

ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือวิเคราะห์และตรวจวัดคุณภาพสิ่งแวดล้อม





JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd.
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Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TISI-TIS 17025
CALIBRATION 0367

Flow measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : COF-014-66

Page 1 of 2 Pages

MEASUREMENT ITEM : Top Load Orifice
MANUFACTURER : TISCH
MODEL/TYPE : TE-5028
SERIAL NUMBER : 3945
ID NUMBER : TNP-F-CAL02
CONDITION AS-RECEIVED : Used item
CUSTOMER : TNP Environment Co., Ltd.
332/173 Vision Smart Life Village, Bangrak Phatthana,
Bang Bua Thong District, Nonthaburi 11110

RECEIVED DATE : 29 Sep 2023
MEASUREMENT DATE : 01 Oct 2023
ISSUE DATE : 01 Oct 2023

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature	: 23.0 ± 3.0	°C
Relative Humidity	: 55.0 ± 15.0	%RH
Atmospheric Pressure	: 1010 ± 10	hPa

CALIBRATION CONDITION:

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are 25.1 °C and 57.0 %RH.

NOTED: The certificate is valid only to the item calibrated on date and place of calibration.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:

The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roots Meter) Model G65/IMC/W2-dp. The WI-CL-004 was used as a calibration guideline.

Traceability:

This certificate provides a traceability of The measurement to recognized the national standards, and to realization of the international system of units (SI) through the VSL (National Metrology Institute of Netherlands) via Certificate number: G2211901

Uncertainty of Measurement:

The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor $k=2$, Which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM 'Evaluation of measurement data - Guide to the expression of uncertainty in measurement'

Calibrated by:



Approved signatory: ...

MEASUREMENT RESULTS:

The Orifice gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Roots Meter). The Humid air was used as a medium in the system. The standard conditions are 25°C (298.15 K) and 760 mmHg for standard temperature and standard pressure respectively.

Table 1: The results of Q Standard calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Δp_{meter} mmHg	$\Delta p_{\text{Orifice}}$ inH ₂ O	γ	Standard Flow [Q_s] m ³ /min
1	0.705	755.985	24.95	23.76	68.702	1.098	1.045	0.641
2	1.005	756.073	24.81	23.66	53.939	2.343	1.527	0.933
3	1.122	756.065	24.44	23.62	48.579	2.981	1.724	1.050
4	1.166	756.080	24.33	23.58	46.771	3.229	1.794	1.093
5	1.421	756.160	24.48	23.64	34.286	4.973	2.226	1.356

Slope (m): 1.65230
Intercept (b): -0.01279
Correlation coefficient (r): 0.99984
Uncertainty ($k=2$): 0.015 m³/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Δp_{meter} mmHg	$\Delta p_{\text{Orifice}}$ inH ₂ O	γ	Standard Flow [Q_s] m ³ /min
1	0.705	755.985	24.95	23.76	68.702	1.098	0.658	0.644
2	1.005	756.073	24.81	23.66	53.939	2.343	0.961	0.937
3	1.122	756.065	24.44	23.62	48.579	2.981	1.083	1.053
4	1.166	756.080	24.33	23.58	46.771	3.229	1.127	1.097
5	1.421	756.160	24.48	23.64	34.286	4.973	1.399	1.360

Slope (m): 1.03492
Intercept (b): -0.00806
Correlation coefficient (r): 0.99984
Uncertainty ($k = 2$): 0.015 m³/min

End of Certificate of Calibration



Analyzer Performance Test

Calibrated Date: 31 October 2023

Instruments Information

Analyzer Type : CO Analyzer
Model : 48C

Manufacturer : Thermo Environmental
Serial Number : 48CHL-67713-358

Calibrator Unit

Dilutor Model : Dasibi Model 5008
Serial Number : 705
ZERO AIR Generator : API MODEL 701
Serial Number : 1924

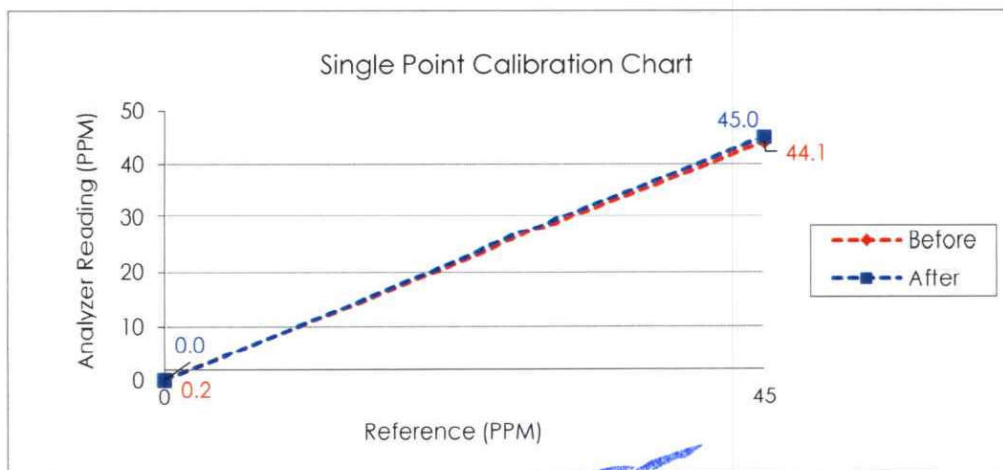
Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM
Sulphur Dioxide (SO₂) 55.11 PPM
Carbon Monoxide (CO) 4,535 PPM
Cylinder number EB0129027
Expire Date: 29 Oct. 2027

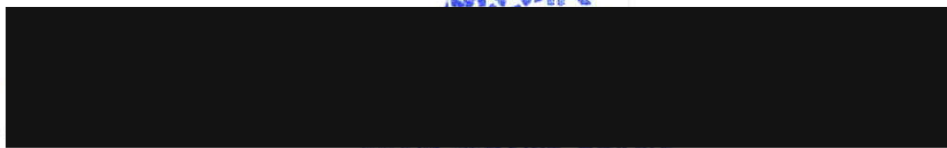
Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.2	0.2	45.0	44.1	-2.0
After	0.0	0.0	0.0	45.0	45.0	0.0



Calibrate By :



ENVIR SERVICE CO., LTD.

42 Ramintra 14 Yeak 9, Tha Raeng, Bang Khen, Bangkok 10230
Tel. 02-9435814-5 Fax. 02-9438201 www.envirservice.co.th

Analyzer Performance Test

Calibrated Date: 18 September 2023

Instruments Information

Analyzer Type : NO-NO2-NOx Analyzer

Manufacturer : Thermo Environmental

Model : 42C

Serial Number : 0413406269

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM

Sulphur Dioxide (SO2) 55.11 PPM

Carbon Monoxide (CO) 4,535 PPM

Cylinder number EB0129027

Expire Date: 29 Oct. 2027

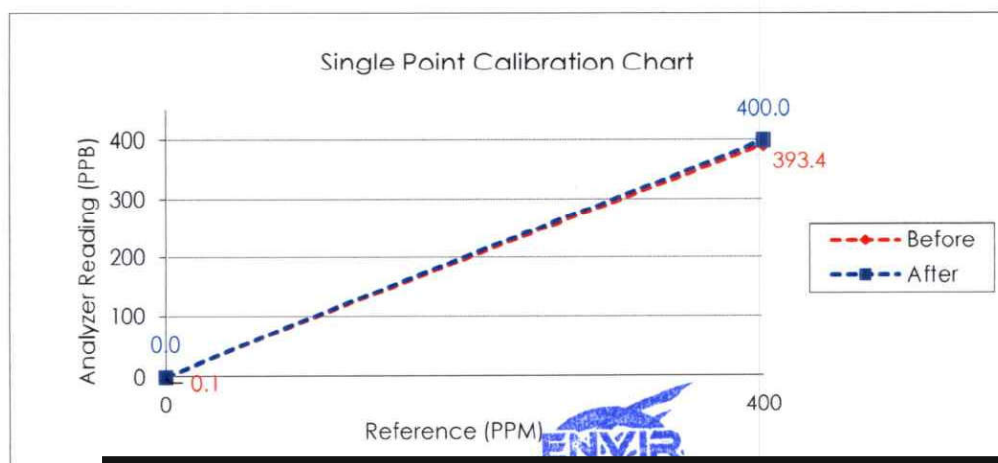
Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report (Before Adjust)

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
NO	0.0	0.1	0.1	400.0	393.4	-1.7
NOx	0.0	0.0	0.0	400.0	394.6	-1.3

Calibration Report (After Adjust)

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
NO	0.0	0.1	0.1	400.0	400.0	0.0
NOx	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :



Analyzer Performance Test

Calibrated Date: 31 October 2023

Instruments Information

Analyzer Type : SO2 Analyzer
Model : 43C

Manufacturer : Thermo Environmental
Serial Number : 0327402325

Calibrator Unit

Dilutor Model : Dasibi Model 5008
Serial Number : 705
ZERO AIR Generator : API MODEL 701
Serial Number : 1924

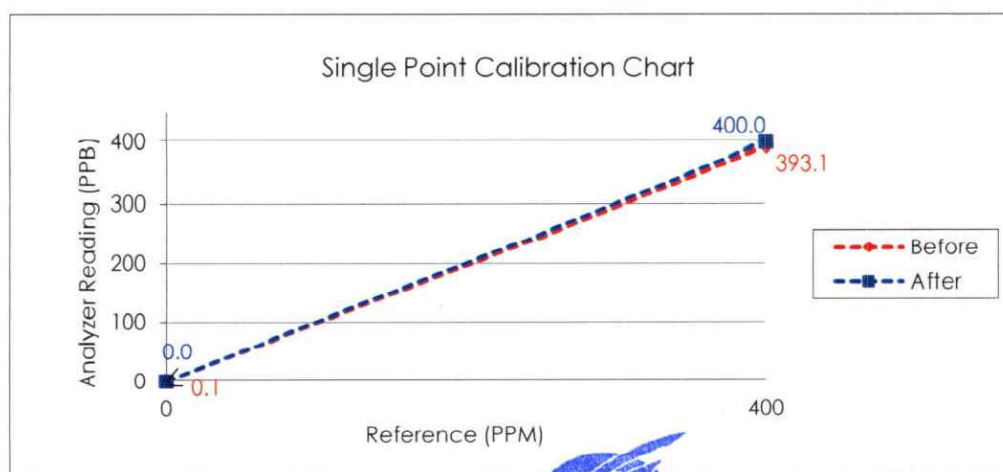
Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM
Sulphur Dioxide (SO2) 55.11 PPM
Carbon Monoxide (CO) 4,535 PPM
Cylinder number EB0129027
Expire Date: 29 Oct. 2027

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	393.1	-1.7
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :



Analyzer Performance Test

Calibrated Date: 2023-Nov-1

Instruments Information

Analyzer Type : CH4-NMHC-THC Analyzer

Manufacturer : HORIBA

Model : APHA-360CE

Serial Number : 423740300209

Calibrator Unit

Dilutor Model : Dasibi Model 5008

Serial Number : 705

ZERO AIR Generator : API MODEL 701

Serial Number : 1924

Standard Gas Concentration

Methane (CH₄) 181.0 PPM

Propane 180.7 PPM

Cylinder number EB0123130

Expire Date: 3 Oct. 2027

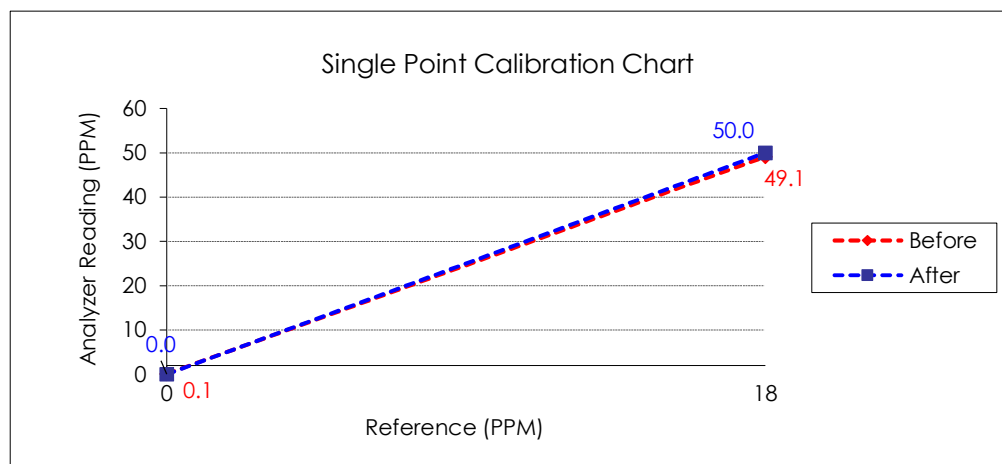
Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report (Before adjust)

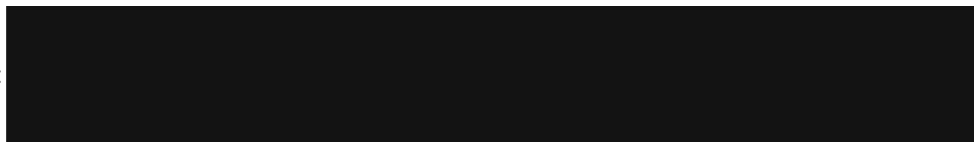
Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Methane	0.0	0.1	0.1	50.0	49.1	-1.8
NMHC	0.0	0.1	0.1	50.0	48.9	-2.2

Calibration Report (After adjust)

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Methane	0.0	0.0	0.0	50.0	50.0	0.0
NMHC	0.0	0.0	0.0	50.0	50.0	0.0



Calibrate By :





Certificate of Calibration

Certificate Number : SPR23070550-1

Page : 1 of 3

Customer : TNP ENVIRONMENT CO.,LTD.

332/173 Moo.3, Bang Rak Phatthana, Bang Bua Thong, Nonthaburi
11110

Equipment Name : Sound Calibrator

Manufacturer : KEPLER

Model : KSM-42C

Serial Number : 160100568

ID. Number : TNP-F-CAL01

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Received Date : 31 Jul 2023

Relative Humidity : $50\% \pm 15\%$

Calibration Date : 02 Aug 2023

Location of Calibration : In-Lab

Recommend Due Date : 02 Aug 2024

Calibration Procedure : In-House Method

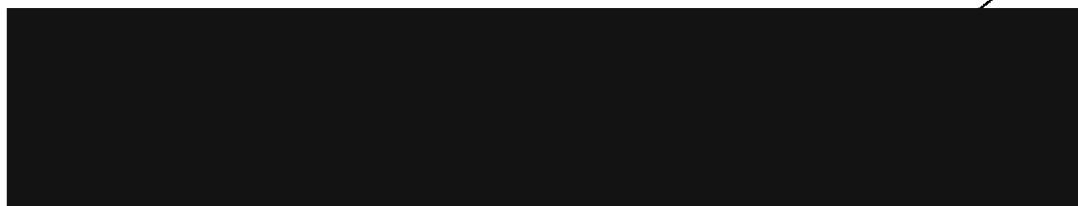
Date of Issue : 03 Aug 2023

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by :



Authorized Signatory



Calibration Report

Certificate Number : SPR23070550-1

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Measuring Receiver	8902A	2950A02471	EF-0001-23	12 Jan 2024
AUDIO Analyzer	8903B	3011A09975	EL05303/23	14 Feb 2024

Traceability

This certification is traceable to the International System of Unit maintained at :

NIMT - The National Institute of Metrology, Thailand.

PCAL - Professional Calibration & Services Co.,Ltd



Result of Calibration

Certificate No. : SPR230/0550-1

Page : 3 of 3

Function : Sound Level

UUC Setting ($\pm$ dB)	Standard Reading (dB)	Error (dB)	Uncertainty ($\pm$ dB)
94	94.0	0.0	1.5
114	114.0	0.0	1.5

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR23060536-1

Page : 1 of 3

Customer : TNP ENVIRONMENT CO.,LTD.

332/1/3 Moo.3, Bang Rak Phatthana, Bang Bua Thong, Nonthaburi
11110

Equipment Name : Sound Level Meter

Manufacturer : Scarlet Tech

Model : ST-25D

Serial Number : 10340942

ID. Number : TNP-F-S23

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Received Date : 30 Jun 2023

Relative Humidity : $50\% \pm 15\%$

Calibration Date : 11 Jul 2023

Location of Calibration : In-Lab

Recommend Due Date : 11 Jul 2024

Calibration Procedure : SP-CPE-04-01

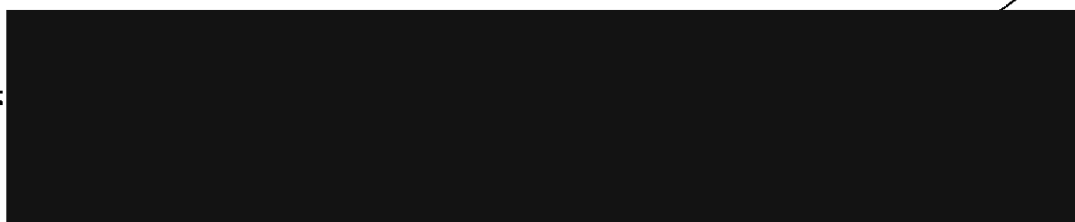
Date of Issue : 12 Jul 2023

Method of Calibration

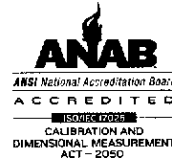
This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by :



Authorized Signatory



Calibration Report

Certificate Number : SPR23060536-1

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 114/0166	17 Jan 2024

Traceability

This certification is traceable to the International System of Unit maintained at :

TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR23060536-1

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.3	114.3	0.3	0.3	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.3	114.3	0.3	0.3	0.15

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

– End of Certificate –



Certificate of Calibration

Certificate Number : SPR23040172-1

Page : 1 of 3

Customer : TNP ENVIRONMENT CO.,LTD.

332/173 Moo.3, Bang Rak Phatthana, Bang Bua Thong, Nonthaburi
11110

Equipment Name : Vibration Meter

Manufacturer : Instantel

Model : 721A0501/721A2901

Serial Number : UM6150/UM12863

ID. Number : TNP-F-V12

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Received Date : 18 Apr 2023

Relative Humidity : $50\% \pm 15\%$

Calibration Date : 21 Apr 2023

Location of Calibration : In-Lab

Recommend Due Date : 21 Apr 2024

Calibration Procedure : In-House Method

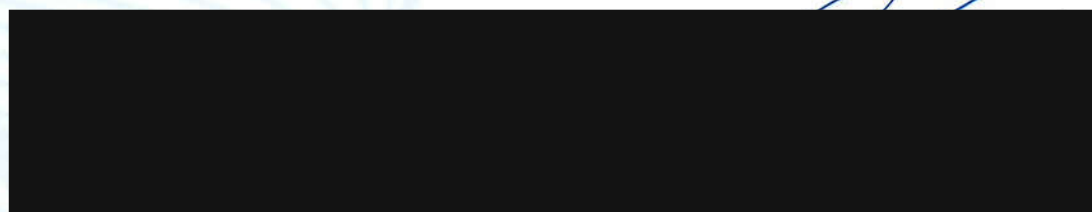
Date of Issue : 22 Apr 2023

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by :



Authorized Signatory



Calibration Report

Certificate Number : SPR23040172-1

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Vibration Calibrator	VC-02	2007014	AV-0050-20	10 Dec 2023

Traceability

This certification is traceable to the International System of Unit maintained at :
NIMT - The National Institute of Metrology, Thailand.



Result of Calibration

Certificate No. : SPR23040172-1

Page : 3 of 3

Results of Calibration : (★) Without () After Adjustment

Velocity Performance Test

Unit : mm/s_{pk}

Frequency (Hz)	STD Reading	UUC. Reading	Error	Uncertainty (±)
80.0	1.002	1.034	0.032	0.012
80.0	2.004	2.045	0.041	0.023
80.0	3.001	3.056	0.055	0.035
80.0	4.004	4.067	0.063	0.046
80.0	5.004	5.051	0.047	0.058
80.0	6.003	6.069	0.066	0.069
80.0	7.005	7.082	0.077	0.081
80.0	8.008	8.112	0.104	0.092
80.0	9.011	9.184	0.173	0.10
80.0	10.015	10.238	0.223	0.12

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2$, providing a level of confidence approximately 95%

- End of Certificate -

Performance Verification Certificate

Job No. LSPR2208846

Equipment : AA SPECTROMETER **Customer :** Environment & Laboratory Co.,Ltd.
Manufacturer : GBC Scientific **Location :** Laboratory
Model Type : SavantAA **Verification Date :** 10 October 2022
Serial No. : A8631

Result of Verification

Test Description	Tolerance	Reading	Result
1. EHT Photometric Noise	< 350 V -	253 V -	PASS
2. Wavelength Accuracy , Cu 324.7 nm	± 0.20 nm	324.80 nm	PASS
3. Wavelength Accuracy , Cs 852.10 nm	± 0.20 nm	852.17 nm	PASS
4. Slit Width 0.2 nm	± 0.02 nm	0.22 nm	PASS
5. Slit Width 0.5 nm	± 0.05 nm	0.52 nm	PASS
6. Slit Width 1.0 nm	± 0.10 nm	1.05 nm	PASS
7. Standard Gauze Screen <u>0.49</u> Abs BC mode with gauze BC mode without gauze * Difference between With gauze and without gauze	± 0.02 Abs < 0.02 Abs	0.489 Abs 0.0007 Abs 0.0009 Abs -0.0002 Abs	PASS PASS
8. ABS Reading 5ppm,Cu	> 0.7 Abs	0.884 Abs	PASS
9. %RSD	< 0.5 %	0.19 %	PASS

We hereby certify that instrument complies with GBC factory specifications

Your satisfaction is our promise @ SPCRT

Verification By :

Issued Date : 12 October 2022

DKSH Technology Limited
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone +662 639 7000, Fax +662 333 1026
Email: marketing.tec.th@dksh.com Website: www.dksh.com

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260
โทรศัพท์ +662 639 7000 โทรสาร +662 333 1026
อีเมล marketing.tec.th@dksh.com www.dksh.com

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PREVENTIVE MAINTENANCE AND PERFORMANCE VERIFICATION REPORT

ATOMIC ABSORPTION SPECTROPHOTOMETER (AAS)

Issued Date: 10/10/22

Customer : บริษัท เอ็นไวรอนเม้นท์ แอนด์ แลборาตอรี จำกัด
Address : 53/3 หมู่ 3 ถนนเรวดี ตำบลตลาดขวัญ อำเภอเมือง
นนทบุรี จังหวัดนนทบุรี 11000
Contract : XXXXXXXXXX

Manufacturer : GBC Scientific Equipment Pty Ltd.
Model : SavantAA
Serial No : A8631
Location : Laboratory

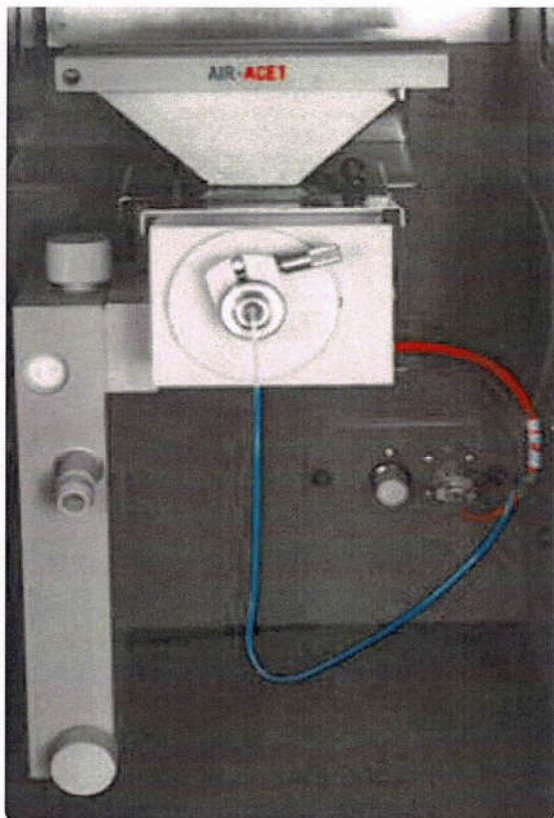
Power on switch and initial status

Instrument Ready สถานะเครื่องพร้อมใช้งาน

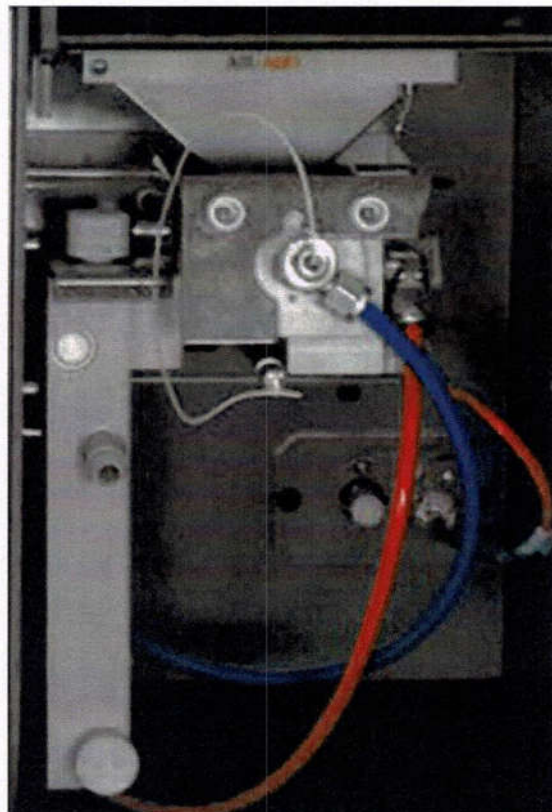
Preventive Maintenance	Pass	Fail	Remarks
<i>Electrical Voltage</i>			
- Main voltage (power supply check 220V $\pm$ 10V).	☒	☐	236.5 VAC
- Power indicator light (Replace if faulty).	☒	☐	N/A
- Power core (Clean or replace as appropriate).	☒	☐	N/A
- Fan (Clean or replace filter element as appropriate).	☒	☐	N/A
<i>Environment</i>			
- Temperature (10 to 35 deg.C)	☒	☐	25.2 C
- Humidity (8 to 80%).	☒	☐	55%
- Air Quality (No Dust)	☒	☐	N/A
- No corrosive vapours present from laboratory sample preparation or external sources.	☒	☐	N/A
<i>Optics</i>			
- Windows lens (Clean or replace as appropriate).	☒	☐	Clean
- Light Source (Check operation. Replace if required).	☒	☐	Ready
- D2 Lamp (Check operation. Replace if required).	☒	☐	Ready
<i>Gas system</i>			
- General (Tube and Fitting /Check for leaks).	☒	☐	Ready
- Air Zero (Inlet pressure range 300-400 kPa).	☒	☐	4 Bar
- Acetylene (Inlet pressure range 55-96 kPa).	☒	☐	0.9 Bar
- Nitrous oxide (Inlet pressure range 300-400 kPa).	☐	☐	
<i>Computer</i>			
- Operating system	☒	☐	Windows 10
- Software Version	☒	☐	SavantAA3.11
- Verify that all computer links and installed software operate correctly	☒	☐	Ready

Spray Chamber Type

☐ ABR Spray Chamber



☒ Standard Spray Chamber



Preventive Maintenance	Pass	Fail	Remark
<i>Flame system</i>			
- Burner head (Clean the jaws using GBC Burner Cleaning Card).	☒	☐	Ready
- Burner mount (Check for wear. Replace the burner retaining plate if required).	☒	☐	Ready
- Spray chamber (Visually inspect the bead for cracks, pitting or solid deposits. Check or replace O-ring kit).	☒	☐	Ready
- Safety interlocks			
➤ Burner (Check for Interlocks connector)	☒	☐	Ready
➤ Spray chamber (Check for Interlocks connector)	☒	☐	Ready
- Pressure relief bung. (Check or replace O-ring)	☒	☐	Ready
- Nebulizer (Clean and check operation).	☒	☐	Ready
- Gas connections (Check for leaks).	☒	☐	Ready
- Capillary tube (Check bends and clog).	☒	☐	Ready
- Liquid trap (Drain / clean and replace O-ring kit).	☒	☐	Ready

Gas Flow Optimisation	Pass	Fail	Remark
- Bleed gas lines (Relieve pressure in the spray chamber).	☒	☐	Ready
- Ignitor (Ignite the flame several times to check ignition reliability. Replace the glow plug if required).	☒	☐	Ready
- Extinguish (Check operation).	☒	☐	Ready
- Horizontal movement (Check operation for STD. Spray Chamber).	☒	☐	Ready
- Vertical movement (Check operation for STD. Spray Chamber).	☒	☐	Ready
- Burner Adjuster (Check operation for ABR Spray Chamber)			
➤ Burner Angle (°C)	☐	☐	
➤ Angle Zero (mm)	☐	☐	
➤ Workhead Height (mm)	☐	☐	
➤ Workhead Centre (mm)	☐	☐	

Note:

Signature	
Customer (.....)	Date :
Service Engineer (.....)	Maintenance Date : 10/Oct/2022

Performance Verification	Specification	Actual Value	Pass	Failed	Remarks
1. Wavelength accuracy (optic calibration check).	Cu 324.75 nm $\pm$ 0.2 nm	324.80 nm	☒	☐	N/A
	Cs 852.10 nm $\pm$ 0.2 nm	852.17 nm	☒	☐	N/A
2. Slit width accuracy (0.2 nm ,0.5 nm,1.0 nm)	0.2 nm $\pm$ 0.02 nm	0.22 nm	☒	☐	N/A
	0.5 nm $\pm$ 0.05 nm	0.52 nm	☒	☐	N/A
	1.0 nm $\pm$ 0.10 nm	1.05 nm	☒	☐	N/A
3. EHT	<350V	253 V	☒	☐	N/A
4. Absorbance accuracy (absorbance calibration check). ➤ Gauze 0.49 A.U.	Reading $\pm$ 10% of calibrated value.	0.4891 Abs.	☒	☐	N/A
5. Background correction (optics alignment check). difference between measurement with and without 0.49 A.U. gauze for 10 samples.	SavantAA <1% SensAA/XplorAA <2%	BC on with gauze: 0.0007 Abs. BC on without gauze: 0.0009 Abs.	☒	☐	N/A
6. Sensitivity /noise flame test (aqueous Cu solution test under air-acetylene flame).	Cu 5 ppm >0.7 A.U.	0.8839 Abs.	☒	☐	N/A
	<0.5% RSD	0.19 %	☒	☐	N/A

Note:

Signature	
Customer (.....)	Date :
Service Engineer (.....)	Maintenance Date : 10/Oct/2022



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 22TM1185

Page.: 1 of 3

Certificate of Calibration

Equipment :	Autoclave
Manufacturer :	Rexall
Model :	LS-2D
Serial No. :	04131
ID No. :	AUT-01
Submitted by :	Environment & Laboratory Co.,Ltd. 40 Soi Liangmueangnonthaburi 13, Talad Kwan, Mueang, Nonthaburi 11000
Location :	Room No. 205
Received Order :	14 July 2022
Calibration Date :	15 July 2022
Ambient Temperature :	(26 ± 10) °C
Relative Humidity :	(50 ± 30) %

Issue Date :

27 July 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0043527



Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2207-0250OC-7

Cert. No.: 22TM1185

Page.: 2 of 3

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT03 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Data Acquisition	34970A	MY44073381	22LM78/1	12 May 2023

2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

4. This result of calibration covers laboratory autoclaves for the sterilization of goods and material which could be infected with organisms categorized as Hazard Group 1, 2 and 3**

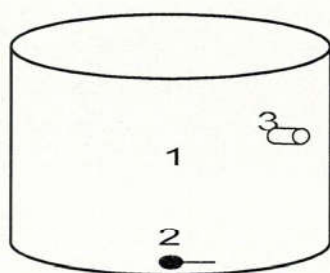
(** = Categorization of pathogens according to hazard and categories of containment, second edition, 1990)

It does not cover autoclaves for use with material infect with organisms in Hazard Group 4, for which complete containment and sterilization of infected condensate is considered to be essential.

This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical or veterinary purposes which are directly concerned with patient care, or those used for fabrics subjected to sterilization which are required to be dry at the end of cycle.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source



	<u>Environmental</u>		
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	27	68	224
Finished of Calibration	28	63	223

<u>Position</u>	<u>Description</u>	<u>Ref. Std. ID No.:</u>
1 =	Center of chamber	20-01TC-01
2 =	Temperature sensor	20-01TC-02
3 =	Exhaust port	20-01TC-03



Equipment : Autoclave

Condition As-Received : Used Item

Reference : 2207-02500C-7

Cert. No.: 22TM1185

Page.: 3 of 3

Result of Calibration :- (*) Without Adjustment

Operating parameter Set : Temperature = 120 °C

Sterilization period = 15 minute

UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (kg/cm ²)	Uncertainty (± °C)	Coverage Factor <i>k</i>
120	-	1	121.644	0.82	1.2	1.2	2
		2	121.524				
		3	121.570				

Average* : The average of 30 values in each position.

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor *k*, providing a level of confidence of approximately 95 %.

-o0o-

MAINTENANCE AND IPV TEST CERTIFICATE MODEL

Avio 200

Customer :	Environment & Laboratory	Date Tested:	September 9, 2022
Address :	40 Soi Liangmueangnon 13 Talad Kwan, Mueang Nonthaburi 11000	Recommendation Recertification	
User Name:		Period	12 Months
Phone:		Recertification Due:	September 9, 2023
E - Mail :		Date Last Certified:	January 14, 2021
		Visit Number:	1 of 1
		PerkinElmer Phone:	02-719-6420 ext 206
		PerkinElmer Fax:	02-318-5597

CONFIGURATION TESTED		
MODEL	SERIAL NUMBER	SOFTWARE
Avio 200	079S16062402	
TESTED EQUIPMENT	CALIBRATION NUMBER	EXPIRATION
IPV Method		
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
Multielement Standard	N069-1579	Jun 30,2023
Instrument Cal. STD4	N930-0221	Nov 30, 2023
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
2 % HNO3		
10 % HNO3		

MAINTENANCE AND IPV TEST CERTIFICATE MODEL**Avio 200****SERIAL NUMBER:** 079S16062402**DATE TESTED:**September 9, 2022**1. MECHANICAL CHECKS**

A. Inspect and clean all fans and filters.

B. Inspect and replace as necessary, all torch components including the RF coil.

C. Inspect all tubing for sign of clacking or leaking.

D. Adjust water and gas pressure regulator settings.

E. Inspect and leak check pneumatics drawers.

F. Clean the exterior of the instrument.

2. OPTICAL CHECKS

A. Inspect and clean all optical components.

B. As required, check and replace all purge filters.

C. Recheck optical alignment.

3. COOLING SYSTEM CHECKS

A. Perform preventive maintenance on chiller.

B. Flush out the chiller every year.

4. PERFORMANCE CHECKS

A. Torch View Alignment.

B. Wavelength Calibration.

MAINTENANCE AND IPV TEST CERTIFICATE MODEL

Avio 200

SERIAL NUMBER: 079S16062402 DATE TESTED: September 9, 2022

PARAMETER SPECIFICATION FINAL VALUE

Spectral Resolution : UV

As	193.696 nm	≤ 0.009 nm	<u>0.00765</u> nm
Ni	231.604 nm	≤ 0.011 nm	<u>0.00885</u> nm
Ni	341.476 nm	≤ 0.015 nm	<u>0.01268</u> nm

Spectral Resolution : VIS

Ba	455.403 nm	≤ 0.020 nm	<u>0.01519</u> nm
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Precision

Zn	206.200 nm	% RSD ≤ 1.0 %	<u>0.58</u> %
Mg	280.271 nm	% RSD ≤ 1.0 %	<u>0.17</u> %
Mg	285.213 nm	% RSD ≤ 1.0 %	<u>0.18</u> %
Ba	455.403 nm	% RSD ≤ 1.0 %	<u>0.22</u> %

Detection Limits : Axial

TI	190.801 nm	3(sd)	<u>0.25</u> ppb
As	193.696 nm	3(sd)	<u>1.92</u> ppb
Se	196.026 nm	3(sd)	<u>0.99</u>
Pb	220.353 nm	3(sd)	<u>1.24</u> ppb

Detection Limits : Radial

As	193.696 nm	3(sd)	<u>1.12</u> ppb
Zn	213.857 nm	3(sd)	<u>0.06</u> ppb
Mn	257.610 nm	3(sd)	<u>0.00</u> ppb
La	379.478 nm	3(sd)	<u>0.09</u> ppb
Ba	455.403 nm	3(sd)	<u>0.01</u> ppb
Ba	493.408 nm	3(sd)	<u>0.01</u> ppb

BEC : Axial (IB X 1000)/(IS-IB)

Mn	257.610 nm	≤ 30 ppb	<u>4.50</u> ppb
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BEC : Radial (IB X 1000)/(IS-IB)

Mn	257.610 nm	≤ 30 ppb	<u>5.91</u> ppb
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MAINTENANCE AND IPV TEST CERTIFICATE MODEL
Avio 200

SERIAL NUMBER: 079S16062402DATE TESTED: September 9, 2022

Remarks :

Commissioning follow as commissioning performance sheets.

This is to certify that the above tests have been performed and the configuration tested



meets



does not meet

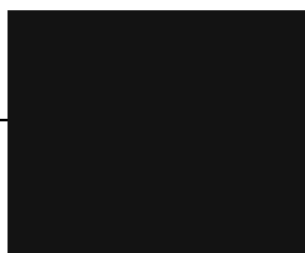
the PerkinElmer Specifications listed on this certificate.

This certificate does not modify PerkinElmer's standard terms and condition of sale,
including warranty terms.

Service Department PerkinElmer Ltd.

Customer Service Engineer:

(



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TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 22TM1184

Page.: 1 of 3

Certificate of Calibration

Equipment :	Incubator
Manufacturer :	Memmert
Model :	BM 500
Serial No. :	D593.0342
ID No. :	CHI-002
Submitted by :	Environment & Laboratory Co.,Ltd. 40 Soi Liangmueangnonthaburi 13, Talad Kwan, Mueang, Nonthaburi 11000
Location :	Room No. 204
Received Order :	14 July 2022
Calibration Date :	15 July 2022
Ambient Temperature :	(26 ± 10) °C
Relative Humidity :	(50 ± 30) %

Issue Date :

27 July 2022

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0043524



Equipment : Incubator
 Condition As-Received : Used Item
 Reference : 2207-0250OC-4

Cert. No.: 22TM1184

Page.: 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44073381	22LM78/1	12 May 2023

2. This certificate is valid only to the item calibrated on date and place of calibration.

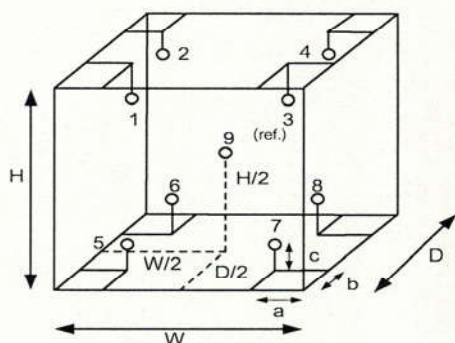
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	23	22
REL.Humid. (%)	67	66
AC Supply (Volt)	223	224



Position :	Ref. Std. ID No.:
1	1RTD-2/1
2	1RTD-2/2
3	22-01RTD-03
4	1RTD-2/4
5	1RTD-2/5
6	1RTD-2/6
7	1RTD-2/7
8	1RTD-2/8
9 (ref.)	1RTD-2/9

Probe Installation Details :

a = 5.0 cm
 b = 5.0 cm
 c = 5.0 cm

Dimension of Chamber :

D = 0.40 m
 W = 0.56 m
 H = 0.48 m
 Capacity = 0.11 m³



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2207-0250OC-4
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 22TM1184

Page.: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor <i>k</i>
35.0	35.0	35.0	0.035	0.55	0.63	0.30	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
35.0	35.100	34.653	35.131	34.871	35.067	34.888	35.092	35.235	35.170

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor *k*, providing a level of confidence of approximately 95 %.

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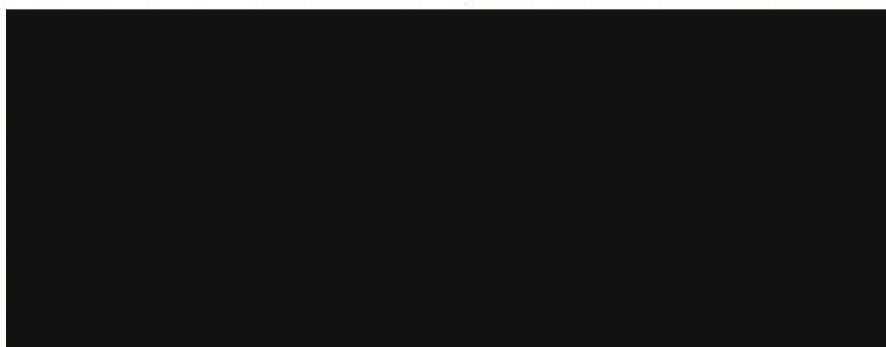


Cert.No.: 22CHO415

Page.: 1 of 3

Certificate of Calibration

Equipment : Spectrophotometer
Manufacturer : Hach
Model : DR 3900
Serial No. : 1988383
ID No. : -
Condition As-Received: Used Item
Received Date : 14 July 2022
Calibration Date : 14 July 2022
Reference : 2207-0250OC-11
Submitted by : Environment & Laboratory Co.,Ltd.
40 Soi Liangmueangnonthaburi 13 Talad Kwan,
Mueang, Nonthaburi 11000
Calibration Place : Room No. 304
Ambient Temperature : (27.5 - 27.2) °C (On-Site)
Relative Humidity : (53.2 - 53.8) % (On-Site)
Calibration Procedure : In - house method :
CP-OCH4 based on ASTM E 275-01



Issue Date : 27 July 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0043531



Cert. No. : 22CHO415

Page : 2 of 3

Condition of calibration result

1. Reference Standard Material :

<u>Material</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1. Absorbance Standard set	8331	86623	08 Sep 2022
2. Wavelength Standard set	14536	89302	19 Jan 2023
3. Wavelength Standard set	14537	89303	19 Jan 2023

2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certificate is traceable to the International System of Unit maintained at :

- National Physical Laboratory (NPL), The United Kingdom of Great Britain and Northern Ireland
- National Institute of Standards and Technology (NIST), The United States of America

4. Spectral BandWidth : 5 nm
Scan Speed : - nm/min

Calibration Results : without adjustment

Wavelength Accuracy

Certified Values of Reference Material (nm)	UUC Reading (nm)	Uncertainty of Measurement ($\pm$ nm)	Coverage Factor <i>k</i>
418.40	418	0.59	2.00
537.00	536	0.59	2.00
638.00	638	0.66	2.00
747.61	748	0.59	2.00
807.04	807	0.59	2.00



Cert. No. : 22CHO415

Page : 3 of 3

Calibration Results : without adjustment

Photometric Accuracy

Wavelength (nm)	Certified Values of Reference Material (Abs)	UUC Reading (Abs)	Uncertainty of Measurement ($\pm$ Abs)	Coverage Factor <i>k</i>
420.0	Zero	0.000	0.0028	2.00
	0.5723	0.571	0.0034	2.00
	0.7522	0.750	0.0031	2.00
	1.0907	1.089	0.0033	2.00
440.0	Zero	0.000	0.0028	2.00
	0.5616	0.560	0.0034	2.00
	0.7345	0.732	0.0032	2.00
	1.0646	1.063	0.0034	2.00
465.0	Zero	0.000	0.0028	2.00
	0.5118	0.513	0.0034	2.00
	0.6773	0.678	0.0031	2.00
	0.9809	0.983	0.0034	2.00
546.1	Zero	0.000	0.0028	2.00
	0.5228	0.522	0.0030	2.00
	0.6861	0.684	0.0030	2.00
	0.9941	0.992	0.0031	2.00
590.0	Zero	0.000	0.0028	2.00
	0.5546	0.552	0.0029	2.00
	0.7159	0.714	0.0032	2.00
	1.0369	1.032	0.0030	2.00
635.0	Zero	0.000	0.0028	2.00
	0.5401	0.538	0.0029	2.00
	0.6835	0.681	0.0030	2.00
	0.9889	0.987	0.0031	2.00

Remark

- Each individual filter is measured against the empty filter holder (blank) used to zero the spectrophotometer

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor *k* , providing a level of confidence of approximately 95 %.

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a 1119205



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TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 22TM1183

Page.: 1 of 3

Certificate of Calibration

Equipment :	Water Bath
Manufacturer :	Memmert
Model :	WB22
Serial No. :	I505.0053
ID No. :	WAB-01
Submitted by :	Environment & Laboratory Co.,Ltd. 40 Soi Liangmueangnonthaburi 13, Talad Kwan, Mueang, Nonthaburi 11000
Location :	Room No. 303
Received Order :	14 July 2022
Calibration Date :	14 - 15 July 2022
Ambient Temperature :	(26 ± 10) °C
Relative Humidity :	(50 ± 30) %

Issue Date : 27 July 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0043523



Equipment : Water Bath
 Condition As-Received : Used Item
 Reference : 2207-0250OC-3

Cert. No.: 22TM1183
 Page.: 2 of 3

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Data Acquisition	34970A	MY44073381	22LM78/1	12 May 2023

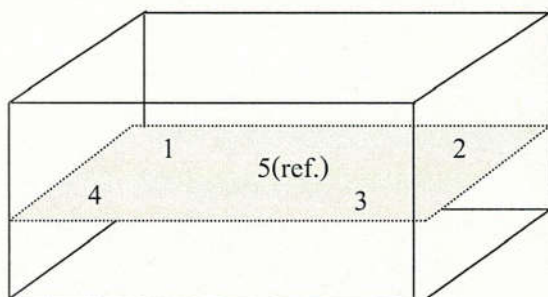
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	31	45	219
Finished of Calibration	30	52	218



Front

Position :	Ref. Std. S/N.:
1	4803988-006
2	4803988-007
3	4804539-014
4	4804539-015
5(ref.)	4804539-016



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2207-0250OC-3
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 22TM1183

Page.: 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)				
			Position				
			1	2	3	4	5 (ref.)
44.5	44.5	44.5	44.514	44.511	44.517	44.498	44.519
60.0	60.0	60.0	60.015	60.009	60.009	59.982	59.991

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor <i>k</i>
44.5	0.047	0.028	0.15	2
60.0	0.073	0.035	0.15	2

Average* : The average of 30 values in each position.

Uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity.

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor *k*, providing a level of confidence of approximately 95 %.

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CLC
Accredited
ISO/IEC 17025

CALIBRATION LABORATORY Co., LTD.

2/10-11,14, 55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : pH METER
MANUFACTURER : SMART SENSOR
MODEL / TYPE : AS218
SERIAL NO. : 6766085/TIZZ9744
CLID. NO. : 272302598
JOB CONTROL NO. : 230911100491

CUSTOMER : TNP ENVIRONMENT CO., LTD.
332/173 MOO 3 TAMBON BANG RAK PHATTANA,
AMPHOE BANG BUA THONG, NONTABURI 11110

DATE OF RECEIVED : 11 September 2023

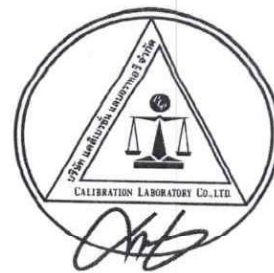
DATE OF ISSUED : 14 September 2023

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By :



Approved By :



14 September 2023

This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q23100491

F3-011-04/01-12

page 1 of 3



@clccalibration

REPORT OF CALIBRATION

FOR

NOMENCLATURE : pH METER
MANUFACTURER : SMART SENSOR
MODEL / TYPE : AS218
SERIAL NO. : 6766085/TIZZ9744
DATE OF CALIBRATION : 12 September 2023

ENVIRONMENT CONDITIONS :

Temperature : $(25 \pm 2.5) ^\circ\text{C}$

Relative Humidity : $(50 \pm 15) \% \text{ RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPCH-01**. The calibration was performed by direct measurement with Certified Reference Material (CRM).

REFERENCE STANDARD USED :

1. pH Standard Solution, NIMT TRM CODE TRM-S-2003, TRM CODE TRM-S-2007.
2. pH Standard Solution, Control Company Catalog Number 06664263,11784256, Lot Number CC752722.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI) , through National Institute of Metrology (Thailand).
Lot Number. 040822 , 230822. Due Date 26 April 2024.
2. The measurements are traceable to International System of Units (SI) , through Control Company.
Certificate No. 4288-13355261 , Due Date 06 May 2024.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor complies with the table which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q23100491

F3-011-04/01-12

page 2 of 3





CLC
Accredited
ISO/IEC 17025

CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230

Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The table in the following gives the calibration results and associated measurement uncertainties of pH meter.

CALIBRATION DATA

pH METER RESULT @ 25 °C

Standard pH Buffer Solution (pH)	pH Meter Reading (pH)	pH Meter Reading (mV)	Correction (pH)	Uncertainty of pH Measurement ($\pm$ pH)	k Factor
4.003	4.02	-	-0.017	0.013	2,15
7.000	7.02	-	-0.020	0.015	2,06
10.003	10.02	-	-0.017	0.016	2,05

Technical Note. Setting function CAL 3 point (4,6.86,9.18).

The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 2,3 of 54

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q23100491

F3-011-04/01-12

page 3 of 3



@clccalibration



CERTIFICATE OF CALIBRATION
CENTER ON INDUSTRIAL INSTRUMENT CALIBRATION



Classroom Building 4, 2nd Floor
King Mongkut's University of Technology Thonburi
126 Pracha-u-thit Road, Bangmod, Thungkru, Bangkok 10140
Tel : 0 2872 5281-2, 0 2470 8311-2 Fax : 0 2872 5283
E-mail : cic.cal@kmutt.ac.th www.cic.kmutt.ac.th



Page 1 of 2

Certificate No. CM230219

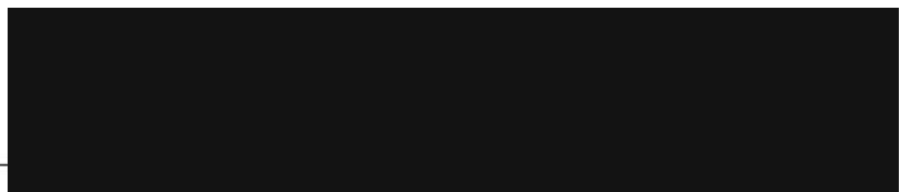
Date of Issue

24 March 2023

Customer : TNP ENVIRONMENT CO.,LTD.
Address : 332/173 Moo 3, Bang Rak Phatthana,
Bang Bua Thong, Nonthaburi 11110
Instrument No. : IM230219
Instrument Name : Weight
Manufacturer : LS
Model : Class F1
Serial No. : S1K30-23

Issue by Mass Laboratory

Approved Signatory





Certificate No. CM230219

Page 2 of 2

INSTRUMENT DESCRIPTION:

Instrument Name: Weight Manufacturer: LS
Model: Class F1 Serial No.: S1K30-23
Environment: Temperature: $(20 \pm 2)^\circ \text{C}$
Relative humidity: $(44 \pm 10)\% \text{ RH}$
Air pressure: 100.9 kPa
Received Date: 23 March 2023
Condition As-Received: New Item
Calibrated Date: 24 March 2023
Calibration Reference: W0908 : in-house method based on OIML R111-1:2004(E)

MEASUREMENTS:

Determination of conventional mass value was done by direct comparison with the standard weight class E2 on a Mass Comparator according to the in-house method based on OIML R 111-1: 2004(E) at ambient conditions.

All reference standards are traceable to recognized National standards which realize the unit of measurement according to the International System of Units (SI).

TRACEABILITY OF CERTIFICATE:

National Institute of Metrology Thailand (NIMT) through

1. NIMT Certificate Number MM-0194-18 for Standard Weight Serial No. 90332845

REFERENCE STANDARDS:

1. Standard Weight Model YCS 01- 652 - 02 Serial No. 90332845 Due. Date 29 October 2024

MEASUREMENT RESULTS:

Nominal Value	Marking	Conventional Mass Value	Measurement Uncertainty	Maximum permissible error
1 kg	None	1 kg + 1.4 mg	$\pm 1.6 \text{ mg}$	$\pm 5.0 \text{ mg}$

End of Certificate

Approved Signatory



Certificate of Calibration

Certificate Number : SPR23100181-1

Page : 1 of 3

Customer : TNP ENVIRONMENT CO.,LTD.

332/173 Moo.3, Bang Rak Phatthana, Bang Bua Thong, Nonthaburi
11110

Equipment Name : Digital Thermometer

Manufacturer : Extech

Model : 39240

Serial Number : 0721B

ID. Number : TNP.LAB.34-2564

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$

Received Date : 12 Oct 2023

Relative Humidity : $50\% \pm 15\%$

Calibration Date : 13 Oct 2023

Location of Calibration : In-Lab

Recommend Due Date : 13 Oct 2024

Calibration Procedure : SP-CPT-04-06

Date of Issue : 14 Oct 2023

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by :



Authorized Signatory



Calibration Report

Certificate Number : SPR23100181-1

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Super Thermometer with PRT	1575/3850-40-392	58087/100288	PSL-T 0400/66	15 Feb 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR23100181-1

Page : 3 of 3

Unit : °C

Setting Value	Standard Reading	UUC Reading	Error	Uncertainty (±)
0.0	0.006	0.2	0.194	0.070
20.0	20.007	20.0	-0.007	0.070
30.0	30.011	30.0	-0.011	0.070
50.0	50.013	49.9	-0.113	0.070

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES

534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

TEL. 0-2717-3000 FAX. 0-2719-9484

Cert.No.: 23TW19

Page.: 1 of 2

Certificate of Testing

Equipment :	DO Meter
Manufacturer :	Horiba
Model :	LAQUA-DO210
Serial No. :	HE0G0013
ID No. :	-
Received Date :	20 January 2023
Test Date :	23 January 2023
Reference :	2301-0699WN-1
Submitted by :	TNP ENVIRONMENT CO.,LTD 332/173 Moo 3, Bang Rak Phatthana, Bang Bua Thong, Nonthaburi 11110
Laboratory Condition :	Temperature (25 ± 5) °C Humidity (50 ± 20) %
Test Procedure :	In - house method : CP-CH9 by Comparison Technique with Azide Modification Method



Issue Date : 24 January 2023



Cert.No.: 23TW19

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

<u>Instruments</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Burette	-	130BU10	21CG1389	25 Mar 2023
2) Balance	1126143764	140RC004	22MM50	20 Sep 2023

2. Standard Material :-

<u>Material</u>	<u>Manufacturer</u>	<u>Lot.No.</u>	<u>Assay</u>
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

Result : **Dissolved Oxygen Meter Adjustment With Air 100 %**

Dissolved Oxygen Probe No.: 9K0E0106

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.14	8.15	0.000

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency, The environmental impact control and present to organization it may concerned. Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full, without written approval of the laboratory

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a 1144750

Certificate No. T/O 660071

Date of issue : 14-Mar-2023

Equipment Description : Incubator
Equipment Model : SMART i250-DS
Equipment Serial No. : 0410-0121-0003
I.D. No. or Control No. : -
Manufacturer : Entech Industrial Solution Co.,Ltd.
Customer Name : TNP ENVIRONMENT CO.,LTD.
Customer Address : 332/173 Moo 3 Tambon Bang Rak Phatthana, Amphoe Bang Bua Thong,
Nonthaburi 11110
Total pages of certificate : 2 pages
Instrument Receiving Date : 3-Mar-2023
Receiving No. : O-230081
Environmental Conditions : All of the measurement were carried out in the working area
Temperature : (25 ± 15) °C
Humidity : (55 ± 30) % RH
Voltage : (220 ± 22) VAC
Calibration Place : 332/173 Moo 3 Tambon Bang Rak Phatthana, Amphoe Bang Bua Thong,
Nonthaburi 11110

Calibration Procedure No. : This instrument was calibrated by comparison of reference radiation source standard
according to calibration work instration no WI-CL-18-C

*The calibration certificate expended uncertainty of measurement is stated as the standard uncertainty of measurement
multiplied by the coverage factor k, which for a normal distribution corresponds to a coverage probability of approximately 95%*

The standard uncertainty of measurement has been determined in accordance with M 3003

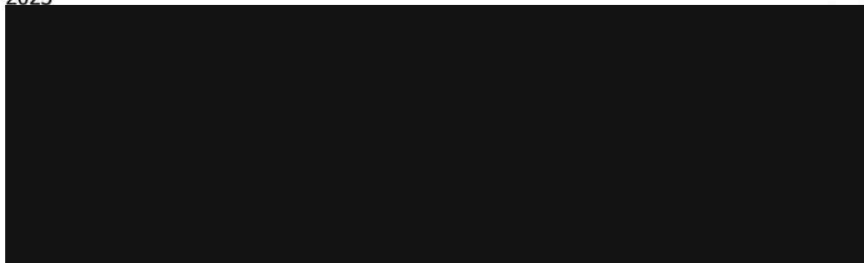
The expression uncertainty and confidence in measurement.

This certificate is applied only to item under test environmental condition.

*This calibration certificate may not be reproduced other than in full except with the permission of the issuing laboratory.
Calibration certificates without signature and seal are not valid and The results relate only to the items tested/calibrated.*

*This calibration certificate documents are traceability to national standards, which realize the unit of measurement
according to the International system of units (SI).*

Date of Calibration : 3-Mar-2023



Certificate No. : T/O 660071

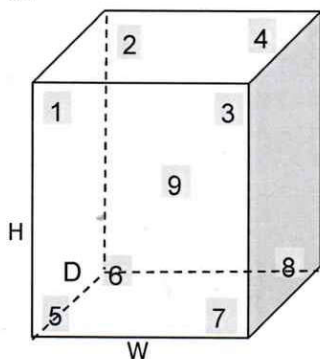
The Reference Standard Instrument :-

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert No.</u>	<u>Due date</u>
1) Data logger with RTD Probe	Agilent 34972A	MY49017365	PSL-T 0524-2/65	4-Apr-2023

Measured room conditions

Temperature :	Minimum: 21.3 °C	Maximum: 22.8 °C
Humidity :	Minimum: 49.3 %RH	Maximum: 54.7 %RH
Voltage :	Minimum: 220.1 VAC	Maximum: 223.4 VAC
Fresh Air Setting:	off	

Sensor Position :



Working Space of chamber :

(Inside Dimensions) W x D x H : 500 mm x 480 mm x 1100 mm

Sensor Installation Details :

- Sensor Number 1 to 8 installed approximately 50 mm From each wall.
- Sensor Number 9 installed approximately geometric of the chamber.

Results : The measurement results of the calibration were reported in the table below.

(*) Without adjustment

() After adjustment

UUC*	UUC*	Temperature Reading of Standard Sensor								
Setting	Reading	Sensor Position								
(°C)	(°C)	1	2	3	4	* 5	6	7	8	9
20.0	20.0	20.34	20.30	20.14	20.18	20.15	20.02	19.93	19.94	20.02

UUC*	UUC*	Temperature	Temperature	Overall	Uncertainty	Coverage
Setting	Reading	Uniformity	Stability	Variation	of Measurement	Factor
(°C)	(°C)	(°C)	(± °C)	(°C)	(± °C)	K
20.0	20.0	0.50	0.40	1.00	0.61	2

UUC* = Unit Under Calibration

Remark :-

- Temperature reading of Standard Sensors shown in the table were taken from the average of Standard reading at each position.
- Temperature Uniformity was calculated from the difference between the maximum and minimum of actual temperature reading from all reference sensors at the same time.
- Temperature Stability was calculated from the maximum stability of nine positions, and formula of Stability is [

Calibration Certificate

Cert. No. : CT-23-01-23295

Page : 1 of 4

Issued date : 24 January 2023

Equipment : Water Bath , Manufacturer : MLAB , Model : WBN30
S/N = 0347 , Customer ID = -

Client : TNP ENVIRONMENT CO.,LTD.
332/173 Moo 3 Bang Rak Phatthana, Bang Bua Thong, Nonthaburi 11110

Received Date : 20 January 2023 Ref. Job No. : SO6601-00020
Calibrated by : Mr.Apiwat Mungsamak Cert. prepare by : Ms.Nattanicha Panumram
Calibrated Date : 20 January 2023 Approved by : Mr.Montree Ruschasetkul

Calibration Place : ห้องปฏิบัติการ2
Environment Condition : Temperature 28.5 ± 2.7 (°c) , Humidity 57.5 ± 14.5 (%RH)

Calibration Method : In-house method based on ASTM E715-80 (Reapproved 2006) , (MTEC WI No. # WICAL-02-003-R01)

Reference Standard Instrument :

No	Instrument	code	Model	Due date
1	Temperature Data Logger	MTEC-CE-0175	MLAB	10/2023
2	Thermo Hygrometer	MTEC-CE-0183	TP-50	06/2023

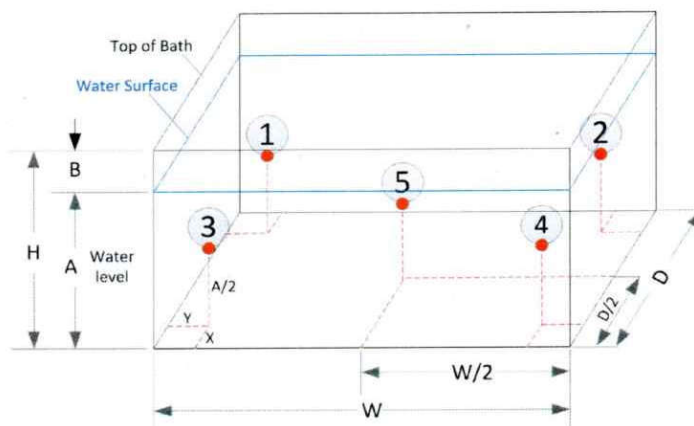
Condition of certificate :

(1) This certificate is traceable to International System of units (SI Units) . , (2) This certificate was certified only for the instrument we calibrated. , (3) This result of calibration was found accurate as show on date and place of calibration only. , (4) The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k =$ (see result table) , providing a level of confidence of approximately 95%. , (5) This certificate may not be reproduced other than in full, except with the prior written approval of the head of Calibration Division, Metrology Technical Co.,Ltd.

Calibration Result :

Condition of UUC :

- 1) Adjust Condition : Without Adjustment
- 2) Lid Cover : Flat Sheet (Plastic , from
- 3) Circulation : without circulation
- 4) X ,Y = 5 cm. , B ~ 3 cm.



Pic 1 : Position of each sensor No.

- (1) The quoted uncertainty include with "Stability".
- (2) Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors , for at least half an hour after reaching sted state.
- (3) Uniformity = The maximum difference of measured temperatures at two any sensor which are observed at the same time.
- (4) Overall variation = The difference of the maximum and the minimum measured temperature throughtout observation time.

Section 1 : Report of Temperature distribution

Unit : (°c)

Calibration Point	UUC Setting (*)	UUC Reading (*)	Measured Temperature @ Sensor No.					Uncertainty (±)	k (**)
			#1	#2	#3	#4	#5		
85	85	85.0	85.30	85.30	84.83	84.76	85.51	0.627	2

(*) = The average of 30 values in each point , (**) = Coverage factor (k) value

Section 2 : Report of Chamber Performance

Unit : (°c)

Calibration Point	UUC Setting (*)	UUC Reading (*)	Temperature Uniformity	Temperature Stability (± °c)	Temperature Overall Variation
85	85	85.0	1.34	0.45	1.64

(*) = The average of 30 values in each point

Approved Signatory : ..

Certificate No. : CT-23-01-23295

Page : 3 of 4

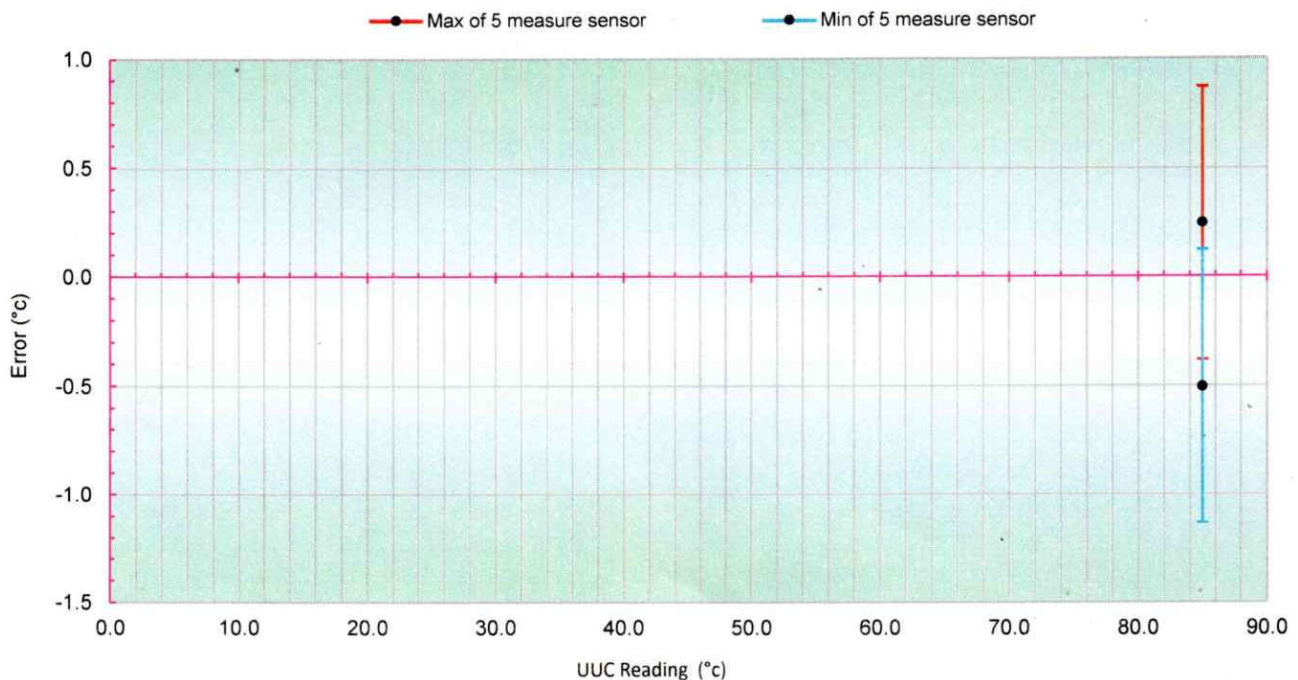
Section 3 : Possible of temperature in chamber. Show minimum and maximum of the average values and Include with uncertainty of measurement. , The average values is average of each position standard sensor throughtout observation time.

Unit : (°c)

Calibration Point	UUC Setting ^(*)	UUC Reading ^(*)	Possible of Minimum temperature in chamber	Possible Maximum temperature in chamber
85	85	85.0	84.13	86.13

(*) = The average of 30 values in each point

Section 4 : Trend of accuracy



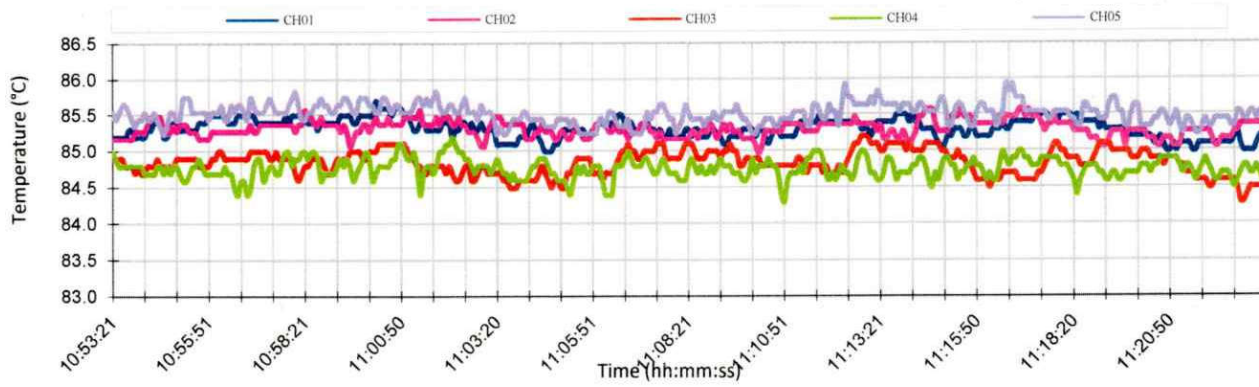
Approved Signator

Certificate No. : CT-23-01-23295

Page : 4 of 4

Section 5 : Graph report for Temperature distribution , not include uncertainty of measurement

(5.1) Temperature Distribution at UUC Reading 85.0 °C



Approved Signatory : ...



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No. : 23T238

Page : 1 of 2

Equipment : Liquid-in Glass Thermometer

Manufacturer: SK

Model : -

Serial No.: -

ID No.: TNP.LAB.12

Condition As-Received: Used Item

Received Date: 27 January 2023

Calibration Date: 07 February 2023
to 10 February 2023

Reference: 2301-0937WN

Submitted by: TNP ENVIRONMENT CO.,LTD

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

This certificate may not be reproduced other than in full,
except with the prior written approval of the head of
Corporate Services 3: Equipment Calibration and Testing Services.

332/173 Moo 3, Bang Rak Phatthana, Bang Bua Thong,
Nonthaburi 11110

Procedure used: Calibration were conducted using in-house calibration procedure CP-T02 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into liquid bath temperature controller.
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Digital Thermometer	1529	A7A609	2211274	17 Oct 2023
2) Industrial Platinum Resistance Thermometer	5627-12	571975	2211274	17 Oct 2023

2.The UUC* was immersed into liquid bath temperature controller and the top about 12 mm of the liquid column above the bath medium in every calibration points.

3.The certificate is valid only to the item calibrated on date and place of calibration.

4.This Certification is traceable to the International System of Unit maintained at:-

-National Institute of Metrology Thailand (NIMT)



Cert. No.: 23T238

Page.: 2 of 2

Result of Calibration:-

Without Adjustment

Function:

Temperature measurement.

Type:

Total Immersion

Scale Division:

1 °C

Reference point (0 °C) Error = -0.9681 °C, with Uncertainty of Measurement of ± 0.16 °C

UUC*	Standard		Uncertainty
Reading	Temperature	Error	of Measurement
(°C)	(°C)	(°C)	($\pm$ °C)
20	21.4342	-1.4342	0.16
30	31.5544	-1.5544	0.16
40	41.1382	-1.1382	0.16

Note: UUC* : Unit Under Calibration

The UUC* readings were made under magnification and resolved to one tenth of one scale division.

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert.No.: 23CH126

Page.: 1 of 2

Certificate of Calibration

Equipment :	pH Meter
Manufacturer :	Adwa
Model :	AD 12
Serial No. :	1328
ID No. :	TNP.LAB.13
Condition As-Received:	Used Item
Received Date :	27 January 2023
Calibration Date :	30 January 2023
Reference :	2301-0937WN-2
Submitted by :	TNP ENVIRONMENT CO.,LTD 332/173 Moo 3, Bang Rak Phatthana, Bang Bua Thong, Nonthaburi 11110
Ambient Temperature :	(25 ± 2.5) °C
Relative Humidity :	(50 ± 15) %
Calibration Procedure :	In - house method : - CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)

Issue Date :

31 January 2023

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0050390



Cert.No.: 23CH126

Page.: 2 of 2

Condition of this calibration result

1. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
pH 4.008	CPA chem	826588	09 July 2024
pH 6.987	CPA chem	826589	09 July 2023
pH 10.008	CPA chem	826590	09 July 2023

2. This certificate is valid only to the item calibrated on date and place of calibration.

Calibration Results

Function : pH Measurement

Performing two buffers standard curve by using buffer nominal pH (4,7)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement ($\pm$)	Coverage factor k
pH Electrode S/N.: 1328	4.008	4.01	N/A	0.0085	2.05
	6.987	6.99	N/A	0.011	2.00
	10.008	10.02	N/A	0.0095	2.00

- Remark**
- pH meter does not have voltage mode.
 - Can not connect the BNC because the plug does not match with the socket.
 - N/A = Not Available

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k , providing a level of confidence of approximately 95 %

-o0o-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No. : 23H486

Page : 1 of 2

Equipment : Digital Thermo-Hygrometer
Manufacturer: EXTECH
Model : 448515
Serial No.: PONPE5899554
ID No.: TNP.LAB.21

This certificate may not be reproduced other than in full,
except with the prior written approval of the head of
Corporate Services 3: Equipment Calibration and Testing Services.

Condition As-Received: Used Item

Received Date: 02 March 2023

Calibration Date: 07 March 2023

Reference: 2303-0104WN

Submitted by: TNP ENVIRONMENT CO.,LTD.

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

332/173 Moo 3, Bang Rak Phatthana, Bang Bua Thong,
Nonthaburi 11110

Procedure used: Calibration were conducted using in-house calibration procedure CP-H03 according to comparison with standard chilled mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Hygro-M2 Dew Point Monitor	5112	2360195	20703	02 Aug 2023
2) Standard Humidity/Temperature Meter	400	10203027	TH-0082-22	22 Aug 2023

2.The certificate is valid only to the item calibrated on date and place of calibration.

3.This Certification is traceable to the International System of Unit maintained at:-

- National Institute of Standards and Technology (NIST) , The United States of America
- National Institute of Metrology Thailand (NIMT)



Cert. No.: 23H486

Page.: 2 of 2

Result of Calibration:-

Without Adjustment

Function:

Humidity Measurement

<u>Reference Temperature</u>	<u>Standard Humidity</u>	<u>UUC* Reading</u>	<u>Error</u>	<u>Uncertainty of Measurement</u>
(°C)	(%R.H.)	(%R.H.)	(%R.H.)	(±%R.H.)
25.0	50.1	48	-2.1	1.6

Result of Calibration:-

Without Adjustment

Function:

Temperature Measurement

<u>Standard Temperature</u>	<u>UUC* Reading</u>	<u>Error</u>	<u>Uncertainty of Measurement</u>
(°C)	(°C)	(°C)	(±°C)
20.06	19.7	-0.36	0.46
24.99	24.9	-0.09	0.46

UUC* : Unit Under Calibration

The reported uncertainty of measurement was base on standard uncertainty multiplied by coverage factor $k = 2.00$, providing confidence level approximately 95%.

-o0o-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No. : 23H487

Page : 1 of 2

Equipment : Digital Thermo-Hygrometer

Manufacturer: EXTECH

Model : 448515

Serial No.: PONPE5899555

ID No.: TNP.LAB.22

Condition As-Received: Used Item

Received Date: 02 March 2023

Calibration Date: 07 March 2023

Reference: 2303-0104WN

Submitted by: TNP ENVIRONMENT CO.,LTD.

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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except with the prior written approval of the head of
Corporate Services 3: Equipment Calibration and Testing Services.

332/173 Moo 3, Bang Rak Phatthana, Bang Bua Thong,
Nonthaburi 11110

Procedure used: Calibration were conducted using in-house calibration procedure CP-H03 according to comparison with standard chilled mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Hygro-M2 Dew Point Monitor	5112	2360195	20703	02 Aug 2023
2) Standard Humidity/Temperature Meter	400	10203027	TH-0082-22	22 Aug 2023

2.The certificate is valid only to the item calibrated on date and place of calibration.

3.This Certification is traceable to the International System of Unit maintained at:-

- National Institute of Standards and Technology (NIST) , The United States of America
- National Institute of Metrology Thailand (NIMT)

B 0310048



Cert. No.: 23H487

Page.: 2 of 2

Result of Calibration:-

Without Adjustment

Function:

Humidity Measurement

<u>Reference</u> <u>Temperature</u> (°C)	<u>Standard</u> <u>Humidity</u> (%R.H.)	<u>UUC*</u> <u>Reading</u> (%R.H.)	<u>Error</u> (%R.H.)	<u>Uncertainty</u> <u>of Measurement</u> (±%R.H.)
25.0	50.1	29	-21.1	1.6

Result of Calibration:-

Without Adjustment

Function:

Temperature Measurement

<u>Standard</u> <u>Temperature</u> (°C)	<u>UUC*</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> <u>of Measurement</u> (±°C)
20.06	19.9	-0.16	0.46
24.99	25.1	0.11	0.46

UUC* : Unit Under Calibration

The reported uncertainty of measurement was based on standard uncertainty multiplied by coverage factor $k = 2.00$, providing confidence level approximately 95%.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No. : 23M455

Page : 1 of 2

Equipment : Standard Weight Set

Manufacturer: -

Model : Class:F1

Serial No.: 15022021-01

ID No.: TNP.LAB.25

Condition As-Received: Used Item

Received Date: 02 March 2023

Calibration Date: 04 March 2023

Reference: 2303-0104WN

Submitted by: TNP ENVIRONMENT CO.,LTD.

Ambient Temperature: (23 $\pm$ 2) °C

Relative Humidity: (50 $\pm$ 15) %

Atmospheric Pressure: 1015.25 mbar

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332/173 Moo 3, Bang Rak Phatthana, Bang Bua Thong,
Nonthaburi 11110

Procedure used: Calibration were conducted using in-house calibration procedure CP-M01 according to comparison method against standard weights on the basis of weighings at an average air density of 1.2 kg/m³ and a temperature of 23.4 °C material density of weight is 8000 kg/m³.

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Standard Weight Set (E2)	73336	20026	MM-0018-22	28 Feb 2024
2) Standard Weight Set (E2)	73338	20028	MM-0019-22	28 Feb 2024

2.This certificate is not certified for any commercial transaction.

3.The certificate is valid only to



Cert No.: 23M455

Page: 2 of 2

Result of calibration

Nominal Value	Conventional mass		Uncertainty of Measurement ($\pm$)	Maximum Permissible error ($\pm$)
	Before Adjustment	After Adjustment		
200 g	199.99986 g	-	0.30 mg	1.0 mg
100 g	100.00015 g	-	0.16 mg	0.50 mg
50 g	50.00015 g	-	0.10 mg	0.30 mg
20 g	20.000116 g	-	0.080 mg	0.25 mg
10 g	10.000041 g	-	0.060 mg	0.20 mg
5 g	5.000010 g	-	0.050 mg	0.16 mg
2 g	1.999936 g	-	0.040 mg	0.12 mg
1 g	0.999973 g	-	0.030 mg	0.10 mg
200 mg	200.059 mg	200.007 mg	0.020 mg	0.060 mg
100 mg	100.037 mg	99.981 mg	0.016 mg	0.050 mg

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95 %.

-o0o-



THAI CALIBRATION SERVICES CO., LTD.

19/8 Moo 9 Soi Raiking 30 Puttamonthon 5 Rd., Sampran, Nakornpatom 73210

Tel. 0-3439-7682-5 Fax: 0-3439-7687

www.thaical.com E-mail : sale@thaicalibration.com, lab@thaicalibration.com



CALIBRATION CERTIFICATE

Certificate No.S2306518S

page 1 of 2

Customer : TNP ENVIRONMENT CO., LTD.
332/173 Moo 3 Tambon Bang Rak Phatthana,
Amphoe Bang Bua Thong, Nonthaburi 11110

Equipment : Non-automatic weighing instrument (Electronic instrument)

Manufacturer : Shimadzu **Order No. :** 66S2523-1

Model : AP225WD **Ambient temperature :** $(26.9 \pm 5.0) ^\circ\text{C}$

Accuracy class : - **Relative humidity :** $(52.0 \pm 10.0) \%$

Capacity : 10 g / 220 g **Received date :** 21-Jun-2023

Resolution : 0.00001 g / 0.0001 g **Date of calibration :** 21-Jun-2023

Serial No. : D316301848 **Date of issue :** 24-Jun-2023

ID No. : TNP.LAB.30 **Condition of the balance :** Good working conditions

Place of calibration : ห้อง LAB

Calibration method

This instrument was calibrated according to the EURAMET Calibration Guide No. 18.

Condition of reference standard weight

<u>Instrument</u>	<u>Nominal value</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due-date</u>	<u>Density (kg/m³)</u>
1 Standard weight set	1 mg to 2 kg	15885+15849	M2210001S	8-Oct-2023	7950

Traceability of the reference standard weight

This certificate is traceable to SI unit through Mass Calibration Laboratory Thai Calibration Services Co., Ltd., NSC-ONSC accredited no. Calibration 0189.

This calibration certificate may not be reproduced other than in full,
except with the prior written approval of the head of TCS calibration laboratory.



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CALIBRATION CERTIFICATE

Certificate No.S2306518S

page 2 of 2

The repeatability of indication

Nominal Value (g)	Standard Deviation of reading (g)	Maximum difference between suscensive reading (g)	n
100	0.000005	0.00001	5
200	0.00005	0.0001	5



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CALIBRATION CERTIFICATE

Certificate No.S2306519S

page 1 of 2

Customer : TNP ENVIRONMENT CO., LTD.
332/173 Moo 3 Tambon Bang Rak Phatthana,
Amphoe Bang Bua Thong, Nonthaburi 11110

Equipment : Non-automatic weighing instrument (Electronic instrument)

Manufacturer : Sartorius **Order No. :** 66S2523-2

Model : SECURA224-1S **Ambient temperature :** $(26.8 \pm 5.0) ^\circ\text{C}$

Accuracy class : - **Relative humidity**



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CALIBRATION CERTIFICATE

Certificate No.S2306519S

page 2 of 2

The repeatability of indication

Nominal Value (g)	Standard Deviation of reading (g)	Maximum difference between successive reading (g)	n
200	0.00000	0.0000	5

The effect of eccentric application of a load on the indication (test load : 100 g)</

CERT.No.: HS-U039F

Harikul Science Co.,Ltd.

694 Soi Ratchadanivet 24, Pracharatbamphen,

Samsaennok, Huaikhwang, Bangkok 10310

Tel: 0-2274-2456 Fax: 0-2274-2443

Email: info@harikul.com www.harikul.com

Certificate of Calibration

Calibration Date : 20 Jun 23

Submitted by : TNP ENVIRONMENT COMPANY LIMITED.

332/173 Moo. 3, Tambon Bang Rak Phatthana,

Amphoe Bang Bua Thong, Nonthaburi 11110

Avg Room Temp : 20 °C

Avg Water Temp : 20 °C