

ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือตรวจวัดและวิเคราะห์





JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd
63/14-15, 67/35-36
Petchkasem 7,7/1, Rd. Watthapra, Bangkokyai,
Bangkok 10600 (Thailand)
Tel: +6608680812
Mobile: +66863999453
E-mail: jnac-calibration@jiranatee.com
Web site: www.jiranatee.com

Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TISI-TIS 17025
CALIBRATION 0367

Flow measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : COF-044-68

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 : 06 Oct 2025
MEASUREMENT DATE : 24 Oct 2025
ISSUE DATE : 24 Oct 2025

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 23.2 °C and 55.1 %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-0016-25.

Uncertainty of Measurement:

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

Calibrated by:

☐

☒

Approved signatory:

Calibration Department Manager



JIRANATEE ASSOCIATES CO., LTD.

Continuation of Certificate of Calibration Number COF-044-68

Page 2 of 2 Pages

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	Y	Standard Flow [Q_s] m^3/min
1	0.703	755.993	23.03	22.14	49.505	1.164	1.079	0.660
2	1.001	755.939	23.01	22.15	36.073	2.458	1.569	0.958
3	1.119	755.877	22.74	22.00	30.417	3.136	1.773	1.079
4	1.168	755.833	22.73	22.09	28.439	3.437	1.856	1.129
5	1.412	755.797	22.66	22.17	18.047	5.182	2.279	1.383

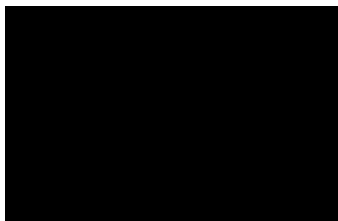
Slope (m): 1.65927
Intercept (b): -0.01732
Correlation coefficient (r): 0.99976
Uncertainty ($k=2$): 0.015 m^3/min

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	Y	Standard Flow [Q_s] m^3/min
1	0.703	755.993	23.03	22.14	49.505	1.164	0.675	0.659
2	1.001	755.939	23.01	22.15	36.073	2.458	0.981	0.956
3	1.119	755.877	22.74	22.00	30.417	3.136	1.108	1.077
4	1.168	755.833	22.73	22.09	28.439	3.437	1.160	1.126
5	1.412	755.797	22.66	22.17	18.047	5.182	1.424	1.380

Slope (m): 1.03929
Intercept (b): -0.01084
Correlation coefficient (r): 0.99976
Uncertainty ($k=2$): 0.015 m^3/min

End of Certificate of Calibration





THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0586

MTC No. EEL. BP. 51/0968

CALIBRATION CERTIFICATE

Submitted by : TNP ENVIROMENT 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 : 16 Sep. 2025

Date of Calibration : 6 Oct. 2025

1 / 2

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.

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0586

MTC No. EEL. BP. 51/0968

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	94.46	0.46	± 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	969.4	-30.6	± 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	1.60	± 0.60	$\pm 4.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Date of Calibration : 6 Oct. 2025

2 / 2

. 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.

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0586

MTC No. EEL. BP. 51/0968

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	114.41	0.41	± 0.10	± 0.75 dB

2. Frequency

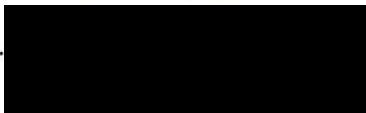
Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	965.3	-34.7	± 1.5	$\pm 2.0\%$

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	2.12	± 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 : 6 Oct. 2025

Date of Issue : 7 Oct. 2025

Ref : 2011268091603699001

End of Certificate

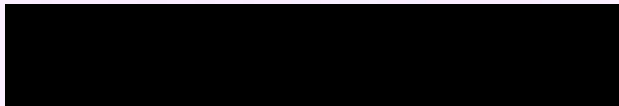
3 / 3

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.



SMART TECH CALIBRATION & SERVICES CO., LTD.



Certificate of Calibration

Certificate No. STCR-2503160-5

Work Order No. STCR-2503160

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 : 10340955
Control Number : TNP-F-S41
Received Date : Mar 22, 2025
Calibration Date : Mar 24, 2025
Recommended Due Date : Mar 24, 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

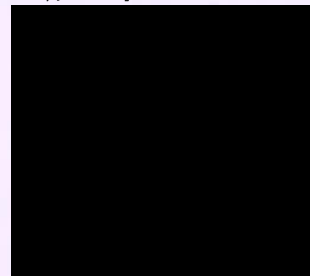
Calibration Result : See data attached

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 25, 2025

Approved by :

Calibrated by :



@smarttechcal

Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2503160-5

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	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-2503160-5

Page 3 of 3

UUC Range : (38 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	114.0 dB	-	0.07 dB	0.40 dB
SLOW	94.09 dB	94.0 dB	-	0.09 dB	0.40 dB
	114.07 dB	114.0 dB	-	0.07 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

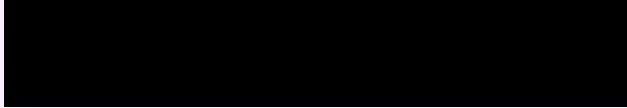
UUC = Unit Under Calibration

- End of Certificate -





SMART TECH CALIBRATION & SERVICES CO., LTD.



Certificate of Calibration

Certificate No. STCR-2503160-6

Work Order No. STCR-2503160

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 : 10340956
Control Number : TNP-F-S42
Received Date : Mar 22, 2025
Calibration Date : Mar 24, 2025
Recommended Due Date : Mar 24, 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

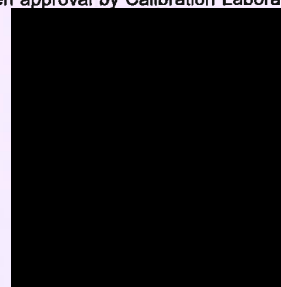
Calibration Result : See data attached

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 25, 2025

Approved by :

Calibrated by :



@smarttechcal

Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2503160-6

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-2503160-6

Page 3 of 3

UUC Range : (38 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	114.0 dB	-	0.07 dB	0.40 dB
SLOW	94.09 dB	94.0 dB	-	0.09 dB	0.40 dB
	114.07 dB	114.0 dB	-	0.07 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	93.9 dB	-	0.19 dB	0.40 dB
	114.07 dB	114.0 dB	-	0.07 dB	0.40 dB
SLOW	94.09 dB	93.9 dB	-	0.19 dB	0.40 dB
	114.07 dB	114.0 dB	-	0.07 dB	0.40 dB

STD = Standard

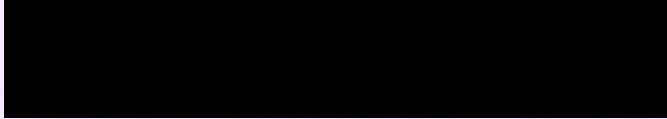
UUC = Unit Under Calibration

- End of Certificate -





SMART TECH CALIBRATION & SERVICES CO., LTD.



Certificate of Calibration

Certificate No. STCR-2502135-1

Work Order No. STCR-2502135

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 : ST11D
Serial Number : 821481
Control Number : TNP-F-S37
Received Date : Feb 26, 2025
Calibration Date : Feb 27, 2025
Recommended Due Date : Feb 27, 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

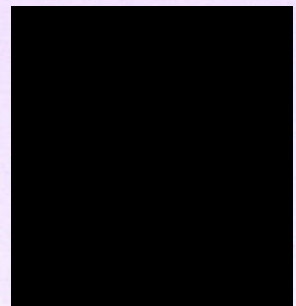
Calibration Result : See data attached

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 : Feb 28, 2025

Approved by :

Calibrated by :



@smarttechcal

Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2502135-1

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-2502135-1

Page 3 of 3

UUC Range : (27 to 140) 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	93.8 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	113.5 dB	113.9 dB	0.17 dB	0.40 dB
SLOW	94.09 dB	93.8 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	113.5 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	93.8 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	113.4 dB	113.9 dB	0.17 dB	0.40 dB
SLOW	94.09 dB	93.8 dB	94.0 dB	0.09 dB	0.40 dB
	114.07 dB	113.4 dB	113.9 dB	0.17 dB	0.40 dB

STD = Standard

UUC = Unit Under Calibration

- End of Certificate -





THAI METEOROLOGICAL DEPARTMENT

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 20 January, 2025

Certification No. 054/25

Page : 1 of 6

Object : Vantage Pro2 Weather Station

Manufacturer : Davis Instruments

Mode No. : 6152CM ID No. : TNP-F-W01

Mfg Code : Display BF200121006 Transmitter BF200121006

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 1011.6 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 : test

STANDARD BAROMETER : Digital Type PT

Calibrated by :

Mechanical Engineer



THAI METEOROLOGICAL DEPARTMENT



The Result of Calibration

Certification No. 054/25

20 January, 2025

Page : 2 of 6

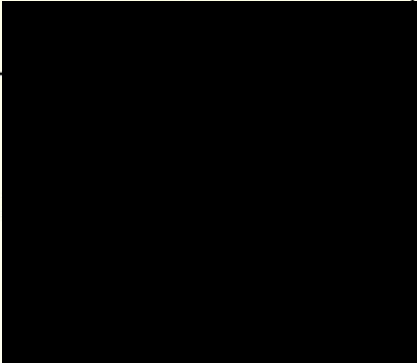
Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
Ultrasonic Anemometer	Pressure	Vacumm	Velocity	Velocity	Correction
m/sec	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	0.9	0.10
3.02	-	-	-	3.0	0.02
5.00	-	-	-	4.9	0.10
7.00	-	-	-	7.0	0.00
9.02	-	-	-	8.9	0.12
11.01	-	-	-	11.0	0.01
13.01	-	-	-	12.9	0.11
15.01	-	-	-	15.0	0.01
17.02	-	-	-	16.9	0.12
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	

Calibrated by :



Mechanical Engineer





THAI METEOROLOGICAL DEPARTMENT

The Result of Calibration

Certification No. 054/25

20 January, 2025

Page : 3 of 6

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
1013.70	1014.8	-1.10
1014.91	1016.0	-1.09
1014.64	1015.8	-1.16
1015.33	1016.4	-1.07
1011.48	1012.4	-0.92
1012.20	1013.4	-1.20
1012.49	1013.6	-1.11
1013.53	1014.7	-1.17
1013.07	1014.1	-1.03
1013.91	1014.8	-0.89
1013.56	1014.7	-1.14
1010.69	1011.7	-1.01
1011.07	1011.9	-0.83
1011.24	1012.3	-1.06
1011.47	1012.6	-1.13
1011.65	1012.7	-1.05
1011.97	1012.9	-0.93
1012.25	1013.7	-1.45
1008.92	1010.0	-1.08
1011.11	1012.3	-1.19

Average

Calibrated by :

Mechanical Engineer



THAI METEOROLOGICAL DEPARTMENT

The Result of Calibration

Certification No. 054/25

20 January, 2025

Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.5	45.6	-0.1
30.2	30.2	0.0
15.6	15.7	-0.1

Calibrated by :

Mechanical Engineer



THAI METEOROLOGICAL DEPARTMENT



The Result of Calibration

Certification No. 054/25

20 January, 2025

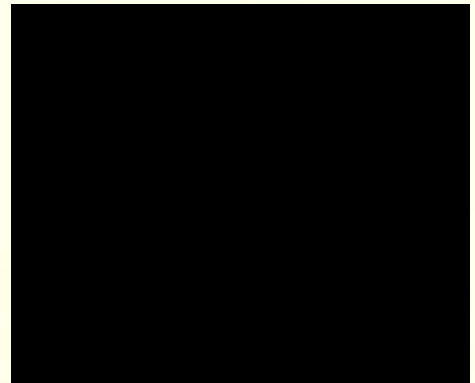
Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
48.2	49	-0.80
62.4	64	-1.60
93.5	96	-2.50

Calibrated by :



Mechanical Engineer





Date of Issue 20 January, 2025

Certification No. 054/25

Page: 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ยี่ห้อ Davis Instruments แบบ TIPPING BUCKET Product No. 6152CM Mfg. Code. BF200121006 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. : UM22200/UM22200
CLID. NO. : 252403052
JOB CONTROL NO. : 241227138135
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 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.

Calibrated By :

Calibration Engineer

Approved By :

Authorized Signatory

06 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. Q24138135

F3-011-05/12-23

page 1 of 1



REPORT OF CALIBRATION FOR

NOMENCLATURE : **VIBRATION METER**
MANUFACTURER : **INSTANTEL**
MODEL / TYPE : **721A2601/721A3301**
SERIAL NO. : **UM22200/UM22200**
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. Q24138135

F3-011-05/12-23

page 2 of 4



@clccalibration

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	10.277	-0.277	1.5
20	80 Hz		20.000	20.338	-0.338	1.5
30	80 Hz		30.000	30.403	-0.403	1.5
40	80 Hz		40.000	40.467	-0.467	1.5
50	80 Hz		50.000	50.558	-0.558	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	99	+1	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.

CLC

End of Certificate

Certificate No. Q24138135

F3-011-05/12-23

page 4 of 4





CERTIFICATE OF CALIBRATION

Certificate No. : 25-0753-026

Work Order No. : 25/0753

Issue Date : 12 June 2025

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

Date of Received : 12 June 2025

Date of Calibration : 12 June 2025

Instrument Details : Description : Electronic Balance
Manufacturer : sartorius
Model : SECURA224-1S
Serial No. : 0041305301
ID No. : TNP.LAB.31
Resolution : 0.0001 g
Capacity : 220 g
Location : ห้องปฏิบัติการ 2 ชั้น 3

Calibration Method : This calibration was conducted by using in-house method according to calibration procedure no. CWI-B-01 based on UKAS LAB14 edition 6, October 2019

Environmental Condition

Temperature : Maximum 25.6°C / Minimum 25.2°C
Humidity : Maximum 48%R.H. / Minimum 44%R.H.
Air Pressure : Maximum 999.3hPa / Minimum 999.2hPa

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 :

Calibration Engineer

Approved by :

Asst. Laboratory Manager

This certificate may not be reproduced other than in full except with the prior written approval of Crystal Calibration Sales and Service co., Ltd.





CERTIFICATE OF CALIBRATION

Certificate No. : 25-0753-026

Issue Date : 12 June 2025

Work Order No. : 25/0753

Details of Calibration

1. Reference Standards Instrument

Instrument	Capacity of Weight	Serial No. / ID No.	Certificate No.	Due date
Weight Set E2	1mg to 200g	B744909236	22-130801	6 December 2025

2. Certificate traceable : This certificate traceable to The International System of Unit refer to Asia Medical and Agricultural Laboratory and Research center Co., Ltd. , NSC-ONSC Calibration No. 0152

3. Condition of item : Used

4. Calibration site : On-site

Result of Calibration

1. Calibration result : Check performance before calibration

Applied Weight g	Balance Reading g	Correction Value g	Uncertainty ($\pm$) g	Coverage Factor (k)
100.0000	100.0000	0.0000	0.00019	2.00
200.0000	200.0000	0.0000	0.00032	2.00

2. The result of check performance in first step has to Reset span

3. Calibration result : After set span by Internal Calibration

3.1 Repeatability number of repeatability is 10 times

Normal Value (g)	Standard Deviation of Reading (g)
100	0.0000316
200	0.0000316

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%.



CERTIFICATE OF CALIBRATION

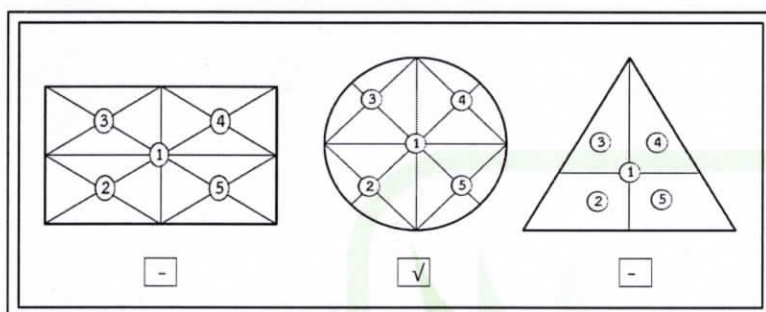
Certificate No. : 25-0753-026

Issue Date : 12 June 2025

Work Order No. : 25/0753

3. Calibration result : After set span by Internal Calibration (continued)

3.2 Eccentric or Off-center Error A mass of 100 g was placed and moved to various position on pan.



Result of Eccentric Error		
Position 1	100.0000	g
Position 2	100.0000	g
Position 3	100.0000	g
Position 4	99.9999	g
Position 5	100.0000	g
(Maximum Difference)	0.0001	g

3.3 Departure of indication from nominal value

Applied Weight g	Balance Reading g	Correction Value g	Uncertainty (±) g	Coverage Factor (k)
Unload	0.0000	0.0000	0.000090	2.00
0.1000	0.1000	0.0000	0.000090	2.00
0.5000	0.5000	0.0000	0.000090	2.00
1.0000	1.0000	0.0000	0.000090	2.00
5.0000	5.0000	0.0000	0.000090	2.00
10.0000	10.0000	0.0000	0.00010	2.00
20.0000	20.0000	0.0000	0.00010	2.00
50.0000	50.0000	0.0000	0.00012	2.00
100.0000	100.0000	0.0000	0.00019	2.00
200.0000	200.0000	0.0000	0.00032	2.00

Note

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%.



Statements of conformity report

Refer to Certificate No. : 25-0753-026

Issue Date : 12 June 2025

Work Order No. : 25/0753

Detail of Equipment

Description : Electronic Balance

Manufacturer : sartorius

ID No. : TNP.LAB.31

Model : SECURA224-1S

Resolution : 0.0001 g

Serial no. : 0041305301

Capacity : 220 g

Result of Calibration

This result of calibration : Adjustment

Unit : g

Applied Weight	Balance Reading	Correction Value	Uncertainty	Uncertainty + Correction	Limit of performance	Evaluation
0.1000	0.1000	0.0000	0.000090	0.000090	0.00016	Pass
0.5000	0.5000	0.0000	0.000090	0.000090	0.00016	Pass
1.0000	1.0000	0.0000	0.000090	0.000090	0.00016	Pass
5.0000	5.0000	0.0000	0.000090	0.000090	0.00016	Pass
10.0000	10.0000	0.0000	0.00010	0.00010	0.00017	Pass
20.0000	20.0000	0.0000	0.00010	0.00010	0.00017	Pass
50.0000	50.0000	0.0000	0.00012	0.00012	0.00019	Pass
100.0000	100.0000	0.0000	0.00019	0.00019	0.00026	Pass
200.0000	200.0000	0.0000	0.00032	0.00032	0.00039	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 NATA User checks and maintenance of laboratory balances consider expanded measurement uncertainty ($k=95\%$)

The tolerance and decision rules ;

Limit of performance (LoP) = $2.26 \text{ sw} + |\text{Corr}| + U(\text{Cal})$ Evaluation of decision = Measurement uncertainty + Absolute correction ; $\leq \text{LoP}$ is pass , $> \text{LoP}$ is Fail

Statements of conformity decision by : _____

Asst. Laboratory Manager



CERTIFICATE OF CALIBRATION

Certificate No. : 25-0753-025

Work Order No. : 25/0753

Issue Date : 12 June 2025

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

Date of Received : 12 June 2025

Date of Calibration : 12 June 2025

Instrument Details : Description : Electronic Balance
Manufacturer : SHIMADZU
Model : AP225WD
Serial No. : D316301848
ID No. : TNP.LAB.30
Resolution : 0.00001 g / 0.0001 g
Capacity : 102 g / 220 g
Location : ห้องปฏิบัติการ 2 ชั้น 3

Calibration Method : This calibration was conducted by using in-house method according to calibration procedure no. CWI-B-01 based on UKAS LAB14 edition 6, October 2019

Environmental Condition

Temperature : Maximum 25.5°C / Minimum 25.2°C
Humidity : Maximum 48%R.H. / Minimum 45%R.H.
Air Pressure : Maximum 999.2hPa / Minimum 999.1hPa

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 :

Calibration Engineer

Approved by :

Asst. Laboratory Manager

This certificate may not be reproduced other than in full except with the prior written approval of Crystal Calibration Sales and Service co., Ltd.





CERTIFICATE OF CALIBRATION

Certificate No. : 25-0753-025

Issue Date : 12 June 2025

Work Order No. : 25/0753

Details of Calibration

1. Reference Standards Instrument

Instrument	Capacity of Weight	Serial No. / ID No.	Certificate No.	Due date
Weight Set E2	1mg to 200g	B744909236	22-130801	6 December 2025

2. Certificate traceable : This certificate traceable to The International System of Unit refer to Asia Medical and Agricultural Laboratory and Research center Co., Ltd. , NSC-ONSC Calibration No. 0152

3. Condition of item : Used

4. Calibration site : On-site

Result of Calibration

1. Calibration result : Check performance before calibration

Applied Weight g	Balance Reading g	Correction Value g	Uncertainty ($\pm$) g	Coverage Factor (k)
50.00005	50.00009	-0.00004	0.000080	2.00
99.99996	100.00004	-0.00008	0.00016	2.00
200.0000	200.0007	-0.0007	0.00032	2.00

2. The result of check performance in first step has to Reset span

3. Calibration result : After set span by External Reset span by weight 100 g ID No. WE2-02

3.1 Repeatability number of repeatability is 10 times

Normal Value (g)	Standard Deviation of Reading (g)
50	0.00000480
100	0.00000480
200	0.0000422

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%.



CERTIFICATE OF CALIBRATION

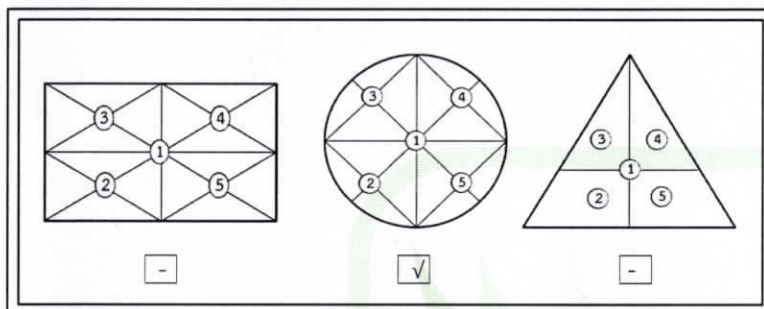
Certificate No. : 25-0753-025

Issue Date : 12 June 2025

Work Order No. : 25/0753

3. Calibration result : After set span by External Reset span by weight 100 g ID No. WE2-02 (continued)

3.2 Eccentric or Off-center Error A mass of 100 g was placed and moved to various position on pan.



Result of Eccentric Error		
Position 1	99.99997	g
Position 2	100.00001	g
Position 3	100.00002	g
Position 4	99.99999	g
Position 5	99.99998	g
(Maximum Difference)	0.00005	g

3.3 Departure of indication from nominal value

Applied Weight g	Balance Reading g	Correction Value g	Uncertainty (±) g	Coverage Factor (k)
Unload	0.00000	0.00000	0.000020	2.00
0.10001	0.10001	0.00000	0.000020	2.00
0.50001	0.50003	-0.00002	0.000020	2.00
1.00001	1.00000	0.00001	0.000020	2.00
5.00002	5.00001	0.00001	0.000020	2.00
10.00001	10.00001	0.00000	0.000040	2.00
19.99999	19.99997	0.00002	0.000050	2.00
50.00005	50.00005	0.00000	0.000080	2.00
99.99996	99.99997	-0.00001	0.00016	2.00
200.0000	200.0000	0.0000	0.00032	2.00

Note

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%.



Statements of conformity report

Refer to Certificate No. : 25-0753-025

Issue Date : 12 June 2025

Work Order No. : 25/0753

Detail of Equipment

Description : Electronic Balance

Manufacturer : SHIMADZU

ID No. : TNP.LAB.30

Model : AP225WD

Resolution : 0.00001 g / 0.0001 g

Serial no. : D316301848

Capacity : 102 g / 220 g

Result of Calibration

This result of calibration : Adjustment

Unit : g

Applied Weight	Balance Reading	Correction Value	Uncertainty	Uncertainty + Correction	Limit of performance	Evaluation
0.10001	0.10001	0.00000	0.000020	0.000020	0.000051	Pass
0.50001	0.50003	-0.00002	0.000020	0.000040	0.000051	Pass
1.00001	1.00000	0.00001	0.000020	0.000030	0.000051	Pass
5.00002	5.00001	0.00001	0.000020	0.000030	0.000051	Pass
10.00001	10.00001	0.00000	0.000040	0.000040	0.000071	Pass
19.99999	19.99997	0.00002	0.000050	0.000070	0.000081	Pass
50.00005	50.00005	0.00000	0.000080	0.000080	0.00011	Pass
99.99996	99.99997	-0.00001	0.00016	0.00017	0.00019	Pass
200.0000	200.0000	0.0000	0.00032	0.00032	0.00035	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 NATA User checks and maintenance of laboratory balances consider expanded measurement uncertainty (k=95%)

The tolerance and decision rules ;

Limit of performance (LoP) = $2.26 \text{ sw} + |\text{Corr}| + U(\text{Cal})$ Evaluation of decision = Measurement uncertainty + Absolute correction ; $\leq \text{LoP}$ is pass , $> \text{LoP}$ is Fail

Statements of conformity decision by :

Asst. Laboratory Manager

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 : 7-Oct-2024

Signatory : 

PREVENTIVE MAINTENANCE AND PERFORMANCE VERIFICATION REPORT

ATOMIC ABSORPTION SPECTROPHOTOMETER (AAS)

Issued Date: 7/10/24

Customer : บริษัท เ็นไวรอนเม้นท์ แอนด์ แลบลอราตอรี จำกัด
Address : 40 ซอย เลี้ยวเมืองนนทบุรี 13 ตำบลตลาดขวัญ อำเภอ
 เมือง จังหวัดนนทบุรี 11000
Contract : XXXXXXXXXX

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

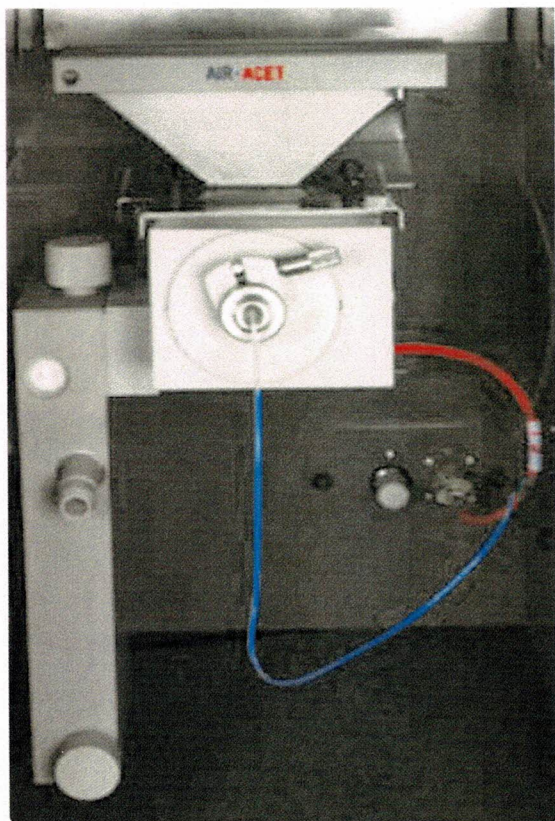
Power on switch and initial status

Instrument Ready สถานะเครื่องพร้อมใช้งาน

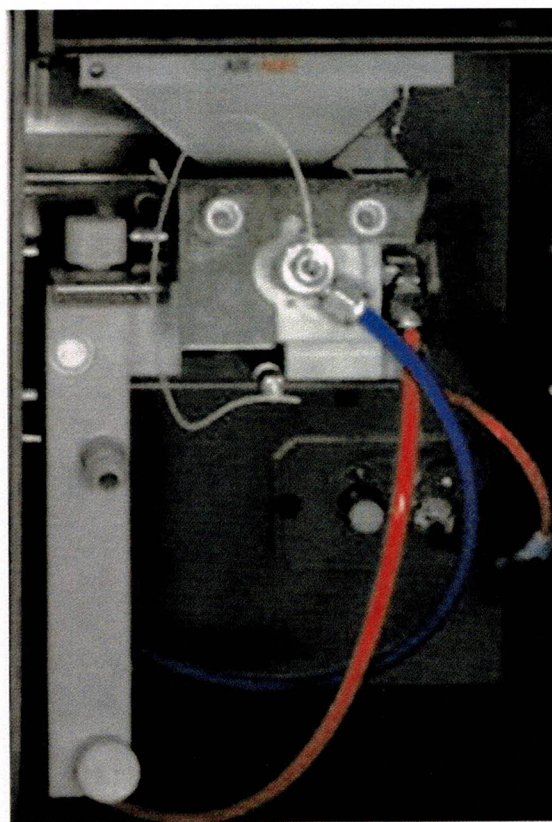
Preventive Maintenance	Pass	Fail	Remarks
Electrical Voltage			
- Main voltage (power supply check 220V $\pm$ 10V).	☒	☐	218.9 VAC
- Power indicator light (Replace if faulty).	☒	☐	N/A
- Power core (Clean or replace as appropriate).	☒	☐	N/A
- Fan (Clean or replace filter element as appropriate).	☒	☐	N/A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

Spray Chamber Type

☐ ABR Spray Chamber



☒ Standard Spray Chamber



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

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

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	☒	☐	N/A
	Cs 852.10 nm $\pm$ 0.2 nm	852.04 nm	☒	☐	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	☒	☐	0.208 nm
	0.5 nm $\pm$ 0.05 nm	324.60,50 / 325.13,50	☒	☐	0.53 nm
	1.0 nm $\pm$ 0.10 nm	324.38,46 / 325.42,46	☒	☐	1.04 nm
3. EHT	<350V	318 V	☒	☐	N/A
4. Absorbance accuracy (absorbance calibration check). ➤ Gauze 0.49 A.U.	Reading $\pm$ 10% of calibrated value.	0.4909 Abs	☒	☐	N/A
5. Background correction (optics alignment check). difference between measurement with and without 0.49 A.U. gauze for 10 samples.	SavantAA <1% SensAA/XplorAA <2%	BC on with gauze: -0.0000 Abs BC on without gauze: 0.0002 Abs	☒	☐	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	☒	☐	N/A
	<0.5% RSD	0.39 %RSD	☒	☐	N/A

Note:

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

This is to certify that



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



CEO



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: [REDACTED]

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

4 Lakewood Boulevard
PO Box 1135
Braeside VIC 3195
Australia

Telephone
(03) 9588 6666
International
+61 3 9588 6666

Visionary Technology
www.gbcsi.com
gbc@gbcsi.com



01-1295-00

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



CRM Operations



Approving Officer

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_j).

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

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:

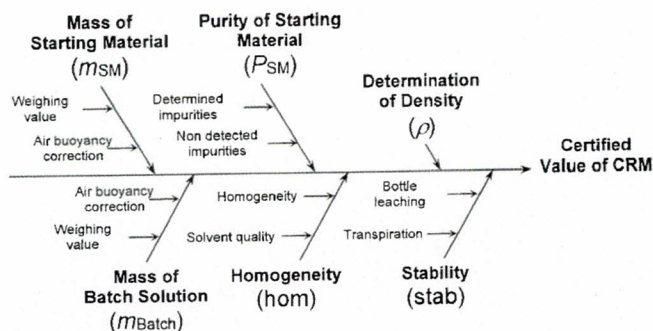
The density measurement is carried out in accordance with ISO/IEC 17025^[4] and ISO 15212-1^[6] using the digital density meter DMA 4500M from Anton Paar with an oscillating U-tube installed. The measurement uncertainty is calculated according to Eurachem/CITAC Guide and reported as combined expanded 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.

The vibrant M, Supelco, and Sigma-Aldrich are trademarks of Merck KGaA, Darmstadt, Germany or its affiliates. Detailed information on trademarks is available via publicly accessible resources.
© 2018 Merck KGaA, Darmstadt, Germany and/or its affiliates. All Rights Reserved.

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>
---	---

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED
MODEL	SERIAL NUMBER	
<u>Avio200</u>	<u>079S16062402</u>	<u>Syngistix 2.0.0.2236</u>
TESTED EQUIPMENT	CALIBRATION NUMBER	EXPIRATION
<u>IPV Methods</u>		
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
<u>Mixed standard 1/10</u>	<u>N069-1579</u>	<u>JUN 30, 2025</u>
<u>Mixed standard 1/100</u>	<u>N930-0221</u>	<u>NOV 30, 2024</u>
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		

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

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



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 : [Redacted]

Approved by :

Approved Signatory

(✓) [Redacted]
() [Redacted]

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-