Generating Equipment I) Modulation Rate Amplitude Modulation Frequency Modulation Phase Modulation	100 kHz to 26.5 GHz ?f ? 2.3 kHz fm ? 100 kHz	0.078 Hz
β ? 0.01 fm ? 200 kHz		0.096 Hz	
β ? 0.01 fm ? 20 kHz		0.064 Hz	
Generating Equipment J) Tuned Rf Level	(See Matrix H & I)		N5531S (Option 1DS) with N5532B Sensor Module (Option 526)

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SITE LOCATION (HQ)	1. CATEGORY I
FIELD(S) OF CALIBRATION :	DIMENSIONAL,ELECTRICAL,FORCE,HEAT & TEMPERATURE,MASS,PRESSURE,TORQUE,VOLUME

SCOPE OF CALIBRATION : HEAT & TEMPERATURE

Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques	Remarks
Temperature Sensor With Indicator	-30 °C to 30 °C 30 °C to 200 °C 200 °C to 400 °C 400 °C to 600 °C	0.1 °C 0.08 °C 0.3 °C 0.69 °C	Comparison with Pt100 In liquid bath and temperature block calibrator
Temperature Controlled Enclosures	-80 °C to -40 °C -40 °C to 250 °C 250 °C to 400 °C 400 °C to 900 °C 900 °C to 1300 °C	0.8 °C 0.2 °C 1.7 °C 2.4 °C 2.6 °C	Calibrated by using temperature recorder with thermocouple and PRT
Temperature Recorders / Indicators A) Type T	-200 °C to -100 °C -100 °C to 400 °C	0.6 °C 0.2 °C	By electrical simulation using calibrator and reference table ITS 90
Temperature Recorders / Indicators B) Type E	-200 °C to -100 °C -100 °C to 1000 °C	0.6 °C 0.2 °C	By electrical simulation using calibrator and reference table ITS 90
Temperature Recorders / Indicators C) Type K	-200 °C to -100 °C -100 °C to 1370 °C	1.1 °C 0.2 °C	By electrical simulation using calibrator and reference table ITS 90
Temperature Recorders / Indicators D) Type R	0°C to 1760 °C	1.0 °C	By electrical simulation using calibrator and reference table ITS 90
Temperature Recorders / Indicators E) Type J	-200 °C to 1200 °C	0.2 °C	By electrical simulation using calibrator and reference table ITS 90
Temperature Recorders / Indicators F) Type S	0 °C to 1760 °C	1.0 °C	By electrical simulation using calibrator and reference table ITS 90
Temperature Recorders / Indicators G) Type B	600 °C to 1800 °C	1.0 °C	By electrical simulation using calibrator and reference table ITS 90

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Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques	Remarks
Temperature Recorders / Indicators H) Type N	-200 °C to -100 °C -100 °C to 1300 °C	1.1 °C 0.2 °C	By electrical simulation using calibrator and reference table ITS 90
Temperature Recorders / Indicators I) Pt 100	-200 °C to 850 °C	0.2 °C	By electrical simulation using calibrator and reference table ITS 90
Humidity Chamber	5 °C to 60 °C 20 %rh to 95 %rh	0.2 °C 2.0 %rh	Calibrated by using thermohygrometer
Temperature Sensor Pt 100	-30 °C to 30 °C 30 °C to 200 °C 200 °C to 400 °C 400 °C to 600 °C	0.10 °C 0.13 °C 0.28 °C 0.70 °C	Comparison with Pt 100 and temperature calibrator in liquid bath and temperature block calibrator
Temperature Sensor Thermocouple	-30 °C to 30 °C 30 °C to 200 °C 200 °C to 400 °C 400 °C to 600 °C	0.3 °C 0.18 °C 0.30 °C 0.71 °C	Comparison with Pt 100 and temperature calibrator in liquid bath and temperature block calibrator
Temperature Block Calibrator	-40 °C to 400 °C 400 °C to 600 °C 600 °C to 1300 °C	0.015 °C 0.02 °C 2.8 °C	Calibration using PRT sensor and thermocouple R/S
Temperature Liquid Bath	-40 °C to 250 °C	0.015 °C	Calibration using PRT sensor
Temperature & Humidity Sensor	5 °C to 50 °C Relative humidity at 25 °C 5 %rh to 50 %rh 50 %rh to 70 %rh 70 %rh to 95 %rh	0.1 °C 1.4 %rh 1.6 %rh 1.8 %rh	Comparison with thermohygrometer and Pt100 sensor in humidity calibrator

SCOPE OF CALIBRATION : MASS

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Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques	Remarks
Balance	Up to 5 g Up to 20 g Up to 50 g Up to 220 g Up to 300 g Up to 1000 g Up to 2500 g Up to 6200 g Up to 10 kg Up to 20 kg Up to 50 kg Up to 120 kg Up to 200 kg Up to 500 kg Up to 1000 kg Up to 2500 kg Up to 4000 kg	0.06 mg 0.11 mg 0.3 mg 1.0 mg 1.5 mg 4.4 mg 23 mg 55 mg 70 mg 0.2 g 0.4 g 1.1 g 44 g 0.10 kg 0.20 kg 0.50 kg 1.0 kg	Calibrated by using standard weights
Standard Weight * (deadweight)	20 kg 25 kg	0.2 g 0.2 g	Calibration by comparison with standard weight of same nominal value * OIML Class M2 and below/ or equivalent classification
Weighing Device (weighing Scale, Hopper Scale & Tank Scale)	Up to 600 kg Up to 2000 kg Up to 4000 kg Up to 6000 kg Up to 8000 kg Up to 10000 kg	0.5 kg 1.1 kg 2.1 kg 3.5 kg 4.5 kg 5.4 kg	Calibration using substitution loads with general reference to Measurement Canada – Field Inspection Manual – Non automatic weighing devices, and Euramet cg-18 v4.0

SCOPE OF CALIBRATION : FORCE

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Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques	Remarks
Universal Tensile / Compression Testing Machine	980 N 9.8 kN 49 kN 98 kN 196 kN 490 kN 980 kN 2000 kN	0.03 N 7.2 N 37 N 85 N 0.32 kN 0.35 kN 3.0 kN 4.2 kN	Calibrated by using load cell based on ISO 7500-1:2018
Load Cell	0 N to 5 N	0.012 N	Calibrated by using standard weights based on ISO 376:2011
	5 N to 1 kN	0.03 N	Calibrated by using dead weights based on ISO 376:2011
	1 kN to 10 kN 10 kN to 50 kN Tension mode only	7.3 N 37 N	Calibrated by using load cell based on ISO 376:2011
	Tension and Compression Mode Up to 10 kN Up to 20 kN Up to 50 kN Compression Mode Only Up to 100 kN	7.4 N 9.3 N 11 N 79 N	Calibrated by using load cell based on ISO 376:2011

SCOPE OF CALIBRATION : TORQUE

Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques	Remarks
Hand Torque Tools	0 N.m to <0.12 N.m 0.12 N.m to <0.2 N.m 0.2 N.m to <2 N.m 2 N.m to <10 N.m 10 N.m to <150 N.m 150 N.m to <400 N.m 400 N.m to 1500 N.m	3.6 % of reading 1.7 % of reading 1.5 % of reading 1.0 % of reading 0.8 % of reading 0.3 % of reading 0.3 % of reading	Calibrated using torque calibrators based on ISO 6789-2:2017

SCOPE OF CALIBRATION : PRESSURE

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Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques	Remarks
Pressure Measuring Device Pneumatic	0 kgf/cm ² to 10 kgf/cm ² 10 kgf/cm ² to 30 kgf/cm ²	0.002 kgf/cm ² 0.005 kgf/cm ²	Calibrated by using test gauge, pressure calibrator and High Pressure Transducer
Pressure Measuring Device Hydraulic	0 kgf/cm ² to 100 kgf/cm ² 100 kgf/cm ² to 300 kgf/cm ² 300 kgf/cm ² to 700 kgf/cm ² 700 kgf/cm ² to 1400 kgf/cm ² 1400 kgf/cm ² to 2812 kgf/cm ² 2812 kgf/cm ² to 4218 kgf/cm ²	0.03 kgf/cm ² 0.06 kgf/cm ² 0.16 kgf/cm ² 0.23 kgf/cm ² 0.43 kgf/cm ² 14 kgf/cm ²	Calibrated by using test gauge, pressure calibrator and High Pressure Transducer
Pressure Measuring Device Vacuum	-0.97 kgf/cm ² to 0 kgf/cm ²	0.0017 kgf/cm ²	Calibrated by using test gauge, pressure calibrator and High Pressure Transducer
Absolute Pressure Measuring Device	0 kPa abs to 200 kPa abs 200 kPa abs to 700 kPa abs	0.075 kPa abs 0.14 kPa abs	Calibrated by using test gauge, pressure calibrator and High Pressure Transducer
Manometer	0 Pa to 500 Pa 500 Pa to 1000 Pa 1000 Pa to 3000 Pa 3000 Pa to 5000 Pa 5000 Pa to 7000 Pa 7 kPa to 70 kPa	0.25 Pa 0.53 Pa 1.6 Pa 3.0 Pa 4.3 Pa 0.02 kPa	Calibrated by using test gauge, pressure calibrator and High Pressure Transducer

SCOPE OF CALIBRATION : VOLUME

Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques	Remarks
Test Measure And Provers - "Volumetric Method"	5 L and 10 L 20 L 50 L 100 L 200 L	0.002 L 0.004 L 0.008 L 0.009 L 0.016 L	Calibrated by volumetric method using standard test measures based on NIST IR 7383 SOP 19 and NIST Handbook 105- 3 (2010)

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SCOPE OF CALIBRATION : DIMENSIONAL

Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques	Remarks
1. Profile Projector Individual Axis	Up to 140 mm 140 mm to 300 mm	1.6 mm 3.1 mm	Calibrated by using glass scale with reference to JIS B 7184:1999
2. Measuring Microscopes (individual Linear X, Y Axis Only)	Up to 20 mm Up to 50 mm Up to 100 mm Up to 150 mm Up to 200 mm Up to 300 mm	0.5 µm 0.8 µm 1.3 µm 1.8 µm 2.3 µm 3.4 µm	Calibrated by using Glass Scale according to JIS B 7153:1995
3. Surface Plate	300 mm ? 300 mm 600 mm X 600 mm 1000 mm ? 1000 mm 1600 mm ? 2500 mm	1.4 mm 2.0 mm 2.6 mm 3.8 mm	Calibrated by using precision inclinometer, micro indicator and variation gauge with reference to BS 817:2008
4. Surface Plate	600 mm X 600 mm 600 mm ? 1000 mm 1000 mm ? 1500 mm 1500 mm ? 2000 mm	1.6 mm 1.9 mm 2.0 mm 2.2 mm	Calibrated by using planeator, microindicator and variation gauge with reference to BS 817:2008

SCOPE OF CALIBRATION : ELECTRICAL

Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques	Remarks
Time & Frequency 1. Revolutions Per Minute (rpm) Measurement -“ Non Contact	60 rpm to 40000 rpm	1 rpm	By comparison with Optical Tachometer
Time & Frequency 2. Tachometer -“ Contact	1 rpm to 99 rpm 100 rpm to 999 rpm 1000 rpm to 4999 rpm 5000 rpm to 9999 rpm	0.2 rpm 0.4 rpm 1.3 rpm 2.3 rpm	By comparison with Optical Tachometer

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Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques	Remarks
Time & Frequency 3. tachometer -" (noncontact / Stroboscope)	30 rpm to 99 rpm 100 rpm to 999 rpm 1000 rpm to 4999 rpm 5000 rpm to 9999 rpm 10000 rpm to 49999 rpm 50000 rpm to 99999 rpm	0.002 rpm 0.007 rpm 0.06 rpm 0.07 rpm 0.60 rpm 0.66 rpm	Using light pulses synchronized to frequencies that correspond to the stated rpm values
Time & Frequency 4. Stopwatch And Timer	0 s to 30 s 30 s to 60 s 60 s to 300 s 300 s to 600 s 600 s to 900 s 1800 s to 3600 s 3600 s to 7200 s 7200 s to 10800 s	0.08 s 0.08 s 0.08 s 0.08 s 0.08 s 0.08 s 0.08 s 0.08 s	Direct Comparison Method
	1 s to 99999 s	4 ms/s	Calibrated using Universal Counter

SCOPE OF CALIBRATION : ELECTRICAL

Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques	Remarks
Measuring Instrument 1. dc Voltage	(0 to 220) mV (0.0 to 2.2) V (0 to 11) V (0 to 22) V (0 to 220) V (0 to 1100) V	9.7 μ V/V 5.4 μ V/V 3.8 μ V/V 4.0 μ V/V 5.3 μ V/V 7.1 μ V/V	Calibrated using Multifunction Calibrator
Measuring Instrument 2. dc Current	(0 to 220) μ A (0.0 to 2.2) mA (0 to 22) mA (0 to 220) mA (0.0 to 2.2) A (2.2 to 2.9) A (2.9 to 10.9) A (10.9 to 20.0) A	0.068 mA/A 0.039 mA/A 0.037 mA/A 0.049 mA/A 0.081 mA/A 0.31 mA/A 0.43 mA/A 0.81 mA/A	Calibrated using Multifunction Calibrator
Measuring Instrument 3. dc Current Via Current Coils	(3.2 to 32) A (32 to 105) A (105 to 200) A (16 to 160) A (160 to 525) A (525 to 1000) A	2.1 mA/A 2.3 mA/A 2.6 mA/A 2.6 mA/A 2.6 mA/A 2.6 mA/A	Calibrated using Multifunction Calibrator & Current Coil

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Measuring Instrument 4.ac Voltage	(0.0 to 220) V	(See Matrix J)	Calibrated using Multifunction Calibrator
	(220 to 1100) V	(See Matrix K)	Calibrated using Multifunction Calibrator
Measuring Instrument 5.ac Current	(0 to 20) A	(See Matrix L)	Calibrated using Multifunction Calibrator
Measuring Instrument 6.ac Current Via Current Coils	(3.2 to 1000) A	(See Matrix M)	Calibrated using Multifunction Calibrator & Current Coil
Measuring Instrument 7.wideband Ac Voltage (frequency From 30 Hz To 500 Khz Into 50 Ω Termination)	(0.3 to 1.1) mV (1.1 to 3) mV (3 to 11) mV (11 to 33) mV (33 to 110) mV (110 to 330) mV (0.33 to 1.1) V (1.1 to 3.5) V	9.9 mV/V 8.0 mV/V 7.7 mV/V 6.5 mV/V 6.4 mV/V 5.5 mV/V 5.6 mV/V 4.1 mV/V	Calibrated using Multifunction Calibrator
Measuring Instrument 8.wideband Ac Voltage Amplitude Flatness at 1 Khz Reference Into 50 Ω Termination)	0.3 mV to 3.5 V	(See Matrix N)	Calibrated using Multifunction Calibrator
Measuring Instrument 9.resistance	0 ? 1 ? 1.9 ? 10 ? 19 ? 100 ? 190 ? 1 k? 1.9 k? 10 k? 19 k? 100 k? 190 k? 1 M? 1.9 M? 10 M? 19 M? 100 M?	40 μ? 95 μ? 95 μ? 46 μ? 79 μ? 300 μ? 570 μ? 0.25 m? 0.48 m? 2.5 m? 4.8 m? 250 m? 480 m? 4.0 ? 7.6 ? 10 ? 19 ? 25 k?	Calibrated using Multifunction Calibrator (Standard Value)
	1 Ω	8 μΩ	Calibrated using Standard Resistance
	10 Ω	11 μΩ	Calibrated using Standard Resistance
	10 kΩ	7 mΩ	Calibrated using Standard Resistance
	(0.0 to 10.9) ? (11 to 32.9) ? (33 to 109.9) ? (0.11 to 1.09) k? (1.1 to 10.9) k? (11 to 109) k? (0.11 to 1.09) M? (1.1 to 3.29) M? (3.3 to 10.9) M? (11 to 32.9) M? (33 to 109.9) M? (110 to 330) M? (330 to 1100) M?	0.041 m?/? 0.031 m?/? 0.028 m?/? 0.028 m?/? 0.029 m?/? 0.029 m?/? 0.033 m?/? 0.062 m?/? 0.13 m?/? 0.27 m?/? 0.54 m?/? 4.8 m?/? 18 m?/?	Calibrated using Multifunction Calibrator

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	(0.01 to 0.1) ? (0.1 to 1) ? (1 to 10) ? (10 to 100) ? (100 to 1000) ? (1 to 10) k? (10 to 100) k? (0.1 to 1) M? (1 to 10) M? (10 to 100) M? (100 to 1000) M? (1 to 10) G? (10 to 100) G? (100 to 1000) G?	23 m?/? 5.8 m?/? 0.58 m?/? 0.58 m?/? 0.58 m?/? 0.58 m?/? 2.3 m?/? 2.3 m?/? 23 m?/? 58 m?/? 58 m?/? 58 m?/?	Calibrated using Decade Resistance Box
Measuring Instrument 10. Capacitance	Stim Repetition Rate ?350 Hz (0.5 to 4.0) nF (4.0 to 40.0) nF (40.0 to 400.0) nF (0.4 to 4.0) μF (4.0 to 40.0) μF (40.0 to 400.0) μF (0.4 to 4.0) mF (4.0 to 40.0) mF	5.4 mF/F 3.0 mF/F 2.7 mF/F 3.5 mF/F 4.3 mF/F 4.5 mF/F 4.6 mF/F 8.9 mF/F 11 mF/F 5.9 mF/F 5.3 mF/F 6.9 mF/F 8.4 mF/F 8.4 mF/F 8.5 mF/F 18 mF/F	Calibrated using Multifunction Calibrator
	Stim Repetition Rate 350 Hz to 1.5 kHz (0.5 to 4.0) nF (4.0 to 40.0) nF (40.0 to 400.0) nF (0.4 to 4.0) μF (4.0 to 40.0) μF (40.0 to 400.0) μF (0.4 to 4.0) mF (4.0 to 40.0) mF		
	at 1 kHz (0.19 to 0.4) nF (0.4 to 1.1) nF (1.1 to 3.3) nF (3.3 to 11) nF (11 to 33) nF (33 to 110) nF (0.11 to 0.33) μF (0.33 to 1.1) μF (1.1 to 3.3) μF (3.3 to 11) μF (11 to 33) μF (33 to 110) μF (110 to 330) μF (0.33 to 1.1) mF (1.1 to 3.3) mF (3.3 to 11) mF (11 to 33) mF (33 to 110) mF	35 mF/F 16 mF/F 9.4 mF/F 4.0 mF/F 6.4 mF/F 4.0 mF/F 4.1 mF/F 4.1 mF/F 4.1 mF/F 5.8 mF/F 6.4 mF/F 6.2 mF/F 6.3 mF/F 6.2 mF/F 6.2 mF/F 9.7 mF/F 15 mF/F	Calibrated using Multifunction Calibrator
	1 pF to 1 μF 1 μF to 10 μF	0.61 mF/F 12 mF/F	Calibrated using Decade Capacitance box
	Fixed Value 10 μF 100 μF 1000 μF	0.50 mF/F 0.70 mF/F 5.1 mF/F	Calibrated using Standard Capacitance

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Measuring Instrument 11. Inductance	(10 to 100) μ H (100 to 1000) μ H (1 to 10) mH (10 to 100) mH (100 to 1000) mH (1 to 10) H	23 mH/H 23 mH/H 23 mH/H 23 mH/H 23 mH/H	Calibrated using Decade Inductance Box
	Fixed Value 100 μ H 1 mH 10 mH 100 mH	12 mH/H 1.2 mH/H 1.2 mH/H 1.2 mH/H	Calibrated using Standard Inductance
Measuring Instrument 12. Frequency	(1 to 1000) Hz (1 to 100) kHz	0.058 mHz/Hz 1.4 mHz/Hz	Calibrated using Multifunction calibrator
13. Oscilloscope Vertical Amplitude A. Acv Square (vp-p) 1 M \bar{I} % Load 50 \bar{I} % Load B.dc Signal 1 M \bar{I} % Load 50 \bar{I} % Load	10 Hz to 10 kHz (1.01 to 130) Vp-p 1 mV to 5 V (0 to 130) V 4.44 mV to 2.78 V	2.9 mV/V 2.9 mV/V 0.58 mV/V 2.9 mV/V	Calibrated using Multifunction calibrator
13. Oscilloscope Time Base	1 ns 2 ns to 5 s	0.029 ms/s 1.2 ms/s	Calibrated using Multifunction calibrator
13. Oscilloscope Edge Function Output Period Rise Time 50 \bar{I} % Load 1 M \bar{I} % Load Fall Time 50 \bar{I} % Load 1 M \bar{I} % Load	100 ns to 100 ms 10 μ s to 10 ms 100 ns to 10 ms 100 ns to 10 ms	29 μ s/s 29 μ s/s 29 μ s/s 29 μ s/s	Calibrated using Multifunction calibrator
13. Oscilloscope Bandwidth -" Amplitude Flatness At 50 Khz Reference	5 mV to 5.5 V 50 kHz to 100 MHz 100 MHz to 250 MHz 5 mV to 3.5 V 250 MHz to 1050 MHz	19 mV/V 25 mV/V 59 mV/V	Calibrated using Multifunction calibrator
13. Oscilloscope Frequency - Accuracy	1 μ Hz to 0.5 Hz 0.5 Hz to 600 MHz 600 MHz to 1050 MHz	5 μ Hz/Hz 2.9 μ Hz/Hz 2.9 μ Hz/Hz	Calibrated using Function Generator, Multifunction Calibrator
13. Oscilloscope Frequency - Amplitude	(0.01 to 5.00) Vpp 1 μ Hz to 100 kHz 100 kHz to 20 MHz 20 MHz to 30.2 MHz (5 to 10) Vpp 1 μ Hz to 100 kHz 100 kHz to 20 MHz 20 MHz to 30.2 MHz	40 mV/V 40 mV/V 40 mV/V 58 mV/V 92 mV/V 210 mV/V	Calibrated using Function Generator

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14. Earth Tester	0.01 ? to 0.1 ? 0.1 ? to 100 ? 100 ? to 1 M?	23 m?/? 0.14 m?/? 2.3 m?/?	Calibrated using Decade Resistance Box
15. Insulation Tester / High Voltage Insulation Tester (up To 5 Kv)	(1 to 100) M? (0.1 to 1) G? (2 to 10) G? (0.01 to 1) T? (1 to 10) T?	1.2 m?/? 2.3 m?/? 5.8 m?/? 19 m?/? 35 m?/?	Calibrated using Decade Resistance Box
Generating/sourcing Instrument 16.dc Voltage	(0 to 100) mV (0 to 1) V (0 to 10) V (0 to 100) V (0 to 1000) V	14 µV/V 6.5 µV/V 5.5 µV/V 8.3 µV/V 8.6 µV/V	Calibrated using Digital Multimeter
Generating/sourcing Instrument 17. Dc High Voltage	(1 to 10) kV (10 to 40) kV	0.97 mV/V 23 mV/V	Calibrated using Digital Multimeter and High Voltage Meter
Generating/sourcing Instrument 18. Dc Current	(0 to 100) µA (0 to 1) mA (0 to 10) mA (0 to 100) mA (0 to 1) A (0 to 2) A (0 to 10) A	33 µA/A 30 µA/A 29 µA/A 46 µA/A 160 µA/A 890 µA/A 2.4 mA/A	Calibrated using Digital Multimeter
Generating/sourcing Instrument 19. Dc Current Via Current Shunt	(0.1 to 1) µA (1 to 10) µA (10 to 100) µA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A (1 to 2) A (2 to 5) A (5 to 10) A (10 to 15) A (15 to 20) A (20 to 25) A (25 to 30) A (3 to 100) A (100 to 500) A	140 µA/A 14 µA/A 2.9 µA/A 140 µA/A 14 µA/A 2.9 µA/A 140 µA/A 68 µA/A 29 µA/A 16 µA/A 12 µA/A 10 µA/A 50 µA/A 50 µA/A 7.3 mA / A 0.33% of the reading + 0.4 A	Calibrated using Digital Multimeter & Current Shut
Generating/sourcing Instrument 20. Ac Voltage	(0 to 700) V (700 to 1000) V (45 to 1000) Hz (1 to 10) kHz	(See Matrix O) 14 mV/V 14 mV/V	Calibrated using Digital Multimeter
Generating/sourcing Instrument 21.ac High Voltage	50 Hz & 60 Hz (1 to 10) kV (10 to 40) kV	12 mV/V 62 mV/V	Calibrated using Digital Multimeter & High Voltage Meter
Generating/sourcing Instrument 22. Ac Current	20 µA to 10 A	(See Matrix P)	Calibrated using Digital Multimeter
Generating/sourcing Instrument 23.ac Current Via Current Shunt	(10 to 100) A (45 to 65) Hz	2.5 mA/A	Calibrated using Digital Multimeter & Current Shunt

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Generating/sourcing Instrument 24. Resistance	(0 to 10) Ω , (10 to 100) Ω , (100 to 1) k Ω , (1 to 10) k Ω , (10 to 100) k Ω , (0.1 to 1) M Ω , (1 to 10) M Ω , (10 to 100) M Ω	0.031 m Ω ?/ 0.022 m Ω ?/ 0.014 m Ω ?/ 0.014 m Ω ?/ 0.015 m Ω ?/ 0.025 m Ω ?/ 0.077 m Ω ?/ 0.62 m Ω ?/	Calibrated using Digital Multimeter
Generating/sourcing Instrument 25. Frequency (100 Mv To 750 V)	(3 to 5) Hz (5 to 10) Hz (10 to 40) Hz (0.03 to 300) kHz	1.2 mHz/Hz 0.58 mHz/Hz 0.35 mHz/Hz 0.12 mHz/Hz	Calibrated using Digital Multimeter
Generating/sourcing Instrument 26. Capacitance	(0.1 to 1) μ F (1 to 10) μ F (10 to 100) μ F (100 to 1000) μ F (1000 to 9999) μ F	18 mF/F 18 mF/F 18 mF/F 18 mF/F 35 mF/F	Calibrated using Digital Multimeter
Rf Measuring Equipment 27. Rf Power Sensor Calibration Factor	Power Level 1.00 mW, Ref = 50 MHz 50 MHz to 1GHz 2 GHz to 5 GHz 6 GHz to 10 GHz 11 GHz to 18 GHz	1.6 % 1.7 % 1.9 % 2.6 %	Calibration Factor Type-N 50 ?, Direct Comparison Method using N432A, 8478B, 11667A, NRVS & NRV-Z51
Rf Measuring Equipment 28. Rf Measurement A) Frequency	0.1 Hz to 18 GHz	2.0×10^{-12}	Generating using Frequency Generator DS345, HP8665A, 68369B ext ref. to EC1S-SO with GPS disciplined
Rf Measuring Equipment B) Rf Power (50 μ W)	-30 dBm to 20 dBm DC to 30 MHz 30 MHz to 6 GHz 6 GHz to 8 GHz 8 GHz to 12.4 GHz 12.4 GHz to 15 GHz 15 GHz to 16 GHz 16 GHz to 18 GHz	0.10 dB 0.10 dB 0.11 dB 0.10 dB 0.12 dB 0.13 dB 0.14 dB	Characterized using 68369B, NRVS and NRVZ52
Rf Measuring Equipment 29. Rf Power Meter	Power Level -25 dBm (3.1623 μ W) -20 dBm (10 μ W) -15 dBm (31.6228 μ W) -10 dBm (100 μ W) -5 dBm (316.2278 μ W) 0 dBm (1 mW) 5 dBm (3.1623 mW) 10 dBm (10 mW) 15 dBm (31.6228 mW) 20 dBm (100 mW)	0.020 μ W 0.017 μ W 0.026 μ W 0.02 μ W 0.04 μ W 0.0001 mW 0.0006 mW 0.002 mW 0.007 mW 0.030 mW	Generation using Agilent 11683A- H01 range calibrator, Fluke 5720A calibrator
Rf Measuring Equipment Reference Output	1mW @ 50 MHz	0.004 mW	Agilent N432A,HP 478A-H75 and HP3458A-002

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Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques	Remarks
Rf Generating Equipment A) Frequency	0.1 Hz to 18 GHz	2.0×10^{-12}	Measurement using CNT-90 ext ref to EC1S-SO with GPS disciplined
Rf Generating Equipment B) Rf Power (50 I%)	-30 dBm to 20 dBm DC to 30 MHz 30 MHz to 6 GHz 6 GHz to 8 GHz 8 GHz to 12.4 GHz 12.4 GHz to 15 GHz 15 GHz to 16 GHz 16 GHz to 18 GHz	0.09 dB 0.07 dB 0.08 dB 0.09 dB 0.11 dB 0.12 dB 0.14 dB	Measurement using NRVS and NRV-Z52
Rf Generating Equipment C) Frequency Modulation Accuracy/deviation	-18 to 30 dBm fc: 250 kHz to 10 MHz fm: 20 Hz to 10 kHz ?f = 200 Hz to 40 kHz ? > 0.2 ? > 1.2 fc: 10 MHz to 6.6 GHz fm: 50 Hz to 200 kHz ?f = 250 Hz to 400 kHz ? > 0.2 ? > 0.45 fc: 6.6 GHz to 13.2 GHz fm: 50 Hz to 200 kHz ?f = 250 Hz to 400 kHz ? > 0.2 ? > 8 fc: 13.2 GHz to 26.5 GHz fm: 50 Hz to 200 kHz ?f = 250 Hz to 400 kHz ? > 0.2 ? > 16 fc: 13.2 GHz to 26.5 GHz fm: 50 Hz to 200 kHz ?f = 250 Hz to 400 kHz ? > 0.2 ? > 16	0.015 Hz/Hz 0.010 Hz/Hz 0.015 Hz/Hz 0.010 Hz/Hz 0.025 Hz/Hz 0.010 Hz/Hz 0.038 Hz/Hz 0.010 Hz/Hz 0.038 Hz/Hz 0.010 Hz/Hz	N5531S fc = Carrier Frequency fm = Modulation Rate ?f = Peak Deviation ? = ?f/fm

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Material / Product Tested	Type Of Test / Properties Measured / Range Of Measurement	Standard Test Methods / Equipment / Techniques	Remarks
Rf Generating Equipment D) Amplitude Modulation Depth	-18 to 30 dBm fc: 100 kHz to 10 MHz fm: 50 Hz to 10 kHz Depth: 5% to 99% fc: 10 MHz to 3 GHz fm: 50 Hz to 100 kHz Depth: 20% to 99% Depth: 5% to 20% fc: 3 GHz to 26.5 GHz fm: 50 Hz to 100 kHz Depth: 20% to 99% Depth: 5% to 20%	0.0075%/ % 0.005%/ % 0.025%/ % 0.015%/ % 0.045%/ %	N5531S fc = Carrier Frequency fm = Modulation Rate
Rf Generating Equipment E) Phase Modulation Accuracy/deviation	-18 to 30 dBm fc: 100 kHz to 6.6 GHz ?: 0.7 rad ??: 0.3 rad fc: 6.6 GHz to 13.2 GHz ?: 2.0 rad ??: 0.6 rad fc: 13.2 GHz to 26.5 GHz ?: 4.0 rad ??: 1.2 rad	0.01 rad/rad 0.03 rad/rad 0.01 rad/rad 0.03 rad/rad 0.01 rad/rad 0.03 rad/rad	N5531S fc = Carrier Frequency ?? = Phase Deviation
Rf Generating Equipment F) Frequency Modulation Distortion	fm: 20 Hz to 1 kHz fc: 1 MHz to 6.6 GHz ?f = 500 Hz to 2.0 kHz ?f ? 2.0 kHz fc: 6.6 GHz to 13.2 GHz ?f ? 2.3 kHz ?f ? 4.5 kHz fc: 13.2 GHz to 26.5 GHz ?f ? 2.7 kHz ?f ? 6.0 kHz	0.12 %/ % + 0.3% 0.12 %/ % + 0.1% 0.12 %/ % + 0.3% 0.12 %/ % + 0.1% 0.12 %/ % + 0.3% 0.12 %/ % + 0.1%	N5531S fc = Carrier Frequency fm = Modulation Rate ?f = Deviation

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Rf Generating Equipment G) Amplitude Modulation Distortion	0.01% to 100% fm: 20 Hz to 1 kHz fc: 100 kHz to 10 MHz Depth > 1% Depth > 3% fc: 10 MHz to 26.5 GHz Depth > 1% Depth > 3%	0.12 %/% + 0.8% 0.12 %/% + 0.3% 0.12 %/% + 1.0% 0.12 %/% + 0.4%	N5531S fc = Carrier Frequency fm = Modulation Rate
Rf Generating Equipment H) Phase Modulation Distortion	-18 to 30 dBm fc: 100 kHz to 6.6 GHz fm: 20 Hz to 500 Hz ?? > 0.8 rad ?? > 2.5 rad fc: 1 MHz to 6.6 GHz fm: 500 Hz to 1 kHz ?? > 0.4 rad ?? > 1.0 rad fc: 6.6 GHz to 13.2 GHz fm: 20 Hz to 500 Hz?? > 1.8 rad ?? > 5.5 rad fc: 6.6 GHz to 13.2 GHz fm: 500 Hz to 1 kHz?? > 0.8 rad ?? > 2.5 rad fc: 13.2 GHz to 26.5 GHz fm: 20 Hz to 500 Hz ?? > 3.5 rad ?? > 10.0 rad fc: 13.2 GHz to 26.5 GHz fm: 500 Hz to 1 kHz ?? > 1.2 rad ?? > 4.0 rad	0.0012 %/% + 0.3% 0.0012 %/% + 0.1% 0.0012 %/% + 0.3% 0.0012 %/% + 0.1% 0.0012 %/% + 0.3% 0.0012 %/% + 0.1% 0.0012 %/% + 0.3% 0.0012 %/% + 0.1% 0.0012 %/% + 0.3% 0.0012 %/% + 0.1%	N5531S fc = Carrier Frequency fm = Modulation Rate ?? = Phase Deviation
Rf Generating Equipment I) Modulation Rate amplitude Modulation frequency Modulation phase Modulation	100 kHz to 26.5 GHz ?f ? 2.3 kHzfm ? 100 kHz β ? 0.01 fm ? 200 kHz β ? 0.01 fm ? 20 kHz	0.078 Hz 0.096 Hz 0.064 Hz	N5531S fm = Modulation Rate ? = ?f/fm
Rf Generating Equipment J) Tuned Rf Level	See Matrix Q & R		N5531S (Option 1DS) with N5532B Sensor Module (Option 526)

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Matrix A

AC Voltage Measurement								
Range	Frequency (kHz)							
	0.01 to 0.02	0.02 to 0.04	0.04 to 20	20 to 50	50 to 100	100 to 300	300 to 500	500 to 1000
(0 to 2.2) mV	2.1	1.9	1.9	2.0	2.8	5.6	16	24
(2.2 to 22) mV	0.43	0.28	0.27	0.39	0.73	1.5	3.5	7.3
(22 to 220) mV	0.3	0.12	0.12	0.23	0.54	0.99	2.3	5.8
(0.22 to 2.2) V	0.26	0.098	0.049	0.080	0.12	0.46	1.1	1.8
(2.2 to 22) V	0.26	0.099	0.049	0.081	0.11	0.30	1.1	1.7
(22 to 220) V	0.26	0.099	0.058	0.087	0.16	-	-	-

The expanded uncertainties given at above table is expressed in mV/V

Matrix B

AC Voltage Measurement								
Range	Frequency (kHz)							
	0.015 to 0.045	0.045 to 0.05	0.05 to 1	1 to 5	5 to 10	10 to 20	20 to 50	50 to 100
(220 to 250) V	0.25	0.16	0.16	0.18	0.18	0.22	0.28	1.7
(250 to 330) V	-	0.16	0.16	0.17	0.17	0.21	0.26	1.7
(330 to 1020) V	-	0.24	0.24	0.20	0.24	-	-	-
(1020 to 1100) V	-	-	0.065	-	-	-	-	-

The expanded uncertainties given at above table expressed in mV/V

Matrix C

AC Current Measurement								
Range	Frequency (kHz)							
	0.01 to 0.02	0.02 to 0.04	0.04 to 1	1 to 3	3 to 5	5 to 10	10 to 20	20 to 30
(0 to 32) μ A	29	29	29	29	57	57	190	280
(32 to 220) μ A	0.34	0.24	0.17	0.32	0.34	1.2	11	16
(220 to 320) μ A	1.7	1.7	1.7	1.7	2.9	2.9	8.3	12
(0.32 to	0.27	0.18	0.14	0.14	0.25	1.4	2.9	3.9

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2.2) mA								
(2.2 to 3.2) mA	0.82	0.82	0.83	0.83	1.3	1.3	2.7	3.5
(3.2 to 22) mA	0.27	0.18	0.14	0.23	0.23	1.3	2.6	3.5
(22 to 32) mA	0.83	0.83	0.83	0.83	1.3	1.3	2.4	3.2
(32 to 220) mA	0.27	0.18	0.13	0.22	0.22	1.1	2.3	2.9
(220 to 320) mA	-	0.93	0.93	0.94	1.2	1.2	2.2	2.8
(0.32 to 2.2) A	-	0.28	0.28	0.49	7.1	7.1	-	-
(2.2 to 3.2) A	0.92	0.92	0.92	0.92	2.6	2.6	-	-
(3.2 to 10.5) A	1.8	1.8	1.8	1.8	4.6	4.6	-	-
(10.5 to 20) A	1.8	1.8	1.8	1.8	4.8	4.8	-	-

The expanded uncertainties given at above table is expressed in mA/A

Matrix D

AC Current via Current Coils Measurement			
Range	Frequency (Hz)		
	10 to 65	10 to 100	100 to 440
(3.2 to 32.0) A	-	3.5	10
(32.0 to 200.0) A	-	4.2	9.6
(200.0 to 1000.0) A	4.2	-	-

The calibration uncertainties given at above table expressed in mA/A

Matrix E

Wideband ACV Amplitude Flatness			
Range	Frequency (Hz)		
	1.1 mV	3 mV	3.5 mV
10 Hz to 30 Hz	3.0	3.0	3.0
30 Hz to 120 Hz	1.1	1.1	1.1
120 Hz to 1.2 kHz	1.1	1.1	1.1
1.2 kHz to 12 kHz	1.1	1.1	1.1
12 kHz to 120 kHz	1.1	1.1	1.1
120 kHz to 1.2 MHz	4.8	2.1	1.1
1.2 MHz to 2 MHz	4.8	2.1	1.1
2 MHz to 10 MHz	6.8	4.1	2.1
10 MHz to 20 MHz	8.9	6.1	4.1
20 MHz to 30 MHz	29	16	10

The calibration uncertainties given at above table expressed in mV/V

Matrix F

AC Voltage Sourcing

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Range	Frequency (Hz)							
	1 to 40	40 to 1 k	1 k to 20 k	20 k to 50 k	50 k to 100 k	100 k to 300 k	300 k to 1 M	1 M to 2 M
(1 to 10) mV	0.70	0.40	0.50	2.2	6.2	46		
(10 to 100) mV	0.22	0.11	0.20	0.41	1.0	3.6	12	17
(0.1 to 1) V	0.20	0.12	0.20	0.37	0.95	3.6	12	17
(1 to 10) V	0.20	0.12	0.20	0.40	1.0	3.9	12	18
(10 to 100) V	0.29	0.23	0.26	0.43	1.4	4.7	17	-
(100 to 700) V	0.52	0.50	0.72	1.4	3.5	-	-	-

The calibration uncertainties given in this table are expressed in mV/V

Matrix G

AC CURRENT Sourcing							
Range	Frequency (Hz)						
	10 to 20	20 to 45	45 to 100	100 to 5 k	5 k to 20 k	20 k to 50 k	50 k to 100 k
(10 to 100) μ A	5.0	2.1	1.1	1.1	-	-	-
(0.1 to 1) mA	4.9	2.0	0.95	0.75	0.94	5.1	8.1
(1 to 100) mA	4.9	2.0	0.94	0.6	0.94	5.1	8.1
(0.1 to 1) A	4.9	2.1	1.2	1.4	3.7	12	-
Frequency (Hz)							
(1 to 2) A	4.2	2.5	3.6	8.1	-	-	-
(2 to 10) A	24	13	13	-	-	-	-

The calibration uncertainties given in this table are expressed in mA/A

Matrix H

Tuned RF Level (Pre-amplifier ON)		
Level Range	Calibration Measurements Capability (dB)	
	30 MHz to 2 GHz	2 GHz to 3.05 GHz
10 dBm to 16 dBm	0.25	0.36
0 dBm to 10 dBm	0.24	0.36
-10 dBm to 0 dBm	0.24	0.35
-20 dBm to -10 dBm	0.24	0.36
-30 dBm to -20 dBm	0.25	0.36
-40 dBm to -30 dBm	0.25	0.37
-50 dBm to -40 dBm	0.26	0.38
-60 dBm to -50 dBm	0.27	0.38
-70 dBm to -60 dBm	0.27	0.39
-80 dBm to -70 dBm	0.28	0.40
-90 dBm to -80 dBm	0.29	0.40
-100 dBm to -90 dBm	0.29	0.41

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-110 dBm to -100 dBm	0.30	0.41
-120 dBm to -110 dBm	0.30	0.42
-130 dBm to -120 dBm	0.45	0.56
-140 dBm to -130 dBm	0.86	0.98

Matrix I

Level Range	Calibration Measurements Capability (dB)			
	3.05 GHz to 6.6 GHz	6.6 GHz to 13.2 GHz	13.2 GHz to 18 GHz	18 GHz to 26.5 GHz
10 dBm to 16 dBm	0.36	0.36	0.36	0.45
0 dBm to 10 dBm	0.36	0.36	0.36	0.45
-10 dBm to 0 dBm	0.35	0.35	0.35	0.44
-20 dBm to -10 dBm	0.36	0.36	0.36	0.45
-30 dBm to -20 dBm	0.36	0.36	0.36	0.45
-40 dBm to -30 dBm	0.37	0.37	0.37	0.46
-50 dBm to -40 dBm	0.38	0.38	0.38	0.47
-60 dBm to -50 dBm	0.38	0.38	0.38	0.47
-70 dBm to -60 dBm	0.37	0.39	0.39	0.48
-80 dBm to -70 dBm	0.40	0.40	0.40	0.49
-90 dBm to -80 dBm	0.40	0.40	0.40	0.49
-100 dBm to -90 dBm	0.41	0.41	0.54	0.63
-110 dBm to -100 dBm	0.41	0.55	0.96	1.05
-120 dBm to -110 dBm	0.56	1.67		
-130 dBm to -120 dBm	0.97			

Matrix J

AC Voltage Measurement								
Range	Calibration Measurements Capability (dB)							
	0.01 to 0.02	0.02 to 0.04	0.04 to 20	20 to 50	50 to 100	100 to 300	300 to 500	500 to 1000
(0 to 2.2) mV	2.1	1.9	1.9	2.0	2.8	5.6	16	24
(2.2 to 22) mV	0.43	0.28	0.27	0.39	0.73	1.5	3.5	7.3
(22 to 220) mV	0.3	0.12	0.12	0.23	0.54	0.99	2.3	5.8
(0.22 to 2.2) V	0.26	0.098	0.049	0.080	0.12	0.46	1.1	1.8
(2.2 V to 22) V	0.26	0.099	0.049	0.081	0.11	0.30	1.1	1.7
(22 to 220) V	0.26	0.099	0.058	0.087	0.16	-	-	-

The expanded uncertainties given at above table is expressed in mV/V

Matrix K

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AC Voltage Measurement								
Range	Frequency (kHz)							
	0.015 to 0.045	0.045 to 0.05	0.05 to 1	1 to 5	5 to 10	10 to 20	20 to 50	50 to 1000
(220 to 250) V	0.25	0.16	0.16	0.18	0.18	0.22	0.28	1.7
(250 to 330) V	-	0.16	0.16	0.17	0.17	0.21	0.26	1.7
(330 to 1020) V	-	0.24	0.24	0.20	0.24	-	-	-
(1020 to 1100) V	-	-	0.065	-	-	-	-	-

The expanded uncertainties given at above table expressed in mV/V

Matrix L

AC Current Measurement								
Range	Frequency (kHz)							
	0.01 to 0.02	0.02 to 0.04	0.04 to 1	1 to 3	3 to 5	5 to 10	10 to 20	20 to 30
(0 to 32) μ A	29	29	29	29	57	57	190	280
(32 to 220) μ A	0.34	0.24	0.17	0.32	0.34	1.2	11	16
(220 to 320) μ A	1.7	1.7	1.7	1.7	2.9	2.9	8.3	12
(0.32 to 2.2) mA	0.27	0.18	0.14	0.14	0.25	1.4	2.9	3.9
(2.2 to 3.2) mA	0.82	0.82	0.83	0.83	1.3	1.3	2.7	3.5
(3.2 to 22) mA	0.27	0.18	0.14	0.23	0.23	1.3	2.6	3.5
(22 to 32) mA	0.83	0.83	0.83	0.83	1.3	1.3	2.4	3.2
(32 to 220) mA	0.27	0.18	0.13	0.22	0.22	1.1	2.3	2.9
(220 to 320) mA	-	0.93	0.93	0.94	1.2	1.2	2.2	2.8
(0.32 to 2.2) A	-	0.28	0.28	0.49	7.1	7.1	-	-
(2.2 to 3.2) A	0.92	0.92	0.92	0.92	2.6	2.6	-	-
(3.2 to 10.5) A	1.8	1.8	1.8	1.8	4.6	4.6	-	-
(10.5 to 20) A	1.8	1.8	1.8	1.8	4.8	4.8	-	-

The expanded uncertainties given at above table is expressed in mA/A

Matrix M

AC Current via Current Coils Measurement

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Range	Frequency (Hz)		
	10 to 65	10 to 100	100 to 440
(3.2 to 32.0) A	-	3.5	10
(32.0 to 200) A	-	4.2	9.6
(200.0 to 1000) A	4.2	-	-

The expanded uncertainties given at above table is expressed in mA/A

Matrix N

Wideband ACV Amplitude Flatness			
Range	Volts		
	1.1 mV	3 mV	3.5 mV
(10 to 30) Hz	3.0	3.0	3.0
(30 to 120) Hz	1.1	1.1	1.1
(0.12 to 1.2) kHz	1.1	1.1	1.1
(1.2 to 12) kHz	1.1	1.1	1.1
(12 to 120) kHz	1.1	1.1	1.1
(0.12 to 1.2) MHz	4.8	2.1	1.1
(1.2 to 2) MHz	4.8	2.1	1.1
(2 to 10) MHz	6.8	4.1	2.1
(10 to 20) MHz	8.9	6.1	4.1
(20 to 30) MHz	29	16	10

The calibration uncertainties given at above table expressed in mV/V

Matrix O

AC Voltage Source										
Range	Frequency (kHz)									
	0.02 to 0.05	0.05 to 0.1	0.1 to 2	2 to 10	10 to 30	30 to 50	50 to 100	100 to 200	200 to 1000	1000 to 2000
(20 to 200) mV	4.6	0.99	0.47	0.50	0.56	0.72	3.7	9.0	24	60
(0.2 to 2) V	3.2	0.98	0.46	0.47	0.53	0.70	3.7	9.0	24	60
(2 to 20) V	3.1	0.98	0.52	0.64	0.75	0.98	3.6	9.0	49	-
(20 to 200) V	3.1	0.98	0.52	0.64	0.75	0.98	3.6	-	-	-
(200 to 700) V	3.1	1.3	0.75	0.87	1.1	-	-	-	-	-

The calibration uncertainties given in this table are expressed in mV/V

Matrix P

AC Current Source				
Range	Frequency (kHz)			
	0.02 to 0.05	0.05 to 0.2	0.2 to 1	1 to 10
(20 to 200) μ A	4.2	2.5	4.8	6.1
(0.2 to 2) mA	3.6	1.9	1.6	2.0
(2 to 20) mA	3.6	1.9	1.6	1.9

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(20 to 200) mA	3.6	1.9	1.6	2.1
(0.2 to 2) A	4.2	2.5	3.6	8.1
(2 to 10) A	24	13	13	-

The calibration uncertainties given in this table are expressed in mA/A

Matrix R

Tuned RF Level (Pre-amplifier OFF)				
Level Range	Calibration Measurements Capability (dB)			
	3.05 GHz to 6.6 GHz	6.6 GHz to 13.2 GHz	13.2 GHz to 18 GHz	18 GHz to 26.5 GHz
10 dBm to 16 dBm	0.36	0.36	0.36	0.45
0 dBm to 10 dBm	0.36	0.36	0.36	0.45
-10 dBm to 0 dBm	0.35	0.35	0.35	0.44
-20 dBm to -10 dBm	0.36	0.36	0.36	0.45
-30 dBm to -20 dBm	0.36	0.36	0.36	0.45
-40 dBm to -30 dBm	0.37	0.37	0.37	0.46
-50 dBm to -40 dBm	0.38	0.38	0.38	0.47
-60 dBm to -50 dBm	0.38	0.38	0.38	0.47
-70 dBm to -60 dBm	0.37	0.39	0.39	0.48
-80 dBm to -70 dBm	0.40	0.40	0.40	0.49
-90 dBm to -80 dBm	0.40	0.40	0.40	0.49
-100 dBm to -90 dBm	0.41	0.41	0.54	0.63
-110 dBm to -100 dBm	0.56	1.67	0.96	1.05
-120 dBm to -110 dBm	0.97			
-130 dBm to -120 dBm				

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