

ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือ

List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
1	Atomic Absorption Spectrometer	COPPER IRON ZINC	Agilent Technologies	AA240FS / MY13160001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	30/1/2025	29/1/2026
2	Analytical Balance	FAT OIL AND GREASE	Mettler Toledo	AB204-S/FACT / 1129361010	United Analyst and Engineering Consultant Co., Ltd.	250422 1 BL002 25	23/4/2025	22/4/2026
3	Analytical Balance	TOTAL DISSOLVED SOLIDS	Mettler Toledo	XSR205DU / C210685394	National Food Institute,Ministry of Industry, Thailand	2502226-002-01	20/3/2025	19/3/2026
4	Analytical Balance	TOTAL SUSPENDED SOLIDS	Mettler Toledo	XSR205DU / C009071872	National Food Institute,Ministry of Industry, Thailand	2502226-001-01	20/3/2025	19/3/2026
5	BOD Incubator	BIOCHEMICAL OXYGEN DEMAND	ARCO	UC4-1320 / 1021	Technology Promotion Association (Thailand-Japan)	25TM1001	7/7/2025	6/7/2026
6	DO Meter	BIOCHEMICAL OXYGEN DEMAND	YSI	5100 / 11B 101863	Technology Promotion Association (Thailand-Japan)	25TW29	17/2/2025	16/2/2026
7	Heating Block	CHEMICAL OXYGEN DEMAND	Hanna Instruments Italia Srl.	HI 839800-02 / H 018500 I	Hanna Instruments (Thailand) Ltd.	HIT-2510-0375	7/3/2025	6/3/2026
8	Hot Air Oven	TOTAL DISSOLVED SOLIDS TOTAL SUSPENDED SOLIDS	Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	25TM579	19/3/2025	18/3/2026
9	Kjeltec System Distilling Unit	TOTAL KJELDAHL NITROGEN	Foss Tecator (Labtec)	KT200 / 91790524	FOSS South East Asia	13319	27/1/2025	26/1/2026
10	Kjeltec Distillation Unit	TOTAL KJELDAHL NITROGEN	FOSS	Kjeltec 8100 / 91889052	FOSS South East Asia	13854	24/2/2025	23/2/2026
11	pH Meter	pH	Horiba	LAQUA-PH210 / HA9M0047	technology promotion association (thailand-japan)	25CH354	20/3/2025	18/3/2026
12	UV-VIS Spectrophotometer	NITRATE	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP25-001	3/1/2025	2/1/2026
13	UV/VIS Spectrophotometer	CHEMICAL OXYGEN DEMAND	Hitachi	U-5100 / 23A4-008	DQE Services Co.,Ltd.	SP25-024	17/6/2025	16/6/2026

Due Date of Calibration* : Based on the annual calibration plan. At least 1 time per year.



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.: 25CH354

Page.: 1 of 3

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA9M0047
ID No. : UAE.EFM.005/2563 (EFM.pH.05/63)
Condition As-Received: Used Item
Received Date : 18 March 2025
Calibration Date : 20 March 2025
Reference : 2503-0612WSC-2
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260

Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with DC voltage
standard and direct measurement with
certified reference material (CRM)
- CP-CH8 by comparison with temperature standard

Calibrated by : Uthen Kankawi

Approved by :

Saithip

Approved Signatory

- () Chakrit Waewwanjua
() Ponpan Paipim
(✓) Saithip Meangmai

Issue Date : 20 March 2025

The Uncertainties are for a confidence probability of approximately 95%

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

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Cert.No.: 25CH354

Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Document Process Calibrator	43160066	130RC092	24E1320	22 Apr 2025
2) Ref. Standard Thermometer	4982054	110RC044	24I757	14 Jul 2025

- This Certification is traceable to SI Through Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials :The measurement results are traceable to SI through Hach Lenge GmbH Ltd.,
Deutsche Akkreditierungsstelle, Accredited No.D-RM-15184-01-00
: The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
pH 4.007	CPA chem	1066665	18 Jan 2027
pH 6.999	Hach Lenge GmbH	C03220	29 Oct 2026
pH 10.010	CPA chem	1066669	18 Jan 2026

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

Calibration Results

Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (4,7)(7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor <i>k</i>
	pH	mV	mV	pH		
pH Meter S/N.: HA9M0047	4.00	177.48	177.7	4.01	0.058	2.00
	7.00	0.00	0.3	7.01	0.058	2.00
	7.00	0.00	0.3	7.01	0.058	2.00
	10.00	-177.48	-176.8	10.01	0.058	2.00

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Cert.No.: 25CH354

Page.: 3 of 3

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7)(7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (\pm)	Coverage factor k
pH Electrode S/N.: -	4.007	4.01	168.5	0.011	2.13
	6.999	7.00	-5.9	0.012	2.09
	6.999	7.00	-6.1	0.011	2.07
	10.010	10.02	-176.7	0.010	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : _____

- Serial No. : _____

Dimension of probe

- Length : 103 mm.

- Diameter : 16 mm.

- Immersion Depth : 90 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (\pm °C)	Coverage factor k
15.0	15.005	15.0	-0.005	0.13	2.00
30.0	30.007	30.0	-0.007	0.13	2.00
45.0	44.995	44.9	-0.095	0.13	2.00

Remark - 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 %.

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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.: 25TM579

Page : 1 of 3

Equipment : Hot Air Oven

Manufacturer : Memmert

Model : UF 55

Serial No. : B212.0411

ID No. : UAE.WAO.005/2556

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260

Location : Lab Floor 2

Received Order : 19 March 2025

Calibration Date : 19 March 2025

Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$

Relative Humidity : $(50 \pm 30) \%$

AC Line Voltage : $(220 \pm 22) \text{ V}$

Calibrated by : Man Pattanapongpaiboon

Kunchit

Approved by :

Approved Signatory

- () Chakrit Waewwanjua
() Suwit Imjai
(✓) Kunchit Promprat

Issue Date : 27 March 2025

The Uncertainties are for a confidence probability of approximately 95%

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

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Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2503-0437OC-3

Cert. No.: 25TM579

Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY44073381	24LM73	TPA	18 May 2025

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

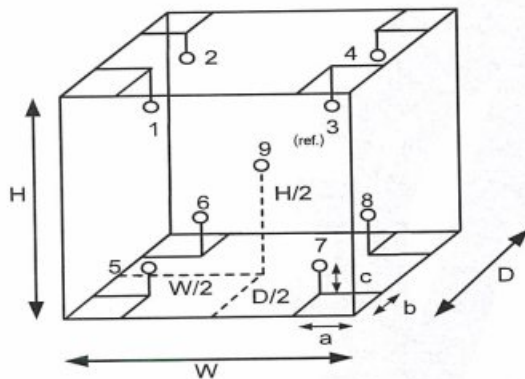
3. This certification is traceable to the International System of Unit.

Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	28
REL.Humid. (%)	49	55
AC Supply (Volt)	221	224

Ref. Std. ID No.: @ Calibration Point		
Position :	(120,180) °C	(104) °C
1	23-01TC-01	1RTD-2/1
2	23-01TC-02	1RTD-2/2
3	23-01TC-03	22-01RTD-03
4	23-01TC-04	1RTD-2/4
5	23-01TC-05	1RTD-2/5
6	23-01TC-06	1RTD-2/6
7	23-01TC-07	23-01RTD-07
8	23-01TC-08	1RTD-2/8
9 (ref.)	23-01TC-09	23-01RTD-09

Probe Installation Details :

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

Dimension of Chamber :

D = 0.50 m
W = 0.80 m
H = 0.75 m
Capacity = 0.30 m³



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2503-0437OC-3
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 25TM579

Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor <i>k</i>
104.0	104.0	104.0	0.040	0.43	0.78	2
120.0	120.0	120.0	0.64	1.3	1.6	2
180.0	180.0	180.0	0.49	1.5	1.8	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (±°C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	104.335	104.135	104.363	104.317	103.649	103.738	104.179	104.229	104.025	0.42
120.0	119.575	119.366	119.807	119.905	118.994	119.194	119.888	119.994	120.064	1.1
180.0	180.286	179.510	180.401	180.551	179.281	179.463	180.196	180.451	180.374	1.2

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

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

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

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

UUC* : Unit Under Calibration

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

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

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



Certificate of Calibration

Cert. No.: 25TM1001

Page : 1 of 3

Equipment : BOD Incubator
Manufacturer : ARCO
Model : UC4-1320
Serial No. : -
ID No. : UAE.WAO.018/2559
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Lab Floor 2
Received Order : 07 July 2025
Calibration Date : 07 July 2025
Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$
AC Line Voltage : $(220 \pm 22) \text{ V}$

Calibrated by : Man Pattanapongpaiboon

Approved by :

Approved Signatory

() Chakrit Waewwanjua
() Suwit Imjai
(✓) Kunchit Promprat

Issue Date : 17 July 2025

The Uncertainties are for a confidence probability of approximately 95%

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

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Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2507-0146OC-2
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 25TM1001

Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor <i>k</i>
20.0	20.0	19.9	0.18	0.60	0.83	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	20.202	19.900	20.390	20.077	20.111	20.044	20.275	20.173	19.835	0.38

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

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

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

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

UUC* : Unit Under Calibration

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

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

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

Certificate of Testing

Cert.No.: 25TW29
Page.: 1 of 2

Equipment : DO Meter
Manufacturer : YSI
Model : 5100
Serial No. : 11B 101863
ID No. : UAE.WAO.004/2554
Received Date : 14 February 2025
Test Date : 17 February 2025
Reference : 2502-0473DSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
Test Procedure : In - house method : CP-CH9
by Comparison Technique with Azide Modification Method
Tested by : Walalak Sirithean
Approved by : 
Approved Signatory
() Chakrit Waewwanjua
() Ponpan Paipim
(✓) Saithip Meangmai
Issue Date : 18 February 2025

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Cert.No.: 25TW29

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

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

<u>Instruments</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1. Burette	-	130BU10	23CG1172	22 Mar 2025
2. Balance	14233821	110RC001	24MM131	04 July 2025

2. Standard Material :-

<u>Material</u>	<u>Manufacturer</u>	<u>Lot.No.</u>	<u>Assay</u>
Sodium Thiosulfate 5-Hydrate AR	KEMAUS	2203162447	99.6%

Result : **Dissolved Oxygen Meter Adjustment With Air 100 %**
 Dissolved Oxygen Probe No.: 24F100202

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.22	8.22	0.0055

This report was certified only for the instrument we tested. It is allowable to use for study
Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced
other in full, without written approval of the laboratory

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สถาบันมาตรวิทยา

บันทึกผลการพวนสอบใบรับรองการสอบเทียบ (Verification of Certificate)

Certificate No. : 25TW29

Equipment : Do Meter

Brand : YSI

Model : 5100

Serial No. : 11B 101863

ID No. : UAE.WAO.004/2554

Calibration results

Titration Method	Standart Deviation (mg/L)	Do meter Reading (mg/L)	Error% (mg/L)	Correction% (mg/L)	Error Total Error (mg/L)	Judgement (± mg/L)	(Total Error < Judgement) (mg/L)
(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(± mg/L)	(mg/L)
8.22	0.0055	8.22	0.0000	0.0000	0.0	0.02	pass

ผู้บันทึก.....อัสรา บุญประกอบ.....

วันที่.....28/02/2025.....

ผู้ตรวจสอบ.....พริ้งพรหม.....

วันที่.....28 ก.พ. 68.....

หมายเหตุ :

...../.....

เป็นใบเพิ่ม.....

FOSS

FOSS South East Asia

3388 Sirinrat Building, 25th – 26th Floor, Unit No. 3388/90,
Rama IV Road, Klongton, Klongtoey, Bangkok, Thailand 10110

Customer Service Report

Report No.:

13319

Date:

Jan 27, 2025

Customer:

UAE

Job No.:

11675

Address:

Bangkok

Instrument:

KT200

Serial:

91790524

Travel To Customer (Hrs)

09.00

1

Labour (Hrs)

10.00

3

Travel From Customer (Hrs)

-

Start
Finish

10.00

13.00

-

Job Type

Application	Special	Standard
Distributor	Courtesy Visit	Installation
Digital Service	PMA Onboarding	Quote
Internal	Warranty	Repair
Investigate	Sales Support	Remote
		Training
		In House
		PM
		Health Check Visit

PMA Type

Smartcare

Smartcare Pro

Fosscore

Smartcare Advance

Fosscore Pro

N/A

Details of Work / Test

- PM -	
+ Visual Check	
- No leak	- ok
- have damage on heater & main switch	- not ok
+ replace heater & main switch	- ok
+ Visual PM kit	- ok
+ Function Check	
- Power on / off	- ok
- Alkali	- ok
- Steam	- ok
- Condenser	- ok
Water pump	- ok
Instrument Ready for Use	OK
	Not OK*

Part No:	Batch	Description	Qty
10069965	11-06-2024	FOSS PM kit KT200 boiler Analyser / 2100	1
10003512	29.03.2024	Heating element Steam	1
15630111	19.10.2022	Switch R595kit + 2 FA	1

I confirm this report is accurate and complete

Signed FOSS

Signed Customer

Name

Name

Email:

Customer Contact.:

*Remark:

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FOSS

FOSS South East Asia

3388 Sirinrat Building, 25th – 26th Floor, Unit No. 3388/90,
Rama IV Road, Klongton , Klongtoey, Bangkok, Thailand 10110

Customer Service Report

Report No.:

13854

Date:

24 February 2025

Customer:

VAE

Job No.:

11735

Address:

Bangkok

Instrument:

KT8100

Serial:

91889052

Start
Finish

Travel To Customer (Hrs)

07:00

09:00

2hrs

Labour (Hrs)

09:00-12:00

13:00-14:00

0hrs

Travel From Customer (Hrs)

15:00

17:00

2hrs

Job Type

Application		Special		Standard	
Distributor	<input checked="" type="checkbox"/>	Courtesy Visit	<input checked="" type="checkbox"/>	Installation	<input checked="" type="checkbox"/>
Digital Service	<input checked="" type="checkbox"/>	PMA Onboarding	<input checked="" type="checkbox"/>	Quote	<input checked="" type="checkbox"/>
Internal	<input checked="" type="checkbox"/>	Warranty	<input checked="" type="checkbox"/>	Repair	<input checked="" type="checkbox"/>
Investigate	<input checked="" type="checkbox"/>	Sales Support	<input checked="" type="checkbox"/>	Remote	<input checked="" type="checkbox"/>
				Training	<input checked="" type="checkbox"/>
				In House	<input checked="" type="checkbox"/>
				PM	<input checked="" type="checkbox"/>
				Health Check Visit	<input checked="" type="checkbox"/>

PMA Type

Smartcare

☒

Smartcare Pro

☒

Fosscore

☒

Smartcare Advance

☒

Fosscore Pro

☒

N/A

☒

Details of Work / Test

APM KT800 12MO

- test before PM
- cleaning KT800, 36 MO replace
- flushing Alkali pump
- test operation
 - Distillation 80 - 80 ml
 - Distillation 6 min 150-170ml
 - Alkali 50-60 ml
 - All pass

Instrument Ready for Use

OK

☒

Not OK*

☒

Part No:

Batch

Description

Qty

60031810

08-01-2024

FOSS PM kit KT800 36 MO

1

I confirm this report is accurate and complete

Signed FOSS



Signed Customer

Suphakorn P.

Name

Name

Email:

Customer Contact.:

*Remark:

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Please scan QR code



Certificate of Calibration

Certificate No.: 250422-1-BL002-25

Code No.: BL002-25

Page: 1 of 3

Customer Name: United Analyst and Engineering Consultant Co., Ltd.
Address: 3 Soi Udom suk 41, Sukhumvit Rd., Bang Chak, Phar Khanong, Bangkok 10260

Equipment: Electronic Balance
Manufacturer: Mettler Toledo
Model: AB204-S/FACT
Serial No.: 1129361010
Asset No. : UAE.WAS.002/2552

Building : N/A Floor : 1 Room : 107

Received Date: April 22, 2025

Date of Calibration : April 23, 2025

Calibration Conditions:	Temperature	22.8 °C	to	23.4 °C
	Humidity	54.8 %	to	68.9 %
	Pressure	756.6 mmHg	to	758.2 mmHg

Calibrated by: Sakkarin Srirahang

Approved by: Suwit Chotnok

Signature: 

Issued Date: April 25, 2025

Note : 1) The Uncertainties are for a confidence probability of approximately 95%

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

3) This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the United Analyst and Engineering Consultant Co.,Ltd. (UAE)

เอกสารไม่ควบคุม

Certificate No.: 250422-1-BL002-25

Code No.: BL002-25

Page: 2 of 3

Equipment: Electronic Balance

Manufacturer: Mettler Toledo

Model: AB204-S/FACT

Readability: 0.0001 g

Serial No.: 1129361010

ID No.: UAE.WAS.002/2552

Max. Capacity: 220 g

Calibration Date: April 23, 2025

Condition As-Received: In Condition

Condition of Equipment:

Condition of This Result of Calibration:

1. Calibration Method: This instrument was calibrated by method UAE.CP.CAL.006 In-House Method based on UKAS Lab 14 : 2022

2. Reference Standards:

Reference Standard:	Model	Serial No.	Calibrated By	Certificate No.	Traceability	Due Date
Standard Weight Class E2 (OIML)	1 mg to 1 kg	B749109122	AMARC	25-009359	Mettler-Toledo	21-Jan-27
Standard Weight Class F1 (OIML)	1 mg to 200 g	11119512	AMARC	24-013840	Mettler-Toledo	04-Feb-26
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Traceability	Due Date
Thermo-Hygro-Baro Meter	MHB-382SD	AK.46457	SUCCESS	SG-H-00997/67	Success Gateway	21-Nov-25
Thermo-Hygro-Baro Meter	MHB-382SD	AK.46457	TPA	25P795	TPA	25-Feb-26

3. This certification is traceable to SI Unit

4. This certification was certified only for the indtrument we calibrated

5. This result of calibration wae found accurate as show on date and place of calibration only.

6. Through the reference standard laboratory of AMARC 25-009359 Calibration 0152

Calibraton Result:

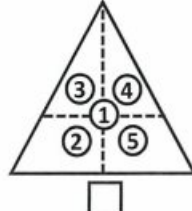
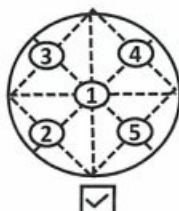
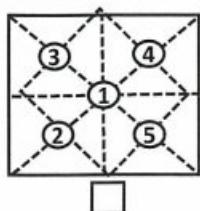
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
200*	0.000045

2. Eccentric or off-center loading

A mass of 100 g was placed and moved to various position on pan

The Balance reading obtained is given in the table.



1 (g)	2 (g)	3 (g)	4 (g)	5 (g)	Maximum Difference (g)
100.0000	99.9996	99.9997	100.0003	100.0005	0.0005

เอกสารไม่ควบคุม

Certificate No.: 250422-1-BL002-25

Code No.: BL002-25

Page: 3 of 3

Equipment: Electronic Balance

Model: AB204-S/FACT

Serial No.: 1129361010

Max. Capacity: 220 g

Calibration Date: April 23, 2025

Manufacturer: Mettler Toledo

Readability: 0.0001 g

ID No.: UAE.WAS.002/2552

Calibration Result: (Continued)

Calibration Range: 0 - 200 g

Calibration Adjustment: Internal Calibration

3. Error of indication from nominal or conventional mass value:

Nominal Value (g)	Reference Value (g)	Indication (g)	Correction (g)	Uncertainty (\pm mg)	Coverage Factor k
Unload	0.0000000	0.0000	0.0000	0.10	2.05
0.01	0.0100025	0.0099	0.0001	0.10	2.05
0.05	0.0500056	0.0500	0.0000	0.10	2.05
0.1	0.1000012	0.0999	0.0001	0.10	2.05
0.5	0.5000133	0.5000	0.0000	0.10	2.05
1	1.0000105	1.0000	0.0000	0.10	2.05
10	10.000010	10.0000	0.0000	0.11	2.04
40	40.000076	40.0000	0.0000	0.14	2.00
50	50.000056	50.0000	0.0001	0.13	2.00
80	80.000107	80.0000	0.0001	0.18	2.00
100	100.000109	99.9999	0.0002	0.17	2.00
120	120.00015	119.9999	0.0003	0.21	2.00
150	150.000165	149.9998	0.0003	0.24	2.00
160	160.000175	159.9997	0.0005	0.26	2.00
200	200.000129	199.9998	0.0004	0.30	2.00

4. Effect of Tare test:

Tare Load (g)	Test Load (g)	Indication (g)	Correction (g)
100	20.000041	19.9999	0.0001
	40.000076	39.9998	0.0002
	60.000066	59.9997	0.0003
	80.000107	79.9999	0.0002
	100.000168	100.0004	-0.0003

Remark:

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

เอกสารไม่ควบคุม



o---o-End-o---


Calibration Certificate

Certificate No.: 2502226-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhnong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Serial No.: C009071872
ID No.: UAE.WAO.012/2563
Order No.: 2502226
Operation No.: 2502226-001
Date of Receipt: 19 March 2025
Date of Calibration: 20 March 2025

Calibrated by Mr.Yothin Charoensuk
Scientist

Approved by 
(Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue: 25 March 2025

The uncertainties are for a confidence probability of approximately 95%

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65



Calibration Report

Certificate No.: 2502226-001-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR205DU

Resolution: 0.00001 g / 0.0001 g

Serial No.: C009071872

ID No.: UAE.WAO.012/2563

Capacity: 82 g / 220 g

Date of Calibration: 20 March 2025

Page 2 of 4

Environment Condition: Ambient Temperature: 21.2 ± 0.6 °C Relative Humidity: 48 ± 3.5 %

Place of Calibration: 208 Balance Room, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	B505567572	TCS	M2404100S	19 April 2025

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH 017/23	Quality Reborn	QR25-0542	10 February 2026

3. This certification is traceable to SI UNIT

4. This certificate was certified only for the instrument we calibrated.

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

Calibration Results:

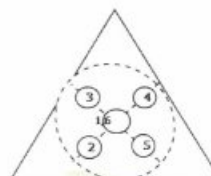
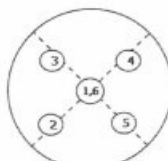
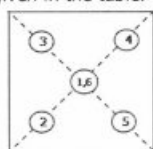
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.0000052
80	0.0000042
100	0.0000000
200	0.0000000

2. Off-Center Error:

A mass of 100 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
100.0001	100.0001	100.0001	100.0001	100.0001	100.0002	0.0001

for N. mijkabul

F-CS-012 Revision: 01 Date: 20-04-65



Calibration Report

Certificate No.: 2502226-001-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR205DU

Resolution: 0.00001 g / 0.0001 g

Serial No.: C009071872

ID No.: UAE.WAO.012/2563

Capacity: 82 g / 220 g

Date of Calibration: 20 March 2025

Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0-80 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 0 - 82 g ; Resolution: 0.00001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unload	0.000000	0.00000	0.00000	0.0000089	2.00
0.001	0.001003	0.00100	0.00000	0.0000092	2.00
0.005	0.005002	0.00500	0.00000	0.0000094	2.00
0.01	0.010003	0.01000	0.00000	0.0000091	2.00
0.05	0.049996	0.05000	0.00000	0.0000098	2.00
0.1	0.100011	0.10000	0.00001	0.000011	2.00
0.5	0.500016	0.50000	0.00002	0.000014	2.00
1	1.000003	1.00001	-0.00001	0.000016	2.00
2	2.000023	2.00005	-0.00003	0.000017	2.00
5	5.000015	5.00005	-0.00003	0.000021	2.00
10	10.000009	10.00005	-0.00004	0.000026	2.00
20	20.000030	20.00012	-0.00009	0.000037	2.00
30	30.000039	30.00012	-0.00008	0.000050	2.00
50	50.000028	50.00014	-0.00011	0.000068	2.00
80	80.000067	80.00020	-0.00013	0.00011	2.00



Calibration Report

Certificate No.: 2502226-001-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR205DU

Resolution: 0.00001 g / 0.0001 g

Serial No.: C009071872

ID No.: UAE.WAO.012/2563

Capacity: 82 g / 220 g

Date of Calibration: 20 March 2025

Page 4 of 4

Calibration Results: (Continued)

Calibration Range: >80-200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: >80 - 200 g ; Resolution: 0.0001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
90	90.00010	90.0002	-0.0001	0.00015	2.00
100	100.00006	100.0001	0.0000	0.00016	2.00
110	110.00007	110.0001	0.0000	0.00017	2.00
120	120.00009	120.0002	-0.0001	0.00018	2.00
130	130.00010	130.0002	-0.0001	0.00019	2.00
140	140.00013	140.0002	-0.0001	0.00019	2.00
150	150.00009	150.0002	-0.0001	0.00021	2.00
160	160.00010	160.0002	-0.0001	0.00022	2.00
170	170.00012	170.0002	-0.0001	0.00023	2.00
200	200.00013	200.0002	-0.0001	0.00028	2.00

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 %.

----- End -----

for N. ingudat

F-CS-012 Revision: 01 Date: 20-04-65


Calibration Certificate

Certificate No.: 2502226-002-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Serial No.: C210685394
ID No.: UAE.WAO.010/2565
Order No.: 2502226
Operation No.: 2502226-002
Date of Receipt: 19 March 2025
Date of Calibration: 20 March 2025

Calibrated by Mr.Yothin Charoensuk
Scientist

Approved by 
(Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue: 25 March 2025

The uncertainties are for a confidence probability of approximately 95%

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65



Calibration Report

Certificate No.: 2502226-002-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR205DU

Resolution: 0.00001 g / 0.0001 g

Serial No.: C210685394

ID No.: UAE.WAO.010/2565

Capacity: 82 g / 220 g

Date of Calibration: 20 March 2025

Page 2 of 4

Environment Condition: Ambient Temperature: 21.2 ± 0.6 °C Relative Humidity: 48 ± 3.5 %

Place of Calibration: 208 Balance Room, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	B505567572	TCS	M2404100S	19 April 2025

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH 017/23	Quality Reborn	QR25-0542	10 February 2026

3. This certification is traceable to SI UNIT

4. This certificate was certified only for the instrument we calibrated.

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

Calibration Results:

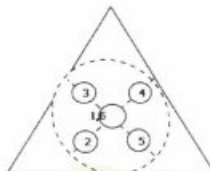
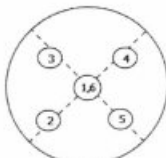
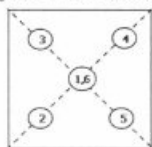
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.0000042
80	0.0000042
100	0.000000
200	0.000000

2. Off-Center Error:

A mass of 100 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



1 (g)	2 (g)	3 (g)	4 (g)	5 (g)	6 (g)	(Maximum Difference) (g)
100.0001	100.0001	100.0001	100.0001	100.0001	100.0001	0.0000

Calibration Report

Certificate No.: 2502226-002-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR205DU

Resolution: 0.00001 g / 0.0001 g

Serial No.: C210685394

ID No.: UAE.WAO.010/2565

Capacity: 82 g / 220 g

Date of Calibration: 20 March 2025

Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0-80 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 0 - 82 g ; Resolution: 0.00001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unload	0.000000	0.00000	0.00000	0.0000087	2.00
0.001	0.001003	0.00100	0.00000	0.0000090	2.00
0.005	0.005002	0.00501	-0.00001	0.0000092	2.00
0.01	0.010003	0.01002	-0.00002	0.0000089	2.00
0.05	0.049996	0.05001	-0.00001	0.0000096	2.00
0.1	0.100011	0.10002	-0.00001	0.000011	2.00
0.5	0.500016	0.50004	-0.00002	0.000014	2.00
1	1.000003	1.00005	-0.00005	0.000016	2.00
2	2.000023	2.00006	-0.00004	0.000017	2.00
5	5.000015	5.00006	-0.00005	0.000020	2.00
10	10.000009	10.00005	-0.00004	0.000026	2.00
20	20.000030	20.00007	-0.00004	0.000037	2.00
30	30.000039	30.00009	-0.00005	0.000050	2.00
50	50.000028	50.00008	-0.00005	0.000068	2.00
80	80.000067	80.00013	-0.00006	0.00011	2.00



Calibration Report

Certificate No.: 2502226-002-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR205DU

Resolution: 0.00001 g / 0.0001 g

Serial No.: C210685394

ID No.: UAE.WAO.010/2565

Capacity: 82 g / 220 g

Date of Calibration: 20 March 2025

Page 4 of 4

Calibration Results: (Continued)

Calibration Range: >80-200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: >80 - 200 g ; Resolution: 0.0001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor <i>k</i>
90	90.00010	90.0002	-0.0001	0.00015	2.00
100	100.00006	100.0001	0.0000	0.00016	2.00
110	110.00007	110.0002	-0.0001	0.00017	2.00
120	120.00009	120.0002	-0.0001	0.00018	2.00
130	130.00010	130.0002	-0.0001	0.00019	2.00
140	140.00013	140.0002	-0.0001	0.00019	2.00
150	150.00009	150.0002	-0.0001	0.00021	2.00
160	160.00010	160.0002	-0.0001	0.00022	2.00
170	170.00012	170.0002	-0.0001	0.00023	2.00
200	200.00013	200.0002	-0.0001	0.00028	2.00

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 %.

----- End -----

for N. important

F-CS-012 Revision: 01 Date: 20-04-65



Certificate No. : HIT-2510-0375

Page : 1 of 2

CERTIFICATE OF CALIBRATION

Equipment : COD Test Tube Heater

Meter Model : HI839800-02 **Serial No. :** H018500I

Tube Heater : 25 Vial Capacity **Resolution :** 0.1°C

Temperature Range : (-10 to 160)°C **Temperature of Reaction :** 150°C

Manufacturer : Hanna Instruments **Made in :** Romania

Condition As-Received : Used Product **Reference :** RE250401

Ambient Temperature : (25 ± 2)°C **Relative Humidity :** (50 ± 15) % RH

Customer name : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Rd., Bangchak,
Phrakhanong, Bangkok 10260

Received date : 5 March 2025

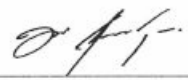
Calibrate date : 7 March 2025

Issue date : 7 March 2025

Calibrated Location : Hanna Instruments (Thailand) Ltd.

Calibration Procedure : This calibrator was conducted by using in-house: calibration procedure
CP-04 by using certified reference standard instruments.

Calibrated by : ☒ Mr. Pichit Petthong
☐ Mr. Channarong Soinak

Approved by : 
Mr. Anan Suwanchaisakul

Authorized Signatory

 **HANNA**
Instruments
(Thailand) Limited

This certificate was certified only for the instrument we calibrated.

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

** This certificate may not be reproduced other than in full, except with the prior written **

approval of the head of Hanna Instrument (Thailand) **เอกสารไม่ควบคุม**

Condition of this calibration result:

Reference Standard Instruments : This certification is traceable to the international unit of unit maintained through:

Instruments	Model	Serial No.	Certificate No.	Traceable
Data Acquisition Switch Unit	34970A	MY44065265	WK2407-141-1	WK Electric Co., Ltd.
Digital Thermo-Hygrometer	HT-771SD	AI.07155	25H171	Technology Promotion Association (Thailand-Japan).

Calibration Result:

Measurement Temperature Source Accuracy for COD Reactor.

Capacity (Vial)	Nominal Value (°C)	Average Value (°C)	Uncertainty of Measurement (±°C)
25 Vial	150.0	150.4	0.47

Unit : °C

(1A)	(2A)	(3A)	(4A)	(5A)
150.407	150.377	150.269	150.402	150.422
(1B)	(2B)	(3B)	(4B)	(5B)
150.426	150.394	150.644	150.690	150.542
(1C)	(2C)	(3C)	(4C)	(5C)
150.477	150.303	150.627	150.257	150.176
(1D)	(2D)	(3D)	(4D)	(5D)
150.462	150.456	150.199	150.406	150.102
(1E)	(2E)	(3E)	(4E)	(5E)
150.185	150.513	150.235	150.460	150.442

Figure: Shows the location of the temperature source.

The report 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 of certificate ****

เอกสารไม่ควบคุม

Agilent 55 240 280 Series Atomic Absorption Spectroscopy Systems

Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended service for your analytical systems to assure reliable operation and the accuracy of your results.

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak. This checklist will be completed at the end of the service and provided to you as a record of the installation.

Note: While non-current production AA instrument and or accessory models are not covered specifically in this document it can be used as a basic reference.

For more information about Agilent Technologies services please visit our web site using the following URL <http://www.agilent.com/en-us/services>

Introduction

Customer Information

- 1 Customers should provide all necessary operating supplies upon request of the engineer.
- 2 A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- 3 Any parts, not included in the Parts Lists section of this document, are not part of the recommended Preventive Maintenance service, nor are they included in the price of this service.
- 4 If a system requires the use of extra or special procedures and/or parts for the maintenance service, then these must be ordered separately and charged as a repair, which may incur additional costs.

Important Customer Web Links

- For more information about *Agilent Technologies services*, please visit our website using the following URL: <http://www.agilent.com/en-us/products/crosslab-instrument-services/service-repair>
- To access *Agilent University*, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- A useful *Agilent Resource Center* web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: <https://www.agilent.com/en-us/agilentresources>
- Need technical support, FAQs, supplies? – visit our *Support Home page* at <http://www.agilent.com/search/support>
- Get answers. Share insights. Build connections:
Join the *Agilent Community* at <https://community.agilent.com/welcome>

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Confirm the ability of the instrument to deliver continued safe operation as established via the Agilent AA safe operation flow chart. (Refer directly to the AA 55/240/280 Preventive Maintenance Scope of Work to make this decision.)
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Section not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance service in the order of the tasks listed.
- Complete the Service Review section together with the customer.
- Complete the fields for page numbers at the foot of each selected page
- Complete the total number of pages field in the Service Completion section
- Ask the customer to sign the Service Completion section including the customer's and your signature.

This information is subject to change without notice.

Instrument Maintenance

System Information

☐ Check this box if an instrument configuration report is attached instead of completing the table.

Instrument System Name and ID	240 FS AAS
Instrument System Site and Location	United Analyst and Engineering Consultant

List System Component Product Numbers	List the Serial Numbers of each Component
1. G 8432 A	M7 13160001
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

Preparation, Safe operation and Initial performance checks

Revision: 10.00, Issued: November 2021

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- ☐ Agilent AA safe operation flow chart inspections (to determine if the PM can be performed).

NOTE: If by following the flow chart the instrument is deemed to be unsafe for continued use you MUST NOT continue PM work. Inform the customer immediately of the Agilent recommendation that use of the instrument be discontinued.

- ☒ Discuss any specific issues with the customer before starting.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. *N/A*
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components, settings as defined by current Service Notes
- ☒ Check for required firmware updates and verify with customers if they would like them installed.
- ☒ Use SVD to perform a Full Wavelength Scan for Cu HCL - "As found test_1"
- ☒ Perform a Basic Cu ABS test - "As found test_2"
- ☒ Print the Details page or screen captures of the test results and attach to the end of this checklist.

Preventive Maintenance Procedures

FLAME SYSTEM section

☐ *Section not applicable*

Electronic components

- ☒ Review and confirm instrument configuration data in SVD
- ☒ Confirm power supply voltages using the *SVD Power Supply diagnostic*.
- ☒ For Dual Beam instruments - Confirm RBC frequency using the *SVD RBC frequency diagnostic*.

Mechanical components

- ☒ Check the burner adjuster controls for complete and free movement. If the burner adjuster needs lubrication, use Molykote 321 or mineral-based molybdenum disulphide grease.
- ☒ Run SVD tests to exercise all motor drives over the full range of their travel:
 - ☒ Monochromator drive
 - ☒ Slit drive
 - ☒ Lamp selector
 - ☐ ABA

Optics components

- ☒ Check that external optical surfaces are clean – Clean or replace as required.
- ☒ Use SVD and perform *Mono Wavelength Correction*.
- ☒ Use SVD and perform *Slit Calibration*.
- ☒ Use SVD and perform *Grating Squareness Diagnostic*.
- ☒ Use SVD and perform *Zero Order Offset/Mono Correction*.
- ☒ Use SVD and perform *Wavelength Repeatability*.
- ☒ Physically inspect selected HC lamps (customer to supply per their choice) and measure the % Gain for each lamp. Advise customer if lamps are showing emission degradation due to age.
- ☒ Check that the signal energy of the D2 and HC lamps track properly. Advise customer if their D2 lamp is showing emission degradation due to age.

Sample Introduction and Atomization

- ☒ Inspect the burner interlock plate to ensure that the interlock pin is secure and correct for the burner type.
- ☒ Clean the burner slot with a clean white card.
- ☒ Check the uniformity of the slot width.
- ☒ Clean the burner if required.
- ☒ Change the burner o-ring.
- ☒ Clean the nebulizer, spray chamber and liquid trap.
- ☒ Change all o-rings and seals in the nebulizer, nebulizer block and spray chamber.
- ☒ Check that the pressure relief bung releases readily.
- ☒ Change o-rings on the fuel and oxidant delivery barbs
- ☒ Leave the liquid trap EMPTY and verify the flame will not ignite in this state.
- ☒ Refill liquid trap and check that overflow drains freely into the drain/waste tube.
- ☒ Check the drain/waste tube for good drainage. It should not have tight bends, kinks or loops and the lower end must be above the liquid level in the waste vessel
- ☒ Check and clean the igniter electrode

Gas handling components and safety interlocks

- ☒ Pressure test for leaks
- ☒ Leak test gasbox internal components and connections
- ☒ Check safety interlock status and operation using the *SVD interlock monitoring diagnostic*.

Analytical performance for Flame systems

- ☒ Ignite a flame.
- ☒ Check that you can adjust the nebulizer uptake rate from 4 to 6.5 mL per minute.
- ☒ Optimize the instrument ready to perform Cu sensitivity test.
- ☒ Create a manual method to perform a Basic Cu ABS test - "Final Performance Testing "
- ☒ Run a PM completed sensitivity test for a 5 ppm copper sample and record the results in the AA PM Performance test results and measurements table.

FURNACE SYSTEM section

☒ Section not applicable

Electronic components

- ☐ Review and confirm instrument configuration data in SVD
- ☐ Confirm power supply voltages using the *SVD Power Supply diagnostic*.

Mechanical components

- ☐ Run SVD tests to exercise all motor drives over the full range of their travel:
 - ☐ Monochromator drive
 - ☐ Slit drive
 - ☐ Lamp selector

Optics components

- ☐ Check that external optical surfaces are clean – Clean or replace as required.
- ☐ Use SVD and perform *Mono Wavelength Correction*.
- ☐ Use SVD and perform *Slit Calibration*.
- ☐ Use SVD and perform *Grating Squareness Diagnostic*.
- ☐ Use SVD and perform *Zero Order Offset/Mono Correction*.
- ☐ Use SVD and perform *Wavelength Repeatability*.
- ☐ Physically inspect selected HC lamps (customer to supply per their choice) and measure the % Gain for each lamp. Advise customer if lamps are showing emission degradation due to age.

Gas handling, water system and workhead component checks

- ☐ Inspect the GTA workhead gas hoses and connections for leaks.
- ☐ Pressure test for gas leaks
- ☐ If the cooler system is accessible (stand-alone) check for correct operation and coolant/water level – this includes any temperature and pressure settings plus filter cleaning (air flow and water).
- ☐ Inspect the GTA workhead water hoses and connections for leaks.
- ☐ Check all graphite components and replace if necessary.

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- ☐ Tube
- ☐ Electrodes
- ☐ Shroud

- ☐ Check and clean the end windows on the workhead.
- ☐ Check safety interlock operation.

Analytical performance for Furnace systems

- ☐ Optimize the instrument ready to perform Cu sensitivity test.
- ☐ Run the sensitivity test for a 25 ppb copper sample and record the results in the results table.

PSD autosampler accessory for Furnace systems

☒ *Section NOT Applicable*

- ☐ Check condition of the PSD capillary – replace if necessary
- ☐ Check condition and operation of PSD syringe – ensure it does not have air locks and bubbles.
- ☐ Change PSD rinse bottle o-ring.
- ☐ Check and clean the rinse vessel.
- ☐ Check the drain tube for good drainage. It should not have tight bends, kinks or loops and the lower end must be above the liquid level in the waste vessel.
- ☐ Ensure that the waste vessel is suitable for use with the furnace system.

Sample introduction pump system (SIPS) accessory

☒ *Section NOT Applicable*

- ☐ Re-torque screws securing the hubs, presser arms and pump rotors.
- ☐ Adjust each roller so that it rotates freely.
- ☐ Wipe clean the pump rotor rollers and pump bands with a dry clean cloth.
- ☐ Ensure that the presser arms and the surfaces near the pump are free from dirt and spills.
- ☐ Remove the pump module rear cover and check for the incursion of liquids and any signs of corrosion.
- ☐ Re-torque the nuts that fasten the motor mounting plates to the chassis.
- ☐ Check clips securing the diluents holder and replace if necessary.
- ☐ Disconnect, clean T-piece, and reassemble the tubing using the following steps.

- ☐ Remove the T-piece by disconnecting the pump tubes, the pump bands and all other tubing.
- ☐ Place the T-piece in an ultrasonic bath containing strong detergent 1-5% Decon 30 or similar, for approximately 5-10 minutes.
- ☐ Wash the T-piece under a tap with a strong flow of water.
- ☐ Rinse with distilled water through all of the inlets in the reverse direction to normal sample flow.
- ☐ Reassemble.

Sample preparation system (SPS 4) accessory

☒ *Section NOT Applicable*

The Agilent SPS 4 autosampler is designed to need minimal maintenance.

The following maintenance requirements are suggested to maintain the performance of the autosampler.

- ☐ Cleaning the spill tray, rack location mat, end frames and chassis accessories with a damp soft cloth and diluted mild detergent.
- ☐ Cleaning the autosampler cover panels with domestic window cleaner.
- ☐ Checking the X- axis and Z- axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes..
- ☐ Check the X- axis, Theta- axis and Z- axis FFC cables for cracks, incorrect positioning, damaged edge or damaged connectors.

NOTE: The autosampler requires no extra lubrication throughout its lifetime.

For further details refer to the SPS 4 service manual G8410-90050.

Sample preparation system (SPS 3) accessory

☒ *Section NOT Applicable*

- ☐ Check the x-axis and z-axis timing belts – Replace if there is are any cracks, splits or color deterioration and belt tension.
- ☐ Check belt tensions - adjust if required
- ☐ Check the lubrication pad for single x-axis shaft. If pad is dry or customer has observed any vibration or erratic movements of the x-axis carriage, add 1 mL of Dow Corning 200 ® Fluid, 200 CS into the well.
- ☐ Check the auto-sampler ability to find tube positions - Calibrate if required.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

Vapor generation accessory VGA (hydride generator)

☐ *Section NOT Applicable*

- ☐ Inspect VGA gas supply hose.
- ☐ Inspect/replace VGA pump tubing.
- ☐ Check low gas pressure interlock setting – adjust if required.
- ☐ Check precision orifice gas flow setting – adjust if required.
- ☐ Check gas regulator pressure to 46 psi (325 kPa) – adjust if required.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

UltrAA lamp accessory (external)

☒ *Section NOT Applicable*

- ☐ Check the condition of the power cable.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

Restore System

- ☐ If you have altered the customer's instrumentation during the course of PM, restore to the original status to allow the customer to conduct their normal activities (e.g., reload the customer's method.)

Guidance

If the PM service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

Signature Page

Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Update/reset instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section if there are additional comments.
- ☒ Review this service, parts replaced, and test results obtained with the customer.
- ☒ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box or if necessary, in the customer's IQ records.

Test Results

Test Description	Expected Test Result	Actual Test Result
Flame optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	49%
Flame performance test with 5 ppm copper sample		
Air /acetylene, mixing paddle removed	Abs value > 0.5	0.5598
Air /acetylene, mixing paddle installed. 10 replicates	%RSD < 1.0	0.2%
Deuterium furnace optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	-
Deuterium furnace performance test with 25 ppb copper sample (324.8 nm)		
Precision %RSD	≤ 4.0%	-
Abs value	≥ 0.15	-
Zeeman furnace analytical performance: 25 ppb copper sample (327.4 nm)		
Precision %RSD	≤ 4.0%	-
Abs value	≥ 0.10	-
MSR%	≥ 70 %	-

AA consumable and parts list table

Part Description	Part Number	Product/Model # where used	PM supplied or Consumable	Instrument-Type
Test Solution – Cu 5ppm solution	6610030100	50 55 140 240 280	PM supplied	Common
Test Solution - Blank solution	5190-7001	50 55 140 240 280	PM supplied	Common
Copper, 1000 ug/ml, 100ml	5190-8279	50 55 140 240 280	*	Common
Kit, Mk 7 O-rings, aqueous, complete set	9910093400	50 55 140 240 280	PM supplied	Flame
Organic Kit	9910093500	50 55 140 240 280	PM supplied	Flame
Wire Nebulizer Cleaning	9910024700	50 55 140 240 280	consumable	Flame
Tubing-Capillary Std Nebs	9910024800	50 55 140 240 280	consumable	Flame
Capillary Tube Hivac Neb (3) (organics only)	9910044000	50 55 140 240 280	consumable	Flame
Glass impact beads (5/pk)	9910025700	50 55 140 240 280	consumable	Flame
Teflon impact beads (5/pk): (organics only)	9910053300	50 55 140 240 280	consumable	Flame
Burner cleaning strip (100/pk)	9910053900	50 55 140 240 280	consumable	Flame
Window UV silica – round (right side)	2010082600	50 55 140 240 280	PM supplied	Common
Window UV silica – rectangular (left side)	2010082500	50 55 140 240 280	PM supplied	Common
Pad adhesive window (round)	4910012700	50 55 140 240 280	PM supplied	Common
Pad adhesive window (rectangular)	4910012800	50 55 140 240 280	PM supplied	Common
Electrode kit (1 pr) (D2)	6310003400	GTA120	PM supplied	Furnace
Shroud (D2)	6310003100	GTA120	PM supplied	Furnace
Zeeman electrode kit (1 pr)	6310003500	GTA120	PM supplied	Furnace
Zeeman shroud	6310003600	GTA120	PM supplied	Furnace
O-ring PSD rinse bottle	6910025900	PSD120	PM supplied	Furnace

* For engineers who only service AA instruments 5190-8279 can be used as a cheaper alternative for 6610030100.

Items classified as PM supplied in the above table are included in the standard PM

Those classified as consumable should be provided by the customer or charged to the customer if supplied by the Agilent service engineer.

Service Engineer Comments (optional)

If there are any specific points you wish to note as part of performing the installation or other items of interest for the customer, please write in this box.

Service Completion

Service request number 6007549143

Date service completed 30 Jan 2025

Agilent signature Kanyakorn S.

Customer signature Manida Y.

Total number of pages in this document 13

SVD Results Report



Report ID: 2 **Diagnostic Start Time:** 1/30/2025 9:14:26 AM **Diagnostic End Time:** 1/30/2025 9:46:06 AM

Customer: UAE

Service Engineer: Kanyakorn S.

Address: Soi Udomsuk 41, Sukhumvit Rd,
Bangkok

Contact Details: 026376363#1

Instrument Configuration

Configuration:

Serial Number: MY13160001	Turret Type: Automatic
Instrument Model: Varian AA140/240/280	Number Of Lamps: 4
Flame Instrument: True	Mono Type: Automatic
Furnace Instrument: True	Gasbox Type: 'Y' Gas Box
Zeeman Present: False	Auto Burner Adjuster: False
Internal Zeeman: False	Mains Frequency: 50
Internal UltraAA: False	Firmware Version: 2.11
Optics Type: Double Beam	Photomultiplier Type: Normal(900nm)
D2 BG Correction Filter: True	PWB Version: 45
Boot Block Version: 1.09	

EEPROM Data:

Instrument Run Hours: 53396.500	D2 Run Hours: 53396.500
Zero Wavelength Offset: 30.133	D2 Serial Number: not set !
Mono Correction: 0.770	D2 Install Date: 1/1/1970
Flame Hours: 32441.834	D2 Original Intensity: 1.000
	D2 Last Intensity: 475.000

Frequency:

Averaging Period: 30.0

Datapoint Count: 20

Upper Limit:
51.00

Highest Measured Frequency:
50.00

Average Frequency:
50.00

Lower Limit:
49.00

Lowest Measured Frequency:
50.00

Result: **Passed**

Power Supply:

Averaging Period: 30.0

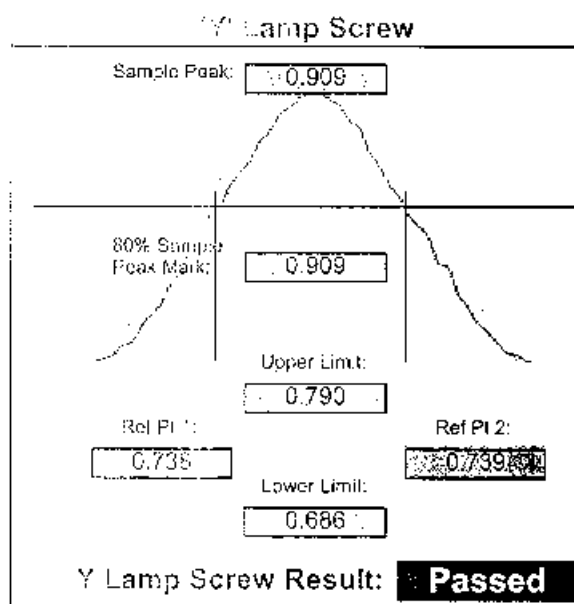
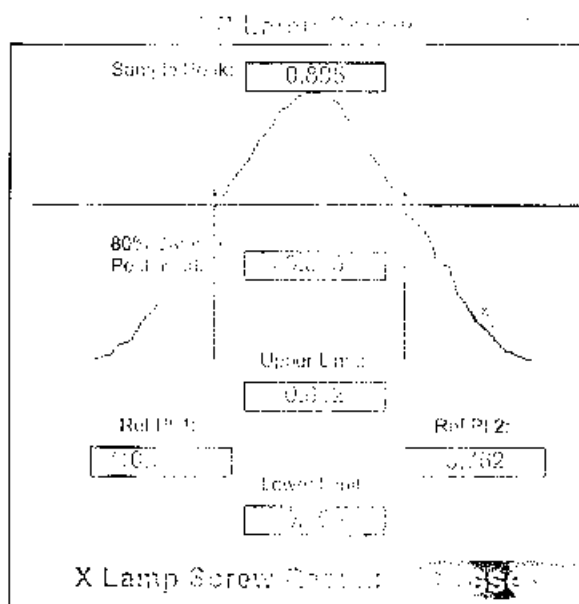
Datapoint Count: 20

	Lower Limit (V)	Actual (V)	Upper Limit (V)	Result:
12.00 V Rail	10.90	12.12	13.20	Passed
-12.00 V Rail	-13.20	-11.90	-10.80	Passed
5.00 V Rail	4.50	5.04	5.50	Passed
310.00 V Rail	270.00	320.00	341.00	Passed

Beam Balance:

Lamp Type: Copper
Lamp Socket Used: 3

Peak Selected: 324.80
Lamp Alignment: **Performed**



Grating Spectrometer


Lamp Element(s): Copper
Lamp Socket Functions: 3
Lamp Current(mA): 4.00
Slit Width (mm): 0.5
1st Order Wavelength(nm): 324.80
Lamp Alignment: **Performed**

	Lower Limit (nm)	Center (nm)	Upper Limit (nm)	Result:
Zero Order	60.10	324.80	60.10	Passed
First Order	324.65	324.75	325.15	Passed
Second Order	649.30	649.51	649.97	Passed

Wavelength Imperial (nm)

Lamp Used: Copper
Peak Used(nm): 324.750
Connected to Socket: 3

Lamp Current(mA): 4
Slit Width(nm): 0.2
Slit Height: Normal

Lamp Alignment: 

Lower Limit(nm) 324.758

324.888 Upper Limit(nm)

(Sampled from Zero Order)

(One-spect function)

Sample 1: 324.821

Sample 2: 324.823

Sample 3: 324.823

Sample 4: 324.823

Sample 5: 324.822

Sample 6: 324.819

Sample 7: 324.819

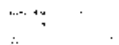
Sample 8: 324.819

Sample 9: 324.822

Sample 10: 324.819

Mean: 324.822

Standard Deviation: 0.003

Result: 

Manual Test Results

Wavelength Drive:

Wavelength Drive: **Working**

Slit Drive:

Slit Drive: **Working**

Turret Drive:

Turret Drive: **Working**

Auto Tuning Offender Alarm:

Auto Tuning Offender Alarm: **Working**

Manual Test Results

Signal Processing Limitation:

Signal Processing Limitation: **Working**

	Lower Limit	Actual	Upper Limit	Result:
01	100	100	297	Passed
02	100	104	191	Passed
03	271	271	332	Passed
04	400	400	679	Passed
05	600	600	1008	Passed
06	800	800	1754	Passed
07	2408	2408	3053	Passed
08	4047	4047	5313	Passed

Interlocks:

Gas Flow: Working	Flame Detect: Working
HSC Gas: Working	ECU Active: Working
Flame Signal: Working	Oxidant Pressure: Working
Gas Flow: Working	Oxidant Changeover: Untested
Pressure: Working	Ignition: Working
Liquid Flow: Working	

Auto Lamp Recognition:

Lamp 1: Uncoded Lamp/Not Connected

Lamp 5: Not Supported

Lamp 2: 87 - Silver/Cadmium/Lead/Zinc(UltrAA) (Ag/CLamp 6: Not Supported

Lamp 3: 14 - Copper (Cu)

Lamp 7: Not Supported

Lamp 4: Uncoded Lamp/Not Connected

Lamp 8: Not Supported

Result: **Passed**

GTA Temperature Monitoring:

Notes:

Signatures:

UAE

Date

Kanyakorn S.

Kanyakorn S.

30 Jan 2025

Date

Analyst

Date Started 1/30/2025 10:33 AM GMT: 1/30/2025 3:33 AM

Worksheet Sensitivity Test 01

Comment

Methods Cu

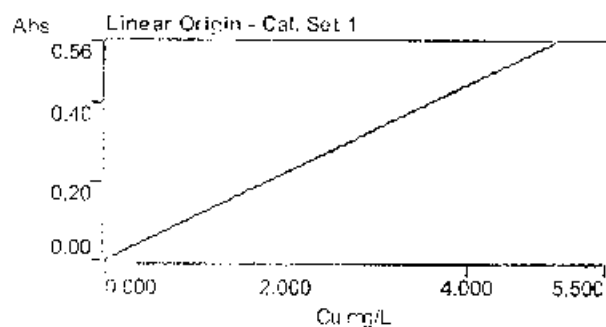
Computer name DESKTOP-R9UIFRS

Serial Number: MY13160001

Method: Cu (Flame)

Sample ID	Conc. mg/L	%RSD	Mean Abs
CAL ZERO	0.000	38.2	0.0002
Readings			
	0.0002	0.0003	0.0001
			1/30/2025 10:51:46 AM

STANDARD 1	0.000	0.1	0.5571
Readings			
	0.5571	0.5563	0.5575
			1/30/2025 10:52:22 AM



Curve Fit = Linear Origin
Characteristic Conc = 0.030 mg/L
 r = 1.0000
Calculated Conc = 0.0025 mg/L
Residuals = -0.002 0.000

Abs = 0.11141 x C

5 ppm Cu	0.0025	0.1	0.5598
Readings			
	0.5592	0.5596	0.5615
			1/30/2025 10:52:54 AM

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Analyst

Date Started

1/30/2025 10:33 AM GMT: 1/30/2025 3:33 AM

Worksheet

Precision Test

Comment

Methods

Cu

Computer name

DESKTOP-RSUIFRS

Serial Number:

MY13160001

Method: Cu (Flame)

Sample ID	Conc. mg/L	%RSD	Mean Abs
CAL ZERO	0.000	64.1	-0.0002

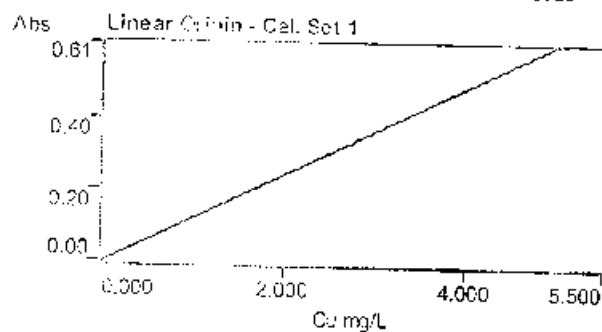
Readings

-0.0003	-0.0003	-0.0001	1/30/2025	10:46:52 AM
---------	---------	---------	-----------	-------------

STANDARD 1	0.000	0.3	0.6052
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Readings

0.6036	0.6073	0.6047	1/30/2025	10:47:24 AM
--------	--------	--------	-----------	-------------



Curve Fit = Linear Origin

Characteristic Conc = 0.125 mg/L

r = 1.0000

Calculated Conc = -0.002 - 5.000

Residuals = 0.002 - 0.000

Abs = 0.12105 x C

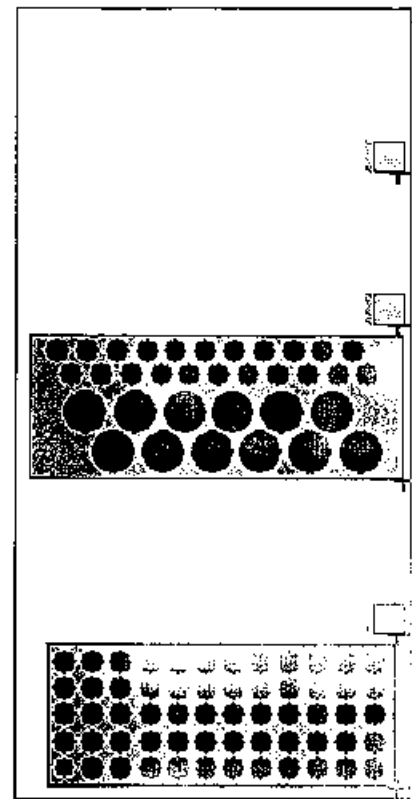
5 ppm Cu	5.000	0.3	0.6051
----------	-------	-----	--------

Readings

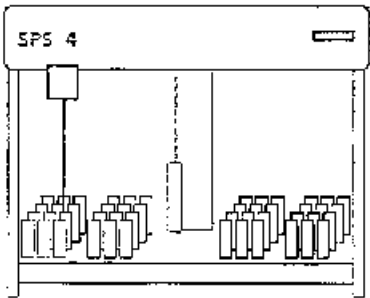
0.6055	0.6052	0.6047	0.6047	0.6042	0.6079
--------	--------	--------	--------	--------	--------

0.6055	0.6078	0.6064	0.6079	1/30/2025	10:48:32 AM
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SPS 4



Down height (mm)

Pump speed

Key to tube colors

- Sample
- Calibration
- Calibration/QC
- Sample/QC
- Not Assigned

Sampler Offline

Goto Tube

Back

Tube

Goto Tube

Align Probe

Rinse

Stop Rinse

Park

Optimization: Lamp

HC Lamp

1.30

1.00

0.50

0.00

0.917

Optimize Lamp

Optimize Sign

Rescale

Inst Zero

Gain 49 %

Ok

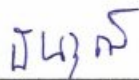
Sensitivity Check

1.5 mg/L gives about 0.2 Abs at 324.8 nm, A/A burner

CERTIFICATE OF CALIBRATION

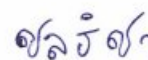
Certificate No. : SP25-001

Page 1 of 5

Customer : United Analyst and Engineering Consultant Co.,Ltd. (Head Office)**Address :** 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260**Location of calibration :** Laboratory 213**Equipment :** UV-Vis Spectrophotometer**Manufacturer :** Hitachi**Model :** U-2900**Serial No. :** 21E22-009**ID No. :** UAE.WAT.051/2564**Received Date :** 3 January 2025**Calibration Date :** 3 January 2025**Issue Date :** 8 January 2025**Condition Instrument :** Good**Calibrated by :**

(Mr.Tanawut Rittidach)

Technical Manager

Approved by :

(Ms. Chonthicha Sangngern)

Quality Manager

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

The measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.

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REPORT OF CALIBRATION

Certificate No. : SP25-001

Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °CRelative humidity 55 ± 20 %RH**Calibration method :** In-house method CP-01 Based on ASTM E275-08**Certified Reference Materials :**

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	115663	25 October 2025
Absorbance Standard set	25757	115638	25 October 2025
Wavelength Standard set	25806	115657	25 October 2025
Wavelength Standard set	25758	115665	25 October 2025

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

Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 1.5 nm.**Scan Speed of UUC :** 200 nm/min**Scan Interval of UUC :** 0.1 nm.**Resolution of UUC :** Photometric 0.001 Abs.

Wavelength 0.1 nm.

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REPORT OF CALIBRATION

Certificate No. : SP25-001

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5780	0.578	0.0000	0.0031	2.00
	1.0484	1.045	0.0034	0.0029	2.00
	2.1876	2.192	-0.0044	0.0075	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.560	-0.0005	0.0034	2.00
	1.0239	1.023	0.0009	0.0035	2.00
	2.1230	2.125	-0.0020	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.521	0.0020	0.0030	2.00
	0.9633	0.961	0.0023	0.0029	2.00
	1.9753	1.977	-0.0017	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.518	0.0001	0.0031	2.00
	1.0002	0.998	0.0022	0.0033	2.00
	1.9973	1.993	0.0043	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.552	-0.0003	0.0030	2.00
	1.0803	1.079	0.0013	0.0030	2.00
	2.0373	2.032	0.0053	0.0079	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.559	0.0001	0.0031	2.00
	1.0518	1.050	0.0018	0.0030	2.00
	1.9274	1.923	0.0044	0.0079	2.00

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SP25-001

Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7469	0.744	0.0029	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8674	0.863	0.0044	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2919	0.290	0.0019	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6430	0.640	0.0030	0.0055	2.00

REPORT OF CALIBRATION

Certificate No. : SP25-001

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor <i>k</i>
241.72	241.1	0.62	0.18	2.00
279.45	279.0	0.45	0.18	2.00
287.81	287.3	0.51	0.18	2.00
334.06	333.8	0.26	0.18	2.00
360.93	360.6	0.33	0.18	2.00
418.59	418.2	0.39	0.18	2.00
445.94	445.5	0.44	0.18	2.00
453.66	453.4	0.26	0.18	2.00
460.02	459.8	0.22	0.18	2.00
536.59	536.6	-0.01	0.18	2.00
637.98	637.7	0.28	0.18	2.00
431.38	431.1	0.28	0.18	2.00
472.50	472.3	0.20	0.18	2.00
513.47	513.4	0.07	0.18	2.00
528.88	528.9	-0.02	0.18	2.00
573.17	573.3	-0.13	0.18	2.00
585.35	585.1	0.25	0.20	2.00
684.40	684.5	-0.10	0.18	2.00
740.72	741.0	-0.28	0.20	2.00
748.55	748.8	-0.25	0.18	2.00
807.03	807.3	-0.27	0.18	2.00
879.28	879.6	-0.32	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k ,

which for a normal distribution corresponds to a coverage probability of approximately 95%

- End of Certificate -

เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

Certificate No. : SP25-024

Page 1 of 5

Customer : United Analyst and Engineering Consultant Co.,Ltd. (Head Office)

Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Location of calibration : Instrument room (207)

Equipment : UV-Vis Spectrophotometer

Manufacturer : HITACHI

Model : U-5100

Serial No. : 23A4-008

ID No. : UAE.WAS.010/2567

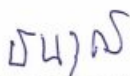
Received Date : 17 June 2025

Calibration Date : 17 June 2025

Issue Date : 20 June 2025

Condition Instrument : Good

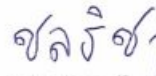
Calibrated by :



(Mr.Tanawut Rittidach)

Technical Manager

Approved by :



(Ms.Chonticha Sangngern)

Quality Manager

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

The measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

REPORT OF CALIBRATION

Certificate No. : SP25-024

Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °CRelative humidity 55 ± 20 %RH**Calibration method :** In-house method CP-01 Based on ASTM E275-08**Certified Reference Materials :**

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	115663	25 October 2025
Absorbance Standard set	25757	115638	25 October 2025
Wavelength Standard set	25806	115657	25 October 2025
Wavelength Standard set	25758	115665	25 October 2025

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

Institute of Standards and Technology (NIST) through Sarna Scientific Limited

Spectral Band Width of UUC : 5.0 nm.**Scan Speed of UUC :** 40**Scan Interval of UUC :** 0.1 nm.**Resolution of UUC :** Photometric 0.001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SP25-024

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5780	0.574	0.0040	0.0031	2.00
	1.0484	1.044	0.0044	0.0029	2.00
	2.1876	2.185	0.0026	0.0075	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.558	0.0015	0.0035	2.00
	1.0239	1.021	0.0029	0.0035	2.00
	2.1230	2.122	0.0010	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.519	0.0040	0.0030	2.00
	0.9633	0.961	0.0023	0.0029	2.00
	1.9753	1.975	0.0003	0.0071	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.515	0.0031	0.0031	2.00
	1.0002	0.996	0.0042	0.0033	2.00
	1.9973	1.994	0.0033	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.549	0.0027	0.0030	2.00
	1.0803	1.078	0.0023	0.0030	2.00
	2.0373	2.031	0.0063	0.0082	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.557	0.0021	0.0031	2.00
	1.0518	1.049	0.0028	0.0030	2.00
	1.9274	1.924	0.0034	0.0081	2.00

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SP25-024

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Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7469	0.747	-0.0001	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8674	0.864	0.0034	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2919	0.293	-0.0011	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6430	0.639	0.0040	0.0055	2.00

REPORT OF CALIBRATION

Certificate No. : SP25-024

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor <i>k</i>
241.00	240.4	0.60	0.18	2.00
279.30	278.8	0.50	0.18	2.00
288.90	288.3	0.60	0.18	2.00
334.50	333.9	0.60	0.18	2.00
361.40	360.8	0.60	0.18	2.00
418.40	417.9	0.50	0.18	2.00
447.20	446.6	0.60	0.18	2.00
459.30	459.1	0.20	0.18	2.00
537.00	536.4	0.60	0.18	2.00
638.00	637.5	0.50	0.18	2.00
441.29	440.7	0.59	0.18	2.00
479.88	479.4	0.48	0.18	2.00
513.75	513.3	0.45	0.18	2.00
528.59	528.2	0.39	0.18	2.00
575.10	574.5	0.60	0.18	2.00
585.56	585.4	0.16	0.20	2.00
684.70	684.1	0.60	0.18	2.00
740.51	740.2	0.31	0.20	2.00
747.61	747.0	0.61	0.18	2.00
807.04	806.4	0.64	0.18	2.00
879.68	879.1	0.58	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k ,

which for a normal distribution corresponds to a coverage probability of approximately 95%

- End of Certificate -

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
1	Analytical Balance	PARTICULATE MATTER (PM10) TOTAL SUSPENDED PARTICULATE	Mettler Toledo	MS204TS/00 / C252436235	National Food Institute, Ministry of Industry, Thailand	2402420-003-01	19/4/2024	18/4/2025
2	Microbalance	PARTICULATE MATTER RESPIRABLE DUST TOTAL DUST	Mettler Toledo	XP6 / B322373893	National Food Institute, Ministry of Industry, Thailand	2402420-002-01	19/4/2024	18/4/2025

Due Date of Calibration* : Based on the annual calibration plan. At least 1 time per year.

Calibration Certificate

Certificate No.: 2402420-002-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XP6
Serial No.: B322373893
ID No.: UAE.AIR.019/2556
Order No.: 2402420
Operation No.: 2402420-002
Date of Receipt: 19 April 2024
Date of Calibration: 19 April 2024

Calibrated by Mr.Pheraphat Tuanjit
Scientist

Approved by 
(Miss Preeyaporn Jaengkarnkit)

Vice President, Department of Laboratory Services
Responsible for the Technical Management Team

Date of Issue: 23 April 2024

The uncertainties are for a confidence probability of approximately 95%

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65



Calibration Report

Certificate No.: 2402420-002-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XP6

Resolution: 0.000001 g

Serial No.: B322373893

ID No.: UAE.AIR.019/2556

Capacity: 6.1 g

Date of Calibration: 19 April 2024

Page 2 of 3

Environment Condition: Ambient Temperature: 22.6 ± 1.8 °C Relative Humidity: 48 ± 6.0 %

Place of Calibration: Room 206 Balance Room 2, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	15880	TCS	M2311181S	28 November 2024
Standard Weight Class E2	1-500g	15882	TCS	M2311182S	28 November 2024

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH 019/23	Quality Reborn	QR24-0492	4 March 2025

3. This certification is traceable to SI UNIT

4. This certificate was certified only for the instrument we calibrated.

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

Calibration Results:

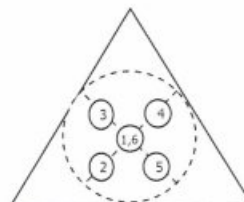
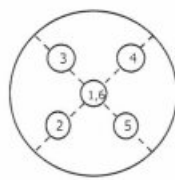
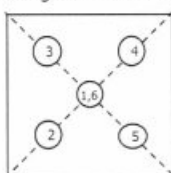
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
3	0.00000057
6	0.00000019

2. Off-Center Error:

A mass of 2 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
1.999981	1.999983	1.999980	1.999984	1.999983	1.999981	0.000003

F-CS-012 Revision: 01 Date: 20-04-65



P. Jongsakulkit
23 April 2024

Calibration Report

Certificate No.: 2402420-002-01

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XP6

Resolution: 0.000001 g

Serial No.: B322373893

ID No.: UAE.AIR.019/2556

Capacity: 6.1 g

Date of Calibration: 19 April 2024

Page 3 of 3

Calibration Results: (Continued)

Calibration Range: 0-6 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unload	0.0000000	0.000000	0.000000	0.0000032	2.00
0.01	0.0099970	0.009999	-0.000002	0.0000047	2.00
0.05	0.0500010	0.050003	-0.000002	0.0000048	2.00
0.10	0.1000010	0.100001	0.000000	0.0000069	2.00
0.15	0.1500020	0.150002	0.000000	0.0000083	2.00
0.17	0.1700050	0.170006	-0.000001	0.000012	2.00
0.20	0.1999990	0.200002	-0.000003	0.0000083	2.00
1.50	1.4999750	1.499971	0.000004	0.000027	2.00
3.00	2.9999680	2.999959	0.000009	0.000028	2.00
4.50	4.4999810	4.499967	0.000014	0.000022	2.00
6.00	5.9999490	5.999931	0.000018	0.000032	2.00

S. Jongsakulkit
23 April 2024

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 %.

----- End -----

F-CS-012 Revision: 01 Date: 20-04-65



Calibration Certificate

Certificate No.: 2402420-003-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhnong, Bangkok 10260

Page 1 of 3

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: MS204TS/00
Serial No.: C252436235
ID No.: UAE.AIR.023/2566
Order No.: 2402420
Operation No.: 2402420-003
Date of Receipt: 19 April 2024
Date of Calibration: 19 April 2024

Calibrated by Mr.Pheraphat Tuanjit
Scientist

Approved by *P. Jaengkarnkit*
(Miss Preeyaporn Jaengkarnkit)

Vice President, Department of Laboratory Services
Responsible for the Technical Management Team

Date of Issue: 23 April 2024

The uncertainties are for a confidence probability of approximately 95%

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65



Calibration Report

Certificate No.: 2402420-003-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: MS204TS/00

Resolution: 0.0001 g

Serial No.: C252436235

ID No.: UAE.AIR.023/2566

Capacity: 220 g

Date of Calibration: 19 April 2024

Page 2 of 3

Environment Condition: Ambient Temperature: 21.7 ± 1.5 °C Relative Humidity: 65 ± 6.7 %

Place of Calibration: Room 206 Balance Room 2, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	15880	TCS	M2311181S	28 November 2024
Standard Weight Class E2	1-500g	15882	TCS	M2311182S	28 November 2024

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH 019/23	Quality Reborn	QR24-0492	4 March 2025

3. This certification is traceable to SI UNIT

4. This certificate was certified only for the instrument we calibrated.

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

Calibration Results:

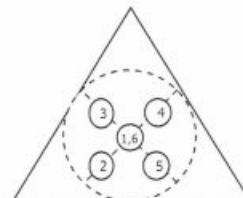
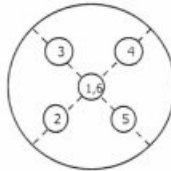
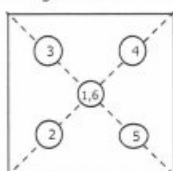
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
100	0.000074
200	0.000074

2. Off-Center Error:

A mass of 100 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
100.0005	100.0006	100.0003	100.0006	100.0003	100.0005	0.0002

P. Jongsakulrat
23 April 2024



Calibration Report

Certificate No.: 2402420-003-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: MS204TS/00

Resolution: 0.0001 g

Serial No.: C252436235

ID No.: UAE.AIR.023/2566

Capacity: 220 g

Date of Calibration: 19 April 2024

Page 3 of 3

Calibration Results: (Continued)

Calibration Range: 0-200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unload	0.00000	0.0000	0.0000	0.000094	2.00
0.1	0.10000	0.1000	0.0000	0.000094	2.00
1	0.99998	1.0000	0.0000	0.000097	2.00
5	4.99997	5.0000	0.0000	0.000096	2.00
10	10.00002	10.0000	0.0000	0.00012	2.00
20	20.00003	20.0001	-0.0001	0.00014	2.00
50	49.99998	50.0003	-0.0003	0.00012	2.00
70	70.00000	70.0005	-0.0005	0.00017	2.00
100	99.99997	100.0006	-0.0006	0.00017	2.00
150	149.99994	150.0012	-0.0013	0.00022	2.00
200	200.00001	200.0015	-0.0015	0.00028	2.00

P. Jongsakul
23 April 2024

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 %.

----- End -----

F-CS-012 Revision: 01 Date: 20-04-65



List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Stack									
1	Pre-Test Console	Total Suspended Particulate	Apex Instruments, USA.	XC-572-V 1701019	Envi Equipment Service Co., Ltd.	E25-050063	19 May 25	18 May 26	-
2	Flue gas Analyzer	Sulphur Dioxide Oxide of Nitrogen as Nitrogen Dioxide Carbon Monoxide	Testo	Testo 350 60899456/701	Entech Industrial Solution Co., Ltd.	G 680203	19 Mar 25	18 Mar 26	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Thermo Scientific	G25A 158M	Jiranatee Associates Co., Ltd.	COF-025-68	21 Jul 25	20 Jul 26	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	25P3506	9 Sep 25	8 Sep 26	-
3	Air Flow Meter	Particular Matter (PM _{2.5})	Mesa Labs	DeltaCal DC1 158850	Innovative Instrument Co.,Ltd.	CGF-009-68	23 Jul 25	22 Jul 26	-
4	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	25P1380	17 Apr 25	16 Apr 26	-
5	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	25H809	10 Apr 25	9 Apr 26	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778106	UAE Consultant Co.,Ltd.	12052025	12 May 25	11 May 26	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1200636463	UAE Consultant Co.,Ltd.	12052025	12 May 25	11 May 26	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Environmental Instrument	42C 42C-78933-390	UAE Consultant Co.,Ltd.	07052025	7 May 25	6 May 26	-
9	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1182920005	UAE Consultant Co.,Ltd.	07052025	7 May 25	6 May 26	-
10	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05NI91E15A0014	6 Jul 23	6 Jul 31	-
11	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387061	UAE Consultant Co.,Ltd.	15052025	15 May 25	14 May 26	-
12	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387063	UAE Consultant Co.,Ltd.	11052025	12 May 25	11 May 26	-
13	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387065	UAE Consultant Co.,Ltd.	12052025	12 May 25	11 May 26	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
14	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387067	UAE Consultant Co.,Ltd.	06052025	6 May 25	5 May 26	-
15	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05NI91E15A0014	6 Jul 23	6 Jul 31	-
16	Wind Speed/Wind Direction	WS/WD	LSI Lastern	E-LOG 305 / DNA 821 20040062/ 20040185	Thai Meteorological Department	338/25	20 May 25	19 May 26	-
17	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	SvanteK	SV35 44792	Innovative Instrument Co.,Ltd.	25-ACT-040	17 Mar 25	16 Mar 26	-
18	Sound Level Meter	L _{Aeq} 24 hr L _{Aeq} 1 hr L _{Amax} L _{A90} 5 min Annoyance Noise	Larson Davis	LxT1 0007302	Electrical And Electronics Institute Foundation For Industrial Development	CP20240324EA	22 Aug 24	21 Aug 26	-
19	Sound Level Meter	L _{Aeq} 24 hr L _{Aeq} 1 hr L _{Amax} L _{A90} 5 min Annoyance Noise	Larson Davis	LxT1 0007303	Electrical And Electronics Institute Foundation For Industrial Development	CP2020339EA	20 Sep 24	19 Sep 26	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Workplace									
1	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Larson Davis	CAL150 6458	Innovative Instrument Co.,Ltd.	25-ACT-073	20 May 25	19 May 26	-
2	Sound Level Meter	L _{Aeq} 8 hrs, L _{Amax}	Rion, Japan	NL-42 01010779	Sithiporn Associates Co., Ltd.	ACL25263	7 Jul 25	6 Jul 26	-
3	Primary Flow Calibrator	Calibrate personal pump	TSLinc	5300 53002052003	Innovative Instrument Co., Ltd.	25-AFM-087	26 Mar 25	25 Mar 26	-
4	Aneroid Barometer	Total Dust Respirable Dust	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	25P1359	17 Apr 25	16 Apr 26	-
5	Digital Thermo - Hygrometer	Total Dust Respirable Dust	Digicon	TH-02 395034173	Technology Promotion Association (Thailand-Japan)	25H1374	8 Jul 25	7 Jul 26	-
6	Thermal Environment Monitor	Heat Meter	3M	QuesTemp 32 TP5030004	Innovative Instrument Co.,Ltd.	25-TPM-422	3 Sep 25	2 Sep 26	-

List of Instruments Certification for Water Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Water									
1	pH Meter	pH	Horiba	LAQUA-PH210 HA0C0025	Technology Promotion Association (Thailand-Japan)	25CH261	26 Feb 25	25 Feb 26	-



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

Flow measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : COF-025-68

Page 1 of 2 Pages

MEASUREMENT ITEM : Top Load Orifice
MANUFACTURER : Graseby GMW
MODEL/TYPE : G25A
SERIAL NUMBER : 158M
ID NUMBER : UAE.EMA2.033/2554
CONDITION AS-RECEIVED : Used item
CUSTOMER : United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong,
Bangkok 10260

RECEIVED DATE : 08 Jul 2025
MEASUREMENT DATE : 21 Jul 2025
ISSUE DATE : 23 Jul 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 24.1 °C and 50.4 %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:

- ☐ Mr. Sorawit Thachalad
☒ Miss Jittraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

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THIS CERTIFICATE OF CALIBRATION MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED
IN WRITING FROM THE LABORATORY



JIRANATEE ASSOCIATES CO.,LTD.

Continuation of Certificate of Calibration Number COF-025-68

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	γ	Standard Flow [Q_s] m^3/min
1	0.705	754.349	23.73	22.79	49.056	1.591	1.259	0.659
2	1.001	754.437	24.15	23.35	53.261	3.204	1.786	0.928
3	1.117	754.417	24.28	23.76	35.572	4.198	2.044	1.061
4	1.172	754.507	24.30	23.80	26.997	4.736	2.171	1.127
5	1.409	754.551	24.20	23.66	25.669	6.905	2.622	1.357

Slope (m): 1.95153
Intercept (b): -0.02703
Correlation coefficient (r): 0.99990
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_a] m^3/min
1	0.705	754.349	23.73	22.79	49.056	1.591	0.791	0.661
2	1.001	754.437	24.15	23.35	53.261	3.204	1.124	0.933
3	1.117	754.417	24.28	23.76	35.572	4.198	1.287	1.067
4	1.172	754.507	24.30	23.80	26.997	4.736	1.366	1.132
5	1.409	754.551	24.20	23.66	25.669	6.905	1.650	1.363

Slope (m): 1.22228
Intercept (b): -0.01696
Correlation coefficient (r): 0.99990
Uncertainty ($k=2$): 0.015 m^3/min

End of Certificate of Calibration



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

Certificate of Calibration

Certificate No. : 25P3506

Page : 1 of 2

Equipment : U-Tube Manometer
Manufacturer: Dwyer
Model : 1221-36-W/M
Serial No.: -
ID No.: UAE.EFM.022/2560

Condition As-Received: Used Item
Received Date: 03 September 2025
Calibration Date: 09 September 2025

Reference: 2509-0144WSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1009 mbar

Submitted by: United Analyst and Engineering Consultant Co.,Ltd.

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

81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong,
Bangkok 10260

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to calibration procedure CP-P04, using " DKD-R 6-1 ; Calibration of Pressure Gauges " as a guidelines.

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Pressure Calibrator	PC106P	1189	MP-0218-24	24 Sep 2025

2.This result of calibration was made on requested at the point specified by customer.

3.Scale and conversion factor is 1 kPa = 4.0146293 inH₂O

4.This instrument was used clean air as pressure media.

5.This instrument was calibrated by applied pressure to high-port (+) side and low-port (-) side open to atmospheric pressure.

6.This instrument was installed in vertical orientation and top of the pressure port was used as the reference level.

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

8.This measurement result is traceable to the International System of Unit maintained through:-

-National Institute of Metrology (Thailand), NSC-ONSC Accredited No. Calibration 0144

Calibrated by : Suksan Khankaew
Issue Date : 10 September 2025

Approved Signatory : Attapol P.

[] Phalinee Prabpaipal

[] Sura Suwannasri

[✓] Attapol Panurach

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Cert.No.: 25P3506

Page: 2 of 2

Result of calibration:- Without adjustment

Range : 0 inH₂O to 36 inH₂O

Function:- Pressure Measurement

Scale Interval : 0.1 inH₂O (The Second Estimate)

Increasing Pressure

Applied Pressure	High-port side	UUC Indication		ΔP	Error
		Low-port side			
0.00	0.00	0.00		0.00	0.00
2.00	0.95	-0.95		1.90	-0.10
4.00	2.00	-1.95		3.95	-0.05
6.00	3.00	-2.95		5.95	-0.05
8.00	4.00	-3.95		7.95	-0.05
10.00	5.00	-4.95		9.95	-0.05
12.00	6.00	-5.95		11.95	-0.05
14.00	7.05	-7.00		14.05	0.05
16.00	8.05	-7.95		16.00	0.00
18.00	9.05	-8.95		18.00	0.00
20.00	10.05	-9.95		20.00	0.00
22.00	11.10	-11.00		22.10	0.10
24.00	12.10	-12.00		24.10	0.10
26.00	13.10	-13.00		26.10	0.10
28.00	14.10	-14.00		28.10	0.10
30.00	15.10	-15.00		30.10	0.10
32.00	16.10	-16.00		32.10	0.10
34.00	17.10	-17.00		34.10	0.10
35.70	18.00	-17.85		35.85	0.15

The uncertainty of measurement was ± 0.11 inH₂O

* ΔP = High-port side - Low-port side

* UUC = Unit Under Calibration

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

-o0o-

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CALIBRATION 0367

Flow measurement laboratory
Calibration services department.

CERTIFICATE OF CALIBRATION

Certificate No. : CGF-009-68

Page 1 of 2 Pages

MEASUREMENT ITEM : Volumetric Air Flow Calibrator
MANUFACTURER : BGI Incorporated
MODEL/TYPE : DeltaCal DC1
SERIAL NUMBER : 158850
ID NUMBER : UAE.EFM.038/2561
CONDITION AS-RECEIVED : Used item
CUSTOMER : United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong,
Bangkok 10260

RECEIVED DATE : 08 Jul 2025
MEASUREMENT DATE : 23 Jul 2025
ISSUE DATE : 23 Jul 2025

Calibration procedure:

The Gas flow meter was calibrated against Standard Gas Flow Meter (Piston Prover) Model ML-800-44. The WI-CL-005 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 NIMT (National Institute of Metrology Thailand) via Certificate number: MW-0046-24.

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'

CONDITION OF THIS RESULT OF CALIBRATION:

- The Unit Under Calibration was preconditioning 24 hours at ambient conditions prior to calibration being performed.
- The Unit Under Calibration was reading under actual conditions.
- Calibration condition:

Flow transmitting medium	: Air	
t_{Amb} average during calibration	: (23.6 ± 0.1)	$^{\circ}\text{C}$
H_{Amb} average during calibration	: (53.7 ± 5.0)	%RH
P_{Amb} average during calibration	: (1004.0 ± 0.5)	hPa
- 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.

Calibrated by:

- ☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

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JIRANATEE ASSOCIATES CO.,LTD.

Continuation of Certificate of Calibration Number CGF-009-68

Page 2 of 2 Pages

MEASUREMENT RESULTS:

The Gas flow meter was calibrated by comparison method with the Standard Gas Flow Meter (Piston Prover). The air was used as a medium in the system.

Calibration in the range of : 15.0 L/min to 18.3 L/min ☒ Without adjustment ☐ With adjustment

The results of calibration and associated measurement uncertainties are reported in the table below.

Standard Reading (L/min)	UUC Reading (L/min)	Error (%)	Uncertainty (k=2) (%)
14.912	15.00	0.59	0.63
15.731	15.82	0.59	0.62
16.551	16.67	0.69	0.61
17.404	17.50	0.57	0.60
18.176	18.29	0.65	0.59

End of Certificate of Calibration



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

Temperature measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : CDT-118-68

Page 1 of 2 Pages

MEASUREMENT ITEM : Temperature sensor with display
MANUFACTURER : BGI Incorporated
MODEL/TYPE : DeltaCal DC1
SERIAL NUMBER : 158850
ID NUMBER : UAE.EFM.038/2561
CONDITION AS-RECEIVED : Used item
CUSTOMER : United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260

RECEIVED DATE : 08 Jul 2025
MEASUREMENT DATE : 23 Jul 2025
ISSUE DATE : 23 Jul 2025

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH

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

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:

The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability:

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-1013-25, Certificate number: ER-0113-24

Reference Used During Calibration:

1. Standard Temperature Probe
Model: STS-100 A500, Serial No.: 667682-09,
Due date: 9 Apr 2026
2. Digital Temperature Indicator
Model: DTI-1000-A MK II, Serial No.: 671407-00591 Due date: ER-0061-25.

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:

- ☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol
☐ Miss Ruangrumpai Phoommit



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

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JIRANATEE ASSOCIATES CO.,LTD.

Continuation of Certificate of Calibration Number CDT-118-68

Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C to 50 °C

Function:

Table 1: This equipment was connected with Ambient temperature sensor probe (Ta) Model: - S/N: -
Dimension: Diameter 2.0 mm. Length 44.0 mm.

<u>Immersion Depth</u> (mm)	<u>Standard Reading</u> (°C)	<u>UUC Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
40	20.059	20.0	-0.1	0.099
40	30.033	30.0	0.0	0.099
40	35.021	35.2	0.2	0.099
40	40.011	40.2	0.2	0.099
40	49.997	49.8	-0.2	0.099

Table 2: This equipment was connected with Filter temperature sensor probe (Tf) Model: - S/N: -
Dimension: Diameter 7.97 mm. Length 102 mm.

<u>Immersion Depth</u> (mm)	<u>Standard Reading</u> (°C)	<u>UUC Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (°C)
90	20.059	20.1	0.0	0.099
90	30.033	30.1	0.1	0.099
90	35.021	35.1	0.1	0.099
90	40.011	40.1	0.1	0.099
90	49.997	49.7	-0.3	0.099

UUC*: Unit Under Calibration

End of Certificate of Calibration



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CALIBRATION 0367

Pressure measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : CPR-014-68

Page 1 of 2 Pages

MEASUREMENT ITEM : Digital barometer with display
MANUFACTURER : BGI Incorporated
MODEL/TYPE : DeltaCal DC1
SERIAL NUMBER : 158850
ID NUMBER : UAE.EFM.038/2561
CONDITION AS-RECEIVED : Used item
CUSTOMER : United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260

RECEIVED DATE : 08 Jul 2025
MEASUREMENT DATE : 23 Jul 2025
ISSUE DATE : 23 Jul 2025

CONDITION OF THIS RESULT OF CALIBRATION:

- Calibration effort for calibration sequence C
- The UUC* was installed in vertical orientation above reference standard instrument and center of UUC* was used as the reference level.
- Calibration conditions:
- Condition : ☒ Normal ☐ Abnormal
Pressure transmitting medium : Air
 ρ_{F1} (20°C, 1 bar) : 1.19 kg/m³
 H_{amb} : (54.0±0.2) %
 t_{amb} : (22.7±0.8) °C
 p_{amb} : (999.6±0.7) mbar
- The certificate is valid only to the item calibrated on date and place of calibration

Calibration procedure:

The Digital barometer was calibrated against Digital pressure calibrator. The WI-CL-003 was used as a calibration guideline.

Traceability:

The measurement results are traceable to the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MP-0017-25

Reference Used During Calibration:

- Absolute Pressure Transducer
Model: CPG2500, Serial No.: 4100126P

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:

- ☒ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

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NSC-TISI-TIS 17025
CALIBRATION 0367

Pressure measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : CPR-014-68

Page 2 of 2 Pages

MEASUREMENT RESULTS : ☐ Without adjustment ☒ With adjustment

CALIBRATION IN THE RANGE OF : 740 mmHg to 765 mmHg

The results of calibration and associated measurement uncertainties are reported in the table below.

STD (mmHg)	UUC* (mmHg)	Error (mmHg)	Uncertainty (k=2) (mmHg)
740.03	740.0	0.0	0.45
745.02	745.0	0.0	0.45
750.00	750.0	0.0	0.45
755.00	755.0	0.0	0.44
759.99	760.0	0.0	0.44
765.01	765.5	0.5	0.44

Note: UUC* Unit Under Calibration

: To convert the result in report unit to Pa should be multiply by 133.32

End of certificate



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



Certificate of Calibration

Certificate No. : 25H809

Page : 1 of 2

Equipment : Dial Thermo-Hygrometer

Manufacturer: Barigo

Model : -

Serial No.: -

ID No.: UAE.ANV.129/2550

Condition As-Received: Used Item

Received Date: 04 April 2025

Calibration Date: 10 April 2025
to 17 April 2025

Reference: 2504-0193WSC

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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

Submitted by: United Analyst and Engineering Consultant Co.,Ltd.

81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260

Procedure used: Calibration were conducted using in-house calibration procedure CP-H02 according to comparison with standard chilled mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Chilled Mirror Hygrometer	Dew Master	44730	22688	10 Sep 2025
2) Handheld Thermometer With Sensor	1521	A5A339	2411176	25 Oct 2025

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

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

-Thunder Scientific Corporation, NVLAB Accreditation No. Calibration 200582-0

-Technology Promotion Association (Thailand-Japan), NSC-ONSC Accredited No. Calibration 0008

Calibrated by : Kraipop Onrat

Issue Date : 18 April 2025

Approved Signatory :

Viporn

[] Chakrit Waewwanjua

[] Pornthippa Tameyakul

[✓] Viporn Tantiyawutti

เอกสารไม่ควบคุม



Cert. No.: 25H809

Page.: 2 of 2

Result of Calibration:- Without Adjustment

Function: Humidity Measurement.

<u>Reference</u> <u>Temperature</u> (°C)	<u>Standard</u> <u>Humidity</u> (%R.H.)	<u>UUC*</u> <u>Reading</u> (%R.H.)	<u>Correction</u> (%R.H.)	<u>Uncertainty</u> <u>of Measurement</u> (±%R.H.)
25.0	40.1	44	-3.9	1.7
25.0	60.0	61	-1.0	1.8
25.0	80.0	77	3.0	1.9

Result of Calibration:- Without Adjustment

Function: Temperature Measurement.

<u>Standard</u> <u>Temperature</u> (°C)	<u>UUC*</u> <u>Reading</u> (°C)	<u>Correction</u> (°C)	<u>Uncertainty</u> <u>of Measurement</u> (±°C)
20.012	20.0	0.012	0.72
25.034	25.0	0.034	0.72
30.032	30.0	0.032	0.72
35.022	35.0	0.022	0.72
40.040	39.5	0.540	0.72

UUC* : Unit Under Calibration

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

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เอกสารไม่ควบคุม



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



Certificate of Calibration

Certificate No. : 25P1380

Page : 1 of 2

Equipment : Aneroid Barometer

Manufacturer: Barigo

Model : -

Serial No.: -

ID No.: UAE.ANV.125/2550

Condition As-Received: Used Item

Received Date: 04 April 2025

Calibration Date: 17 April 2025

Reference: 2504-0196WSC

Submitted by: United Analyst and Engineering Consultant Co.,Ltd.

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1005 mbar

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.

81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to calibration procedure CP-P10, using " DKD-R 6-1 ; Calibration of Pressure Gauges " as a guidelines.

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Standard Barometer	DPI142	1422505046	MP-0133-24	15 May 2025

2.This instrument was installed in vertical orientation and center of the dial was used as the reference level.

3.This result of calibration was made on requested at the point specified by customer.

4.This result of calibration instrument was in absolute pressure.

5.This instrument was used clean air as pressure media.

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

7.This Certification is traceable to the International System of Unit maintained through:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Kaerkpon Saivichai

Issue Date : 21 April 2025

Approved Signatory :

Attapol P.

[] Phalinee Prabpaipal

[] Sura Suwannasri

[✓] Attapol Panurach

เอกสารไม่ควบคุม



Cert.No.: 25P1380

Page: 2 of 2

Result of calibration:- Without adjustment

Range : 960 hPa to 1030 hPa

Function:- Absolute Pressure Measurement

Scale Interval : 1 hPa (The Fifth Estimate)

Increasing Pressure

Applied Pressure (hPa)	961.40	971.90	981.62	992.25	1001.35	1009.76	1019.56	1029.44
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0
Error (hPa)	-1.40	-1.90	-1.62	-2.25	-1.35	0.24	0.44	0.56

Decreasing Pressure

Applied Pressure (hPa)	1029.44	1019.30	1009.48	1000.54	991.38	981.80	971.62	961.62
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0
Error (hPa)	0.56	0.70	0.52	-0.54	-1.38	-1.80	-1.62	-1.62

The uncertainty of measurement was ± 0.25 hPa

* UUC = Unit Under Calibration

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

-o0o-

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : May 12, 2025

Equipment : Gas Analyzer (NO₂)

Model : 42i

Manufacturer : Thermo Scientific

Serial Number : 1201778106

Standard Gas Concentration

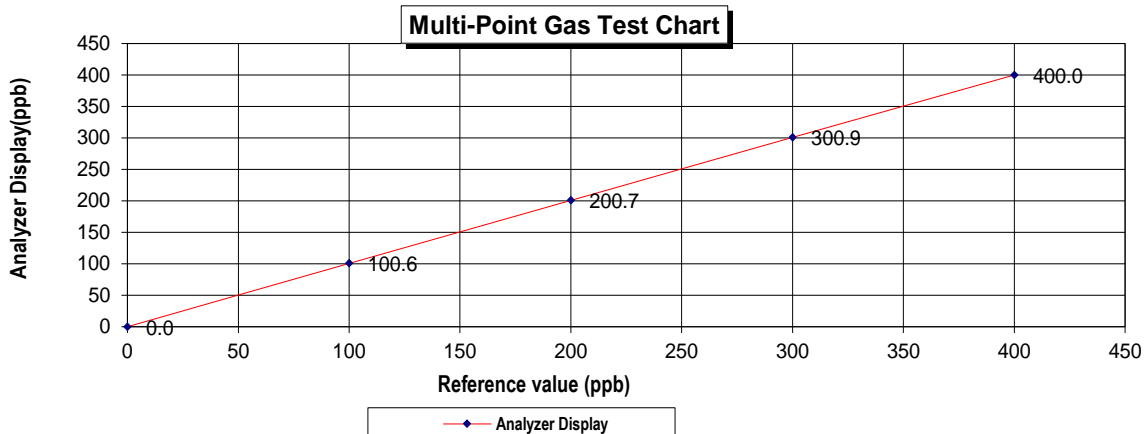
Sulphur Dioxide (SO ₂)	42.89
Nitric Oxide (NO)	46.77
Methane (CH ₄)	-
Carbon Monoxide (CO)	965.9
Cylinder No. :	EB0159156
Expiration Date :	Nov 6, 2026

Dilutor Detail

Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.6	0.60	0.60	0.60
Level 3	40.00%	200.0	200.7	0.70	0.35	0.35
Level 4	60.00%	300.0	300.9	0.90	0.30	0.30
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb				Average Difference (%)		0.25



Calculate by

Grichai G.
12 / 05 / 2025

Approve by

Pattana A.
7 / May / 2025

MULTI-POINT GAS TEST REPORT

Test Date : May 12, 2025

Equipment : Gas Analyzer (NO₂)

Model : 42i

Manufacturer : Thermo Scientific

Serial Number : 1200636463

Standard Gas Concentration

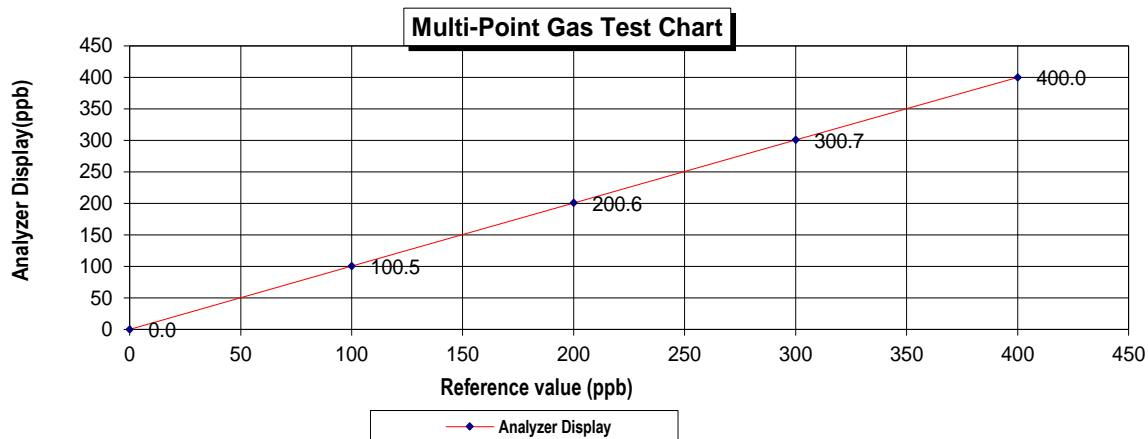
Sulphur Dioxide (SO ₂)	42.89
Nitric Oxide (NO)	46.77
Methane (CH ₄)	-
Carbon Monoxide (CO)	965.9
Cylinder No. :	EB0159156
Expiration Date :	Nov 6, 2026

Dilutor Detail

Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.5	0.50	0.50	0.50
Level 3	40.00%	200.0	200.6	0.60	0.30	0.30
Level 4	60.00%	300.0	300.7	0.70	0.23	0.23
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb				Average Difference (%)		0.21



Calculate by

Girichai G.
12 / 05 / 2025

Approve by

Pattana A.
7 / May / 2025

MULTI-POINT GAS TEST REPORT

Test Date : May 7, 2025

Equipment : Gas Analyzer (NO₂)

Model : 42C

Manufacturer : Thermo Environmental Instruments

Serial Number : 42C-78933-390

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	42.89
Nitric Oxide (NO)	46.77
Methane (CH ₄)	-
Carbon Monoxide (CO)	965.9
Cylinder No. :	EB0159156
Expiration Date :	Nov 6, 2026

Dilutor Detail

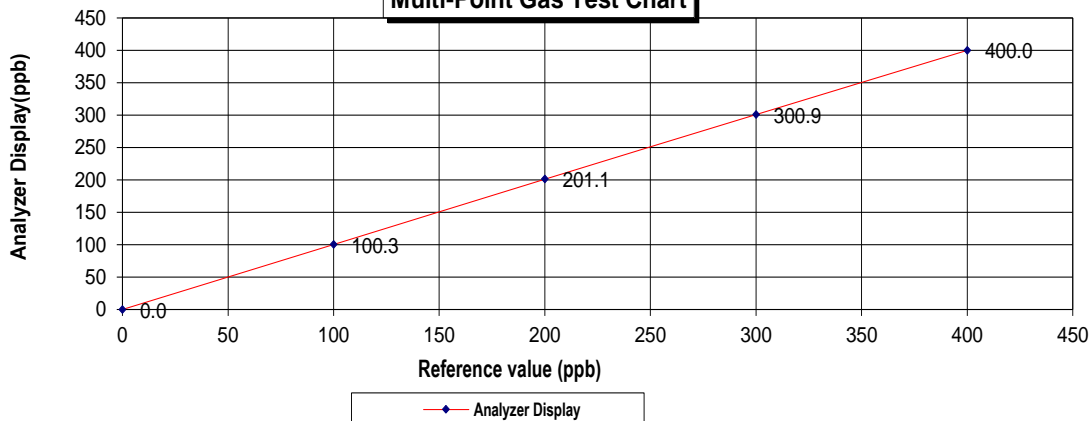
Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

	Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.3	0.30	0.30	0.30
Level 3	40.00%	200.0	201.1	1.10	0.55	0.55
Level 4	60.00%	300.0	300.9	0.90	0.30	0.30
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb			Average Difference (%)		0.23	

:Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



Calculate by

Grichai C.
7 / 05 / 2025

Approve by

Pattana B.
7 / May / 2025

MULTI-POINT GAS TEST REPORT

Test Date : May 7, 2025

Equipment : Gas Analyzer (NO₂)

Model : 42i

Manufacturer : Thermo Scientific

Serial Number : 1182920005

Standard Gas Concentration

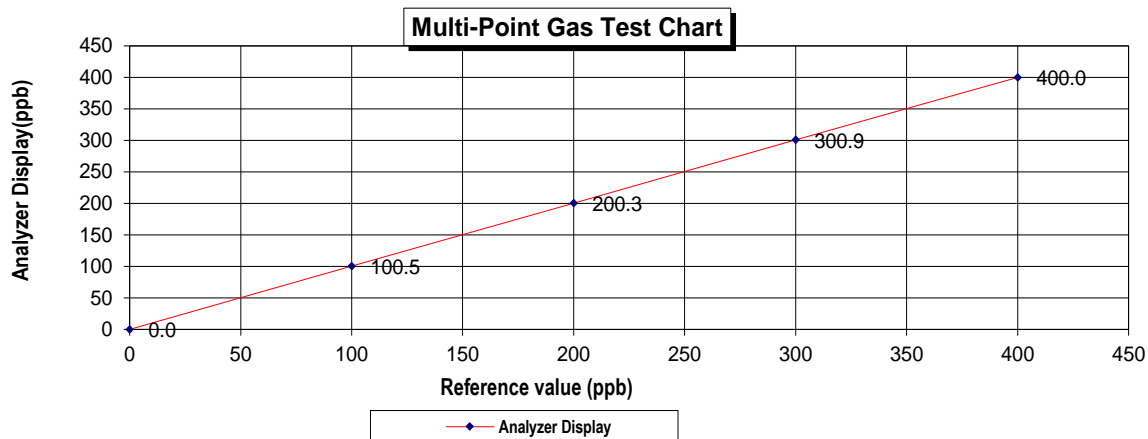
Sulphur Dioxide (SO ₂)	42.89
Nitric Oxide (NO)	46.77
Methane (CH ₄)	-
Carbon Monoxide (CO)	965.9
Cylinder No. :	EB0159156
Expiration Date :	Nov 6, 2026

Dilutor Detail

Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.5	0.50	0.50	0.50
Level 3	40.00%	200.0	200.3	0.30	0.15	0.15
Level 4	60.00%	300.0	300.9	0.90	0.30	0.30
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb				Average Difference (%)		0.19



Calculate by

Grichai G.
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7 / 05 / 2025
...../...../.....

Approve by

Pattana A.
.....
7 / May / 2025
...../...../.....

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND)

LTD

Part Number: E05NI91E15A0014

Cylinder Number: EB0162121

Laboratory: 124 - Plumsteadville - PA

PGVP Number: A12023

Gas Code: CO,CO₂,NO,NO₂,SO₂,BALN

Reference Number: 160-402772205-1

Cylinder Volume: 144.0 CF

Cylinder Pressure: 2016 PSIG

Valve Outlet: 660

Certification Date: Jul 06, 2023

Expiration Date: Jul 06, 2031

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	100.0 PPM	100.4 PPM	G1	+/- 0.9% NIST Traceable	06/27/2023, 07/06/2023
NITRIC OXIDE	100.0 PPM	100.2 PPM	G1	+/- 0.9% NIST Traceable	06/27/2023, 07/06/2023
SULFUR DIOXIDE	100.0 PPM	100.0 PPM	G1	+/- 1.4% NIST Traceable	06/27/2023, 07/06/2023
CARBON MONOXIDE	200.0 PPM	199.2 PPM	G1	+/- 0.3% NIST Traceable	06/26/2023
CARBON DIOXIDE	8.000 %	7.982 %	G1	+/- 1.2% NIST Traceable	06/27/2023
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMIS	104202308	CC754364	98.36 PPM NITRIC OXIDE/NITROGEN	+/- 0.4%	Jan 04, 2031
PRM	C2219101	APE1514048	100.19 PPM NITRIC OXIDE/NITROGEN	+/- 0.3%	Feb 28, 2025
GMIS	2023042525	CC754381	98.52 PPM NITRIC OXIDE/NITROGEN	+/- 0.4%	Apr 25, 2031
PRM	12409	D913660	15.01 PPM NITROGEN DIOXIDE/AIR	+/- 1.5%	Feb 17, 2023
GMIS	153400202002	EB0130037	9.693 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.6%	Sep 29, 2025
NTRM	160102-22	KAL003820	97.69 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Nov 01, 2027
CO	230601	CC745902	249.47 PPM CARBON MONOXIDE/NITROGEN	+/- 0.3%	Dec 09, 2028
NTRM	130606-02	CC411730	13.359 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	May 14, 2025

The SRM, NTRM, PRM, or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet iS50 FTIR AUP2010245 CO ₂	FTIR	Jun 15, 2023
SIEMENS ULTRAMAT6E N1-C8-180	NDIR	Jun 14, 2023
Nicolet iS50 FTIR AUP2010245 NO	FTIR	Jun 29, 2023
Nicolet iS50 FTIR AUP2010245 NO ₂	FTIR	Jun 15, 2023
Nicolet iS50 FTIR AUP2010245 SO ₂	FTIR	Jun 08, 2023


Approved for Release

MULTI-POINT GAS TEST REPORT

Test Date : May 15, 2025

Equipment : Gas Analyzer (SO₂)

Model : 43i

Manufacturer : Thermo SCIENTIFIC

Serial Number : CM22387061

Standard Gas Concentration

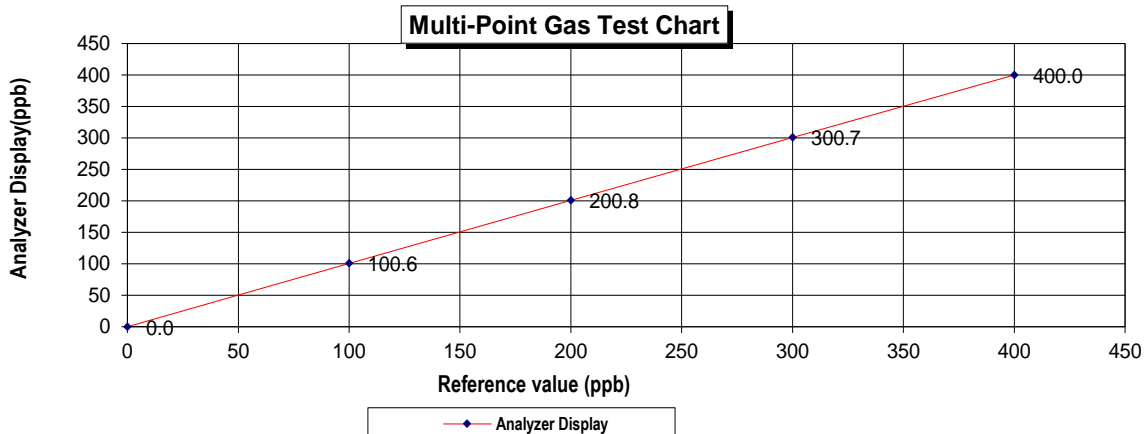
Sulphur Dioxide (SO ₂)	42.89
Nitric Oxide (NO)	46.77
Methane (CH ₄)	-
Carbon Monoxide (CO)	965.9
Cylinder No. :	EB01159156
Expiration Date :	Nov 06, 2026

Dilutor Detail

Manufacturer :	Thermo SCIENTIFIC
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.6	0.60	0.60	0.60
Level 3	40.00%	200.0	200.8	0.80	0.40	0.40
Level 4	60.00%	300.0	300.7	0.70	0.23	0.23
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb				Average Difference (%)		0.25



Calculate by

15 / 05 / 2025

Approve by

15 / May / 2025

MULTI-POINT GAS TEST REPORT

Test Date : May 12, 2025

Equipment : Gas Analyzer (SO₂)

Model : 43i

Manufacturer : Thermo SCIENTIFIC

Serial Number : CM22387063

Standard Gas Concentration

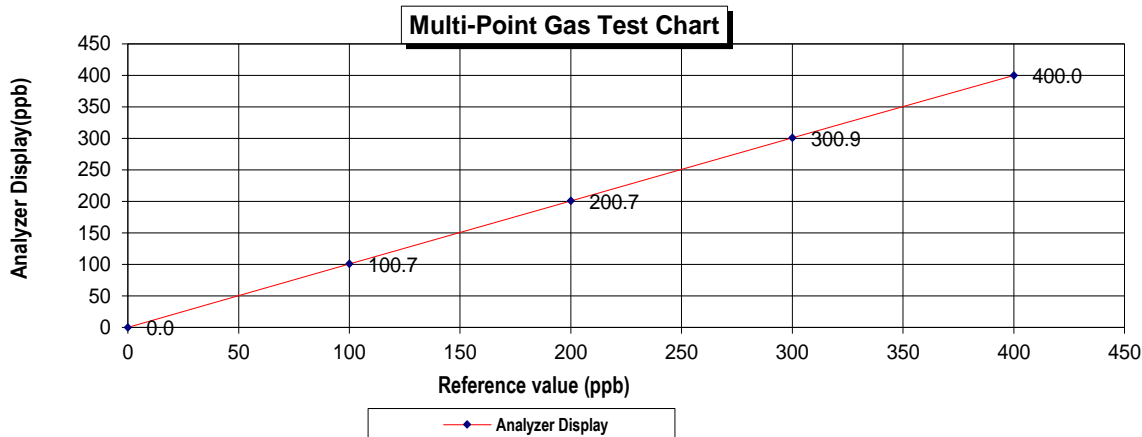
Sulphur Dioxide (SO ₂)	42.89
Nitric Oxide (NO)	46.77
Methane (CH ₄)	-
Carbon Monoxide (CO)	965.9
Cylinder No. :	EB0159156
Expiration Date :	Nov 06, 2026

Dilutor Detail

Manufacturer :	Thermo SCIENTIFIC
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.7	0.70	0.70	0.70
Level 3	40.00%	200.0	200.7	0.70	0.35	0.35
Level 4	60.00%	300.0	300.9	0.90	0.30	0.30
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb				Average Difference (%)		0.27



Calculate by

Girichai G.
.....
12...../.....05...../.....2025.

Approve by

Pattana A.
.....
.....12...../.....May...../.....2025

MULTI-POINT GAS TEST REPORT

Test Date : May 15, 2025

Equipment : Gas Analyzer (SO₂)

Model : 43i

Manufacturer : Thermo SCIENTIFIC

Serial Number : CM22387065

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	42.89
Nitric Oxide (NO)	46.77
Methane (CH ₄)	-
Carbon Monoxide (CO)	965.9
Cylinder No. :	EB01159156
Expiration Date :	Nov 06, 2026

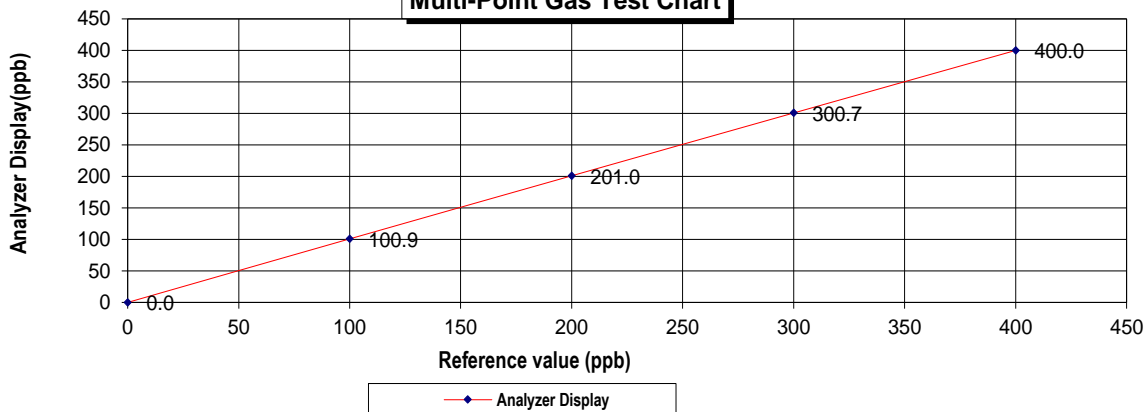
Dilutor Detail

Manufacturer :	Thermo SCIENTIFIC
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.9	0.90	0.89	0.89
Level 3	40.00%	200.0	201.0	1.00	0.50	0.50
Level 4	60.00%	300.0	300.7	0.70	0.23	0.23
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb			Average Difference (%)			0.32

Multi-Point Gas Test Chart



Calculate by

15 / 05 / 2025

Approve by

15 / May / 2025

MULTI-POINT GAS TEST REPORT

Test Date : May 6, 2025

Equipment : Gas Analyzer (SO₂)

Model : 43i

Manufacturer : Thermo SCIENTIFIC

Serial Number : CM22387067

Standard Gas Concentration

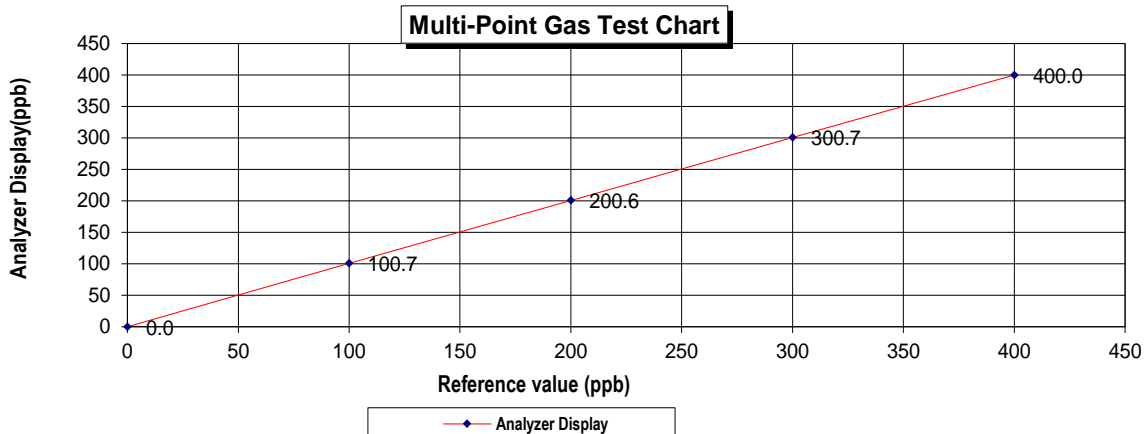
Sulphur Dioxide (SO ₂)	42.89
Nitric Oxide (NO)	46.77
Methane (CH ₄)	-
Carbon Monoxide (CO)	965.9
Cylinder No. :	EB0159156
Expiration Date :	Nov 06, 2026

Dilutor Detail

Manufacturer :	Thermo SCIENTIFIC
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.7	0.70	0.70	0.70
Level 3	40.00%	200.0	200.6	0.60	0.30	0.30
Level 4	60.00%	300.0	300.7	0.70	0.23	0.23
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb				Average Difference (%)		0.25



Calculate by

Grichai. G
.....
6 / 05 / 2025

Approve by

P. Kham
.....
6 / May / 2025

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND)

LTD.

Part Number: E05NI91E15A0014

Cylinder Number: EB0162121

Laboratory: 124 - Plumsteadville - PA

PGVP Number: A12023

Gas Code: CO, CO2, NO, NOX, SO2, BALN

Reference Number: 160-402772205-1

Cylinder Volume: 144.0 CF

Cylinder Pressure: 2016 PSIG

Valve Outlet: 660

Certification Date: Jul 06, 2023

Expiration Date: Jul 06, 2031

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	100.0 PPM	100.4 PPM	G1	+/- 0.9% NIST Traceable	06/27/2023, 07/06/2023
NITRIC OXIDE	100.0 PPM	100.2 PPM	G1	+/- 0.9% NIST Traceable	06/27/2023, 07/06/2023
SULFUR DIOXIDE	100.0 PPM	100.0 PPM	G1	+/- 1.4% NIST Traceable	06/27/2023, 07/06/2023
CARBON MONOXIDE	200.0 PPM	199.2 PPM	G1	+/- 0.3% NIST Traceable	06/26/2023
CARBON DIOXIDE	8.000 %	7.982 %	G1	+/- 1.2% NIST Traceable	06/27/2023
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMIS	104202308	CC754364	98.36 PPM NITRIC OXIDE/NITROGEN	+/- 0.4%	Jan 04, 2031
PRM	C2219101	APE1514048	100.19 PPM NITRIC OXIDE/NITROGEN	+/- 0.3%	Feb 28, 2025
GMIS	2023042525	CC754381	98.52 PPM NITRIC OXIDE/NITROGEN	+/- 0.4%	Apr 25, 2031
PRM	12409	D913660	15.01 PPM NITROGEN DIOXIDE/AIR	+/- 1.5%	Feb 17, 2023
GMIS	153400202002	EB0130037	9.693 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.6%	Sep 29, 2025
NTRM	160102-22	KAL003820	97.69 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Nov 01, 2027
CO	230601	CC745902	249.47 PPM CARBON MONOXIDE/NITROGEN	+/- 0.3%	Dec 09, 2028
NTRM	130606-02	CC411730	13.359 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	May 14, 2025

The SRM, NTRM, PRM, or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet iS50 FTIR AUP2010245 CO2	FTIR	Jun 15, 2023
SIEMENS ULTRAMAT6E N1-C8-180	NDIR	Jun 14, 2023
Nicolet iS50 FTIR AUP2010245 NO	FTIR	Jun 29, 2023
Nicolet iS50 FTIR AUP2010245 NO2	FTIR	Jun 15, 2023
Nicolet iS50 FTIR AUP2010245 SO2	FTIR	Jun 08, 2023


Approved for Release



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 May, 2025

Certification No. 338/25

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : LSI Lastem ID No. : UAE.EFM.133/2563

Type : Dato Logger E-LOG 305 wind speed and wind direction DNA 821

Serial No. : Dato Logger 20040062 wind speed and wind direction 20040185

Customer : United Analyst and Engineering Consultant Co.,Ltd.
81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.6 hPa

NATIONAL STANDARD WIND TUNNEL :

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119

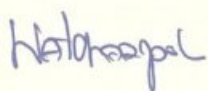
: HOOK GAGE NO 1425 Pitot Tube Theodor Friedrichs Type 0800.0000 serial 9023

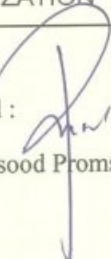
N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: 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

Calibrated by : 
Mr. Watcharapol Subwat
Mechanical Engineer

Signed : 
Mr. Pisood Promsut



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 338/25

20 May, 2025

Page : 2 of 2

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches H ₂ O	Vacuum inches H ₂ O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	2.9	0.12
5.00	-	-	-	5.0	0.00
7.04	-	-	-	6.9	0.14
9.02	-	-	-	9.0	0.02
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 DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by :

Watchapol

Mr. Watchapol Subwat

Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau



เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING
CONSULTANT CO.,LTD.
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Prakanong, Bangkok 10260

Certificate No : 25-ACT-040
Request No : Req-2025-0481

Unit Under Calibration Details

Measurement item : Acoustic Calibrator Class : 1
Manufacturer : SVANTEK Range : 94 , 114 dB / 1000 Hz
Model : SV 35 Instrument Status : Used
Serial Number : 44792
ID : UAE.EFM.020/2559

Calibration Environment and Details

Temperature : (23 ±2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ±10.0 hPa)
Received Date : 19 February 2025
Calibration Date : 17 March 2025
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEI	12 June 2025
THD Multimeter	2015	1047765	NIMT	4 February 2026

Traceability : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k=2$, providing a level of confidence approximately 95 %.

Calibrated By : _____
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : _____
Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 17 March 2025

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Certificate No : 25-ACT-040

Request No : Req-2025-0481

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)	Result
	Measured	Deviated value	Measured	Deviated value			
94 dB / 1000 Hz	93.96	-0.04	-	-	0.13	0.25	Pass
114 dB / 1000 Hz	114.03	0.03	-	-	0.13	0.25	Pass

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)	Result
	Measured (Hz)	Deviated	Measured (Hz)	Deviated			
94 dB / 1000 Hz	1000.00	0.00	-	-	0.01	0.70	Pass
114 dB / 1000 Hz	1000.00	0.00	-	-	0.01	0.70	Pass

Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)

Calibration Range (Hz)	Without Adjustment	Adjustment	Uncertainty (± %)	Acceptance limit Class 1 (± %)	Result
	Measured (%)	Measured (%)			
94 dB / 1000 Hz	1.34	-	0.40	2.5	Pass
114 dB / 1000 Hz	0.45	-	0.40	2.5	Pass

Note :

Function	Maximum-permitted Uncertainty of measurement
Sound pressure level	0.15 dB
Frequency	0.20%
Total distortion+noise	0.50%

- Acceptance limit was IEC60942:2017 Class 1

- The calibration results exclude the calibrator pressure correction

- The calibration results exclude the microphone volume correction

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The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-ACT-02 Rev.03 Issue date 5/6/24

Certificate No : 25-ACT-040

Request No : Req-2025-0481

Decision Rule for Statements of Conformity

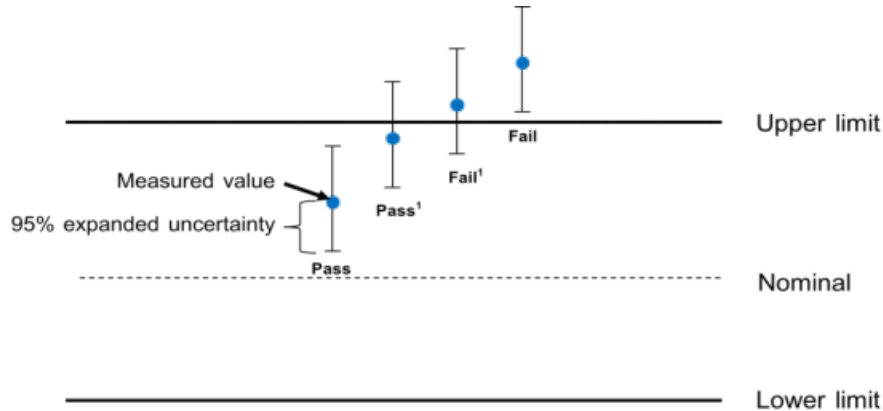
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

Pass = The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass¹ = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail¹ = The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail = The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



End of Calibration

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**ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT**

975 Moo 4, Bangpoo Industrial Estate, Soi 8, Sukhumvit Road km 37,

Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280

Tel: +66 2709 4860 Fax: +66 2324 0917



Certificate No.: CP20240324EA
Operation No.: CP2024080295

Certificate of Calibration

Equipment: Sound Level Meter

Manufacturer: Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)

Model/Type: LxT1 (Meter), 377B02 (Microphone), PRMLxT1 (Preamplifier)

Serial No.: 0007302 (Meter), 344896 (Microphone), 0776637 (Preamplifier)

ID No.: UAE.EFM.035/2566

Customer: United Analyst and Engineering Consultant Co.,Ltd.

Address: 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak
Phrakhanong, Bangkok 10260

Received Date: 9 August 2024

Calibrated Date: 22 - 27 August 2024

Issued Date: 28 August 2024

Calibrated by: Ms. Juntaporn Kunhakom

Approved by: _____

(Mr. Sittichai Swaksuriyawong)
Group Manager

This report was prepared electronically using applicable electronic signature. Printing or copy of file are considered as a copy of the document.

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor (k) providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.

Certificate No.: CP20240324EA

Calibration Report

Equipment: Sound Level Meter
Manufacturer: Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)
Model/Type: LxT1 (Meter), 377B02 (Microphone), PRMLxT1 (Preamplifier)
Serial No.: 0007302 (Meter), 344896 (Microphone), 0776637 (Preamplifier)
ID No.: UAE.EFM.035/2566
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Pressure: (101.3 ± 1.5) kPa
Method of Calibration :-
 IEC 61672-3:2013.

Condition of this result of calibration

1. Reference standards instrument :-

	<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1)	Standard microphone	4180	2787490	AA-1012-23	12 November 2024
2)	Arbitrary Function Generator	AFG2021	C010063	CK20240048EA	23 June 2025
3)	Programmable Attenuator	PA5	2755	EF-0040-23	1 October 2024
4)	6.5 Digit precision multimeter	8846A	9610014	CB20230200EA	15 November 2024
5)	Pressure humidity and Temperature Transmitter	PTU301	L3950483	CL1-P240023 CD20240142EA	24 March 2025 12 June 2025
6)	Pressure humidity and Temperature Transmitter	PTU301	L3950484	CL1-P240030 CD20240143EA	11 April 2025 12 June 2025
7)	Performance Audio Analyzer	U8903B	MY56510003	CB20240035EB CK20230072EA	13 February 2025 13 September 2024

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

3. This certification is traceable to the international system of unit maintained at :-

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- National Institute of Metrology (Thailand)

- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
-	-	-	-

Certificate No.: CP20240324EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
28.8

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	28.6
C-weighting	28.4
Z-weighting	34.3

Function : 3. Acoustical signal tests of frequency weightings (Without Windscreen)

Meter free-field acoustic response at a level of 84 dB.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.1	0.1	0.1	±1.0
1000	0.0	0.0	0.0	±0.7
8000	-0.2	-0.2	-0.1	+1.5; -2.5

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	-0.1	0.0	0.0	±1.0
125	0.0	0.0	-0.1	±1.0
250	-0.1	0.0	-0.1	±1.0
500	0.0	0.0	-0.1	±1.0
1000	0.0	0.0	0.0	±0.7
2000	0.0	0.0	0.0	±1.0
4000	0.0	0.0	0.0	±1.0
8000	-0.1	0.0	0.0	+1.5; -2.5
16000	0.0	0.0	-0.1	+2.5; -16.0

Certificate No.: CP20240324EA

Calibration Report

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
C-weighting	94.0	0.0	±0.2
A-weighting	94.0	0.0	±0.2
Z-weighting	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	±0.1
Slow	94.0	0.0	±0.1
LAeq	94.0	0.0	±0.1

Function : 6. Long-Term Stability

Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	±0.1

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.8
99.0	99.0	0.0	±0.8
104.0	104.0	0.0	±0.8
109.0	109.0	0.0	±0.8
114.0	114.0	0.0	±0.8
119.0	119.0	0.0	±0.8
124.0	124.0	0.0	±0.8
129.0	129.0	0.0	±0.8
134.0	134.0	0.0	±0.8
139.0	139.0	0.0	±0.8

Certificate No.: CP20240324EA

Calibration Report

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.1	0.1	±0.8
39.0	39.4	0.4	±0.8

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	136.0	0.0	±0.5
	2	118.8	-0.2	+1.0 ; -1.5
	0.25	109.7	-0.3	+1.0 ; -3.0
Slow	200	129.5	-0.1	±0.5
	2	109.9	-0.1	+1.0 ; -3.0
	0.25	100.9	-0.1	+1.0 ; -3.0
LAE	200	130.0	0.0	±0.5
	2	110.0	0.0	+1.0 ; -1.5
	0.25	100.9	-0.1	+1.0 ; -3.0

Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	135.4	134.8	-0.6	±2.0
Positive half cycle	134.4	134.0	-0.4	±1.0
Negative half cycle	134.4	134.1	-0.3	±1.0

Certificate No.: CP20240324EA

Calibration Report

Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
143.6	143.4	-0.2	±1.5

Function : 11. High-Level Stability

High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	139.0	139.0	0.0	±0.1

Uncertainty of measurement

Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings - Free-field sound pressure response level	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Tone burst response	0.20	0.30
9) Peak C sound level	0.20	0.35
10) Overload indication	0.20	0.25
11) High-Level Stability	0.10	0.10

Remarks:

1. Indication at the calibration check frequency can not measured because customer does not provide a sound calibrator.
2. The acceptance limit is for the deviated value.
3. Acceptance limits was IEC61672-3:2013 Class 1.
4. The coverage factor $k = 2.00$

-- End of Report --

เอกสารไม่ควบคุม

Certificate No.: CP20240339EA
Operation No.: CP2024090310

Certificate of Calibration

Equipment: Sound Level Meter

Manufacturer: Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)

Model/Type: LxT1 (Meter), 377B02 (Microphone), PRMLxT1 (Preamplifier)

Serial No.: 0007303 (Meter), 345232 (Microphone), 077638 (Preamplifier)

ID No.: UAE.EFM.036/2566

Customer: United Analyst and Engineering Consultant Co.,Ltd.

Address: 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak
Phrakhanong, Bangkok 10260

Received Date: 3 September 2024

Calibrated Date: 20 - 24 September 2024

Issued Date: 26 September 2024

Calibrated by: Ms. Juntaporn Kunhakom

Approved by:



(Mr. Sittichai Swaksuriyawong)
Group Manager

This report was prepared electronically using applicable electronic signature. Printing or copy of file are considered as a copy of the document.

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor (k) providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.

Certificate No.: CP20240339EA

Calibration Report

Equipment: Sound Level Meter
 Manufacturer: Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)
 Model/Type: LxT1 (Meter), 377B02 (Microphone), PRMLxT1 (Preamplifier)
 Serial No.: 0007303 (Meter), 345232 (Microphone), 077638 (Preamplifier)
 ID No.: UAE.EFM.036/2566
 Ambient Temperature: (23 ± 2) °C
 Relative Humidity: (50 ± 15) %
 Pressure: (101.3 ± 1.5) kPa

Method of Calibration :-

IEC 61672-3:2013.

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1012-23	12 November 2024
2) Arbitrary Function Generator	AFG2021	C010063	CK20240048EA	23 June 2025
3) Programmable Attenuator	PA5	2755	EF-0040-23	1 October 2024
4) 6.5 Digit precision multimeter	8846A	9610014	CB20230200EA	15 November 2024
5) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P240022 CD20240180EA	20 March 2025 7 August 2025
6) Performance Audio Analyzer	U8903B	MY56510003	CB20240035EB CK20240069EA	13 February 2025 19 September 2025

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

3. This certification is traceable to the international system of unit maintained at :-

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)
- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

Reference standards instrument for Electrical function

- National Institute of Metrology (Thailand)
- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
-	-	-	-

Certificate No.: CP20240339EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
29.7

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	29.6
C-weighting	29.5
Z-weighting	35.1

Function : 3. Acoustical signal tests of frequency weightings (Without Windscreen)

Meter free-field acoustic response at a level of 84 dB.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.5	0.4	0.4	±1.0
1000	-0.1	-0.1	-0.1	±0.7
8000	0.3	0.3	0.3	+1.5; -2.5

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	0.0	0.0	0.0	±1.0
125	0.0	0.0	0.0	±1.0
250	0.0	0.0	0.0	±1.0
500	0.1	-0.1	0.0	±1.0
1000	0.0	0.0	0.0	±0.7
2000	0.0	0.0	0.1	±1.0
4000	0.0	0.0	0.0	±1.0
8000	-0.1	-0.1	0.1	+1.5; -2.5
16000	0.0	0.0	0.0	+2.5; -16.0

Certificate No.: CP20240339EA

Calibration Report

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
C-weighting	94.0	0.0	±0.2
A-weighting	94.0	0.0	±0.2
Z-weighting	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	±0.1
Slow	94.0	0.0	±0.1
LAeq	94.0	0.0	±0.1

Function : 6. Long-Term Stability

Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	±0.1

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.8
99.0	99.0	0.0	±0.8
104.0	104.0	0.0	±0.8
109.0	109.0	0.0	±0.8
114.0	114.0	0.0	±0.8
119.0	119.0	0.0	±0.8
124.0	124.0	0.0	±0.8
129.0	129.0	0.0	±0.8
134.0	134.1	0.1	±0.8
139.0	139.1	0.1	±0.8
140.0	140.1	0.1	±0.8

Certificate No.: CP20240339EA

Calibration Report

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.1	0.1	±0.8
43.0	43.1	0.1	±0.8
42.0	42.2	0.2	±0.8
41.0	41.3	0.3	±0.8
40.0	40.4	0.4	±0.8

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	135.9	-0.1	±0.5
	2	118.8	-0.2	+1.0 ; -1.5
	0.25	109.8	-0.2	+1.0 ; -3.0
Slow	200	129.5	-0.1	±0.5
	2	109.9	-0.1	+1.0 ; -3.0
	0.25	101.0	0.0	+1.0 ; -3.0
LAE	200	130.0	0.0	±0.5
	2	110.0	0.0	+1.0 ; -1.5
	0.25	101.0	0.0	+1.0 ; -3.0

Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	135.4	134.8	-0.6	±2.0
Positive half cycle	134.4	134.0	-0.4	±1.0
Negative half cycle	134.4	134.0	-0.4	±1.0

Certificate No.: CP20240339EA

Calibration Report

Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
143.6	143.5	-0.1	±1.5

Function : 11. High-Level Stability

High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	139.0	139.0	0.0	±0.1

Uncertainty of measurement

Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings - Free-field sound pressure response level	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Tone burst response	0.20	0.30
9) Peak C sound level	0.20	0.35
10) Overload indication	0.24	0.25
11) High-Level Stability	0.10	0.10

- Remarks:
1. Indication at the calibration check frequency can not measured because customer does not provide a sound calibrator.
 2. The acceptance limit is for the deviated value.
 3. Acceptance limits was IEC61672-3:2013 Class 1.
 4. The coverage factor $k = 2.00$

- - End of Report - -



Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING
CONSULTANT CO.,LTD.
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Prakanong, Bangkok 10260

Certificate No : 25-ACT-073
Request No : Req-2025-1017

Unit Under Calibration Details

Measurement item : Acoustic Calibrator Class : 2
Manufacturer : LARSON DAVIS Range : 94 , 114 dB / 1000 Hz
Model : CAL150 Instrument Status : Used
Serial Number : 6458
ID : UAE.EFM.056/2564

Calibration Environment and Details

Temperature : (23 ±2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ±10.0 hPa)
Received Date : 9 May 2025
Calibration Date : 20 May 2025
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEI	12 June 2025
THD Multimeter	2015	1047765	NIMT	4 February 2026

Traceability : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k=2$, providing a level of confidence approximately 95 %.

Calibrated By : me
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : msm
Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 20 May 2025

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Certificate No : 25-ACT-073

Request No : Req-2025-1017

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)
	Measured	Deviated value	Measured	Deviated value	
94 dB / 1000 Hz	93.88	-0.12	-	-	0.12
114 dB / 1000 Hz	113.91	-0.09	-	-	0.11

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)
	Measured (Hz)	Deviated value	Measured (Hz)	Deviated value	
94 dB / 1000 Hz	1000.0	0.00	-	-	0.01
114 dB / 1000 Hz	1000.0	0.00	-	-	0.010

Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)

Calibration Range (Hz)	Without Adjustment	Adjustment	Uncertainty (± %)
	Measured (%)	Measured (%)	
94 dB / 1000 Hz	1.30	-	0.17
114 dB / 1000 Hz	0.64	-	0.17

Note :

- The calibration results exclude the calibrator pressure correction
- The calibration results exclude the microphone volume correction

End of Calibration

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Cert. No. : ACL25263

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 01010779 / 194534 / 14657
ID No.: UAE.EFM.082/2565

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK SUB-DISTRICT,
PHRAKHANONG DISTRICT, BANGKOK 10260
THAILAND.

Location : -

Ambient Temperature : (23.0 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

Received Date : 18 JUNE 2025
Calibration Date : 07 JULY 2025
Date of Issue : 07 JULY 2025

Calibrated by :

Nathakorn Pisutpaisan

Approved by :

Wichok
(Wichok Ekpongpradit)

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

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Cert. No. : ACL25263
Job No. : VC68AC0130
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0011-25	11-FEB-26
Waveform Generator	33511B	MY52302742	EF-0012-25	11-FEB-26
Digital Multimeter	33461A	MY53220104	EEL.BP 24/0268	22-APR-26
Digital Multimeter	33461A	MY53220076	EEL.BP 23/0268	22-APR-26
Digital Multimeter	34461A	MY60024273	CA2025120EA	18-MAR-26
Programmable Attenuator	MAT-1070	62100114	EF-0006-25	11-FEB-26
Condenser Microphone	4180	2977900	AA-1002-25	19-FEB-26
Measuring Amplifier	NA-42KAI	34560495	AA-3002-25	19-FEB-26

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

3.3 Electrical And Electronics Institute (EEI).

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Cert. No. : ACL25263
Job No. : VC68AC0130
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.2	N/A
3. Acoustical signal tests of frequency weightings		
125 Hz	0.3	0.6
1000 Hz	0.3	0.6
8000 Hz	0.3	0.7
4. Electrical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	0.6
For > 4 kHz to 10 kHz	0.3	0.7
For > 10 kHz to 20 kHz	0.3	1.0
5. Frequency and time weightings at 1 kHz	0.2	0.2
6. Long - term stability	0.1	0.1
7. Level linearity on the reference level range	0.2	0.3
8. Level linearity including the level range control	0.2	0.3
9. Tone burst response	0.2	0.3
10. Peak C sound level	0.2	0.35
11. Overload indication	0.2	0.25
12. High level stability	0.1	0.1

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Cert. No. : ACL25263
Job No. : VC68AC0130
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Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.94)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.7

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Weighting (dB)
A - weight	9.9
C - weight	16.5
Flat	21.9

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.4	0.4	± 1.5
1000	0.2	0.2	0.2	± 1.0
8000	-1.3	-1.2	-1.2	±5.0

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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.1	0.1	±3.0
8000	0.1	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
Leq	94.0	94.0	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.1	0.1	± 0.3

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Cert. No. : ACL25263

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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.0	0.0	± 1.1

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8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±1.1

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	29.0	28.9	-0.1	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	108.0	0.0	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.0 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

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Cert. No. : ACL25263
Job No. : VC68AC0130
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10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{cpeak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.4	0.0	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.5	-0.1	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$
or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

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HTchon B.

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok
10260

Certificate No : 25-AFM-087

Request No : Req-2025-0715

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : TSI Sensor Model : -
Model : 5300 Sensor Serial Number : -
Serial Number : 5300 2052 003 Instrument Status : Used
ID : UAE.EFM.162/2564
Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 24 March 2025
Calibration Date : 26 March 2025
Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator


Reference Standard	Model	Serial Number	Traceble	Due Calibration
Air Flow Meter	Gilibrator 3 High flow	18501012012	Sensidyne	1 August 2025
Air Flow meter	4045 F	4045 0533 001	MIT	23 December 2025
Temperature meter	GT 11	08000057	Qreborn	15 October 2025
Pressure meter	CPG2400	41000KDU/651882	TPA	21 October 2025


Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01 and MIT NSC-TISI-TIS Accreditation No. 0052

Note :

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibration By : 
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 26 March 2025

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Certificate No : 25-AFM-087
Request No : Req-2025-0715

Result of Calibration : Without Adjustment

STD Reading			UUC Readingg			Error (l/min)	Uncertainty		
Temperature (°C)	Pressure (kPa)	Flow (l/min)	Temperature (°C)	Pressure (kPa)	Flow (l/min)		(l/min)	(°C)	(kPa)
23.8	100.47	1.688	24.0	100.91	1.60	-0.088	0.030	1.0	0.50
25.0	100.35	10.41	25.2	100.95	10.00	-0.41	0.19	1.0	0.50
24.7	100.81	20.82	25.0	100.99	20.00	-0.82	0.38	1.0	0.50
25.2	100.82	51.5	25.0	101.19	50.00	-1.5	1.3	1.0	0.50
26.1	102.02	102.2	25.9	101.82	100.00	-2.2	2.6	1.0	0.50
24.8	104.04	153.0	24.5	102.87	150.00	-3.0	3.9	1.0	0.50
25.7	106.38	203.5	25.5	104.11	200.00	-3.5	5.2	1.0	0.50

Note STD : Standard UUC : Unit Under Calibration
- UUC Reference Condition : 21.1 °C, 101.3 kPa, Air
- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{meas} = Q_{ref} \times \frac{P_{ref}}{P_{meas}} \times \frac{T_{meas}}{T_{ref}}$$

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature
 meas = Measurement Condition ref = Standard Condition

* Indicates non accredited

End of Certificate

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



Certificate of Calibration

Certificate No. : 25P1359

Page : 1 of 2

Equipment : Aneroid Barometer
Manufacturer: Barigo
Model : 111MS
Serial No.: -
ID No.: UAE.EMA2.067/2552

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

Condition As-Received: Used Item

Received Date: 10 April 2025

Calibration Date: 17 April 2025

Reference: 2504-0315WSC

Submitted by: United Analyst and Engineering Consultant Co.,Ltd.

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Phrakhanong, Bangkok 10260

Atmospheric Pressure: 1009 mbar

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to calibration procedure CP-P10, using " DKD-R 6-1 ; Calibration of Pressure Gauges " as a guidelines.

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Standard Barometer	DPI142	1422505046	MP-0133-24	15 May 2025

2.This instrument was installed in vertical orientation and center of the dial was used as the reference level.

3.This result of calibration was made on requested at the point specified by customer.

4.Scale and conversion factor is 1 kPa = 7.50062 mmHg

5.This result of calibration instrument was in absolute pressure.

6.This instrument was used clean air as pressure media.

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

8.This Certification is traceable to the International System of Unit maintained through:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Kaerkpon Saivichai
Issue Date : 21 April 2025

Approved Signatory :

Attapol P.

[] Phalinee Prabpaipal

[] Sura Suwannasri

[✓] Attapol Panurach

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Result of calibration:- Without adjustment

Range : 720 mmHg to 780 mmHg

Function:- Absolute Pressure Measurement

Scale Interval : 1 mmHg (The Fifth Estimate)

Increasing Pressure

Applied Pressure (mmHg)	717.92	728.95	739.74	750.28	761.55	773.52	784.47
UUC* Indication (mmHg)	720.0	730.0	740.0	750.0	760.0	770.0	780.0
Error (mmHg)	2.08	1.05	0.26	-0.28	-1.55	-3.52	-4.47

Decreasing Pressure

Applied Pressure (mmHg)	784.47	773.53	761.51	750.35	739.81	729.05	718.10
UUC* Indication (mmHg)	780.0	770.0	760.0	750.0	740.0	730.0	720.0
Error (mmHg)	-4.47	-3.53	-1.51	-0.35	0.19	0.95	1.90

The uncertainty of measurement was ± 0.24 mmHg

* UUC = Unit Under Calibration

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



Certificate of Calibration

Certificate No. : 25H1374

Page : 1 of 2

Equipment : Digital Thermo-Hygrometer

Manufacturer: Digicon

Model : TH-02

Serial No.: 395034173

ID No.: UAE.EFM.182/2565

Condition As-Received: Used Item

Received Date: 04 July 2025

Calibration Date: 08 July 2025
to 15 July 2025

Reference: 2507-0215WSC

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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

Submitted by: United Analyst and Engineering Consultant Co.,Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

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

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Dew Point Hygrometer	Optidew 401	164756	TH-0005-25	05 Feb 2026
2) Handheld Thermometer With Sensor	1523	5717096	241241	18 Nov 2025

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

3.This measurement result is traceable to the International System of Unit maintained through:-

- National Institute of Metrology (Thailand), NSC-ONSC Accredited No. Calibration 0144
- Technology Promotion Association (Thailand-Japan), NSC-ONSC Accredited No. Calibration 0008

Calibrated by : Somchal Dumwor
Issue Date : 21 July 2025

Approved Signatory :

Viporn

- [] Chakrit Waewwanjua
[] Pornthippa Tameyakul
[✓] Viporn Tantiyawutti

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Cert. No.: 25H1374

Page.: 2 of 2

Result of Calibration:- Without Adjustment

Function: Humidity Measurement.

<u>Reference</u> <u>Temperature</u> (°C)	<u>Standard</u> <u>Humidity</u> (%R.H.)	<u>UUC*</u> <u>Reading</u> (%R.H.)	<u>Correction</u> (%R.H.)	<u>Uncertainty</u> <u>of Measurement</u> (±%R.H.)
25.0	40.1	38	2.1	1.3
25.0	50.1	45	5.1	1.6
25.0	60.0	55	5.0	1.6
25.0	70.2	64	6.2	1.6

Result of Calibration:- Without Adjustment

Function: Temperature Measurement.

<u>Standard</u> <u>Temperature</u> (°C)	<u>UUC*</u> <u>Reading</u> (°C)	<u>Correction</u> (°C)	<u>Uncertainty</u> <u>of Measurement</u> (±°C)
19.953	20.4	-0.447	0.42
25.001	25.4	-0.399	0.42
30.043	30.4	-0.357	0.42
40.023	40.4	-0.377	0.42

UUC* : Unit Under Calibration

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

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Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT
CO.,LTD.
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong,
Bangkok 10260

Certificate No : 25-TPM-422

Request No : Req-2025-1830

Page : 1/2

Unit Under Calibration Details

Calibration Parameter	: Temperature	Range Calibration	: 20°C to 60°C
Instrument Name	: Thermal Environment Monitor	Type of Sensor	: RTD
Manufacturer	: 3M	Sensor Diameter (mm)	: 4.5
Model	: QT-32	Calibration Position (mm)	: 67.5
Serial Number	: TPS030004	Instrument Status	: Used
Resolution	: 0.1 °C		
ID Number	: UAE.EFM.079/2561		

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 7 August 2025
Calibrated Date : 3 September 2025
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT111/ RTD100, SN: 12000077,
ID: AR-TPM Which was calibrated on 15 October 2024, Calibration Certificate No. : QR24-2836

Traceability : This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No.:
Calibration 0292

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k=2$, providing a level of confidence approximately 95 %.

Approved By :

me

Mr. Noppadon Luangart

Technical Manager

Issue Date :

3 September 2025

Calibration Note

Certificate No : 25-TPM-422

UUC Adjustment : Not Adjust

Request No : Req-2025-1830

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
WET	20.003	20.2	- 0.2	0.14
	25.003	25.2	- 0.2	0.14
	30.003	30.2	- 0.2	0.14
	35.004	35.2	- 0.2	0.14
	40.002	40.2	- 0.2	0.14
	45.002	45.2	- 0.2	0.14
	50.003	50.2	- 0.2	0.14
	60.002	60.2	- 0.2	0.14
DRY	20.003	20.2	- 0.2	0.14
	25.004	25.2	- 0.2	0.14
	30.003	30.2	- 0.2	0.14
	35.002	35.2	- 0.2	0.14
	40.003	40.2	- 0.2	0.14
	45.002	45.2	- 0.2	0.14
	50.003	50.2	- 0.2	0.14
	60.003	60.2	- 0.2	0.14
GLOBE	20.003	20.1	- 0.1	0.14
	25.002	25.1	- 0.1	0.14
	30.002	30.1	- 0.1	0.14
	35.003	35.1	- 0.1	0.14
	40.003	40.1	- 0.1	0.14
	45.005	45.1	- 0.1	0.14
	50.003	50.1	- 0.1	0.14
	60.004	60.1	- 0.1	0.14

End of Certificate

Calibrated By :



Mr. Sittichok Jirapukdeesakul



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.: 25CH261

Page.: 1 of 3

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA0C0025
ID No. : UAE.EFM.117/2563(EFM.pH.07/63)
Condition As-Received: Used Item
Received Date : 25 February 2025
Calibration Date : 26 to 28 February 2025
Reference : 2502-0783WSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

Ambient Temperature : (25 \pm 2.5) °C
Relative Humidity : (50 \pm 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with DC voltage
standard and direct measurement with
certified reference material (CRM)
- CP-CH8 by comparison with temperature standard

Calibrated by : Warakorn Lerngagtrakul

Approved by : 
Approved Signatory

() Chakrit Waewwanjua
() Ponpan Paipim
(✓) Saithip Meangmai

Issue Date : 28 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.

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Cert.No.: 25CH261

Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1)Document Process Calibrator	54030049	130RC116	24E2759	25 Aug 2025
2)Ref. Standard Thermometer	4982054	110RC044	24I757	14 July 2025

- This Certification is traceable to SI Through Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials :The measurement results are traceable to SI through Hach Lenge GmbH Ltd.,
Deutsche Akkreditierungsstelle, Accredited No.D-RM-15184-01-00
: The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
pH 4.007	CPA chem	1066665	18 Jan 2027
pH 6.999	Hach Lenge GmbH	C03220	29 Oct 2026
pH 10.010	CPA chem	1066669	18 Jan 2026

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

Calibration Results

Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (4,7)(7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor <i>k</i>
	pH	mV	mV	pH		
pH Meter S/N.: HA0C0025	4.00	177.48	177.5	4.01	0.058	2.00
	7.00	0.00	0.0	7.02	0.058	2.00
	7.00	0.00	0.0	7.02	0.058	2.00
	10.00	-177.48	-177.5	10.01	0.058	2.00

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Cert.No.: 25CH261

Page.: 3 of 3

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7)(7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (\pm)	Coverage factor k
pH Electrode S/N.: Q9AG0214	4.007	4.01	178.4	0.0071	2.00
	6.999	7.00	4.1	0.0092	2.00
	6.999	7.00	3.0	0.0095	2.00
	10.010	10.01	-169.8	0.0092	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652-10D

- Serial No. : Q9AG0214

Dimension of probe

- Length : 110 mm.

- Diameter : 16 mm.

- Immersion Depth : 80 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (\pm °C)	Coverage factor k
15.0	15.002	15.0	-0.002	0.13	2.00
30.0	30.003	30.0	-0.003	0.13	2.00
45.0	45.002	44.9	-0.102	0.13	2.00

Remark - 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 %.

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Envi Equipment Service Co., Ltd.

110/254 Moo 3, Tumbon Bang Rak Phatthana, Amphur Bang Bua Thong, Nonthaburi 11110

Tel. 098 362 9152, 089 478 7885

E-mail: sales@envi-ees.com

Certificate No.: E25-050063

Page.: 1 of 6

CERTIFICATE OF CALIBRATION

Customer : United Analyst and Engineering Consultant Co., Ltd.

Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Description of Equipment : Console meter

Manufacturer : Apex Instrument

Model Number : XC-572-V

Serial Number : 1701019

ID./Control No. : UAE.EFM 013/2560

Environment Conditions : **Temperature** (25 ± 2) °C
: **Humidity** (50 ± 15) % RH

Cal. Date : 19/05/2025

Issue Date : 19/05/2025

Calibration Method or Calibration Procedure Used

US EPA Method (United State Environmental Protection Agency)

This certificate is traceable to national standard, which realize the units of measurement according to the International System of Units (IS).

Result of Calibration

This certificate may not be reproduced other than in full except with prior Written approval of the Technical Manager, Envi Equipment Service Company Limited.

These reported uncertainties of measurement are expanded by a coverage factor of k=2, providing a 95% confidence level

Calibrated by : Mr. Sanya Sangnil

Approved by :

(Mr. Mana Fuekhu)

Technical Manger

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**METHOD 5 CONSOLE CALIBRATION
USING REFERENCE WET GAS METER W-NK-2.5-B-Z No.547425
5-POINT METRIC UNIT**

Meter Console Information	
Console Model Number	XC-572-V
Console Serial Number	1701019
DGM Model Number	SK25EX
DGM Serial Number	00002028

Calibration Conditions			
Date	Time	19/05/2025	00:40 PM
Calibration Reference No.		SER25-050025	
Barometric Pressure		755.91	mmHg
Calibration Meter Gamma		1.001	

Factors/Conversions		
Std Temp	293	K
Std Press	760	mm Hg
K ₁	0.386	
Console Leak Check		PASS

Calibration Data									
Run Time	Metering Console					Calibration Meter			
Elapsed	DGM Orifice DH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final
(Q)	(P _m)	(V _{mi})	(V _{mf})	(t _{mi})	(t _{mf})	(V _{wi})	(V _{wf})	(t _{wi})	(t _{wf})
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
12.13	13.0	3253.125	3253.265	33	33	315.95000	316.08636	28	28
12.17	13.0	3253.265	3253.405	32	32	316.08636	316.22286	27	27
8.55	26.0	3253.413	3253.553	31	31	316.22558	316.36162	27	27
8.53	26.0	3253.553	3253.693	31	31	316.36162	316.49724	26	26
13.88	40.0	3253.702	3253.982	31	31	316.50602	316.78246	26	26
13.87	40.0	3253.982	3254.262	32	32	316.78246	317.05886	26	26
10.35	70.0	3254.274	3254.554	32	32	317.06144	317.33654	25	25
10.33	70.0	3254.554	3254.834	32	32	317.33654	317.61120	25	25
9.08	90.0	3254.844	3255.124	32	32	317.61930	317.89328	25	25
9.07	90.0	3255.124	3255.404	33	33	317.89328	318.16756	25	25



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**METHOD 5 CONSOLE CALIBRATION
USING REFERENCE WET GAS METER W-NK-2.5-B-Z No.547425
5-POINT METRIC UNIT**

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	19/05/2025	00:40 PM	Std Temp	293	K
Console Serial Number	1701019	Calibration Reference No.		SER25-050025		Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure		755.91		K ₁	0.386	
DGM Serial Number	00002028	Calibration Meter Gamma		1.001		Console Leak Check		PASS

Calibration Data								
Results								
Standardized Data				Dry Gas Meter				
Dry Gas Meter		Calibration Meter		Calibration Factor		Flowrate		
(V _{m(std)})	(Q _{m(std)})	(V _{w(std)})	(Q _{w(std)})	Value	Variation	Std & Corr	.0212 m ³ _{std} /min	Variation
m ³	m ³ /min	m ³	m ³ /min	(Y)	(ΔY)	(Q _{m(std)} (corr))	(ΔH _@)	(ΔH _@)
						m ³ /min	mm H ₂ O	
0.136	0.011	0.132	0.011	0.974	-0.001	0.011	47.962	0.951
0.136	0.011	0.133	0.011	0.975	0.000	0.011	47.967	0.956
0.136	0.016	0.132	0.015	0.970	-0.005	0.015	47.817	0.807
0.137	0.016	0.132	0.016	0.967	-0.008	0.016	47.767	0.756
0.274	0.020	0.270	0.019	0.984	0.009	0.019	46.945	-0.066
0.274	0.020	0.270	0.019	0.984	0.009	0.019	46.846	-0.165
0.276	0.027	0.269	0.026	0.977	0.002	0.026	46.218	-0.793
0.276	0.027	0.269	0.026	0.975	0.000	0.026	46.217	-0.794
0.276	0.030	0.268	0.030	0.971	-0.004	0.030	46.321	-0.690
0.276	0.030	0.268	0.030	0.972	-0.003	0.030	46.051	-0.960
				0.975	Y Average		47.011	ΔH _@ Average

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.02.

For ΔH_@, orifice pressure differential that equates to 0.75 cfm (0.0212 m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1mm) H₂O.



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Meter Console Information	
Console Model Number	XC-572-V
Console Serial Number	1701019
DGM Model Number	SK25EX
DGM Serial Number	00002028

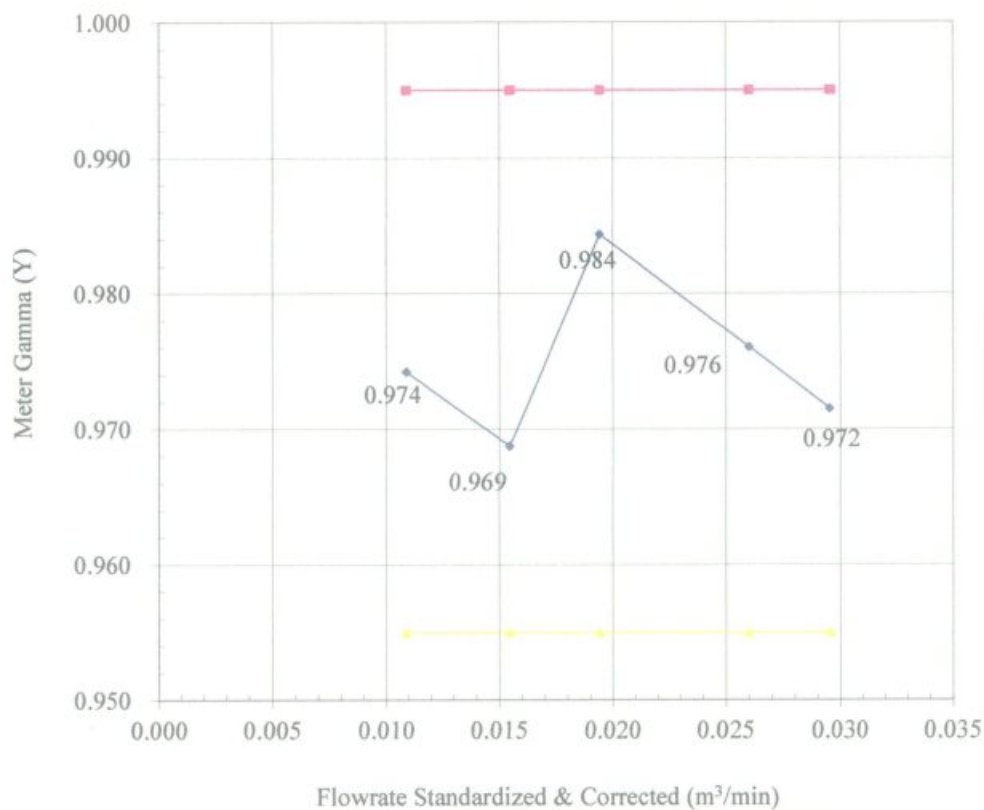
Calibration Conditions			
Date	Time	19/05/2025	00:40 PM
Calibration Reference No.		SER25-050025	
Barometric Pressure		755.91	mmHg
Calibration Meter Gamma		1.001	

Factors/Conversions		
Std Temp	293	K
Std Press	760	mm Hg
K ₁	0.386	
Console Leak Check		PASS

Calibration Date: 19-5-2025

Calibration Reference No: SER25-050025

Meter Gamma vs Flowrate



Console Serial: 1701019

Console Model: XC-572-V



Meter Console Information	
Console Model Number	XC-572-V
Console Serial Number	1701019
DGM Model Number	SK25EX
DGM Serial Number	00002028

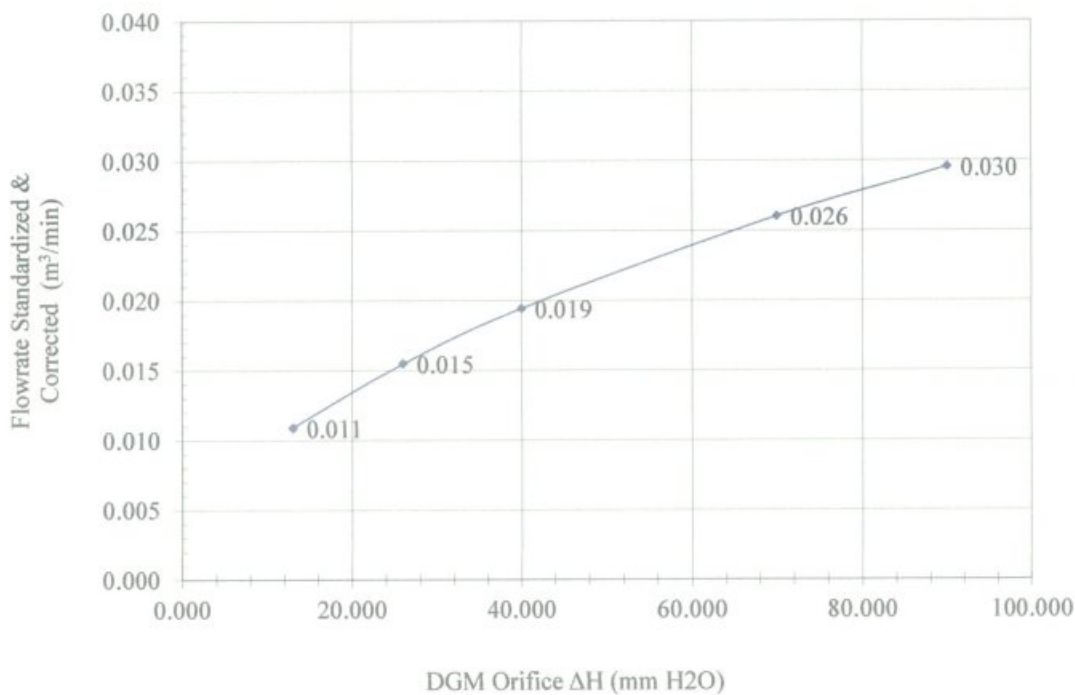
Calibration Conditions			
Date	Time	19/05/2025	00:40 PM
Calibration Reference No.		SER25-050025	
Barometric Pressure		755.91	mmHg
Calibration Meter Gamma		1.001	

Factors/Conversions		
Std Temp	293	K
Std Press	760	mm Hg
K ₁	0.386	
Console Leak Check		PASS

Calibration Date: 19-5-2025

Calibration Reference No: SER25-050025

Meter Pressure vs Flowrate



Console Serial: 1701019

Console Model: XC-572-V



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THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information	
Console Model Number	XC-572-V
Console Serial Number	1701019
DGM Model Number	SK25EX
DGM Serial Number	00002028
Meter Box Model Number	JENCO 765 KF
Meter Box Serial Number	JC 19777

Calibration Conditions			
Date	Time	19/05/2025	02:45 PM
Calibration Reference No.	SER25-050025		
Reference Thermometer	DIGICON		
Serial Number	183169105		

Results											
Console Thermocouple Simulator											
Channel and test point	Meter Box Channel Temperature Reading (°C)										
	-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	816.0	1038.0
Stack	-17.0	26.0	39.0	94.0	149.0	257.0	368.0	477.0	587.0	805.0	1023.0
Aux	-17.0	26.0	39.0	94.0	149.0						
Probe	-17.0	26.0	39.0	94.0	149.0						
Filter	-17.0	26.0	39.0	94.0	149.0						
Oven	-17.0	26.0	39.0	94.0	149.0						
Exit	-17.0	26.0	39.0								

Tolerance Range

Stack ± 1.50% Absolute
 Probe ± 3.0 °C
 Filter ± 3.0 °C

Meter ± 3.0 °C
 Exit ± 2.0 °C



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Certificate No: G 680203

Date of issue : 19-Mar-25

Instrument description : Flue Gas Analyzer
Instrument model : Testo 350 New
Instrument serial no. : 60899456/701
Control unit serial no. : 03099404/701
ID no. or control no. : UAE.EFM.005/2560
Manufacturer : Testo SE & Co. KGaA
Probe description : -
Probe model : -
Probe serial no. : -
Customer name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Customer address : 81 SOI UDOMSUK41,SUKHUMVIT ROAD,BANGCHAK PRAKANONG BANGKOK 10260

Total pages of certificate : 3 Pages
Receiving no. : L-250877
Receiving date. : 12-Mar-25
Parameter of calibration : Gas Calibration(Oxygen 2.50,9.984,21.02 %vol, Carbon Monoxide 80.15,302,1007 ppm, Nitrogen Dioxide 30.68,81.8,202.6 ppm, Nitric Oxide 30.0,151.8,322.5 ppm, Sulphur Dioxide 50.36,100.7,600.8 ppm)

Condition of UUC. : Used
Ambient condition : All of the Measurment ware caried out the stabilized labotary
 Temperature : 23 ±5 °C
 Humidity : 55 ± 15 %RH

Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210 THAILAND

Calibration procedure no : This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction no. WI-CL-28-C

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurent Multiplied by coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

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

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

This calibration certificate documents are traceability to national standards, which realize measurement according to the International System of Units (SI).

Date of calibration : 19-Mar-25



Mr. Kwanchai Khamdoun

Calibration Technician



Mrs. Nongluck Wongsettee

Technical Manager

Certificate No.: G 680203

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O ₂) 2.50 % Vol	2412/23	Linde	27-Aug-27
Oxygen (O ₂) 9.984 % Vol	CG-0113-24	Nimt	01-Aug-29
Oxygen (O ₂) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide (CO) 80.45 ppm	CG-0132-24	Nimt	10-Sep-29
Carbon monoxide (CO) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide (CO) 1007 ppm	1870/24	Linde	17-Jun-26
Nitrogen Dioxide (NO ₂) 30.68 ppm	2832/24	Linde	08-Sep-26
Nitrogen Dioxide (NO ₂) 81.8 ppm	2330/24	Linde	01-Aug-26
Nitrogen Dioxide (NO ₂) 202.6 ppm	3794/24	Linde	23-Dec-26
Nitric Oxide (NO) 30.0 ppm	CG-0065-24	Nimt	06-May-26
Nitric Oxide (NO) 151.8 ppm	0404/25	Linde	09-Feb-27
Nitric Oxide (NO) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide (SO ₂) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide (SO ₂) 100.7 ppm	2662/24	Linde	25-Aug-26
Sulphur Dioxide (SO ₂) 600.8 ppm	2003/23	Linde	17-Jul-25

Measured room conditions

Temperature : 22.4 °C Humidity : 59.8 %RH Pressure : 1011.4 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,300 ml/min Gas pressure : 1016.7 mbar

Calibration Results (Before adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O ₂ (%Vol)	2.50	2.47	-0.03	0.15
O ₂ (%Vol)	9.984	10.06	0.076	0.20
O ₂ (%Vol)	21.02	21.10	0.08	0.30
CO (ppm)	80.45	80	-0.45	3.0
CO (ppm)	302	301	-1	6.0
CO (ppm)	1007	1004	-3	12
NO ₂ (ppm)	30.68	26.4	-4.28	8.0
NO ₂ (ppm)	81.8	69.3	-12.5	8.0
NO ₂ (ppm)	202.6	171.4	-31.2	12
NO (ppm)	30.0	28	-2.0	8.0
NO (ppm)	151.8	145	-6.8	8.0
NO (ppm)	322.5	306	-16.5	12
SO ₂ (ppm)	50.36	49	-1.36	6.0
SO ₂ (ppm)	100.7	100	-0.7	6.0
SO ₂ (ppm)	600.8	599	-1.8	13

Calibration Results (After adjustment) (Table 3)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty { ± }
O ₂ (%Vol)	2.50	2.47	-0.03	0.15
O ₂ (%Vol)	9.984	10.06	0.076	0.20
O ₂ (%Vol)	21.02	21.10	0.08	0.30
CO (ppm)	80.45	80	-0.45	3.0
CO (ppm)	302	301	-1	6.0
CO (ppm)	1007	1004	-3	12
NO ₂ (ppm)	30.68	32.2	1.52	8.0
NO ₂ (ppm)	81.8	83.1	1.3	8.0
NO ₂ (ppm)	202.6	203.5	0.9	12
NO (ppm)	30.0	31	1.0	8.0
NO (ppm)	151.8	152	0.2	8.0
NO (ppm)	322.5	321	-1.5	12
SO ₂ (ppm)	50.36	49	-1.36	6.0
SO ₂ (ppm)	100.7	100	-0.7	6.0
SO ₂ (ppm)	600.8	599	-1.8	13

Remark : 1 cmol/mol = 1 %vol. 1 μmol/mol = 1 ppm.

End of Report