S/N: 0468

STANDARDS MALAYSIA

Certificate of Accreditation

No: SAMM 011

Accredited since: 16 July 1992

This is to certify that

PYROMETRO SERVICES (M) SDN. BHD.
SHAH ALAM, SELANGOR
MALAYSIA

Scan QR Code or visit
www.jsm.gov.my/cab-directories
for the current scope of accreditation

has been granted accreditation in respect of the scope of accreditation described in the schedule, subject to the terms and conditions governing the *Skim Akreditasi Makmal Malaysia* (SAMM), the Laboratory Accreditation Scheme of Malaysia.

Laboratories accredited under SAMM meet the requirements of MS ISO/IEC 17025. This Malaysian Standard is identical with ISO/IEC 17025 published by the International Organization for Standardization (ISO).

Department of Standards Malaysia

(DATUK FADILAH BAHARIN)
Director General
Department of Standards Malaysia

Date of issue: 3 July 2017

Issuance of this Certificate is governed by Section 16 Subsections (2) and (3) of Standards of Malaysia Act, 1996 (Act 549)

Issue date: 29 January 2018
Valid until: 16 July 2020

MS ISO/IEC 17025

NO: SAMM 011
(Issue 2, 29 January 2018 replacement of SAMM 011 dated 3 July 2017)

LABORATORY LOCATION:
(PERMANENT LABORATORY)

PYROMETRO SERVICES (M) SDN. BHD.
LOT 148, NO 2A, JALAN JURUKUR U1/19
HICOM GLENMARIE INDUSTRIAL PARK
40150 SHAH ALAM
SELANGOR
MALAYSIA

FIELDS OF CALIBRATION: **HEAT & TEMPERATURE, MASS, FORCE, TORQUE, HARDNESS, PRESSURE, VOLUME, FLOW, VISCOSITY, DENSITY, OPTICAL, DIMENSIONAL, TIME & FREQUENCY, ELECTRICAL**

FIELD OF TESTING: **MECHANICAL**

This laboratory has demonstrated its technical competence to operate in accordance with MS ISO/IEC 17025:2005 (ISO/IEC 17025:2005).

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 expanded uncertainties are based on an estimated confidence probability of approximately 95% and have a coverage factor of k=2 unless stated otherwise.**

SCOPE OF CALIBRATION: HEAT AND TEMPERATURE

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Temperature Sensor	-196 °C	0.3 °C	Comparison with Pt 100 in liquid nitrogen storage container
	-70 °C to -40 °C	0.1 °C	Comparison with Pt 100 in low temperature chamber
	-40 °C to -30 °C -30 °C to 30 °C 30 °C to 250 °C 250 °C to 400 °C 400 °C to 600 °C 600 °C to 1200 °C 1200 °C to 1300 °C	0.080 °C 0.053 °C 0.023 °C 0.16 °C 0.21 °C 1.6 °C 2.0 °C	Comparison with Pt 100 and thermocouple in liquid bath and temperature block calibrator

SCOPE OF CALIBRATION: HEAT AND TEMPERATURE

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Temperature Sensor with indicator	-196 °C	0.3 °C	Comparison with Pt 100 in liquid nitrogen storage container
	-70 °C to -40 °C	0.2 °C	Comparison with Pt 100 in low temperature chamber
	-40 °C to -30 °C -30 °C to 30 °C 30 °C to 250 °C 250 °C to 400 °C 400 °C to 600 °C 600 °C to 1200 °C 1200 °C to 1300 °C	0.075 °C 0.045 °C 0.033 °C 0.15 °C 0.23 °C 1.6 °C 2.0 °C	Comparison with Pt 100 and thermocouple in liquid bath and temperature block calibrator
Temperature Recorders / Indicators (by electrical simulation)			By electrical simulation using calibrator and reference table ITS 90
a) Type T	-270 °C to -100 °C -100 °C to 400 °C	0.5 °C 0.1 °C	
b) Type E	-250 °C to -100 °C -100 °C to 1000 °C	0.5 °C 0.1 °C	
c) Type K	-270 °C to -100 °C -100 °C to 1370 °C	1.1 °C 0.1 °C	
d) Type R	-50 °C to 500 °C 500 °C to 1760 °C	0.3 °C 0.1 °C	
e) Type J	-210 °C to 1200 °C	0.1 °C	
f) Type S	-50 °C to 500 °C 500 °C to 1760 °C	0.3 °C 0.1 °C	
g) Type B	200 °C to 500 °C 500 °C to 1800 °C	1.0 °C 0.2 °C	
h) Type N	-200 °C to -100 °C -100 °C to 1300 °C	1.0 °C 0.1 °C	
i) Pt 100	-200 °C to 850 °C	0.1 °C	

SCOPE OF CALIBRATION: HEAT AND TEMPERATURE

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Temperature Calibrator **(I) Simulation**			By electrical measurement using multimeter and reference table ITS 90
a) Type T	-270 °C to -100 °C -100 °C to 400 °C	0.6 °C 0.1 °C	
b) Type E	-270 °C to -100 °C -100 °C to 1000 °C	0.6 °C 0.1 °C	
c) Type K	-270 °C to -100 °C -100 °C to 1370 °C	1.1 °C 0.1 °C	
d) Type R	-50 °C to 500 °C 500 °C to 1760 °C	0.3 °C 0.1 °C	
e) Type J	-210 °C to 1200 °C	0.1 °C	
f) Type S	-50 °C to 500 °C 500 °C to 1760 °C	0.3 °C 0.2 °C	
g) Type B	100 °C to 500 °C 500 °C to 1800 °C	1.1 °C 0.3 °C	
h) Type N	-200 °C to -100 °C -100 °C to 1300 °C	1.1 °C 0.1 °C	
i) Pt 100	-200 °C to 850 °C	0.1 °C	
(II) Measurement			By electrical simulation using calibrator and reference table ITS 90
a) Type T	-270 °C to -100 °C -100 °C to 400 °C	0.5 °C 0.1 °C	
b) Type E	-250 °C to -100 °C -100 °C to 1000 °C	0.6 °C 0.1 °C	
c) Type K	-270 °C to -100 °C -100 °C to 1370 °C	1.1 °C 0.1 °C	
d) Type R	-50 °C to 500 °C 500 °C to 1760 °C	0.3 °C 0.1 °C	
e) Type J	-210 °C to 1200 °C	0.1 °C	
f) Type S	-50 °C to 500 °C 500 °C to 1760 °C	0.3 °C 0.1 °C	

SCOPE OF CALIBRATION: HEAT AND TEMPERATURE

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Temperature Calibrator (II) Measurement (continued)			
g) Type B	200 °C to 500 °C 500 °C to 1800 °C	1.1 °C 0.3 °C	
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
i) Pt 100	-200 °C to 850 °C	0.1 °C	
Liquid-in-glass Thermometer (Total Immersion)	-40 °C to -30 °C -30 °C to 30 °C 30 °C to 200 °C 200 °C to 400 °C	0.08 °C 0.045 °C 0.019 °C 0.15 °C	Comparison with Pt100 in liquid bath and temperature block calibrator
Liquid-in-glass Thermometer (Partial Immersion)	-40 °C to -30 °C -30 °C to 30 °C 30 °C to 200 °C 200 °C to 400 °C	0.08 °C 0.045 °C 0.019 °C 0.15 °C	

Signatories:

1. **Kwan Yee Hong**
2. **Muna Salsabila Binti Abdullah**
3. **Teo Hun Wei**
4. ****Azlan Othman**
5. ** **Hasnas Hussain** [except for Temperature Sensor (range: -196 °C and -70 °C to -40 °C) & Temperature Sensor with Indicator (range: -196 °C and -70 °C to -40 °C)]

** Non-resident signatory

SCOPE OF CALIBRATION: HEAT AND TEMPERATURE

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Temperature & Humidity Indicator or Recorder	-40 °C to 5 °C 5 °C to 50 °C 50 °C to 80 °C	0.3 °C 0.1 °C 0.3 °C	Comparison with Pt100 sensor in chamber and humidity calibrator
	Relative humidity at 25 °C 5 %rh to 50 %rh 50 % rh to 70 %rh 70 %rh to 95 %rh 95 %rh to 98 %rh	 1.4 %rh 1.6 %rh 1.8 %rh 2.2 %rh	Comparison with thermohygrometer and wet & dry bulb in chamber and humidity 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

Signatories:

1. **Teo Hun Wei**
2. **Kwan Yee Hong**
3. **Muna Salsabila Binti Abdullah** (except Temperature Block Calibrator)
4. ****Azlan Othman**

** Non-resident signatory

SCOPE OF CALIBRATION: HEAT AND TEMPERATURE

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Radiation Thermometer	50 °C to 100 °C 100 °C to 200 °C 200 °C to 400 °C 400 °C to 1200 °C	0.6 °C 1.0 °C 1.5 °C 3.3 °C	Comparison with Pt100, thermocouple and radiation thermometer

Signatories:

1. **Kwan Yee Hong**
2. **Teo Hun Wei**
3. ****Azlan Othman**

** Non-resident signatory

SCOPE OF CALIBRATION: HEAT AND TEMPERATURE

SITE: CATEGORY I

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Temperature Sensor with Indicator	-20 °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	Calibrate by using temperature recorder with thermocouple and PRT
Temperature Recorders / Indicators (by electrical simulation)			By electrical simulation using calibrator and reference table ITS 90
a) Type T	-200 °C to -100 °C -100 °C to 400 °C	0.6 °C 0.2 °C	
b) Type E	-200 °C to -100 °C -100 °C to 1000 °C	0.6 °C 0.2 °C	
c) Type K	-200 °C to -100 °C -100 °C to 1370 °C	1.1 °C 0.2 °C	
d) Type R	0 °C to 1760 °C	1.0 °C	
e) Type J	-200 °C to 1200 °C	0.2 °C	
f) Type S	0 °C to 1760 °C	1.0 °C	
g) Type B	600 °C to 1800 °C	1.0 °C	
h) Type N	-200 °C to -100 °C -100 °C to 1300 °C	1.1 °C 0.2 °C	
i) Pt 100	-200 °C to 850 °C	0.2 °C	

SCOPE OF CALIBRATION: HEAT AND TEMPERATURE

SITE: CATEGORY I

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
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 Thermocouple	 0 °C to 200 °C 200 °C to 400 °C 400 °C to 600 °C 0 °C to 200 °C 200 °C to 400 °C 400 °C to 600 °C	 0.13 °C 0.28 °C 0.70 °C 0.18 °C 0.30 °C 0.71 °C	Comparison with Pt 100 and temperature calibrator in liquid bath and temperature block calibrator

Signatories:

1. **Teo Hun Wei**
2. **Senthil Kumar Balaraman**
3. **Kwan Yee Hong**
4. **Norhafikah Abd Kadir**

SCOPE OF CALIBRATION: HEAT AND TEMPERATURE

SITE: CATEGORY I

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
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

Signatories:

1. **Teo Hun Wei**
2. **Kwan Yee Hong**

SCOPE OF CALIBRATION: HEAT AND TEMPERATURE

SITE: CATEGORY I

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Temperature & Humidity Indicator or Recorder	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

Signatories:

1. **Teo Hun Wei**
2. **Kwan Yee Hong**
3. ****Azlan Othman**

** Non-resident signatory

SCOPE OF CALIBRATION: MASS

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	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	
	5 mg	0.003 mg	
	10 mg	0.003 mg	
	20 mg	0.005 mg	
	50 mg	0.005 mg	
	100 mg	0.005 mg	
	200 mg	0.006 mg	
	500 mg	0.006 mg	
	1 g	0.008 mg	
	2 g	0.009 mg	
	5 g	0.009 mg	
	10 g	0.015 mg	
	20 g	0.015 mg	
	50 g	0.05 mg	
	100 g	0.08 mg	
	200 g	0.09 mg	
	500 g	0.3 mg	
	1 kg	0.6 mg	
	2 kg	1 mg	
	5 kg	5 mg	
	10 kg	15 mg	
	20 kg	0.02 g	
	25 kg	0.2 g	
	30 kg	0.2 g	

Signatories:

1. **Teo Hun Wei**
2. **Fatimah Azlan**
3. ****Hasnas Hussain**

** Non-resident signatory

SCOPE OF CALIBRATION: MASS

SITE: CATEGORY I

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Balance	Up to 5 g 5 g to 20 g 20 g to 200 g 200 g to 1 kg 1 kg to 5 kg 5 kg to 10 kg 10 kg to 20 kg 20 kg to 50 kg 50 kg to 100 kg 100 kg to 500 kg 500 kg to 1000 kg 1000 kg to 2000 kg	0.01 mg 0.03 mg 0.08 mg 1 mg 7 mg 20 mg 50 mg 2 g 5 g 100 g 160 g 300 g	Calibrated by using standard weights
Standard Weight (Deadweight)	1 kg 2 kg 5 kg 10 kg 20 kg 25 kg 30 kg	0.1 g 0.1 g 0.1 g 0.2 g 0.2 g 0.2 g 0.2 g	Calibration by comparison with standard weight of same nominal value

Signatories:

1. **Teo Hun Wei**
2. **Senthil Kumar Balaraman**
3. **Fatimah Azlan**
4. **Kwan Yee Hong**
5. **Norhafikah Abd Kadir**
6. ****Hasnas Hussain**

** Non-resident signatory

SCOPE OF CALIBRATION: MASS

SITE: CATEGORY I

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Weighing Device (Platform Scale, Hopper Scale & Tank Scale)	Up to 1000 kg 1000 kg to 2000 kg 2000 kg to 3000 kg 3000 kg to 6000 kg 6000 kg to 10000 kg	0.3 kg 1 kg 2 kg 3 kg 4 kg	Calibrated by substitution test method using standard weights based on Measurement Canada – Field Inspection Manual – Non Automatic Weighing Devices

Signatory:

1. **Kwan Yee Hong**

SCOPE OF CALIBRATION: FORCE

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	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 10 kN to 50 kN 50 kN to 100 kN	6.1 N 7.6 N 78 N	Calibrated by using load cell generally based on ISO 376:2011
Force Measurement Device (Tension)	100 kN to 300 kN	410 N	
Force Measurement Device (Compression)	100 kN to 500 kN	0.3 kN	

Signatories:

1. **Kwan Yee Hong**
2. **Teo Hun Wei**
3. ****Azlan Othman**

** Non-resident signatory

SCOPE OF CALIBRATION: FORCE

SITE: CATEGORY I

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	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 7500-1:2015
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

Signatories:

1. **Teo Hun Wei**
2. **Senthil Kumar Balamaran**
3. **Kwan Yee Hong**

SCOPE OF CALIBRATION: TORQUE

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Torque Measuring Device	0 Nm to 10 Nm 10 Nm to 25 Nm 25 Nm to 150 Nm 150 Nm to 400 Nm 400 Nm to 1500 Nm	0.03 % of reading 0.05 % of reading 0.15 % of reading 0.091 % of reading 0.12 % of reading	Calibrated by using torque calibrator with based on BS7882:2008
Hand Torque Tools	0.5 Nm to 1 Nm 1 Nm to 10 Nm 10 Nm to 150 Nm 150 Nm to 400 Nm 400 Nm to 1500 Nm	0.003 Nm 0.29 % of reading 0.15 % of reading 0.091 % of reading 0.12 % of reading	Calibrated by using torque calibrator with based on ISO 6789:2003

Signatories:

1. **Teo Hun Wei**
2. **Kwan Yee Hong**
3. **Mohd Azan Bin Seliman**
4. ****Azlan Othman**

** Non-resident signatory

SCOPE OF CALIBRATION: TORQUE

SITE: CATEGORY I

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Hand Torque Tools	0 N.m to 20 N.m 20 N.m to 40 N.m 40 N.m to 80 N.m 80 N.m to 400 N.m 400 N.m to 1500 N.m	0.55 % of reading 0.30 % of reading 0.18 % of reading 0.11 % of reading 0.16 % of reading	Calibrated by using torque calibrator with based on ISO 6789:2003

Signatories:

1. **Teo Hun Wei**
2. **Kwan Yee Hong**
3. **Mohd Azan Bin Seliman**
4. ****Azlan Othman**

** Non-resident signatory

SCOPE OF CALIBRATION: HARDNESS

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Durometer (Type A, B, C, D, E, O, DO, OO)	0 to 100 shore hardness index	0.5 shore hardness index	Calibrate by using balance, block gauges and profile projector with refer ASTM D2240:2002. Measurements of spring force, indenter travel and indenter extension excluding indenter cone angle.

Signatories:

1. **Teo Hun Wei**
2. **Kwan Yee Hong**
3. ****Azlan Othman**

** Non-resident signatory

SCOPE OF CALIBRATION: PRESSURE

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Pressure Measuring Device Pneumatic	0 kgf/cm^2 to 6 kgf/cm^2 6 kgf/cm^2 to 30 kgf/cm^2	0.0016 kgf/cm^2 0.0078 kgf/cm^2	Calibrated by using calibrator with reference to AS1349 (1986)
Hydraulic	0 kgf/cm^2 to 1200 kgf/cm^2 (0 psi to 17068 psi) 1200 kgf/cm^2 to 1968 kgf/cm^2 (17068 psi to 28000 psi) 1968 kgf/cm^2 to 2812 kgf/cm^2 (28000 psi to 40000 psi)	0.0005 kgf/cm^2 or 0.02 % of reading (whichever is larger) 0.016 % of reading 0.016 % of reading	Calibrated by using dead weight tester with reference to with reference to AS1349 (1986)
Vacuum Absolute Pressure Measuring Device	-0.97 kgf/cm^2 to 0 kgf/cm^2 0 kgf/cm^2 to 7 kgf/cm^2 abs	0.00011 kgf/cm^2 0.0006 kgf/cm^2	Comparison with test gauge with reference to AS1349 (1986)
Manometer	0 kgf/cm^2 to 0.07 kgf/cm^2 0.07 kgf/cm^2 to 0.7 kgf/cm^2	0.000014 kgf/cm^2 0.00010 kgf/cm^2	Comparison with pressure meter with reference to AS1349 (1986)

Signatories:

1. **Teo Hun Wei**
2. **Kwan Yee Hong**
3. **Mohd Azan Bin Seliman**
4. ****Azlan Othman**

** Non-resident signatory

SCOPE OF CALIBRATION: PRESSURE

SITE: CATEGORY I

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Pressure Measuring Device			Calibrate by using test gauge or pressure calibrator
Pneumatic	0 kgf/cm^2 to 6 kgf/cm^2 6 kgf/cm^2 to 30 kgf/cm^2	0.0033 kgf/cm^2 0.0075 kgf/cm^2	
Hydraulic	0 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	0.09 kgf/cm^2 0.16 kgf/cm^2 0.23 kgf/cm^2 0.43 kgf/cm^2	
Vacuum	-0.97 kgf/cm^2 to 0 kgf/cm^2	0.00032 kgf/cm^2	
Absolute Pressure Measuring Device	0 kgf/cm^2 to 7 kgf/cm^2 abs	0.0006 kgf/cm^2	
Manometer	0 kgf/cm^2 to 0.07 kgf/cm^2 0.07 kgf/cm^2 to 0.7 kgf/cm^2	0.00002 kgf/cm^2 0.00010 kgf/cm^2	

Signatories:

1. **Teo Hun Wei**
2. **Senthil Kumar Balaraman**
3. **Kwan Yee Hong**
4. **Norhafikah Abd Kadir**

SCOPE OF CALIBRATION: VOLUME

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
POVA Pipette	0.1 µl to 2.5 µl 2.5 µl to 10 µl 10 µl to 100 µl 100 µl to 300 µl 300 µl to 1000 µl 1000 µl to 5000 µl 5 ml to 10 ml	0.020 µl 0.025 µl 0.1 µl 0.2 µl 0.7 µl 3.5 µl 7.1 µl	Calibrated by gravimetric method with refer to AS2162.2 & ISO 8655-6:2002
Graduated & One Mark Pipette	Graduated 1 ml 5 ml 10 ml to 25 ml One Mark 0.5 ml to 1 ml 2 ml to 10 ml 25 ml 50 ml	 0.015 ml 0.02 ml 0.03 ml 0.01 ml 0.01 ml 0.015 ml 0.02 ml	Calibrated by gravimetric method with refer to AS2162.1
Burette	10 ml 25 ml 50 ml 100 ml	0.013 ml 0.02 ml 0.03 ml 0.06 ml	
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	
One Mark Volumetric Flask	10 ml to 25 ml 50 ml 100 ml 250 ml 500 ml 1000 ml 2000 ml	0.02 ml 0.03 ml 0.04 ml 0.08 ml 0.15 ml 0.30 ml 0.6 ml	

SCOPE OF CALIBRATION: VOLUME

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Dispenser / Digital Burette	1 ml to 5 ml 5 ml to 10 ml 10 ml to 25 ml 25 ml to 50 ml 50 ml to 100 ml	0.006 ml 0.007 ml 0.011 ml 0.019 ml 0.58 ml	Calibrated by gravimetric method based on AS 2162.2

Signatories:

1. **Fatimah Azlan**
2. ****Hasnas Hussain**

** Non-resident signatory

SCOPE OF CALIBRATION: VOLUME

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
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)
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)

Signatory:

1. **Kwan Yee Hong**

SCOPE OF CALIBRATION: VOLUME

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Conductivity Meter	1, 10 µS/cm 84 µS/cm 1413 µS/cm 12.88 mS/cm 111.8 mS/cm	0.36 µS/cm 1.0 µS/cm 5.4 µS/cm 0.06 mS/cm 0.43 mS/cm	Calibrated by using standard solution based on ASTM D 1125-14
pH meter	4.01 pH, 7.01 pH & 10.01 pH	0.02 pH	Calibrated by using standard solution based on JIS K 0102:2008
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 4787:2010

Signatory:

1. **Fatimah Azlan**

SCOPE OF CALIBRATION: VOLUME

SITE: CATEGORY I

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	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)
Tank	Up to 500 L 500 L to 1000 L 1000 L to 5000 L 5000 L to 12000 L	0.98 L 2.0 L 9.8 L 22 L	Calibrated by water incremental method using flow meter based on ISO 4269:2001(E)

Signatory:

1. **Kwan Yee Hong**

SCOPE OF CALIBRATION: FLOW

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

Signatory:

1. **Kwan Yee Hong**

SCOPE OF CALIBRATION: VISCOSITY

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	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 based on ASTM D4212-10
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 based on ASTM 1200-10
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

Signatories:

1. **Fatimah Azlan**
2. ****Hasnas Hussain** (Except rotational viscometer)

** Non-resident signatory

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 1.850 g/mL	0.0006 g/mL	Calibrated by using standard density hydrometer based on BS 718:1991

Signatory:

1. **Fatimah Azlan**

SCOPE OF CALIBRATION: OPTICAL

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

Signatories:

1. **Fatimah Azlan**
2. ****Hasnas Hussain**

** Non-resident signatory

SCOPE OF CALIBRATION: DIMENSIONAL

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Precision Caliper (Internal & External)	Up to 300 mm 300 mm to 600 mm 600 mm to 1000 mm	9 µm 17 µm 19 µm	Calibrated by using caliper checker and gauge block with reference to JIS B 7507:2016
Micrometer Internal	Up to 50 mm 50 mm to 125 mm 125 mm to 300 mm 300 mm to 500 mm	1.5 µm 2 µm 3 µm 4 µm	Calibrated by using gauge block and inside micro checker with reference to JIS B 7502:2016
External 25 mm to 100 mm frame 100 mm to 175 mm frame 175 mm to 275 mm frame	Up to 25 mm 25 mm travel 25 mm travel 25 mm travel	0.5 µm 1.2 µm 1.5 µm 2.0 µm	Calibrated by using gauge block and optical parallel with reference to JIS B 7502:2016
Dial gauge	Up to 25 mm 25 mm to 50 mm 50 mm to 100 mm	2 µm 4 µm 6 µm	Calibrated by using micrometer head with reference to JIS B 7503:2011
Ruler	Up to 1000 mm 1000 mm to 2000 mm	0.2 mm 0.3 mm	Calibrated by using linear scale with reference to JIS B 7516:2005
Feeler Gauge	0.01 mm to 3 mm	0.5 µm	Calibrated by using MU checker with reference to JIS B 7524:2008
Dial Thickness Gauge	Up to 20 mm	1 µm	Calibrated by using gauge block and balance with reference to JIS B 7536:1982

SCOPE OF CALIBRATION: DIMENSIONAL

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
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
Gauge Block	Up 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 Up to 0.5 inch 0.5 to 1 inch 1 to 2 inch 2 to 3 inch 3 to 4 inch	0.09 µm 0.1 µm 0.14 µm 0.15 µm 0.2 µm 0.21 µm 0.24 µm 0.31 µm 5.1 µinch 5.7 µinch 6 µinch 7 µinch 10 µinch	Calibrated by using gauge block and gauge block comparator with reference to JIS B 7506:2004
Depth Gauge	Up to 50 mm 50 mm to 100 mm 100 mm to 200 mm 200 mm to 300 mm	3.2 µm 3.3 µm 3.7 µm 4.4 µm	Calibrated by using depth micro checker and gauge block with reference to JIS B 7544:1994
Height Gauge	Up to 300 mm 300 mm to 600 mm 600 mm to 1000 mm	7.2 µm 7.4 µm 12 µm	Calibrated by using caliper checker, dial test indicator and squareness tester with reference to JIS B 7517:1993
Micrometer Head & Calibration Tester	Up to 25 mm 25 mm to 50 mm	0.3 µm 0.8 µm	Calibrated by using gauge block, optical flat and MU checker with reference to JIS B 7502:2016

SCOPE OF CALIBRATION: DIMENSIONAL

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Measuring Tape	Up 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 with reference to JIS B 7512:2016, JIS B 7522:2016
Dial Test Indicator	0.14 mm to 0.28 mm 0.28 mm to 0.5 mm 0.5 mm to 0.8 mm 0.8 mm to 1 mm	1.5 µm 2.1 µm 3.6 µm 3.9 µm	Calibrated by using calibration tester with reference to JIS B 7533:2015
Snap Micrometer -Micrometer range -Indicator range	 Up to 75 mm 75 mm to 100 mm 100 mm to 125 mm Up to ± 0.08 mm ± 0.15 mm	 1.5 µm 1.6 µm 1.8 µm 0.7 µm 3.2 µm	Calibrated by using gauge block with reference to JIS B 7520:1981
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 µm 1.5 µm 2 µm 2.5 µm 3 µm 3.5 µm 4 µm 4.5 µm 5 µm 5.6 µm	Calibrated by using MU checker with reference to JIS B 7420:1997
Non-metallic Thickness Foil	Up to 2.5 mm	0.3 µm	Calibrated by using MU checker with reference to BS EN ISO 2178:2016
Glass Scale	Up to 200 mm 200 mm to 400 mm 400 mm 1000 mm	0.01 mm 0.05 mm 0.09 mm	Calibrated by using profile projector / linear scale with reference to JIS B 7541:2001

SCOPE OF CALIBRATION: DIMENSIONAL

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Test Sieve	0.032 mm to 125 mm	2 µm	Calibrated by using profile projector and caliper with reference to BS 410-1:2000
Plain Plug / Pin Gauge (diameter only)	0.1 mm to 25 mm 25 mm to 50 mm	0.6 µm 1.7 µm	Calibrated by using laser scan micrometer and bench comparator with reference to JIS B 7420:1997
External Parallel Screw Thread Gauge	2 mm to 50 mm	Major diameter: 1.5 µm Simple pitch diameter: 3 µm	Calibrated by using profile projector, 3 wire pin set scale and bench comparator with reference to JIS B 0261:2004
Square	Up to 75 mm 75 mm to 150 mm 150 mm to 300 mm 300 mm to 400 mm	6.0 µm 8.0 µm 11 µm 12 µm	Calibrated by using square tester, dial tester indicator, parallel bar and granite tri-square with reference to JIS 7526:1995
Angle	Up to 180 ° (Degree)	3 minute	Calibrated by using angle blocks, beveled protractor, sine bar, gauge blocks and dial test indicator with reference to JIS B 0405:1991
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 digimatic head, gauge blocks and ring gauge with reference to JIS B 7515:1982

SCOPE OF CALIBRATION: DIMENSIONAL

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Microindicator	± 25 µm (Resolution: 0.5 µm) ± 50 µm to 100 µm (Resolution : 1 µm) Above 100 µm (Resolution : 2 µm)	0.2 µm 0.8 µm 1.5 µm	Calibrated by using gauge blocks and calibration tester with reference to JIS B 7519:1994
Coating Thickness Gauge	23.6 µm to 2.766 mm	0.7 µm	Calibrated by using thickness foil
Linear Height	Up to 200 mm 200 mm to 400 mm 400 mm to 600 mm	1.0 µm 2.0 µm 2.4 µm	Calibrated by using gauge block with reference to BS EN ISO 13225:2012

Signatories:

1. **Nik Suriayati Nik Ismail**
2. **Teo Hun Wei**
3. **Lim Mei Fun**
4. ****Hasnas Hussain** (except Coating Thickness Gauge & Linear Height)
5. ****Aida Binti Ismail** (except Gauge Block, Micrometer Head & Calibration Tester, Snap Micrometer, External Parallel Screw Thread Gauge, Square, Angle, Dial Bore Tester/Gauge, Coating Thickness Gauge & Linear Height)

** Non-resident signatory

SCOPE OF CALIBRATION: DIMENSIONAL

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Vee Block	Up to 150 mm X 150 mm X 65 mm	20 µm	Calibrated by using dial test indicator and surface plate with reference to JIS B 7540:1972
Three point Internal Micrometer (Holtest)	Up to 50 mm 50 mm to 100 mm	1.6 µm 2.3 µm	Calibrated by using plain ring gauge with reference to DIN 863-4:1999
Digital Indicator	Up to 25 mm 25 mm to 50 mm	0.5 µm 1.2 µm	Calibrated by using digimatic head, gauge block and calibration tester with reference to JIS B 7536:1982
Electrical comparator / MU checker	Up to 2 mm	0.18 µm	Calibrated by using gauge block, calibration tester or micrometer head with reference to JIS B7536:1982

Signatories:

1. **Nik Suriayati Nik Ismail**
2. **Teo Hun Wei**
3. **Lim Mei Fun**
4. ****Hasnas Hussain**
5. ****Aida Binti Ismail**

** Non-resident signatory

SCOPE OF CALIBRATION: DIMENSIONAL

SITE: CATEGORY I

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Profile Projector Individual axis	Up to 140 mm 140 mm to 300 mm	1.6 µm 3.1 µm	Calibrated by using glass scale with reference to JIS B 7184:1995
Surface Plate	300 mm X 300 mm 600 mm X 600 mm 1000 mm X 1000 mm 1600 mm X 2500 mm	1.4 µm 2.0 µm 2.6 µm 3.8 µm	Calibrated by using precision inclinometer, micro indicator and variation gauge with reference to BS 817:2008

Signatories:

1. **Senthil Kumar Balaraman**
2. ****Hasnas Hussain**

** Non-resident signatory

SCOPE OF CALIBRATION: TIME AND FREQUENCY

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Tachometer - Non Contact	60 rpm to 40000 rpm	1 rpm	Calibrated by using frequency calibrator
- 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

Signatories:

1. **Teo Hun Wei**
2. **Kwan Yee Hong**
3. ****Azlan Othman**

** Non-resident signatory

SCOPE OF CALIBRATION: TIME AND FREQUENCY

SITE: CATEGORY I

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
RPM Measuring Instruments - Non Contact	60 rpm to 40000 rpm	1 rpm	Calibrated by using tachometer

Signatories:

1. **Teo Hun Wei**
2. **Senthil Kumar Balaraman**
3. **Kwan Yee Hong**

SCOPE OF CALIBRATION: TIME AND FREQUENCY

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
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 900 s to 1800 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 0.012 s	Direct comparison method

Signatories:

1. **Azhari Alwi**
2. **Tang Wen Lih**

SCOPE OF CALIBRATION: TIME AND FREQUENCY

SITE: CATEGORY I

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
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 900 s to 1800 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 0.08 s	Direct comparison method

Signatories:

1. **Azhari Alwi**
2. **Tang Wen Lih**

SCOPE OF CALIBRATION: ELECTRICAL

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Measuring Instrument DC Voltage	0 mV to 200 mV 200 mV to 2.2 V 2.2 V to 11 V 11 V to 22 V 22 V to 220 V 220 V to 1100 V	0.00038 mV 0.0037 mV 0.037 mV 0.12 mV 0.00077 V 0.0077 V	Generation using calibrator model Fluke 5700A
DC Current	0 mV to 220 µA 220 µA to 2.2 mA 2.2 mA to 22 mA 22 mA to 220 mA 220 mA to 2.2 A	0.0069 µA 0.019 µA 0.00022 mA 0.0046 mA 0.057 mA	Generation using calibrator model Fluke 5700A
	329 mA to 11 A	1.5 mA	Generation using calibrator model Fluke 5500A
AC Voltage	**0 mV to 2.2 mV** 10 Hz to 1 MHz **2.2 mV to 22 mV** 500 kHz to 1 MHz **22 mV to 220 mV** 500 kHz to 1 MHz **220 mV to 2.2 V** 500 kHz to 1 MHz **2.2 V to 22 V** 500 kHz to 1 MHz **22 V to 220 V** 10 Hz to 50 kHz 50 kHz to 100 kHz **220 V to 1100 V** 1 Hz to 1 kHz	0.0017 mV 0.053 mV 0.088 mV 0.72 mV 0.018 V 0.0079 V 0.026 V 0.033 V	Generation using calibrator model Fluke 5700A

SCOPE OF CALIBRATION: ELECTRICAL

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
AC Current	**0 µA to 220 µA**		
	10 Hz to 5 kHz	0.016 µA	
	5 kHz to 10 kHz	0.026 µA	
	220 µA to 2.2 mA		
	10 Hz to 5 kHz	0.68 µA	
	5 kHz to 10 kHz	0.0012 mA	
	2.2 mA to 22 mA		Generation using calibrator model Fluke 5700A
	10 Hz to 5 kHz	0.0012 mA	
	5 kHz to 10 kHz	0.0012 mA	
	22 mA to 220 mA		
	10 Hz to 5 kHz	0.011 mA	
	5 kHz to 10 kHz	0.011 mA	
	220 mA to 2.2 A		
	10 Hz to 5 kHz	0.24 mA	
	5 kHz to 10 kHz	0.00061 A	
	0.33 A to 11 A		
	45 Hz to 1 kHz	5.1 mA	Generation using calibrator model Fluke 5500A
Resistance	0 Ω to 1.9 Ω	0.13 mΩ	
	1.9 Ω to 19 Ω	0.00023 Ω	
	19 Ω to 190 Ω	0.0017 Ω	
	190 Ω to 1.9 kΩ	0.12 Ω	Generation using calibrator model Fluke 5700A
	1.9 kΩ to 19 kΩ	0.17 Ω	
	19 kΩ to 190 kΩ	0.0017 kΩ	
	190 kΩ to 1.9 MΩ	0.021 kΩ	
	1.9 MΩ to 19 MΩ	0.00051 MΩ	
	19 MΩ to 100 MΩ	0.013 MΩ	
	119 MΩ to 290 MΩ	1.1 MΩ	Generation using calibrator model Fluke 5500A

SCOPE OF CALIBRATION: ELECTRICAL

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Measuring Instrument (continued) Capacitance	**50 Hz to 1000 Hz** 0.33 nF to 1.0999 nF	0.0014 nF	Generation using calibrator model Fluke 5500A
	50 Hz to 1000 Hz 1.1 nF to 3.2999 nF	0.0025 nF	
	50 Hz to 1000 Hz 3.3 nF to 10.999 nF	0.0062 nF	
	50 Hz to 1000 Hz 11 nF to 109.999 nF	0.062 nF	
	50 Hz to 1000 Hz 110 nF to 300 nF	0.16 nF	
	50 Hz to 400 Hz 0.33 µF to 10.999 µF	0.0062 µF	
	50 Hz to 400 Hz 11 µF to 32.999 µF	0.025 µF	
	50 Hz to 100 Hz 33 µF to 300 µF	0.17 µF	
	50 Hz to 100 Hz 300 µF to 329.99 µF	0.25 µF	
	50 Hz to 100 Hz 330 µF to 1100 µF	0.62 µF	
Frequency	0.1 Hz to 110 Hz 110 Hz to 1100 Hz 1.1 kHz to 11 kHz 11 kHz to 100 kHz 100 kHz to 500 kHz 500 kHz to 1 MHz	0.00017 Hz 0.017 Hz 0.00017 kHz 0.0017 kHz 0.0017 kHz 17 Hz	Calibrated by using Fluke 5700A

SCOPE OF CALIBRATION: ELECTRICAL

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Oscilloscope: Vertical Deflection DC V @ 50 Ohm Load	0 mVp-p to 5mVp-p 5 mVp-p to 10 mVp-p 10 mVp-p to 22 mVp-p 22 mVp-p to 25 mVp-p 25 mVp-p to 55 mVp-p 55 mVp-p to 100 mVp-p 100 mVp-p to 220 mVp-p 220 mVp-p to 250 mVp-p 250 mVp-p to 550 mVp-p 550 mVp-p to 700 mVp-p 700 mVp-p to 2.2 Vp-p	0.011 mVp-p 0.011 mVp-p 0.011 mVp-p 0.011 mVp-p 0.064 mVp-p 0.075 mVp-p 0.23 mVp-p 0.32 mVp-p 0.14 mVp-p 0.36 mVp-p 0.06 Vp-p	
Vertical Deflection AC V Square Wave Signal @ 50 Ohm Load	5 mVp-p to 10 mVp-p 10 mVp-p to 20 mVp-p 20 mVp-p to 50 mVp-p 50 mVp-p to 100 mVp-p 100 mVp-p to 200 mVp-p 200 mVp-p to 0.5 Vp-p 0.5 Vp-p to 1 Vp-p 1 Vp-p to 2 Vp-p	0.038 mVp-p 0.06 mVp-p 0.045 mVp-p 0.14 mVp-p 0.24 mVp-p 0.0011 mVp-p 0.0011 Vp-p 0.0019 Vp-p	Generation using calibrator model Fluke 5500A (SC 300)
Horizontal Deflection Timer marker	2 ns 5 ns 10 ns 20 ns 50 ns 1 µs 10 µs 20 µs 50 µs 10 ms 20 ms 50 ms 2 s 5 s	0.011 ns 0.011 ns 0.0059 ns 0.0059 ns 0.0059 ns 0.0011 µs 0.0059 µs 0.0059 µs 0.0059 µs 0.0059 ms 0.010 ms 0.0059 ms 0.0011 s 0.0011 s	
Bandwidth Frequency @ 3 Vp-p	50 kHz 500 kHz 5 MHz 50 MHz 300 MHz	0.0011 kHz 0.0011 kHz 0.0011 MHz 0.0011 MHz 00011 MHz	

SCOPE OF CALIBRATION: ELECTRICAL

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Generating / Sourcing Instrument			
DC Voltage	0 mV to 100 mV	0.0019 mV	
	100 mV to 1 V	0.0048 mV	
	1 V to 10 V	0.047 mV	
	10 V to 100 V	0.81 mV	
	100 V to 1000 V	6.9 mV	
DC Current	0 to 10 mA	0.37 µA	
	10 mA to 100 mA	4.8 µA	
	100 mA to 1 A	0.094 mA	
	1 A to 3 A	0.18 mA	
AC Voltage	**0 mV to 100 mV**		
	3 Hz to 1 kHz	0.015 mV	
	1 kHz to 50 kHz	0.027 mV	
	50 kHz to 1 MHz	0.48 mV	
	100 mV to 1 V		
	3 Hz to 1 kHz	0.14 mV	
	1 kHz to 50 kHz	0.20 mV	Calibrated by using Agilent 34401A multimeter
	50 kHz to 1 MHz	0.48 mV	
	1 V to 750 V		
	3 Hz to 1 kHz	0.054 V	
	1 kHz to 50 kHz	0.38 V	
	50 kHz to 1 MHz	0.38 V	
AC Current	**0 to 1 A**		
	3 Hz to 1 kHz	0.31 mA	
	1 kHz to 5 kHz	0.31 mA	
	1 A to 3 A		
	3 Hz to 1 kHz	0.56 mA	
	1 kHz to 5 kHz	0.56 mA	
Resistance	0 to 100 Ω	4.1 mΩ	
	100 Ω to 1 kΩ	0.019 Ω	
	1kΩ to 10 kΩ	0.22 Ω	
	10 kΩ to 100 kΩ	2.5 Ω	
	100 kΩ to 1 MΩ	0.029 kΩ	
	1 MΩ to 10 MΩ	0.80 kΩ	
	10 MΩ to 100 MΩ	0.44 MΩ	

SCOPE OF CALIBRATION: ELECTRICAL

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Generating / Sourcing Instrument (continued) Frequency	3 Hz to 40 Hz 40 Hz to 1 kHz	0.0032 Hz 0.53 Hz	Calibrated by using Agilent 34401A multimeter
Clamp Meter DC Current 50 turn – coil	0 A to 10 A 10 A to 16.5 A 16.5 A to 150 A 150 A to 550 A	0.04 A 0.08 A 0.55 A 1.7 A	
AC Current 50 turn – coil	**0 to 10 A** 45 Hz to 65 Hz	0.10 A	
	10 A to 16.5 A 45 Hz to 65 Hz	0.11 A	
	16.5 A to 150 A 45 Hz to 65 Hz	0.65 A	Generation using calibrator model Fluke 5500A
	150 A to 550 A 45 Hz to 65 Hz	2.1 A	
	0 to 10 A 65 Hz to 440 Hz	0.15 A	
	10 A to 16.5 A 65 Hz to 440 Hz	0.20 A	
	16.5 A to 150 A 65 Hz to 440 Hz	1.6 A	
	150 to 550 A 65 Hz to 440 Hz	5.3 A	

Signatories:

1. **Azhari Alwi**
2. **Tang Wen Lih**

SCOPE OF CALIBRATION: ELECTRICAL

SITE: CATEGORY I

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Measuring Instrument			
DC Voltage	0 to 300 mV	0.0017 mV	
	300 mV to 50 V	0.25 mV	
	50 V to 900 V	0.011 V	
DC Current	0 to 3.29 mA	0.075 µA	
	3.29 mA to 32.9 mA	1.1 µA	
	32.9 mA to 329 mA	0.03 mA	
	329 mA to 11 A	1.5 mA	
AC Voltage	**0 to 30 mV** 45 Hz to 450 kHz	0.023 mV	
	30 mV to 300 mV 45 Hz to 500 kHz	0.079 mV	
	300 mV to 3 V 45 Hz to 500 kHz	0.0013 V	
	3 V to 30 V 45 Hz to 90 kHz	0.0026 V	Generation using calibrator model Fluke 5500A
	30 V to 300 V 45 Hz to 18 kHz	0.0082 V	
	300 V to 1000 V 45 Hz to 18 kHz	0.049 V	
AC Current	**33 µA to 190 µA** 1 kHz to 10 kHz	0.077 µA	
	190 µA to 329 µA		
	45 Hz to 1 kHz	0.079 µA	
	1 kHz to 10 kHz	0.12 µA	
	329 µA to 0.3 mA		
	45 Hz to 1 kHz	0.099 µA	
	1 kHz to 5 kHz	0.13 µA	
	5 kHz to 10 kHz	0.48 µA	

SCOPE OF CALIBRATION: ELECTRICAL

SITE: CATEGORY I

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Measuring Instrument (continued) AC Current (continued)	**0.3 mA to 1.9 mA** 1 kHz to 10 kHz	0.47 µA	Generation using calibrator model Fluke 5500A
	1.9 mA to 3.3 mA 1 kHz to 10 kHz	0.87 µA	
	3.3 mA to 19 mA 1 kHz to 10 kHz	4.4 µA	
	33 mA to 190 mA 1 kHz to 5 kHz	0.044 mA	
	190 mA to 329 mA 1 kHz to 10 kHz	0.074 mA	
	329 mA to 0.33 A 10 Hz to 10 kHz	0.15 mA	
	0.33 A to 11 A 45 Hz to 1 kHz	0.0051 A	
Resistance	0 to 300 Ω 300 Ω to 3 kΩ 3 kΩ to 30 kΩ 30 kΩ to 330 kΩ 330 kΩ to 10.9 MΩ 10.9 MΩ to 30 MΩ 30 MΩ to 119 MΩ 119 MΩ to 290 MΩ	2.5 mΩ 34 mΩ 0.25 Ω 18 Ω 0.81 kΩ 13 kΩ 0.086 MΩ 1.1 MΩ	
Capacitance	**50 Hz to 1000 Hz** 0.33 nF to 1.0999 nF	0.0014 nF	
	50 Hz to 1000 Hz 1.1 nF to 3.2999 nF	0.0025 nF	
	50 Hz to 1000 Hz 3.3 nF to 10.999 nF	0.0062 nF	

SCOPE OF CALIBRATION: ELECTRICAL

SITE: CATEGORY I

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Measuring Instrument (continued) Capacitance (continued)	**50 Hz to 1000 Hz** 11 nF to 109.999 nF	0.062 nF	Generation using calibrator model Fluke 5500A
	50 Hz to 1000 Hz 110 nF to 300 nF	0.16 µF	
	50 Hz to 400 Hz 0.33 µF to 10.999 µF	0.0062 µF	
	50 Hz to 400 Hz 11 µF to 32.999 µF	0.025 µF	
	50 Hz to 100 Hz 33 µF to 300 µF	0.17 µF	
	50 Hz to 100 Hz 300 µF to 329.99 µF	0.25 µF	
	50 Hz to 100 Hz 330 µF to 110 µF	0.62 µF	
Generating / Sourcing Instrument DC Voltage	0 mV to 100 mV 100 mV to 1 V 1 V to 10 V 10 V to 100 V 100 V to 1000 V	0.0019 mV 0.0048 mV 0.047 mV 0.81 mV 6.9 mV	Measuring using Agilent 34401A multimeter
DC Current	0 to 10 mA 10 mA to 100 mA 100 mA to 1 A 1 A to 3 A	0.37 µA 4.8 µA 0.094 mA 0.18 mA	
AC Voltage	**0 mV to 100 mV** 3 Hz to 1 kHz 1 kHz to 50 kHz 50 kHz to 1 MHz	 0.015 mV 0.027 mV 0.48 mV	

SCOPE OF CALIBRATION: ELECTRICAL

SITE: CATEGORY I

Instrument Calibrated/ Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty(±)*	Remarks
Generating / Sourcing Instrument (continued)			
AC Voltage (continued)	**100 mV to 1 V**		
	3 Hz to 1 kHz	0.14 mV	
	1 kHz to 50 kHz	0.20 mV	
	50 kHz to 1 MHz	0.45 mV	
	1 V to 750 V		
	3 Hz to 1 kHz	0.054 V	
	1 kHz to 50 kHz	0.38 V	
	50 kHz to 1 MHz	0.38 V	
AC Current	**0 to 1 A**		Measuring using Agilent 34401A multimeter
	3 Hz to 5 kHz	0.31 mA	
	1 A to 3 A		
	3 Hz to 5 kHz	0.56 mA	
Resistance	0 to 100 Ω	4.1 mΩ	
	100 Ω to 1 kΩ	0.019 Ω	
	1kΩ to 10 kΩ	0.22 Ω	
	10 kΩ to 100 kΩ	2.5 Ω	
	100 kΩ to 1 MΩ	0.029 kΩ	
	1 MΩ to 10 MΩ	0.8 kΩ	
	10 MΩ to 100 MΩ	0.44 MΩ	

Signatories:

1. **Azhari Alwi**
2. **Tang Wen Lih**

SCOPE OF TESTING: MECHANICAL

Materials/ Products Tested	Type of Test/ Properties Measured/ Range of Measurement	Standard Test Methods/ Equipment/Techniques
Geometric Measurement	Length measurement (Only for single directional measurement. Excluding dimension with relative datum and combined multi axis jig fixture.) <u>Contact</u> Up to 1000 mm <u>Non-contact</u> Up to 100 mm	Calibrate by using: Digimatic Micrometer, Linear Height, Bench Comparator, Height Gauge & Caliper Profile Projector
	Diameter measurement (Excluding dimension with relative datum and combined multi axis jig fixture.) <u>Contact</u> Up to 300 mm <u>Non-contact</u> Up to 100 mm	 Laser Scan Micrometer, Linear Height, Micrometer & Bench Comparator Profile Projector
	Angle Measurement Up to 360 °	Protractor, Angle Block, Dial Test Indicator
	Straightness & Parallelism Measurement	Dial Test Indicator & Surface Plate

Signatories:

1. **Nik Suriayati Nik Ismail**
2. **Teo Hun Wei**
3. **Lim Mei Fun**