

ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือตรวจวัดและวิเคราะห์





THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0575

MTC No. EEL. BP. 15/0867

CALIBRATION CERTIFICATE

Submitted by : TNP ENVIRONMENT CO.,LTD.

Address : 332/173 Moo 3 Bang Rak Phatthana, Bang Bua Tong, Nonthaburi 11110.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : KEPLER

Model : KSM-42C

Serial No. : 160100568

Ambient Environment

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

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

Ambient Pressure : $(101.325 \pm 1.500) \text{ kPa}$

- Standards used :**
1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
 2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
 3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
 4. Digital Multimeter Agilent 34401A S/N MY44005560.
 5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
 6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.
 7. Condenser Microphone B&K 4180 S/N 2633526.

Calibration Procedure: CP-102-04 based on IEC 60942-2003. The sound pressure level of instrument was measured by standard microphone using an insert voltage technique.

This instrument has been calibrated against standards maintained at Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

Date of Receipt : 6 Aug. 2024

Date of Calibration : 26 Aug. 2024

The results relate only to the items tested/calibrated or value assigned.

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BL.MTC.002 Rev.5

Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9036
Fax. (66) 0 2577 9009

Office/Laboratory

668 Mu 2 Tambon Bangpoomai, Amphoe Muang Samutprakan,
Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
(66) 08 3219 9440
E-mail : mtc@tistr.or.th Website : www.tistr.or.th

Office

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Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0575

MTC No. EEL. BP. 15/0867

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.

Nominal Output of Unit Under Test = 94 dB re 20 μ Pa at 1000 Hz

Acoustic Output in dB re 20 μ Pa , Corrected to Reference Conditions : 101.325 kPa , 23.0°C and 50 %RH

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	94.30	0.30	± 0.10	± 0.75 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	969.9	-30.1	± 1.5	$\pm 2.0\%$

3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	1.70	± 0.50	$\pm 4.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Date of Calibration : 26 Aug. 2024

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0575

MTC No. EEL. BP. 15/0867

Nominal Output of Unit Under Test = 114 dB re 20 μ Pa at 1000 Hz

Acoustic Output in dB re 20 μ Pa , Corrected to Reference Conditions : 101.325 kPa , 23.0 °C and 50 %RH

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	114.33	0.33	± 0.10	± 0.75 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	965.6	-34.4	± 1.5	$\pm 2.0\%$

3. Total Distortion

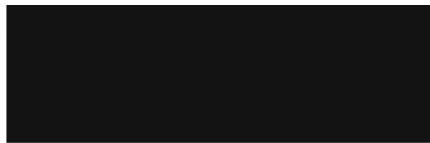
Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	2.15	± 0.50	$\pm 4.0\%$

Note : 1. No adjustment.

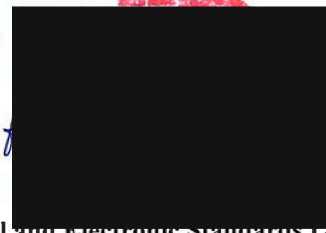
2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :



Approved by :



Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 26 Aug. 2024

Date of Issue : 27 Aug. 2024

Ref : 2011167080602911001

End of Certificate

3 / 3

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FM.BL.MTC.002 Rev.5

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**SMART TECH CALIBRATION & SERVICES CO., LTD.**

14/506 MOO 3, RANGSIT-NAKHON NAYOK ROAD, LAM PHAK KUT,
THANYABURI, PATHUM THANI 12110, THAILAND

Tel. +662-114-3148 Email : stcal.md@gmail.com Website : stc-cal.com



Certificate of Calibration

Certificate No. STCR-2407095-1

Work Order No. STCR-2407095

Page 1 of 3

Customer Name : TNP Environment Co., Ltd.
332/173 Vision Smart Life Village, Bang Rak Pattana Subdistrict,
Bang Bua Thong District, Nonthaburi Province 11110

Equipment Name : Sound Level Meter
Manufacturer : SCARLET
Model : ST-25D
Serial Number : 10341001
Control Number : TNP-F-S32
Received Date : Jul 4, 2024
Calibration Date : Jul 4, 2024
Recommended Due Date : Jul 4, 2025
Calibration Method : Calibration Procedure No. CPE-04-01

Environmental Conditions

Ambient Temperature : $(25 \pm 2) ^\circ\text{C}$
Ambient Relative Humidity : $(50 \pm 15) \% \text{RH}$
Calibration Place : Permanent Calibration Laboratory

Condition as received : Normal

Calibration Result : See data attached

1. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.
2. The Unit Under Calibration (UUC) has been calibrated by using the working standard which is traceable to SI-Units. The calibration procedure documented is intended to implement the requirements of ISO/IEC 17025 : 2017
3. The working standard is indicated in page 2 of this certificate.
4. This report applies to the item calibrated and shall not be reproduced except in full, without written approval by Calibration Laboratory, Smart Tech Calibration & Services Co., Ltd.
5. This results of this report only to the items calibrated.

Date of Issue : Jul 4, 2024

Approved by :

Calibrated by :



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Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2407095-1

Page 2 of 3

Standards Equipment Used

<u>Equipment Name</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>	<u>Traceability to</u>
Sound Calibrator	N975185	5523631031354566	Nov 6, 2025	MP-TH

Traceability

This calibration is traceable to the International System of Unit via :

- MP-TH : Micro Precision Calibration Laboratory (Thailand) Co., Ltd.



Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2407095-1

Page 3 of 3

UUC Range : (28 to 133) dB

Resolution : 0.1 dB

Results of Calibration: [] Without adjustment [☒] With adjustment

Appearance and Function of Use Inspection : GOOD

Sound Level Calibration @ Frequency 1 kHz

Select : A

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB	88.6 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	108.6 dB	113.9 dB	0.17 dB	0.40 dB
SLOW	94.09 dB	88.6 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	108.6 dB	113.9 dB	0.17 dB	0.40 dB

Sound Level Calibration @ Frequency 1 kHz

Select : C

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB	88.6 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	108.6 dB	113.9 dB	0.17 dB	0.40 dB
SLOW	94.09 dB	88.6 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	108.6 dB	113.9 dB	0.17 dB	0.40 dB

STD = Standard

UUC = Unit Under Calibration

- End of Certificate -



**SMART TECH CALIBRATION & SERVICES CO., LTD.**

14/506 MOO 3, RANGSIT-NAKHON NAYOK ROAD, LAM PHAK KUT,
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Tel. +662-114-3148 Email : stcal.md@gmail.com Website : stc-cal.com

**Certificate of Calibration****Certificate No. STCR-2407094-5****Work Order No. STCR-2407094**

Page 1 of 3

Customer Name : TNP Environment Co., Ltd.
332/173 Vision Smart Life Village, Bang Rak Pattana Subdistrict,
Bang Bua Thong District, Nonthaburi Province 11110

Equipment Name : Sound Level Meter
Manufacturer : SCARLET
Model : ST-25D
Serial Number : 10340946
Control Number : TNP-F-S31
Received Date : Jul 1, 2024
Calibration Date : Jul 1, 2024
Recommended Due Date : Jul 1, 2025
Calibration Method : Calibration Procedure No. CPE-04-01

Environmental Conditions

Ambient Temperature : $(25 \pm 2) ^\circ\text{C}$
Ambient Relative Humidity : $(50 \pm 15) \% \text{RH}$
Calibration Place : Permanent Calibration Laboratory

Condition as received : Normal

Calibration Result : See data attached

1. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.
2. The Unit Under Calibration (UUC) has been calibrated by using the working standard which is traceable to SI-Units. The calibration procedure documented is intended to implement the requirements of ISO/IEC 17025 : 2017
3. The working standard is indicated in page 2 of this certificate.
4. This report applies to the item calibrated and shall not be reproduced except in full, without written approval by Calibration Laboratory, Smart Tech Calibration & Services Co., Ltd.
5. This results of this report only to the items calibrated.

Date of Issue : Jul 1, 2024

Approved by :

Calibrated by :



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Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2407094-5

Page 2 of 3

Standards Equipment Used

<u>Equipment Name</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>	<u>Traceability to</u>
Sound Calibrator	N975185	5523631030478623	Nov 9, 2024	MP-TH

Traceability

This calibration is traceable to the International System of Unit via :

- MP-TH : Micro Precision Calibration Laboratory (Thailand) Co., Ltd.



Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2407094-5

Page 3 of 3

UUC Range : (30 to 130) dB

Resolution : 0.1 dB

Results of Calibration: [☒] Without adjustment [☐] With adjustment

Appearance and Function of Use Inspection : GOOD

Sound Level Calibration @ Frequency 1 kHz

Select : A

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB	94.0 dB	-	0.09 dB	0.40 dB
	114.07 dB	114.1 dB	-	-0.03 dB	0.40 dB
SLOW	94.09 dB	94.1 dB	-	-0.01 dB	0.40 dB
	114.07 dB	114.1 dB	-	-0.03 dB	0.40 dB

Sound Level Calibration @ Frequency 1 kHz

Select : C

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB	94.1 dB	-	-0.01 dB	0.40 dB
	114.07 dB	114.0 dB	-	0.07 dB	0.40 dB
SLOW	94.09 dB	94.1 dB	-	-0.01 dB	0.40 dB
	114.07 dB	114.0 dB	-	0.07 dB	0.40 dB

STD = Standard

UUC = Unit Under Calibration

- End of Certificate -

**SMART TECH CALIBRATION & SERVICES CO., LTD.**

14/506 MOO 3, RANGSIT-NAKHON NAYOK ROAD, LAM PHAK KUT,
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Certificate of Calibration

Certificate No. STCR-2503156-1

Work Order No. STCR-2503156

Page 1 of 3

Customer Name : TNP Environment Co., Ltd.
332/173 Vision Smart Life Village, Bang Rak Pattana Subdistrict,
Bang Bua Thong District, Nonthaburi Province 11110

Equipment Name : Sound Level Meter
Manufacturer : Scarlet Tech
Model : ST-25D
Serial Number : 10340912
Control Number : TNP-F-S38
Received Date : Mar 12, 2025
Calibration Date : Mar 13, 2025
Recommended Due Date : Mar 13, 2026
Calibration Method : Calibration Procedure No. CPE-04-01

Environmental Conditions

Ambient Temperature : $(25 \pm 2) ^\circ\text{C}$
Ambient Relative Humidity : $(50 \pm 15) \% \text{RH}$
Calibration Place : Permanent Calibration Laboratory

Condition as received : Normal

Calibration Result : See data attached

1. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.
2. The Unit Under Calibration (UUC) has been calibrated by using the working standard which is traceable to SI-Units. The calibration procedure documented is intended to implement the requirements of ISO/IEC 17025 : 2017
3. The working standard is indicated in page 2 of this certificate.
4. This report applies to the item calibrated and shall not be reproduced except in full, without written approval by Calibration Laboratory, Smart Tech Calibration & Services Co., Ltd.
5. This results of this report only to the items calibrated.

Date of Issue : Mar 14, 2025

Approved by :

Calibrated by :



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Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2503156-1

Page 2 of 3

Standards Equipment Used

<u>Equipment Name</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>	<u>Traceability to</u>
Sound Calibrator	N975185	5523631031354566	Nov 6, 2025	MP-TH

Traceability

This calibration is traceable to the International System of Unit via :

- MP-TH : Micro Precision Calibration Laboratory (Thailand) Co., Ltd.



Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2503156-1

Page 3 of 3

UUC Range : (30 to 130) dB

Resolution : 0.1 dB

Results of Calibration: [] Without adjustment [☒] With adjustment

Appearance and Function of Use Inspection : GOOD

Sound Level Calibration @ Frequency 1 kHz

Select : A

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB	94.7 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	114.6 dB	113.9 dB	0.17 dB	0.40 dB
SLOW	94.09 dB	94.7 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	114.6 dB	113.9 dB	0.17 dB	0.40 dB

Sound Level Calibration @ Frequency 1 kHz

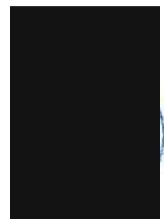
Select : C

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB	94.7 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	114.6 dB	113.9 dB	0.17 dB	0.40 dB
SLOW	94.09 dB	94.7 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	114.6 dB	113.9 dB	0.17 dB	0.40 dB

STD = Standard

UUC = Unit Under Calibration

- End of Certificate -





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.



NSC – TISI – TIS 17025
CALIBRATION 0367

CERTIFICATE OF CALIBRATION

Certificate No. : COF-044-67

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 Oct 2024
MEASUREMENT DATE : 30 Oct 2024
ISSUE DATE : 30 Oct 2024

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 23.9 °C and 55.8 %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 NIMT (National Metrology Institute of Thailand) via Certificate number: MW-0063-23.

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:

☐
☒

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

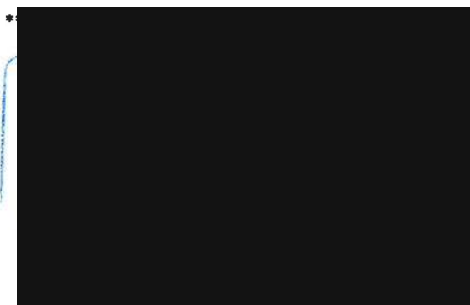
Plate	Flow rate m^3/min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Δp_{meter} mmHg	$\Delta p_{Orifice}$ inH ₂ O	γ	Standard Flow [Q_s] m^3/min
1	0.703	758.163	23.78	22.67	49.921	1.158	1.077	0.660
2	0.999	758.204	23.26	22.30	35.795	2.480	1.577	0.959
3	1.117	758.225	23.29	22.38	30.579	3.143	1.776	1.079
4	1.164	758.281	23.31	22.57	28.519	3.425	1.854	1.127
5	1.414	758.199	23.33	22.86	18.318	5.237	2.292	1.387

Slope (m): **1.66978**
 Intercept (b): **-0.02500**
 Correlation coefficient (r): **0.99989**
 Uncertainty ($k=2$): **0.015** m^3/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	$\Delta p_{Orifice}$ inH ₂ O	γ	Standard Flow [Q_s] m^3/min
1	0.703	758.163	23.78	22.67	49.921	1.158	0.673	0.659
2	0.999	758.204	23.26	22.30	35.795	2.480	0.985	0.955
3	1.117	758.225	23.29	22.38	30.579	3.143	1.109	1.075
4	1.164	758.281	23.31	22.57	28.519	3.425	1.157	1.123
5	1.414	758.199	23.33	22.86	18.318	5.237	1.431	1.382

Slope (m): **1.04588**
 Intercept (b): **-0.01565**
 Correlation coefficient (r): **0.99989**
 Uncertainty ($k = 2$): **0.015** m^3/min



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Certificate of Calibration

Certificate No. STCR-2407094-1**Work Order No.** STCR-2407094

Page 1 of 3

Customer Name : TNP Environment Co., Ltd.
332/173 Vision Smart Life Village, Bang Rak Pattana Subdistrict,
Bang Bua Thong District, Nonthaburi Province 11110

Equipment Name : Sound Level Meter
Manufacturer : SCARLET
Model : ST-25D
Serial Number : 10340942
Control Number : TNP-F-S23
Received Date : Jul 1, 2024
Calibration Date : Jul 1, 2024
Recommended Due Date : Jul 1, 2025
Calibration Method : Calibration Procedure No. CPE-04-01

Environmental Conditions

Ambient Temperature : $(25 \pm 2) ^\circ\text{C}$
Ambient Relative Humidity : $(50 \pm 15) \% \text{RH}$
Calibration Place : Permanent Calibration Laboratory

Condition as received : Normal

Calibration Result : See data attached

1. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.
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5. This results of this report only to the items calibrated.



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Date of Issue : Jul 1, 2024**Calibrated by** : **Approved by** :

Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2407094-1

Page 2 of 3

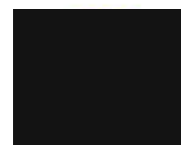
Standards Equipment Used

<u>Equipment Name</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>	<u>Traceability to</u>
Sound Calibrator	N975185	5523631030478623	Nov 9, 2024	MP-TH

Traceability

This calibration is traceable to the International System of Unit via :

- MP-TH : Micro Precision Calibration Laboratory (Thailand) Co., Ltd.



Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2407094-1

Page 3 of 3

UUC Range : (30 to 130) dB

Resolution : 0.1 dB

Results of Calibration: [] Without adjustment [☒] With adjustment

Appearance and Function of Use Inspection : GOOD

Sound Level Calibration @ Frequency 1 kHz

Select : A

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB	108.0 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	127.9 dB	113.9 dB	0.17 dB	0.40 dB
SLOW	94.09 dB	108.0 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	127.8 dB	113.9 dB	0.17 dB	0.40 dB

Sound Level Calibration @ Frequency 1 kHz

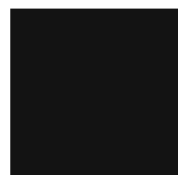
Select : C

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB	108.1 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	127.8 dB	113.9 dB	0.17 dB	0.40 dB
SLOW	94.09 dB	108.0 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	127.9 dB	113.9 dB	0.17 dB	0.40 dB

STD = Standard

UUC = Unit Under Calibration

- End of Certificate -





THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 20 January, 2025

Certification No. 055/25

Page : 1 of 6

Object : Vantage Pro2 Weather Station

Manufacturer : Davis Instruments

Mode No. : 6152CM ID No. : TNP-F-W02

Mfg Code : Display BF210628045 Transmitter BF210628045

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

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1011.1 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)
Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: Thermoschneider No.9188 : testo, testo 645 Serial No. 02848057

S
C
N

type PTB220 No. V1220015





THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Certification No. 055/25

20 January, 2025

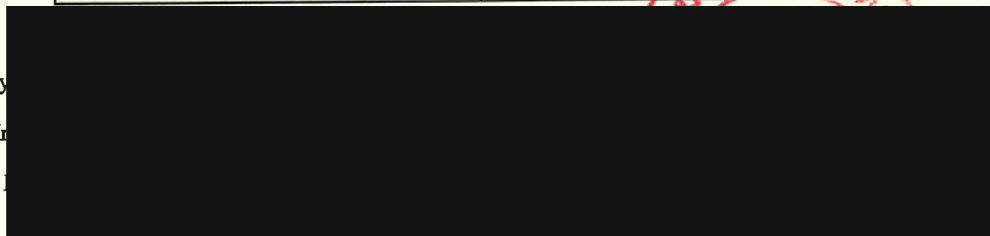
Page : 2 of 6

Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches H2O	Vacumm inches H2O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	0.9	0.10
3.02	-	-	-	3.0	0.02
5.00	-	-	-	4.9	0.10
7.00	-	-	-	7.0	0.00
9.02	-	-	-	8.9	0.12
11.01	-	-	-	11.0	0.01
13.01	-	-	-	13.0	0.01
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRETION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by

Md





THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Certification No. 055/25

20 January, 2025

Page : 3 of 6

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
1013.70	1013.9	-0.20
1014.91	1014.9	0.01
1014.64	1014.7	-0.06
1015.33	1015.3	0.03
1011.48	1011.6	-0.12
1012.20	1012.3	-0.10
1012.49	1012.5	-0.01
1013.53	1013.5	0.03
1013.07	1013.0	0.07
1013.91	1013.7	0.21
1013.56	1013.5	0.06
1010.69	1010.7	-0.01
1011.07	1011.0	0.07
1011.24	1011.2	0.04
1011.47	1011.5	-0.03
1011.65	1011.6	0.05
1011.97	1011.9	0.07
1012.25	1012.2	0.05
1008.92	1009.1	-0.18
1011.11	1011.2	-0.09

Calibrated by

Mr. V

Me



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

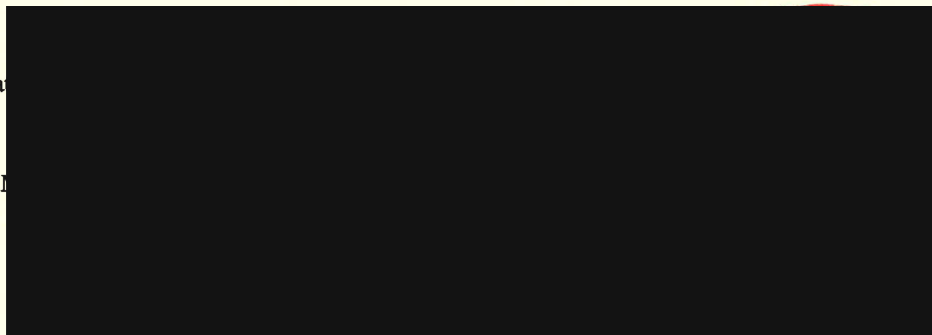
Certification No. 055/25

20 January, 2025

Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading	Correction
	°C	°C
45.5	45.5	0.0
30.2	30.2	0.0
15.6	15.7	-0.1

Calibra



reau



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Certification No. 055/25

20 January, 2025

Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading	Correction
	% R.H.	% R.H.
48.2	48	0.20
62.4	64	-1.60
93.5	97	-3.50

Calibrated by



au



Date of Issue 20 January, 2025

Certification No. 055/25

Page: 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ยี่ห้อ Davis Instruments แบบ TIPPING BUCKET Product No. 6152CM Mfg. Code. BF210628045 ทำการสอบเทียบกับแก้ววัดฝนแบบ แก้วตวง GAUGE DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON No. 71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.2 mm./TIP)



ลงชื่อ



วิศวกรชำนาญการ

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601/721A3301
SERIAL NO. : UM22048/UM22048
CLID. NO. : 252403049
JOB CONTROL NO. : 241226138069
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

DATE OF RECEIVED : 26 December 2024

DATE OF ISSUED : 04 January 2025

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By :

Approved By :



04 January 2025

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. Q24138069

F3-011-05/12-23

page 1 of 1



REPORT OF CALIBRATION FOR

NOMENCLATURE : **VIBRATION METER**
MANUFACTURER : **INSTANTEL**
MODEL / TYPE : **721A2601/721A3301**
SERIAL NO. : **UM22048/UM22048**
DATE OF CALIBRATION : **27 December 2024**

ENVIRONMENT CONDITIONS :

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

Relative Humidity : $(55 \pm 15) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPEE-08** based on **ISO 16063-21** as calibration guideline.

The calibration was performed by using Digital Multimeter, Programmable Timer/Counter, Vibration Calibrator which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Vibration Calibrator, The Modal Shop Model 9110D S/N. 11424.
2. Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.
3. Digital Multimeter, Keysight Technologies Model 3458A S/N. MY59352733.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0030-24, Due Date 19 July 2025.
2. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0050/24 , Due Date 13 May 2025 .
3. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. EE-0060-24, Due Date 26 June 2025.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2,00$ 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. Q24138069

F3-011-05/12-23

page 2 of 4



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
10	80 Hz	peak	10.000	10.216	-0.216	1.5
20	80 Hz		20.000	20.288	-0.288	1.5
30	80 Hz		30.000	30.356	-0.356	1.5
40	80 Hz		40.000	40.412	-0.412	1.5
50	80 Hz		50.000	50.492	-0.492	1.5

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 2 of 67



CALIBRATION DATA

*2. FREQUENCY RESULT

STD Applied (Hz)	DUC Reading (Hz)	Correction (Hz)	Uncertainty \pm (Hz)
50	49	+1	0.6
80	80	0	0.6
100	100	0	0.6

Note. * means Calibrations marked " Not ANAB Accredited " in this Certificate have been included for completeness.

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

End of Certificate

Certificate No. Q24138069

F3-011-05/12-23

page 4 of 4



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601/721A3301
SERIAL NO. : UM19129/UM19129
CLID. NO. : 252402965
JOB CONTROL NO. : 241212132656
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

DATE OF RECEIVED : 12 December 2024

DATE OF ISSUED : 19 December 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By :

Approved By :

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. Q24132656

F3-011-05/12-23

page 1 of 4

REPORT OF CALIBRATION

FOR

NOMENCLATURE : **VIBRATION METER**
MANUFACTURER : **INSTANTEL**
MODEL / TYPE : **721A2601/721A3301**
SERIAL NO. : **UM19129/UM19129**
DATE OF CALIBRATION : **13 December 2024**

ENVIRONMENT CONDITIONS :

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

Relative Humidity : $(55 \pm 15) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPEE-08** based on **ISO 16063-21** as calibration guideline.

The calibration was performed by using Digital Multimeter, Programmable Timer/Counter, Vibration Calibrator which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Vibration Calibrator, The Modal Shop Model 9110D S/N. 11424.
2. Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.
3. Digital Multimeter, Keysight Technologies Model 3458A S/N. MY59352733.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0030-24, Due Date 19 July 2025.
2. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0050/24 , Due Date 13 May 2025 .
3. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. EE-0060-24, Due Date 26 June 2025.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2,00$ 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. Q24132656

F3-011-05/12-23

page 2 of 4

CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	\pm (% of rdg.)
10	80 Hz	peak	10.000	10.077	-0.077	1.5
20	80 Hz		20.000	20.149	-0.149	1.5
30	80 Hz		30.000	30.188	-0.188	1.5
40	80 Hz		40.000	40.242	-0.242	1.5
50	80 Hz		50.000	50.294	-0.294	1.5

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 2 of 67



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 : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601/721A3301
SERIAL NO. : UM19244/UM19244
CLID. NO. : 252402113
JOB CONTROL NO. : 240919100992
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

DATE OF RECEIVED : 19 September 2024

DATE OF ISSUED : 28 September 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By :



Approved By :

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. Q24100992

F3-011-05/12-23

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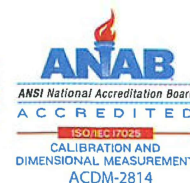


@clccalibration



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



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601/721A3301
SERIAL NO. : UM19244/UM19244
DATE OF CALIBRATION : 26 September 2024

ENVIRONMENT CONDITIONS :

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

Relative Humidity : $(55 \pm 15) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPEE-08** based on **ISO 16063-21** as calibration guideline.
The calibration was performed by using Digital Multimeter, Programmable Timer/Counter, Accelerometer and Measuring Amplifier which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Digital Multimeter, Hewlett Packard Model 34401A S/N. 3146A75935.
2. Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.
3. Accelerometer with Measuring Amplifier, Bruel & Kjaer Model 8305, 2626 S/N. 705491, 1741406.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. EE-0130-23, Due Date 29 November 2024.
2. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0050/24 , Due Date 13 May 2025 .
3. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0053-23, Due Date 12 October 2024.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2,00$ 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. **Q24100992**

F3-011-05/12-23

page 2 of 4



@clccalibration



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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 : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	\pm (% of rdg.)
10	80 Hz	peak	10.000	10.089	-0.089	1.6
20	80 Hz		20.000	20.156	-0.156	1.1
30	80 Hz		30.000	30.196	-0.196	1.0
40	80 Hz		40.000	40.256	-0.256	0.9
50	80 Hz		50.000	50.311	-0.311	0.9

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 2 of 67

Certificate No. Q24100992

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page 3 of 4



@clccalibration



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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



CALIBRATION DATA

*2. FREQUENCY RESULT

STD Applied (Hz)	DUC Reading (Hz)	Correction (Hz)	Uncertainty \pm (Hz)
50	50	0	0.8
80	80	0	0.8
100	100	0	0.8

Note. * means Calibrations marked " Not ANAB Accredited " in this Certificate have been included for completeness.

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

End of Certificate

Certificate No. Q24100992

F3-011-05/12-23

page 4 of 4



@clccalibration

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601/721A3301
SERIAL NO. : UM15019/UM15019
CLID. NO. : 252000717
JOB CONTROL NO. : 241227138133
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

DATE OF RECEIVED : 27 December 2024

DATE OF ISSUED : 06 January 2025

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.



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. Q24138133

F3-011-05/12-23

page 1 of 1



REPORT OF CALIBRATION FOR

NOMENCLATURE : **VIBRATION METER**
MANUFACTURER : **INSTANTEL**
MODEL / TYPE : **721A2601/721A3301**
SERIAL NO. : **UM15019/UM15019**
DATE OF CALIBRATION : **03 January 2025**

ENVIRONMENT CONDITIONS :

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

Relative Humidity : $(55 \pm 15) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPEE-08** based on **ISO 16063-21** as calibration guideline.

The calibration was performed by using Digital Multimeter, Programmable Timer/Counter, Vibration Calibrator which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Vibration Calibrator, The Modal Shop Model 9110D S/N. 11424.
2. Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.
3. Digital Multimeter, Keysight Technologies Model 3458A S/N. MY59352733.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0030-24, Due Date 19 July 2025.
2. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0050/24 , Due Date 13 May 2025 .
3. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. EE-0060-24, Due Date 26 June 2025.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2,00$ 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. Q24138133

F3-011-05/12-23

page 2 of 4



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
10	80 Hz	peak	10.000	10.186	-0.186	1.5
20	80 Hz		20.000	20.211	-0.211	1.5
30	80 Hz		30.000	30.274	-0.274	1.5
40	80 Hz		40.000	40.325	-0.325	1.5
50	80 Hz		50.000	50.391	-0.391	1.5

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 2 of 67



CALIBRATION DATA

*2. FREQUENCY RESULT

STD Applied (Hz)	DUC Reading (Hz)	Correction (Hz)	Uncertainty \pm (Hz)
50	49	+1	0.6
80	79	+1	0.6
100	100	0	0.6

Note. * means Calibrations marked " Not ANAB Accredited " in this Certificate have been included for completeness.

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

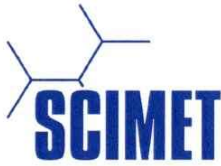
End of Certificate

Certificate No. Q24138133

F3-011-05/12-23

page 4 of 4





SCIMET Co., Ltd.
818/124 Udomsuk Rd., Bangna-Nuea,
Bangna, Bangkok 10260 Thailand
Email: scimet2022@gmail.com, Tel: 02 460 9239
https://www.scimet.co.th



Certificate No. C07250018

Calibration Certificate

Equipment: SPECTROPHOTOMETER
Model: T6U
Serial No.(or ID): 31-1654-01-1055 (TNP.LAB.48)
Manufacturer: PG Instrument
Condition: In Condition

Job No.: KSMT2500582
Received Date: 17 February 2025
Issued Date: 17 February 2025
Page: 1 of 3

Customer

TNP ENVIRONMENT CO., LTD.
332/173 Village No. 3, Bangrak Phatthana Subdistrict,
Bang Bua Thong District, Nonthaburi Province 11110

Calibration Place

TNP ENVIRONMENT CO., LTD. (ห้องปฏิบัติการ 2)
332/173 Village No. 3, Bangrak Phatthana Subdistrict,
Bang Bua Thong District, Nonthaburi Province 11110

Calibration Date

17 February 2025

Environment Condition

Temperature: 27.1 °C ± 0.3 °C
Humidity: 50.3 %RH ± 2.9 %RH

The Method used

In-house method, WI07, based on ASTM E 275-08 and
ASTM E 387-04

Traceability

This certificate is traceable to the CRM maintained by National Institute
of Standards and Technology (NIST) through Starna Scientific Limited.

The standard for Wavelength Certificate No. 125472 and 125471

The standard for Photometric Certificate No. 125567 and 125517

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ($k=2$) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of SCIMET Co., Ltd.

Condition of reference standards Instruments / CRM:

<u>Instruments</u>	<u>Set No.</u>	<u>Certificate No.</u>	<u>Due date</u>
Didymium Oxide Glass Reference	131033	125472	16-Sep-26
Holmium Oxide Glass Reference	136650	125471	16-Sep-26
Neutral Density Filter Reference	45329	125567	17-Sep-26
Potassium Dichromate Solution References	45328	125517	17-Sep-26

Calibration Results:
Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUC at 2 nm

Standard Wavelength (nm)	Unit Under Calibration (nm)	Correction (nm)	Uncertainty of Measurement (± nm)
219.30	219.8	-0.50	0.14
241.29	241.8	-0.51	0.14
287.62	287.8	-0.18	0.14
360.43	360.4	0.03	0.14
417.72	418.4	-0.68	0.14
431.57	431.0	0.57	0.14
472.47	473.0	-0.53	0.14
513.41	513.8	-0.39	0.14
528.83	528.6	0.23	0.14
537.13	537.2	-0.07	0.14
573.33	573.6	-0.27	0.14
585.29	585.6	-0.31	0.14
640.94	641.0	-0.06	0.14
684.49	684.8	-0.31	0.14
740.18	739.8	0.38	0.14
748.48	748.8	-0.32	0.14
807.03	806.6	0.43	0.14
879.27	879.4	-0.13	0.14

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance (Abs)	Unit Under Calibration (Abs)	Correction (Abs)	Uncertainty of Measurement(± Abs)
235 nm	0.0000	0.000	0.0000	0.0080
	0.7328	0.733	-0.0002	0.0080
257 nm	0.0000	0.000	0.0000	0.0080
	0.8537	0.852	0.0017	0.0080
313 nm	0.0000	0.000	0.0000	0.0080
	0.2855	0.287	-0.0015	0.0080
350 nm	0.0000	0.000	0.0000	0.0080
	0.6338	0.633	0.0008	0.0080

Calibration Results:
Without Adjustment
Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance (Abs)	Unit Under Calibration (Abs)	Correction (Abs)	Uncertainty of Measurement(\pm Abs)
420 nm	0.0000	0.000	0.0000	0.0045
	0.2352	0.236	-0.0008	0.0045
	0.5716	0.573	-0.0014	0.0045
	0.7146	0.716	-0.0014	0.0045
	1.0179	1.020	-0.0021	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.2314	0.232	-0.0006	0.0045
	0.5566	0.558	-0.0014	0.0045
	0.7028	0.703	-0.0002	0.0045
	1.0016	1.003	-0.0014	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.2107	0.212	-0.0013	0.0045
	0.5192	0.521	-0.0018	0.0045
	0.6638	0.664	-0.0002	0.0045
	0.9447	0.944	0.0007	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.2187	0.220	-0.0013	0.0045
	0.5207	0.522	-0.0013	0.0045
	0.7002	0.700	0.0002	0.0045
	1.0001	1.000	0.0001	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.2430	0.243	0.0000	0.0045
	0.5546	0.555	-0.0004	0.0045
	0.7756	0.775	0.0006	0.0045
	1.1117	1.112	-0.0003	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.2635	0.264	-0.0005	0.0045
	0.5622	0.563	-0.0008	0.0045
	0.7651	0.765	0.0001	0.0045
	1.0974	1.097	0.0004	0.0045

The End of Certificate

Statements of conformity:

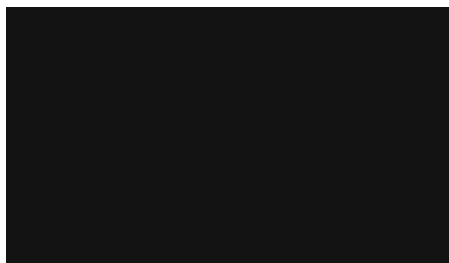
This conformity certificate documents the validity of the following statements of conformity based on the measurement results of corresponding calibration certificate:

The error of temperature determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, ASTM E 275-08 and ASTM E 387-04. Therefore, those parameters have not been assessed separately.

Tolerance and Decision rules:

Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

- Decision rule :** ☐ Choice A Binary Statement for Simple Acceptance Rule ($w = 0$), Specific Risk $< 50\%$ PFA.
- ☒ Choice B Non-binary statement with guard band ($w = 1 U$), Pass or Fail Specific Risk $< 2.5\%$ PFA and Condition Pass or Condition Fail Specific Risk $< 50\%$ PFA.
- ☐ Choice C Customer defined, Customers may define arbitrary multiple of r to have applied as guard band ($w = r U$) .
- ; PFA – Probability of False Accept



Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUC at 2 nm

Unit Under Calibration	Correction	Guard Band (w)	Tolerance (\pm)	Conformity
219.8	-0.50	0.14	1.5	Pass
241.8	-0.51	0.14	1.5	Pass
287.8	-0.18	0.14	1.5	Pass
360.4	0.03	0.14	1.5	Pass
418.4	-0.68	0.14	1.5	Pass
431.0	0.57	0.14	1.5	Pass
473.0	-0.53	0.14	1.5	Pass
513.8	-0.39	0.14	1.5	Pass
528.6	0.23	0.14	1.5	Pass
537.2	-0.07	0.14	1.5	Pass
573.6	-0.27	0.14	1.5	Pass
585.6	-0.31	0.14	1.5	Pass
641.0	-0.06	0.14	1.5	Pass
684.8	-0.31	0.14	1.5	Pass
739.8	0.38	0.14	1.5	Pass
748.8	-0.32	0.14	1.5	Pass
806.6	0.43	0.14	1.5	Pass
879.4	-0.13	0.14	1.5	Pass

Photometric Accuracy (Absorbance)

Wavelength	Unit Under Calibration	Correction	Guard Band (w)	Tolerance (\pm)	Conformity
235 nm	0.000	0.0000	0.0080	0.02	Pass
	0.733	-0.0002	0.0080	0.02	Pass
257 nm	0.000	0.0000	0.0080	0.02	Pass
	0.852	0.0017	0.0080	0.02	Pass
313 nm	0.000	0.0000	0.0080	0.02	Pass
	0.287	-0.0015	0.0080	0.02	Pass
350 nm	0.000	0.0000	0.0080	0.02	Pass
	0.633	0.0008	0.0080	0.02	Pass



Refer to Certificate No.: C07250018

Page: 3 of 3

Without Adjustment

Photometric Accuracy (Absorbance)

Wavelength	Unit Under Calibration	Correction	Guard Band (w)	Tolerance (\pm)	Conformity
420 nm	0.000	0.0000	0.0045	0.015	Pass
	0.236	-0.0008	0.0045	0.015	Pass
	0.573	-0.0014	0.0045	0.015	Pass
	0.716	-0.0014	0.0045	0.015	Pass
	1.020	-0.0021	0.0045	0.02	Pass
440 nm	0.000	0.0000	0.0045	0.015	Pass
	0.232	-0.0006	0.0045	0.015	Pass
	0.558	-0.0014	0.0045	0.015	Pass
	0.703	-0.0002	0.0045	0.015	Pass
	1.003	-0.0014	0.0045	0.015	Pass
465 nm	0.000	0.0000	0.0045	0.015	Pass
	0.212	-0.0013	0.0045	0.015	Pass
	0.521	-0.0018	0.0045	0.015	Pass
	0.664	-0.0002	0.0045	0.015	Pass
	0.944	0.0007	0.0045	0.015	Pass
546.1 nm	0.000	0.0000	0.0045	0.015	Pass
	0.220	-0.0013	0.0045	0.015	Pass
	0.522	-0.0013	0.0045	0.015	Pass
	0.700	0.0002	0.0045	0.015	Pass
	1.000	0.0001	0.0045	0.015	Pass
590 nm	0.000	0.0000	0.0045	0.015	Pass
	0.243	0.0000	0.0045	0.015	Pass
	0.555	-0.0004	0.0045	0.015	Pass
	0.775	0.0006	0.0045	0.015	Pass
	1.112	-0.0003	0.0045	0.015	Pass
635 nm	0.000	0.0000	0.0045	0.015	Pass
	0.264	-0.0005	0.0045	0.015	Pass
	0.563	-0.0008	0.0045	0.015	Pass
	0.765	0.0001	0.0045	0.015	Pass
	1.097	0.0004	0.0045	0.015	Pass

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

The End of Statements of Conformity



ใบตรวจสอบสภาพเครื่อง Spectrophotometer

เลขที่ใบงาน: KSMT2500582

ชนิดเครื่องมือ: SPECTROPHOTOMETER

รุ่น: T6U

หมายเลขเครื่อง: 31-1654-01-1055

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
17 Feb 2025			17 Feb 2025		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ ปิด – เปิด เครื่อง (On-Off Swicth)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. ช่องวัดหลายตัวอย่าง (Carousel Module)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

เพิ่มเติม/ข้อแนะนำ :

Mr. Hattapong Pumnil

Service Engineer



CERTIFICATE OF CALIBRATION

Certificate No. : 24-1179-001

Issue Date : 7 September 2024

Work Order No. : 24/1179

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

Date of Received : 6 September 2024

Date of Calibration : 6 September 2024

Instrument Details : Description : pH meter
Manufacturer : HORIBA
Model : LAQUA-PH1100
Serial No. : B80A0042
ID No. : TNP.LAB.02
Resolution : 0.01 pH
Location : Laboratory

Calibration Method : This instrument was calibrated by in-house calibration procedure no. CWI-C-02 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

Environmental Condition

Temperature : Area Monitoring between 15°C to 40°C
Humidity : Area Monitoring between 30%RH to 85%RH

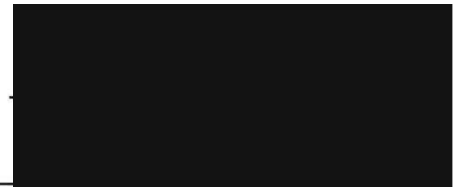
Traceability of Measurement

: This certificate of calibration documents the traceability to national standard, which realize the unit of measurement according to the International system of Units (SI)

Calibrated by :



Approved by :



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45/48 Soi Salathammasop31, Salathammasop Rd.,
Salathammasop, Thawewatthana, Bangkok 10170 Thailand

Tel : 0-2408-8474-5 Fax : 0-2408-8477 Email : info@crystalcal.com www.crystalcal.com



CERTIFICATE OF CALIBRATION

Certificate No. : 24-1179-001

Issue Date : 7 September 2024

Work Order No. : 24/1179

Details of Calibration

1. Certified Reference Material / Certified of Instrument

Certified Reference Material	CRM Code	Lot no.	Expire Date
1.1 Buffer Solution pH 4.00	TRM-S-2027	150823	1 July 2025
1.2 Buffer Solution pH 7.00	TRM-S-2034	230524	1 July 2025
1.3 Buffer Solution pH 10.00	TRM-S-2031	160823	1 July 2025

Instrument	Certificate no.	Serial No. / ID No.	Due Date
1.4 DC Source Calibrator	23E3042	9791008	14 September 2024
1.5 Digital Thermometer with sensor	24-0002-013	316A14010055 / RTD-PH-02	8 January 2025

2. This certificate traceable to the international unit (SI)

Buffer solution no. 1.1 traceable to : Nation Institute of Metrology (Thailand)
Buffer solution no. 1.2 traceable to : Nation Institute of Metrology (Thailand)
Buffer solution no. 1.3 traceable to : Nation Institute of Metrology (Thailand)
Instrument no. 1.4 traceable to : Technology Promotion Association (Thailand-Japan) NAC Calibration No. 0008
Instrument no. 1.5 traceable to : Crystal Calibration sales and service Co., Ltd., NAC Calibration No. 0260

3. Condition of item : Used

4. Calibration location : On-site

Result of Calibration

Measurement Function : mV Measurement
Performing : Standard curve by Voltage calibrator at pH (4, 7, 10)

Nominal value pH	Applied DC voltage mV	Average indicator reading		Uncertainty (±) mV	Coverage Factor k
		mV	pH		
0	414.1	414.0	0.03	0.083	2.00
2	295.8	295.8	2.02	0.083	2.00
4	177.5	177.5	4.01	0.083	2.00
7	0.0	-0.1	7.00	0.083	2.00
9	-118.3	-118.3	9.00	0.083	2.00
10	-177.5	-177.6	10.01	0.083	2.00
12	-295.8	-295.9	12.01	0.083	2.00
14	-414.1	-414.2	14.02	0.083	2.00

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CERTIFICATE OF CALIBRATION

Certificate No. : 24-1179-001

Issue Date : 7 September 2024

Work Order No. : 24/1179

Result of calibration

Measurement Function : pH Measurement with electrode

Performing : Three buffer standard curve using buffer nominal pH (4, 7, 10)

STD buffer solution pH @ 25 °C	Average indicator reading			Uncertainty (\pm) pH	Coverage factor k
	pH	mV	pH correction		
4.01	3.99	155.6	0.02	0.012	2.00
7.00	6.99	-21.4	0.01	0.012	2.00
10.01	10.02	-197.0	-0.01	0.012	2.00

Descriptions of electrode :

Electrode Type : Glass electrode

Manufacturer : HORIBA

Serial no. : 9XB0575

Model : 9615S

ID No. : N/A

Detail of % slope form calculation

pH range	% Slope value	% Slope recommend
4 pH to 7 pH	100.1	95% - 105%
7 pH to 10 pH	98.6	

Note : Calibrate items in good condition and this report customer request and accepted in certificate

This result of calibration was found accurate as shown on date and place of calibration only.

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%.



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CERTIFICATE OF CALIBRATION

Issue Date : 7 September 2024
Certificate No. : 24-1179-002
Work Order No. : 24/1179

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

Date of Received : 6 September 2024

Date of Calibration : 6 September 2024

Instrument Details : Description : Digital Thermometer with probe
Manufacturer : HORIBA
Model : LAQUA-PH1100
Serial No. : B80A0042
ID No. : TNP.LAB.02
Resolution : 0.1 °C
Location : Laboratory

Calibration Method : This instrument was calibrated by comparison of indication with Standard Thermometer into calibration bath temperature controller according to calibration procedure no. CWI-T-09

Environmental Condition

Temperature : Area Monitoring between 15°C to 40°C

Humidity : Area Monitoring between 30%RH to 85%RH

Traceability of Measurement

: This certificate of calibration documents the traceability to national standard, which realize the unit of measurement according to the International system of Units (SI) and The temperature scale in use at this laboratory is The International Temperature scale of 1990.

Calibrated by :



Approved by :



Laboratory Manager

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PAGE 1/2

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CERTIFICATE OF CALIBRATION

Certificate No. : 24-1179-002

Issue Date : 7 September 2024

Work Order No. : 24/1179

Details of Calibration

1. Reference Standards Instrument

Instrument	Serial No. / ID No.	Certification	Due Date
Thermometer Readout	316A14010055	24-0002-001	5-Jan-2025
Standard Thermometers (RTD)	4706698-001	24-0002-001	5-Jan-2025

2. Certificate traceable : This certificate traceable to The International System of Unit (SI unit)

3. Condition of equipment : Used

4. Calibration site : On-Site

Result of Calibration

Calibration result : Without Adjustment

Calibration point (°C)	STD. Value (°C)	UUC Reading (°C)	Correction value (°C)	Uncertainty ± (°C)
25	25.00	25.0	+ 0.00	0.11

Note : Calibrate items it good condition and this report customer request and accepted in certificate

Electrode Type : Combination Electrode

Manufacturer : HORIBA

Model : 9615S

Serial no. : 9XB0575

ID No. : N/A

UUC : Unit Under Calibration.

This result of calibration was found accurate as shown on date and place of calibration only.

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%.

--END--

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CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.

45/48 Soi Salathammasop31, Salathammasop Rd.,

Salathammasop, Thawewatthana, Bangkok 10170 Thailand

Tel : 0-2408-8474-5 Fax : 0-2408-8477 Email : info@crystalcal.com www.crystalcal.com

Statements of conformity report

Refer to Certificate No. : 24-1179-002

Issue Date : 7 September 2024

Work Order No. : 24/1179

Detail of Equipment

Description : Digital Thermometer with probe

Manufacturer : HORIBA

Serial no. : B80A0042

Model : LAQUA-PH1100

ID No. : TNP.LAB.02

Result of Calibration

This result of calibration : Without adjustment

Tolerance	1 °C
-----------	------

Resolution : 0.1 °C

Calibration point	STD value	UUC reading	Correction	Uncertainty	Uncertainty + Absolute correc.	Evaluation
25	25.00	25.0	0.00	0.11	0.11	Pass

The conformity certificate documents validity following ISO/IEC Guide 98-4 : Role of measurement uncertainty in conformity assessment based on statement with guard band refer to specification tolerance limit of customer consider expanded measurement uncertainty (k=95%)

The tolerance and decision rules ;

MPE of Customer = Measurement uncertainty + Absolute error ; \leq MPE is pass , $>$ MPE is Fail

Statements of conformity decision by :

Laboratory Manager



CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.

45/48 Soi Salathammasop31, Salathammasop Rd.,

Salathammasop, Thawewatthana, Bangkok 10170 Thailand

Tel : 0-2408-8474-5 Fax : 0-2408-8477 Email : info@crystalcal.com www.crystalcal.com



CERTIFICATE OF CALIBRATION

Certificate No. : 24-1179-007

Work Order No. : 24/1179

Issue Date : 11 September 2024

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

Date of Received : 5 September 2024

Date of Calibration : 10 September 2024

Instrument Details : Description : Digital Thermo hygrometer
Manufacturer : EXTECH
Model : 445814
Serial No. : PONPE5816745
ID No. : TNP.LAB.04
Location : Humidity and Temperature Laboratory

Calibration Method : This instrument was calibrated by comparison of indication with Standard Chilled Mirror Hygrometer and Standard Thermometer into Temperature and Humidity Chamber controller according to calibration procedure no. CWI-H-01

Environmental Condition

Temperature : Laboratory Control at $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Humidity : Laboratory Control at $55\%\text{RH} \pm 20\%\text{RH}$

Traceability of Measurement

: This certificate of calibration documents the traceability to national standard, which realize the unit of measurement according to the International system of Units (SI) and The temperature scale in use at this laboratory is The International Temperature scale of 1990.

Calibrated by :

Calibration Engineer

Approved by :

Laboratory Manager

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Crystal Calibration Sales and Service Co., Ltd.

PAGE 1/2

45/48 Salathommasop 31, Salathommasop Rd.,Salathommasop, Thawewatthana, Bangkok 10170

Phone : 0-2408-8474 Fax : 0-2408-8477 <http://www.crystalcal.com>

Email : info@crystalcal.com





CERTIFICATE OF CALIBRATION

Certificate No. : 24-1179-007

Issue Date : 11 September 2024

Work Order No. : 24/1179

Details of Calibration

1. Reference Standards Instrument

Instrument	Serial No.	Certification	Due Date
1.1 Chilled Mirror Hygrometer	157151 / 157152	TH-0069-23	24 February 2025
1.2 Digital Thermometer with RTD	15000016 / RTD-11	23-1415-003	16 October 2024

2. Certificate traceable : This certificate traceable to The International System of Unit refer to
No. 1.1 National Institute of Metrology (Thailand), NAC Calibration No. 0144
No. 1.2 Crystal Calibration Sales and Service Co., Ltd. , NAC Calibration No. 0260

3. Condition of item : Used

4. Calibration location : Permanent

Result of Calibration

1. Temperature Measurement : Without Adjustment

Resolution of UUC : 0.1 °C

Calibration Point (°C)	Average Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty ± (°C)
17	17.066	17.0	+ 0.066	0.30
23	23.050	23.3	- 0.250	0.30
30	30.050	30.5	- 0.450	0.30

2. Humidity Measurement : Without Adjustment

Resolution of UUC : 1 %RH

Calibration Point (%RH)	Calculated Standard Reading (%RH)	UUC Reading (%RH)	Correction (%RH)	Uncertainty ± (%RH)
40	40.46	36	+ 4.46	1.6
50	50.05	45	+ 5.05	1.6
65	65.63	59	+ 6.63	1.7

Note : 1. Process calibration humidity measurement Reference temperature control at 25°C

2. Calculated STD humidity refer to dew-point temperature and convert to humidity by magnus's Equation

3. Calibrate items it good condition and this report customer request and accepted in certificate

This result of calibration was found accurate as shown on date and place of calibration only.

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%.



CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.

45/48 Soi Salathammasop31, Salathammasop Rd.,

Salathammasop, Thawewatthana, Bangkok 10170 Thailand

Tel : 0-2408-8474-5 Fax : 0-2408-8477 Email : info@crystalcal.com www.crystalcal.com

Statements of conformity report

Refer to Certificate No. : 24-1179-007

Issue Date : 11 September 2024

Work Order No. : 24/1179

Detail of Equipment

Description : Digital Thermo hygrometer

Manufacturer : EXTECH

Serial no. : PONPE5816745

Model : 445814

ID No. : TNP.LAB.04

Result of Calibration

This result of calibration : Without adjustment

MPE part Temp.	3	°C
----------------	---	----

Resolution : 0.1 °C

Calibration point	STD value	UUC reading	Correction	Uncertainty	Uncertainty + Absolute correc.	Evaluation
17	17.066	17.0	0.066	0.30	0.366	Pass
23	23.050	23.3	-0.250	0.30	0.550	Pass
30	30.050	30.5	-0.450	0.30	0.750	Pass

MPE part Humid	15	%RH
----------------	----	-----

Resolution : 1 %RH

Calibration point	STD value	UUC reading	Correction	Uncertainty	Uncertainty + Absolute correc.	Evaluation
40	40.46	36	4.46	1.6	6.06	Pass
50	50.05	45	5.05	1.6	6.65	Pass
65	65.63	59	6.63	1.7	8.33	Pass

The conformity certificate documents validity following ISO/IEC Guide 98-4 : Role of measurement uncertainty in conformity assessment based on statement with guard band refer to specification tolerance limit of customer consider expanded measurement uncertainty (k=95%)

The tolerance and decision rules ;

MPE of Customer = Measurement uncertainty + Absolute error ; ≤ MPE is pass

Statements of conformity decision by :

Laboratory Manager



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 : HOT AIR OVEN
MANUFACTURER : MEMMERT
MODEL / TYPE : UF75
SERIAL NO. : B320.0251
CLID. NO. : 332402706
JOB CONTROL NO. : 241212132142
CALIBRATION SERVICE : ☐ IN-LABORATORY ☒ ON-SITE

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

DATE OF RECEIVED : 12 December 2024

DATE OF ISSUED : 23 December 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By :

Approved By :

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. Q24132142

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REPORT OF CALIBRATION

FOR

NOMENCLATURE : **HOT AIR OVEN**
MANUFACTURER : **MEMMERT**
MODEL / TYPE : **UF75**
SERIAL NO. : **B320.0251**
LOCATION SITE : **LABORATORY ROOM 2 FLOOR 3**
DATE OF CALIBRATION : **17 December 2024**

ENVIRONMENT CONDITIONS :

Temperature : 25 °C to 26 °C

Relative Humidity : 52% to 54 %

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPTH-07** based on **TLAS G-20** as calibration guidelines.

The calibration was performed by using Hydra Data Logger which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Hydra Data Logger, Fluke Model 2635A S/N. 5499551.

TRACEABILITY :

The measurements are traceable to International System of Units (SI) , through Calibration Laboratory Co., Ltd.

Certificate No. Q24099493, Due Date 25 September 2025.

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. **Q24132142**

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@clccalibration



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CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The table in the following gives the calibration results and associated measurement uncertainties of the measuring hot air oven.

CALIBRATION DATA

1. HOT AIR OVEN PERFORMANCE

DUC		Measured Uniformity	Measured Stability	Measured Overall
Setting (°C)	Indicating (°C)	(°C)	(°C)	Variation (°C)
85.0	85.0	0.33	0.07	0.53
104.0	104.0	0.38	0.10	0.62
180.0	180.0	0.58	0.17	0.98

Certificate No. Q24132142

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@clccalibration

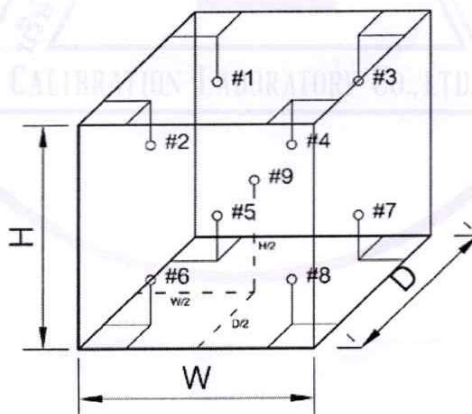
CALIBRATION DATA

2. TEMPERATURE DISTRIBUTION

DUC		Measured Temperature (°C)@Probe No.9 is Ref.									Uncertainty \pm (°C)	Coverage factor <i>k</i>
Setting (°C)	Indicating (°C)	1	2	3	4	5	6	7	8	9		
85.0	85.0	84.77	85.05	84.96	84.74	84.81	84.84	85.04	84.64	84.77	0.25	2,00
104.0	104.0	103.64	104.00	103.85	103.60	103.77	103.83	104.05	103.61	103.72	0.43	2,00
180.0	180.0	179.20	179.83	179.33	179.09	179.56	179.67	179.93	179.41	179.45	0.47	2,00

Technical Note : W = 40 cm, D = 33 cm, H = 56 cm.

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 58 of 67



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

End of Certificate

Certificate No. Q24132142

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CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : pH METER
MANUFACTURER : ADWA
MODEL / TYPE : AD12
SERIAL NO. : 1328[TNP.LAB.13]
CLID. NO. : 272500209
JOB CONTROL NO. : 250127009951
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

DATE OF RECEIVED : 27 January 2025

DATE OF ISSUED : 29 January 2025

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By :



Approved By :

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. Q25009951

F3-011-05/12-23

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REPORT OF CALIBRATION

FOR

NOMENCLATURE : pH METER
MANUFACTURER : ADWA
MODEL / TYPE : AD12
SERIAL NO. : 1328[TNP.LAB.13]
DATE OF CALIBRATION : 28 January 2025

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 CC788789.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI) , through National Institute of Metrology (Thailand).
Lot Number. 040822 , 120124. Due Date 04 March 2025.
2. The measurements are traceable to International System of Units (SI) , through Control Company.
Certificate No. 4288-14548619 , Due Date 17 October 2025.

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. Q25009951

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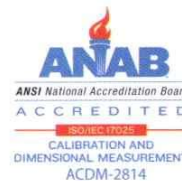
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CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

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	4.00	-	+0.003	0.020	2,65
7.005	6.99	-	+0.015	0.020	2,28
10.015	9.96	-	+0.055	0.016	2,05

Technical Note. Setting function CAL 2 point (4,6.86).

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 014 Page 4 of 68

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

End of Certificate

Certificate No. Q25009951

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CERTIFICATE OF CALIBRATION FOR

NOMENCLATURE : CYLINDER
MANUFACTURER : GLASSCO
MODEL / TYPE : 25 ml
SERIAL NO. : N/A[TNP-LAB-G.10]
CLID. NO. : 272500213
JOB CONTROL NO. : 250127009955
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

DATE OF RECEIVED : 27 January 2025

DATE OF ISSUED : 31 January 2025

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By :

Approved By :

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. Q25009955

F3-011-05/12-23

page 1 of 3



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REPORT OF CALIBRATION FOR

NOMENCLATURE : **CYLINDER**
MANUFACTURER : **GLASSCO**
MODEL / TYPE : **25 ml**
SERIAL NO. : **N/A[TNP-LAB-G.10]**
DATE OF CALIBRATION : **30 January 2025**

ENVIRONMENT CONDITIONS :

Temperature : $(20 \pm 2.5) ^\circ\text{C}$

Relative Humidity : $(50 \pm 10) \% \text{ RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPGW-01** based on **ASTM E542-01** as calibration guidelines.
The calibration was performed by using Electronic Balance, Thermo-hygrograph, Barometer and Thermometer
which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Barometer, Barigo S/N.001.
2. Electronic Balance, Sartorius Model CPA224S S/N.23908487.
3. Thermo-hygrograph, Isuzu Model 3-3126 S/N.30760420.
4. Thermometer, Brannan S/N. 1.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd.
Certificate No. Q23136335, Due Date 20 February 2025.
2. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd.
Certificate No. Q24137029, Due Date 27 December 2025.
3. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd.
Certificate No. Q24121014, Due Date 18 November 2025.
4. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd.
Certificate No. Q24137031, Due Date 26 December 2025.

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. Q25009955

F3-011-05/12-23

page 2 of 3



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The calibration was performed by applied volume to the Device Under Calibration (DUC) . The actual volume readings from STD were reported in average of seven times measurements.

CALIBRATION DATA

CORRECTION OF VOLUME

DUC Test point (ml)	Actual volume (ml)	Correction (ml)	Uncertainty \pm (ml)	Coverage factor <i>k</i>
15	15.1263	+0.1263	0.012	2,00
25	25.0472	+0.0472	0.012	2,00

Type of glassware : ☒ to Contain ☐ to Deliver

The Exact value : Water Temperature : 20.0 °C, Relative Humidity : 51 % , Barometric Pressure : 1009 hPa

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 014 Page 53 of 68

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

End of Certificate

Certificate No. Q25009955

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CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : BURETTE
MANUFACTURER : GLASSCO
MODEL / TYPE : 50 ml
SERIAL NO. : N/A[TNP-LAB-G.21]
CLID. NO. : 272500222
JOB CONTROL NO. : 250127009964
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

DATE OF RECEIVED : 27 January 2025

DATE OF ISSUED : 31 January 2025

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By :

Approved By :

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. Q25009964

F3-011-05/12-23

page 1 of 3



@clccalibration

REPORT OF CALIBRATION FOR

NOMENCLATURE : **BURETTE**
MANUFACTURER : **GLASSCO**
MODEL / TYPE : **50 ml**
SERIAL NO. : **N/A[TNP-LAB-G.21]**
DATE OF CALIBRATION : **29 January 2025**

ENVIRONMENT CONDITIONS :

Temperature : $(20 \pm 2.5) ^\circ\text{C}$

Relative Humidity : $(50 \pm 10) \% \text{ RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPGW-03** based on **ASTM E542-01** as calibration guidelines.

The calibration was performed by using Electronic Balance, Thermo-hygrograph, Barometer and Thermometer which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Barometer, Barigo S/N.001.
2. Electronic Balance, Sartorius Model CPA224S S/N.23908487.
3. Thermo-hygrograph, Isuzu Model 3-3126 S/N.30760420.
4. Thermometer, Brannan S/N. 1.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd. Certificate No. Q23136335, Due Date 20 February 2025.
2. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd. Certificate No. Q24137029, Due Date 27 December 2025.
3. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd. Certificate No. Q24121014, Due Date 18 November 2025.
4. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd. Certificate No. Q24137031, Due Date 26 December 2025.

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. Q25009964

F3-011-05/12-23

page 2 of 3



@clccalibration

CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The calibration was performed by applied volume to the Device Under Calibration (DUC) . The actual volume readings from STD were reported in average of seven times measurements.

CALIBRATION DATA

CORRECTION OF VOLUME

DUC Test point (ml)	Actual volume (ml)	Correction (ml)	Uncertainty \pm (ml)	Coverage factor <i>k</i>
10	10.0049	+0.0049	0.0038	2,00
25	24.9989	-0.0011	0.0066	2,00
50	50.0259	+0.0259	0.010	2,00

Type of glassware : ☐ to Contain ☒ to Deliver

The Exact value : Water Temperature : 20.0 °C, Relative Humidity : 51 % , Barometric Pressure : 1009 hPa

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 014 Page 54 of 68

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

End of Certificate

Certificate No. Q25009964

F3-011-05/12-23

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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : CYLINDER
MANUFACTURER : GLASSCO
MODEL / TYPE : 1000 ml
SERIAL NO. : 0732-63[TNP-LAB-G.07]
CLID. NO. : 272500211
JOB CONTROL NO. : 250127009953
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

DATE OF RECEIVED : 27 January 2025

DATE OF ISSUED : 31 January 2025

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By :

Approved By :

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. Q25009953

F3-011-05/12-23

page 1 of 3



@clccalibration

REPORT OF CALIBRATION FOR

NOMENCLATURE : **CYLINDER**
MANUFACTURER : **GLASSCO**
MODEL / TYPE : **1000 ml**
SERIAL NO. : **0732-63[TNP-LAB-G.07]**
DATE OF CALIBRATION : **30 January 2025**

ENVIRONMENT CONDITIONS :

Temperature : $(20 \pm 2.5) ^\circ\text{C}$

Relative Humidity : $(50 \pm 10) \% \text{ RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPGW-01** based on **ASTM E542-01** as calibration guidelines.
The calibration was performed by using Electronic Balance, Thermo-hygrograph, Barometer and Thermometer which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Barometer, Barigo S/N.001.
2. Electronic Balance, Sartorius Model Secura6102-1s S/N.0042104938.
3. Thermo-hygrograph, Isuzu Model 3-3126 S/N.30760420.
4. Thermometer, Brannan S/N. 1.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd. Certificate No. Q23136335, Due Date 20 February 2025.
2. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd. Certificate No. Q24112878, Due Date 22 October 2025.
3. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd. Certificate No. Q24121014, Due Date 18 November 2025.
4. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd. Certificate No. Q24137031, Due Date 26 December 2025.

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. Q25009953

F3-011-05/12-23

page 2 of 3



@clccalibration

CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The calibration was performed by applied volume to the Device Under Calibration (DUC) . The actual volume readings from STD were reported in average of seven times measurements.

CALIBRATION DATA

CORRECTION OF VOLUME

DUC Test point (ml)	Actual volume (ml)	Correction (ml)	Uncertainty \pm (ml)	Coverage factor <i>k</i>
500	499.40	-0.60	0.090	2,00
1000	1001.82	+1.82	0.16	2,00

Type of glassware : ☒ to Contain ☐ to Deliver

The Exact value : Water Temperature : 20.0 °C, Relative Humidity : 51 % , Barometric Pressure : 1009 hPa

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 014 Page 53 of 68

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

End of Certificate

Certificate No. Q25009953

F3-011-05/12-23

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@clccalibration



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 : VOLUMETRIC PIPETTE
MANUFACTURER : GLASSCO
MODEL / TYPE : 5 ml
SERIAL NO. : N/A[TNP-LAB-G.13]
CLID. NO. : 272500215
JOB CONTROL NO. : 250127009957
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

DATE OF RECEIVED : 27 January 2025

DATE OF ISSUED : 31 January 2025

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By :

Approved By :



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. Q25009957

F3-011-05/12-23

page 1 of 3



@clccalibration

REPORT OF CALIBRATION FOR

NOMENCLATURE	:	VOLUMETRIC PIPETTE
MANUFACTURER	:	GLASSCO
MODEL / TYPE	:	5 ml
SERIAL NO.	:	N/A[TNP-LAB-G.13]
DATE OF CALIBRATION	:	29 January 2025

ENVIRONMENT CONDITIONS :

Temperature : $(20 \pm 2.5) ^\circ\text{C}$

Relative Humidity : $(50 \pm 10) \% \text{ RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPGW-06** based on **ASTM E542-01** as calibration guidelines.

The calibration was performed by using Electronic Balance, Thermo-hygrograph, Barometer and Thermometer which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Barometer, Barigo S/N.001.
2. Electronic Balance, Sartorius Model CPA224S S/N.23908487.
3. Thermo-hygrograph, Isuzu Model 3-3126 S/N.30760420.
4. Thermometer, Brannan S/N. 1.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd. Certificate No. Q23136335, Due Date 20 February 2025.
2. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd. Certificate No. Q24137029, Due Date 27 December 2025.
3. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd. Certificate No. Q24121014, Due Date 18 November 2025.
4. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd. Certificate No. Q24137031, Due Date 26 December 2025.

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. **Q25009957**

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@clccalibration



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 : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The calibration was performed by applied volume to the Device Under Calibration (DUC) . The actual volume readings from STD were reported in average of seven times measurements.

CALIBRATION DATA

CORRECTION OF VOLUME

DUC Test point (ml)	Actual volume (ml)	Correction (ml)	Uncertainty \pm (ml)	Coverage factor k
5	4.9922	-0.0078	0.0025	2,00

Type of glassware : ☐ to Contain ☒ to Deliver

The Exact value : Water Temperature : 20.0 °C, Relative Humidity : 51 % , Barometric Pressure : 1009 hPa

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 014 Page 55 of 68

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

End of Certificate

Certificate No. Q25009957

F3-011-05/12-23

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@clccalibration



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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 : MEASURING PIPETTE
MANUFACTURER : GLASSCO
MODEL / TYPE : 25 ml
SERIAL NO. : N/A[TNP-LAB-G.16]
CLID. NO. : 272500218
JOB CONTROL NO. : 250127009960
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

DATE OF RECEIVED : 27 January 2025

DATE OF ISSUED : 31 January 2025

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By :

Approved By :

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. Q25009960

F3-011-05/12-23

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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



REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	MEASURING PIPETTE
MANUFACTURER	:	GLASSCO
MODEL / TYPE	:	25 ml
SERIAL NO.	:	N/A[TNP-LAB-G.16]
DATE OF CALIBRATION	:	29 January 2025

ENVIRONMENT CONDITIONS :

Temperature : $(20 \pm 2.5) ^\circ\text{C}$

Relative Humidity : $(50 \pm 10) \% \text{ RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPGW-06** based on **ASTM E542-01** as calibration guidelines.

The calibration was performed by using Electronic Balance, Thermo-hygrograph, Barometer and Thermometer which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Barometer, Barigo S/N.001.
2. Electronic Balance, Sartorius Model CPA224S S/N.23908487.
3. Thermo-hygrograph, Isuzu Model 3-3126 S/N.30760420.
4. Thermometer, Brannan S/N. 1.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd. Certificate No. Q23136335, Due Date 20 February 2025.

2. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd. Certificate No. Q24137029, Due Date 27 December 2025.

3. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd. Certificate No. Q24121014, Due Date 18 November 2025.

4. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd. Certificate No. Q24137031, Due Date 26 December 2025.

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. Q25009960

F3-011-05/12-23

page 2 of 3



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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 : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The calibration was performed by applied volume to the Device Under Calibration (DUC) . The actual volume readings from STD were reported in average of seven times measurements.

CALIBRATION DATA

CORRECTION OF VOLUME

DUC Test point (ml)	Actual volume (ml)	Correction (ml)	Uncertainty \pm (ml)	Coverage factor <i>k</i>
5	5.0014	+0.0014	0.0025	2,00
15	14.9514	-0.0486	0.0065	2,00
25	24.9191	-0.0809	0.0066	2,00

Type of glassware : ☐ to Contain ☒ to Deliver

The Exact value : Water Temperature : 20.0 °C, Relative Humidity : 51 % , Barometric Pressure : 1009 hPa

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 014 Page 55 of 68

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

End of Certificate

Certificate No. Q25009960

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@clccalibration



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 : MEASURING PIPETTE
MANUFACTURER : GLASSCO
MODEL / TYPE : 1 ml
SERIAL NO. : N/A[TNP-LAB-G.20]
CLID. NO. : 272500221
JOB CONTROL NO. : 250127009963
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

DATE OF RECEIVED : 27 January 2025

DATE OF ISSUED : 01 February 2025

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By :

Approved By :

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. Q25009963

F3-011-05/12-23

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REPORT OF CALIBRATION FOR

NOMENCLATURE : **MEASURING PIPETTE**
MANUFACTURER : **GLASSCO**
MODEL / TYPE : **1 ml**
SERIAL NO. : **N/A[TNP-LAB-G.20]**
DATE OF CALIBRATION : **29 January 2025**

ENVIRONMENT CONDITIONS :

Temperature : **$(20 \pm 2.5) ^\circ\text{C}$**

Relative Humidity : **$(50 \pm 10) \% \text{ RH}$**

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPGW-06** based on **ASTM E542-01** as calibration guidelines.
The calibration was performed by using Electronic Balance, Thermo-hygrograph, Barometer and Thermometer which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Barometer, Barigo S/N.001.
2. Electronic Balance, Sartorius Model CPA224S S/N.23908487.
3. Thermo-hygrograph, Isuzu Model 3-3126 S/N.30760420.
4. Thermometer, Brannan S/N. 1.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd. Certificate No. Q23136335, Due Date 20 February 2025.
2. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd. Certificate No. Q24137029, Due Date 27 December 2025.
3. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd. Certificate No. Q24121014, Due Date 18 November 2025.
4. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd. Certificate No. Q24137031, Due Date 26 December 2025.

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. Q25009963

F3-011-05/12-23

page 2 of 3



@clccalibration

CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The calibration was performed by applied volume to the Device Under Calibration (DUC) . The actual volume readings from STD were reported in average of seven times measurements.

CALIBRATION DATA

CORRECTION OF VOLUME

DUC Test point (ml)	Actual volume (ml)	Correction (ml)	Uncertainty \pm (ml)	Coverage factor k
0.2	0.2026	+0.0026	0.0025	2,00
0.5	0.5040	+0.0040	0.0025	2,00
1	0.9937	-0.0063	0.0025	2,00

Type of glassware : ☐ to Contain ☒ to Deliver

The Exact value : Water Temperature : 20.0 °C, Relative Humidity : 51 % , Barometric Pressure : 1009 hPa

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 014 Page 55 of 68

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

End of Certificate

Certificate No. Q25009963

F3-011-05/12-23

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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.0-2717-3000-29 FAX.0-2719-9484



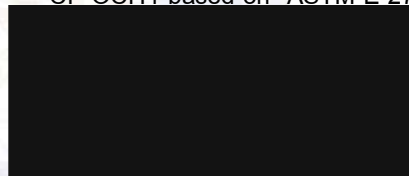
Certificate of Calibration

Cert.No.: 24CHO364

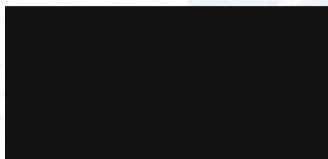
Page.: 1 of 3

Equipment : Spectrophotometer
Manufacturer : Hach
Model : DR3900
Serial No. : 1988383
ID No. : SPE-002
Condition As-Received: Used Item
Received Date : 09 July 2024
Calibration Date : 09 July 2024
Reference : 2407-0154OC-9
Submitted by : Environment & Laboratory Co.,Ltd
40 Soi Liangmueangnonthaburi 13
Talad Kwan, Mueang, Nonthaburi 11000
Calibration Place : Room No.304
Ambient Temperature : (27.1 to 27.5) °C (On-Site)
Relative Humidity : (64.1 to 63.5) % (On-Site)
Calibration Procedure : In - house method :
CP-OCH4 based on ASTM E 275-01

Calibrated by :



Approved by :



Approved Signatory

Issue Date :

14 July 2024

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.



Cert. No. : 24CHO364

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	43532	119613	22 Feb 2026
2. Absorbance Standard set	8331	105939	28 Sep 2024
3. Wavelength Standard set	29829	114509	11 Sep 2025
4. Wavelength Standard set	29829	114510	11 Sep 2025

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 through :

- Starna Scientific Ltd.

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>
361.40	361	0.59	2.00
447.20	447	0.59	2.00
537.00	537	0.59	2.00
638.00	638	0.59	2.00
740.51	741	0.59	2.00
807.04	807	0.59	2.00



Cert. No. : 24CHO364

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>
350.0	Zero	0.000	0.0046	2.00
	0.4271	0.425	0.0046	2.00
	0.6391	0.635	0.0050	2.00
440.0	Zero	0.000	0.0028	2.00
	0.5607	0.560	0.0030	2.00
	0.7336	0.733	0.0030	2.00
	1.0636	1.064	0.0031	2.00
546.1	Zero	0.000	0.0028	2.00
	0.5224	0.522	0.0028	2.00
	0.6856	0.684	0.0029	2.00
	0.9937	0.993	0.0028	2.00
635.0	Zero	0.000	0.0028	2.00
	0.5397	0.538	0.0028	2.00
	0.6832	0.680	0.0029	2.00
	0.9886	0.986	0.0028	2.00

Remark

- Each individual filter is measured against the empty filter holder (blank) used to zero the spectrophotometer
- The Potassium Dichromate filled cells are measured against a Perchloric acid blank.
- UUC = Unit Under Calibration

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 %.

Performance Verification Certificate

Job No. WO-00043742

Equipment : AA SPECTROMETER
Manufacturer : GBC Scientific
Model Type : SavantAA
Customer : Environment & Laboratory Co.,Ltd.
 40 Soi Liangmueangnonthaburi 13 Talad Kwan,Mueang, Nonthaburi 11000, Thailand

Serial No. : A8631
Verification Date : 7-Oct-2024

Result of Verification

Test Description	Criteria	Reading	Result
1. EHT	< 350 V	318 V	PASS
Photometric Noise (if >350 V)	Std. Dev <0.0002	-	
2. Wavelength Accuracy , Cu 324.75 nm	± 0.20 nm	324.83 nm	PASS
3. Wavelength Accuracy , Cs 852.10 nm	± 0.20 nm	852.04 nm	PASS
4. Slit Width 0.2 nm	± 0.02 nm	0.21 nm	PASS
5. Slit Width 0.5 nm	± 0.05 nm	0.53 nm	PASS
6. Slit Width 1.0 nm	± 0.10 nm	1.04 nm	PASS
7. Standard Gauze Screen <u>0.49</u> Abs*	± 0.02 Abs.	0.4909 Abs.	PASS
BC mode with gauze		-0.0000 Abs.	
BC mode without gauze		0.0002 Abs.	
Difference between With gauze and without gauze	< 0.004 Abs.	0.0002 Abs.	PASS
8. ABS Reading 5ppm,Cu	> 0.7 Abs.	0.842 Abs.	PASS
9. %RSD	< 0.5 %	0.39 %	PASS

* Write in the criteria column the Abs reading on the gauze screen calibration label

We hereby certify that instrument complies with GBC factory speccifications

Your satisfaction is our promise @ DKSH Technology Limited

Verification By :

Issued Date :

Signatory :

PREVENTIVE MAINTENANCE AND PERFORMANCE VERIFICATION REPORT

ATOMIC ABSORPTION SPECTROPHOTOMETER (AAS)

Issued Date: 7/10/24

Customer : บริษัท เ็นไวรอนเม้นท์ แอนด์ แลบอลราตอรี จำกัด

Manufacturer : GBC Scientific Equipment Pty Ltd.

Address : 40 ซอย เลี้ยวเมืองนนทบุรี 13 ตำบลตลาดขวัญ อำเภอ
เมือง จังหวัดนนทบุรี 11000

Model : SavantAA

Serial No : A8631

Contract :

Location : Laboratory

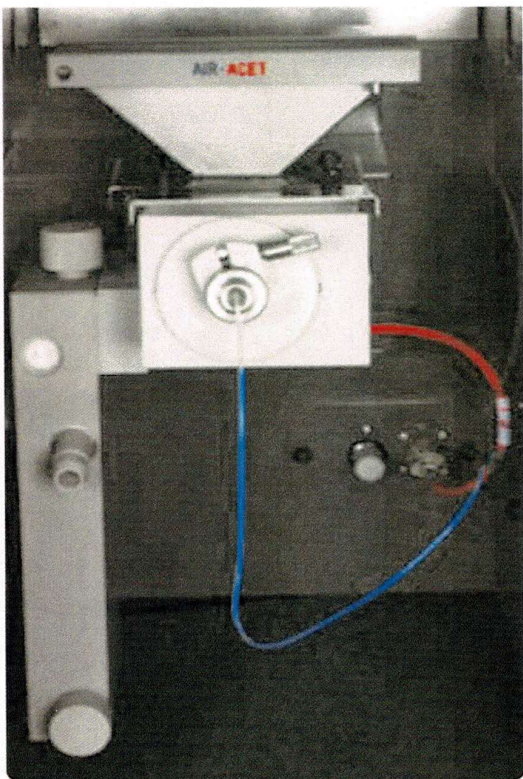
Power on switch and initial status

Instrument Ready สถานะเครื่องพร้อมใช้งาน

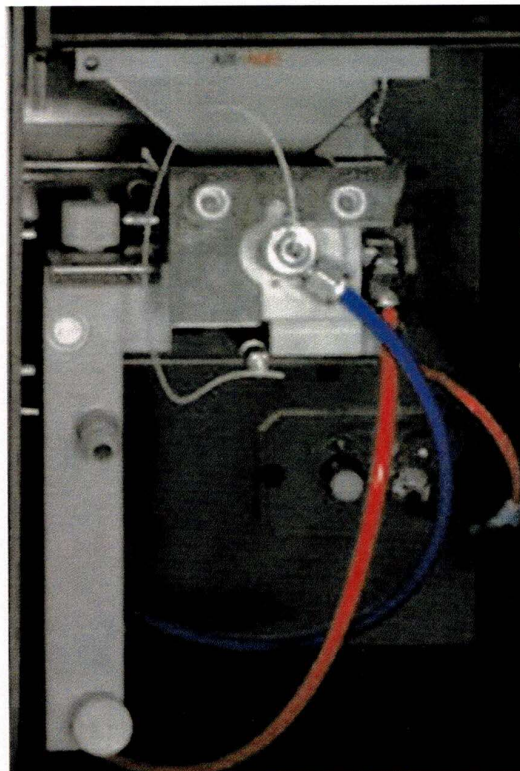
Preventive Maintenance	Pass	Fail	Remarks
Electrical Voltage			
- Main voltage (power supply check 220V \pm 10V).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	218.9 VAC
- Power indicator light (Replace if faulty).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
- Power core (Clean or replace as appropriate).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
- Fan (Clean or replace filter element as appropriate).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
Environment			
- Temperature (10 to 35 deg.C)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	22.5 C
- Humidity (8 to 80%).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	57 %
- Air Quality (No Dust)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
- No corrosive vapours present from laboratory sample preparation or external sources.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
Optics			
- Windows lens (Clean or replace as appropriate).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Clean
- Light Source (Check operation. Replace if required).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- D2 Lamp (Check operation. Replace if required).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
Gas system			
- General (Tube and Fitting /Check for leaks).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Air Zero (Inlet pressure range 300-400 kPa).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4 Bar
- Acetylene (Inlet pressure range 55-96 kPa).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0.9 Bar
- Nitrous oxide (Inlet pressure range 300-400 kPa).	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-
Computer			
- Operating system	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Windows 10
- Software Version	<input checked="" type="checkbox"/>	<input type="checkbox"/>	SavantAA3.11
- Verify that all computer links and installed software operate correctly	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready

Spray Chamber Type

☐ ABR Spray Chamber



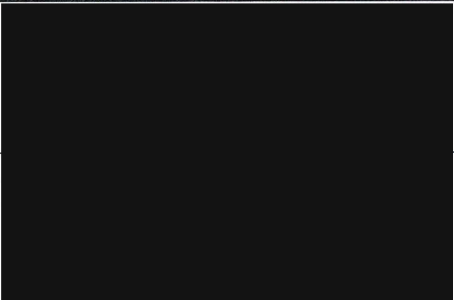
☒ Standard Spray Chamber



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

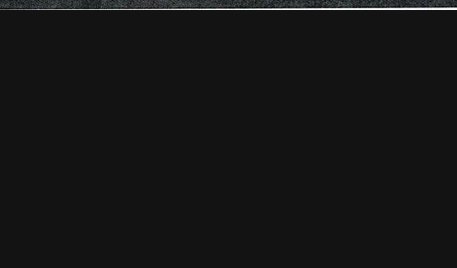
<i>Gas Flow Optimisation</i>	Pass	Fail	Remark
- Bleed gas lines (Relieve pressure in the spray chamber).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Ignitor (Ignite the flame several times to check ignition reliability. Replace the glow plug if required).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Extinguish (Check operation).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Horizontal movement (Check operation for STD. Spray Chamber).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Vertical movement (Check operation for STD. Spray Chamber).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Burner Adjuster (Check operation for ABR Spray Chamber)			
➤ Burner Angle (° C)	<input type="checkbox"/>	<input type="checkbox"/>	
➤ Angle Zero (mm)	<input type="checkbox"/>	<input type="checkbox"/>	
➤ Work head Height (mm)	<input type="checkbox"/>	<input type="checkbox"/>	
➤ Work head Centre (mm)	<input type="checkbox"/>	<input type="checkbox"/>	

Note:

Signature		
Customer :		Date : 7/10/24
Service Engineer :		Maintenance Date : 7/oct/2024

Performance Verification	Specification	Actual Value	Pass	Fail	Remarks
1. Wavelength accuracy (optic calibration check).	Cu 324.75 nm \pm 0.2 nm	324.83 nm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
	Cs 852.10 nm \pm 0.2 nm	852.04 nm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
2. Slit width accuracy (0.2 nm ,0.5 nm,1.0 nm)	0.2 nm \pm 0.02 nm	324.752,46 / 324.960,46	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0.208 nm
	0.5 nm \pm 0.05 nm	324.60,50 / 325.13,50	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0.53 nm
	1.0 nm \pm 0.10 nm	324.38,46 / 325.42,46	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1.04 nm
3. EHT	<350V	318 V	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
4. Absorbance accuracy (absorbance calibration check). ➤ Gauze 0.49 A.U.	Reading \pm 10% of calibrated value.	0.4909 Abs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	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: -0.0000 Abs BC on without gauze: 0.0002 Abs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
6. Sensitivity /noise flame test (aqueous Cu solution test under air-acetylene flame).	Cu 5 ppm >0.7 A.U.	0.8421 Abs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
	<0.5% RSD	0.39 %RSD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A

Note:

Signature			
Customer :		Date :	7/10/24
Service Engineer :		Maintenance Date :	7/Oct/2024

This is to certify that

Niwat Supatanit

From

**DKSH Technology Limited
Thailand**

has successfully completed GBC Service
Training including hardware and software training,
installation and repair on the following instruments:

AAS Instruments and Accessories
UV-Vis Instruments and Accessories
ICP-OES Quantima and Accessories

Introduction to:

ICP-TOFMS OptiMass
High Performance Liquid Chromatography
X-ray Equipment Emma

Training conducted in Penang, Malaysia
From 22 July to 2 August 2019



GBC Scientific Equipment Pty Ltd

Certificate of Conformance

This is to certify that the gauze membrane serial number: F104

Reads a value of: 0.49 A.U. at a wavelength of **440 nm**, using a

GBC Cintra serial number V 4331 referenced to a NIST neutral

density filter: 8661/SRM 930D (1210).

Valid for 12 months from date of issue.

Date: 22/03/2024

Operator: 

GBC Scientific
Equipment Pty Ltd
A.C.N. 008 472 686
A.B.N. 30 005 472 686

4 Lakewood Boulevard
PO Box 1135
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gbc@gbcscl.com



01-1026-00

Supelco®

www.sigmaaldrich.com

Certified Reference Material Reference material certificate

Copper Standard for AAS

TraceCERT®
Traceable Certified Reference Materials

Product no.: 38996
Lot no.: BCCH9264
Description of CRM: Copper metal (pure material) in 2% HNO₃ (prepared with HNO₃ suitable for trace analysis and high-purity water, 18.2 MΩ·cm, 0.22 µm filtered).
Expiry date: JUN 2025
Storage: Store at 5°C-25°C
Density (certified) at 20°C: 1011.3 kg m⁻³ ± 0.5 kg m⁻³

Constituent	Certified values at 20°C and expanded uncertainties, $U = k \cdot u$ ($k = 2$) [1][2]			
Copper	989	mg kg ⁻¹	± 4	mg kg ⁻¹
	1000	mg L ⁻¹	± 4	mg L ⁻¹

Metrological traceability: Certified values are traceable to the International System of units (SI) through a metrologically valid weighing process. Details see "Details on metrological traceability".^[3]

Measurement method: The certified value is determined by high-precision weighing of thoroughly characterized starting materials and verified by measurement against NIST SRMs or similar CRMs in accordance with ISO/IEC 17025.^[4]

Intended use: Calibration of AAS, ICP, spectrophotometry or any other analytical technique.

Instructions for handling and correct use: The bottle's temperature must be 20°C. Shake well before every use. If storage of a partially used bottle is necessary (at the user's risk), the cap should be tightly sealed and the bottle should be stored at reduced temperature (e.g. refrigerator) to minimize transpiration rate.

Health and safety information: Please refer to the Safety Data Sheet for detailed information about the nature of any hazard and appropriate precautions to be taken.

Packaging: 250 mL HDPE bottle

Accreditation: Sigma-Aldrich Production GmbH is accredited by the Swiss Accreditation Service SAS as reference material producer under no. SRMS 0001 in accordance with international standard ISO 17034^[5]

Certificate issue date: 29 JUL 2022



ISO 17034
SRMS 0001



fficer

Sigma-Aldrich Production GmbH, Industriestrasse 25, 9471 Buchs, Switzerland;
 Tel +41-81-755-2511; Fax +41-81-756-5449; www.sigmaaldrich.com
 Sigma-Aldrich Production GmbH is a subsidiary of Merck KGaA, Darmstadt, Germany.

Certificate Page 1 of 3

Certificate version 01



Certification process details:

To guarantee top reliability of the values for this **TraceCERT®** certified reference material, three independent procedures were followed. The values have to agree in the range of their uncertainties, but the value from the gravimetric preparation has been chosen as certified value ^[3]:

1. Gravimetric preparation using pure materials is a practical realization of concentration units, through conversion of mass to amount of substance ^[3]. If the purity of the materials is demonstrated and if contamination and loss of material is strictly prevented this approach allows highest accuracy and small uncertainties. The certified value of this **TraceCERT®** reference material is based on this approach and directly traceable to the SI unit kilogram. Therefore comprehensively characterized materials of high purity are used. All balances are calibrated annually by an ISO/IEC 17025 accredited laboratory and certified according to DKD guidelines. Calibration is checked daily with OIML Class E2 or F2 weights.
2. The starting material is measured against a certified reference material (i.e. NIST or BAM) followed by gravimetric preparation using balances calibrated with SI-traceable weights. Consequently the value calculated by this unbroken chain of comparisons is traceable to the reference to which the starting material is compared.
3. Whenever applicable the bottled **TraceCERT®** calibration solution is compared to a second reference which is independent from the first reference.

Details on metrological traceability:

Only internationally accepted reference materials e.g. from NIST (USA) or BAM (Germany) have been carefully selected to provide the basis for traceability to the SI unit mole. When no such reference is available, an elemental metal or an adequate salt of highest available purity is used to confirm traceability to this pure material (and therefore to the SI unit kg).

To underpin the certified gravimetric value all traceability measurements are performed with the most accurate and precise analytical technique available. Therefore titrimetry measurement series are applied whenever possible (corrected for trace impurities). When no titrimetric technique is available, the traceability measurements are performed with another analytical technique, e.g. ICP-OES or AAS.

Reference and applied technique used for traceability measurements of the

starting material: NIST SRM 728 / complexometric titration

bottled solution: BAM 365 / complexometric titration

Details on starting materials:

For high purity materials ($P > 99.9\%$) the most appropriate way of purity determination is to quantify the impurities (w_i) and to subtract the sum from 100%. Impurities below the detection limit are considered with a contribution of half of the detection limit (DL_i).

$$P = 100\% - \sum_i w_i - \sum_i \left(\frac{DL_i}{2} \right)$$

Water containing materials were dried to absolute dryness by individual drying conditions (up to 600°C). When drying is impossible due to decomposition water was determined by high-precision KF-titration.

Homogeneity assessment:

Due to the production process, a homogeneous solution derives. Nevertheless a small homogeneity contribution is included into the calculation of content uncertainty of this CRM.

Density Measurement:

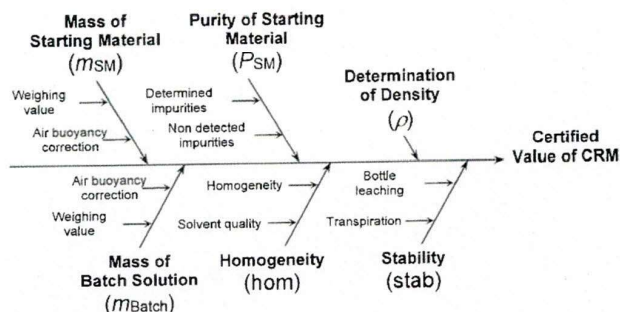
The density measurement is carried out in accordance with ISO/IEC 17025^[4] and ISO 15212-1^[6] using the digital density meter DMA 4500M from Anton Paar with an oscillating U-tube installed. The measurement uncertainty is calculated according to Eurachem/CITAC Guide and reported as combined expanded uncertainty at the 95% confidence level, using a coverage factor of $k = 2$.

Uncertainty evaluation:

The uncertainty contributions are illustrated by the following cause-effect diagram [7]:

Typical relative contributions are:

$u(m_{SM})$	< 0.01 %
$u(m_{Batch})$	< 0.01 %
$u(P_{SM})$	< 0.05 %
u_{hom}	< 0.03 %
u_{stab}	< 0.17 %
$u(\rho)$	< 0.05 %



The combined standard uncertainty is calculated by combination of the standard uncertainties of the input estimates according to Eurachem/CITAC Guide "Quantifying Uncertainty in Analytical Measurement" and ISO 17034.[2][5]

Expanded uncertainty is then calculated to a confidence level of 95%, typically by multiplying with a confidence level factor of $k=2$.

References:

- [1] ISO Guide 35:2017, "Reference materials - Guidance for characterization and assessment of homogeneity and stability"
- [2] Eurachem/CITAC Guide, 3rd Ed. (2012), "Quantifying uncertainty in analytical measurement"
- [3] Eurachem/CITAC Guide, 2nd Ed. (2019), "Metrological Traceability in chemical measurement"
- [4] The accredited testing laboratory STS 0490 performs the measurements and weighing steps for the certification of this CRM under ISO/IEC 17025:2017, "General requirements for the competence of testing and calibration laboratories"
- [5] ISO 17034:2016, "General requirements for the competence of reference material producers"
- [6] DIN EN ISO 15212-1:1998, Oscillation-type density meters - Part 1: Laboratory instruments
- [7] Reichmuth, A., Wunderli, S., Weber, M., Meyer, V. R. (2004), "The uncertainty of weighing data obtained with electronic analytical balances", Microchimica Acta 148: 133-141.

Certificate of analysis revision history:

Certificate version	Certificate issue date	Reason for version
01	29 JUL 2022	Initial version

Disclaimer:

The purchaser must determine the suitability of this product for its particular use. Sigma-Aldrich Production GmbH makes no warranty of any kind, express or implied, other than its products meet all quality control standards set by Sigma-Aldrich Production GmbH. We do not guarantee that the product can be used for a special application.

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The life science business of Merck KGaA, Darmstadt, Germany operates as MilliporeSigma in the US and Canada.



PREVENTIVE MAINTENANCE REPORT

Avio200

Customer : <u>Environment & Laboratory Co.,Ltd</u> Address : <u>40 Soi Liangmueangnonthaburi 13</u> <u>Talad Kwan Mueang,</u> <u>Nonthaburi 11000</u> User Name: <u> </u> Phone: <u> </u> Fax: <u> </u>	Date Tested: <u>October 16, 2024</u> Recommendation Recertification Period <u>12</u> Recertification Due <u>October 16, 2025</u> Date Last Certified: <u>October 16, 2023</u> Visit Number: <u>1 of 1</u> PerkinElmer Phone <u>02-719-6420 ext 206</u> PerkinElmer Fax: <u>02-318-5597</u>
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CONFIGURATION TESTED

MODEL	SERIAL NUMBER	
<u>Avio200</u>	<u>079S16062402</u>	
<u> </u>	<u> </u>	

TESTED EQUIPMENT	CALIBRATION NUMBER	
<u>IPV Methods</u>	<u> </u>	

TEST STANDARD USED	PART NUMBER	
<u>Mixed standard 1/10</u>	<u>N069-1579</u>	
<u>Mixed standard 1/100</u>	<u>N930-0221</u>	

CUSTOMER SUPPLIED	COMMENTS	
<u>2 % HNO3</u>	<u> </u>	
<u>10 % HNO3</u>	<u> </u>	

ACCESSORIES/COMPONENT NOT INCLUDED

Syngistix 2.0.0.2236

EXPIRATION

EXPIRATION DATE		
<u>JUN 30, 2025</u>	<u> </u>	
<u>NOV 30, 2024</u>	<u> </u>	

CUSTOMER INITIALS

PREVENTIVE MAINTENANCE REPORT

Avio200

SERIAL NUMBER : 079S16062402DATE TESTED : October 16, 2024**1. MECHANICAL CHECKS**

A. Inspect and clean all fans and filters.

☐ OK

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

☐ OK

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

☐ OK

D. Adjust water and gas pressure regulator settings.

☐ OK

E. Inspect and leak check pneumatics drawers.

☐ OK

F. Clean the exterior of the instrument.

☐ OK**2. OPTICAL CHECKS**

A. Inspect and clean all optical components.

☐ OK

B. As required, check and replace all purgebfilters.

☐ OK

C. Recheck optical alignment.

☐ OK**3. COOLING SYSTEM CHECKS**

A. Perform preventive maintenance on chiller.

☐ OK

B. Flush out the chiller every six months.

☐ OK**4. PERFORMANCE CHECKS**

A. Torch View Alignment.

☐ OK

B. Wavelength Calibration.

☐ OK

PREVENTIVE MAINTENANCE REPORT

Avio200

SERIAL NUMBER : 079S16062402

DATE TESTED : October 16, 2024

PARAMETER	SPECIFICATION			FINAL VALUE
Spectral Resolution : UV	As 193.696 nm	≤ 0.009		0.00726
	Ni 231.604 nm	≤ 0.011		0.00923
	Ni 341.476 nm	≤ 0.015		0.01321
Spectral Resolution : VIS	Ba 455.403 nm	≤ 0.020		0.01693
Precision				
	Zn 206.200 nm	% RSD ≤ 1.0		0.34
	Mg 280.271 nm	% RSD ≤ 1.0		0.32
	Mg 285.213 nm	% RSD ≤ 1.0		0.36
	Ba 455.403 nm	% RSD ≤ 1.0		0.39
Detection Limits : Axial	As 193.696 nm	3(SD) ppb		63.71
	Se 196.026 nm	3(SD) ppb		8.95
	Tl 190.801 nm	3(SD) ppb		3.13
	Pb 220.353 nm	3(SD) ppb		0.63
Detection Limits : Radial	As 193.696 nm	3(SD) ppb		10.24
	Zn 213.857 nm	3(SD) ppb		9.08
	Mn 257.610 nm	3(SD) ppb		4.98
	La 379.478 nm	3(SD) ppb		3.50
	Ba 455.403 nm	3(SD) ppb		0.70
	Ba 493.408 nm	3(SD) ppb		5.16
BEC : Axial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 30 ppb		0.88
BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 30 ppb		2.08

PREVENTIVE MAINTENANCE REPORT

Avio200

SERIAL NUMBER : 079S16062402DATE TESTED : October 16, 2024**Remarks :**Commissioning follow as commissioning performance sheets.Found As, Ba, Mn, Zn, blank has high intensity with analysis air - need to replace new Injector and torch

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.

Authorized Representative : _____


Customer Support Engineer



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3000-29 FAX.0-2719-9484



Certificate of Calibration

Cert.No.: 25CG465

Page.: 1 of 2

Equipment :	Burette
Capacity :	50 mL
Serial No. :	-
ID. No. :	BUR-001
Manufacturer :	Witeg
Made in :	Germany
Submitted by :	Environment & Laboratory Co.,Ltd. 40 Soi Liangmueangnonthaburi 13 Talad Kwan, Mueang, Nonthaburi 11000
Ambient Temperature :	(20 ± 2.5) °C
Relative Humidity :	(50 ± 10) %
Barometric Pressure :	756 mmHg
Calibration Procedure :	ASTM E 542 - 01
Calibrated by :	N [Redacted]
Approved by :	[Redacted] Approved Signatory
(✓) Srisuda Khamtha	
() Ponpan Paipim	
Issue Date :	6 February 2025

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.



Equipment : Burette
Received Date : 4 February 2025
Condition As-Received : Used Item
Calibration Date : 6 February 2025
Reference : 2502-0076DC-6

Cert.No.: 25CG465

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

<u>Instruments</u>	<u>Model</u>	<u>Serial No.</u>	<u>ID. No.</u>	<u>Certificate No.</u>	<u>Traceability</u>	<u>Due date</u>
1) Balance	XP205DR	1126143764	140RC004	24MM602/1	TPA	17 Sep 2025
2) Thermo-Hygrograph	THDX-CE	00016540	140EC001	24H1153	TPA	10 June 2025
3) Thermometer	-	1594592	140EC010	24I175	TPA	20 Feb 2025

This certification is traceable to SI Unit

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

3. True value is converted to true volume at the standard temperature of 20 °C

Calibration result :

Nominal capacity (mL)	Reading (mL)	Uncertainty (± mL)	k Factor
50	49.9874	0.010	2.00

Remark mL = cm³

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-