

ภาคผนวก จ  
เอกสารสอบเทียบเครื่องมือ

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## 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	TOTAL SUSPENDED SOLIDS	Mettler Toledo	XSR205DU / C009071872	National Food Institute,Ministry of Industry, Thailand	2502226-001-01	20/3/2025	19/3/2026
2	BOD Incubator	BIOCHEMICAL OXYGEN DEMAND	ARCO	UC4-1320 / 1021	Technology Promotion Association (Thailand-Japan)	24TM1113	11/7/2024	16/7/2025
3	BOD Incubator	BIOCHEMICAL OXYGEN DEMAND	ARCO	UC4-1320 / 1021	Technology Promotion Association (Thailand-Japan)	24TM1114	11/7/2024	10/7/2025
4	BOD Incubator	BIOCHEMICAL OXYGEN DEMAND	ARCO	UR-1320 / -	Technology Promotion Association (Thailand-Japan)	24TM587	1/4/2024	31/3/2025
5	DO Meter	BIOCHEMICAL OXYGEN DEMAND	YSI	5100 / 11B 101863	Technology Promotion Association (Thailand-Japan)	24TW39	21/2/2024	20/2/2025
6	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
7	Heating Block	CHEMICAL OXYGEN DEMAND	Hanna Instruments Inc.(Romania)	HI839800-02 / 4500052101	Hanna Instruments (Thailand) Ltd.	HIT-2427-0942	1/7/2024	30/6/2025
8	Hot Air Oven	TOTAL SUSPENDED SOLIDS	Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	24TM589	1/4/2024	31/3/2025
9	pH Meter	pH	Horiba	LAQUA-PH210 / HA0A0007	technology promotion association (thailand-japan)	24CH399	2/4/2024	1/4/2025
10	pH Meter	pH	Horiba	LAQUA-PH210 / HA0E0041	technology promotion association (thailand-japan)	24CH725	19/6/2024	17/6/2025
11	UV/VIS Spectrophotometer	CHEMICAL OXYGEN DEMAND	Hitachi	U-5100 / 23A4-008	DQE Services Co.,Ltd.	SP24-028	11/9/2024	9/9/2025

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

## 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 FUME IRON FUME	Perkin Elmer	PinAAcle 900F / PFB20031902	Perkin Elmer Co.,Ltd.	Preventive Maintenance Report	29/4/2025	28/4/2026
2	Analytical Balance	PARTICULATE MATTER (PM10) TOTAL SUSPENDED PARTICULATE	Mettler Toledo	MS204TS/00 / C252436235	National Food Institute, Ministry of Industry, Thailand	2502228-003-01	19/3/2025	18/3/2026
3	Gas Chromatography	ACETALDEHYDE ACETONE ACETONITRILE BENZENE ETHANOL ETHYL ACETATE FORMALDEHYDE TOLUENE	SCION INSTRUMENT,USA	456-GC / GC1802G112	Thai Unique Co.,Ltd.	SV0425/23011	26/4/2025	25/4/2026
4	Inductively Coupled Plasma- Optical Emission Spectrometer(ICP-OES)	ALUMINUM	Agilent Technologies, USA	5110 VDV(G8015AA) / MY8030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	4/11/2024	3/11/2025
5	Dionex Aquion RFIC Ion Chromatography	CHLORINE HYDROGEN CHLORIDE NITRIC ACID	Thermo Scientific	Dionex Aquion RFIC / 220380031	ARCHEMICA LAB CO., LTD	ID1047	23/4/2025	22/4/2026
6	Microbalance	RESPIRABLE DUST TOTAL DUST	Mettler Toledo	XP6 / B322373893	National Food Institute, Ministry of Industry, Thailand	2502228 002 01	20/3/2025	19/3/2026
7	UV-VIS Spectrophotometer	AMMONIA	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP25-001	3/1/2025	2/1/2026
8	UV/VIS Spectrophotometer	HYDROGEN PEROXIDE	Hitachi	U-5100 / 23A4-008	DQE Services Co.,Ltd.	SP24-028	11/9/2024	9/9/2025

**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  
53/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-29 FAX. 0 2719-9481



Cert.No.: 24CH399

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## Certificate of Calibration

**Equipment :** pH Meter  
**Manufacturer :** Horiba  
**Model :** LAQUA-PH210  
**Serial No. :** HA0A0007  
**ID No. :** UAE.EFM.002/2563(EFM.pH.02/63)  
**Condition As-Received:** Used Item  
**Received Date :** 01 April 2024  
**Calibration Date :** 02 April 2024  
**Reference :** 2404-0037WSC-1  
**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 :** Warakorn Lerngagtrakul

**Approved by :**

Approved Signatory

- ( ) Pornthippa Tameyakul  
( ) Unnoppol Harachai  
(✓) Saithip Meangmai

**Issue Date :** 06 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 24CH399

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	23E2802	27 Aug 2024
2) Ref. Standard Thermometer	4982054	110RC044	23I908	26 July 2024

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

- Technology Promotion Association (Thailand-Japan)

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

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
pH 4.008	CPA chem	940102	27 Nov 2025
pH 6.986	CPA chem	940104	02 Nov 2024
pH 9.997	CPA chem	940106	02 Nov 2024

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 k
	pH	mV	mV	pH		
pH Meter S/N.: HA0A0007	4.00	177.48	177.5	4.01	0.058	2.00
	7.00	0.00	0.2	6.98	0.058	2.00
	7.00	0.00	0.2	6.98	0.058	2.00
	10.00	-177.48	-177.3	10.01	0.058	2.00

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a 1209881



Cert.No.: 24CH399

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.: Q92M0181	4.008	4.01	180.2	0.0079	2.00
	6.986	6.98	1.3	0.0099	2.00
	6.986	7.00	-0.9	0.0099	2.00
	9.997	10.00	-169.4	0.011	2.05

**Function : Temperature Measurement****(\*) Without adjustment**

This equipment was connected with Temperature Probe;

- Model : 9652-10D  
- Serial No. : Q92M0181

Dimension of probe

- Length : 103 mm.  
- Diameter : 16 mm.  
- Immersion Depth : 90 mm.

Calibration Point ( $^{\circ}\text{C}$ )	Standard Temperature ( $^{\circ}\text{C}$ )	UUC* Reading ( $^{\circ}\text{C}$ )	Error ( $^{\circ}\text{C}$ )	Uncertainty of measurement ( $\pm^{\circ}\text{C}$ )	Coverage factor $k$
25.0	25.002	25.0	-0.002	0.13	2.00
30.0	30.003	30.0	-0.003	0.13	2.00
35.0	35.003	35.0	-0.003	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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Sathip

a 1209882



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



Cert. No.: 24TM589

Page : 1 of 3

## Certificate of Calibration

**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 :** 01 April 2024  
**Calibration Date :** 01 - 02 April 2024  
**Ambient Temperature :** (  $26 \pm 10$  ) °C  
**Relative Humidity :** (  $50 \pm 30$  ) %

**Calibrated by :** Krisda Malee

**Approved by :**

Approved Signatory

- ( ) Ponpan Paipim  
( ☒ ) Suwit Imjai  
( ) Kunchit Promprat

**Issue Date :** 5 April 2024

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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A 0065065



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2404-0004OC-3  
Procedure Used :-

Cert. No.: 24TM589  
Page : 2 of 3

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	MY57013711	23LM115	TPA	11 Jul 2024

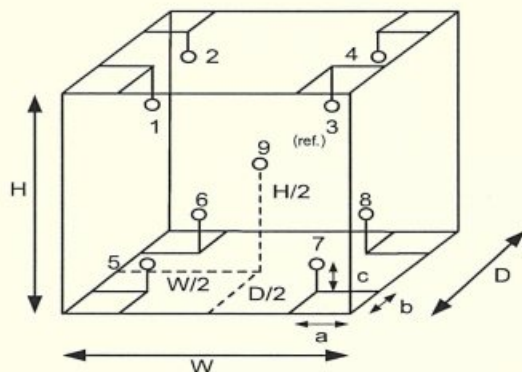
2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certification is traceable to the International System of Unit.

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	26
REL.Humid. ( % )	47	48
AC Supply ( Volt )	221	220

Ref. Std. ID No.: @ Calibration Point		
Position :	( 120 to 180 ) °C	( 104 ) °C
1	21-18TC-01	22-18RTD-2/1
2	21-18TC-02	18RTD-2/2
3	21-18TC-03	18RTD-2/3
4	21-18TC-04	18RTD-2/4
5	21-18TC-05	18RTD-2/5
6	21-18TC-06	18RTD-2/6
7	21-18TC-07	18RTD-2/7
8	21-18TC-08	18RTD-2/8
9 (ref.)	21-18TC-09	18RTD-2/9

Probe Installation Details :      Dimension of Chamber :

a = 5.0 cm	D = 0.50 m
b = 5.0 cm	W = 0.80 m
c = 5.0 cm	H = 0.75 m
	Capacity = 0.30 m <sup>3</sup>



Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2404-0004OC-3  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 24TM589

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	0.032	0.47	0.84	2
120.0	120.0	120.0	0.12	0.72	1.3	2
180.0	180.0	180.0	0.13	1.2	1.5	2

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty  ( ±°C )
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	104.464	103.847	104.226	104.232	104.106	103.691	104.275	104.127	104.013	0.42
120.0	120.486	120.089	120.635	120.596	119.531	119.644	120.364	120.144	120.158	1.1
180.0	180.574	179.769	180.285	180.870	179.594	179.790	180.287	179.961	179.802	1.1

**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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a 1209738



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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## Certificate of Calibration

Cert. No.: 24TM1113

Page : 1 of 3

**Equipment :** BOD Incubator

**Manufacturer :** ARCO

**Model :** UC4-1320

**Serial No. :** -


**ID No. :** UAE.WAO.002/2550

**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 :** 11 July 2024  
**Calibration Date :** 11 July 2024  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %

**Calibrated by :** Tawatchai Pama

**Approved by :**   
Approved Signatory

( ) Ponpan Paipim  
(✓) Suwit Imjai  
( ) Kunchit Promprat

**Issue Date :** 14 July 2024

**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 : 2407-0243OC-1

Cert. No.: 24TM1113

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 ).

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	MY49023932	23LM122	TPA	26 Jul 2024

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.

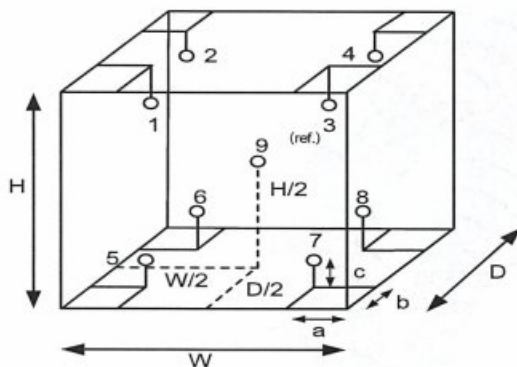
**Remark :** TPA : Technology Promotion Association ( Thailand - Japan )

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

**Fresh air setting :** Not Available

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	29	32
REL.Humid. ( % )	78	65
AC Supply ( Volt )	233	234



Position :	Ref. Std. ID No.:
1	19-16RTD-01
2	19-16RTD-02
3	19-16RTD-03
4	19-16RTD-04
5	19-16RTD-05
6	19-16RTD-06
7	21-16RTD-07
8	19-16RTD-08
9 (ref.)	19-16RTD-09

**Probe Installation Details :**

a = 10 cm  
b = 10 cm  
c = 10 cm

**Dimension of Chamber :**

D = 0.62 m  
W = 1.2 m  
H = 1.2 m  
Capacity = 0.89 m<sup>3</sup>



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2407-0243OC-1  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Not Available

Cert. No.: 24TM1113

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	19.8	0.55	0.66	1.5	2

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty  ( ± °C )
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	20.210	20.331	20.162	19.645	20.287	20.070	19.838	19.781	19.954	0.79

**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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## Certificate of Calibration

Cert. No.: 24TM1114

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 : 11 July 2024

Calibration Date : 11 July 2024

Ambient Temperature : (  $26 \pm 10$  ) °C

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

Calibrated by : Tawatchai Pama

Approved by :   
Approved Signatory

( ) Ponpan Paipim  
( ☒ ) Suwit Imjai  
( ) Kunchit Promprat

Issue Date : 14 July 2024

**The Uncertainties are for a confidence probability of approximately 95%**

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Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2407-0243OC-2

Cert. No.: 24TM1114

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 ).

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	MY49023932	23LM122	TPA	26 Jul 2024

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.

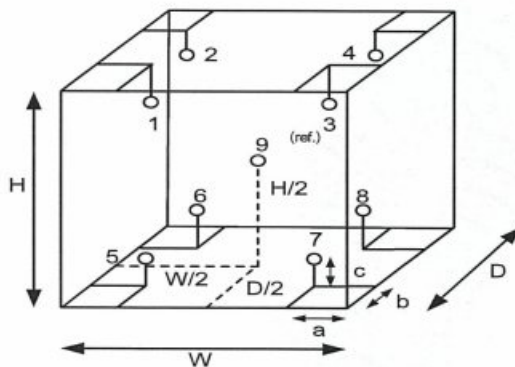
**Remark :** TPA : Technology Promotion Association ( Thailand - Japan )

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

**Fresh air setting :** Not Available

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	29	29
REL.Humid. ( % )	78	72
AC Supply ( Volt )	233	234



Position :	Ref. Std. ID No.:
1	20-16RTD-10
2	20-16RTD-02
3	20-16RTD-03
4	23-16RTD-04
5	22-16RTD-05
6	20-16RTD-06
7	20-16RTD-07
8	22-16RTD-08
9 (ref.)	22-16RTD-09

**Probe Installation Details :**

a = 10 cm  
b = 10 cm  
c = 10 cm

**Dimension of Chamber :**

D = 0.62 m  
W = 1.2 m  
H = 1.2 m  
Capacity = 0.89 m<sup>3</sup>



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2407-0243OC-2  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Not Available

Cert. No.: 24TM1114

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	0.29	0.81	1.2	2

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty  ( ± °C )
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	20.361	19.640	20.312	20.079	19.908	19.872	19.955	19.818	19.758	0.48

**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.

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

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

**Cert.No.:** 24TW39

**Page.:** 1 of 2

## Certificate of Testing

<b>Equipment :</b>	DO Meter
<b>Manufacturer :</b>	YSI
<b>Model :</b>	5100
<b>Serial No. :</b>	11B 101863
<b>ID No. :</b>	UAE.WAO.004/2554
<b>Received Date :</b>	20 February 2024
<b>Test Date :</b>	21 February 2024
<b>Reference :</b>	2402-0629DSC-1
<b>Submitted by :</b>	United Analyst and Engineering Consultant Co.,Ltd. 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
<b>Laboratory Condition :</b>	Temperature ( $25 \pm 5$ ) °C Humidity ( $50 \pm 20$ ) %
<b>Test Procedure :</b>	In - house method : CP-CH9 by Comparison Technique with Azide Modification Method
<b>Tested by :</b>	Walalak Sirithean

**Approved by :**

  
Approved Signatory

- ( ) Pornthippa Tameyakul  
( ) Unnopphol Harachai  
( ☒ ) Saithip Meangmai

**Issue Date :** 22 February 2024

**เอกสารไม่ควบคุม**



Cert.No.: 24TW39

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	23MM405	16 July 2024

2. Standard Material :-

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

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

Dissolved Oxygen Probe No.: 22B100125

<b>Titration Method (Azide Modification Method)</b> (mg/L)	<b>DO Meter Reading</b> (mg/L)	<b>Standard Deviation</b> (mg/L)
8.20	8.19	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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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.0-2717-3000-29 FAX.0-2719-9484



## Certificate of Calibration

Cert.No.: 25CH353

Page.: 1 of 3

**Equipment :** pH Meter  
**Manufacturer :** Horiba  
**Model :** LAQUA-PH210  
**Serial No. :** HA0A0007  
**ID No. :** UAE.EFM.002/2563(EFM.pH.02/63)  
**Condition As-Received:** Used Item  
**Received Date :** 18 March 2025  
**Calibration Date :** 20 March 2025  
**Reference :** 2503-0612WSC-1  
**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 :** \_\_\_\_\_  
Approved Signatory  
  
( ) Chakrit Waewwanjua  
( ) Ponpan Paipim  
(✓) Saithip Meangmai  
  
**Issue Date :** 20 March 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.



**Cert.No.:** 25CH353

**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 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)**

<b>Unit Under Calibration</b>	<b>Nominal Value</b>	<b>Standard Voltage Input</b>	<b>Actual Reading</b>		<b>Uncertainty of Measurement ( ±mV )</b>	<b>Coverage factor <i>k</i></b>
	<b>pH</b>	<b>mV</b>	<b>mV</b>	<b>pH</b>		
pH Meter S/N.: HA0A0007	4.00	177.48	177.6	4.01	0.058	2.00
	7.00	0.00	0.3	6.98	0.058	2.00
	7.00	0.00	0.3	6.98	0.058	2.00
	10.00	-177.48	-177.1	10.01	0.058	2.00



Cert.No.: 25CH353

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.: 992H0385	4.007	4.00	150.1	0.0085	2.05
	6.999	7.00	-26.1	0.0095	2.00
	6.999	7.00	-26.7	0.011	2.05
	10.010	10.01	-202.4	0.010	2.00

#### Function : Temperature Measurement

##### ( \* ) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652

- Serial No. : 992H0385

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	15.006	15.0	-0.006	0.13	2.00
30.0	29.998	30.0	0.002	0.13	2.00
45.0	44.993	45.0	0.007	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  
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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 (  $25 \pm 5$  ) °C  
Humidity (  $50 \pm 20$  ) %  
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

เอกสารไม่ควบคุม



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**

<b>Titration Method (Azide Modification Method)</b> (mg/L)	<b>DO Meter Reading</b> (mg/L)	<b>Standard Deviation</b> (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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บันทึกผลการทวนสอบใบรับรองการสอบเทียบ (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	Do meter Reading	Error%	Correction%	Error   Total Error	Judgement	(Total Error < Judgement )
( 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	poss
ผู้บันทึก..... อิศรา นฤพรเกษม.....							
วันที่..... 28/02/2025.....							
ผู้ตรวจสอบ..... พงษ์ภรณ.....							
วันที่..... 28 ก.พ. 68.....							
หมายเหตุ :							

เก็บใบนี้ที่.....

.....

เอกสารไม่ควบคุม

## Calibration Certificate

**Certificate No.:** 2402283-001-01  
**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.:** 2402283  
**Operation No.:** 2402283-001  
**Date of Receipt:** 2 April 2024  
**Date of Calibration:** 2 April 2024

**Calibrated by** Mr.Jerawut Prapawuttipong  
Scientist

**Approved by**

( Mr.Pheraphat Tuanjit )

Manager, Division of Calibration Laboratory

**Date of Issue:** 9 April 2024

Responsible for the Technical Management Team

**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.:** 2402283-001-01

**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:** 220 g

**Date of Calibration:** 2 April 2024

Page 2 of 4

**Environment Condition:** Ambient Temperature: 24.5 ± 0.5 °C Relative Humidity: 47.5 ± 2.5 %

**Place of Calibration:** Laboratory, 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	M2304053S	8 April 2024

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH 016/23	Quality Reborn	QR24-0343	9 February 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:**

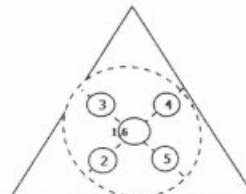
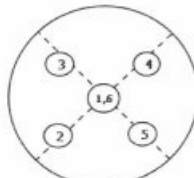
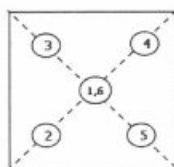
**1. Repeatability of Reading:**

Nominal Value ( g )	Standard Deviation of Reading ( g )
40	0.0000052
80	0.0000063
100	0.000048
200	0.000053

**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 )
100.0002	100.0001	100.0002	99.9999	100.0001	100.0001	0.0003

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



# Calibration Report

**Certificate No.:** 2402283-001-01

**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:** 220 g

**Date of Calibration:** 2 April 2024

Page 3 of 4

**Calibration Results:** (Continued)

**Calibration Range:** 0 - 80 g

**Calibration Adjustment:** Internal Calibration

**3. Departure from Nominal Value:** (Range: 0 - 80 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	0.0000088	2.00
0.001	0.001003	0.00101	-0.00001	0.0000091	2.00
0.005	0.005003	0.00499	0.00001	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	0.50001	0.00001	0.000014	2.00
1	1.000003	1.00002	-0.00002	0.000016	2.00
2	2.000023	2.00001	0.00001	0.000017	2.00
5	5.000017	5.00002	0.00000	0.000020	2.00
10	10.000009	10.00000	0.00001	0.000026	2.00
20	20.000031	20.00002	0.00001	0.000037	2.00
30	30.000040	30.00003	0.00001	0.000052	2.00
50	50.000028	50.00004	-0.00001	0.000068	2.00
80	80.000068	80.00005	0.00002	0.00011	2.00



# Calibration Report

**Certificate No.:** 2402283-001-01

**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:** 220 g

**Date of Calibration:** 2 April 2024

Page 4 of 4

**Calibration Results:** (Continued)

**Calibration Range:** 81 - 200 g

**Calibration Adjustment:** Internal Calibration

**3. Departure from Nominal Value:** (Range: 81 - 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	90.0000	0.0001	0.00015	2.00
100	100.00006	100.0000	0.0001	0.00015	2.00
110	110.00007	110.0001	0.0000	0.00017	2.00
120	120.00009	120.0000	0.0001	0.00018	2.00
130	130.00010	130.0000	0.0001	0.00019	2.00
140	140.00014	140.0000	0.0001	0.00020	2.00
150	150.00009	150.0001	0.0000	0.00020	2.00
160	160.00010	160.0001	0.0000	0.00022	2.00
170	170.00012	170.0001	0.0000	0.00023	2.00
200	200.00016	200.0000	0.0002	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 -----

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



## Calibration Certificate

**Certificate No.:** 2502226-001-01  
**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.:** 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**

*for N. ningsubart*

( Mr.Pheraphat Tuanjit )

Manager, Division of Calibration Laboratory

**Date of Issue:** 25 March 2025

Responsible for the Technical Management Team

**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:**

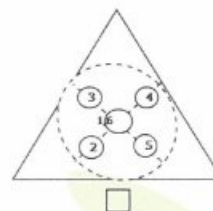
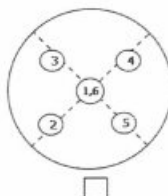
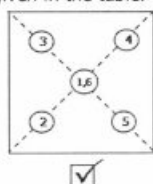
**1. Repeatability of Reading:**

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

for N. mijaubut

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 <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	110.0001	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


Certificate No. : HIT-2427-0942

Page : 1 of 2

**CERTIFICATE OF CALIBRATION**

<b>Equipment :</b>	COD Test Tube Heater		
<b>Meter Model :</b>	HI839800-02	<b>Serial No. :</b>	04500052101
<b>Tube Heater :</b>	25 Vial Capacity	<b>Resolution :</b>	0.1°C
<b>Temperature Range :</b>	(-10 to 160)°C	<b>Temperature of Reaction :</b>	150°C
<b>Manufacturer :</b>	Hanna Instruments	<b>Made in :</b>	Romania
<b>Condition As-Received :</b>	Used Product	<b>Reference :</b>	RE241152
<b>Ambient Temperature :</b>	(25 ± 2)°C	<b>Relative Humidity :</b>	(50 ± 15)%RH
<b>Customer name :</b>	United Analyst and Engineering Consultant Co., Ltd. 3 Soi Udomsuk 41, Sukhumvit Rd., Bangchak, Phrakhanong, Bangkok 10260		
<b>Received date :</b>	26 June 2024		
<b>Calibrate date :</b>	1 July 2024		
<b>Issue date :</b>	3 July 2024		
<b>Calibrated Location :</b>	Hanna Instruments (Thailand) Ltd.		
<b>Calibration Procedure :</b>	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



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	WK2307-164-1	WK Electric Co., Ltd.
Digital Thermo-Hygrometer	HT-771SD	AI.07155	24H41	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	149.8	0.48

Unit : °C

(1A) 149.574	(2A) 149.873	(3A) 149.861	(4A) 149.748	(5A) 149.878
(1B) 149.490	(2B) 149.940	(3B) 149.954	(4B) 150.103	(5B) 150.048
(1C) 149.625	(2C) 150.036	(3C) 150.080	(4C) 150.015	(5C) 149.580
(1D) 149.801	(2D) 149.541	(3D) 149.662	(4D) 150.010	(5D) 149.499
(1E) 149.563	(2E) 149.611	(3E) 149.569	(4E) 149.831	(5E) 149.762

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

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%

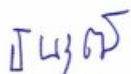
**\*\* End of certificate \*\***

**เอกสารไม่ควบคุม**

## CERTIFICATE OF CALIBRATION

**Certificate No. :** SP24-028

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 315**Equipment :** UV-Vis Spectrophotometer**Manufacturer :** HITACHI**Model :** U-5100**Serial No. :** 23A4-008**ID No. :** UAE.WAS.010/2567**Received Date :** 10 September 2024**Calibration Date :** 10 September 2024**Issue Date :** 13 September 2024**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.

**เอกสารไม่ควบคุม**

## REPORT OF CALIBRATION

**Certificate No. :** SP24-028

Page 2 of 5

**Environment Condition :** Ambient Temperature  $25 \pm 5$  °CRelative humidity  $55 \pm 20$  %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.

## REPORT OF CALIBRATION

Certificate No. : SP24-028

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	0.575	0.0030	0.0031	2.00
	1.0484	1.044	0.0044	0.0029	2.00
	2.1876	2.190	-0.0024	0.0075	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.557	0.0025	0.0034	2.00
	1.0239	1.021	0.0029	0.0035	2.00
	2.1230	2.121	0.0020	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.519	0.0040	0.0029	2.00
	0.9633	0.961	0.0023	0.0028	2.00
	1.9753	1.975	0.0003	0.0070	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	0.997	0.0032	0.0033	2.00
	1.9973	1.996	0.0013	0.0085	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	0.0029	2.00
	2.0373	2.031	0.0063	0.0081	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	0.0029	2.00
	1.9274	1.923	0.0044	0.0080	2.00

## REPORT OF CALIBRATION

Certificate No. : SP24-028

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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	0.743	0.0039	0.0056	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8674	0.862	0.0054	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2919	0.291	0.0009	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. : SP24-028

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	278.7	0.60	0.18	2.00
288.90	288.5	0.40	0.18	2.00
334.50	334.2	0.30	0.18	2.00
361.40	361.1	0.30	0.18	2.00
418.40	418.0	0.40	0.18	2.00
447.20	446.7	0.50	0.18	2.00
459.30	459.6	-0.30	0.18	2.00
537.00	536.6	0.40	0.18	2.00
638.00	637.4	0.60	0.18	2.00
441.29	440.8	0.49	0.18	2.00
479.88	479.6	0.28	0.18	2.00
513.75	513.5	0.25	0.18	2.00
528.59	528.6	-0.01	0.18	2.00
575.10	574.9	0.20	0.18	2.00
585.56	585.3	0.26	0.20	2.00
684.70	684.1	0.60	0.18	2.00
740.51	740.0	0.51	0.20	2.00
747.61	747.2	0.41	0.18	2.00
807.04	806.3	0.74	0.18	2.00
879.68	878.9	0.78	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 -


## Calibration Certificate

**Certificate No.:** 2502228-002-01  
**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.:** 2502228  
**Operation No.:** 2502228-002  
**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.:** 2502228-002-01

**Equipment:** Electronic Balance

**Model:** XP6

**Serial No.:** B322373893

**Capacity:** 6.1 g

**Manufacturer:** METTLER TOLEDO

**Resolution:** 0.000001 g

**ID No.:** UAE.AIR.019/2556

**Date of Calibration:** 20 March 2025

Page 2 of 3

**Environment Condition:** Ambient Temperature: 22.8 ± 0.4 °C Relative Humidity: 48 ± 0.95 %

**Place of Calibration:** 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	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:

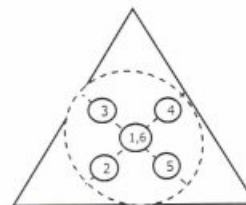
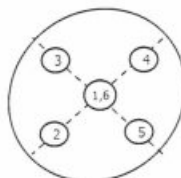
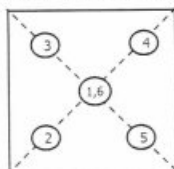
### 1. Repeatability of Reading:

Nominal Value ( g )	Standard Deviation of Reading ( g )
3	0.00000079
6	0.00000067

### 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 )
2.000018	2.000017	2.000014	2.000014	2.000024	2.000019	0.000006



## Calibration Report

**Certificate No.:** 2502228-002-01

**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:** 20 March 2025

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 <i>k</i>
Unload	0.0000000	0.000000	0.000000	0.0000032	2.00
0.001	0.0010030	0.001002	0.000001	0.0000032	2.00
0.01	0.0100030	0.010003	0.000000	0.0000034	2.00
0.05	0.0499960	0.050001	-0.000005	0.0000044	2.00
0.10	0.1000110	0.100011	0.000000	0.0000057	2.00
0.15	0.1500070	0.150010	-0.000003	0.0000071	2.00
0.17	0.1700130	0.170012	0.000001	0.0000077	2.00
0.20	0.2000110	0.200015	-0.000004	0.0000065	2.00
1.50	1.5000190	1.500017	0.000002	0.000017	2.00
3.00	3.0000260	3.000017	0.000009	0.000019	2.00
4.50	4.5000610	4.500023	0.000038	0.000023	2.00
6.00	6.0000180	6.000014	0.000004	0.000023	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. Niyudat

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




## Calibration Certificate

**Certificate No.:** 2502228-003-01  
**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.:** 2502228  
**Operation No.:** 2502228-003  
**Date of Receipt:** 19 March 2025  
**Date of Calibration:** 19 March 2025

**Calibrated by** Mr.Yothin Charoensuk  
Scientist

**Approved by**   
( Mr.Pheraphat Tuanjit )

Manager, Division of Calibration Laboratory

**Date of Issue:** 25 March 2025

Responsible for the Technical Management Team

**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.:** 2502228-003-01

**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 March 2025

Page 2 of 3

**Environment Condition:** Ambient Temperature: 21.1 ± 0.6 °C Relative Humidity: 55 ± 0.75 %

**Place of Calibration:** 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	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:**

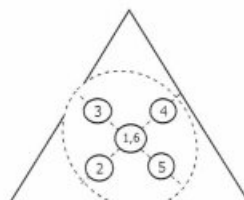
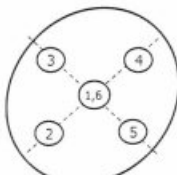
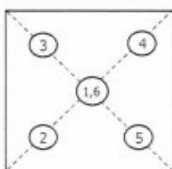
**1. Repeatability of Reading:**

Nominal Value ( g )	Standard Deviation of Reading ( g )
100	0.000052
200	0.000079

**2. Off-Center Error:**

A mass of 200 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 )
99.9997	99.9995	99.9995	99.9997	99.9999	99.9998	0.0003

for N. ingrat

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

## Calibration Report

**Certificate No.:** 2502228-003-01

**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 March 2025

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 <i>k</i>
Unload	0.00000	0.0000	0.0000	0.000089	2.00
0.1	0.10001	0.1001	-0.0001	0.000089	2.00
1	1.00000	1.0000	0.0000	0.000089	2.00
3	3.00003	3.0000	0.0000	0.000091	2.00
5	5.00002	5.0000	0.0000	0.000090	2.00
10	10.00001	9.9999	0.0001	0.000092	2.00
20	20.00003	20.0000	0.0000	0.000096	2.00
50	50.00003	49.9998	0.0002	0.00012	2.00
70	70.00006	69.9998	0.0003	0.00013	2.00
100	100.00006	99.9998	0.0003	0.00016	2.00
150	150.00009	150.0000	0.0001	0.00021	2.00
200	200.00013	200.0000	0.0001	0.00029	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. ingrat

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



## Certificate of Calibration

**Aquion: (Anion System ID#1047)**

This certificate is to verify that instrument below are calibrated

By Archemica Lab Co., Ltd.

**Aquion**

**S/N: 220380031**

**AS-DV**

**S/N: 2203880133**

**For**

**UAE Consultant Co., Ltd.**



Operator Signature: Saharat Popayom

Date: Apr 23-24, 2025

(Mr.Saharat Popayom)

Test Engineer

เอกสารไม่ควบคุม

# **Qualification Report**

**PM\_Checklist: CM\_OQ and PQ  
Aquion: Anion (ID#1047)**

**For  
UAE Consultant Co., Ltd.  
(1<sup>st</sup> Contract)**

**เอกสารไม่ควบคุม**

# PM

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## Preventive Maintenance Check List

เอกสารไม่ควบคุม



### Dionex Ion Chromatography Preventive Maintenance Report

Customer Organization	Name/ Department
United Analyst and Engineering Consultant Co.,Ltd.	K.Suwanna
Engineer	Date
Mr.Saharat Popayom	23-24/Apr/2025

#### Instrument Detail

Instrument Model	Application
Aquion (ID#1047, 1st Contract)	Anion
Instrument components	Serial Number
Aquion	220380031
AS-DV Autosampler	2203880133

#### Consumable Detail

Columns	Guard Columns	Suppressors	Concentrators	Etc.
AS18	AG18	ADRS600	-	EGC III KOH
				CR-ATC

Remark: -

Perform By Archemica



Saharat  
Archemica  
24 / Apr / 2025  
Date

Sumon  
Customer  
24 / Apr / 2025  
Date

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## General ICS Maintenance Checklist

No.	Description	Result			
<b>Power on &amp; Connection</b>		<b>Checked</b>	<b>Cleaned</b>	<b>Replaced</b>	<b>N/A</b>
1	Instrument power on	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
2	Instrument connection	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
<b>Injection Valve Rebuild</b>		<b>Checked</b>	<b>Cleaned</b>	<b>Replaced</b>	<b>N/A</b>
3	Rebuilt injection valve 6 port	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	- Rotor seal	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	- Stator face	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Optional Auxiliary Valve Rebuild</b>		<b>Checked</b>	<b>Cleaned</b>	<b>Replaced</b>	<b>N/A</b>
6	Rebuilt auxiliary valve - port	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
7	- Rotor seal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
8	- Stator face	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>Check Valve Cartridge</b>		<b>Checked</b>	<b>Cleaned</b>	<b>Replaced</b>	<b>N/A</b>
9	Inlet check valve assembly	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	Outlet check valve assembly	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	Verified correct flow orientation	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
<b>Pump Piston Rinse Seal, Piston Seal and Piston</b>		<b>Checked</b>	<b>Cleaned</b>	<b>Replaced</b>	<b>N/A</b>
12	Piston rinse seal in <i>primary</i> pump head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13	Piston seal in <i>primary</i> pump head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14	Piston in <i>primary</i> pump head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	Piston rinse seal in <i>secondary</i> pump head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16	Piston seal in <i>secondary</i> pump head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17	Piston in <i>secondary</i> pump head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Waste Valve and Priming Valve</b>		<b>Checked</b>	<b>Cleaned</b>	<b>Replaced</b>	<b>N/A</b>
18	Waste valve	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19	Priming valve	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Cell Detector</b>		<b>Checked</b>	<b>Cleaned</b>	<b>Replaced</b>	<b>N/A</b>
20	Check conductivity cell	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21	Check electrochemical cell	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
22	- Working electrode	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
23	- Reference electrode	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
24	- Gasket	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
25	- Cell body	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>Other</b>		<b>Checked</b>	<b>Cleaned</b>	<b>Replaced</b>	<b>N/A</b>
26	Sample Loop	Size 25 uL	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
27	End-line filter		<input type="checkbox"/>	-	<input type="checkbox"/>
28	Leak sensor		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29	Lubricate pump mechanic		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
30	Reconnected liquid lines to the valve		<input checked="" type="checkbox"/>	-	<input type="checkbox"/>
31	Reconnected liquid lines to pump heads		<input checked="" type="checkbox"/>	-	<input type="checkbox"/>
32	Primed pump		<input checked="" type="checkbox"/>	-	<input type="checkbox"/>
33	Checked pump for leaks		<input checked="" type="checkbox"/>	-	<input type="checkbox"/>
34	Checked gas for leaks		<input checked="" type="checkbox"/>	-	<input type="checkbox"/>



## AS-DV Autosampler Preventive Maintenance Checklist

Model	Serial number	Firmware Version
<input checked="" type="checkbox"/> AS-DV	2203880133	-

No.	Description	Result			
Power on & Connection		Checked	Cleaned	Replaced	N/A
1.	AS-DV power on	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
2.	AS-DV connection	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
Sampling Tip		Checked	Cleaned	Replaced	N/A
3.	Sampling needle	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Sampling tubing (Transfer line)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Reconnect sampling needle & tubing	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
Other		Checked	Cleaned	Replaced	N/A
6.	Check carousel movement	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
7.	Check needle movement	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
8.	Lubricate needle drive	<input checked="" type="checkbox"/>	<input type="checkbox"/> Lubricated	-	<input type="checkbox"/>
9.	AS-DV cover	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Optional High Pressure Valve		Checked	Cleaned	Replaced	N/A
10.	High pressure valve Port	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
11.	- Rotor seal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
12.	- Stator face	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
13.	- Reconnected liquid line to the valve	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Others / comments

# CM OQ

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**Chromeleon**

**Operation Qualification**

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**ThermoFisher**  
SCIENTIFIC  
**Chromeleon Operational Qualification**

**General Information**

	Computer Name	Version Number:
Instrument Controller:	DESKTOP-C4FS3L7	7.3.1 Build 6535
Client:	DESKTOP-C4FS3L7	7.3.1.6535
Operator:	Saharat Popayom	
<b>Overall Test Result:</b>	<b>Passed</b>	

**Comparison Format:**

All Parameters:	Significant Digits:	10
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*Suman 24/ Apr/2025*

Reviewer's Signature // Date



*Saharat 24 Apr 2025*

Operator's Signature // Date

# ThermoFisher SCIENTIFIC

## Chromeleon Operational Qualification, Part 1

### Verification of Selected Results

Detection Algorithm: Cobra  
Calibration Type: Lin, WithOffset  
Evaluation Type: Area  
Standard Method: External  
Calibration Mode: Total

Report Variable	Peak Name	Status
Offset (c0)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Slope (c1)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Correlation Coeffi.	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Variance	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Std. Deviation	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Rel. Std. Dev.	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Variance Coeff.	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok

# ThermoFisher SCIENTIFIC

## Chromeleon Operational Qualification, Part 1

### Verification of Selected Results

<i>Report Variable</i>	<i>Peak Name</i>	<i>Status</i>
Calibration Point X	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Calibration Point Y	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Amount [ng]	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Resolution (EP)	Acetanilide	ok
	Acetophenone	ok
Resolution (USP)	Acetanilide	ok
	Acetophenone	ok
Peak Asymmetry (EP/USP)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Peak Asymmetry (AIA)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok

# ThermoFisher SCIENTIFIC

## Chromeleon Operational Qualification, Part 1

### Verification of Selected Results

<i>Report Variable</i>	<i>Peak Name</i>	<i>Status</i>
Theoretical Plates (EP)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Theoretical Plates (USP)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Theoretical Plates (JP)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok

**Test Result:**      **Passed**



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Detection Algorithm: Cobra  
Calibration Type: Lin. With Offset  
Evaluation Type: Area  
Standard Method: External  
Calibration Mode: Total

Variable Category	Report Variable	Peak Name	Status
Injection	No.		ok
	Name		ok
	Type		ok
	Position		ok
	Status		ok
	Volume		ok
	Dilution Factor		ok
	Weight		ok
	IntStd		ok
	InstrumentMethod		ok
	ProcessingMethod		ok
Chromatogram	Channel		ok
	No. of Peaks		ok
	Chromatogram Start Time		ok
	Signal Min.		ok
	Signal Max.		ok
	Unit		ok
	Noise		ok
Peak Results	No.	Acetanilide	ok
	No.	Acetophenone	ok
	No.	Propiophenone	ok
	Peak Name	Acetanilide	ok
	Peak Name	Acetophenone	ok
	Peak Name	Propiophenone	ok
	Ret.Time	Acetanilide	ok
	Ret.Time	Acetophenone	ok
	Ret.Time	Propiophenone	ok

## ThermoFisher SCIENTIFIC

### Chromeleon Operational Qualification, Part 2

#### Most Frequently Used Parameters: Comparison with Expected Results

<u>Variable Category</u>	<u>Report Variable</u>	<u>Peak Name</u>	<u>Status</u>
Peak Results	Abs.Ret.Dev.	Acetanilide	ok
	Ret.Dev.(abs)	Acetophenone	ok
	Ret.Dev.(abs)	Propiophenone	ok
	Rel.Ret.Dev.	Acetanilide	ok
	Ret.Dev.(rel)	Acetophenone	ok
	Ret.Dev.(rel)	Propiophenone	ok
	Area	Acetanilide	ok
	Area	Acetophenone	ok
	Area	Propiophenone	ok
	Rel.Area	Acetanilide	ok
	Rel.Area (Total)	Acetophenone	ok
	Rel.Area (Total)	Propiophenone	ok
	Height	Acetanilide	ok
	Height	Acetophenone	ok
	Height	Propiophenone	ok
	Rel.Height (Total)	Acetanilide	ok
	Rel.Height (Total)	Acetophenone	ok
	Rel.Height (Total)	Propiophenone	ok
	Amount	Acetanilide	ok
	Amount	Acetophenone	ok
	Amount	Propiophenone	ok
	Concentration	Acetanilide	ok
	Concentration	Acetophenone	ok
	Concentration	Propiophenone	ok
	Rel.Amount	Acetanilide	ok
	Rel.Amount	Acetophenone	ok
	Rel.Amount	Propiophenone	ok
	Peak Width (0%)	Acetanilide	ok
	Peak Width (0%)	Acetophenone	ok
	Peak Width (0%)	Propiophenone	ok
	Peak Width (5%)	Acetanilide	ok
	Peak Width (5%)	Acetophenone	ok
	Peak Width (5%)	Propiophenone	ok
	Peak Width (10%)	Acetanilide	ok
	Peak Width (10%)	Acetophenone	ok
	Peak Width (10%)	Propiophenone	ok



## Chromeleon Operational Qualification, Part 2

### Most Frequently Used Parameters: Comparison with Expected Results

<i>Variable Category</i>	<i>Report Variable</i>	<i>Peak Name</i>	<i>Status</i>
Peak Results	Peak Width (50%)	Acetanilide	ok
	Peak Width (50%)	Acetophenone	ok
	Peak Width (50%)	Propiophenone	ok
	Left Width (0%)	Acetanilide	ok
	Left Width (0%)	Acetophenone	ok
	Left Width (0%)	Propiophenone	ok
	Right Width (0%)	Acetanilide	ok
	Right Width (0%)	Acetophenone	ok
	Right Width (0%)	Propiophenone	ok
	Peak Start	Acetanilide	ok
	Peak Start	Acetophenone	ok
	Peak Start	Propiophenone	ok
	Peak Stop	Acetanilide	ok
	Peak Stop	Acetophenone	ok
	Peak Stop	Propiophenone	ok
	Peak Start Value	Acetanilide	ok
	Peak Start Value	Acetophenone	ok
	Peak Start Value	Propiophenone	ok
	Peak Stop Value	Acetanilide	ok
	Peak Stop Value	Acetophenone	ok
	Peak Stop Value	Propiophenone	ok
	BL-Value Peak Start	Acetanilide	ok
	BL-Value Peak Start	Acetophenone	ok
	BL-Value Peak Start	Propiophenone	ok
	BL-Value Peak Stop	Acetanilide	ok
	BL-Value Peak Stop	Acetophenone	ok
	BL-Value Peak Stop	Propiophenone	ok
	Type	Acetanilide	ok
	Type	Acetophenone	ok
	Type	Propiophenone	ok
	Resolution (EP)	Acetanilide	ok
	Resolution(EP)	Acetophenone	ok
	Resolution(USP)	Acetanilide	ok
	Resolution(USP)	Acetophenone	ok
	Asymmetry(EP)	Acetanilide	ok
	Asymmetry(EP)	Acetophenone	ok
	Asymmetry(EP)	Propiophenone	ok

# ThermoFisher SCIENTIFIC

## Chromeleon Operational Qualification, Part 2

### Most Frequently Used Parameters: Comparison with Expected Results

<i>Variable Category</i>	<i>Report Variable</i>	<i>Peak Name</i>	<i>Status</i>
Peak Results	Asymmetry(AIA)	Acetanilide	ok
	Asymmetry(AIA)	Acetophenone	ok
	Asymmetry(AIA)	Propiophenone	ok
	Theor. Plates(EP)	Acetanilide	ok
	Theor. Plates(EP)	Acetophenone	ok
	Theor. Plates(EP)	Propiophenone	ok
	Theor. Plates(USP)	Acetanilide	ok
	Theor. Plates(USP)	Acetophenone	ok
	Theor. Plates(USP)	Propiophenone	ok
	Theor. Plates (JP)	Acetanilide	ok
	Theor. Plates(JP)	Acetophenone	ok
	Theor. Plates(JP)	Propiophenone	ok
Peak Calibration	Cal.Mode	Acetanilide	ok
	Cal.Mode	Acetophenone	ok
	Cal.Mode	Propiophenone	ok
	Cal.Type	Acetanilide	ok
	Cal.Type	Acetophenone	ok
	Cal.Type	Propiophenone	ok
	Weights	Acetanilide	ok
	Weights	Acetophenone	ok
	Weights	Propiophenone	ok
	Calibr. Coefficient C0	Acetanilide	ok
	Calibr. Coefficient C0	Acetophenone	ok
	Calibr. Coefficient C0	Propiophenone	ok
	Calibr. Coefficient C1	Acetanilide	ok
	Calibr. Coefficient C1	Acetophenone	ok
	Calibr. Coefficient C1	Propiophenone	ok
	RF-Value	Acetanilide	ok
	RF-Value	Acetophenone	ok
	RF-Value	Propiophenone	ok
	No. of Points	Acetanilide	ok
	No. of Points	Acetophenone	ok

## ThermoFisher SCIENTIFIC

### Chromeleon Operational Qualification, Part 2

#### Most Frequently Used Parameters: Comparison with Expected Results

<i>Variable Category</i>	<i>Report Variable</i>	<i>Peak Name</i>	<i>Status</i>
Peak Calibration	No. of Points	Propiophenone	ok
	No. of Points(disabled)	Acetanilide	ok
	No. of Points(disabled)	Acetophenone	ok
	No. of Points(disabled)	Propiophenone	ok
	Variance	Acetanilide	ok
	Variance	Acetophenone	ok
	Variance	Propiophenone	ok
	Var.Coeff	Acetanilide	ok
	Var.Coeff	Acetophenone	ok
	Var.Coeff	Propiophenone	ok
	Std.Dev.	Acetanilide	ok
	Std.Dev.	Acetophenone	ok
	Std.Dev.	Propiophenone	ok
	Rel.Std.Dev.	Acetanilide	ok
	Rel.Std.Dev.	Acetophenone	ok
	Rel.Std.Dev.	Propiophenone	ok
	Corr.Coeff.	Acetanilide	ok
	Corr.Coeff.	Acetophenone	ok
	Corr.Coeff.	Propiophenone	ok
	R-Square	Acetanilide	ok
	R-Square	Acetophenone	ok
	R-Square	Propiophenone	ok
	Adj. R-Square	Acetanilide	ok
	Adj. R-Square	Acetophenone	ok
	Adj. R-Square	Propiophenone	ok
	X	Acetanilide	ok
	X	Acetophenone	ok
	X	Propiophenone	ok
	Y	Acetanilide	ok
	Y	Acetophenone	ok
	Y	Propiophenone	ok
	W	Acetanilide	ok
	W	Acetophenone	ok
	W	Propiophenone	ok
	F(X)	Acetanilide	ok
	F(X)	Acetophenone	ok
	F(X)	Propiophenone	ok

# ThermoFisher SCIENTIFIC

## Chromeleon Operational Qualification, Part 2

### Most Frequently Used Parameters: Comparison with Expected Results

<i>Variable Category</i>	<i>Report Variable</i>	<i>Peak Name</i>	<i>Status</i>
Peak Calibration	Residual for Cal.Point X	Acetanilide	ok
	Residual for Cal.Point X	Acetophenone	ok
	Residual for Cal.Point X	Propiophenone	ok
	Calibration Point Status	Acetanilide	ok
	Calibration Point Status	Acetophenone	ok
	Calibration Point Status	Propiophenone	ok
	Amount	Acetanilide	ok
	Amount	Acetophenone	ok
	Amount	Propiophenone	ok
Component	Cal.Type	Acetanilide	ok
	Peak Type	Acetanilide	ok
	Left Limit	Acetophenone	ok
	Right Limit	Acetanilide	ok
	Group	Acetanilide	ok
	Factor	Acetophenone	ok
	Amount	Acetanilide	ok
	Conc.Unit	Acetophenone	ok

## ThermoFisher SCIENTIFIC

### Chromeleon Operational Qualification, Part 2

#### Most Frequently Used Parameters: Comparison with Expected Results

<i>Variable Category</i>	<i>Report Variable</i>	<i>Peak Name</i>	<i>Status</i>
Peak Purity	PPI	Acetanilide	ok
	PPI	Acetophenone	ok
	PPI	Propiophenone	ok
	RSD PPI	Acetanilide	ok
	RSD PPI	Acetophenone	ok
	RSD PPI	Propiophenone	ok
	Match	Acetanilide	ok
	Match	Acetophenone	ok
	Match	Propiophenone	ok
	RSD Match	Acetanilide	ok
	RSD Match	Acetophenone	ok
	RSD Match	Propiophenone	ok
	Rel.Max at	Acetanilide	ok
	Rel.Max at	Acetophenone	ok
	Rel.Max at	Propiophenone	ok

**Test Result:**      **Passed**

# ThermoFisher SCIENTIFIC

## Chromeleon Operational Qualification, Part 3 System Suitability Test: Comparison with Expected Results

<u>Variable Category</u>	<u>Report Variable</u>	<u>Status</u>
System Suitability Test Case	Number	ok
	Name	ok
	Inj. Condition	ok
	Eval. Formula	ok
	Operator	ok
	Statistics	ok
	Rounding	ok
	MinimumNumberOfInjections	ok
	MaximumNumberOfInjections	ok
	Channel	ok
	Peak	ok
	Ref. Value Formula 1	ok
	Ref. Value Formula 2	ok
	N.A.	ok
System Suitability Test Case Result	Inj. Eval. Result	ok
	Eval. Result	ok
	Peak Result	ok
	Injection Condition Result	ok
	Ref. Value 1	ok
	Ref. Value 2	ok
	Result	ok
	Message	ok
	Average	ok
	Count	ok
	Maximum	ok
	Minimum	ok
	Range	ok
	Rel. Range	ok
	Rel. Std. Dev.	ok
	Std. Dev.	ok
	Sum	ok

**Test Result:** *Passed*

# PQ

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## Performance Qualification

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# IC PUMP FLOW RATE ACCURACY

**ThermoFisher**  
SCIENTIFIC

## IC Pump Flow Rate

Set Point (mL) (mL/min)	Reading (mL/min)	Deviation (%)	OQ Limit (%)	Result
0.5	0.4964	0.720	± 2.0	PASS
1.0	0.9958	0.42	± 2.0	PASS

OVERALL TEST RESULT: PASS

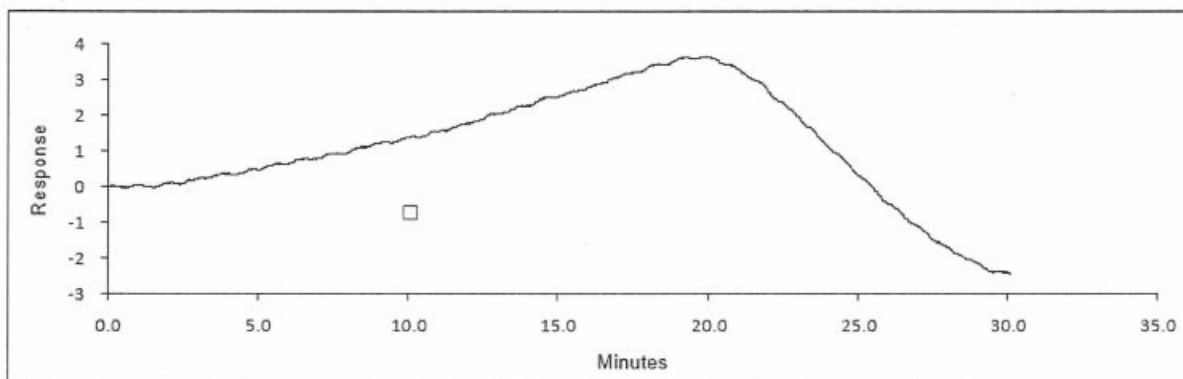
บริษัท อาร์เคมีกา แล  
ARCHEMICA LAB

Field Service Representative Signature:	Customer Signature:
Saharath	Simon
Date: 20 Apr 2025	Date: Apr 24 2025

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## NOISE AND DRIFT (CD)

**ThermoFisher**  
SCIENTIFIC



### Information

System Name	AquionRFIC
Detector SN	220360045
Data Path	chrom://desktop-c4fs3l7/ChromeleonLocal/Archemica/Service Contract/2025/1st Con 23-Apr-2025/AquionRFIC %231047/IC OQ.seq/884.smp/ECD_1.channel/ECD_1.chm

### Noise and Drift

Test	Measured (nS)	OQ Limit (nS)	Result	Conversion Factor
Noise	0.2 nS	$\leq 2.0$ nS	PASS	1000
Drift	12.9 nS/hr	$\leq 20.0$ nS/hr	PASS	1000



OVERALL TEST RESULT: **PASS**  
ARCHHEMICA LAB CO. LTD

Field Service Representative Signature:	Customer Signature:
<i>Saharat</i>	
Date: <i>24 Apr / 2025</i>	Date:

**เอกสารไม่ควบคุม**

## TEST EQUIPMENT AND STANDARDS

**ThermoFisher**  
SCIENTIFIC

### Test Equipment

Equipment	Manufacturer	Model	Serial Number	Cal/Ver Date	Good Until
Multimeter	Fluke	289	59270015	N/A	N/A
Thermocouple	Fluke	K-Type	59270015	N/A	N/A
Balance	MettlerToledo	AB204-S	1129361010	N/A	N/A
IC Qualification	Thermo Scientific	Test Box	24159332	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A

### Standards/Chemicals

Description	Manufacturer	Concentration	Part Number	Lot Number	Expiration Date
Nitrate	Thermo Scientific	5 ppm	060254	241021	Oct-2025
Nitrate	Thermo Scientific	10 ppm	060254	241021	Oct-2025
Nitrate	Thermo Scientific	25 ppm	060254	241021	Oct-2025
Nitrate	Thermo Scientific	50 ppm	060254	241021	Oct-2025
Nitrate	Thermo Scientific	100 ppm	060254	241021	Oct-2025
Nitrate	Thermo Scientific	1000 ppm	060254	241021	Oct-2025
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A



Field Service Representative Signature:	Customer Signature:
Saharat	<i>[Signature]</i>
Date: 24 Apr 2025	Date: Apr 24, 2025

**เอกสารไม่ควบคุม**

## REPEATABILITY (CD)

ThermoFisher  
SCIENTIFIC

## Information

System Name	AquionRFIC
Detector SN	220360045
Data Path	ChromeleonLocal://Archemica/Service Contract/2025/1st Con 23-Apr-2025/AquionRFIC #1047/IC OQ

## Peak Results

Sample Name	Injection Volume (µL)	Retention Time (min)	Area
Repeatability 01	25	0.4467	3.611
Repeatability 02	25	0.4467	3.616
Repeatability 03	25	0.4467	3.607
Repeatability 04	25	0.4467	3.627
Repeatability 05	25	0.4467	3.615
Repeatability 06	25	0.4467	3.571

## Repeatability

Test	Measured (% RSD)	OQ Limit (% RSD)	Result
Retention Time	0.0	≤ 5.0	PASS
Area	0.5	≤ 1.0	PASS

OVERALL TEST RESULT: PASS



Field Service Representative Signature:	Customer Signature:
Saharat	Sinlan
Date: 24 Apr 2025	Date: Apr 24, 2025

เอกสารไม่ควบคุม

## CARRYOVER (CD)

ThermoFisher  
SCIENTIFIC

## Information

System Name	Aquion
Detector SN	220360045
Data Path	ChromeleonLocal://Archemica/Service Contract/2025/1st Con 23-Apr-2025/AquionRFIC #1047/IC OQ

## Peak Results

Sample Name	Injection Volume (µL)	Retention Time (min)	Area
Reference Blank	25	0.4467	0.056
High Standard	25	0.4483	47.903
Carryover	25	0.4467	0.06

## Results

Test	Observed (%)	OQ Limit (%)	Result
AREA	0.01	≤ 0.10	PASS



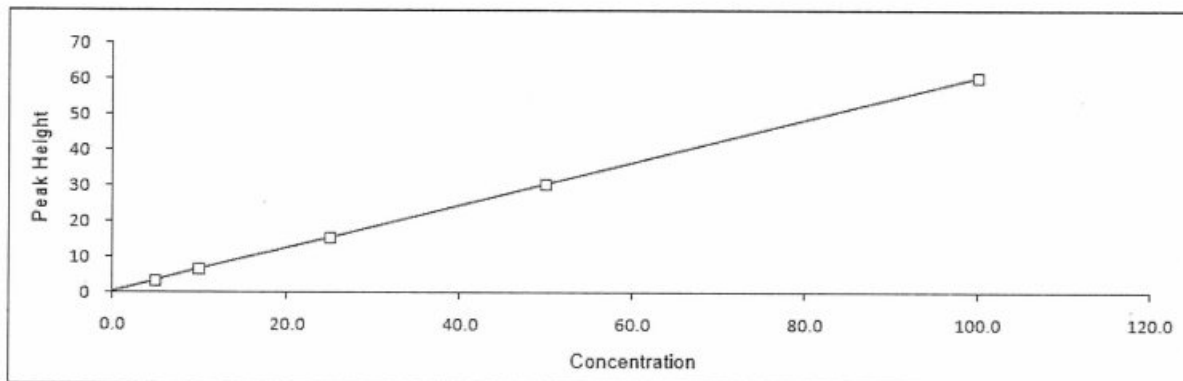
OVERALL TEST RESULT: PASS

ARCHÉMICA LAB  
ARCHÉMICA LAB CO.

Field Service Representative Signature:	Customer Signature:
Sahardh	Suman
Date: 24 Apr 2025	Date: Apr 24, 2025

เอกสารไม่ควบคุม

## DETECTOR LINEARITY (CD)

ThermoFisher  
SCIENTIFIC

## Information

System Name	Aquion
Detector SN	220360045
Data Path	ChromeleonLocal://Archemica/Service Contract/2025/1st Con 23-Apr-2025/AquionRFIC #1047/IC OQ

## Peak Results

Sample Name	Concentration	Peak Height	Calculated
Detector Linearity 01	5	3.478	5.01
Detector Linearity 02	10	6.52	10.08
Detector Linearity 03	25	15.515	25.08
Detector Linearity 04	50	30.296	49.71
Detector Linearity 05	100	60.532	100.11

## Linearity

Test	Observed	OQ Limit	Result
$r^2$	1.000	$\geq 0.999$	PASS

OVERALL TEST RESULT: **PASS**บริษัท อาร์เคมีกา แล็บ จำกัด  
ARCHEMICA LAB CO., LTD

Field Service Representative Signature:	Customer Signature:
Saharat	Sunan
Date: 24 Apr 2025	Date: Apr 24, 2025

เอกสารไม่ควบคุม

# TEMPERATURE ACCURACY

**ThermoFisher**  
SCIENTIFIC

## Column Compartment

Set Point (°C)	Reading (°C)	Deviation (°C)	OQ Limit (°C)	Result
30.0	30.7	0.7	± 2.0	PASS



OVERALL TEST RESULT: PASS  
บริษัท อีเค้า แล็บ จำกัด  
ARCHEMICA LAB CO.,LTD

Field Service Representative Signature:	Customer Signature:
Saharat	Sinan
Date: 24 Apr 2025	Date: Apr 24, 2026

เอกสารไม่ควบคุม

# Certificate

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## Certificate of Standards and Instruments for Qualification

เอกสารไม่ควบคุม



# SYSTRONICS INSLAB COMPANY LIMITED

19/11-12, Sukhumvit Rd., Nernphra, Muang Rayong, Rayong 21150, Thailand

Tel.+66(38) 694 145-8, Email : calibration@systronics.co.th



## CERTIFICATE OF CALIBRATION

Certificate No : EL241787

Job No : 24110052

Page : 1 of 5

Customer Name. : Archemica Lab Co., Ltd.

Customer Address. : 39 Soi Sukhumvit 63 ( Ekamai )

: Sukhumvit Rd., North Klongton,

: Wattana , Bangkok 10110

Instrument Description. : TRUE RMS MULTIMETER

Manufacturer. : FLUKE

Model No. : 289

Serial Number. : 59270015

Received Date : 14 Nov 2024

Calibrated Date : 18 Nov 2024

Issued Date : 18 Nov 2024

Tag No : -

Service : -

Condition As Received : Used

### Calibration Procedure.

Calibration were conducted using in-house calibration procedure according to direct measurement with reference standard.

### Procedure No.

CP-EL-01, 02, 03, 04, 05, 06, 07, 10.

### Comment.

### Reference Standards Instrument.

Instrument Name	Model	Serial No.	Cert. No.	Due Date.
Multi-Function Calibrator	Fluke 5522A	2177901	EE-0033-23	03 Apr 2025
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

### Traceability Information.

- Traceable to the International System of Units (SI) through the National Institute of Metrology (Thailand), NIMT.

### Environmental Conditions.

Temperature :  $(23 \pm 3) ^\circ\text{C}$  Relative Humidity :  $(50 \pm 15) \%$

### Calibration Information.

- The result of calibration was found accurate as show on date and place of calibration only.
- The reported uncertainty of measurement is based on standard uncertainty multiplied by a coverage factor  $k = 2$ , providing confidence level of approximately 95%.

Calibrated by : Mr.Suputthana Prapasai

Approved by :

Approved Signatory

Mr. Phitsanu Wangchai

Mr. Tanawat Siripakdee

This certificate may not be reproduced, except in full unless permission for the publication of an approved abstract is obtained in writing from the calibration organization issuing this report.

เอกสารไม่ควบคุม

**SYSTRONICS INSLAB COMPANY LIMITED**

19/11-12, Sukhumvit Rd., Nernphra, Muang Rayong, Rayong 21150, Thailand

Tel:+66(38) 694 145-8, Email : calibration@systronics.co.th

NSC - TSI - ITS 17025  
CALIBRATION 0312**CERTIFICATE OF CALIBRATION**

Certificate No. EL241787

Page. 2 of 5

Range	Standard Value	UUC*Reading	Error	(±) Uncertainty
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**Function : DC Voltage Measurement (Without Adjustment)**

50	mV	0.0000 mV	0.000 mV	0.000 mV	0.0016 mV
50	mV	5.0000 mV	4.995 mV	-0.005 mV	0.0016 mV
50	mV	45.0000 mV	44.993 mV	-0.007 mV	0.0022 mV
50	mV	-45.0000 mV	-45.002 mV	-0.002 mV	0.0022 mV
500	mV	50.0000 mV	50.00 mV	0.00 mV	0.0061 mV
500	mV	450.000 mV	449.98 mV	-0.02 mV	0.0080 mV
500	mV	-450.000 mV	-449.99 mV	0.01 mV	0.0080 mV
5	V	0.500000 V	0.5000 V	0.0000 V	0.000059 V
5	V	4.50000 V	4.4997 V	-0.0003 V	0.000082 V
5	V	-4.50000 V	-4.4997 V	0.0003 V	0.000082 V
50	V	5.00000 V	5.000 V	0.000 V	0.00059 V
50	V	45.0000 V	44.997 V	-0.003 V	0.00095 V
50	V	-45.0000 V	-44.997 V	0.003 V	0.00095 V
500	V	50.0000 V	50.00 V	0.00 V	0.0059 V
500	V	450.000 V	449.97 V	-0.03 V	0.0095 V
500	V	-450.000 V	-449.97 V	0.03 V	0.0095 V
1000	V	100.0000 V	100.0 V	0.0 V	0.058 V
1000	V	900.000 V	900.0 V	0.0 V	0.060 V
1000	V	-900.000 V	-900.0 V	0.0 V	0.060 V

**Function : DC Voltage Measurement LoZ (Without Adjustment)**

1000	V	0.000000 V	0.0 V	0.0 V	0.058 V
1000	V	100.0000 V	100.1 V	0.1 V	0.058 V
1000	V	900.000 V	900.8 V	0.8 V	0.060 V
1000	V	-900.000 V	-900.8 V	-0.8 V	0.060 V

**Function : AC Voltage Measurement (Without Adjustment)**

50	mV	5.000 mV	50 Hz	4.988 mV	-0.012 mV	0.0053 mV
50	mV	45.000 mV	50 Hz	45.003 mV	0.003 mV	0.013 mV
500	mV	50.000 mV	50 Hz	49.94 mV	-0.06 mV	0.014 mV
500	mV	450.00 mV	50 Hz	450.13 mV	0.13 mV	0.11 mV
5	V	0.50000 V	50 Hz	0.4986 V	-0.0014 V	0.00012 V
5	V	4.5000 V	50 Hz	4.5012 V	0.0012 V	0.0011 V
50	V	5.0000 V	50 Hz	4.988 V	-0.012 V	0.0012 V
50	V	45.000 V	50 Hz	45.012 V	0.012 V	0.0085 V
500	V	50.000 V	50 Hz	49.88 V	-0.12 V	0.011 V
500	V	450.00 V	50 Hz	450.16 V	0.16 V	0.12 V
1000	V	100.000 V	50 Hz	100.0 V	0.0 V	0.060 V
1000	V	900.00 V	50 Hz	900.4 V	0.4 V	0.23 V

**Remark :** (\*) UUC : Unit Under Calibration**เอกสารไม่ควบคุม**



# SYSTRONICS INSLAB COMPANY LIMITED

19/11-12, Sukhumvit Rd., Nernphra, Muang Rayong, Rayong 21150, Thailand

Tel.+66(38) 694 145-8, Email : calibration@systronics.co.th



## CERTIFICATE OF CALIBRATION

Certificate No. EL241787

Page. 3 of 5

Range		Standard Value			UUC*Reading	Error	(±) Uncertainty
Function : AC Voltage Measurement LoZ (Without Adjustment)							
1000	V	100.000 V	50	Hz	100.4 V	0.4 V	0.060 V
1000	V	900.00 V	50	Hz	905.7 V	5.7 V	0.23 V
Function : DC Current Measurement (Without Adjustment)							
500	uA	0.000 uA			0.00 uA	0.00 uA	0.017 uA
500	uA	50.000 uA			49.99 uA	-0.01 uA	0.023 uA
500	uA	450.00 uA			449.95 uA	-0.05 uA	0.078 uA
5000	uA	500.00 uA			500.0 uA	0.0 uA	0.097 uA
5000	uA	4500.0 uA			4499.4 uA	-0.6 uA	0.57 uA
50	mA	5.0000 mA			5.001 mA	0.001 mA	0.00082 mA
50	mA	45.000 mA			44.996 mA	-0.004 mA	0.0058 mA
400	mA	40.000 mA			39.99 mA	-0.01 mA	0.0077 mA
400	mA	360.00 mA			359.93 mA	-0.07 mA	0.090 mA
5	A	0.50000 A			0.5001 A	0.0001 A	0.00013 A
5	A	4.5000 A			4.4991 A	-0.0009 A	0.0022 A
10	A	1.00000 A			1.000 A	0.000 A	0.00061 A
10	A	9.0000 A			8.998 A	-0.002 A	0.0040 A
Function : AC Current Measurement (Without Adjustment)							
500	uA	50.00 uA	50	Hz	49.82 uA	-0.18 uA	0.13 uA
500	uA	450.00 uA	50	Hz	449.85 uA	-0.15 uA	0.48 uA
5000	uA	500.00 uA	50	Hz	499.8 uA	-0.2 uA	0.51 uA
5000	uA	4500.0 uA	50	Hz	4501.0 uA	1.0 uA	3.1 uA
50	mA	5.0000 mA	50	Hz	4.988 mA	-0.012 mA	0.0032 mA
50	mA	45.000 mA	50	Hz	44.981 mA	-0.019 mA	0.031 mA
400	mA	40.000 mA	50	Hz	39.96 mA	-0.04 mA	0.029 mA
400	mA	360.00 mA	50	Hz	360.13 mA	0.13 mA	0.22 mA
5	A	0.50000 A	50	Hz	0.4990 A	-0.0010 A	0.00028 A
5	A	4.5000 A	50	Hz	4.4972 A	-0.0028 A	0.0038 A
10	A	1.00000 A	50	Hz	1.000 A	0.000 A	0.00075 A
10	A	9.0000 A	50	Hz	8.999 A	-0.001 A	0.0059 A

Remark : (\*) UUC : Unit Under Calibration

บริษัท อาร์เคมีกา แล็บ จำกัด  
ARCHEMICA LAB CO., LTD.

Saharat  
24 Apr 2025

Signature

เอกสารไม่ควบคุม



# SYSTRONICS INSLAB COMPANY LIMITED

19/11-12, Sukhumvit Rd., Naphra, Muang Rayong, Rayong 21150, Thailand

Tel:+66(38) 684 145-8, Email : calibration@systronics.co.th



## CERTIFICATE OF CALIBRATION

Certificate No. EL241787

Page. 4 of 5

Range	Standard Value	UUC*Reading	Error	(±) Uncertainty
<b>Function : Resistance Measurement (Without Adjustment)</b>				
500 Ω	0.0000 Ω	0.00 Ω	0.00 Ω	0.0075 Ω
500 Ω	50.0000 Ω	49.99 Ω	-0.01 Ω	0.0084 Ω
500 Ω	450.000 Ω	449.93 Ω	-0.07 Ω	0.017 Ω
5 kΩ	0.500000 kΩ	0.4999 kΩ	-0.0001 kΩ	0.000060 kΩ
5 kΩ	4.50000 kΩ	4.4986 kΩ	-0.0014 kΩ	0.00017 kΩ
50 kΩ	5.00000 kΩ	5.000 kΩ	0.000 kΩ	0.00060 kΩ
50 kΩ	45.0000 kΩ	45.001 kΩ	0.001 kΩ	0.0017 kΩ
500 kΩ	50.0000 kΩ	49.99 kΩ	-0.01 kΩ	0.0060 kΩ
500 kΩ	450.000 kΩ	449.87 kΩ	-0.13 kΩ	0.018 kΩ
5 MΩ	0.500000 MΩ	0.4998 MΩ	-0.0002 MΩ	0.000061 MΩ
5 MΩ	4.50000 MΩ	4.4981 MΩ	-0.0019 MΩ	0.00056 MΩ
30 MΩ	3.000000 MΩ	3.000 MΩ	0.000 MΩ	0.00061 MΩ
30 MΩ	27.00000 MΩ	26.987 MΩ	-0.013 MΩ	0.0075 MΩ
50 MΩ	5.00000 MΩ	5.00 MΩ	0.00 MΩ	0.0059 MΩ
50 MΩ	45.0000 MΩ	44.97 MΩ	-0.03 MΩ	0.021 MΩ
100 MΩ	10.00000 MΩ	10.0 MΩ	0.0 MΩ	0.058 MΩ
100 MΩ	90.0000 MΩ	89.9 MΩ	-0.1 MΩ	0.069 MΩ
500 MΩ	250.0000 MΩ	249.4 MΩ	-0.6 MΩ	0.68 MΩ
500 MΩ	450.00 MΩ	448.0 MΩ	-2.0 MΩ	5.9 MΩ

### Function : Resistance Measurement LoΩ (Without Adjustment)

50 Ω	0.0000 Ω	0.000 Ω	0.000 Ω	0.0047 Ω
50 Ω	5.0000 Ω	5.004 Ω	0.004 Ω	0.0049 Ω
50 Ω	25.0000 Ω	24.996 Ω	-0.004 Ω	0.0057 Ω
50 Ω	45.0000 Ω	44.993 Ω	-0.007 Ω	0.0060 Ω

### Function : Capacitance Measurement (Without Adjustment)

1 nF	0.0000 nF	0.000 nF	0.000 nF	0.0078 nF
1 nF	0.5000 nF	0.499 nF	-0.001 nF	0.0098 nF
1 nF	0.9000 nF	0.898 nF	-0.002 nF	0.012 nF
10 nF	1.0000 nF	1.00 nF	0.00 nF	0.013 nF
10 nF	9.0000 nF	9.00 nF	0.00 nF	0.029 nF
100 nF	10.0000 nF	10.0 nF	0.0 nF	0.064 nF
100 nF	90.0000 nF	90.0 nF	0.0 nF	0.29 nF
1 uF	0.100000 uF	0.100 uF	0.000 uF	0.00064 uF
1 uF	0.900000 uF	0.900 uF	0.000 uF	0.0029 uF
10 uF	1.00000 uF	1.00 uF	0.00 uF	0.0064 uF
10 uF	9.0000 uF	9.00 uF	0.00 uF	0.028 uF
100 uF	10.0000 uF	10.0 uF	0.0 uF	0.064 uF
100 uF	90.000 uF	90.0 uF	0.0 uF	0.42 uF
1000 uF	100.000 uF	100 uF	0 uF	0.72 uF
1000 uF	900.00 uF	899 uF	-1 uF	4.2 uF
10 mF	1.00000 mF	1.00 mF	0.00 mF	0.0072 mF
10 mF	9.0000 mF	9.00 mF	0.00 mF	0.043 mF
100 mF	10.0000 mF	10.0 mF	0.0 mF	0.072 mF
100 mF	90.000 mF	89.8 mF	-0.2 mF	0.89 mF

Remark : (\*) UUC : Unit Under Calibration

05/16

เอกสารไม่ควบคุม



# SYSTRONICS INSLAB COMPANY LIMITED

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Tel.+66(38) 694 145-8, Email : calibration@systronics.co.th



## CERTIFICATE OF CALIBRATION

Certificate No. EL241787

Page. 5 of 5

Range		Standard Value		UUC*Reading	Error	(±) Uncertainty
Function : Frequency Measurement (Without Adjustment)						
100	Hz	10.00 Hz	@ 1 V	10.000 Hz	0.000 Hz	0.00059 Hz
100	Hz	90.00 Hz	@ 1 V	90.000 Hz	0.000 Hz	0.00066 Hz
1000	Hz	100.00 Hz	@ 1 V	100.00 Hz	0.00 Hz	0.0058 Hz
1000	Hz	900.0 Hz	@ 1 V	900.00 Hz	0.00 Hz	0.0061 Hz
10	kHz	1.0000 kHz	@ 1 V	1.0000 kHz	0.0000 kHz	0.000058 kHz
10	kHz	9.000 kHz	@ 1 V	9.0000 kHz	0.0000 kHz	0.00007 kHz
100	kHz	10.000 kHz	@ 1 V	10.000 kHz	0.000 kHz	0.00058 kHz
100	kHz	90.00 kHz	@ 1 V	90.000 kHz	0.000 kHz	0.00061 kHz
1000	kHz	100.00 kHz	@ 1 V	100.00 kHz	0.00 kHz	0.0058 kHz
1000	kHz	500.0 kHz	@ 1 V	500.00 kHz	0.00 kHz	0.0059 kHz

Range	Standard Value	Required UUC*Reading	UUC*Reading	Error	(±) Uncertainty
<b>Function : Thermocouple Measurement K Type (Without Adjustment)</b>					
-200 to 1350 °C	-5.550 mV	-180.0 °C	-178.6 °C	1.4 °C	0.37 °C
-200 to 1350 °C	0.000 mV	0.0 °C	0.6 °C	0.6 °C	0.24 °C
-200 to 1350 °C	4.096 mV	100.0 °C	100.6 °C	0.6 °C	0.22 °C
-200 to 1350 °C	24.905 mV	600.0 °C	600.6 °C	0.6 °C	0.22 °C
-200 to 1350 °C	37.326 mV	900.0 °C	900.6 °C	0.6 °C	0.22 °C
-200 to 1350 °C	48.838 mV	1200.0 °C	1200.7 °C	0.7 °C	0.23 °C

**Remark :** (\*) UUC : Unit Under Calibration

**END OF CALIBRATION**

ARCHIMICA LAB  
บริษัท อาร์เคมีกา แล็บ จำกัด  
ARCHIMICA LAB CO.,LTD

Saharat

26 Apr 2025

5/1/25

เอกสารไม่ควบคุม

# Thermo SCIENTIFIC CERTIFICATE OF CONFORMITY

## IC QUALIFICATION TEST BOX II

This certificate validates that the product values referenced below meet or exceed all Thermo Scientific functional specifications and release requirements.

Instrument Serial Number: 24159332  
Instrument Part Number: 22000-60001

### TEST BOX LOADS AND FUNCTIONS

<input checked="" type="checkbox"/> AES	100 $\Omega$	+/- 5%	<input checked="" type="checkbox"/> CR-TC 3-pin ANA INT	1.3K $\Omega$	+/- 5%
<input checked="" type="checkbox"/> EGC CAP KOH	100 $\Omega$	+/- 5%	<input checked="" type="checkbox"/> CR-TC 3-pin CAP INT	13.05k $\Omega$	+/- 1%
<input checked="" type="checkbox"/> EGC CAP MSA	100 $\Omega$	+/- 5%	<input checked="" type="checkbox"/> CR-TC 4-pin ANA INT	1.3K $\Omega$	+/- 5%
<input checked="" type="checkbox"/> EGC ANA KOH	100 $\Omega$	+/- 5%	<input checked="" type="checkbox"/> CR-TC 4-pin CAP INT	13.05k $\Omega$	+/- 1%
<input checked="" type="checkbox"/> EGC ANA MSA	100 $\Omega$	+/- 5%	<input checked="" type="checkbox"/> ERS - Memory Test		
<input checked="" type="checkbox"/> ERS (CC)	12 $\Omega$	+/- 5%	<input checked="" type="checkbox"/> ERS - Memory Test		
<input checked="" type="checkbox"/> ERS (CV)	250 $\Omega$	+/- 5%	<input checked="" type="checkbox"/> CR-TC - Memory Test		

Tester: Alicia Palacios

บริษัท อีซีเคมีคัล แล็บ  
ARCHÉMICA LAB CO., LTD

Date: 11-April-2024

*Subrata*  
20 Apr 2025

# Certificate of Analysis

Better Separations Through  
Better Chemistry

## Dionex Nitrate OQ/PQ IC Standards Kit (Set of 6)

Product Number 060254  
Certificate of Analysis

Lot Number 241021

Expiration of Certification  
October 2025

The Dionex Nitrate Standard was developed to aid the analysis of anions by Ion Chromatography (IC). The single-ion standard was prepared by the dissolution of high-purity salt in  $\geq 18.2$  megohm deionized water, which was tested by IC for ionic contaminants. The bottle label states the nominal concentration value of the ionic component for informational purposes only. The actual ion concentration value was determined by Ion Chromatography. The IC system was standardized using the National Institute of Standards & Technology (NIST), Standard Reference Material, SRM 3185 (Nitrate Standard Solution). Actual concentration values determined for the single-ion is listed below.

### Dionex Nitrate Standard

<u>Vial #</u>	<u>Concentration</u> (mg/L)
1	4.95 $\pm$ 0.09
2	9.97 $\pm$ 0.02
3	25.33 $\pm$ 0.12
4	50.46 $\pm$ 0.28
5	101.4 $\pm$ 1
6	1004 $\pm$ 4



S. Khawat

24 Apr 2025

The concentration value is based a proven reliable method of analysis. The estimated uncertainties are two standard deviations of the concentration value. The concentration value is warranted to be stable for one year from the date of manufacture.

The preparation and analyses of the Dionex Nitrate Standard was performed with extreme care by Thermo Scientific Corporation Consumables Manufacturing Department in Sunnyvale California.

Document No. 078690-01

20-Dec-2011

[thermoscientific.com/dionex](http://thermoscientific.com/dionex)

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XX21149-EN 0215S 031318-11

Thermo Fisher Scientific  
1228 Titan Way  
P.O. Box 3603  
Sunnyvale, CA 94088-3603  
(408) 737-0700

thermo  
scientific

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# Certificate of Completion

This certifies that

**Saharat Popayom**

Has successfully completed

## OJT RPG Mentoring: Ion Chromatography System Qualification Service Training



Valid for 3 years from:

Aug/26/2024

*Saharat*

*26/ Apr / 2028*

Issued electronically and  
approved by:

Thermo Fisher University LMS  
Certification Management and  
Compliance Group  
[tmc.training@thermofisher.com](mailto:tmc.training@thermofisher.com)

The world leader in serving science

Important note: The certificate is only valid during employment with the Thermo Fisher Scientific including its subsidiaries and certified contractors.

สถาบันวิทยาศาสตร์

## Agilent CrossLab Start Up Services

# Agilent 5100 5110 ICP-OES Preventive Maintenance



Agilent Preventive Maintenance provides factory recommended service for your analytical instruments 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 what you need to reduce unplanned downtime and keep your systems operating at their peak performance.

This checklist is used as a guide for completing the preventive maintenance tasks. A signed copy of this checklist is provided for your records.

## Introduction

### Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures. Customers are responsible for regular maintenance and are encouraged to observe the service representative.
- 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.
- 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.
- For customers using HF applications, the instrument should be returned to its standard sample introduction system.

## Important Customer Web Links

- 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.
- To access the **Agilent Resource Center** web page, visit <https://www.agilent.com/en-us/agilentresources>. The following information topics are available:
  - Sample Prep and Containment
  - Chemical Standards
  - Analysis
  - Service and Support
  - Application Workflows
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>
- Videos about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>
- **Need to place a service call?** [Flexible Repair Options | Agilent](#)

## Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- 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 **"Service not applicable"** check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance services in the most logical order relevant to the individual system 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
- Add relevant page numbers to selected pages and complete the total number of pages field in the Service Completion section
- **Ask the customer to sign the Service Verification section including the customer's and your signature.**

## Instrument Maintenance

### System Information

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

Instrument System Name and ID	5110 VDV ICP-OES
Instrument System Site and Location	United Analyst and Engineering Consultant

List System Component Product Numbers	List the Serial Numbers of each Component
1. G 8015A	MY 18030001
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

ICP-OES Configuration Table	Circle the type or write in the type if other
Nebulizer Type	SeaSpray   <u>OneNeb</u>   Conikal   Other
Spray Chamber	Cyclonic Single Pass   <u>Cyclonic Double Pass</u>   Other
Torch	Radial   <u>Dual View</u>   Other
Torch Type	One Piece   <u>Semi Demountable</u>   Fully Demountable   Other
Injector Diameter	2.4mm   <u>1.8mm</u>   1.4mm   0.8mm   Other
Injector Material	<u>Quartz</u>   Ceramic   Other

## Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ 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 and implementation of Service Notes
- ☒ Check for required firmware/software updates and verify with customers if they would like them installed.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. *ป.18*
- ☒ Ask the customer to remove any samples from the ICP-OES sample introduction area, auto sampler or around the ICP-OES.

## Preventive Maintenance Procedures

### Record Pre-PM instrument performance

- ☒ Run Instrument Performance test.
- ☒ Record results in Instrument Performance Test Results Table – Pre-PM.

### Clean and inspect ICP-OES system

- ☒ Look for any obvious external damage or problems.
- ☒ Inspect water cooling hoses, gas lines and power cord for excessive wear or damage.
- ☒ Perform a general internal inspection of the system for excessive dust accumulation, clean if necessary.
- ☒ Inspect sample introduction components and record any required maintenance in the Service Engineer Comments and notify the customer as the required actions required.
- ☒ Record the instrument operating conditions in the ICP-OES Status Results Table.
- ☒ Replace the polychromator purge filter.
- ☒ Replace the radial pre-optics window
- ☒ Replace the axial pre-optics window for SVDV and VDV instruments.
- ☒ Check exhaust flow for the correct positive extraction at the exhaust duct to insure they meet minimum specifications.
- ☒ Replace air inlet dust filter.
- ☐ Replace high capacity air inlet dust filter element if installed. N/A
- ☒ Remove and clean instrument water inlet filter.

### Agilent Water Recirculator

- ☐ **Service not applicable**
- ☒ Drain cooling fluid and remove any particles from the chiller reservoir
- ☒ Remove, clean and reinstall water inlet metal mesh filter if present.
- ☒ Re fill with Agilent Cool Clear cooling fluid.
- ☒ Clean the cooling system Air filter and the condenser.

### SPS 3 Auto Sampler

- ☒ **Service not applicable**
- ☐ Power cycle the autosampler and verify successful initialization.
- ☐ Inspect X and Z axis belts for wear. Replace is necessary.
- ☐ Clean X and Z axis slide shafts.
- ☐ Using customer's racks and the Agilent software move the sample probe to the 4 outermost corners and rinse port, ensure that the probe is approximately centered in the vial.

### SPS 4 Auto sampler

- ☒ **Service not applicable**
- ☐ Clean the spill tray, rack location mat, end frames and chassis with a damp soft cloth and diluted mild detergent.
- ☐ Clean the auto sampler cover panels, if cover kit is installed, with domestic window cleaner.
- ☐ Check 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 edges or damaged connectors.
- ☐ Pump Tubing Replacement. Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles
- ☐ Test using customer's tray and move the sample probe to the sample vial 1, wash vial and rinse port and ensure that the probe is centered in the vial. If not use calibration wizard and calibrate the position.

### AVS 4, 6, 7 Advanced Valve System

- ☒ **Service not applicable**
- ☐ Replace valve rotor seal
- ☐ Check fittings for signs of leaks
- ☐ Check tubing including autosampler tubing for kinks or excessive wear
- ☐ Check high flow pump for signs of leaks

## ICP-OES adjustment

- ☒ Check position of Zn peak, adjust if required.
- ☒ Check Argon Ratio, adjust to specified value if required.
- ☒ Perform Detector Calibration.
- ☒ Perform Instrument Calibration.

## Record Post-PM instrument performance

- ☒ Run Instrument Performance test.
- ☒ Record results in Instrument Performance Test Results Table - Post PM.
- ☒ For systems using ICP Expert version 7.3 and above, run the following Instrument tests
  - ☒ Subsystem Communications Test
  - ☒ Air Flow
  - ☒ Water Flow
  - ☒ Gas Flows
  - ☒ RF Generator
  - ☒ Camera Test
  - ☒ Optics Test
  - ☒ Nebulizer Test
- ☒ Record the result in the Instrument Test Results Table

## Restore Instrument

- ☐ For HF applications, ask the customer to reinstall their sample introduction system. N/A
- ☒ Leave system in an idle state: on and purging.
- ☒ 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.

## Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Record the PM event in the Smart Alerts logbook, if applicable.
- ☒ 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. Systems in a compliant environment may need additional documentation.
- ☒ **Complete the Signature Page with both Service Engineer and Customer signatures.**

## Test Results

### Instrument Performance Test Results Table

Note: These measurements do not form part of any specification and are for reference only.

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial *	Radial	Axial*
Zn 213.857 nm SRBR	1500.8	2217.4	4124.8	6965.9
Mn 257.610 nm SRBR	3915.0	7492.2	13017.8	31121.6
Al 396.152 nm SBR	7.7	10.7	9.7	21.1
K 766.491 nm SBR	5.7	28.1	4.8	45.3

\* Axial result is not applicable for G8016AA, G8012AA Radial View instruments.

### Instrument Test Results Table

Note: The Instrument Test results are for systems using ICP Expert version 7.3 and above only.

Instrument Test	Result
Subsystem Communications Test	Pass
Air Flow	Pass
Water Flow	Pass
Gas Flows	Pass
RF Generator	Pass
Camera Test	Pass
Optics Test	Pass
Nebulizer test	Pass

## ICP-OES Status Results Table

Note: These measurements do not form part of any specification and are for reference only.

Measurement	Standby Mode		Plasma On	
Mains Voltage	231.411	VAC	226.871	VAC
Mains Current	0.081	A	0.105	A
Instrument Temperature	22.1	°C	23.5	°C
RF Air Flow (sensor speed)	14.0	Hz	19.0	Hz
Plasma Exhaust Temperature	No measurement		63.8	°C
Water Flow Oscillator	No measurement		1.34	L/min
Water Flow Detector	0.86	L/min	0.81	L/min
Water Inlet Temperature	19.7	°C	19.7	°C
Polychromator Temperature	35.0	°C	35.0	°C
CCD Temperature	-40.1	°C	-39.8	°C
Thermal Stabilizer	35.0	°C	35.0	°C
Argon Supply Pressure	648.92	kPa	591.55	kPa
Purge Gas Supply Pressure*1	646.66	kPa	612.41	kPa
Option Gas Supply Pressure*1	-	kPa	-	kPa
Nebulizer Flow	No measurement		0.70	L/min
Nebulizer Back Pressure	No measurement		158.43	kPa
Plasma Gas Flow	No measurement		11.91	L/min
Auxiliary Gas Flow	No measurement		1.00	L/min
RF Power	No measurement		1204.7	W
RF Supply Current	No measurement		7.858	A
RF Supply Voltage	No measurement		204.417	V

\*1 If option installed

## Consumed PM Parts

Part Description	Part Number	Product or Model# where used	Quantity consumed
Axial Pre-Optic Window	G8010-68014	G8010A, G8011A, G8014A/G8015A	1
Radial Pre-Optic Window	G8010-68015	All	1
Agilent Cool Clear Coolant Fluid	5799-0037	Agilent Water Recirculator	-
Purge Gas Filter	G8010-60136	All	1
Air inlet filter	G8000-68002	All	1
High Capacity Air Filter	G8010-60189	Optional	-
Rotor seal for 6-7 port valve for AVS6/7	G8494-60002	G8494A/G8495	-
Rotor seal for 4 port valve for AVS4	G8493-60002	G8493A	-
Rinse solution to rinse station 2.5mm id x 1m	G8410-80123	SPS 4	-
Barb connector 2.5mm-1.5mm ID	G8410-80124	SPS 4	-
PVC waste tubing, 8mm od x 5mm id, 2m	G8410-80122	SPS 4	-
<b>Additional Parts may be required from engineer's stock:</b>			
X axis drive belt	5410047500	SPS 3	-
Z axis drive belt	5410047400	SPS 3	-
Peristaltic pump tubing, PVC SolvaFlex, 3 bridged,	3710049000	SPS 4	-

## Consumed Parts Reference (Purchased by customer, not included as part of PM)

☒ Section Not Applicable.

Part Description	Part Number	Product or Model# where used	Quantity consumed

## Signature Page

### 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 Verification

Service Request Number:

6007197100

Service Engineer Name:

Kanyakorn S.

Service Engineer Signature:

Kanyakorn S.

Total number of pages in this document:

14

Date Service Completed:

04 Nov 2024

Customer Name:

Aphorn Onkong

Customer Signature:

Aphorn Onkong

**Report Summary**

Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	Pre Test_PM_Kanyakorn S.
Test Completed On	11/4/2024 9:19:10 AM

**Result Summary**

Subsystem Communications Test	Skipped
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Skipped
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Fail
Precision Test	Pass

**Resolution Test****Pass**

Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	6.98
As (188.980 nm)	≤ 8.20	6.17
C (193.027 nm)	≤ 11.50	8.30
Mo (202.032 nm)	≤ 8.20	6.38
Cr (206.158 nm)	≤ 13.40	8.98
Zn (213.857 nm)	≤ 8.70	6.60
Pb (220.353 nm)	≤ 9.50	7.09
Co (228.615 nm)	≤ 17.20	11.67
Ba (230.424 nm)	≤ 9.40	7.20
Mn (257.610 nm)	≤ 13.30	9.43
Mn (260.568 nm)	≤ 20.30	14.11
Cr (267.716 nm)	≤ 11.00	8.04
Cu (324.754 nm)	≤ 25.00	18.97
Cu (327.395 nm)	≤ 14.20	11.23
Sr (338.071 nm)	≤ 33.50	24.30
Ba (455.403 nm)	≤ 44.00	33.47
Sr (460.733 nm)	≤ 36.00	17.23
Ba (493.408 nm)	≤ 36.00	25.37
Ba (614.171 nm)	≤ 42.00	25.54
Ar (675.283 nm)	≤ 74.00	56.51
K (766.491 nm)	≤ 80.00	65.86

**Sensitivity Test****Fail****Radial**

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	104.1	793.0	50.8
Se (196.026 nm)	≥ 41.0	SRBR	87.6	862.0	79.7
Zn (213.857 nm)	≥ 1421.0	SRBR	1500.8	41823.3	749.0
Pb (220.353 nm)	≥ 46.0	SRBR	170.7	2432.0	174.9
Mn (257.610 nm)	≥ 3518.0	SRBR	3915.0	264700.2	4420.0
Al (396.152 nm)	≥ 3.4	SBR	7.7	48454.6	5563.2
Ba (493.408 nm)	≥ 34.0	SBR	45.9	1966719.7	41903.8
K (766.491 nm)	≥ 1.8	SBR	5.7	99036.2	14687.7

**Axial**

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	126.5	1498.8	119.0
Se (196.026 nm)	≥ 159.0	SRBR	112.0	1773.6	197.8
Zn (206.200 nm)	≥ 234.0	SRBR	466.0	6784.2	199.7
Zn (213.857 nm)	≥ 1743.0	SRBR	2217.4	95597.6	1789.7
Cd (214.439 nm)	≥ 4227.0	SRBR	1919.3	68724.6	1236.4
Pb (220.353 nm)	≥ 320.0	SRBR	332.6	7929.5	499.0
Mn (257.610 nm)	≥ 10625.0	SRBR	7492.2	991238.3	16911.7
Cr (267.716 nm)	≥ 1048.0	SRBR	2254.6	129706.6	3150.9
Cu (324.754 nm)	≥ 19.0	SBR	26.9	290746.3	10407.5
Al (396.152 nm)	≥ 6.0	SBR	10.7	211329.2	18005.0
Ba (493.408 nm)	≥ 60.0	SBR	49.3	6956460.4	138336.9
K (766.491 nm)	≥ 24.0	SBR	28.1	1395190.2	47996.2

**Precision Test****Pass****Radial**

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	$\leq 2.60$	0.73
Se (196.026 nm)	$\leq 2.60$	0.95
Zn (213.857 nm)	$\leq 1.50$	0.31
Pb (220.353 nm)	$\leq 2.60$	0.73
Mn (257.610 nm)	$\leq 1.50$	0.39
Al (396.152 nm)	$\leq 1.50$	0.39
Ba (493.408 nm)	$\leq 1.50$	0.87
K (766.491 nm)	$\leq 1.50$	0.32

**Axial**

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	$\leq 1.50$	1.21
Se (196.026 nm)	$\leq 1.50$	0.84
Zn (206.200 nm)	$\leq 1.50$	0.56
Zn (213.857 nm)	$\leq 1.50$	0.96
Cd (214.439 nm)	$\leq 1.50$	0.26
Pb (220.353 nm)	$\leq 1.50$	0.51
Mn (257.610 nm)	$\leq 1.50$	0.97
Cr (267.716 nm)	$\leq 1.50$	0.22
Cu (324.754 nm)	$\leq 1.50$	0.24
Al (396.152 nm)	$\leq 1.50$	0.33
Ba (493.408 nm)	$\leq 1.50$	0.40
K (766.491 nm)	$\leq 1.50$	0.65

### Report Summary

Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Platform	3442
Tested By	Post Test_PM_Kanyakorn S.
Test Completed On	11/4/2024 11:07:24 AM

### Result Summary

Subsystem Communications Test	Pass
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Pass
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Fail
Precision Test	Pass
Subsystem Communications Test	Pass

### Optics Test

	Radial	Axial
Intensity	3184054	3177175
Wavelength	737.212	737.212

Resolution Test		Pass
Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	6.97
As (188.980 nm)	≤ 8.20	6.14
C (193.027 nm)	≤ 11.50	8.33
Mo (202.032 nm)	≤ 8.20	6.33
Cr (206.133 nm)	≤ 13.40	9.06
Zn (213.637 nm)	≤ 8.70	6.70
Pb (220.353 nm)	≤ 9.50	7.03
Co (228.615 nm)	≤ 17.20	11.72
Ba (230.424 nm)	≤ 9.40	7.32
Mn (257.610 nm)	≤ 13.30	9.44
Mn (260.568 nm)	≤ 20.30	14.21
Cr (267.716 nm)	≤ 11.00	7.94
Cu (324.754 nm)	≤ 25.00	18.99
Cu (327.395 nm)	≤ 14.20	11.27
Sr (338.071 nm)	≤ 33.50	24.40
Ba (455.403 nm)	≤ 44.00	33.50
Sr (460.733 nm)	≤ 36.00	17.31
Ba (493.408 nm)	≤ 36.00	25.44
Ba (614.171 nm)	≤ 42.00	25.16
Ar (675.283 nm)	≤ 74.00	56.15
K (766.491 nm)	≤ 80.00	65.56

## Sensitivity Test

Fail

## Radial

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	130.6	977.1	50.4
Se (196.026 nm)	≥ 41.0	SRBR	106.0	958.7	70.2
Zn (213.857 nm)	≥ 1421.0	SRBR	4124.8	44037.7	113.4
Pb (220.353 nm)	≥ 46.0	SRBR	207.2	2554.7	136.2
Mn (257.610 nm)	≥ 3518.0	SRBR	13017.8	271846.6	434.7
Al (396.152 nm)	≥ 3.4	SBR	9.7	50615.5	4717.0
Ba (493.408 nm)	≥ 34.0	SBR	133.7	2069203.0	15359.3
K (766.491 nm)	≥ 1.8	SBR	4.8	100199.5	17235.5

## Axial

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	174.9	1566.7	73.0
Se (196.026 nm)	≥ 159.0	SRBR	167.0	1863.4	110.2
Zn (206.200 nm)	≥ 234.0	SRBR	740.9	6836.0	83.1
Zn (213.857 nm)	≥ 1743.0	SRBR	6965.9	101568.1	211.7
Cd (214.439 nm)	≥ 4227.0	SRBR	5781.0	72852.9	158.1
Pb (220.353 nm)	≥ 320.0	SRBR	501.0	8464.3	267.7
Mn (257.610 nm)	≥ 10625.0	SRBR	31121.6	1006637.8	1044.0
Cr (267.716 nm)	≥ 1048.0	SRBR	4424.8	132202.9	880.8
Cu (324.754 nm)	≥ 19.0	SBR	68.7	302907.8	4345.6
Al (396.152 nm)	≥ 6.0	SBR	21.1	218771.0	9892.3
Ba (493.408 nm)	≥ 60.0	SBR	250.6	7137380.9	28367.3
K (766.491 nm)	≥ 24.0	SBR	45.3	1435050.6	31025.0

## Precision Test

Pass

## Radial

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	$\leq 2.60$	0.81
Se (196.026 nm)	$\leq 2.60$	0.98
Zn (213.857 nm)	$\leq 1.50$	0.22
Pb (220.353 nm)	$\leq 2.60$	0.37
Mn (257.610 nm)	$\leq 1.50$	0.27
Al (396.152 nm)	$\leq 1.50$	0.25
Ba (493.408 nm)	$\leq 1.50$	0.53
K (766.491 nm)	$\leq 1.50$	0.15

## Axial

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	$\leq 1.50$	0.81
Se (196.026 nm)	$\leq 1.50$	0.65
Zn (206.200 nm)	$\leq 1.50$	0.79
Zn (213.857 nm)	$\leq 1.50$	0.81
Cd (214.439 nm)	$\leq 1.50$	0.35
Pb (220.353 nm)	$\leq 1.50$	0.33
Mn (257.610 nm)	$\leq 1.50$	1.02
Cr (267.716 nm)	$\leq 1.50$	0.32
Cu (324.754 nm)	$\leq 1.50$	0.51
Al (396.152 nm)	$\leq 1.50$	0.37
Ba (493.408 nm)	$\leq 1.50$	0.68
K (766.491 nm)	$\leq 1.50$	0.74

**Report Summary**

Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	Post Test_PM_Kanyakorn S.
Test Completed On	11/4/2024 11:30:15 AM

**Result Summary**

Subsystem Communications Test	Pass
Air Flow Test	Pass
Water Flow Test	Pass
Gas Flows Test	Pass
RF Generator Test	Pass
Camera Test	Pass
Optics Test	Skipped
Advanced Valve System Test	Skipped
Resolution Test	Skipped
Sensitivity Test	Skipped
Precision Test	Skipped

Subsystem Communications Test	Pass
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Air Flow Test	Pass
---------------	------

30% Air Flow (relative speed)	75% Air Flow (relative speed)
15.00	19.00

Water Flow Test	Pass
-----------------	------

RF Water Flow(L/min)	Camera Water Flow (L/min)	Water Inlet Temperature (°C)
1.30	0.81	20.55

**Gas Flows Test****Pass**

Nebulizer Target Flow	Actual Flow	Back Pressure	Auxiliary Target Flow	Actual Flow	Back Pressure
0.70	0.70	154.65	2.00	2.00	110.92
Makeup Target Flow	Actual Flow	Back Pressure	Plasma Target Flow	Actual Flow	Back Pressure
2.00	2.00	115.38	18.00	17.97	21.48

**RF Generator Test****Pass**

RF Power Supply Test	Passed
RF Power Supply (V)	128.554
RF Oscillator Test	Passed
RF Oscillator Frequency (MHz)	25.834
Work Coil Current (A)	44.660
RF Power Supply Current (A)	1.999

**Camera Test****Pass**

	Integration Time (ms)	Standard Deviation	Status
Electronic Offset Test	1000	5.228	Passed
Dark Current Test	6000	1.168	Passed
Array Test	5	0.024	Passed
Linearity Test		0.118	Passed

### Report Summary

Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	change mirror
Test Completed On	11/6/2024 10:35:26 AM

### Result Summary

Subsystem Communications Test	Skipped
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Skipped
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Pass
Precision Test	Pass

**Resolution Test****Pass**

Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	6.79
As (188.980 nm)	≤ 8.20	5.80
C (193.027 nm)	≤ 11.50	8.15
Mo (202.032 nm)	≤ 8.20	5.90
Cr (206.158 nm)	≤ 13.40	8.85
Zn (213.857 nm)	≤ 8.70	6.77
Pb (220.353 nm)	≤ 9.50	6.61
Co (228.615 nm)	≤ 17.20	11.79
Ba (230.424 nm)	≤ 9.40	7.25
Mn (257.610 nm)	≤ 13.30	9.47
Mn (260.568 nm)	≤ 20.30	14.50
Cr (267.716 nm)	≤ 11.00	7.91
Cu (324.754 nm)	≤ 25.00	18.72
Cu (327.395 nm)	≤ 14.20	11.09
Sr (338.071 nm)	≤ 33.50	25.39
Ba (455.403 nm)	≤ 44.00	33.09
Sr (460.733 nm)	≤ 36.00	18.54
Ba (493.408 nm)	≤ 36.00	25.74
Ba (614.171 nm)	≤ 42.00	25.23
Ar (675.283 nm)	≤ 74.00	58.92
K (766.491 nm)	≤ 80.00	63.16

**Sensitivity Test****Pass****Radial**

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	110.5	868.9	54.3
Se (196.026 nm)	≥ 41.0	SRBR	88.3	934.7	91.3
Zn (213.857 nm)	≥ 1421.0	SRBR	3535.4	44017.7	153.9
Pb (220.353 nm)	≥ 46.0	SRBR	184.5	2492.3	159.8
Mn (257.610 nm)	≥ 3518.0	SRBR	11099.6	249595.3	503.6
Al (396.152 nm)	≥ 3.4	SBR	8.7	50274.4	5172.0
Ba (493.408 nm)	≥ 34.0	SBR	124.5	1903164.1	15166.0
K (766.491 nm)	≥ 1.8	SBR	6.9	110041.4	13991.2

**Axial**

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	253.3	3744.3	196.3
Se (196.026 nm)	≥ 159.0	SRBR	206.7	4199.7	347.2
Zn (206.200 nm)	≥ 234.0	SRBR	923.0	12282.3	172.1
Zn (213.857 nm)	≥ 1743.0	SRBR	6398.3	157551.5	601.7
Cd (214.439 nm)	≥ 4227.0	SRBR	5069.2	99873.7	385.2
Pb (220.353 nm)	≥ 320.0	SRBR	389.0	10641.1	658.6
Mn (257.610 nm)	≥ 10625.0	SRBR	21190.4	985528.7	2153.6
Cr (267.716 nm)	≥ 1048.0	SRBR	3054.1	131797.6	1811.5
Cu (324.754 nm)	≥ 19.0	SBR	36.3	301401.4	8082.9
Al (396.152 nm)	≥ 6.0	SBR	10.8	228359.5	19280.5
Ba (493.408 nm)	≥ 60.0	SBR	106.5	6460421.5	60122.8
K (766.491 nm)	≥ 24.0	SBR	30.2	1639840.6	52562.1

**Precision Test****Pass****Radial**

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	$\leq 2.60$	1.56
Se (196.026 nm)	$\leq 2.60$	1.16
Zn (213.857 nm)	$\leq 1.50$	0.50
Pb (220.353 nm)	$\leq 2.60$	0.74
Mn (257.610 nm)	$\leq 1.50$	0.63
Al (396.152 nm)	$\leq 1.50$	0.54
Ba (493.408 nm)	$\leq 1.50$	0.78
K (766.491 nm)	$\leq 1.50$	0.44

**Axial**

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	$\leq 1.50$	0.82
Se (196.026 nm)	$\leq 1.50$	0.82
Zn (206.200 nm)	$\leq 1.50$	0.35
Zn (213.857 nm)	$\leq 1.50$	0.34
Cd (214.439 nm)	$\leq 1.50$	0.44
Pb (220.353 nm)	$\leq 1.50$	0.48
Mn (257.610 nm)	$\leq 1.50$	0.83
Cr (267.716 nm)	$\leq 1.50$	0.53
Cu (324.754 nm)	$\leq 1.50$	0.69
Al (396.152 nm)	$\leq 1.50$	0.56
Ba (493.408 nm)	$\leq 1.50$	1.29
K (766.491 nm)	$\leq 1.50$	0.74



# PinAAcle 900F Preventive Maintenance Report

Company Name: UAE Consultant Co., LTD.

Instrument Location: 41 Sukumvit Rd.,

Phra Khanong, Bangkok 10260


Instrument Serial No.: PFBS20031902

Date: 29-Apr-2025

เอกสารไม่ควบคุม

## ***PinAAcle 900F Preventive Maintenance (PM)***

<b>Company Name:</b>	United Analyst and Engineering Consultant Co., LTD.		
<b>Address (Instrument Location):</b>	41 Sukumvit Rd., Phra Khanong, Bangkok 10260		
<b>Serial Number:</b>	PFB520031902	<b>PM Number:</b>	1 of 2
<b>Customer Name (if applicable):</b>	K. Yainda	<b>Telephone Number:</b>	095-5580049
<b>Customer Support Engineer Name:</b>	K. Chayanon	<b>Service Order Number:</b>	WO-03126047
<b>Date PM Performed: (DD-MMM-YYYY)</b>	29-Apr-2025	<b>Next PM Due Date: (DD-MMM-YYYY)</b>	29-Oct-2025
<b>Standard Labor Hours to Complete PM :</b>		<b>5 hours</b>	

<b>Part Number</b>	<b>Release</b>	<b>Publication Date</b>	
09370145 Rev.9	A	January 2018	

### **Scope**

The purpose of this PM is to ensure the continued functionality of the PinAAcle 900F by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer.

The customer should save their method before the PM begins.

### **General Instructions:**

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM.

Always check with the customer before making any changes that may affect the customer's analysis or calibration, including a current back-up of system software and/or data files.

The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer.

Update the PM sticker and instrument logbook as required.

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## Component List

Component / Specific Model	Serial #	Configuration Notes
PinAAcle900F	PFBS20031902	Syngistix V4.0.1.1935
FIAS100	100S24040501	

## Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
B0501696	Fan Filters	2
N3160156	O-Ring Kits for Sampling Introduction ( Stainless Steels Nebulizer)	N/A
N3160157	O-Ring Kits for Sampling Introduction ( Plastic Nebulizer)	1
N9301714	Replacement Acetylene Filter Cartridge	1
TH001022	Replacement Air Filter Cartridge	1

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quality	Batch/Lot #	Expired Date (MM/YY)
N9300183	1000 mg/L Copper Standard	AR	27-39CUIY1	Nov 2025

Additional Reagents and Standards Required for PM (Customer Support Solution)				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A	DI Water	250 ml.	AR	AR
N/A	0.5% HNO <sub>3</sub>	250 ml.	AR	AR

Additional Tools Required for PM			
Part Number (If applicable)	Description	Quantity	Serial #
N1013000	0.2A Neutral density filter	1	101N0089015
N1013002	1.0A Neutral density filter	1	101N0089015
03030997	System 2 EDL Driver	1	03030997
N3050605	As System 2 EDL	1	16148
N3050121	Cu Lumina HCL	1	060419-030180
N3050109	Ba Lumina HCL	1	061219-020041
N3050139	K Lumina HCL	1	030819-010130
N3050152	Ni Lumina HCL	1	052719-020020

## Procedure Checklist

Use (✓) to check off those steps in the checklist that have been completed.

### 1. General:

- ☒ Review the instrument performance with the customer and document any recent problems.
- ☒ Inspect the customer log book and make any appropriate PM entries.
- ☒ Perform general inspection of system for cleanliness.

### 2. PC Instrument Software:

- ☒ Instrument Software user files/databases archived, packed, and/or deleted as needed.

### 3. Mechanical:

- ☒ Inspect and clean all fans and filters. Replace filters if necessary
- ☒ Inspect all gas lines for leaks and/or wear. Replace if needed.
- ☒ Clean exterior of the instrument.
- ☒ Inspect the burner head, burner chamber, and nebulizer. Clean if needed as stated in the Hardware Guide.
- ☒ Check burner head dimensions with the feeler gauge as stated in the Hardware Guide in the Maintenance chapter section on cleaning the burner head and checking sloth width. Replace if out of specification
- ☒ Check the condition of the end cap, burner head, and nebulizer O-rings. Replace if necessary.
- ☒ Check the drain system for signs of wear. Replace worn or damaged parts.
- ☒ Visually check for proper flame conditions when igniting the Air-C<sub>2</sub>H<sub>2</sub> and N<sub>2</sub>O-C<sub>2</sub>H<sub>2</sub> flames (if applicable).

### 4. Electrical:

- ☒ Inspect PC boards. Clean if necessary.
- ☒ Carefully check all internal and external cable connections.
- ☒ Check instrument firmware revisions upgrade to current levels (if necessary)
- ☒ Run Diagnostics Test within the Advanced function of the Spectrometer page. Check the results in the service log folder in the Spectrometer BM Log Viewer.

### 5. Optics:

- ☒ Inspect and clean the sample compartment windows, if needed.
- ☒ Inspect optics. Clean or replace if necessary,

### 6. Gasses:

- ☒ Verify that the Gasses supplied to the instrument are within the pressure and purity specifications found in the PinAAcle 900 Series Pre-installation Checklist SDB.
- ☒ Verify that the acetylene filter and air filter element is dry. Replace if necessary.

## 7. Flame Interlock Check:

Description: Check to ensure that all safety interlocks are closed.

Parameter	Specification	Test Results	Pass/Fail
Flame Sensor	Air/C <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
Drain Sensor	Air/C <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
Nebulizer Sensor	Air/C <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
C <sub>2</sub> H <sub>2</sub> Pressure Sensor	Air/C <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
Air Pressure Sensor	Air/C <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
Burner Head Sensor	Choosing Nitrous Oxide as the oxidant should trigger an interlock shuts down	Active	Passed

## 8. After PM Performance tests:

### 8.1 Detector Linearity with Barium

Description: Ensures that the detector is linear in the Visible Range.

Parameter	Specification	Certificate Value at 553.6 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.	0.9668	0.9878	Passed
0.2 A ND Filter	± 5% from Cert.	0.1953	0.1876	Passed

### 8.2 Baseline Noise at 1.0 Absorbance with Barium

Description: Ensures that a high absorbance will not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0005	Passed

### 8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.001	0.0001	Passed

#### 8.4 D<sub>2</sub> Background Compensation with Copper

Description: Verifies the instruments ability to compensate for Background absorption.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.009	Passed

#### 8.5 AA-BG Baseline Noise with Copper

Description: Ensures that background correction does not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0001	Passed

#### 8.6 AA-BG Baseline Noise with Arsenic

Description: Ensures that background correction does not produce excessive noise at a low wavelength.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0004	Passed

#### 8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity	Specification	Results (Abs.)	Pass/Fail
5 mg/L Sensitivity SS Neb (if applicable)	> 0.250 Abs.	N/A	Not Applicable
2 mg/L Sensitivity HS Neb (if applicable)	> 0.250 Abs.	N/A	Passed

#### 10. Review:

- ☒ Review with the customer PM work performed.
- ☒ Review with the customer routine maintenance procedures.
- ☒ Discuss recommended customer supplied materials to have on hand.
- ☒ Attach PM sticker.

### Additional Comments

Additional Comments Regarding the PM	

## Review

<p><i>The preventive maintenance checks and if applicable performance tests for PinAAcle 900F have been completed.</i></p>	
<p><b>This PinAAcle 900F</b> Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> <b>the preventive maintenance.</b></p>	
<p><b>Review of Preventive Maintenance:</b></p>	
<p>Authorized PerkinElmer Representative:</p> <p><i>Chapman K.</i></p>	<p>Date:</p> <p>29 Apr 2025</p> <p>(DD-MMM-YYYY)</p>
<p>Authorized Customer Representative:</p> <p><i>W. Brown</i></p>	<p>Date:</p> <p>29 Apr 2025</p> <p>(DD-MMM-YYYY)</p>

## Service Report

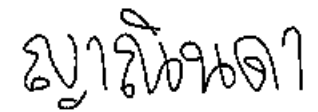

Work Order Number	Activity Code	Billing Type	Requested Start Date	Model	Serial Number
WO-03126047	Planned Maintenance	Contract	10/01/2568 11:08 น.	AAN3200051	PFBS20031902
Service Representative Name	Contract Number	Expiry Date	Equipment ID	System ID	
Kanan, Chayanon	SC-0035664109	31/10/2025	N/A	N/A	
UDI Number					
N/A					
Equipment Location			Bill To Name		
บริษัท ยูโนเค็ด แอนะลิติกส์ แอนด์ เซิร์ฟเวอร์จาก เขตพระโขนง กรุงเทพมหานคร 51 10260 TH			บริษัท ยูโนเค็ด แอนะลิติกส์ แอนด์ เซิร์ฟเวอร์จาก เขตพระโขนง กรุงเทพมหานคร 51 10260 TH		
Customer Contact	Phone Number	Fax Number	Email	Purchase Order	
K. กุญชรินตา แซ่มเล็ก(โนนหม่อน)	095-6580049	N/A	nichakorn.praemai1998@gmail.com	HPO-250100002	

Work Description		
- PM 2/2 (AAเครื่องเก่า) - Cleaning Cell, Chamber, Filter - Wavelength Calibrate ; Pass - Wavelength Scan As,Cu,Ba,K,Ni ; Pass -Align cell with Hg. : OK		
Start Date	End Date	Work Description
29/04/2025	09/05/2025	

Tools Used					
Quantity	Calibrated Tool	Description	Serial Number	Last Calibration Date	Next Calibration Date
*** No Calibrated Tools Used ***					

Material Used				
Part Number	Part Description	Note	Lot/Serial Number	Quantity
*** No Parts Used ***				

Labour Details			
Part Number	Part Description	Start Date	Quantity
SV000013	Preventative maintenance	29/04/2025	4

Work Complete		Customer Signature	Technician Signature
Yes	<input checked="" type="checkbox"/>	No	<input type="checkbox"/>
PM/OQ/IPV Left with Customer		 9/5/2568 K. กุญชรินตา แซ่มเล็ก(โนนหม่อน)	 9/5/2568 Kanan, Chayanon
Yes	<input type="checkbox"/>	No	<input checked="" type="checkbox"/>


Terms & Conditions

Customer Acknowledgment of receipt of the above repair / replacement.

Special Terms and Conditions: This is not an invoice.

Taxes will be applied to your invoice if applicable.

<b>Atomic Absorption/FIAS 100/400 Preventive Maintenance (PM)</b>			
<b>Company Name:</b>	United Analyst and Engineering Consultant Co., LTD.		
<b>Address (Instrument Location):</b>	41 Sukumvit Rd., Phra Khanong, Bangkok 10260		
<b>Room Number:</b>	Lab		
<b>Asset Number (if applicable):</b>	2 of 2W	<b>Customer System ID:</b>	K. Yanida
<b>Service Engineer Name:</b>	K. Chayanan	<b>Service Order Number:</b>	WO-03051971
<b>Date PM Performed: (DD-MMM-YYYY)</b>	29-Apr-2025	<b>Next PM Due Date: (DD-MMM-YYYY)</b>	29-Oct-2025

Part Number	Release	Publication Date	
09370005	C	January 2013	

#### Scope

The purpose of this PM is to ensure the continued functionality of the Atomic Absorption/FIAS 100/400 by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer.

The customer should save their method before the PM begins.

#### General Instructions:

Always check with the customer before making any changes that may affect the customer's analysis or calibration.

The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer.

Update the PM sticker and instrument logbook as required.

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## Component List

Component / Specific Model	Serial #	Firmware Version	Configuration Notes
FIAS100	100S24040501	2.20	Syngistix V4.0.1.1935

## Parts Lists

Parts Included with the PM				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
B050 2706	Fan Filter	1	N/A	N/A

Additional Tools Required for PM				
Part Number (if applicable)	Description	Quantity	Serial #	Calibration Due Date (MM/YY)
N/A	Digital Volt Meter	1	N/A	N/A
Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A	N/A	N/A	N/A	N/A

# Procedure Checklist

Use (✓) to check off those steps in the checklist that have been completed.

## 1. General:

- ☒ Review the instrument performance with the customer and document any recent problems.

- 
- ☒ Is the Working Environment Acceptable? If not, document.

- 
- ☐ Visual Damage (if yes, describe)

- 
- ☒ Check incoming AC line voltage for proper levels and grounding.
  - ☒ Verify Voltage switch on back of instrument is correct
  - ☒ Perform general inspection of system for cleanliness. Clean if needed.
  - ☒ Gas supply cylinders secured, lines leak checked and argon or nitrogen supply pressure verified (45 – 58 psi).
  - ☒ Inspect the customer log book and make any appropriate PM entries.
  - ☒ Fan checked and filter cleaned
  - ☒ Heating mantle or Universal Cell Holder checked

## 2. Instrument components

- ☒ Non-return valve checked/repaired/replaced if needed (B019 8111). Clean the valve if there is any liquid in it. Replace the rubber sleeve (B013 5123) if it is worn. Check the flow meter for any signs of fluid in it. Clean the flow meter if needed.
- ☒ Verify condition of pump pressure adjustment levers (B050 7794 - look for cracks or problems with the springs), pump rollers (B300 0251 check for wear), and thumb screws (B050 7796).
- ☒ Check the Multiport valve for proper switching, flow, and insure there are no leaks. Clean valve parts and replace o-rings if needed (large o-ring: B050 1250, small o-ring: B004 5095). Use a squirt bottle & fishing line to try to dislodge clogs.
- ☒ Firmware Version checked. Latest is 2.20.

## 3. Mixing/Separation Assembly & Pump Tubing:

- ☒ Mixing separator assembly checked
- ☒ Filter/membrane checked (B050 8306)
- ☒ Condition of the pump tubing (replace if necessary), correct pump tubing for the solutions being run. Make sure the correct magazines are being used. B050 7791 for 0.13 – 1.80 mm tubing; B050 7792 for 1.60 – 3.18 mm tubing.

**4. Cell, Cell Windows, Transfer Line:**

- ☒ Cell checked
- ☒ Cell windows checked
- ☒ Transfer line checked for moisture (if moisture is a problem, the Nafion dryer might be needed)

**5. Operational Tests:**

- ☒ Run DI water through the carrier/reductant/sample system. Verify smooth flow of liquid throughout without leaks. Replace tubing & fittings if needed.

**6. Review:**

- ☒ Review with the customer PM work performed.
- ☒ Review with the customer routine maintenance procedures.
- ☒ Discuss recommended customer-supplied materials to have on hand.
- ☒ Attach PM sticker.
- ☒ Update Logbook.

## Additional Comments

Additional Comments Regarding the PM

## Review

<i>The preventive maintenance checks and if applicable performance tests for FIAS 100/400 have been completed.</i>	
<i>This FIAS 100/400 Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.</i>	
<b>Review of Preventive Maintenance:</b>	
Authorized PerkinElmer Representative: <i>Chayman K.</i>	Date: 29 Apr 2025 (DD-MMM-YYYY)
Authorized Customer Representative: <i>สุวิทย์ ห่อ</i>	Date: 29 Apr 2025 (DD-MMM-YYYY)

## Document History

Revision	Description of Change	Page(s)	Date
A	First release		May 2008
B	Addition of Batch/Lot Number, Expiration Date, and Report Fields.	2,7	February 2009
C	Update to new format	All	January 2013

## Service Report

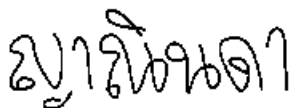

Work Order Number	Activity Code	Billing Type	Requested Start Date	Model	Serial Number
WO-03051871	Planned Maintenance	Contract	10/03/2568 23:08 น.	B0508570	100S24040531
Service Representative Name	Contract Number	Expiry Date	Equipment ID	System ID	
Kanan, Chayanon	SC-0035659090	24/05/2025	N/A	N/A	
UDI Number					
N/A					
Equipment Location			Bill To Name		
บริษัท ซูโนเค็ด ออโตโมบิลส์ แอนด์ เซเว่นจาก เซตพระโขนง กรุงเทพมหานคร 51 10260 TH			บริษัท ซูโนเค็ด ออโตโมบิลส์ แอนด์ เซเว่นจาก เซตพระโขนง กรุงเทพมหานคร 51 10260 TH		
Customer Contact	Phone Number	Fax Number	Email	Purchase Order	
K. Nichakorn พรหมโน	095-5580049	N/A	penpichai.42@gmail.com	HPO-240400211	

Work Description		
<ul style="list-style-type: none"> <li>PM 2i2 Warranty</li> <li>Cleaning Port Vale, Manifold, Tuning</li> <li>Run Hg test ; Pass</li> </ul>		
Start Date	End Date	Work Description
29/04/2025	29/04/2025	
29/04/2025	29/04/2025	

Tools Used					
Quantity	Calibrated Tool	Description	Serial Number	Last Calibration Date	Next Calibration Date
*** No Calibrated Tools Used ***					

Material Used				
Part Number	Part Description	Note	Lot/Serial Number	Quantity
*** No Parts Used ***				

Labour Details			
Part Number	Part Description	Start Date	Quantity
SV000013	Preventative maintenance	29/04/2025	3
SV000002	Service Travel	29/04/2025	1

Work Complete	Customer Signature	Technician Signature
Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	 9/5/2568 K. Nichakorn พรหมโน	 9/5/2568 Kanan, Chayanon
PM/OQ/IV Left with Customer		
Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>		

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Special Terms and Conditions: This is not an invoice.

Taxes will be applied to your invoice if applicable.

Terms & Conditions

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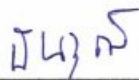
Special Terms and Conditions: This is not an invoice.

Taxes will be applied to your invoice if applicable.

## CERTIFICATE OF CALIBRATION

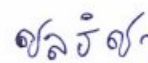
**Certificate No. :** SP25-001

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.

**เอกสารไม่ควบคุม**

## REPORT OF CALIBRATION

**Certificate No. :** SP25-001

Page 2 of 5

**Environment Condition :** Ambient Temperature  $25 \pm 5$  °CRelative humidity  $55 \pm 20$  %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.

**เอกสารไม่ควบคุม**

## 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



## GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0425/23011

Instrument Type : Gas Chromatography

Manufacturer : SCION INSTRUMENT

Model : 456-GC

Serial Number : GC1802G112

Organization : United Analyst and Engineering Consultant Co.,Ltd

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

Date : 26/04/2025

### ELECTRONIC TEST

CPU	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
LED & DISPLAY TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
VENT TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
KEY ECHO TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
DESTRUCTION RAM TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL

### RUN CHROMATOGRAM TEST

DETECTOR : Flame Ionization Detectors ( Front-FID )

INJECTOR : Split/Split Less Injector (Front-SSL)

#### GC CONDITION:

Column	80 °C hold 1 min., rate 20 °C/min. to 200 °C hold 1min.
Injector	220 °C
Detector	300 °C
Column flow	5 mL/min
Makeup flow	25 mL/min
Air flow	300 mL/min
Hydrogen flow	30 mL/min

Column: Capillary Column CP sil 5 CB 0.25 ID x 15 M

Sample: 1 µL Injection FID Test Sample 0.218 g/L C14,C15,C16 in hexane Dilute to 30ppm

SENSITIVITY TEST: C15. ( Area count  $\geq 1,667 \mu V \cdot \text{Min}$  ) = 14,380.3  $\mu V \cdot \text{Min}$ .





Detector Sensitivity (FID)

Detector Response	Result	Specification
Baseline Noise ( $\mu$ V)	34.0	$\leq 50$
Baseline Drift (%)	0.14	$\leq 1$
Sensitivity (S/N for C15)	23,826	$\geq 1,024$

Temperature Specification

Temperature	Set	Result	Specification
Column Oven ( $^{\circ}$ C)	80	78.0	$\pm 5$
Injector ( $^{\circ}$ C)	220	220	$\pm 5$
Detector ( $^{\circ}$ C)	300	299	$\pm 5$
Incubator ( $^{\circ}$ C)	60	N/A	$\pm 5$

Relative Standard Deviation % (% RSD)

Checkout Procedure	Result	Specification
Area C15 (%)	0.55	$\leq 5$
Retention Time C15 (%)	0	$\leq 0.5$

APPROVAL :

Signature: 

Engineer : Somchai Pohtongkam

Date : 26/04/2025



VARIAN



Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	SSL Injector
C15 Area 1	14,432.6
C15 Area 2	14,355.2
C15 Area 3	14,296.1
C15 Area 4	14,490.1
C15 Area 5	14,327.5
C15 Area Average	14,380.3
* % RSD ( ≤ 2 % )	0.55

\* The precision specification should be less than 2.0 % RSD \*\* ( Relative Standard Deviation ) for an Auto sampler injection and less than 5 % for Manual injections. To calculate the %RSD, select the C15 peak area for each of the five ( 5 ) samples.

\*\* (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

$$\% \text{ RSD} = ( \text{std.dev} / \text{avg} ) * 100$$

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by		
Date	26/04/2025	



Comments			
Reviewed by		Date	26/04/2025



Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	SSL Injector
C15 RT 1	3.90
C15 RT 2	3.90
C15 RT 3	3.90
C15 RT 4	3.90
C15 RT 5	3.90
C15 RT Average	3.90
* % RSD ( ≤ 0.5 % )	0

\* The precision specification should be less than 0.5 % RSD \*\* ( Relative Standard Deviation ) for an Auto sampler injection and less than 0.5 % for Manual injections. To calculate the %RSD, select the RT C15 peak for each of the five ( 5 ) samples.

\*\* (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

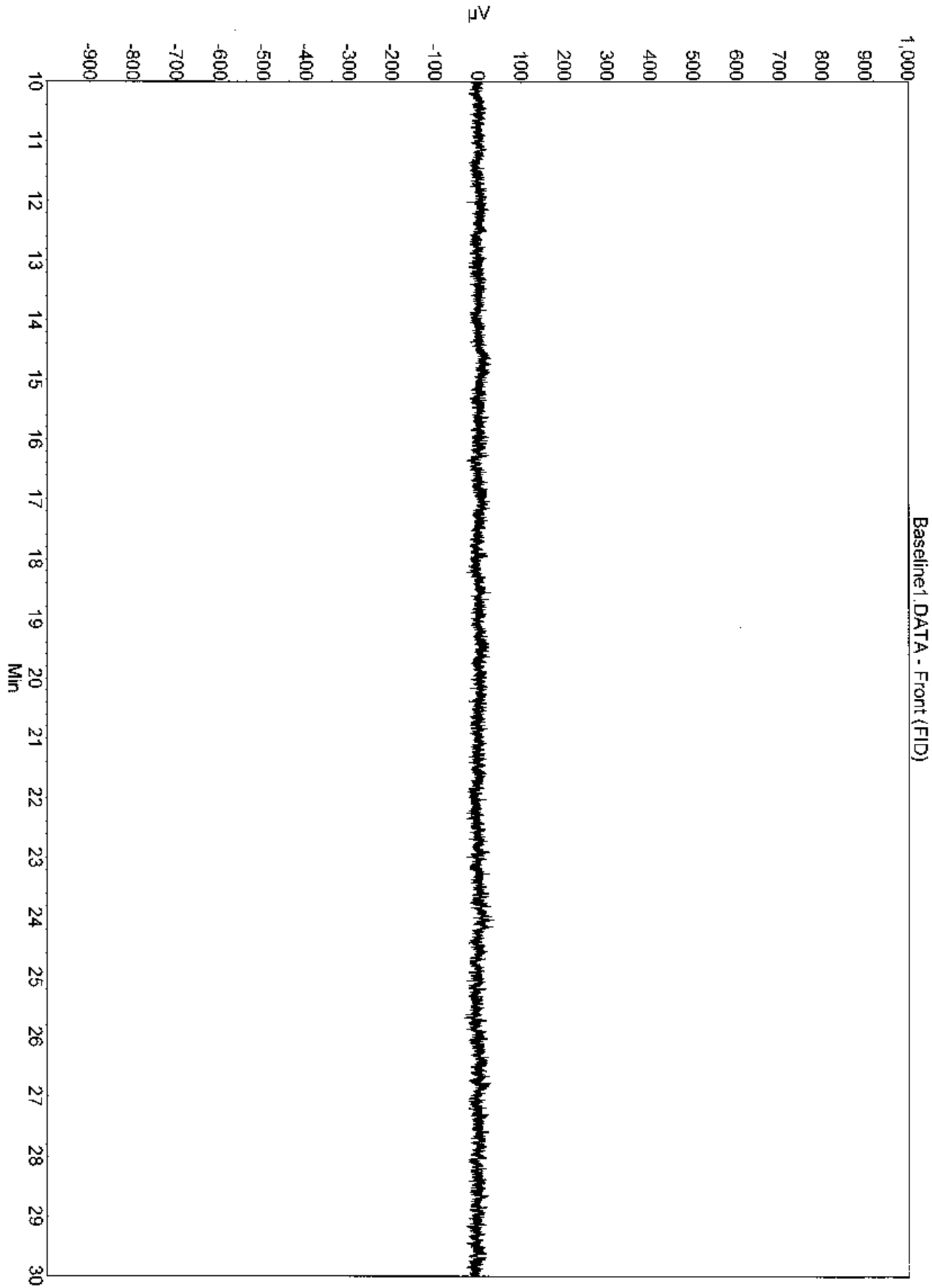
$$\% \text{ RSD} = ( \text{std.dev} / \text{avg} ) * 100$$

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by		
Date	26/04/2025.	



Comments			
Reviewed by		Date	26/04/2025

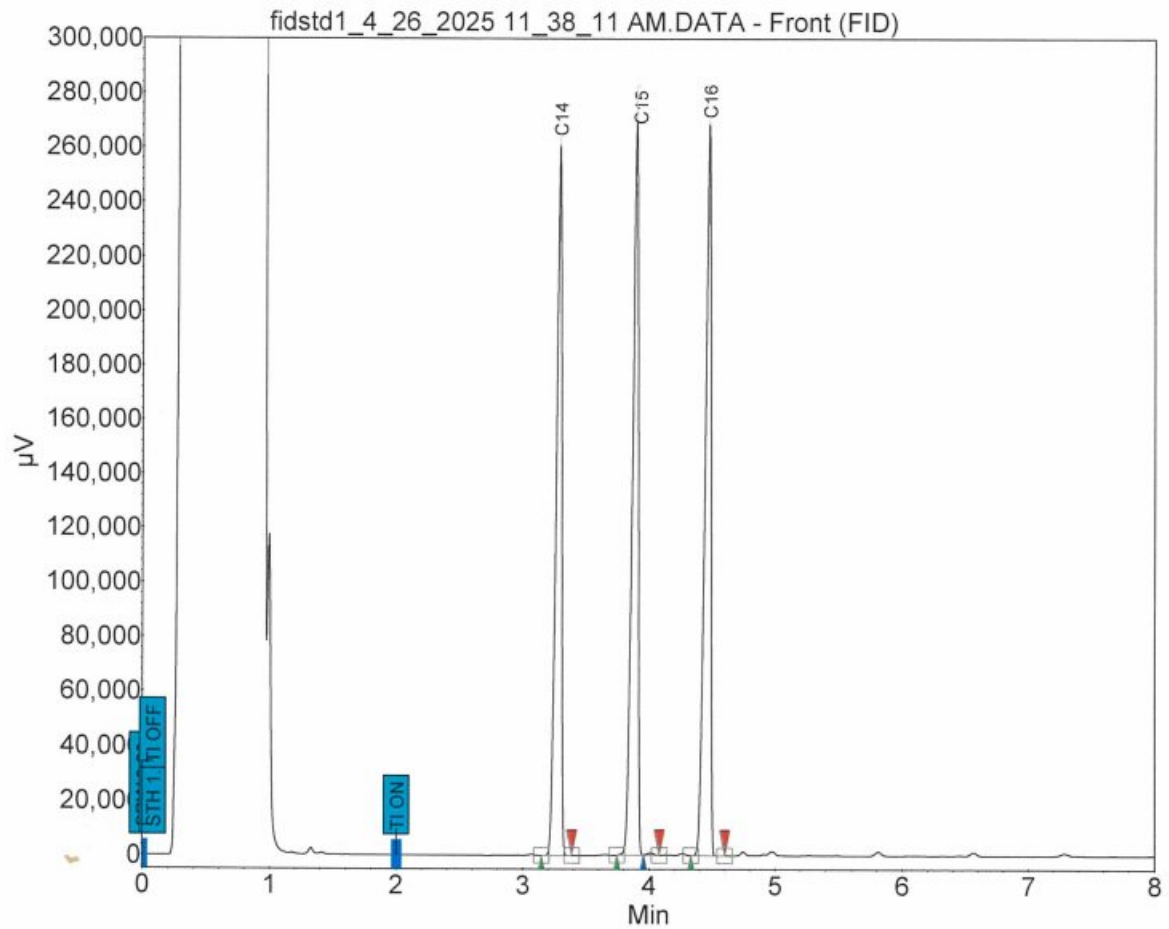
Chromatogram : Baseline1\_channel1



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## ANALYSIS / TEST REPORT

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED

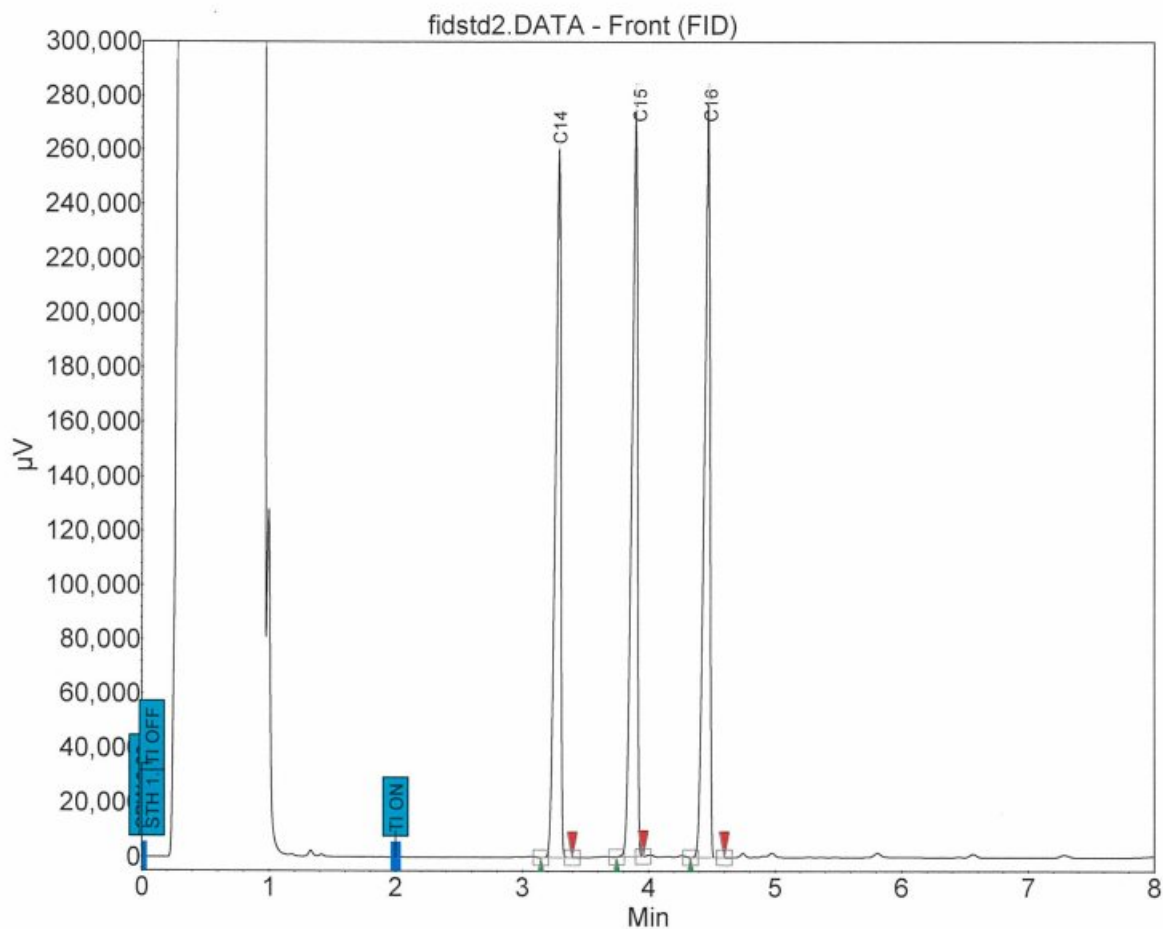


Index	Name	Time [Min]	Quantity [ng/ $\mu\text{L}$ ]	Height [ $\mu\text{V}$ ]	Area % [%]	Area [ $\mu\text{V} \cdot \text{Min}$ ]	Area [ $\mu\text{V} \cdot \text{Sec}$ ]	Width 50% [Min]
1	C14	3.29	30.09	261050.9	31.334	13207.7	792462.3	0.05
2	C15	3.90	30.11	270040.3	34.240	14432.6	865958.5	0.05
4	C16	4.47	30.09	268890.5	34.293	14454.9	867295.1	0.05
Total			90.29	800856.1	100.000	42151.4	2529083.7	

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# ANALYSIS / TEST REPORT

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED

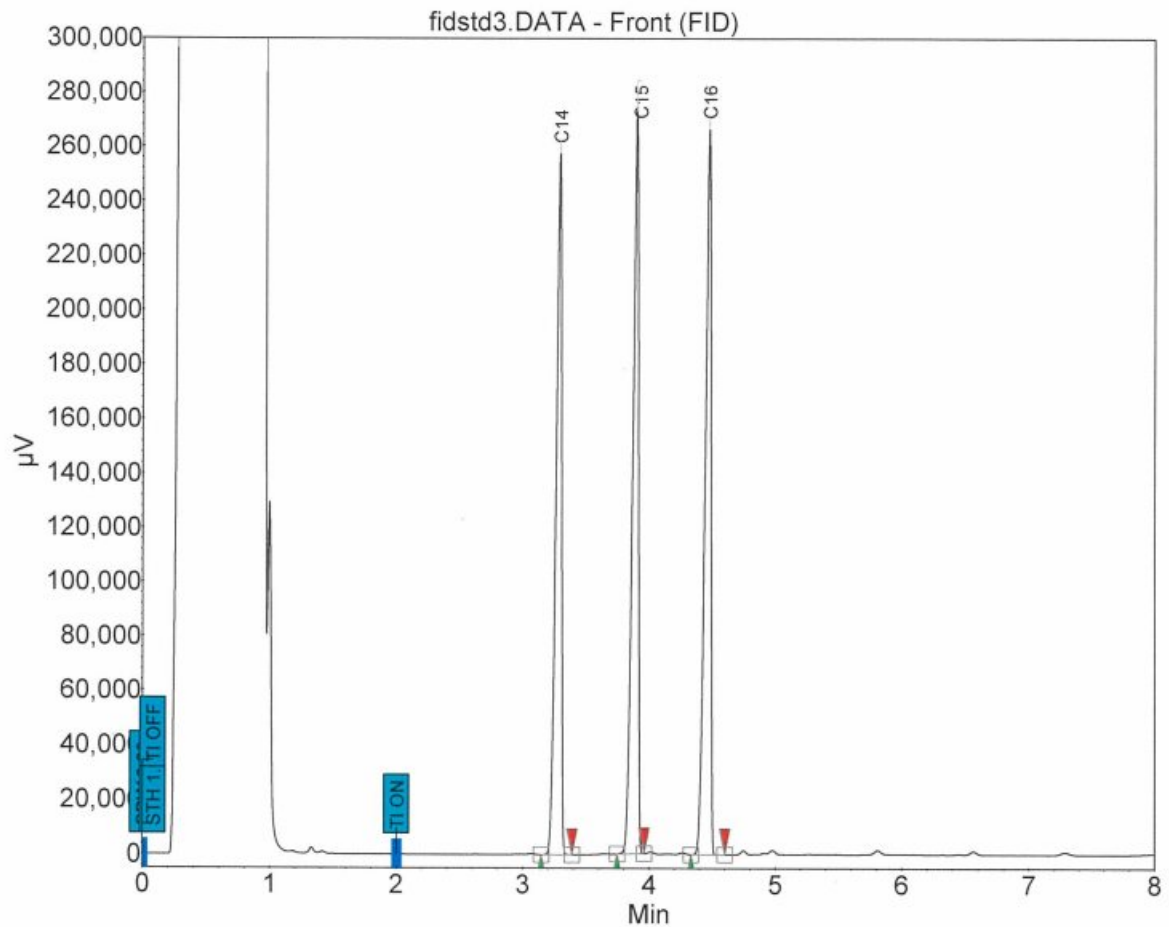


Index	Name	Time [Min]	Quantity [ng/uL]	Height [ $\mu V$ ]	Area % [%]	Area [ $\mu V \cdot \text{Min}$ ]	Area [ $\mu V \cdot \text{Sec}$ ]	Width 50% [Min]
1	C14	3.29	29.97	260370.6	31.386	13155.5	789331.9	0.05
2	C15	3.90	29.95	273845.9	34.248	14355.2	861309.7	0.05
3	C16	4.47	29.98	276898.6	34.365	14404.1	864243.3	0.05
Total			89.90	811115.0	100.000	41914.7	2514885.0	

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## ANALYSIS / TEST REPORT

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED

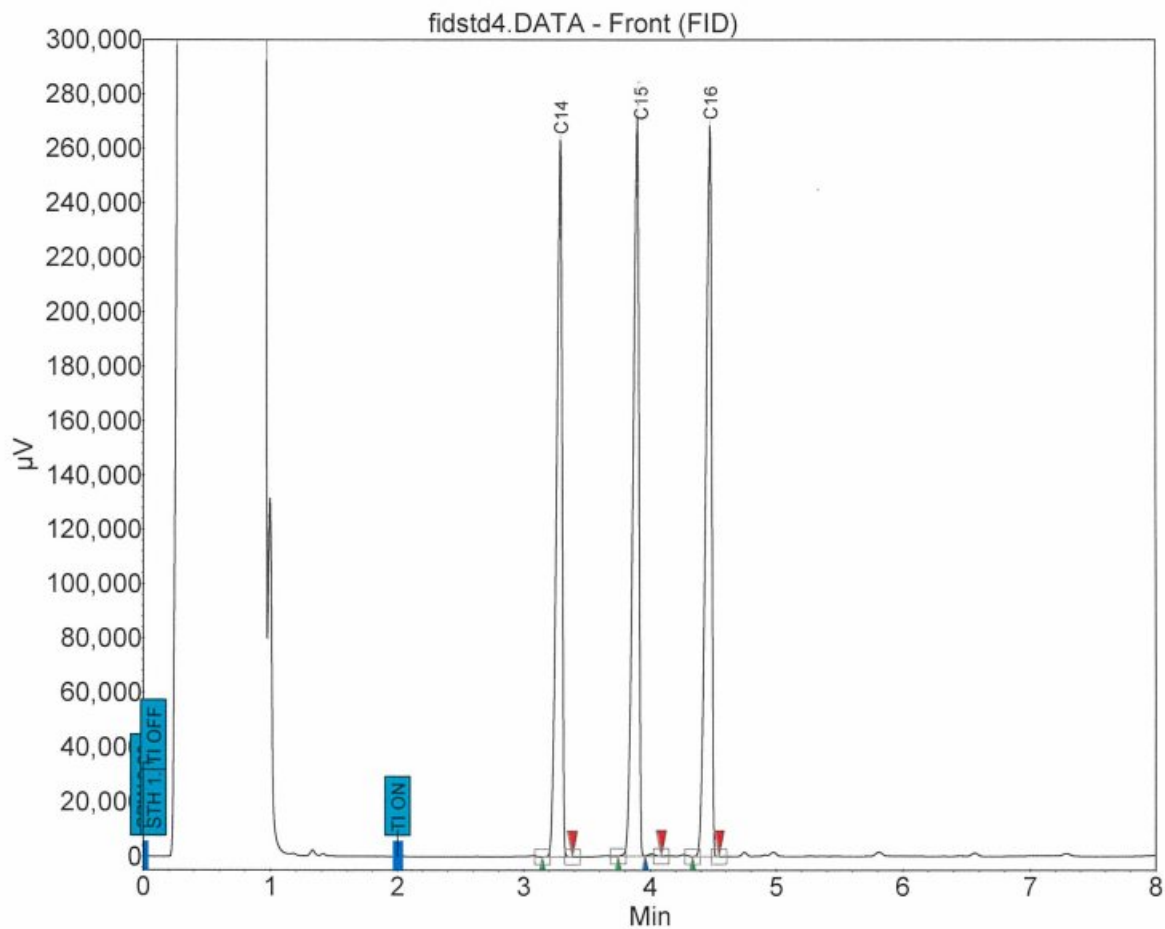


Index	Name	Time [Min]	Quantity [ng/μL]	Height [μV]	Area % [%]	Area [μV.Min]	Area [μV.Sec]	Width 50% [Min]
1	C14	3.29	29.86	257876.7	31.400	13106.6	786393.4	0.05
2	C15	3.90	29.82	273243.5	34.250	14296.1	857767.2	0.05
3	C16	4.47	29.85	266672.1	34.349	14337.3	860240.2	0.05
Total			89.53	797792.3	100.000	41740.0	2504400.7	

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# ANALYSIS / TEST REPORT

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED

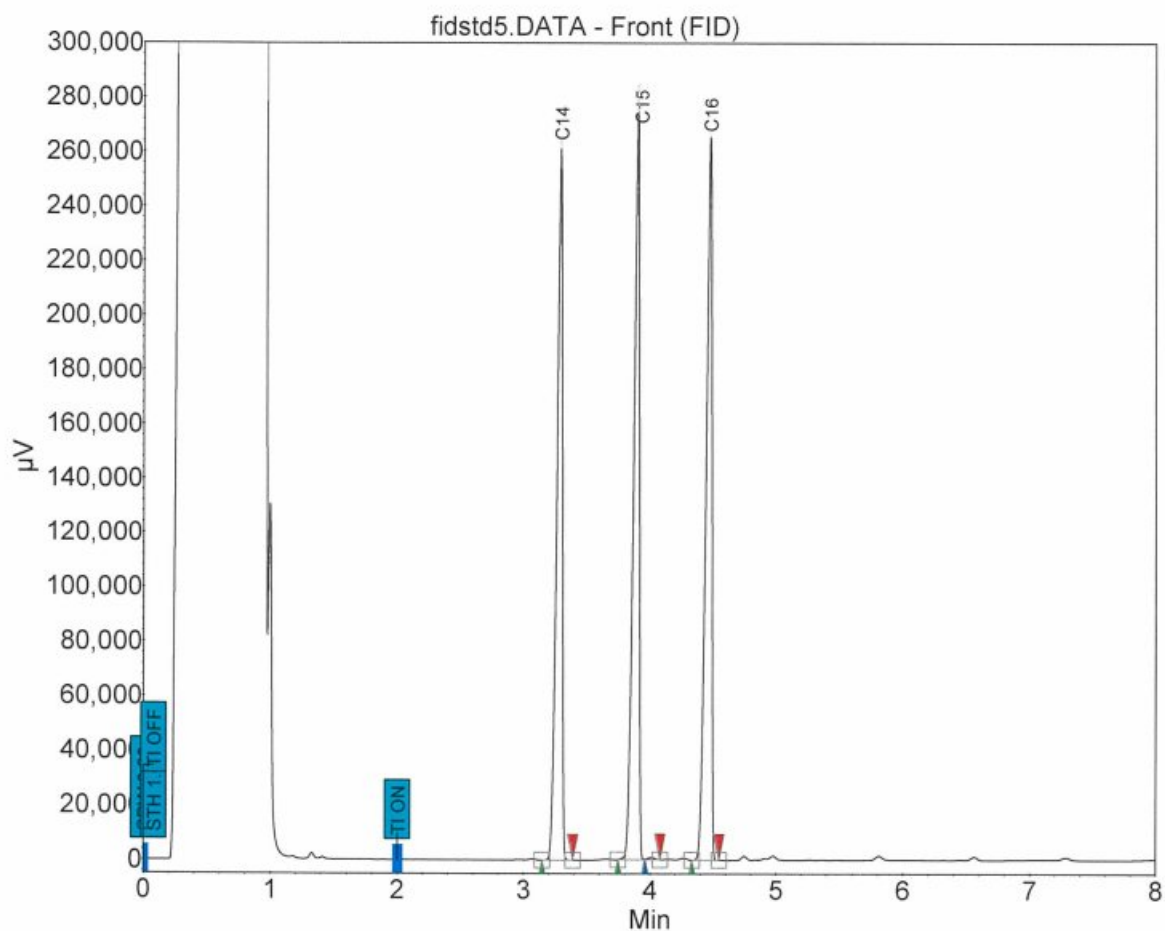


Index	Name	Time [Min]	Quantity [ng/uL]	Height [ $\mu V$ ]	Area % [%]	Area [ $\mu V \cdot \text{Min}$ ]	Area [ $\mu V \cdot \text{Sec}$ ]	Width 50% [Min]
1	C14	3.29	30.23	263354.5	31.347	13268.2	796090.9	0.05
2	C15	3.90	30.23	271861.3	34.234	14490.1	869404.6	0.05
4	C16	4.47	30.21	268560.8	34.288	14513.0	870781.9	0.05
Total			90.67	804657.1	100.000	42326.3	2539580.9	

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## ANALYSIS / TEST REPORT

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY LIMITED



Index	Name	Time [Min]	Quantity [ng/μL]	Height [μV]	Area % [%]	Area [μV.Min]	Area [μV.Sec]	Width 50% [Min]
1	C14	3.29	29.86	261391.7	31.330	13107.3	786435.0	0.05
2	C15	3.90	29.89	274115.6	34.246	14327.5	859648.1	0.05
4	C16	4.47	29.87	265568.4	34.294	14347.5	860849.8	0.05
Total			89.62	801922.2	100.000	41836.3	2510180.7	

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Agilent Technologies

## Certificate of Analysis

### FID-TCD Performance Evaluation Sample Kit

**Agilent Part**

**Number:** 5080-8842, 18710-60170

**Sample Lot**

**Number:** 0006750304

This analytical reference material was manufactured and verified in accordance with an ISO 9001 registered quality system, and the analyte concentrations were verified by an ISO 17025 accredited laboratory. The certified value for each analyte was determined gravimetrically.

**Concentrations:**

n-tetradecane	0.218 g/L ( $\pm 0.5\%$ )	0.033 w/w %
n-pentadecane	0.218 g/L ( $\pm 0.5\%$ )	0.033 w/w %
n-hexadecane	0.218 g/L ( $\pm 0.5\%$ )	0.033 w/w %

**Solvent:** hexane

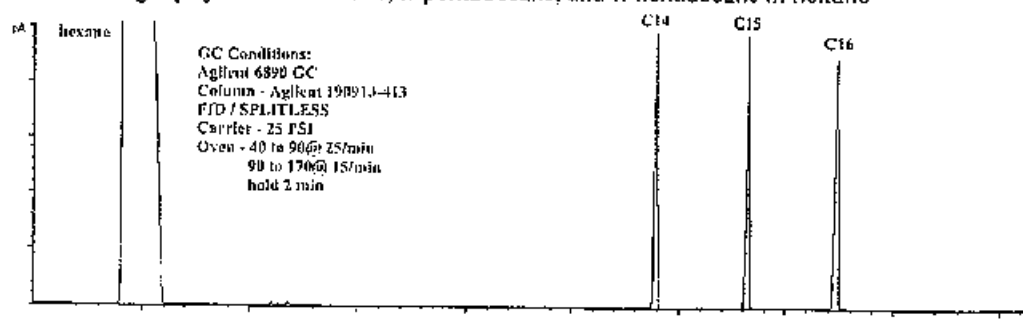
Calibrated Class A glassware and clean bottles were used in the manufacture of this standard. Balances used in the manufacture of this standard are calibrated with weights traceable to NIST in compliance with ANSI/NCSL Z-540-1 and ISO 9001.

**Purities:**

n-tetradecane	99.6%
n-pentadecane	99%
n-hexadecane	99.5%
hexane	99%

### Typical Analytical Spectrum or Chromatography

GC Chromatography – n-tetradecane, n-pentadecane, and n-hexadecane in hexane



**Date of release:** 30 June 2023

**Date of expiration:** 31 July 2025

*Monica Bourgeois*

Monica Bourgeois  
QMS Representative

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# Certificate of Calibration

Certificate No.: WK2412-053-1

Page 1 of 2

Customer : THAI UNIQUE CO., LTD.  
80-82 Prachathipatai Rd., Bangkhunphrom,  
Pranakorn, Bangkok 10200

Instrument : AMD Flow Meter  
Manufacturer : Agilent Technologies  
Model : G6691A  
Serial No. : MY16470347  
Identity No. : SV-DF-001  
Range : 0 ml/min to 750 ml/min  
Resolution : See to Data  
Calibration Method : CP-WK-M10

Ambient Temperature :  $(23 \pm 2) ^\circ\text{C}$   
Humidity :  $(50 \pm 15) \% \text{RH}$   
Received Date : 4-Dec-24  
Calibrated Date : 11-Dec-24  
Issued Date : 13-Dec-24  
Calibrated Location : In Lab

## Reference standard instruments :

Instrument	Serial No.	Certificate No.	Due Date	Traceability to
Flow Calibrator	140215-134	L202304114-001	18-Apr-25	MIT
Primary Flow Calibrator	1107-S	WK2405-049-5	22-May-25	WK Electric Co., Ltd.

MIT : Miracle International Technology Co., Ltd.

This result calibrate was found accurate as shown on date place of calibrate only

This certificate is traceability to the International System of Unit (SI)

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

Calibrated by : Mr.Thippatai Mungpungklang

Approved by :

Ms. Budsagorn Patcha  
Authorized Signatory

This certificate may not be reproduced except in full unless permission for the reproduction has been obtained in writing from the laboratory.



**Measuretronix Limited**  
2425/2 Lat Phrao Road, Saphan Song  
Wangthonglang, Bangkok 10310, Thailand  
Phone : 0-2514-1000, 0-2514-1234  
Fax : 0-2514-0001, 0-2514-0003  
Website : www.measuretronix.com



## Certificate of Calibration

**Certificate Number** : LF24-0278  
**Equipment** : Thermometer  
**Manufacturer** : Fluke  
**Model** : 51  
**Serial Number** : 5910857  
**Asset Number** : 5910857  
**Customer** : Thai Unique Co., Ltd.  
80-82 Prachathipatai Road,  
Bangkhunphrom, Pranakorn,  
Bangkok 10200  
**Date of Calibrate** : 26-Jun-2024  
**Date of Issue** : 27-Jun-2024

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

*This calibration certificate applies only to the item identified and shall not be reproduced other than in full, without specific written approved by Measuretronix Cal-Lab. Calibration certificates without signature are not valid.*

*The measurements marked with an asterisk (\*) in this certificate are outside our range of accreditation. They have been included for completeness.*

*The Calibration interval (Cal.Due) is the responsibility of the end user.*

Calibrated by

*Nanthiya Ngampring*

Mrs. Nanthiya Ngampring  
Metrology Technician

Approved by

*A. S.*

Mrs. Arunee Bamrungham  
Cal-Lab Manager

# CERTIFICATE

This is to certify, that

***Somchai Pohthongkham***

has participated the course

***Basic GC and Sampler training***

Date: ***24 – 27 May 2004***

Location: ***Middelburg***

Instructor: ***W.J. Buys***

Signature instructor:



Varian Analytical Instruments  
Varian Chrompack International BV  
Herculesweg 8  
P.O. Box 8033  
4330 EA Middelburg  
The Netherlands  
Tel.: +31 118 671000  
Fax: +31 118 633118  
[www.varianinc.com](http://www.varianinc.com)

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



## Certificate of Calibration

Cert.No.: 24CH725

Page.: 1 of 3

**Equipment :** pH Meter  
**Manufacturer :** Horiba  
**Model :** LAQUA-PH210  
**Serial No. :** HA0E0041  
**ID No. :** UAE.EFM.069/2564(EFM.pH.02/64)  
**Condition As-Received:** Used Item  
**Received Date :** 18 June 2024  
**Calibration Date :** 19 June 2024  
**Reference :** 2406-0570WSC-3  
**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 :** Warakorn Lerngagtrakul

**Approved by :**

Approved Signatory

( ) Unnopphol Harachai

( ) Ponpan Paipim

(✓) Saithip Meangmai

**Issue Date :** 20 June 2024

**The Uncertainties are for a confidence probability of approximately 95%**

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



Cert.No.: 24CH725

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	23E2802	27 Aug 2024
2) Ref. Standard Thermometer	4982054	110RC044	23I908	26 July 2024

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

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

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
pH 4.008	CPA chem	970851	25 Apr 2026
pH 6.986	CPA chem	970852	25 Apr 2025
pH 9.997	CPA chem	970853	25 Apr 2025

**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)**

<b>Unit Under Calibration</b>	<b>Nominal Value</b>	<b>Standard Voltage Input</b>	<b>Actual Reading</b>		<b>Uncertainty of Measurement ( ±mV )</b>	<b>Coverage factor <i>k</i></b>
	<b>pH</b>	<b>mV</b>	<b>mV</b>	<b>pH</b>		
pH Meter S/N.: HA0E0041	4.00	177.48	177.4	4.01	0.058	2.00
	7.00	0.00	0.1	7.00	0.058	2.00
	7.00	0.00	0.1	7.00	0.058	2.00
	10.00	-177.48	-177.2	10.01	0.058	2.00



Cert.No.: 24CH725

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.: Q9AA0001	4.008	4.01	177.6	0.0085	2.05
	6.986	7.00	2.5	0.012	2.05
	6.986	7.00	3.1	0.011	2.00
	9.997	10.01	-170.8	0.0092	2.00

**Function : Temperature Measurement****( \* ) Without adjustment**

This equipment was connected with Temperature Probe;

- Model : 9652-10D

- Serial No. : Q9AA0001

Dimension of probe

- Length : 103 mm.

- Diameter : 16 mm.

- Immersion Depth : 80 mm.

Calibration Point ( $^{\circ}\text{C}$ )	Standard Temperature ( $^{\circ}\text{C}$ )	UUC* Reading ( $^{\circ}\text{C}$ )	Error ( $^{\circ}\text{C}$ )	Uncertainty of measurement ( $\pm$ $^{\circ}\text{C}$ )	Coverage factor $k$
25.0	25.004	25.0	-0.004	0.13	2.00
30.0	30.002	30.0	-0.002	0.13	2.00
35.0	35.002	35.0	-0.002	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



Cert. No.: 24TM587  
Page : 1 of 3

## Certificate of Calibration

**Equipment :** BOD Incubator

**Manufacturer :** ARCO

**Model :** UR-1320

**Serial No. :** -

**ID No. :** UAE.WAO.018/2551

**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 :** 01 April 2024  
**Calibration Date :** 01 April 2024  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %

**Calibrated by :** Krisda Malee

**Approved by :**

Approved Signatory

- ( ) Ponpan Paipim  
( ☒ ) Suwit Imjai  
( ) Kunchit Promprat

**Issue Date :** 5 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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

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A 0065063



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2404-0004OC-1  
Procedure Used :-

Cert. No.: 24TM587  
Page : 2 of 3

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 ).  
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	MY57013711	23LM115	TPA	11 Jul 2024

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 )

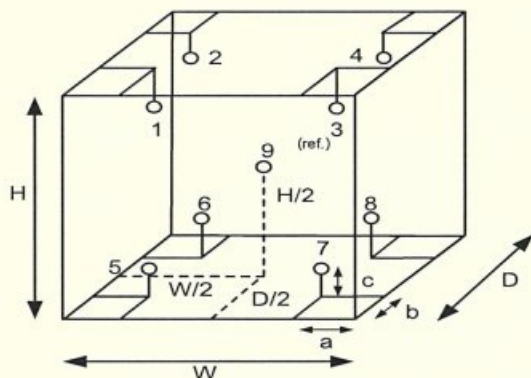
**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

**Fresh air setting :** Not Available

**Environment during calibration**

	Beginning	Finished
Temp. ( °C )	27	26
REL.Humid. ( % )	48	49
AC Supply ( Volt )	221	220



Position :	Ref. Std. ID No.:
1	18-18RTD-01
2	18-18RTD-02
3	18-18RTD-03
4	18-18RTD-04
5	18-18RTD-05
6	23-18RTD-06
7	18-18RTD-07
8	22-18RTD-08
9 (ref.)	18-18RTD-09

**Probe Installation Details :**

a = 10 cm  
b = 10 cm  
c = 10 cm

**Dimension of Chamber :**

D = 0.62 m  
W = 1.2 m  
H = 1.2 m  
Capacity = 0.89 m<sup>3</sup>

*Signature*

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a 1209743



**Equipment :** BOD Incubator  
**Condition As-Received :** Used Item  
**Reference :** 2404-0004OC-1  
**Result of Calibration :-** ( \* ) Without Adjustment  
**Function of UUC\* :** Temperature Source  
**Fresh air setting :** Not Available

**Cert. No.:** 24TM587

**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	20.0	0.45	0.55	1.3	2

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty  ( ± °C )
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	19.954	20.183	20.235	19.707	19.706	19.739	19.785	19.821	19.828	0.66

**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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*Signature*

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a 1209742

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 0807047	Envi Equipment Service Co., Ltd.	E24-080074	26 Aug 24	25 Aug 25	-
2	Flue gas Analyzer	Sulphur Dioxide Oxide of Nitrogen as Nitrogen Dioxide	Testo	Testo 350 60723967	Entech Industrial Sulation Co., Ltd.	G 670643	13 Sep 24	12 Sep 25	-

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 <sub>10</sub> )	Tisch Environmental,Inc.	TE-5025A 3540	Jiranatee Associates Co., Ltd.	COF-045-67	4 Nov 24	3 Nov 25	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	24P1250	10 Apr 24	9 Apr 25	-
3	Mass Flow Meter	Ethyl Alcohol	Alicat Scientific, Inc.	MB-5SCCM-D/5M 202984	Miracle International Technology Co.,Ltd.	L202408224-0003	27 Aug 24	26 Aug 25	-
4	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> ) Ethyl Alcohol	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	24P1369	22 Apr 24	21 Apr 25	-
5	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> ) Ethyl Alcohol	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	24H752	10 Apr 24	9 Apr 25	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778110	UAE Consultant Co.,Ltd.	17102024	17 Oct 24	16 Oct 25	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1200636462	UAE Consultant Co.,Ltd.	04102024	4 Oct 24	3 Oct 25	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1200636463	UAE Consultant Co.,Ltd.	20092024	20 Sep 24	19 Sep 25	-
9	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05NI91E15A0014	6 Jun 23	6 Jun 31	-
10	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778113	UAE Consultant Co.,Ltd.	04092024	4 Sep 24	3 Sep 25	-
11	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778116	UAE Consultant Co.,Ltd.	19062024	19 Jun 24	18 Jun 25	-
12	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1182920012	UAE Consultant Co.,Ltd.	04092024	4 Sep 24	3 Sep 25	-
13	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05NI91E15A0014	6 Jun 23	6 Jun 31	-

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	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	01dB	CAL31 84065	Innovative Instrument Co.,Ltd.	24-ACT-087	25 Jun 24	24 Jun 25	-
15	Sound Level Meter	$L_{Aeq\ 24\ hrs}$ , $L_{Aeq\ 1\ hr}$ , $L_{Amax}$ , $L_{A90}$ , $L_{Adn}$	Larson Davis	LxT2 0005346	Innovative Instrument Co.,Ltd.	24-SLM-235	10 Jul 24	9 Jul 25	-
16	Sound Level Meter	$L_{Aeq\ 24\ hrs}$ , $L_{Aeq\ 1\ hr}$ , $L_{Amax}$ , $L_{A90}$ , $L_{Adn}$	Larson Davis	LxT2 0005393	Innovative Instrument Co.,Ltd.	24-SLM-237	10 Jul 24	9 Jul 25	-
17	Sound Level Meter	$L_{Aeq\ 24\ hrs}$ , $L_{Aeq\ 1\ hr}$ , $L_{Amax}$ , $L_{A90}$ , $L_{Adn}$	Larson Davis	LxT2 0005398	Innovative Instrument Co.,Ltd.	24-SLM-214	2 Jul 24	1 Jul 25	-

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	Ecosence	pH100A 24H005160JEN	Technology Promotion Association (Thailand-Japan)	24CH1422	14 Nov 24	13 Nov 25	-

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	Primary Flow Calibrator	Calibrate personal pump	TSL,Inc	4146 41462327002	Innovative Instrument Co., Ltd.	24-AFM-156	19 Aug 24	18 Aug 25	-
2	Aneroid Barometer	Total Dust Respirable Dust Ethyl Alcohol TVOCs	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	24P1370	22 Apr 24	21 Apr 25	-
3	Digital Thermo - Hygrometer	Total Dust Respirable Dust Ethyl Alcohol TVOCs	Digicon	TH-02 435031147	Technology Promotion Association (Thailand-Japan)	24H1486	15 Jul 24	14 Jul 25	-
4	Gas Detector	TVOCs	RAE Systems, Inc.	MiniRAE 3000 592-908144	Executive Trading Limited	RA 168/24	15 Jul 24	14 Jul 25	-
5	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	-
6	Sound Level Meter	$L_{Aeq\ 8\ hrs}$ , $L_{Amax}$	Rion, Japan	NL-42 00408980	Sithiporn Associates Co., Ltd.	ACL25113	28 Jan 25	27 Jan 26	-
7	Sound Level Meter	$L_{Aeq\ 8\ hrs}$ , $L_{Amax}$	Rion, Japan	NL-42 01010786	Sithiporn Associates Co., Ltd.	ACL25034	13 Jan 25	12 Jan 26	-
8	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 117689	Innovative Instrument Co.,Ltd.	24-NDM-105	25 Apr 24	24 Apr 25	-
9	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 117690	Innovative Instrument Co.,Ltd.	24-NDM-127	17 May 24	16 May 25	-
10	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 117721	Innovative Instrument Co.,Ltd.	25-NDM-037	19 Feb 25	18 Feb 26	-
11	Light Meter	Lux	Extech Instrument, Taiwan	407026 A 062336	Innovative Instrument Co., Ltd.	24-LXM-197	1 Aug 24	31 Jul 25	-

## 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.: E24-080074

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** : 0807047

**ID./Control No.** : UAE.ANV 212/2551

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

**Cal. Date** : 26/08/2024

**Issue Date** : 26/08/2024

### 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 Fuekhud)

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	0807047
DGM Model Number	SK25EX
DGM Serial Number	00003580

Calibration Conditions			
Date	Time	26/08/2024	01:10 PM
Calibration Reference No.		SER24-080032	
Barometric Pressure		755.91	mmHg
Calibration Meter Gamma		1.001	

Factors/Conversions		
Std Temp	293	K
Std Press	760	mm Hg
K <sub>1</sub>	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 <sub>m</sub> )	(V <sub>mi</sub> )	(V <sub>mf</sub> )	(t <sub>mi</sub> )	(t <sub>mf</sub> )	(V <sub>wi</sub> )	(V <sub>wf</sub> )	(t <sub>wi</sub> )	(t <sub>wf</sub> )
min	mm H <sub>2</sub> O	m <sup>3</sup>	m <sup>3</sup>	°C	°C	m <sup>3</sup>	m <sup>3</sup>	°C	°C
11.88	13.0	1160.277	1160.417	24	24	249.83548	249.97320	25	25
11.87	13.0	1160.417	1160.557	23	23	249.97320	250.11036	25	25
8.47	26.0	1160.565	1160.705	23	23	250.11794	250.25472	25	25
8.43	26.0	1160.705	1160.845	23	23	250.25472	250.39116	25	25
13.70	40.0	1160.856	1161.136	24	24	250.39676	250.67384	25	25
13.63	40.0	1161.136	1161.416	24	24	250.67384	250.94928	25	25
10.27	70.0	1161.428	1161.708	25	25	250.95446	251.23044	25	25
10.23	70.0	1161.708	1161.988	26	26	251.23044	251.50574	25	25
8.98	90.0	1162.001	1162.281	26	26	251.51066	251.78586	24	24
8.95	90.0	1162.281	1162.561	27	27	251.78586	252.06032	24	24



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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	26/08/2024	01:10 PM	Std Temp	293	K
Console Serial Number	0807047	Calibration Reference No.		SER24-080032		Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure		755.91		K <sub>1</sub>	0.386	
DGM Serial Number	00003580	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	.0212 m <sup>3</sup> <sub>std</sub> /min	Variation
				Value	Variation	Std & Corr		
(V <sub>m(std)</sub> )	(Q <sub>m(std)</sub> )	(V <sub>w(std)</sub> )	(Q <sub>w(std)</sub> )	(Y)	(ΔY)	(Q <sub>m(std)</sub> )(corr)	(ΔH <sub>@</sub> )	(ΔH <sub>@</sub> )
m <sup>3</sup>	m <sup>3</sup> /min	m <sup>3</sup>	m <sup>3</sup> /min			m <sup>3</sup> /min	mm H <sub>2</sub> O	
0.137	0.012	0.135	0.011	0.981	0.005	0.011	44.831	-0.558
0.137	0.012	0.134	0.011	0.977	0.001	0.011	45.071	-0.318
0.137	0.016	0.134	0.016	0.974	-0.003	0.016	46.259	0.870
0.137	0.016	0.133	0.016	0.971	-0.005	0.016	46.125	0.736
0.275	0.020	0.271	0.020	0.985	0.008	0.020	45.532	0.143
0.275	0.020	0.269	0.020	0.979	0.002	0.020	45.628	0.240
0.276	0.027	0.270	0.026	0.978	0.001	0.026	45.368	-0.021
0.276	0.027	0.269	0.026	0.976	-0.001	0.026	45.297	-0.092
0.277	0.031	0.270	0.030	0.973	-0.003	0.030	44.935	-0.454
0.277	0.031	0.269	0.030	0.971	-0.006	0.030	44.843	-0.546
				0.977	Y Average		45.389	ΔH <sub>@</sub> 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<sub>@</sub>, orifice pressure differential that equates to 0.75 cfm (0.0212 m<sup>3</sup>/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1mm) H<sub>2</sub>O.



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Meter Console Information	
Console Model Number	XC-572-V
Console Serial Number	0807047
DGM Model Number	SK25EX
DGM Serial Number	00003580

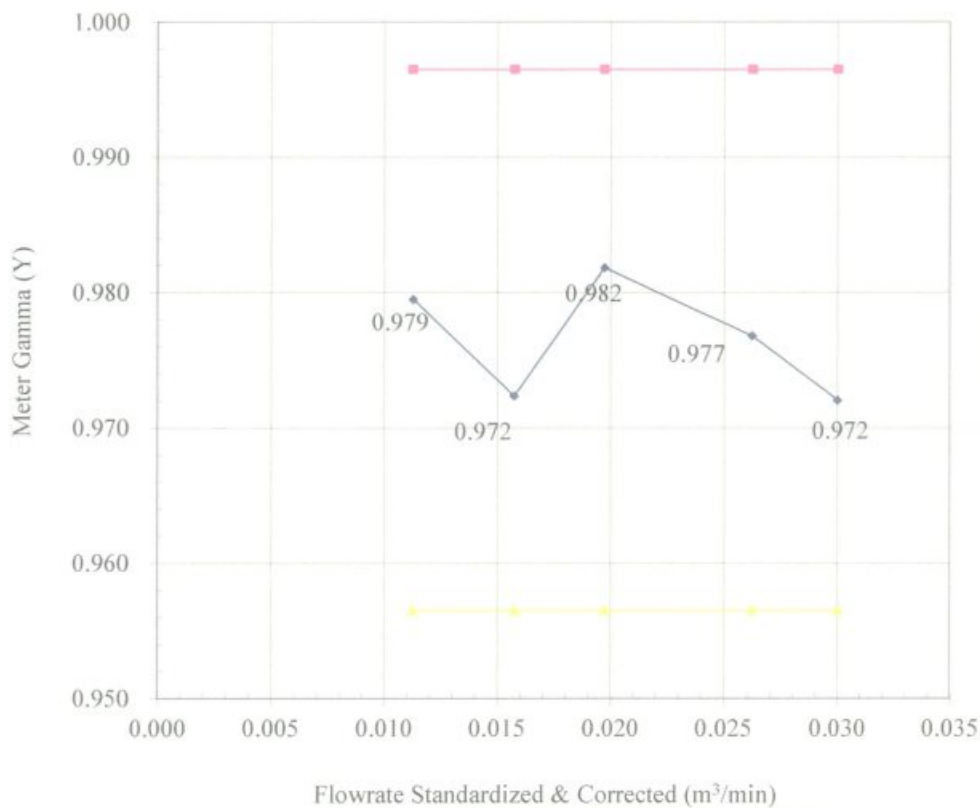
Calibration Conditions			
Date	Time	26/08/2024	01:10 PM
Calibration Reference No.	SER24-080032		
Barometric Pressure	755.91	mmHg	
Calibration Meter Gamma	1.001		

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

Calibration Date: 26-8-2024

Calibration Reference No: SER24-080032

Meter Gamma vs Flowrate



Console Serial: 0807047

Console Model: XC-572-V



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Meter Console Information	
Console Model Number	XC-572-V
Console Serial Number	0807047
DGM Model Number	SK25EX
DGM Serial Number	00003580

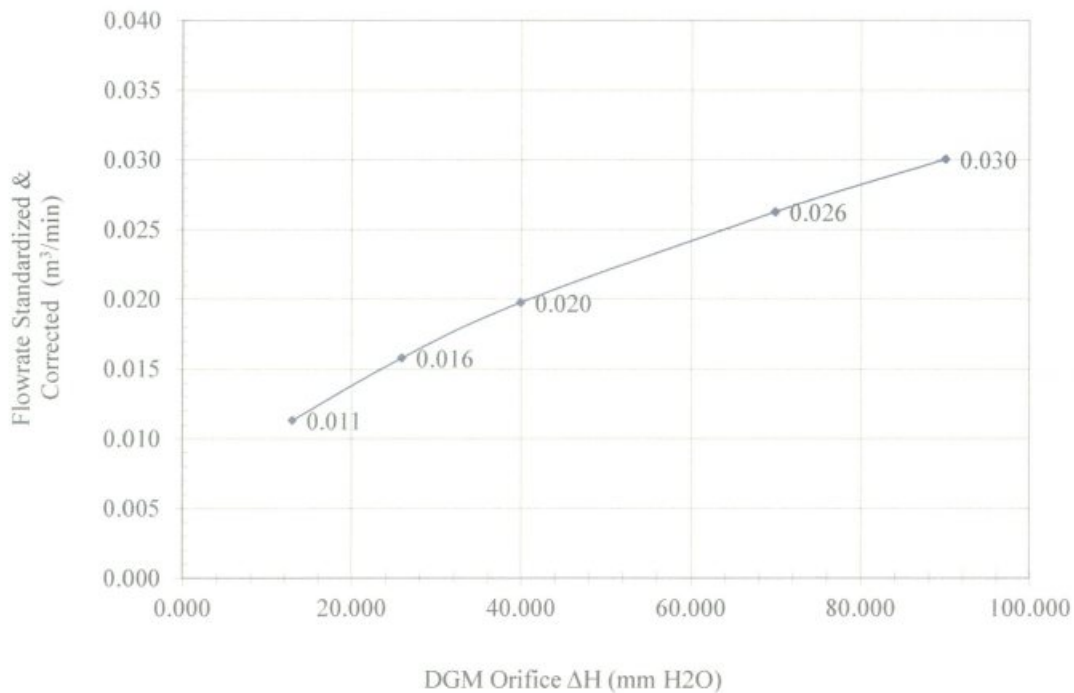
Calibration Conditions			
Date	Time	26/08/2024	01:10 PM
Calibration Reference No.	SER24-080032		
Barometric Pressure	755.91	mmHg	
Calibration Meter Gamma	1.001		

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

Calibration Date: 26-8-2024

Calibration Reference No: SER24-080032

Meter Pressure vs Flowrate



Console Serial: 0807047

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	0807047
DGM Model Number	SK25EX
DGM Serial Number	00003080
Meter Box Model Number	JENCO 765 KF
Meter Box Serial Number	JC 19778

Calibration Conditions			
Date	Time	26/08/2024	03:10 PM
Calibration Reference No.		SER24-080032	
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	25.0	38.0	92.0	147.0	256.0	368.0	485.0	590.0	814.0	1036.0
Aux	-17.0	25.0	38.0	92.0	147.0						
Probe	-17.0	25.0	38.0	92.0	147.0						
Filter	-17.0	25.0	38.0	92.0	147.0						
Oven	-17.0	25.0	38.0	92.0	147.0						
Exit	-17.0	25.0	38.0								

### 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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### MULTI-POINT GAS TEST REPORT

**Test Date : Oct 17, 2024**

**Equipment :** Gas Analyzer (NO<sub>2</sub>)

**Model :** 42i

**Manufacturer :** Thermo Scientific

**Serial Number :** 1201778110

#### Standard Gas Concentration

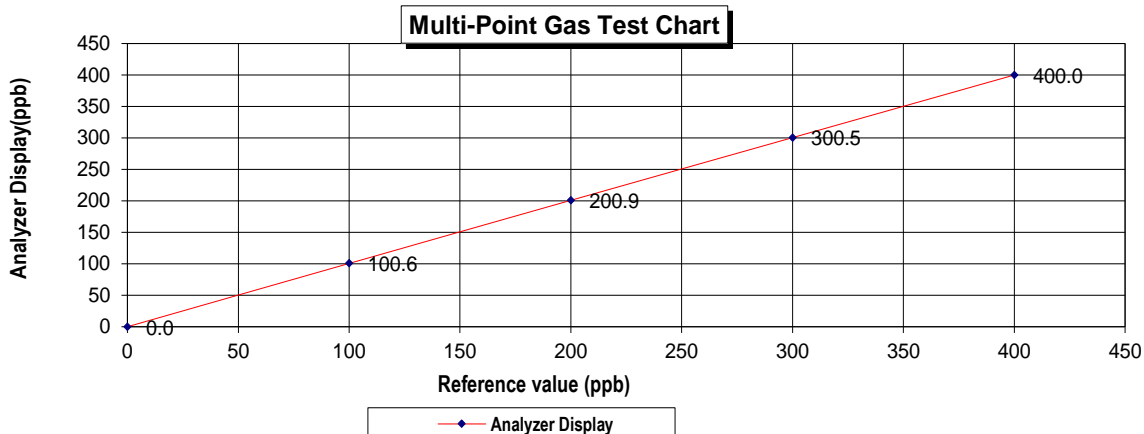
Sulphur Dioxide (SO <sub>2</sub> )	42.89
Nitric Oxide (NO)	46.77
Methane (CH <sub>4</sub> )	-
Carbon Monoxide (CO)	965.9
Cylinder No. :	EB0159156
Expiration Date :	Nov 6, 2026

#### 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	200.9	0.90	0.45	0.45
Level 4	60.00%	300.0	300.5	0.50	0.17	0.17
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb				Average Difference (%)		0.24



Calculate by

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Approve by

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### MULTI-POINT GAS TEST REPORT

**Test Date : Oct 4, 2024**

**Equipment :** Gas Analyzer (NO<sub>2</sub>)

**Model :** 42i

**Manufacturer :** Thermo Scientific

**Serial Number :** 1200636462

#### Standard Gas Concentration

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

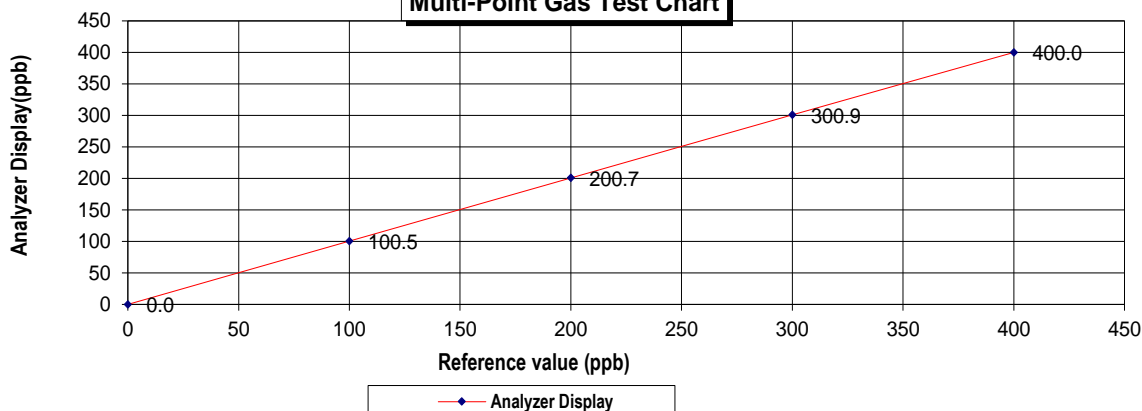
#### Dilutor Detail

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	200.7	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 (%)		0.23

**Multi-Point Gas Test Chart**



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*Patikom K.*  
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### MULTI-POINT GAS TEST REPORT

**Test Date** : Sep 20,2024

**Equipment** : Gas Analyzer (NO<sub>2</sub>)

**Model** : 42i

**Manufacturer** : Thermo Scientific

**Serial Number** : 1200636463

#### Standard Gas Concentration

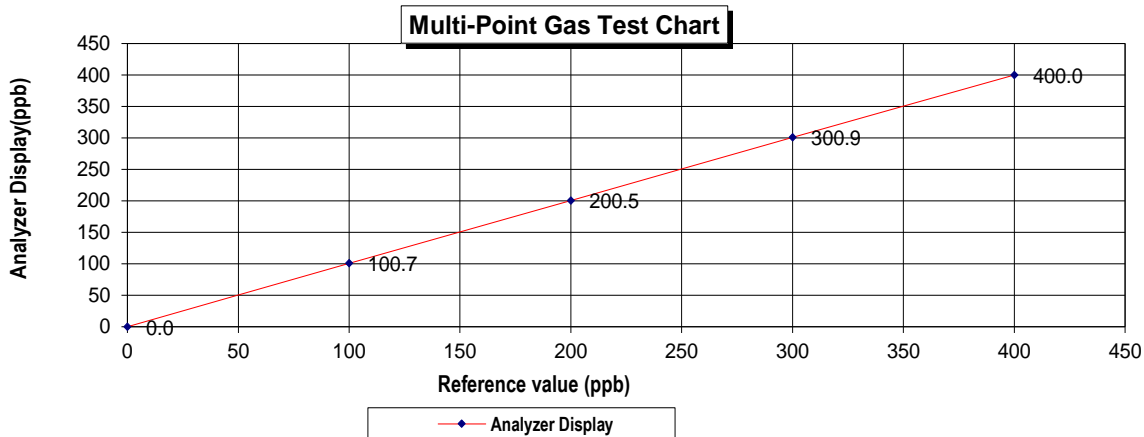
Sulphur Dioxide (SO <sub>2</sub> )	42.89
Nitric Oxide (NO)	46.77
Methane (CH <sub>4</sub> )	-
Carbon Monoxide (CO)	965.9
Cylinder No. :	EB0159156
Expiration Date :	Nov 6,2026

#### 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	100.7	0.70	0.70	0.70
Level 3	40.00%	200.0	200.5	0.50	0.25	0.25
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



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## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND)

LTD.

Part Number: E05NI91E15A0014

Reference Number: 160-402772205-1

Cylinder Number: EB0162121

Cylinder Volume: 144.0 CF

Laboratory: 124 - Plumsteadville - PA

Cylinder Pressure: 2016 PSIG

PGVP Number: A12023

Valve Outlet: 660

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

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

### MULTI-POINT GAS TEST REPORT

**Test Date** : Sep 4, 2024

**Equipment** : Gas Analyzer (SO<sub>2</sub>)

**Model** : 43i

**Manufacturer** : Thermo SCIENTIFIC

**Serial Number** : 1201778113

#### Standard Gas Concentration

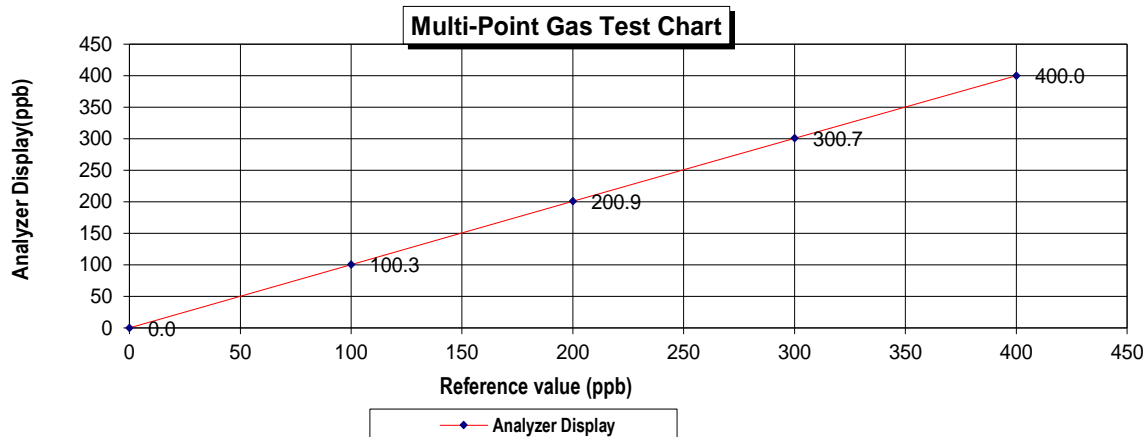
Sulphur Dioxide (SO <sub>2</sub> )	42.89
Nitric Oxide (NO)	46.77
Methane (CH <sub>4</sub> )	-
Carbon Monoxide (CO)	965.9
Cylinder No. :	EB0159156
Expiration Date :	Nov 06, 2026

#### 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	100.3	0.30	0.30	0.30
Level 3	40.00%	200.0	200.9	0.90	0.45	0.45
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 (%)		0.20



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## MULTI-POINT GAS TEST REPORT

**Test Date : June 19, 2024**

**Equipment :** Gas Analyzer (SO<sub>2</sub>)

**Model :** 43i

**Manufacturer :** Thermo SCIENTIFIC

**Serial Number :** 1201778116

### Standard Gas Concentration

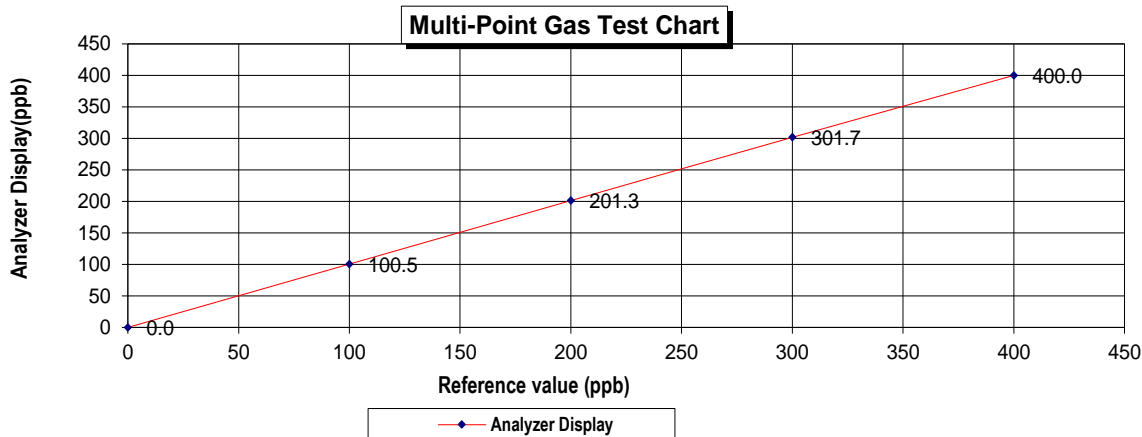
Sulphur Dioxide (SO <sub>2</sub> )	42.89
Nitric Oxide (NO)	46.77
Methane (CH <sub>4</sub> )	-
Carbon Monoxide (CO)	965.9
Cylinder No. :	EB0159156
Expiration Date :	Nov 06, 2026

### 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	100.5	0.50	0.50	0.50
Level 3	40.00%	200.0	201.3	1.30	0.65	0.65
Level 4	60.00%	300.0	301.7	1.70	0.56	0.56
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb				Average Difference (%)		0.34



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Approve by

*P. K. K.*

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### MULTI-POINT GAS TEST REPORT

**Test Date** : Sep 4, 2024

**Equipment** : Gas Analyzer (SO<sub>2</sub>)

**Model** : 43i

**Manufacturer** : Thermo SCIENTIFIC

**Serial Number** : 1182920012

#### Standard Gas Concentration

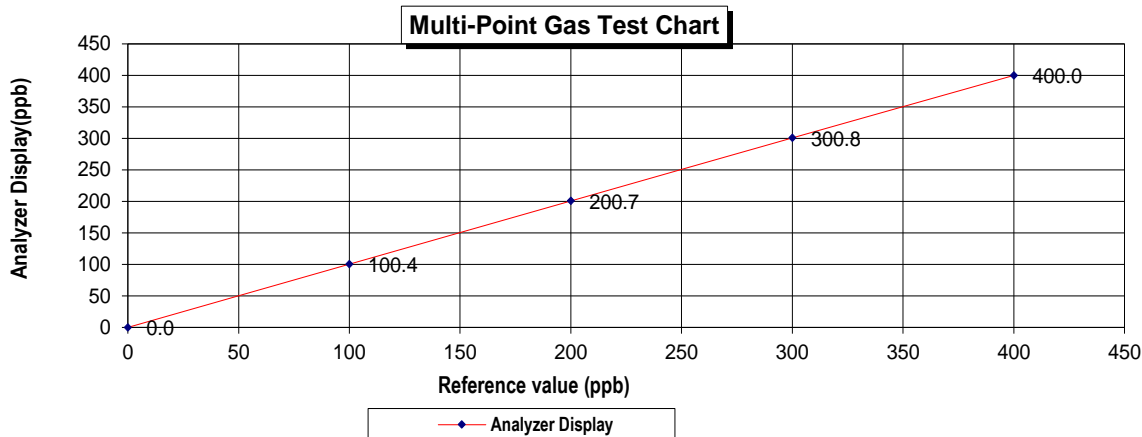
Sulphur Dioxide (SO <sub>2</sub> )	42.89
Nitric Oxide (NO)	46.77
Methane (CH <sub>4</sub> )	-
Carbon Monoxide (CO)	965.9
Cylinder No. :	EB01159156
Expiration Date :	Nov 06, 2026

#### 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	100.4	0.40	0.40	0.40
Level 3	40.00%	200.0	200.7	0.70	0.35	0.35
Level 4	60.00%	300.0	300.8	0.80	0.27	0.27
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range			500.0 ppb	Average Difference (%)		0.20



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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 : 24-ACT-087

Request No : Req-2024-1365

### Unit Under Calibration Details

Measurement item : Acoustic Calibrator Class : 1  
Manufacturer : 01dB Range : 94 dB / 1000 Hz  
Model : CAL31 Instrument Status : Used  
Serial Number : 84065  
ID : UAE.EFM.167/2561

### Calibration Environment and Details


Temperature : (  $23 \pm 2$  °C )  
Humidity : (  $50 \pm 20$  %RH )  
Barometric Pressure : (  $1013 \pm 10.0$  hPa )  
Received Date : 20 June 2024  
Calibration Date : 25 June 2024  
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	16 January 2025

**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 : 25 June 2024

Certificate No : 24-ACT-087

Request No : Req-2024-1365

**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	93.78	-0.22	-	-	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

**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	0.14	-	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

Certificate No : 24-ACT-087

Request No : Req-2024-1365

### Decision Rule for Statements of Conformity

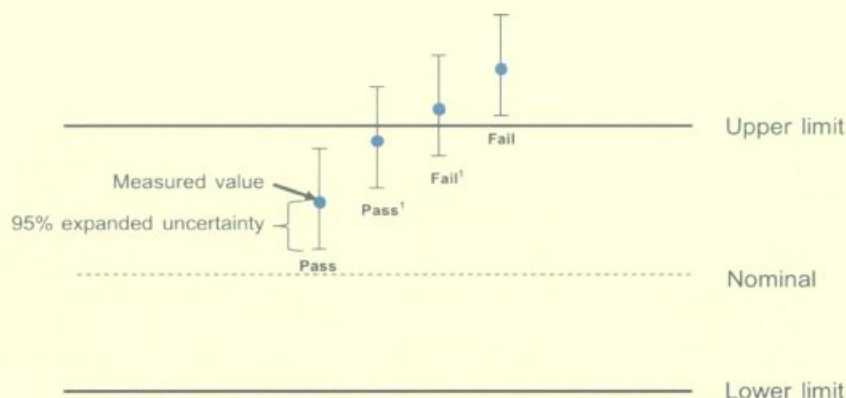
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

Pass<sup>1</sup> = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail<sup>1</sup> = 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

## 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 : 24-SLM-235

Request No : Req-2024-1454

### Unit Under Calibration Details

Measurement item : Sound Level Meter  
Manufacturer : Larson Davis  
Model : LxT2  
Serial Number : 0005346  
ID : UAE.EFM.043/2563  
Resolution : 0.1 dB  
Microphone Class : 2  
Microphone Model : 375B02  
Microphone S/N : 11798  
Preamplifier Model : PRMLxT2B  
Preamplifier S/N : 056138  
Instrument Status : Used

### Calibration Environment and Details


Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 1 July 2024  
Calibrated Date : 10 July 2024  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic


### Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	20 August 2024	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	26 July 2024	TSI
Audio Generator	Svantek	Svan401	131	8 October 2024	WK Electric

### 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 : 10 July 2024

Certificate No : 24-SLM-235

Request No : Req-2024-1454

### 1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY  ( ± dB)	Acceptance Limit ( ± dB)	Result
FAST / A / 37-139	Level (dB)	UUC	ERR	UUC	ERR			
Calibrator Setting		(dB)	(dB)	(dB)	(dB)			
1000 Hz 114 dB	113.76	115.3	1.54	113.8	+0.04	0.20	0.30	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 58079

### 2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	( ± dB)
A	31.4	0.10

### 3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	( ± dB)
A	31.1	0.10
C	30.5	0.10
Z	35.0	0.10

### 4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Responce curve			UNCERTAINTY  ( ± dB)	Acceptance Limit ( ± dB)	Result
	A	C	Z			
FAST / 37-139	(dB)	(dB)	(dB)	0.60 0.60 0.60 0.70	1.5 1.0 3.0 5.0	Pass Pass Pass Pass1
STD Setting	(dB)	(dB)	(dB)			
125 Hz	0.0	0.1	0.1			
1000 Hz	0.0	0.0	0.0			
4000 Hz	1.1	1.1	1.1			
8000 Hz	2.6	2.5	2.6			

Certificate No : 24-SLM-235

Request No : Req-2024-1454

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency			UNCERTAINTY	Acceptance	Result
FAST / 37-139	Weighting Response curve				Limit	
STD Setting	A (dB)	C (dB)	Z (dB)	( ± dB)	( ± dB)	
63 Hz	-0.1	0.0	0.1	0.20	2.0	Pass
125 Hz	-0.1	0.0	0.0		1.5	Pass
250 Hz	-0.1	0.0	0.0		1.5	Pass
500 Hz	0.0	0.1	0.0		1.5	Pass
1000 Hz	0.0	0.0	0.0		1.0	Pass
2000 Hz	0.0	0.1	0.0		2.0	Pass
4000 Hz	0.0	-0.1	0.0		3.0	Pass
8000 Hz	-0.1	-0.1	0.0		5.0	Pass
16000 Hz	-0.1	-0.1	-0.1		+5, -INF.	Pass

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	Result
FAST / 37-139		UUC	ERR			
UUC Weighting	(dB)	(dB)	(dB)	( ± dB)	( ± dB)	
A	114.00	114.0	0.0	0.20	0.20	Pass
C	114.00	114.0	0.0		0.20	Pass
Z	114.00	114.0	0.0		0.20	Pass

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	Result
37-139 / A		UUC	ERR			
UUC Time Response	(dB)	(dB)	(dB)	( ± dB)	( ± dB)	
Fast	114.00	114.0	0.0	0.20	0.10	Pass
Slow	114.00	114.0	0.0		0.10	Pass
Leq	114.00	114.0	0.0		0.10	Pass

Certificate No : 24-SLM-235

Request No : Req-2024-1454

### 7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)	( ± dB)	( ± dB)	
Initial	114.0			
Final	114.0			
Deviated	0.0	0.10	0.30	Pass

### 8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	REF	UUC	ERR		Limit	
STD dB	(dB)	(dB)	(dB)	( ± dB)	( ± dB)	
139.00	139	139.0	0.0	0.30	1.1	Pass
134.00	134	134.0	0.0		1.1	Pass
129.00	129	129.0	0.0		1.1	Pass
124.00	124	124.0	0.0		1.1	Pass
119.00	119	119.0	0.0		1.1	Pass
114.00	114	114.0	0.0		1.1	Pass
109.00	109	109.0	0.0		1.1	Pass
104.00	104	104.0	0.0		1.1	Pass
99.00	99	99.0	0.0		1.1	Pass
94.00	94	94.0	0.0		1.1	Pass
89.00	89	89.0	0.0		1.1	Pass
84.00	84	84.0	0.0		1.1	Pass
79.00	79	79.0	0.0		1.1	Pass
74.00	74	74.0	0.0		1.1	Pass
69.00	69	69.0	0.0		1.1	Pass
64.00	64	64.0	0.0		1.1	Pass
59.00	59	59.0	0.0		1.1	Pass
54.00	54	54.0	0.0		1.1	Pass
49.00	49	49.1	0.1		1.1	Pass
44.00	44	44.2	0.2		1.1	Pass
43.00	43	43.3	0.3		1.1	Pass
42.00	42	42.3	0.3		1.1	Pass
41.00	41	41.4	0.4		1.1	Pass

Certificate No : 24-SLM-235

Request No : Req-2024-1454

### 9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	Result
FAST / A	REF	UUC	ERR		Limit	
UUC Range	(dB)	(dB)	(dB)	( $\pm$ dB)	( $\pm$ dB)	
37-139	46.40	46.5	0.1	0.30	1.1	Pass
	114	114.0	0.0		1.1	Pass

### 10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance	Result
A / 37-139	Toneburst	Ref	UUC	ERR		Limit	
UUC Time Response	(ms)	(dB)	(dB)	(dB)	( $\pm$ dB)	( $\pm$ dB)	
Fast	200	135.0	134.9	-0.1	0.20	1.0	Pass
	2	118.0	117.6	-0.4		+1.0, -2.5	Pass
	0.25	109.0	108.5	-0.5		+1.5, -5.0	Pass
Slow	200	128.6	128.4	-0.2		1.0	Pass
	2	109.0	108.8	-0.2		+1.0, -5.0	Pass
SEL	200	129.0	129.0	0.0		1.0	Pass
	2	109.0	108.8	-0.2		+1.0, -2.5	Pass
	0.25	100.0	99.7	-0.3		+1.5, -5.0	Pass

### 11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY	Acceptance	Result
FAST / C / 95-142	REF	UUC	ERR		Limit	
STD Setting	(dB)	(dB)	(dB)	( $\pm$ dB)	( $\pm$ dB)	
Complete cycle	137.4	136.8	-0.60	0.20	3.0	Pass
Positive half cycle	136.4	136.2	-0.20		2.0	Pass
Negative half cycle	136.4	136.2	-0.20		2.0	Pass

Certificate No : 24-SLM-235

Request No : Req-2024-1454

## 12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC	( ± dB)	Limit	
STD Setting	(dB)		( ± dB)	
Positive one-half cycle	145.4			
Negative one-half cycle	145.3			
Deviated	0.1	0.20	1.5	Pass

## 13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC	( ± dB)	Limit	
STD Setting	(dB)		( ± dB)	
Initial	138.0			
Final	138.0			
Deviated	0.0	0.10	0.30	Pass

## Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at >4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C Sound level	0.35 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

- Acceptance limit and Maximum-permitted Uncertainty was IEC 61672-1:2013

Certificate No : 24-SLM-235

Request No : Req-2024-1454

### Decision Rule for Statements of Conformity

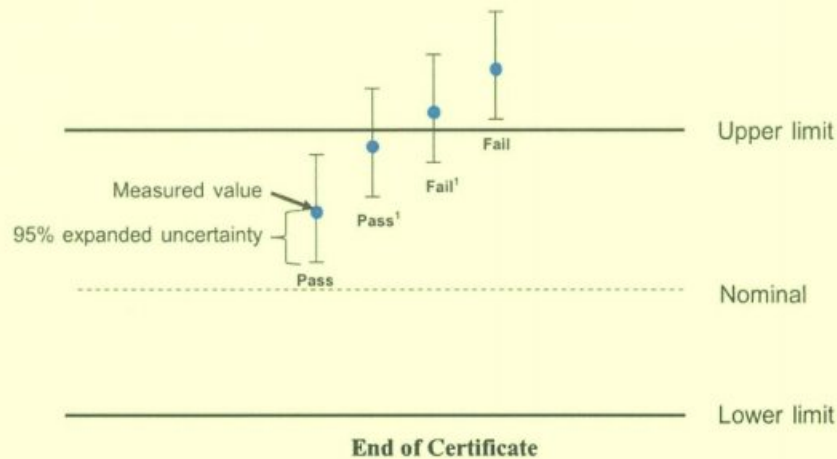
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

Pass<sup>1</sup> = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail<sup>1</sup> = 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.



## 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 : 24-SLM-237

Request No : Req-2024-1456

### Unit Under Calibration Details

Measurement item : Sound Level Meter  
Manufacturer : Larson Davis  
Model : LxT2  
Serial Number : 0005393  
ID : UAE.EFM.030/2564  
Resolution : 0.1 dB  
Microphone Class : 2  
Microphone Model : 375A04  
Microphone S/N : 329354  
Preamplifier Model : PRMLxT2C  
Preamplifier S/N : 073808  
Instrument Status : Used

### Calibration Environment and Details


Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 1 July 2024  
Calibrated Date : 10 July 2024  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic


### Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	20 August 2024	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	26 July 2024	TSI
Audio Generator	Svantek	Svan401	131	8 October 2024	WK Electric

### 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 : 10 July 2024

Certificate No : 24-SLM-237

Request No : Req-2024-1456

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY  ( ± dB)	Acceptance Limit ( ± dB)	Result
FAST / A / 37-139	Level (dB)	UUC	ERR	UUC	ERR			
Calibrator Setting		(dB)	(dB)	(dB)	(dB)			
1000 Hz 114 dB	113.76	114.3	0.54	113.8	+0.04	0.20	0.30	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 58079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	( ± dB)
A	28.7	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	( ± dB)
A	28.4	0.10
C	28.4	0.10
Z	32.9	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY  ( ± dB)	Acceptance Limit ( ± dB)	Result
	A	C	Z			
FAST / 37-139	(dB)	(dB)	(dB)	0.60 0.60 0.60 0.70	1.5 1.0 3.0 5.0	Pass Pass Pass Pass
STD Setting	(dB)	(dB)	(dB)			
125 Hz	0.0	0.1	0.1			
1000 Hz	0.0	0.0	0.0			
4000 Hz	0.6	0.6	0.6			
8000 Hz	0.3	0.3	0.4			

Certificate No : 24-SLM-237

Request No : Req-2024-1456

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency			UNCERTAINTY	Acceptance	Result
FAST / 37-139	Weighting Response curve				Limit	
STD Setting	A (dB)	C (dB)	Z (dB)	( ± dB)	( ± dB)	
63 Hz	-0.1	0.0	0.0	0.20	2.0	Pass
125 Hz	-0.1	0.0	0.0		1.5	Pass
250 Hz	-0.1	0.0	0.0		1.5	Pass
500 Hz	0.0	0.0	0.0		1.5	Pass
1000 Hz	0.0	0.0	0.0		1.0	Pass
2000 Hz	0.0	0.1	0.0		2.0	Pass
4000 Hz	0.0	0.0	0.0		3.0	Pass
8000 Hz	0.0	0.0	0.0		5.0	Pass
16000 Hz	-0.1	-0.1	-0.1		+5, -INF.	Pass

6. Frequency and time weightings at 1kHz

UUC Setting	STD REF (dB)	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
FAST / 37-139		UUC (dB)	ERR (dB)			
UUC Weighting						
A	114.00	114.0	0.0	0.20	0.20	Pass
C	114.00	114.0	0.0		0.20	Pass
Z	114.00	114.0	0.0		0.20	Pass

UUC Setting	STD REF (dB)	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
37-139 / A		UUC (dB)	ERR (dB)			
UUC Time Response						
Fast	114.00	114.0	0.0	0.20	0.10	Pass1
Slow	114.00	114.0	0.0		0.10	Pass1
Leq	114.00	114.0	0.0		0.10	Pass1

Certificate No : 24-SLM-237

Request No : Req-2024-1456

### 7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)	( ± dB)	( ± dB)	
Initial	114.0			
Final	114.0			
Deviated	0.0	0.10	0.30	Pass

### 8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	REF	UUC	ERR		Limit	
STD dB	(dB)	(dB)	(dB)	( ± dB)	( ± dB)	
139.00	139	139.0	0.0	0.30	1.1	Pass
134.00	134	134.0	0.0		1.1	Pass
129.00	129	129.0	0.0		1.1	Pass
124.00	124	124.0	0.0		1.1	Pass
119.00	119	119.0	0.0		1.1	Pass
114.00	114	114.0	0.0		1.1	Pass
109.00	109	109.0	0.0		1.1	Pass
104.00	104	104.0	0.0		1.1	Pass
99.00	99	99.0	0.0		1.1	Pass
94.00	94	94.0	0.0		1.1	Pass
89.00	89	89.0	0.0		1.1	Pass
84.00	84	84.0	0.0		1.1	Pass
79.00	79	79.0	0.0		1.1	Pass
74.00	74	74.0	0.0		1.1	Pass
69.00	69	69.0	0.0		1.1	Pass
64.00	64	64.0	0.0		1.1	Pass
59.00	59	59.0	0.0		1.1	Pass
54.00	54	54.0	0.0		1.1	Pass
49.00	49	49.0	0.0		1.1	Pass
44.00	44	44.1	0.1		1.1	Pass
39.00	39	39.4	0.4		1.1	Pass
38.00	38	38.5	0.5		1.1	Pass

Certificate No : 24-SLM-237

Request No : Req-2024-1456

### 9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY  ( ± dB)	Acceptance	Result
FAST / A	REF	UUC	ERR		Limit	
UUC Range	(dB)	(dB)	(dB)		( ± dB)	
37-139	43.80	43.9	0.1	0.30	1.1	Pass
	114	114.0	0.0		1.1	Pass

### 10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY  ( ± dB)	Acceptance	Result
A / 37-139	Toneburst	Ref	UUC	ERR		Limit	
UUC Time Response	(ms)	(dB)	(dB)	(dB)		( ± dB)	
Fast	200	135.0	134.9	-0.1	0.20	1.0	Pass
	2	118.0	117.9	-0.1		+1.0, -2.5	Pass
	0.25	109.0	108.7	-0.3		+1.5, -5.0	Pass
Slow	200	128.6	128.4	-0.2		1.0	Pass
	2	109.0	108.8	-0.2		+1.0, -5.0	Pass
SEL	200	129.0	129.0	0.0		1.0	Pass
	2	109.0	109.1	+0.1		+1.0, -2.5	Pass
	0.25	100.0	99.9	-0.1		+1.5, -5.0	Pass

### 11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY  ( ± dB)	Acceptance	Result
FAST / C / 95-142	REF	UUC	ERR		Limit	
STD Setting	(dB)	(dB)	(dB)		( ± dB)	
Complete cycle	137.4	136.8	-0.60	0.20	3.0	Pass
Positive half cycle	136.4	136.2	-0.20		2.0	Pass
Negative half cycle	136.4	136.2	-0.20		2.0	Pass

Certificate No : 24-SLM-237

Request No : Req-2024-1456

## 12. Overload indication

UUC Setting	Measured	UNCERTAINTY  ( ± dB)	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)		( ± dB)	
Positive one-half cycle	142.6			
Negative one-half cycle	142.6			
Deviated	0.0	0.20	1.5	Pass

## 13. High Level Stability

UUC Setting	Measured	UNCERTAINTY  ( ± dB)	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)		( ± dB)	
Initial	138.0			
Final	138.0			
Deviated	0.0	0.10	0.30	Pass

### Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at >4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C Sound level	0.35 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

- Acceptance limit and Maximum-permitted Uncertainty was IEC 61672-1:2013

Certificate No : 24-SLM-237

Request No : Req-2024-1456

### Decision Rule for Statements of Conformity

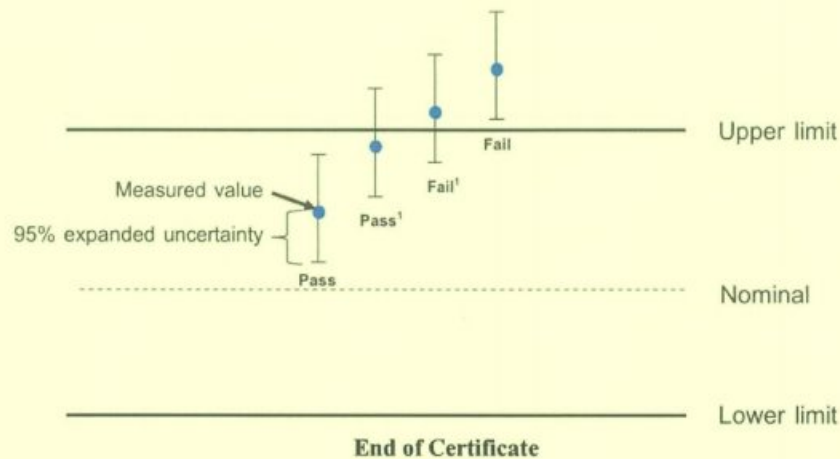
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

Pass<sup>1</sup> = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail<sup>1</sup> = 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.






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.: 24CH1422

Page.: 1 of 3

**Equipment :** pH Meter  
**Manufacturer :** EcoSense  
**Model :** pH100A  
**Serial No. :** 24H005160JEN  
**ID No. :** UAE.EFM.042/2567(EFM.pH.05/67)  
**Condition As-Received:** Used Item  
**Received Date :** 13 November 2024  
**Calibration Date :** 14-15 November 2024  
**Reference :** 2411-0421WSC-5  
**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  
11/14/2025 12:00:00 AM  
  
**Calibrated by :** Warakorn Lerngagtrakul  
  
**Approved by :** \_\_\_\_\_  
Approved Signatory  
  
( ) Unnophol Harachai  
( ) Ponpan Paipim  
(✓) Saithip Meangmai  
  
**Issue Date :** 20 November 2024

The Uncertainties are for a confidence probability of approximately 95%

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

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Cert.No.: 24CH1422

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 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 4.008	CPA chem	1034203	27 Sep 2026
pH 6.999	Hach Lenge GmbH	C03145	28 Feb 2026
pH 10.010	CPA chem	1034205	27 Sep 2025

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.: 24H005160JEN	4.00	177.48	177	4.01	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-177	10.01	0.58	2.00

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Cert.No.: 24CH1422

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.: 240904SIA605377	4.008	4.01	173	0.0071	2.00
	6.999	7.00	0	0.0092	2.00
	6.999	7.00	0	0.0085	2.00
	10.010	10.01	-173	0.0085	2.00

**Function : Temperature Measurement****(\*) Without adjustment**

This equipment was connected with Temperature Probe;

- Model : -  
- Serial No. : 240904SIA605377

Dimension of probe

- Length : 110 mm.  
- Diameter : 12 mm.  
- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement ( $\pm$ °C)	Coverage factor $k$
15.0	15.002	15.1	0.098	0.13	2.00
30.0	30.002	30.0	-0.002	0.13	2.00
45.0	45.003	44.8	-0.203	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 %.

-o0o-

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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 : 24-SLM-214

Request No : Req-2024-1379

### Unit Under Calibration Details

Measurement item :	Sound Level Meter	Microphone Class :	2
Manufacturer :	Larson Davis	Microphone Model :	375A04
Model :	LxT2	Microphone S/N :	328675
Serial Number :	0005398	Preamplifier Model :	PRMLxT2C
ID :	UAE.EFM.035/2564	Preamplifier S/N :	073793
Resolution :	0.1 dB	Instrument Status :	Used

### Calibration Environment and Details


Temperature :  $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$   
Humidity :  $50\% \text{RH} \pm 20\% \text{RH}$   
Barometric Pressure :  $1013 \text{ hPa} \pm 10 \text{ hPa}$   
Received Date : 24 June 2024  
Calibrated Date : 2 July 2024  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic


### Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	20 August 2024	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	26 July 2024	TSI
Audio Generator	Svantek	Svan401	131	8 October 2024	WK Electric

### 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 : 2 July 2024

Certificate No : 24-SLM-214

Request No : Req-2024-1379

### 1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR			
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)			
1000 Hz 114 dB	113.76	114.0	0.24	113.8	+0.04	0.20	0.30	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 58079

### 2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	( $\pm$ dB)
A	28.8	0.10

### 3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	( $\pm$ dB)
A	28.1	0.10
C	27.9	0.10
Z	32.1	0.10

### 4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Responce curve			UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
FAST / 37-139	A	C	Z			
STD Setting	(dB)	(dB)	(dB)			
125 Hz	-0.1	0.1	0.1	0.60	1.5	Pass
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass
4000 Hz	0.6	0.6	0.6	0.60	3.0	Pass
8000 Hz	0.5	0.4	0.4	0.70	5.0	Pass

Certificate No : 24-SLM-214

Request No : Req-2024-1379

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency			UNCERTAINTY  ( ± dB)	Acceptance	Result
FAST / 37-139	Weighting Response curve				Limit	
STD Setting	A (dB)	C (dB)	Z (dB)		( ± dB)	
63 Hz	-0.1	0.0	0.0	0.20	2.0	Pass
125 Hz	-0.1	0.0	0.0		1.5	Pass
250 Hz	-0.1	0.0	0.0		1.5	Pass
500 Hz	0.0	0.0	0.0		1.5	Pass
1000 Hz	0.0	0.0	0.0		1.0	Pass
2000 Hz	0.1	0.1	0.0		2.0	Pass
4000 Hz	0.0	0.0	0.1		3.0	Pass
8000 Hz	0.0	0.0	0.1		5.0	Pass
16000 Hz	0.0	0.0	-0.1		+5, -INF.	Pass

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)	Result
FAST / 37-139		UUC	ERR			
UUC Weighting	(dB)	(dB)	(dB)			
A	114.00	114.0	0.0	0.20	0.20	Pass
C	114.00	114.0	0.0		0.20	Pass
Z	114.00	114.0	0.0		0.20	Pass

UUC Setting	STD	Measured		UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)	Result
37-139 / A		UUC	ERR			
UUC Time Response	(dB)	(dB)	(dB)			
Fast	114.00	114.0	0.0	0.20	0.10	Pass1
Slow	114.00	114.0	0.0		0.10	Pass1
Leq	114.00	114.0	0.0		0.10	Pass1

Certificate No : 24-SLM-214

Request No : Req-2024-1379

## 7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance	
FAST / A / 37-139	UUC		Limit	Result
STD Setting	(dB)	( ± dB)	( ± dB)	
Initial	114.0			
Final	114.0			
Deviated	0.0	0.10	0.30	Pass

## 8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY	Acceptance	
FAST / A / 37-139	REF	UUC	ERR		Limit	Result
STD dB	(dB)	(dB)	(dB)	( ± dB)	( ± dB)	
139.00	139	139.0	0.0	0.30	1.1	Pass
134.00	134	134.0	0.0		1.1	Pass
129.00	129	129.0	0.0		1.1	Pass
124.00	124	124.0	0.0		1.1	Pass
119.00	119	119.0	0.0		1.1	Pass
114.00	114	114.0	0.0		1.1	Pass
109.00	109	109.0	0.0		1.1	Pass
104.00	104	104.0	0.0		1.1	Pass
99.00	99	99.0	0.0		1.1	Pass
94.00	94	93.9	-0.1		1.1	Pass
89.00	89	88.9	-0.1		1.1	Pass
84.00	84	83.9	-0.1		1.1	Pass
79.00	79	78.9	-0.1		1.1	Pass
74.00	74	73.9	-0.1		1.1	Pass
69.00	69	68.9	-0.1		1.1	Pass
64.00	64	63.9	-0.1		1.1	Pass
59.00	59	58.9	-0.1		1.1	Pass
54.00	54	53.9	-0.1		1.1	Pass
49.00	49	49.0	0.0		1.1	Pass
44.00	44	44.0	0.0		1.1	Pass
39.00	39	39.3	0.3		1.1	Pass
38.00	38	38.4	0.4		1.1	Pass

Certificate No : 24-SLM-214

Request No : Req-2024-1379

### 9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	Result
FAST / A	REF	UUC	ERR	( ± dB)	Limit	
UUC Range	(dB)	(dB)	(dB)		( ± dB)	
37-139	43.60	43.7	0.1	0.30	1.1	Pass
	114	114.0	0.0		1.1	Pass

### 10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance	Result
A / 37-139	Toneburst	Ref	UUC	ERR	( ± dB)	Limit	
UUC Time Response	(ms)	(dB)	(dB)	(dB)		( ± dB)	
Fast	200	135.0	135.0	0.0	0.20	1.0	Pass
	2	118.0	117.8	-0.2		+1.0, -2.5	Pass
	0.25	109.0	108.6	-0.4		+1.5, -5.0	Pass
Slow	200	128.6	128.5	-0.1		1.0	Pass
	2	109.0	108.9	-0.1		+1.0, -5.0	Pass
SEL	200	129.0	129.0	0.0		1.0	Pass
	2	109.0	109.0	0.0		+1.0, -2.5	Pass
	0.25	100.0	99.8	-0.2		+1.5, -5.0	Pass

### 11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY	Acceptance	Result
FAST / C / 95-142	REF	UUC	ERR	( ± dB)	Limit	
STD Setting	(dB)	(dB)	(dB)		( ± dB)	
Complete cycle	137.4	136.7	-0.70	0.20	3.0	Pass
Positive half cycle	136.4	136.2	-0.20		2.0	Pass
Negative half cycle	136.4	136.2	-0.20		2.0	Pass

Certificate No : 24-SLM-214

Request No : Req-2024-1379

## 12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC	( ± dB)	Limit	
STD Setting	(dB)		( ± dB)	
Positive one-half cycle	142.0			
Negative one-half cycle	142.1			
Deviated	-0.1	0.20	1.5	Pass

## 13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC	( ± dB)	Limit	
STD Setting	(dB)		( ± dB)	
Initial	138.0			
Final	138.0			
Deviated	0.0	0.10	0.30	Pass

### Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at >4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C Sound level	0.35 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

- Acceptance limit and Maximum-permitted Uncertainty was IEC 61672-1:2013

Certificate No : 24-SLM-214

Request No : Req-2024-1379

### Decision Rule for Statements of Conformity

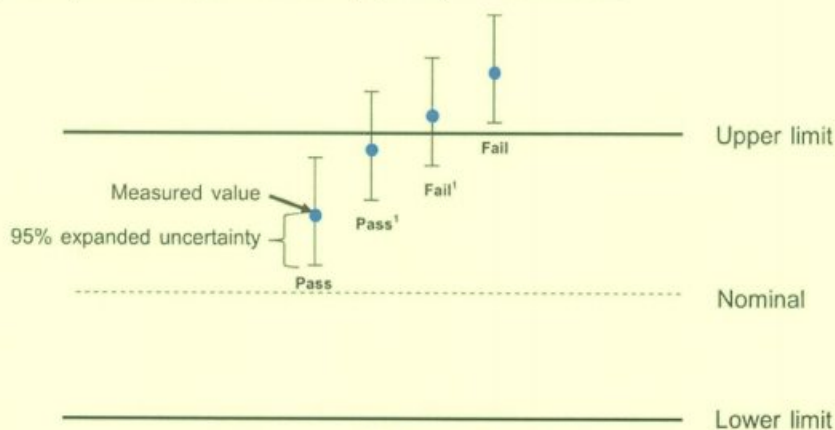
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

Pass<sup>1</sup> = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail<sup>1</sup> = 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 Certificate

## 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 : 24-AFM-156

Request No : Req-2024-1575

### Unit Under Calibration Details

Measurement Item : Air Flow Meter  
Manufacturer : TSI Accuracy : 2% of Reading  
Model : 4146 Sensor Model : -  
Serial Number : 41462327002 Sensor Serial Number : -  
ID : UAE.EFM.125/2566 Instrument Status : Used  
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 : 15 July 2024  
Calibration Date : 19 August 2024  
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 Low flow	18501010006	Sensidyne	6 August 2025
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	2 August 2025
Temperature meter	GT 11	08000057	Qreborn	1 March 2025
Pressure meter	CPG2400	41000KDU/651882	TPA	9 November 2024

### Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01

### 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 : me  
Mr. Noppadon Luangart  
Service Calibration Engineer

Approved By : ป. 57  
Mr. Pacit Mathavorn  
Calibration Engineer Supervisor

Issue Date : 27 August 2024

**เอกสารไม่ควบคุม**

Certificate No : 24-AFM-156

Request No : Req-2024-1575

**Result of Calibration : Without Adjustment**

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Uncertainty (l/min)	MPE (l/min)	Result
21.50	100.55	0.020	0.021	0.001	0.0013	0.005	N/A
21.30	100.53	0.050	0.052	0.002	0.0033	0.005	N/A
21.40	100.56	0.099	0.101	0.002	0.0028	0.005	N/A
21.30	100.58	0.200	0.204	0.004	0.0056	0.005	N/A
21.50	100.54	0.500	0.505	0.005	0.007	0.010	N/A
21.60	100.52	1.000	1.019	0.019	0.014	0.020	N/A
21.40	100.58	1.698	1.731	0.033	0.024	0.034	N/A
21.70	100.63	1.999	2.037	0.038	0.029	0.040	N/A
21.60	100.64	2.998	3.057	0.059	0.043	0.060	N/A
22.00	100.80	4.002	4.079	0.077	0.056	0.080	N/A
22.30	100.96	5.001	5.094	0.093	0.072	0.100	N/A

**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 :

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

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

\* Indicates non accredited

MPE = Maximum Permissible Error (Specified in Manufacturer's Specifications)

N/A = Not Available, Customer does not require a statement of conformity.

**เอกสารไม่ควบคุม**

Certificate No : 24-AFM-156

Request No : Req-2024-1575

### Decision Rule for Statements of Conformity

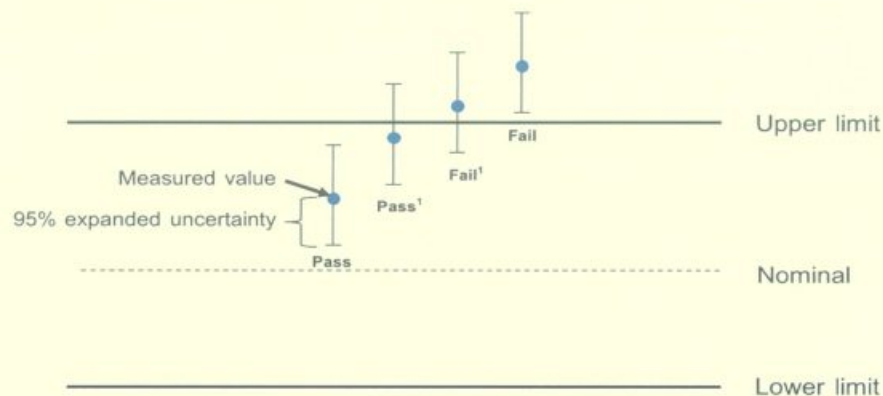
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

Pass<sup>1</sup> = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail<sup>1</sup> = 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 Certificate

**เอกสารไม่ควบคุม**



## Certificate of Calibration

Certificate No. : 24P1370

Page : 1 of 2

**Equipment :** Aneroid Barometer  
**Manufacturer:** Barigo  
**Model :** 111MS  
**Serial No.:** -  
**ID No.:** UAE.EMA2.065/2552

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

**Condition As-Received:** Used Item

**Received Date:** 05 April 2024

**Calibration Date:** 22 April 2024

**Reference:** 2404-0243WSC

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

**Ambient Temperature:** ( 23 ± 2 ) °C

**Relative Humidity:** ( 50 ± 15 ) %

**Atmospheric Pressure:** 1007 mbar

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-0094-23	03 May 2024

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 :** Suksan Khankaew  
**Issue Date :** 23 April 2024

**Approved Signatory :** \_\_\_\_\_  
[ ] Phalinee Prabpaipal  
[ ] Sura Suwannasri  
[✓] Attapol Panurach

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Cert.No.: 24P1370

Page: 2 of 2

**Result of calibration:- Without adjustment**

**Range :** 720 mmHg to 770 mmHg

**Function:- Absolute Pressure Measurement**

**Scale Interval :** 1 mmHg ( The Fifth Estimate )

**Increasing Pressure**

Applied Pressure (mmHg)	715.75	726.88	738.53	749.84	761.99	774.19
UUC* Indication (mmHg)	720.0	730.0	740.0	750.0	760.0	770.0
Error (mmHg)	4.25	3.12	1.47	0.16	-1.99	-4.19

**Decreasing Pressure**

Applied Pressure (mmHg)	774.19	761.85	749.40	738.00	726.53	715.75
UUC* Indication (mmHg)	770.0	760.0	750.0	740.0	730.0	720.0
Error (mmHg)	-4.19	-1.85	0.60	2.00	3.47	4.25

The uncertainty of measurement was  $\pm 0.24$  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. : 24H1486

Page : 1 of 2

Equipment : Digital Thermo-Hygrometer  
Manufacturer: Digicon  
Model : TH-02A  
Serial No.: 435031147  
ID No.: UAE.EFM.005/2567  
Condition As-Received: New Item  
Received Date: 10 July 2024  
Calibration Date: 15 July 2024  
to 17 July 2024  
Reference: 2407-0393WSC  
Ambient Temperature: ( 25  $\pm$  3 ) °C  
Relative Humidity: ( 50  $\pm$  20 ) %

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

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 :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Chilled Mirror Hygrometer Sensor	Dew Prime II	31863	21819	25 Sep 2024
2) Handheld Thermometer With Sensor	1523	5717096	2311321	08 Nov 2024

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 : Surasit Phansudnoi  
Issue Date : 17 July 2024

Approved Signatory :

Viporn

[ ] Chakrit Waewwanjua

[✓] Viporn Tantiyawutti

[ ] Unnopphol Harachai

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Cert. No.: 24H1486

Page.: 2 of 2

**Result of Calibration:-** Without Adjustment

**Function:** Humidity Measurement.

<u>Reference</u> <u>Temperature</u> (°C)	<u>Standard</u> <u>Humidity</u> (%R.H.)	<u>UUC*</u> <u>Reading</u> (%R.H.)	<u>Error</u> (%R.H.)	<u>Uncertainty</u> <u>of Measurement</u> (±%R.H.)
25.0	40.1	39	-1.1	1.4
25.0	50.1	48	-2.1	1.6
25.0	60.0	58	-2.0	1.6
25.0	70.2	69	-1.2	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>Error</u> (°C)	<u>Uncertainty</u> <u>of Measurement</u> (±°C)
20.014	20.3	0.286	0.42
24.984	25.2	0.216	0.42
30.050	30.2	0.150	0.42
40.027	40.1	0.073	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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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

**เอกสารไม่ควบคุม**

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

**เอกสารไม่ควบคุม**

Certificate No : 25-ACT-040

Request No : Req-2025-0481

### Decision Rule for Statements of Conformity

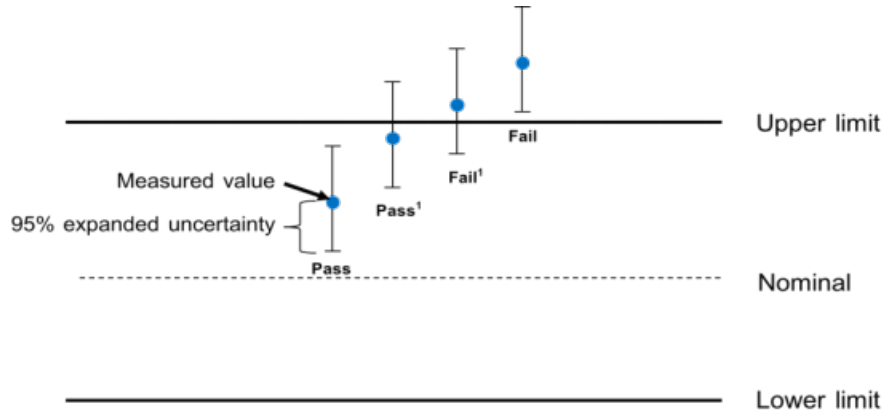
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Fail = The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



End of Calibration

**เอกสารไม่ควบคุม**

Cert. No. : ACL25113

Pages : 1 of 8

## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42 / Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 00408980 / 186170 / 90425  
**ID No.:** UAE.EFM.007/2564

**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 :** 14 JANUARY 2025  
**Calibration Date :** 28 JANUARY 2025  
**Date of Issue :** 30 JANUARY 2025

**Calibrated by :**

Nathakorn Pisutpaisan

**Approved by :**

  
( Thanakul Petchurai )

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.

**เอกสารไม่ควบคุม**

**Cert. No. : ACL25114**  
**Job No. : VC68AC0061**  
**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 :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL.BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL.BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL.BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

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).

**เอกสารไม่ควบคุม**

*T. Petch...*

Cert. No. : ACL25114  
Job No. : VC68AC0061  
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

Cert. No. : ACL25114  
Job No. : VC68AC0061  
Page : 4 of 8

**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 )
14.8

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

Frequency Weighting	Weighting ( dB )
A - weight	11.6
C - weight	17.7
Flat	23.6

**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	0.3	0.3	± 1.5
1000	0.2	0.2	0.2	± 1.0
8000	2.4	2.4	2.4	±5.0

Cert. No. : ACL25114

Job No. : VC68AC0061

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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	0.0	±2.0
125	0.1	0.1	0.0	±1.5
250	0.1	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	0.0	0.0	±3.0
8000	0.0	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	94.0	0.0	± 0.3

เอกสารไม่ควบคุม

*J. Ketch.*

Cert. No. : ACL25114  
Job No. : VC68AC0061  
Pages : 6 of 8

**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	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 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	53.9	-0.1	± 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	28.1	0.1	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.2	0.2	± 1.1

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T. R. Ch.

Cert. No. : ACL25114  
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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	29.0	0.0	±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	107.9	-0.1	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	1.5 ; -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	128.1	0.1	±1.0

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*T. Reksa*

Cert. No. : ACL25114  
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**10. Peak C sound level**

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, L <sub>peak</sub> ( 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	132.9	-0.1	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

**11. Overload indication**

Measured value ( dB )		Deviated Value ( dB )	Acceptance Limits ( dB )
Positive one-half cycle	Negative one-half cycle		
89.5	89.5	0.0	±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

เอกสารไม่ควบคุม  
*[Signature]*

**Cert. No. : ACL25034**

**Pages : 1 of 8**

## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42 / Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 01010786 / 194541 / 14664  
**ID No.:** UAE.EFM.089/2565

**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 :** 03 JANUARY 2025  
**Calibration Date :** 13 - 14 JANUARY 2025  
**Date of Issue :** 15 JANUARY 2025

**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :**

  
( Thanakul Petchurai )

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.

**เอกสารไม่ควบคุม**

**Cert. No. : ACL25034**  
**Job No. : VC68AC0056**  
**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 :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL.BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL.BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL.BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25

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).

**เอกสารไม่ควบคุม**  
*F. K. K.*

Cert. No. : ACL25034  
Job No. : VC68AC0056  
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

**เอกสารไม่ควบคุม**  
*Z. K. P. N.*

Cert. No. : ACL25034  
Job No. : VC68AC0056  
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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 )
14.4

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

Frequency Weighting	Weighting ( dB )
A - weight	10.8
C - weight	17.2
Flat	23.0

**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	0.3	± 1.5
1000	0.2	0.2	0.2	± 1.0
8000	1.0	1.1	1.1	±5.0

Cert. No. : ACL25034

Job No. : VC68AC0056

Pages : 5 of 8

#### 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	-0.1	-0.1	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	-0.1	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.0	±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	± 0.2

เอกสารไม่ควบคุม

*[Signature]*

Cert. No. : ACL25034  
Job No. : VC68AC0056  
Pages : 6 of 8

**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	28.1	0.1	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.1	0.1	± 1.1

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*[Signature]*

Cert. No. : ACL25034  
Job No. : VC68AC0056  
Pages : 7 of 8

**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	29.0	0.0	±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	1.5 ; -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

Cert. No. : ACL25034  
Job No. : VC68AC0056  
Pages : 8 of 8

**10. Peak C sound level**

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, Lcpeak ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	130.0	130.0	0.0	±3.0
One	133.4	133.3	-0.1	±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	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

**11. Overload indication**

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

เอกสารไม่ควบคุม  
*S. Keron*

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.      Certificate No : 24-NDM-105  
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260      Request No : Req-2024-0726

Unit Under Calibration Details

Measurement item : Noise Dosimeter      Microphone Class : 2  
Manufacturer : SVANTEK      Microphone Model : SV27  
Model : SV 104      Microphone S/N : 112934  
Serial Number : 117689      Preamplifier Model : -  
ID : UAE.EFM.113/2565      Preamplifier S/N : -  
Resolution : 0.1 dB      Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 15 March 2024  
Calibrated Date : 25 April 2024  
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017  
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	25 July 2024	TSI
Standard Microphone	GRAS	40AN	188273	21 August 2024	GRAS
Sine Generator	Svantek	Svan401	131	9 October 2024	WK Electric
Timer	EXTECH	-	05-ACT	14 March 2025	TPA

**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 : ปัทมา  
Mr. Pacit Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 25 April 2024

Certificate No : 24-NDM-105

Request No : Req-2024-0726

### 1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error		
Calibrator Setting	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(%)	(%)	(%)
1000 Hz 114 dB	120	120	3.18	3.13	-1.6	3.1	-21, +26

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 58079

### 2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances Limit
FAST / 55-140	A	C	( ± dB)	( ± dB)
STD Setting	(dB)	(dB)		
*63 Hz	0.1	0.1	0.40	2.0
125 Hz	-0.2	-0.1	0.40	1.5
250 Hz	0.0	0.1	0.40	1.5
500 Hz	0.0	0.1	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	0.0	0.0	0.40	2.0
4000 Hz	2.1	2.1	0.40	3.0
8000 Hz	0.6	0.6	0.40	5.0

Certificate No : 24-NDM-105  
Request No : Req-2024-0726

3. Linearity of response to steady signals  
a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

UUC Setting		FAST / A / High									
1000 Hz	Ref	(dB)	55.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0
	Level A	(dB)	54.6	80.2	90.2	100.0	110.0	114.0	120.0	130.0	140.0
	Error	(dB)	-0.4	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0
8000 Hz	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9
	Level A	(dB)			89.0	98.9	108.9	112.9	118.9	128.9	138.8
	Error	(dB)			0.1	0.0	0.0	0.0	0.0	0.0	-0.1
63 Hz	Ref	(dB)						87.8	93.8	103.8	113.8
	Level A	(dB)						87.8	93.7	103.7	113.7
	Error	(dB)						0.0	-0.1	-0.1	-0.1
Tolerances Limit		(±dB)	1.0								
UNCERTAINTY		(±dB)	0.3								

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error		Limit
Calibrator Setting							
1000 Hz 110 dB	27	27	0.30	0.30	0.00	5.6	-21, +26
1000 Hz 110 dB	45	45	0.50	0.50	0.00		
1000 Hz 110 dB	90	90	1.00	0.99	-1.00		
1000 Hz 110 dB	180	180	2.00	1.98	-1.00		
1000 Hz 120 dB	36	36	4.00	4.03	+0.75		
1000 Hz 120 dB	72	72	8.00	8.05	+0.63	5.6	
1000 Hz 120 dB	90	90	10.00	10.13	+1.30		
1000 Hz 120 dB	180	180	20.00	20.22	+1.10		
1000 Hz 120 dB	360	360	40.00	40.34	+0.85		
1000 Hz 120 dB	720	720	80.00	80.49	+0.61		



Certificate No : 24-NDM-105

Request No : Req-2024-0726

#### 4. Response to short duration

##### a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error		
Calibrator Setting	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)
4000 Hz 95 dB	2846	2846	1.00	0.98	-0.02	0.052	-0.29 - +0.41

##### b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error		
Calibrator Setting	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(%)	(%)	(%)
Burst 1 ms, 95 dB	2846	2846	1.00	0.98	-2.00	5.6	-21 - +26
Burst 1 ms, 100 dB	900	900	1.00	0.98	-2.00		-29 - +41
Burst 1 ms, 108 dB	143	143	1.00	0.99	-1.00		-29 - +41

#### 5. Response to unipolar pulse

UUC Setting	Time	Exposure Measurement		UNCERTAINTY	Tolerances Limit
FAST / A / 55-140	UUC	UUC	Different		
Calibrator Setting	(s)	(Pa <sup>2</sup> h)	(%)	(%)	(%)
Continuous Rectangle +	29	10.37	0.00	3.7	-21 - +26
Continuous Rectangle -		10.37			

\* Indicates non accredited

End of Certificate

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.      Certificate No : 24-NDM-127  
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260      Request No : Req-2024-1030

Unit Under Calibration Details

Measurement item : Noise Dosimeter      Microphone Class : 2  
Manufacturer : SVANTEK      Microphone Model : SV27  
Model : SV 104      Microphone S/N : 112809  
Serial Number : 117690      Preamplifier Model : -  
ID : UAE.EFM.114/2565      Preamplifier S/N : -  
Resolution : 0.1 dB      Instrument Status : Used


Calibration Environment and Details


Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 8 May 2024  
Calibrated Date : 17 May 2024  
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017  
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	25 July 2024	TSI
Standard Microphone	GRAS	40AN	188273	21 August 2024	GRAS
Sine Generator	Svantek	Svan401	131	9 October 2024	WK Electric
Timer	EXTECH	-	05-ACT	14 March 2025	TPA

**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 May 2024

Certificate No : 24-NDM-127  
 Request No : Req-2024-1030

### 1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error		
Calibrator Setting	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(%)	(%)	(%)
1000 Hz 114 dB	120	120	3.23	3.13	-3.1	3.1	-21, +26

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 73249

### 2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances Limit
FAST / 55-140	A	C	(± dB)	(± dB)
STD Setting	(dB)	(dB)		
*63 Hz	0.1	0.1	0.40	2.0
125 Hz	0.0	0.2	0.40	1.5
250 Hz	0.0	0.2	0.40	1.5
500 Hz	0.0	0.3	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	0.1	0.2	0.40	2.0
4000 Hz	1.8	1.9	0.40	3.0
8000 Hz	1.1	1.3	0.40	5.0

Certificate No : 24-NDM-127

Request No : Req-2024-1030

### 3. Linearity of response to steady signals

#### a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

UUC Setting		FAST / A / High									
1000 Hz	Ref	(dB)	55.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0
	Level A	(dB)	54.6	80.4	90.1	100.0	110.0	114.0	120.0	130.0	140.0
	Error	(dB)	-0.4	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0
8000 Hz	Ref	(dB)				88.9	98.9	108.9	112.9	118.9	128.9
	Level A	(dB)				89.0	99.0	108.9	112.9	118.9	128.9
	Error	(dB)				0.1	0.1	0.0	0.0	0.0	-0.1
63 Hz	Ref	(dB)						87.8	93.8	103.8	113.8
	Level A	(dB)						87.8	93.8	103.8	113.8
	Error	(dB)						0.0	0.0	0.0	0.0
Tolerances Limit		(±dB)	1.0								
UNCERTAINTY		(±dB)	0.3								

#### b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error		Limit
Calibrator Setting	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(%)	(%)	(%)
1000 Hz 110 dB	27	27	0.30	0.30	0.00	5.6	-21, +26
1000 Hz 110 dB	45	45	0.50	0.50	0.00		
1000 Hz 110 dB	90	90	1.00	1.01	+1.00		
1000 Hz 110 dB	180	180	2.00	2.02	+1.00		
1000 Hz 120 dB	36	36	4.00	3.94	-1.50	5.6	
1000 Hz 120 dB	72	72	8.00	7.87	-1.63		
1000 Hz 120 dB	90	90	10.00	9.90	-1.00		
1000 Hz 120 dB	180	180	20.00	19.76	-1.20		
1000 Hz 120 dB	360	360	40.00	39.42	-1.45		
1000 Hz 120 dB	720	720	80.00	78.66	-1.68		

Certificate No : 24-NDM-127  
 Request No : Req-2024-1030

#### 4. Response to short duration

##### a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error		Limit
Calibrator Setting	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)
4000 Hz 95 dB	2846	2846	1.00	0.98	-0.02	0.052	-0.29 - +0.41

##### b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error		Limit
Calibrator Setting	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(%)	(%)	(%)
Burst 1 ms, 95 dB	2846	2846	1.00	0.98	-2.00	5.6	-21 - +26
Burst 1 ms, 100 dB	900	900	1.00	0.98	-2.00		-29 - +41
Burst 1 ms, 108 dB	143	143	1.00	0.99	-1.00		-29 - +41

#### 5. Response to unipolar pulse

UUC Setting	Time	Exposure Measurement		UNCERTAINTY	Tolerances
FAST / A / 55-140	UUC	UUC	Different		Limit
Calibrator Setting	(s)	(Pa <sup>2</sup> h)	(%)	(%)	(%)
Continuous Rectangle +	29	10.13	0.00	3.7	-21 - +26
Continuous Rectangle -		10.13			

\* Indicates non accredited

End of Certificate

## 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-NDM-037  
Request No : Req-2025-0195

### Unit Under Calibration Details

Measurement item : Noise Dosimeter  
Manufacturer : SVANTEK  
Model : SV 104  
Serial Number : 117721  
ID : UAE.EFM.118/2565  
Resolution : 0.1 dB  
Microphone Class : 2  
Microphone Model : SV 27  
Microphone S/N : 73696  
Preamplifier Model : -  
Preamplifier S/N : -  
Instrument Status : Used

### Calibration Environment and Details


Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 24 January 2025  
Calibrated Date : 19 February 2025  
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017  
Location of Calibration : Lab Acoustic


### Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Standard Microphone	Bruel&Kjaer	4192	2294985	25 June 2025	NIMT
Audio Generator	Svantek	SVAN 401	131	15 October 2025	WK Electric
Timer	EXTECH	-	05-ACT	14 March 2025	TPA

### 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 : 19 February 2025

Certificate No : 25-NDM-037

Request No : Req-2025-0195

### 1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances	Result
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error			
Calibrator Setting	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(%)	(%)	Limit	
1000 Hz 114 dB	120	120	3.17	3.13	-1.3	3.1	-21, +26	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand Svantek, Model SV 35A, SN. 58079

### 2. Frequency weightings

UUC Setting		Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances Limit	Result
FAST / 55-140	A	C	( ± dB)	( ± dB)		
STD Setting	(dB)	(dB)				
*63 Hz	0.2	0.4	0.40	2.0	Pass	
125 Hz	0.1	0.2	0.40	1.5	Pass	
250 Hz	-0.1	0.0	0.40	1.5	Pass	
500 Hz	-0.1	0.0	0.40	1.5	Pass	
1000 Hz	0.0	0.0	0.40	-	-	
2000 Hz	0.7	0.7	0.40	2.0	Pass	
4000 Hz	1.7	1.6	0.40	3.0	Pass	
8000 Hz	3.0	3.0	0.40	5.0	Pass	

Certificate No : 25-NDM-037

Request No : Req-2025-0195

### 3. Linearity of response to steady signals

#### a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

UUC Setting		FAST / A / High									
1000 Hz	Ref	(dB)	55.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0
	Level A	(dB)	54.5	80.2	90.2	100.1	110.1	114.0	120.0	130.0	140.0
	Error	(dB)	-0.5	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0
8000 Hz	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9
	Level A	(dB)			88.9	98.9	108.9	112.9	118.9	128.8	138.7
	Error	(dB)			0.0	0.0	0.0	0.0	0.0	-0.1	-0.2
63 Hz	Ref	(dB)						87.8	93.8	103.8	113.8
	Level A	(dB)						87.8	93.7	103.7	113.7
	Error	(dB)						0.0	-0.1	-0.1	-0.1
Tolerances Limit		(±dB)	1.0								
UNCERTAINTY		(±dB)	0.3								
Result			Pass								

#### b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances	Result
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error		Limit	
Calibrator Setting	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(%)	(%)	(%)	
1000 Hz 110 dB	27	27	0.30	0.30	0.00	5.6	-21, +26	Pass
1000 Hz 110 dB	45	45	0.50	0.50	0.00			Pass
1000 Hz 110 dB	90	90	1.00	0.99	-1.00			Pass
1000 Hz 110 dB	180	180	2.00	1.98	-1.00			Pass
1000 Hz 120 dB	36	36	4.00	3.94	-1.50			Pass
1000 Hz 120 dB	72	72	8.00	7.87	-1.63	5.6		Pass
1000 Hz 120 dB	90	90	10.00	9.90	-1.00			Pass
1000 Hz 120 dB	180	180	20.00	19.76	-1.20			Pass
1000 Hz 120 dB	360	360	40.00	39.42	-1.45			Pass
1000 Hz 120 dB	720	720	80.00	78.66	-1.68			Pass

**เอกสารไม่ควบคุม**

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

Certificate No : 25-NDM-037

Request No : Req-2025-0195

#### 4. Response to short duration

##### a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (Pa <sup>2</sup> h)	Tolerances Limit (Pa <sup>2</sup> h)	Result
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error			
Calibrator Setting	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)			
4000 Hz 95 dB	2846	2846	1.00	0.98	-0.02	0.052	-0.29 - +0.41	Pass

##### b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)	Result
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error			
Calibrator Setting	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(%)			
Burst 1 ms, 95 dB	2846	2846	1.00	0.98	-2.00	5.6	-21 - +26	Pass
Burst 1 ms, 100 dB	900	900	1.00	0.98	-2.00		-29 - +41	Pass
Burst 1 ms, 108 dB	143	143	1.00	0.99	-1.00		-29 - +41	Pass

#### 5. Response to unipolar pulse

UUC Setting	Time	Exposure Measurement		UNCERTAINTY (%)	Tolerances Limit (%)	Result
FAST / A / 55-140	UUC	UUC	Different			
Calibrator Setting	(s)	(Pa <sup>2</sup> h)	(%)			
Continuous Rectangle +	29	10.37	0.00	3.7	-21 - +26	Pass
Continuous Rectangle -		10.37				Pass

\* Indicates non accredited

Certificate No : 25-NDM-037

Request No : Req-2025-0195

### Decision Rule for Statements of Conformity

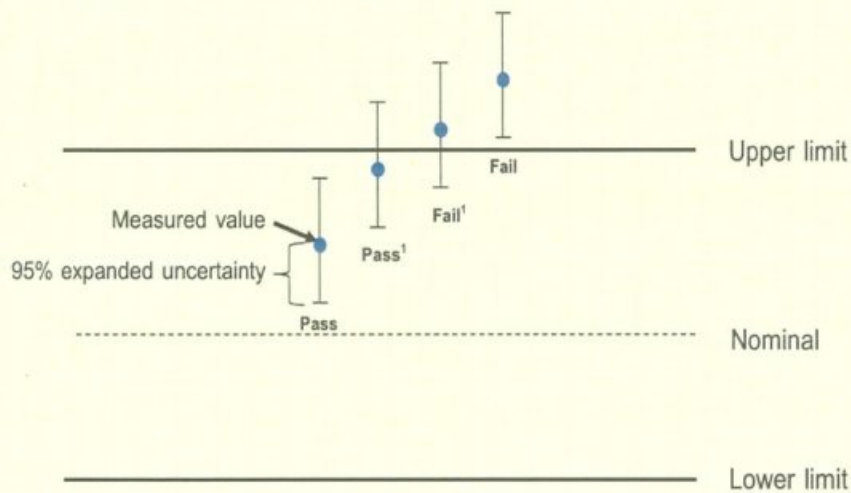
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

Pass<sup>1</sup> = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail<sup>1</sup> = 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 Certificate

**Certificate No:** G 670643

**Date of issue :** 13-Sep-24

**Instrument description :** Flue Gas Analyzer  
**Instrument model :** Testo 350 New  
**Instrument serial no. :** 60723967/609  
**Control unit serial no. :** 03064673/609  
**ID no. or control no. :** UAE.EFM.027/2559  
**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 :** 2 Pages  
**Receiving no. :** L-243478  
**Receiving date. :** 06-Sep-24  
**Parameter of calibration :** Gas Calibration(Oxygen 2.50,10.04,21.02 %vol, Carbon Monoxide 80.18,302,1007 ppm, Nitrogen Dioxide 30.68,81.32,201.9 ppm, Nitric Oxide 30.01,151.5,322.5 ppm, Sulphur Dioxide 50.36,100.8,600.8 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  
**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 tracebility to national standards, which realize measurement according to the International System of Units (SI).*

**Date of calibration :** 13-Sep-24



Mr. Kwanchai Khamdoun  
Calibration Technician



Mrs. Nongluck Wongsettee  
Technical Manager

**Certificate No.:** G 670643

**Standard References (Table 1)**

Standard	Certificate No.	Vendor	Due date
Oxygen ( O <sub>2</sub> ) 2.50 % Vol	2412/23	Linde	27-Aug-27
Oxygen ( O <sub>2</sub> ) 10.04 % Vol	CG-0153-21	Nimt	18-Nov-26
Oxygen ( O <sub>2</sub> ) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide ( CO ) 80.18 ppm	CG-0002-24	Nimt	11-Jan-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 <sub>2</sub> ) 30.68 ppm	2832/24	Linde	08-Sep-26
Nitrogen Dioxide ( NO <sub>2</sub> ) 81.32 ppm	3546/23	Linde	14-Jan-26
Nitrogen Dioxide ( NO <sub>2</sub> ) 201.9 ppm	1975/23	Linde	17-Jul-25
Nitric Oxide ( NO ) 30.01 ppm	CG-0014-23	Nimt	19-Feb-25
Nitric Oxide ( NO ) 151.5 ppm	0161/23	Linde	22-Jan-25
Nitric Oxide ( NO ) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide ( SO <sub>2</sub> ) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide ( SO <sub>2</sub> ) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide ( SO <sub>2</sub> ) 600.8 ppm	2003/23	Linde	17-Jul-25

**Measured room conditions**

Temperature : 22.7 °C Humidity : 61.2 %RH Pressure : 1010.7 mbar

**Calibration conditions**

Gas Temperature : 23 °C Flow rate : 1,200 ml/min Gas pressure : 1013.8 mbar

**Calibration Results (Without adjustment) (Table 2)**

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty ( ± )
O <sub>2</sub> (%Vol)	2.50	2.47	-0.03	0.15
O <sub>2</sub> (%Vol)	10.04	10.11	0.07	0.20
O <sub>2</sub> (%Vol)	21.02	21.12	0.10	0.30
CO (ppm)	80.18	81	0.82	3.0
CO (ppm)	302	304	2	6.0
CO (ppm)	1007	1011	4	12
NO <sub>2</sub> (ppm)	30.68	32.9	2.56	8.0
NO <sub>2</sub> (ppm)	81.32	80.2	-1.12	8.0
NO <sub>2</sub> (ppm)	201.9	204.2	2.3	12
NO (ppm)	30.01	31	0.99	8.0
NO (ppm)	151.5	154	2.5	8.0
NO (ppm)	322.5	324	1.5	12
SO <sub>2</sub> (ppm)	50.36	51	0.64	6.0
SO <sub>2</sub> (ppm)	100.8	100	-0.8	6.0
SO <sub>2</sub> (ppm)	600.8	598	-2.8	13

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

**End of Report**



JIRANATEE ASSOCIATES CO.,LTD.

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

Flow measurement laboratory  
Calibration services department.



## CERTIFICATE OF CALIBRATION

Certificate No. : COF-045-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Top Load Orifice  
MANUFACTURER : TISCH  
MODEL/TYPE : TE-S025A  
SERIAL NUMBER : 3540  
ID NUMBER : UAE.EFM.176/2561  
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 : 24 Oct 2024  
MEASUREMENT DATE : 04 Nov 2024  
ISSUE DATE : 05 Nov 2024

### Calibration procedure:

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

### Traceability:

This certificate provides a traceability of the measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MW-0063-23.

### Uncertainty of Measurement:

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

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

### CALIBRATION CONDITION:

Preconditioning : 24 hours at ambient conditions.  
Measurement Condition : The average values during measurement are  $23.7^{\circ}\text{C}$  and  $49.7\% \text{RH}$ .

**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.

### Calibrated by:

- ☐ Mr. Sorawit Thachalad  
☒ Miss Jittraporn Lertsomphol



Approved signatory: .....

Mr. Parinya Booncharoen  
Calibration Department Manager

**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	$\Delta p_{meter}$ mmHg	$\Delta p_{Orifice}$ inH <sub>2</sub> O	$\gamma$	Standard Flow [ $Q_s$ ] $m^3/min$
1	0.702	755.241	23.67	22.27	57.134	1.612	1.268	0.651
2	1.000	755.312	23.55	22.71	61.321	3.248	1.801	0.920
3	1.117	755.324	23.36	22.72	41.180	4.309	2.075	1.057
4	1.163	755.361	23.37	22.77	30.028	4.806	2.192	1.119
5	1.417	755.397	23.65	23.10	29.199	7.191	2.680	1.363

Slope ( $m$ ): 1.98270  
 Intercept ( $b$ ): -0.02316  
 Correlation coefficient ( $r$ ): 0.99988  
 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	$\Delta p_{meter}$ mmHg	$\Delta p_{Orifice}$ inH <sub>2</sub> O	$\gamma$	Standard Flow [ $Q_a$ ] $m^3/min$
1	0.702	755.241	23.67	22.27	57.134	1.612	0.796	0.652
2	1.000	755.312	23.55	22.71	61.321	3.248	1.129	0.921
3	1.117	755.324	23.36	22.72	41.180	4.309	1.301	1.058
4	1.163	755.361	23.37	22.77	30.028	4.806	1.374	1.119
5	1.417	755.397	23.65	23.10	29.199	7.191	1.681	1.365

Slope ( $m$ ): 1.24186  
 Intercept ( $b$ ): -0.01454  
 Correlation coefficient ( $r$ ): 0.99988  
 Uncertainty ( $k = 2$ ): 0.015  $m^3/min$

\*\*\*End of Certificate of Calibration\*\*\*



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## Certificate of Calibration

Certificate No. : 24P1250

Page : 1 of 2

Equipment : U Tube Manometer

Manufacturer: Dwyer

Model : 1221-36-W/M

Serial No.: -

ID No.: UAE.EFM.076/2566

Condition As-Received: Used Item

Received Date: 03 April 2024

Calibration Date: 10 April 2024

Reference: 2404-0118WSC

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

Ambient Temperature: ( 23 ± 2 ) °C

Relative Humidity: ( 50 ± 15 ) %

Atmospheric Pressure: 1007 mbar

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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-0176-23	12 Sep 2024

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 inH<sub>2</sub>O

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 Certification 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 : 17 April 2024

Approved Signatory :

[ ] Phalinee Prabpaipal

[ ] Sura Suwannasri

[✓] Attapol Panurach

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Cert.No.: 24P1250

Page: 2 of 2

**Result of calibration:- Without adjustment**

**Range :** 0 inH<sub>2</sub>O to 36 inH<sub>2</sub>O

**Function:- Pressure Measurement**

**Scale Interval :** 0.1 inH<sub>2</sub>O ( The Second Estimate )

**Increasing Pressure**

Applied Pressure	High-port side	UUC Indication		$\Delta P$	Error
		Low-port side			
0.00	0.00	0.00		0.00	0.00
2.00	1.00	-1.00		2.00	0.00
4.00	2.00	-2.00		4.00	0.00
6.00	3.00	-3.00		6.00	0.00
8.00	4.00	-4.00		8.00	0.00
10.00	5.05	-4.95		10.00	0.00
12.00	6.05	-5.95		12.00	0.00
14.00	7.05	-6.95		14.00	0.00
16.00	8.10	-7.95		16.05	0.05
18.00	9.10	-8.95		18.05	0.05
20.00	10.10	-9.95		20.05	0.05
22.00	11.10	-10.95		22.05	0.05
24.00	12.10	-11.95		24.05	0.05
26.00	13.15	-12.95		26.10	0.10
28.00	14.15	-13.95		28.10	0.10
30.00	15.20	-14.95		30.15	0.15
32.00	16.20	-15.95		32.15	0.15
34.00	17.20	-16.95		34.15	0.15
35.50	18.00	-17.70		35.70	0.20

The uncertainty of measurement was  $\pm 0.11$  inH<sub>2</sub>O

\*  $\Delta P$  = 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 %.

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MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

214 Bangwaek Rd. Bangpai Bangkae Bangkok 10160  
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 <http://www.mit.in.th>



## CALIBRATION CERTIFICATE

Certificate No. : L202408224-0003

Date Issued : 28-Aug-24

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

**Equipment** : Mass Flow Meter

**Manufacturer** : Alicat Scientific

**Model** : MB-50SCCM-D/5M

**Serial No.** : 202984

**ID No./Tag No.** : UAE.EFM.197/2562

**Date Received** : 19-Aug-24

**Date Calibrated** : 27-Aug-24

**Calibrated by** : Saruth Srichutikul

### Calibration Method or Calibration Procedure Used

In-house method : CP-34 by comparison against mass flow calibrator.

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

### Result of Calibration

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

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Approved by:

*Sarayuth T.*  
(Sarayuth Tochua)



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Certificate No. : L202408224-0003

Environment : Ambient temperature : ( 23  $\pm$  2 ) °C  
Relative humidity : ( 50  $\pm$  15 ) % RH

Capacity Range : 50 ml/min

Calibration Media : Air

Type : Mass Flowmeter

Unit Under Calibration Reference Condition : Pressure 101.325 kPa(abs) , 25 °C , Air

Temperature ( ° C )	Pressure ( kPa )	UUC Reading ( ml/min )	STD Reading ( ml/min )	Error ( ml/min )	Uncertainty ( $\pm$ ml/min )	MPE $\pm$ ( ml/min )	Pass / Fail Simple Acceptance
21.05	100.82	0.00	0.000 *	0.000	0.063	0.100	Pass
22.67	101.37	3.00	3.048	-0.048	0.13	0.124	Pass
22.31	101.35	3.33	3.419	-0.089	0.14	0.127	Pass
21.92	101.58	4.00	4.035	-0.035	0.16	0.132	Pass
21.19	102.57	9.00	9.107	-0.107	0.17	0.172	Pass
20.82	102.84	10.00	10.113	-0.113	0.18	0.180	Pass

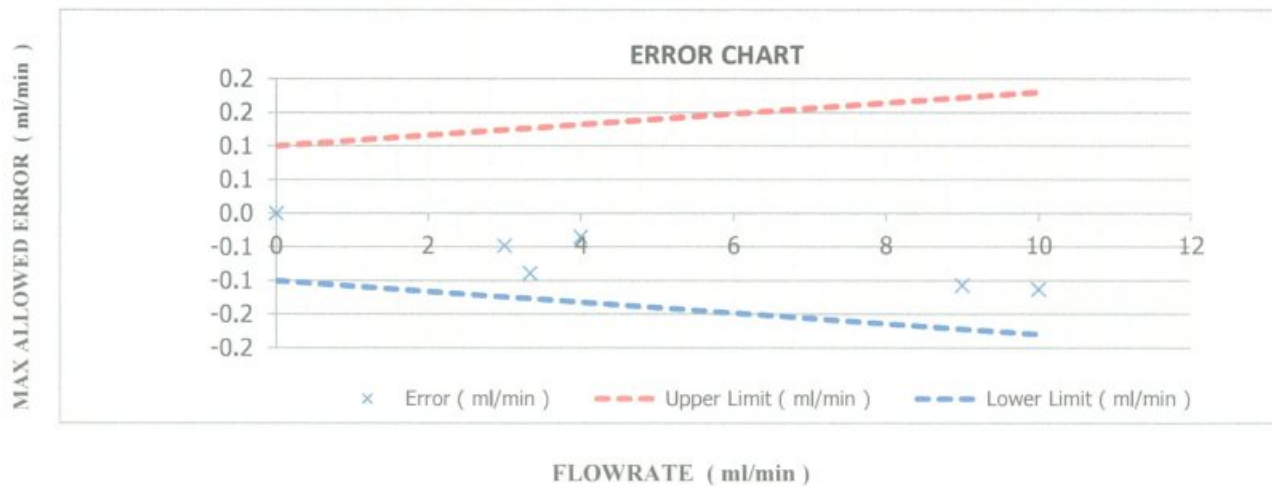
Error = Unit Under Calibration - Standard

Pass = |error| $\leq$  |MPE|

MPE = Maximum Permissible Error

Fail = |error| > |MPE|

Marked \* are not included in the NSC-ONSC accreditation schedule for our laboratory.



Certificate No. : L202408224-0003

**Note :** The actual flow rate is determined by the equation :

$$Q_{Meas} = Q_{Ref} \times \frac{P_{Ref}}{P_{Meas}} \times \frac{T_{Meas}}{T_{Ref}}$$

; Q = Flow rate

; P = Absolute pressure

; T = Absolute temperature

; Subscript "Meas" = Measurement condition

; Subscript "Ref" = Reference condition

Condition As-Received : Used Item

The measurement results and statements of conformity with specification only relate to the item calibrated.

**Traceability of Certificate :**

The International System of Units (SI) through

MIT Calibration Certificate No. L202210258-007 for Mass Flow Calibrator (200 SCCM) Serial No. 96093001W, Due 07-Nov-24

**End of Certificate**

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## Certificate of Calibration

Certificate No. : 24P1369

Page : 1 of 2

Equipment : Aneroid Barometer

Manufacturer: Barigo

Model : -

Serial No.: -

ID No.: UAE.ANV.013/2547

Condition As-Received: Used Item

Received Date: 05 April 2024

Calibration Date: 22 April 2024

Reference: 2404-0243WSC

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

Ambient Temperature: ( 23 ± 2 ) °C

Relative Humidity: ( 50 ± 15 ) %

Atmospheric Pressure: 1007 mbar

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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-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-0094-23	03 May 2024

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 : Suksan Khankaew

Issue Date : 23 April 2024

Approved Signatory :

[ ] Phalinee Prabpaipal

[ ] Sura Suwannasri

[✓] Attapol Panurach

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Cert.No.: 24P1369

Page: 2 of 2

**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)	718.40	729.71	740.61	751.07	761.97	773.05	786.91
UUC* Indication (mmHg)	720.0	730.0	740.0	750.0	760.0	770.0	780.0
Error (mmHg)	1.60	0.29	-0.61	-1.07	-1.97	-3.05	-6.91

**Decreasing Pressure**

Applied Pressure (mmHg)	786.91	772.99	761.71	750.69	740.13	729.35	718.44
UUC* Indication (mmHg)	780.0	770.0	760.0	750.0	740.0	730.0	720.0
Error (mmHg)	-6.91	-2.99	-1.71	-0.69	-0.13	0.65	1.56

The uncertainty of measurement was  $\pm 0.24$  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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## Certificate of Calibration

Certificate No. : 24H752

Page : 1 of 2

Equipment : Dial Thermo-Hygrometer

Manufacturer: Barigo

Model : -

Serial No.: -

ID No.: UAE.ANV.004/2548

Condition As-Received: Used Item

Received Date: 05 April 2024

Calibration Date: 10 April 2024  
to 18 April 2024

Reference: 2404-0247WSC

Ambient Temperature: ( 25 ± 3 ) °C

Relative Humidity: ( 50 ± 20 ) %

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

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	21656	02 Aug 2024
2) Handheld Thermometer With Sensor	1521	A5A339	2311238	16 Oct 2024

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 : Chakrit Waewwanjua  
Issue Date : 18 April 2024

Approved Signatory : \_\_\_\_\_  
[ ] Chakrit Waewwanjua  
[✓] Viporn Tantiyawutti  
[ ] Unnopphol Harachai

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Cert. No.: 24H752

Page.: 2 of 2

**Result of Calibration:-**

Without Adjustment

Function:

Humidity Measurement.

<u>Reference Temperature</u> (°C)	<u>Standard Humidity</u> (%R.H.)	<u>UUC* Reading</u> (%R.H.)	<u>Error</u> (%R.H.)	<u>Uncertainty of Measurement</u> (±%R.H.)
25.0	40.1	41	0.9	1.6
25.0	60.0	60	0.0	1.7
25.0	80.0	78	-2.0	1.8

**Result of Calibration:-**

Without Adjustment

Function:

Temperature Measurement.

<u>Standard Temperature</u> (°C)	<u>UUC* Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty of Measurement</u> (±°C)
20.014	20.5	0.486	0.72
25.033	25.0	-0.033	0.72
30.010	30.0	-0.010	0.72
35.027	34.5	-0.527	0.72
40.013	39.5	-0.513	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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