

ภาคผนวก จ

## เอกสารสอบเทียบความถูกต้องของเครื่องมือ

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## List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration
<b>Ambient</b>							
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Andersen Instruments, Inc.	G25A 1901	Jiranatee Associates Co., Ltd.	COF-002-66	14 Jul 23
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)	23P1402	9 May 23
3	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23P1860	2 Jun 23
4	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23H1201	5 Jun 23
5	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1182920005	UAE Consultant Co.,Ltd.	13112023	13 Nov 23
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1182920006	UAE Consultant Co.,Ltd.	01112023	1 Nov 23
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1182920007	UAE Consultant Co.,Ltd.	03052023	3 May 23
8	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21
9	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43C 43C-0607415779	UAE Consultant Co.,Ltd.	03052023	3 May 23
10	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43C 43C-0611116459	UAE Consultant Co.,Ltd.	07042023	7 Apr 23
11	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43C 43C-62236-334	UAE Consultant Co.,Ltd.	03052023	3 May 23
12	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21

## List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration
<b>Ambient</b>							
13	Carbon Monoxide Analyzer	Carbon Monoxide	Horiba	APMA-370 YRLHTB7G	UAE Consultant Co.,Ltd.	08122023	8 Dec 23
14	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48C 48CTL-65506-348	UAE Consultant Co.,Ltd.	08122023	8 Dec 23
15	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i CM08140004	UAE Consultant Co.,Ltd.	13112023	13 Nov 23
16	Standard Gases (Mixture)	Carbon Monoxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21
17	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DR0041	Thai Meteorological Department	119/24	13 Mar 24
18	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DR0052	Thai Meteorological Department	098/24	22 Feb 24
19	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DT0058	Thai Meteorological Department	121/24	13 Mar 24
20	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 RATFJBXS	UAE Consultant Co.,Ltd.	21122023	21 Dec 23
21	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 GY21PTED	UAE Consultant Co.,Ltd.	21122023	21 Dec 23
22	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 GAL13KSE	UAE Consultant Co.,Ltd.	21122023	21 Dec 23
23	Standard Gas	Total Hydrocarbons	Linde	D824432	Linde	09042013	4 Aug 20

## List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration
<b>Ambient</b>							
24	Smoke Meter	Opacity	Wager Co.,Inc.	6500 12043	KR Autogroup Co.,Ltd.	12112564	12 Nov 21
25	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Larson Davis	CAL150 6307	Innovative Instrument Co.,Ltd.	23-ACT-067	12 May 23
26	Sound Level Meter	$L_{Aeq\ 1\ hr}$ , $L_{Aeq\ 24\ hr}$ , $L_{Amax}$ , $L_{A90}$ , $L_{Adn}$ $L_{Aeq\ 5\ min}$	Rion, Japan	NL-62 00511776	Sithiporn Associates Co., Ltd.	ACL23183	8 Jun 23
27	Sound Level Meter	$L_{Aeq\ 1\ hr}$ , $L_{Aeq\ 24\ hr}$ , $L_{Amax}$ , $L_{A90}$ , $L_{Adn}$ $L_{Aeq\ 5\ min}$	Rion, Japan	NL-62 00901739	Sithiporn Associates Co., Ltd.	ACL23151	9 May 23
28	Sound Level Meter	$L_{Aeq\ 1\ hr}$ , $L_{Aeq\ 24\ hr}$ , $L_{Amax}$ , $L_{A90}$ , $L_{Adn}$ $L_{Aeq\ 5\ min}$	Rion, Japan	NL-62 00511775	Sithiporn Associates Co., Ltd.	ACL23150	9 May 23



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 <sup>3</sup> /min	Pressure [Pa] mmHg	Temperature [T <sub>a</sub> ] °C	Temperature [T <sub>m</sub> ] °C	Ap_meter mmHg	Ap_Office inH <sub>2</sub> O	Y	Standard Flow [Q <sub>s</sub> ] m <sup>3</sup> /min
1	0.701	754.115	23.87	23.10	55.600	1.626	1.273	0.648
2	0.997	754.083	23.80	23.23	61.350	3.236	1.795	0.914
3	1.121	754.005	23.81	23.20	41.923	4.338	2.079	1.057
4	1.172	754.004	23.72	23.16	30.933	4.891	2.208	1.122
5	1.410	753.994	23.76	23.18	29.415	7.159	2.671	1.352

Slope (m): 1.98463  
Intercept (b): -0.01636  
Correlation coefficient (r): 0.99972  
Uncertainty (k=2): 0.015 m<sup>3</sup>/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m <sup>3</sup> /min	Pressure [Pa] mmHg	Temperature [T <sub>a</sub> ] °C	Temperature [T <sub>m</sub> ] °C	Ap_meter mmHg	Ap_Office inH <sub>2</sub> O	Y	Standard Flow [Q <sub>s</sub> ] m <sup>3</sup> /min
1	0.701	754.115	23.87	23.10	55.600	1.626	0.800	0.651
2	0.997	754.083	23.80	23.23	61.350	3.236	1.129	0.917
3	1.121	754.005	23.81	23.20	41.923	4.338	1.307	1.061
4	1.172	754.004	23.72	23.16	30.933	4.891	1.388	1.126
5	1.410	753.994	23.76	23.18	29.415	7.159	1.679	1.357

Slope (m): 1.24306  
Intercept (b): -0.01029  
Correlation coefficient (r): 0.99972  
Uncertainty (k=2): 0.015 m<sup>3</sup>/min

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



CERTIFICATE OF CALIBRATION

Certificate No. : COF-002-66

MEASUREMENT ITEM  
MANUFACTURER : Top Load Office  
MODEL/TYPE : Andersen Instruments  
SERIAL NUMBER : G25A  
ID NUMBER : 1901  
CONDITION AS-RECEIVED : UAE ANV.051/25-47  
CUSTOMER : Used item  
United Analyst and Engineering Consultant Co., Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong,  
Bangkok 10260

RECEIVED DATE : 07 Jul 2023  
MEASUREMENT DATE : 14 Jul 2023  
ISSUE DATE : 18 Jul 2023

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:  
Temperature : 23.0 ± 3.0 °C  
Relative Humidity : 55.0 ± 15.0 %RH  
Atmospheric Pressure : 1010 ± 10 hPa

CALIBRATION CONDITION:

Preconditioning : 24 hours at ambient conditions.  
Measurement Condition : The average values during measurement are 23.9 °C and 54.5%RH.

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

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:  
The Orifice gas flow device was calibrated against  
Standard Rotary Displacement Meter (Roots  
Meter) Model G55/MC/M2-dp. The Wt-CL-004  
was used as a calibration guideline.

Traceability:  
This certificate provides a traceability of the  
measurement to recognized the national  
standards and to realization of the international  
system of units (SI) through the VSL (National  
Metrology Institute of Netherlands) via Certificate  
number: 63211901

Uncertainty of Measurement:

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



Calibrated by:

☐ Mr. Sorawit Thachalad  
☒ Miss Jitraporn Lertsomphol

Approved signatory:

Mr. Parinya Booncharoen  
Calibration Department Manager

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Cert.No.: 23P1402  
Page: 2 of 2

Result of calibration:- Without adjustment  
Function:- Pressure Measurement  
Increasing Pressure

Range: 0 inH<sub>2</sub>O to 36 inH<sub>2</sub>O  
Scale Interval: 0.1 inH<sub>2</sub>O (The Fifth Estimate)

Applied Pressure (inH <sub>2</sub> O)	UUC Indication		ΔP (inH <sub>2</sub> O)	Error (inH <sub>2</sub> O)
	High-port side (inH <sub>2</sub> O)	Low-port side (inH <sub>2</sub> O)		
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	5.00	-5.00	10.00	0.00
12.00	6.00	-6.00	12.00	0.00
14.00	7.00	-7.02	14.02	0.02
16.00	8.00	-8.02	16.02	0.02
18.00	9.02	-9.04	18.06	0.06
20.00	10.02	-10.04	20.06	0.06
22.00	11.00	-11.04	22.04	0.04
24.00	12.02	-12.06	24.08	0.08
26.00	13.02	-13.06	26.08	0.08
28.00	14.02	-14.04	28.06	0.06
30.00	15.02	-15.02	30.04	0.04
32.00	16.00	-16.02	32.02	0.02
34.00	17.00	-17.00	34.00	0.00
35.80	17.96	-17.98	35.94	0.14

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

\* UUC = Unit Under Calibration

\* ΔP = High-port side - Low-port side

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  
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484

## Certificate of Calibration

Certificate No. : 23P1402  
Page : 1 of 2

Equipment : U Tube Manometer

Manufacturer: Dwyer

Model : 1221-36-W/M

Serial No.:

ID No.: UAE.EFM.180/2561

Condition As-Received: Used Item

Received Date: 26 April 2023

Calibration Date: 09 May 2023

Reference: 2304-0703WSC

Ambient Temperature: (  $23 \pm 2$  ) °C

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

Atmospheric Pressure: 1010 mbar

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

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 in-house calibration procedure CP-P04, using "DKO-R 6-1 : Calibration of Pressure Gauges, Edition 03/2014 " as a guidelines.

### Condition of this result of calibration

1.Reference standards instruments :

1) Pressure Calibrator  
Instrument Model Serial No. Certificate No. Due Date  
PC-106P 1189 MP-Q137-22 24 Aug 2023

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 (NIMT)

Calibrated by : Suwit Aussarree  
Issue Date : 11 May 2023

Approved Signatory :

Attapol P.

( ) Phalinee Prabpalai

( ) Sura Suwanasri

(x) Attapol Panurach

Attapol P.

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TEL. 0-2717-3000-24 FAX. 0-2719-9484

Certification 0088

## Certificate of Calibration

Certificate No. : 23P1860  
Page : 1 of 2

Equipment : Aneroid Barometer

Manufacturer : Barigo

Model : -

Serial No. : -

ID No. : UAE.ANV.153/2550

Condition As-Received: Used Item

Received Date: 28 May 2023

Calibration Date: 02 June 2023

Reference: 2305.0919WSC

Ambient Temperature: ( 23 ± 2 ) °C

Relative Humidity: ( 50 ± 15 ) %

Atmospheric Pressure: 1006 mbar

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

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 in-house calibration procedure CP-P10, using " DKD-R 6-1 ; Calibration of Pressure Gauges, Edition 03/2014 " as a guidelines.

### Condition of this result of calibration

1.Reference standards instruments :

Instrument

Model

Serial No.

Certificate No.

Due Date

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.This result of calibration instrument was in absolute pressure.

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suksan Khankaew

Issue Date : 08 June 2023

Approved Signatory :

Attapol P.

[ ] Phalinee Prabpaipal

[ ] Sura Suwannasri

[x] Attapol Panurach

Cert.No.: 23P1860

Page: 2 of 2

Result of calibration:- Without adjustment

Function:- Absolute Pressure Measurement

Increasing Pressure

Applied Pressure (hPa)	963.65	975.02	984.39	993.76	1002.66	1011.75	1020.25	1030.28
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0
Error (hPa)	-3.65	-5.02	-4.39	-3.78	-2.66	-1.75	-0.25	-0.28

Decreasing Pressure

Applied Pressure (hPa)	1030.28	1020.59	1012.07	1002.79	993.81	984.44	975.05	964.28
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0
Error (hPa)	-0.28	-0.59	-2.07	-2.79	-3.81	-4.44	-5.05	-4.28

The uncertainty of measurement was ± 0.30 hPa

\* UUC = Unit Under Calibration

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

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Result of Calibration:-  
Function:

Humidity Measurement  
Before Adjustment

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	55	14.9	1.6
25.0	60.0	66	6.0	1.7
25.0	80.0	78	-2.0	1.9

Result of Calibration:-  
Function:

Humidity Measurement  
After Adjustment

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	46	5.9	1.6
25.0	60.0	60	0.0	1.7
25.0	80.0	72	-8.0	1.9

Result of Calibration:-  
Function:

Temperature Measurement  
Without Adjustment

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
19.987	20.0	0.013	0.72
30.016	30.0	-0.016	0.72
39.944	39.0	-0.944	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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Approved Signatory

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## Certificate of Calibration

Certificate No. : 23H1201  
Page : 1 of 2

Equipment : Dial Thermo-Hygrometer

Manufacturer: Barigo

Model : -

Serial No.: -

ID No.: UAE/EMA2.014/2555

Condition As-Received: Used Item

Received Date: 28 May 2023

Calibration Date: 30 May 2023  
to 06 June 2023

Reference: 2305-0919WSC

Ambient Temperature: ( 25 ± 3 ) °C

Relative Humidity: ( 50 ± 20 ) %

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 :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Hygro-M2 Dew Point Monitor	5112	2360195	20703	02 Aug 2023
2) Handheld Thermometer With Sensor	1523	3240076	23105	15 Mar 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:-

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

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

Calibrated by : Somchai Dumwor  
Issue Date : 07 June 2023

Approved Signatory :

[✓] Chakrit Waewwanjua

[ ] Pornthippa Tameyakul

[ ] Viporn Tantiyawutti

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MULTI-POINT GAS TEST REPORT

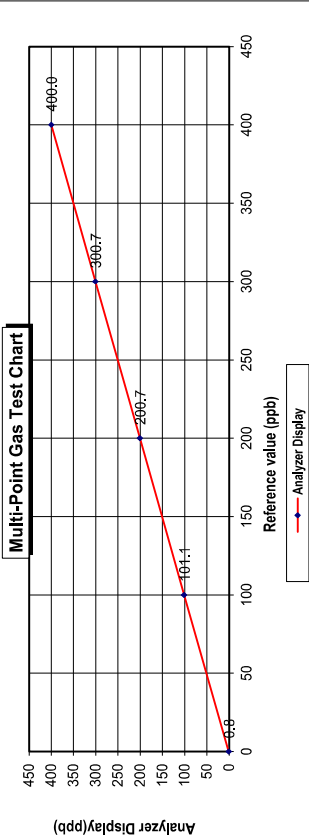
Test Date : Nov 1,2023

Equipment : Gas Analyzer (NO<sub>2</sub>)  
Manufacturer : Thermo Scientific

Model : 42i  
Serial Number : 1182920006

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO <sub>2</sub> )	44.68	PPM	Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	146i
Methane (CH <sub>4</sub> )	-	PPM	1180540071
Carbon Monoxide (CO)	984.8		
Cylinder No. :	EB0143262		
Expiration Date :	Jun 21,2024		

Multi-point gas test data					
Reference Value (ppb)		Analyzer Display (ppb)		Percent Error	
Level 1	Zero	0.0	0.8	0.80	0.80
Level 2	20.00%	100.0	101.1	1.10	1.09
Level 3	40.00%	200.0	200.7	0.70	0.35
Level 4	60.00%	300.0	300.7	0.70	0.23
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range		500.0 ppb		Average Difference (%)	
				:Acceptable Limit ± 5%	



Calculate by  
13 Nov 2023

Approve by  
01 Nov 2023

MULTI-POINT GAS TEST REPORT

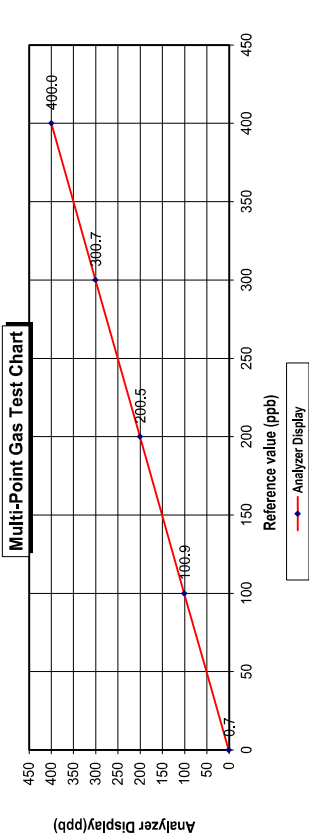
Test Date : Nov 13,2023

Equipment : Gas Analyzer (NO<sub>2</sub>)  
Manufacturer : Thermo Scientific

Model : 42i  
Serial Number : 1182920005

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO <sub>2</sub> )	44.68	PPM	Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	146i
Methane (CH <sub>4</sub> )	-	PPM	1180540071
Carbon Monoxide (CO)	984.8		
Cylinder No. :	EB0143262		
Expiration Date :	Jun 21,2024		

Multi-point gas test data					
Reference Value (ppb)		Analyzer Display (ppb)		Percent Error	
Level 1	Zero	0.0	0.7	0.70	0.70
Level 2	20.00%	100.0	100.9	0.90	0.89
Level 3	40.00%	200.0	200.5	0.50	0.25
Level 4	60.00%	300.0	300.7	0.70	0.23
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range		500.0 ppb		Average Difference (%)	
				:Acceptable Limit ± 5%	



Calculate by  
13 Nov 2023

Approve by  
13 Nov 2023



# CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Part Number	E04JN59E15A01D3	Reference Number:	123400135-87-1
Cylinder Number:	E80143262	Cylinder Volume:	14.4 CF
Laboratory	184 - Durham (SAP) - NC	Cylinder Pressure:	2015 PSI/G
GGF Number	82207	Valve Outlet	56
Gas Code	CO/NO/NOX SC2/EAL Y	Certification Date:	Jun 21 2021

**Expiration Date:** JUN 21, 2024

[illegible]

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Date: 10/10/2010  
Time: 10:10:10  
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ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Date
NOX	45.00 PPM	45.00 PPM	G1	+/- 1.1% NIST Traceable	09/14/2021, 09/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	+/- 1.4% NIST Traceable	09/14/2021, 09/21/2021
SULFUR DIOXIDE	45.00 PPM	44.93 PPM	G1	+/- 1.0% NIST Traceable	09/14/2021, 09/21/2021
CARBON MONOXIDE	100.00 PPM	98.46 PPM	G1	+/- 0.7% NIST Traceable	09/14/2021
ACETONE					

CALIBRATION STANDARDS			
Type	Lot ID	Concentration	Uncertainty
NITRA	20281110	48.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%
PM10	12-200	9.91 PPM NITROGEN DIOXIDE/PM10	+/- 2.0%
PM2.5	431423658102	4.349 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1
NITRA	15011043	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 2.8%
NITRA	14080112	93.93 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%
The SRU, PM10, and PM2.5 are only in reference to the SRU used in the assay, and not part of the analysis.			

ANALYTICAL EQUIPMENT	
Instrument/Make/Model	Analytical Principle
Model 8700 AHR00301333 CO	FTIR
Model 8700 AHR00301333 NO	FTIR
Model 8700 AHR00301333 NO2	FTIR
Model 8700 AHR00301333 SO2	FTIR

Last Multipoint Calibration	
Instrument	Date
Model 8700 AHR00301333 CO	Jun 03, 2021
Model 8700 AHR00301333 NO	Jun 03, 2021
Model 8700 AHR00301333 NO2	Jun 03, 2021
Model 8700 AHR00301333 SO2	Jun 03, 2021

Trade Data Available Upon Request

NOTES: P. 252-1007807

GROSS WT: 28.40kg

Bye: 1:56:34



**CERT 3082.01**

## เอกสารไม่ควบคุม

The analytical test results reported on this certificate relate only to the cylinder number specified above. This concludes the test report.

**Approved for Release**

## MULTI-POINT GAS TEST REPORT

Test Date : May 3, 2023

Equipment :	Gas Analyzer (NO <sub>2</sub> )	Model :	42i
Manufacturer :	Thermo Scientific	Serial Number :	1182920007

## Standard Gas Concentration

Sulphur Dioxide (SO <sub>2</sub> )	44.68	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	Model :	146i
Methane (CH <sub>4</sub> )	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	984.8			
Cylinder No. :	EB0143262			
Expiration Date :	Jun 21, 2024			

## Multi-point gas test data

Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	% Error ]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	0.90	0.89	0.89
Level 3	40.00%	200.0	1.20	0.60	0.60
Level 4	60.00%	300.0	1.80	0.60	0.60
Level 5	80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range			Average Difference (%)		0.42
500.0 ppb					

Remark : Measuring Range	500.0 mm
--------------------------	----------

:Acceptable Limit + 5%

Multi-Point Gas Test Chart



Calculate by

Arbhat K.

11 3 2

Approved by \_\_\_\_\_

At Work ✓

..... 11.57.03

# MULTI-POINT GAS TEST REPORT

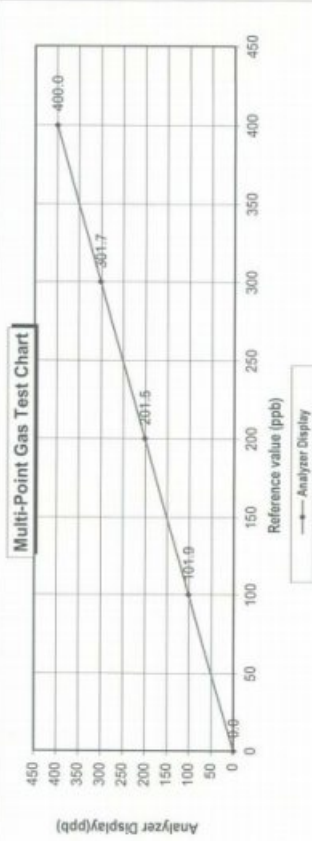
Test Date : Apr 7, 2023

Equipment : Gas Analyzer (SO<sub>2</sub>) Model : 43C  
Manufacturer : Thermo Electron Corporation Serial Number : 43C-0611116459

Standard Gas Concentration			Dilutor Detail		
Sulphur Dioxide (SO <sub>2</sub> )	44.68	PPM	Manufacturer :	Thermo SCIENTIFIC	
Nitric Oxide (NO)	45.94	PPM	Model :	146i	
Methane (CH <sub>4</sub> )	-	PPM	Serial Number :	1180540071	
Carbon Monoxide (CO)	984.8	PPM			
Cylinder No. :	EB0143262				
Expiration Date :	Jun 24, 2024				

## 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%	101.9	1.90	1.86	1.86
Level 3 40.00%	201.5	1.50	0.74	0.74
Level 4 60.00%	301.7	1.70	0.56	0.56
Level 5 80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb		Average Difference (%)		0.63
:Acceptable Limit ± 5%				



Calculate by  
Aphiwat K.  
7.4.23

Approve by  
Pichan W.  
7. Apr 2023

# MULTI-POINT GAS TEST REPORT

Test Date : May 3, 2023

Equipment : Gas Analyzer (SO<sub>2</sub>) Model : 43C  
Manufacturer : Thermo Electron Corporation Serial Number : 43C-0607415779

Standard Gas Concentration			Dilutor Detail		
Sulphur Dioxide (SO <sub>2</sub> )	44.68	PPM	Manufacturer :	Thermo SCIENTIFIC	
Nitric Oxide (NO)	45.94	PPM	Model :	146i	
Methane (CH <sub>4</sub> )	-	PPM	Serial Number :	1180540071	
Carbon Monoxide (CO)	984.8	PPM			
Cylinder No. :	EB0143262				
Expiration Date :	Jun 24, 2024				

## 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%	101.3	1.30	1.28	1.28
Level 3 40.00%	201.1	1.10	0.55	0.55
Level 4 60.00%	301.5	1.50	0.50	0.50
Level 5 80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb		Average Difference (%)		0.47
:Acceptable Limit ± 5%				



Calculate by  
Aphiwat K.  
3.5.23

Approve by  
Pichan W.  
3. May 2023



# CERTIFICATE OF ANALYSIS

**Grade of Product: EPA Protocol**

Part Number	E04JN59E15A01D3	Reference Number:	123400135-87-1
Cylinder Number:	E80143262	Cylinder Volume:	14.4 CF
Laboratory	184 - Durham (SAP) - NC	Cylinder Pressure:	2015 PSI/G
GGF Number	82207	Valve Outlet	56
Gas Code	CO/NO/NOX SC2/EALY	Certification Date:	Jun 21 2021

Certification is obtained in accordance with EPA's "Guidance for Protection of Class 1 Concentrations of Gaseous Contaminants" (September 1994) (EPA-94-3). U.S. EPA's latest procedures require that any physical laboratory data requires to monitor and analyze the reference. The sample must be analyzed "immediately" as defined within the EPA's "Guidance for Protection of Class 1 Concentrations of Gaseous Contaminants" (September 1994) (EPA-94-3). The sample must be analyzed within 15 minutes after the time of collection.

Page: 12345678910111213141516171819202122232425262728293031323334353637383940414243444546474849505152535455565758596061626364656667686970717273747576777879808182838485868788899091929394959697989910010110210310410510610710810911011111211311411511611711811912012112212312412512612712812913013113213313413513613713813914014114214314414514614714814915015115215315415515615715815916016116216316416516616716816917017117217317417517617717817918018118218318418518618718818919019119219319419519619719819920020120220320420520620720820921021121221321421521621721821922022122222322422522622722822923023123223323423523623723823924024124224324424524624724824925025125225325425525625725825926026126226326426526626726826927027127227327427527627727827928028128228328428528628728828929029129229329429529629729829930030130230330430530630730830931031131231331431531631731831932032132232332432532632732832933033133233333433533633733833934034134234334434534634734834935035135235335435535635735835936036136236336436536636736836937037137237337437537637737837938038138238338438538638738838939039139239339439539639739839940040140240340440540640740840941041141241341441541641741841942042142242342442542642742842943043143243343443543643743843944044144244344444544644744844945045145245345445545645745845946046146246346446546646746846947047147247347447547647747847948048148248348448548648748848949049149249349449549649749849950050150250350450550650750850951051151251351451551651751851952052152252352452552652752852953053153253353453553653753853954054154254354454554654754854955055155255355455555655755855956056156256356456556656756856957057157257357457557657757857958058158258358458558658758858959059159259359459559659759859960060160260360460560660760860961061161261361461561661761861962062162262362462562662762862963063163263363463563663763863964064164264364464564664764864965065165265365465565665765865966066166266366466566666766866967067167267367467567667767867968068168268368468568668768868969069169269369469569669769869970070170270370470570670770870971071171271371471571671771871972072172272372472572672772872973073173273373473573673773873974074174274374474574674774874975075175275375475575675775875976076176276376476576676776876977077177277377477577677777877978078178278378478578678778878979079179279379479579679779879980080180280380480580680780880981081181281381481581681781881982082182282382482582682782882983083183283383483583683783883984084184284384484584684784884985085185285385485585685785885986086186286386486586686786886987087187287387487587687787887988088188288388488588688788888989089189289389489589689789889990090190290390490590690790890991091191291391491591691791891992092192292392492592692792892993093193293393493593693793893994094194294394494594694794894995095195295395495595695795895996096196296396496596696796896997097197297397497597697797897998098198298398498598698798898999099199299399499599699799899910001001100210031004100510061007100810091010101110121013101410151016101710181019102010211022102310241025102610271028102910301031103210331034103510361037103810391040104110421043104410451046104710481049105010511052105310541055105610571058105910601061106210631064106510661067106810691070107110721073107410751076107710781079108010811082108310841085108610871088108910901091109210931094109510961097109810991100110111021103110411051106110711081109111011111112111311141115111611171118111911201121112211231124112511261127112811291130113111321133113411351136113711381139114011411142114311441145114611471148114911501151115211531154115511561157115811591160116111621163116411651166116711681169117011711172117311741175117611771178117911801181118211831184118511861187118811891190119111921193119411951196119711981199120012011202120312041205120612071208120912101211121212131214121512161217121812191220122112221223122412251226122712281229123012311232123312341235123612371238123912401241124212431244124512461247124812491250125112521253125412551256125712581259126012611262126312641265126612671268126912701271127212731274127512761277127812791280128112821283128412851286128712881289129012911292129312941295129612971298129913

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Date
HDX	45.00 ppm	45.07 ppm	G1	+/- 1.1% NIST Traceable	09/14/2021, 09/28/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	+/- 1.4% NIST Traceable	09/14/2021, 09/28/2021
SULFUR DIOXIDE	45.00 PPM	44.93 PPM	G1	+/- 1.0% NIST Traceable	09/14/2021, 09/28/2021
CARBON MONOXIDE	100.00 PPM	98.46 PPM	G1	+/- 0.7% NIST Traceable	09/14/2021
ACETONE					

CALIBRATION STANDARDS			
Type	-o- ID	Concentration	Uncertainty
NTRM	20581110	48.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%
PMS	12-200	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%
CHL	431423658102	4.349 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1
NTRM	15011043	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 2.8%
NTRM	14080112	93.93 PPM CARBON MONOXIDE /NITROGEN	+/- 0.6%

The SRU, PMD, CHL & MSM have been verified by EPA reference lab.

ANALYTICAL EQUIPMENT	
Instrument/Make/Model	Analytical Principle
FIDnet 670C AHR00301333 CG	FTIR
NI COLE 670C AHR00301333 AQ	FTIR
NI COLE 670C AHR00301333 AQ2	FTIR
Nicolet 670C AHR00301333 SQ2	FTIR

Last Multipoint Calibration	
	Jun 03, 2021
	Jun 03, 2021
	Jun 03, 2021
	Jun 03, 2021

**Trid Data Available Upon Request**

NOTES: P. 252: 1007807

GUSS WT: 28.40kg

Bye: 1:56:34



**CERT 3082.01**

# เอกสารไม่ควบคุม

The analytical test results reported on this certificate relate only to the cylinder number specified above. This concludes the test report.

**Approved for Release**

## MULTI-POINT GAS TEST REPORT

Test Date : May 3 2023

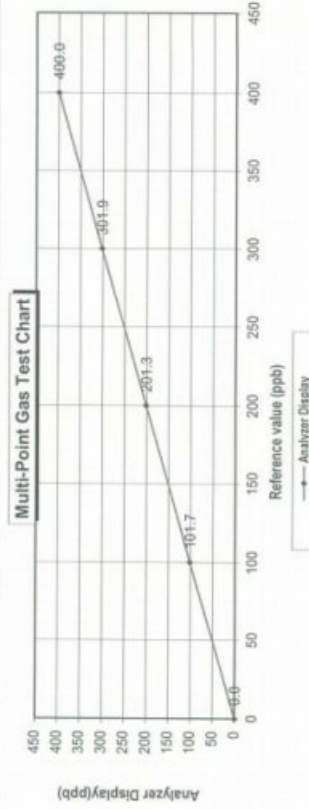
<b>Equipment:</b>	Gas Analyzer (SO <sub>2</sub> )	<b>Model:</b>	43C
<b>Manufacturer:</b>	Thermo Environmental Instruments	<b>Serial Number:</b>	43C-62236-334

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO <sub>2</sub> )	44.68	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	45.94	Model :	146i
Methane (CH <sub>4</sub> )	-	Serial Number :	1180540071
Carbon Monoxide (CO)	984.8		
Cylinder No. :	EB0143262		
Expiration Date :	Jun 24, 2024		

## Multi-point gas test data

Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	% Error ]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	1.70	1.67	1.67
Level 3	40.00%	200.0	1.30	0.65	0.65
Level 4	60.00%	300.0	1.90	0.63	0.63
Level 5	80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range		500.0 ppb	Average Difference (%)		0.59

Remark : Measuring Range  
:Acceptable Limit + 5%



**Calculate by**

Approve by \_\_\_\_\_

3, May, 2023





CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Bar Number: E041859E15A01D3  
Cylinder Number: EB0143262  
Laboratory: T4 - Duhaib (SAP) - NC  
PG/P Number: B2202  
Gas Code: CO/NO/NOX SC2/EAL V

Reference Number: 122-402135-67-1  
Cylinder Volume: 144.4 CF  
Cylinder Pressure: 2015 PSI/G  
Valve Outlet: 56J  
Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification is performed in accordance with EPA Method 100 for the analysis of Nitrogen Oxides (NOx) and Carbon Monoxide (CO) in ambient air. The results are reported in parts per million (ppm) and are valid for a period of 12 months from the date of certification. The results are reported in parts per million (ppm) and are valid for a period of 12 months from the date of certification.

Example Test Report for 100 ppm CO and 100 ppm NOx

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Assay Value
NOX	45.00 PPM	45.00 PPM	G1	0.0142321, 0.0142321, 0.0142321
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	0.0142321, 0.0142321, 0.0142321
SULFUR DIOXIDE	45.00 PPM	44.68 PPM	G1	0.0142321, 0.0142321, 0.0142321
CARBON MONOXIDE	100.0 PPM	98.48 PPM	G1	0.0142321, 0.0142321, 0.0142321
NITROGEN	30.00 PPM	30.00 PPM	G1	0.0142321, 0.0142321, 0.0142321

CALIBRATION STANDARDS				
Type	Cylinder No	Concentration	Uncertainty	Expiration Date
HYDRA	20081130	49.82 PPM NITRIC DIOXIDE/NOX	±1.10%	Jun 03, 2021
PER	12306	9.91 PPM NITROGEN DIOXIDE/NOX	±1.20%	Jun 03, 2021
CHL	40142385122	4.04 PPM NITROGEN DIOXIDE/NOX	±1.21%	Jun 03, 2021
NITRO	15611043	49.02 PPM SULFUR DIOXIDE/SO2	±1.18%	Jun 03, 2021
HYDRA	14080113	93.19 PPM CARBON MONOXIDE/CO	±1.08%	Jun 03, 2021

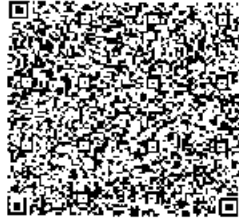
ANALYTICAL EQUIPMENT				
Instrument Make/Model	Analytical Principle	Last Calibration	Calibration Date	Calibration By
Model 670C AHR0001333 DO	FTIR	Jun 03, 2021	Jun 03, 2021	Jun 03, 2021
Model 670C AHR0001333 NO	FTIR	Jun 03, 2021	Jun 03, 2021	Jun 03, 2021
Model 670C AHR0001333 SO2	FTIR	Jun 03, 2021	Jun 03, 2021	Jun 03, 2021

Test Data Available Upon Request

NOTES: POC #5231002807

GRUSS WT: 26.40kg

NET WT: 4.73kg



The analytical test results reported on this certificate relate only to the cylinder number specified above. This includes the test report.

Approved for Release

Approved for Release

เอกสารไมควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Nov 13, 2023

Equipment : Gas Analyzer (CO) Model : 481  
Manufacturer : Thermo Scientific Serial Number : CM08140004

Standard Gas Concentration

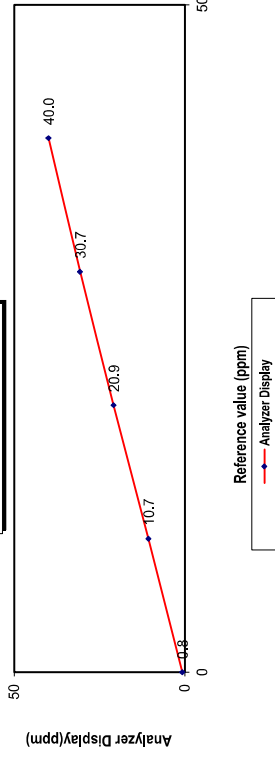
Sulphur Dioxide (SO<sub>2</sub>) 44.68 PPM Manufacturer : Thermo Scientific  
Nitric Oxide (NO) 45.94 PPM Model : 1461  
Methane (CH<sub>4</sub>) - PPM Serial Number : 1180540071  
Carbon Monoxide (CO) 984.8 PPM  
Cylinder No. : EB0143262  
Expiration Date : Jun 20, 2024

Multi-point gas test data

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	% Error ]
Level 1	Zero	0.0	0.8	0.8	0.8
Level 2	20.00%	10.0	10.7	0.7	6.5
Level 3	40.00%	20.0	20.9	0.9	4.3
Level 4	60.00%	30.0	30.7	0.7	2.3
Level 5	80.00%	40.0	40.0	0.0	0.0

Remark : Measuring Range 50.0 ppm  
Acceptable Limit ± 5%

Multi-Point Gas Test Chart



Calculate by

Approve by

13 / 11 / 2023

13 / Nov / 2023



Issued by : Calibration & Test Section : Meteorological Instruments Bureau  
Date of Issue 13 March, 2024 Certification No. 119/24  
Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger  
Manufacturer : SCARLET/TECH  
Type : WL-21  
Mfg Code : Wireless Receiver 2111DR0041  
Wind Sensor 2111DT0041  
Customer : United Analyst and Engineering Consultant Co.,Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Prakanong, Bangkok 10260.  
Calibration Condition : Temperature 25.1 °C Barometric Pressure 1010.6 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs FC014 Serial No. 8310119 : HOOK GAGE NO 1425  
N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec  
: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)  
Serial Number 110730029 (sensor 120629586)  
JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec  
STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94  
: testo, testo 645 Serial No. 02846057 : Thermoschneider No.918802  
STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220-No. V1220015

Calibrated by : **Natthapol** Signed : **Natthapol** (Authorized Signatory)  
Mr. Watcharapol Subwat for the Chief  
Mechanical Engineer Mr. Pisod Promsut Sub-Standard Instrument

เอกสารไม่ควบคุม



**The Result of Calibration**

13 March, 2024 Certification No. 119/24  
Page : 2 of 5

Standard	HOOK GAGE NO. 1425		TESTED ANEMOMETER	
	Pressure Inches H2O	Vacuum Inches H2O	Velocity m/sec	Correction m/sec
Ultrasonic Anemometer				
m/sec				
1.00	-	-	1.0	0.00
3.02	-	-	3.0	0.02
5.00	-	-	5.0	0.00
7.04	-	-	7.0	0.04
9.02	-	-	8.9	0.12
11.02	-	-	11.0	0.02
13.01	-	-	13.0	0.01
15.01	-	-	14.9	0.11
17.02	-	-	17.0	0.02
20.02	-	-	20.0	0.02

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

Calibrated by : **Natthapol**  
Mr. Watcharapol Subwat  
Mechanical Engineer

Calibration & Test Section  
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



The Result of Calibration

Certification No. 119/24

13 March, 2024

Page : 4 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction mmHg
757.25	757	0.25
757.15	757	0.15
757.64	758	-0.36
758.27	758	0.27
758.66	758	0.66
758.94	759	-0.06
759.11	759	0.11
759.84	760	-0.16
759.95	760	-0.05
759.73	760	-0.27
759.96	760	-0.04
760.14	760	0.14
760.42	761	-0.58
760.70	761	-0.30
762.03	762	0.03
762.24	762	0.24
761.79	762	-0.21
761.48	761	0.48
759.71	760	-0.29
760.28	760	0.28

Average

0.02

Calibrated by : *Wattana*

Mr. Watchapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



The Result of Calibration

Certification No. 119/24

13 March, 2024

Page : 3 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction mbar
1009.59	1009	0.59
1009.45	1009	0.45
1010.10	1010	0.10
1010.94	1011	-0.06
1011.46	1011	0.46
1011.84	1012	-0.16
1012.06	1012	0.06
1013.04	1013	0.04
1013.18	1013	0.18
1012.89	1013	-0.11
1013.20	1013	0.20
1013.44	1014	-0.56
1013.81	1014	-0.19
1014.19	1014	0.19
1015.96	1016	-0.04
1016.23	1016	0.23
1015.64	1016	-0.36
1015.23	1015	0.23
1012.87	1013	-0.13
1013.63	1014	-0.37

Average

0.04

Calibrated by : *Wattana*

Mr. Watchapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



# Calibration Certificate



Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 22 February, 2024 Certification No. 098/24

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2111DR0052

Wind Sensor 2111DT0052

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.5 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Alobt Plotting Board

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

N.I.S.T. Test Reference Number 731/241460

: Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer

Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629566)

JAPAN QUALITY ASSURANCE ORGANIZATION

: Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER

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

: testo, testo 645 Serial No. 02848057 : Thermoschneider No.918802

STANDARD BAROMETER

: Digital Barometer Vaisala Type PTB2220 No. V1220015

: Digital Barometer Vaisala Type PTB3356 No. R4320001

Calibrated by : Watchapol

(Authorised Signatory)

Mr. Watchapol Subwat

Signed : Mr. Pisod Promsut

Mechanical Engineer



เอกสารไม่ควบคุม



# The Result of Calibration

Certification No. 119/24

13 March, 2024

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.1	45	0.1
30.2	30	0.2
15.4	15	0.4

Calibrated by : Watchapol

Mr. Watchapol Subwat

Mechanical Engineer



เอกสารไม่ควบคุม



The Result of Calibration

22 February, 2024  
Certification No. 098/24  
Page : 3 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction mbar
1010.84	1011	-0.16
1010.60	1010	0.60
1011.71	1012	-0.29
1012.17	1012	0.17
1012.31	1012	0.31
1012.25	1012	0.25
1012.79	1013	-0.21
1012.95	1012	0.95
1013.52	1014	-0.48
1014.16	1014	0.16
1015.79	1016	-0.21
1016.02	1016	0.02
1015.86	1016	-0.14
1015.69	1015	0.69
1011.51	1012	-0.49
1011.80	1012	-0.20
1012.06	1012	0.06
1012.81	1013	-0.19
1013.22	1013	0.22
1013.49	1013	0.49
Average		0.08

Calibrated by :   
Mr. Watcharapol Subwat  
Mechanical Engineer



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The Result of Calibration

22 February, 2024  
Certification No. 098/24  
Page : 2 of 5

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425		TESTED ANEMOMETER	
	Pressure Inches H2O	Vacuum Inches H2O	Velocity m/sec	Correction m/sec
1.00	-	-	1.0	0.00
3.02	-	-	3.0	0.02
5.00	-	-	5.0	0.00
7.04	-	-	7.0	0.04
9.02	-	-	9.0	0.02
11.02	-	-	11.0	0.02
13.01	-	-	13.0	0.01
15.01	-	-	15.0	0.01
17.02	-	-	16.9	0.12
20.02	-	-	19.9	0.12

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

Calibrated by :   
Mr. Watcharapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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



The Result of Calibration

22 February, 2024  
Certification No. 098/24  
Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.2	45	0.2
30.3	30	0.3
15.8	15	0.8

Calibrated by : *Wathapol*  
Mr. Watcharapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม

The Result of Calibration

22 February, 2024  
Certification No. 098/24  
Page : 4 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction mmHg
758.19	758	0.19
758.01	758	0.01
758.84	759	-0.16
759.19	759	0.19
759.29	759	0.29
759.25	759	0.25
759.85	760	-0.35
759.77	760	-0.23
760.20	760	0.20
760.68	760	0.68
761.90	762	-0.10
762.08	762	0.08
761.96	762	-0.04
761.83	762	-0.17
758.69	759	-0.31
758.91	759	-0.09
759.11	759	0.11
759.67	760	-0.33
759.98	760	-0.02
760.18	760	0.18

Average

0.02

Calibrated by : *Wathapol*  
Mr. Watcharapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม





Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau  
Date of Issue 13 March, 2024 Certification No. 121/24  
Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger  
Manufacturer : SCARLET/TECH  
Type : WL-21  
Mfg Code : Wireless Receiver 2111DR0058  
Wind Sensor 2111DT0058  
Customer : United Analyst and Engineering Consultant Co.,Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Prakanong, Bangkok 10260.  
Calibration Condition : Temperature 25.1 °C Barometric Pressure 1011.9 hPa

NATIONAL STANDARD WIND TUNNEL

Micromanometer Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425  
N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec  
Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)  
Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec  
STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: testo, testo 645 Serial No. 02848057 : Thermoschneider No.918802

STANDARD BAROMETER

: Digital Barometer Vaisala Type PTB220 No. V1220015  
: Digital Barometer Vaisala Type PTB330 No. V4380001

Calibrated by : Watcharapol Subwat  
Mechanical Engineer  
Signed : Mr. Pisood Promsat  
(Authorized Signatory)  
for the Chief  
Sub-Standard Instrument



The Result of Calibration

13 March, 2024 Certification No. 121/24  
Page : 2 of 5

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425		TESTED ANEMOMETER	
	Pressure inches H2O	Vacuum inches H2O	Velocity m/sec	Correction m/sec
1.00	-	-	1.0	0.00
3.02	-	-	3.0	0.02
5.00	-	-	5.0	0.00
7.04	-	-	7.0	0.04
9.02	-	-	8.9	0.12
11.02	-	-	11.0	0.02
13.01	-	-	13.0	0.01
15.01	-	-	15.0	0.01
17.02	-	-	17.0	0.02
20.02	-	-	19.9	0.12

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

Calibrated by : Watcharapol Subwat  
Mechanical Engineer







The Result of Calibration

Certification No. 121/24

13 March, 2024

Page : 4 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction mmHg
757.25	757	0.25
757.15	757	0.15
757.64	758	-0.36
758.27	758	0.27
758.66	758	0.66
758.94	759	-0.06
759.11	759	0.11
759.84	760	-0.16
759.95	760	-0.05
759.73	760	-0.27
759.96	760	-0.04
760.14	760	0.14
760.42	761	-0.58
760.70	761	-0.30
762.03	762	0.03
762.24	762	0.24
761.79	762	-0.21
761.48	762	-0.52
759.71	760	-0.29
760.28	760	0.28
Average		-0.03

Calibrated by :

Watharapol

Mr. Watcharapol Subwat

Mechanical Engineer



เอกสารไม่ควบคุม



The Result of Calibration

Certification No. 121/24

13 March, 2024

Page : 3 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction mbar
1009.59	1009	0.59
1009.45	1010	-0.55
1010.10	1010	0.10
1010.94	1011	-0.06
1011.46	1011	0.46
1011.84	1012	-0.16
1012.06	1012	0.06
1013.04	1013	0.04
1013.18	1013	0.18
1012.89	1013	-0.11
1013.20	1013	0.20
1013.44	1013	0.44
1013.81	1014	-0.19
1014.19	1014	0.19
1015.96	1016	-0.04
1016.23	1016	0.23
1015.64	1015	0.64
1015.23	1015	0.23
1012.87	1013	-0.13
1013.63	1014	-0.37
Average		0.08

Calibrated by :

Watharapol

Mr. Watcharapol Subwat

Mechanical Engineer



เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Dec 21, 2023

Equipment : Hydrocarbon Analyzer

Model : APHA-370

Manufacturer : HORIBA

Serial Number : RATEJBXS

Standard Gas Concentration

Sulphur Dioxide (SO<sub>2</sub>)

PPM

Manufacturer :

Nitric Oxide (NO)

PPM

Model :

Methane (CH<sub>4</sub>)

PPM

Serial Number :

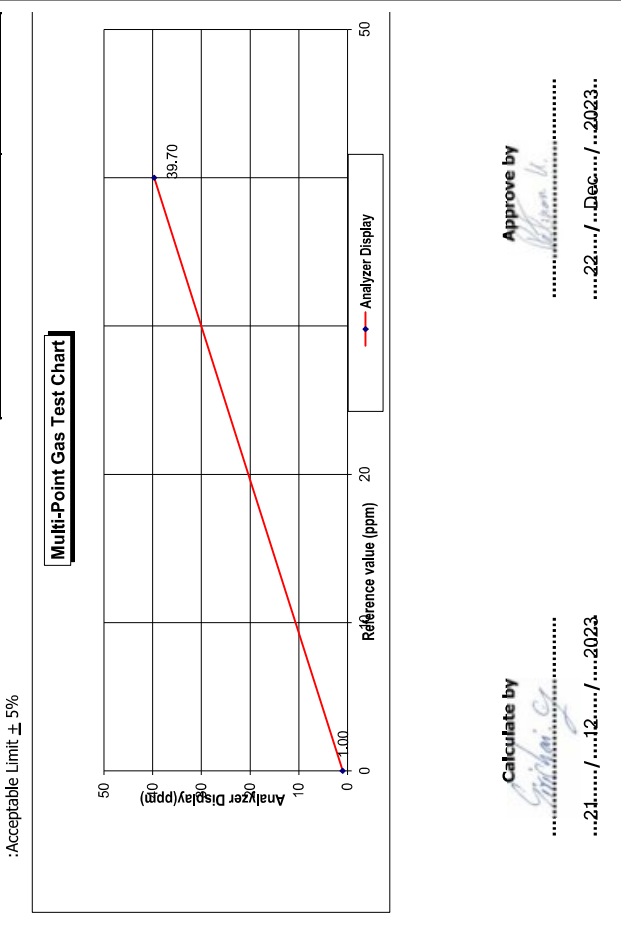
Carbon Monoxide (CO)

PPM

Cylinder No. : D824432

Expiration Date : Aug 4, 2028

Multi-point gas test data				
Reference Value (ppm)		Analyzer Display (ppm)	Difference Error	Percent Error
Level 1	Zero	0.00	1.00	1.00
Level 2	80.00%	40.00	-0.30	-0.76
Remark : Measuring Range 50.00 ppm			Average Difference (%)	
			0.88	



MULTI-POINT GAS TEST REPORT

Test Date : Dec 21,2023

Equipment : Hydrocarbon Analyzer

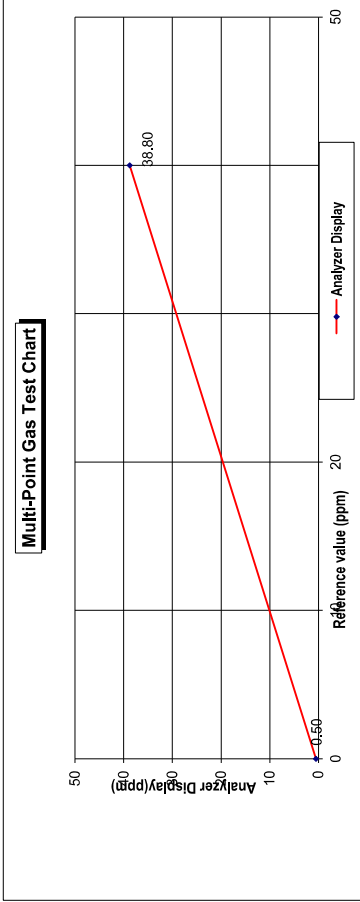
Model : APHA-370

Manufacturer : HORIBA

Serial Number : GAL13KSE

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO <sub>2</sub> )	-	PPM	Manufacturer :
Nitric Oxide (NO)	-	PPM	Model :
Methane (CH <sub>4</sub> )	39.8	PPM	Serial Number :
Carbon Monoxide (CO)	-	PPM	
Cylinder No. :	D824432		
Expiration Date :	Aug 4,2028		

Multi-point gas test data				
Reference Value (ppm)		Analyzer Display (ppm)	Difference Error	Percent Error
Level 1	Zero	0.00	0.50	0.50
Level 2	80.00%	40.00	-1.20	-3.09
Remark : Measuring Range		50.00 ppm	Average Difference (%)	
				1.80
:Acceptable Limit ± 5%				



Calculate by  
.....  
21...../.....12...../..2023..

Approve by  
.....  
22...../ ..Dec..../ ..2023..

MULTI-POINT GAS TEST REPORT

Test Date : Dec 21,2023

Equipment : Hydrocarbon Analyzer

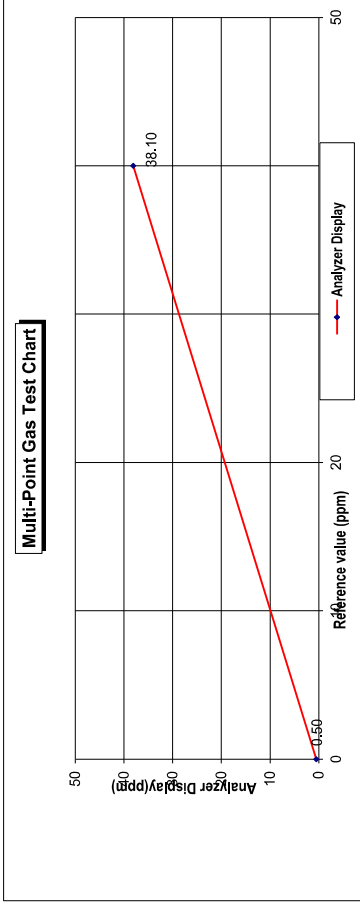
Model : APHA-370

Manufacturer : HORIBA

Serial Number : GY21PTED

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO <sub>2</sub> )	-	PPM	Manufacturer :
Nitric Oxide (NO)	-	PPM	Model :
Methane (CH <sub>4</sub> )	39.8	PPM	Serial Number :
Carbon Monoxide (CO)	-	PPM	
Cylinder No. :	D824432		
Expiration Date :	Aug 4,2028		

Multi-point gas test data				
Reference Value (ppm)		Analyzer Display (ppm)	Difference Error	Percent Error
Level 1	Zero	0.00	0.50	0.50
Level 2	80.00%	40.00	-1.90	-4.99
Remark : Measuring Range		50.00 ppm	Average Difference (%)	
				2.74
:Acceptable Limit ± 5%				



Calculate by  
.....  
21...../.....12...../..2023..

Approve by  
.....  
22...../ ..Dec..../ ..2023..





Certificate of Calibration

Customer

Name

Address

: UNITED ANALYST AND ENGINEERING CONSULTANT

: CO.,LTD.

: 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,

Prakanong, Bangkok 10260

Certificate No : 23-ACT-067

Request No : Req-2023-0978

Unit Under Calibration Details

Measurement item

Manufacturer

Model

Serial Number

ID

: Acoustic Calibrator

: LARSON DAVIS

: CAL150

: 6307

: UAE.EFM.049/2563

Class : 2

Range : 94 , 114 dB / 1000 Hz

Instrument Status : Used

Calibration Environment and Details

Temperature

Humidity

Barometric Pressure

Received Date

Calibration Date

Location of Calibration

Calibration Procedure

: ( 23 ±2 °C )

: ( 50 ± 20 %RH )

: (1013 ±10.0 hPa )

: 9 May 2023

: 12 May 2023

: LAB 1 Acoustic

: 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	EEL	31 May 2023
THD Multimeter	2015	1047765	NIMT	31 January 2024

Traceability

Note

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

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

Calibrated By :

Approved By :

Mr. Noppadon Luangart

Mr. Pacit Mathavorn

Service Calibration Engineer

Calibration Engineer Supervisor

Issue Date : 12 May 2023

CERTIFICATE OF CALIBRATION

Date of issue:	12/11/2564
Certificate Number	2021110760
Model:	6500
Serial Number	012043

Reference Item	Standard	Tolerance (-)	Tolerance (+)	As Found	Deviation	Unit
0	0.0	-1.0	1.0	0.0	0.0	Opacity (%)
22701	50.858	49.858	51.858	50.4	0.458	Opacity (%)
22926	97.056	96.056	98.056	97.3	-0.244	Opacity (%)
22914	99.050	98.050	100.050	99.1	-0.05	Opacity (%)
100.0	100.0	99.0	101.0	100.0	0.0	Opacity (%)

The uncertainty assigned to the above measurements is limited to +/-1.0 %.

Performed by **KR Autogroup Co., Ltd.**



Authorized Signature

## Calibration Certificate

Equipment :

Manufacturer :

Model :

Serial No.:

ID No.:

SOUND LEVEL METER

RION

NL-62 / Microphone UC-59L / Preamplifier NH-26

00511776 / 02267 / 11974

UAE-EFM.092/2565

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 :

Pressure :

Relative Humidity :

°C

kPa

%

( 23.0 ± 3 )

( 101.3 ± 3 )

( 50.0 ± 20 )

Received Date :

Calibration Date :

Date of Issue :

29 MAY 2023

07-08 JUNE 2023

09 JUNE 2023

Calibrated by :

Nathakorn Pisutpaisan

Approved by :

T. Petchurai

( 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.

### Calibration Results : Without Adjustment

### Sound pressure level

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty ( ± dB)	Acceptance limit Class 2 ( ± dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	93.98	-0.02	-	-	0.13	0.40
114 dB / 1000 Hz	114.12	0.12	-	-	0.13	0.40

### Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty ( ± %)	Acceptance limit Class 2 ( ± %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	999.11	0.09	-	-	0.01	1.7
114 dB / 1000 Hz	999.11	0.09	-	-	0.01	1.7

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

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty ( ± %)	Acceptance limit Class 2 ( ± %)
	Measured	Error (%)	Measured	Error (%)		
94 dB / 1000 Hz	0.12	-	-	-	0.40	3.0
114 dB / 1000 Hz	0.22	-	-	-	0.40	3.0

### Note :

- Acceptance limit was IEC60942:2017 Class 1
- The calibration results exclude the calibrator pressure correction
- The calibration results exclude the microphone volume correction

End of Calibration



Continuation of Calibration Certificate

Cert. No. : ACL23183  
Job No. : VC66AC0062  
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.4	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

Note : Pass/Fail evaluation for each parameter, will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

Continuation of Calibration Certificate

Cert. No. : ACL23183  
Job No. : VC66AC0062  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

**Calibration Method :**

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM). The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

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

**Condition of this result of calibration :**

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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).

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	-0.1	±1.0
125	0.0	0.1	±1.0
250	0.0	0.0	±1.0
500	0.0	0.0	±1.0
1000	0.0	0.0	±1.0
2000	0.0	0.1	±1.0
4000	0.0	0.0	±1.0
8000	0.0	0.1	+ 1.5, - 2.5
16000	0.1	-1.2	-1.1

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	± 0.1

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal ( dB )	Measured Value ( dB )	Deviation ( dB )	Acceptance Limit ( dB )
93.9 (93.98)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value ( dB )
15.4

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

Frequency Weighting	Measured value ( dB )
A - weight	10.8
C - weight	15.4
Flat	22.9

3. Acoustical signal tests of frequency weightings

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight Acceptance Limits
125	0.4	0.4	± 1.0
1000	0.3	0.3	± 0.7
8000	0.8	0.9	+ 1.5, - 2.5



Continuation of Calibration Certificate

Cert. No. : ACL23183  
Job No. : VC66AC0062  
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)
Auto	94.0	94.0	0.0	±0.8

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
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

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	133.0	133.0	0.0	±2.0
One	136.4	135.5	-0.9	±2.0

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	±1.0
Positive half cycle	135.4	135.2	-0.2	±1.0
Negative half cycle	135.4	135.2	-0.2	±1.0

Continuation of Calibration Certificate

Cert. No. : ACL23183  
Job No. : VC66AC0062  
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	±0.8
136.0	136.0	0.0	±0.8
135.0	135.0	0.0	±0.8
134.0	134.0	0.0	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.0	0.0	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	34.0	0.0	±0.8
30.0	30.0	0.0	±0.8
29.0	29.0	0.0	±0.8
28.0	28.0	0.0	±0.8
27.0	27.0	0.0	±0.8
26.0	26.0	0.0	±0.8
25.0	25.0	0.0	±0.8



## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-62 / Microphone UC-59L / Preamplifier NH-26  
**Serial No.:** 00901739 / 02317 / 01844  
**ID No.:** UAE.EFM.094/2565

**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 ± 3 ) °C  
**Pressure :** ( 101.3 ± 3 ) kPa  
**Relative Humidity :** ( 50.0 ± 20 ) %

**Received Date :** 05 MAY 2023  
**Calibration Date :** 08-09 MAY 2023  
**Date of Issue :** 10 MAY 2023

**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.

### 11. Overload indication

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

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



Continuation of Calibration Certificate

Cert. No. : ACL23151  
Job No. : VC66AC0053  
Pages : 3 of 8

**Summary of Measurement Result :**

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.4	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

Note : Pass/Fail evaluation for each parameter, will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

Continuation of Calibration Certificate

Cert. No. : ACL23151  
Job No. : VC66AC0053  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

**Calibration Method :**

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).  
The SLM had tests to Acoustical and Electrical signal tests of frequency weighing with Anechoic chamber and Reference Standard Instruments.

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

**Condition of this result of calibration :**

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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).

Continuation of Calibration Certificate

Cert. No. : ACL23151  
Job No. : VC66AC0053  
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 Limits
63	0.1	-0.2	±1.0
125	0.0	-0.1	±1.0
250	0.0	0.0	±1.0
500	0.0	0.0	±1.0
1000	0.0	-0.1	±1.0
2000	0.0	0.0	±1.0
4000	0.0	0.0	±1.0
8000	0.1	0.0	+ 1.5, - 2.5
16000	0.1	-1.2	+ 2.5, -16.0

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	94.1	0.1	± 0.2
Flat	94.0	94.1	0.1	± 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	94.1	0.1	± 0.1
Leq	94.0	94.1	0.1	± 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	± 0.1

Continuation of Calibration Certificate

Cert. No. : ACL23151  
Job No. : VC66AC0053  
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal ( dB )	Measured Value ( dB )	Deviation ( dB )	Acceptance Limit ( dB )
93.9 (93.98)	94.0	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	Measured value ( dB )
A - weight	11.1
C - weight	15.9
Flat	23.8

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 Limits
125	0.5	0.4	± 1.0
1000	0.3	0.3	± 0.7
8000	1.0	0.9	+ 1.5, - 2.5



Continuation of Calibration Certificate

Cert. No. : ACL23151  
Job No. : VC66AC0053  
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)
Auto	94.0	94.0	0.0	±0.8

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	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±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
	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
SEL	2	8	108.0	107.9	-0.1	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

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	133.0	133.0	0.0	±2.0
One	136.4	135.6	-0.8	±2.0

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	±1.0
Positive half cycle	135.4	135.1	-0.3	±1.0
Negative half cycle	135.4	135.1	-0.3	±1.0

Continuation of Calibration Certificate

Cert. No. : ACL23151  
Job No. : VC66AC0053  
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	137.1	0.1	±0.8
136.0	136.1	0.1	±0.8
135.0	135.1	0.1	±0.8
134.0	134.1	0.1	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.1	0.1	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	34.0	0.0	±0.8
30.0	30.0	0.0	±0.8
29.0	28.9	-0.1	±0.8
28.0	28.0	0.0	±0.8
27.0	27.0	0.0	±0.8
26.0	25.9	-0.1	±0.8
25.0	24.9	-0.1	±0.8



## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-62 / Microphone UC-59L / Preamplifier NH-26  
**Serial No.:** 00511775 / 02266 / 11973  
**ID No.:** UAE-EFM.091/2565

**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 ± 3 ) °C  
**Pressure :** ( 101.3 ± 3 ) kPa  
**Relative Humidity :** ( 50.0 ± 20 ) %

**Received Date :** 05 MAY 2023  
**Calibration Date :** 08-09 MAY 2023  
**Date of Issue :** 10 MAY 2023

**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.

### 11. Overload indication

Measured value ( dB )		Deviated Value ( dB )	Acceptance Limits ( dB )
Positive one-half cycle	Negative one-half cycle	0.2	±1.5
89.4	89.6		

### 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	±0.1

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



Continuation of Calibration Certificate

Cert. No. : ACL23150  
Job No. : VC66AC0053  
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.3	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

Note : Pass/Fail evaluation for each parameter, will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

Continuation of Calibration Certificate

Cert. No. : ACL23150  
Job No. : VC66AC0053  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

**Calibration Method :**

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM). The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

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

**Condition of this result of calibration :**

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EP-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EP-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EP-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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).

Continuation of Calibration Certificate

Cert. No. : ACL23150  
Job No. : VC66AC0053  
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 Limits
63	0.0	-0.1	±1.0
125	0.0	0.0	±1.0
250	0.0	0.0	±1.0
500	0.0	0.0	±1.0
1000	0.0	0.0	±1.0
2000	0.0	0.0	±1.0
4000	0.0	0.0	±1.0
8000	0.0	0.1	+ 1.5, - 2.5
16000	0.0	-1.2	+ 2.5, -16.0

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	± 0.1

เอกสารไม่ควบคุม  
จ. เบลอ

Continuation of Calibration Certificate

Cert. No. : ACL23150  
Job No. : VC66AC0053  
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal ( dB )	Measured Value ( dB )	Deviation ( dB )	Acceptance Limit ( dB )
93.9 (93.98)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value ( dB )
15.1

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

Frequency Weighting	Measured value ( dB )
A - weight	10.8
C - weight	16.4
Flat	23.5

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 Limits
125	0.5	0.5	± 1.0
1000	0.3	0.3	± 0.7
8000	0.3	0.4	+ 1.5, - 2.5

เอกสารไม่ควบคุม  
จ. เบลอ



## Continuation of Calibration Certificate

Cert. No. : ACL23150  
Job No. : VC66AC0053  
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)
Auto	94.0	94.0	0.0	±0.8

## 9. Tone burst response

Time Weighting	Tone burst duration, T <sub>b</sub> (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	134.0	0.0	±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

## 10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
One	136.4	135.7	-0.7	±2.0

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	±1.0
Positive half cycle	135.4	135.1	-0.3	±1.0
Negative half cycle	135.4	135.1	-0.3	±1.0

## Continuation of Calibration Certificate

Cert. No. : ACL23150  
Job No. : VC66AC0053  
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	±0.8
136.0	136.0	0.0	±0.8
135.0	135.0	0.0	±0.8
134.0	134.0	0.0	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.0	0.0	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.1	0.1	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.1	0.1	±0.8
69.0	69.1	0.1	±0.8
64.0	64.0	0.0	±0.8
59.0	59.1	0.1	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	34.0	0.0	±0.8
30.0	30.0	0.0	±0.8
29.0	29.0	0.0	±0.8
28.0	28.0	0.0	±0.8
27.0	27.0	0.0	±0.8
26.0	26.0	0.0	±0.8
25.0	24.9	-0.1	±0.8

Continuation of Calibration Certificate

Cert. No. : ACL23150  
 Job No. : VC66AC0053  
 Pages : 8 of 8

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	±0.1

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

รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์คุณภาพอากาศ									
1	Analytical Balance (Readability 0.1 mg)	ปริมาณฝุ่นละอองรวม (TSP) ฝุ่นละอองขนาดเล็กกว่า 10 ไมครอน (PM10)	Mettler-Toledo	MS204TS/00  C252436235	National Food Institute, Ministry of Industry, Thailand	2402420-003-01	19 Apr 24	18 Apr 25	-
2	Analytical Balance (Readability 0.1 mg)		Mettler-Toledo	AB204-S/FACT /  B108115858	National Food Institute, Ministry of Industry, Thailand	2402420-001-01	19 Apr 24	18 Apr 25	-
เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์คุณภาพน้ำ									
3	pH Meter	ความเป็นกรดต่าง (pH) อุณหภูมิ (Temperature)	Mettler-Toledo	Seven Easy S20 /  1230525212	DKSH (Thailand) Ltd.	C07240167	9 Apr 24	8 Apr 25	-
4	pH Meter								
5	Analytical Balance (Readability 0.01 mg)	สารแขวนลอยทั้งหมด (SS) ของแข็งละลายน้ำทั้งหมด (Total Dissolved Solids)	Mettler-Toledo	XSR205DU /  C210685394	National Food Institute, Ministry of Industry, Thailand	2402283-002-01	2 Apr 24	1 Apr 25	-
6	Hot Air Oven		Memmert	UF55 /  B216.1666	National Food Institute, Ministry of Industry, Thailand	2400141-001-01	11 Oct 23	10 Oct 24	-
7	Analytical Balance (Readability 0.1 mg)	น้ำมันและไขมัน (Oil and Grease)	Mettler-Toledo	XSR204 /  C117635043	Technology Promotion Association (Thailand-Japan)	24MM293	11 May 24	10 May 25	-
8	BOD Incubator	บีโอดี (BOD)	Arco	UC4-1320 / (UAE.WAO.015/2561)	Technology Promotion Association (Thailand-Japan)	24TM303	10 Feb 24	9 Feb 25	-
9	DO Meter		YSI	5100 /  11B101863	Technology Promotion Association (Thailand-Japan)	24TW39	21 Feb 24	20 Feb 25	-
10	Fluorescence Spectrophotometer	สารอินทรีย์คาร์บอนทั้งหมด (Total Organic Carbon)	Perkin Elmer	LS 55 /  81440	Perkin Elmer Ltd.	FLR1001/2023	21 Feb 23	20 Feb 24	-



รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์คุณภาพน้ำ									
11	UV-VIS Spectrophotometer	ไนเตรตในหน่วยไนโตรเจน (Nitrate Nitrogen)  ฟอสเฟต-ฟอสฟอรัส (Phosphate Phosphorus)  แอมโมเนีย (Ammonia)	Agilent  Technologies	Cary60 G6860A /  MY15410009	DQE Services Co.,Ltd.	SP24-018	7 May 24	6 May 25	-
12	Digestor Unit	ทีเคเอ็น (TKN)	FOSS TECATOR	DT2520 / 91794469	FOSS South East Asia	9809	8 Feb 24	7 Feb 25	-
13	Distillation Unit (Kjeldahl Method)		FOSS TECATOR	KT8100/ 91889052	FOSS South East Asia	8411	29 May 23	28 May 24	-
14	Incubator	แบคทีเรียกลุ่มโคลิฟอร์มทั้งหมด (Total Coliform Bacteria)  แบคทีเรียกลุ่มฟีคอลโคลิฟอร์ม (Fecal Coliform Bacteria)	Memmert	IPP 260 / V615.0187	Technology Promotion Association (Thailand-Japan)	24TM648	1 Apr 24	31 Mar 25	-
15	Incubator		Memmert	IPP 260 / V618.0033	Technology Promotion Association (Thailand-Japan)	24TM651	2 Apr 24	1 Apr 25	-
16	Water Bath		Memmert	WNE 14 / L416.0606	Technology Promotion Association (Thailand-Japan)	24TM29	10 Feb 24	8 Feb 25	-
17	Water Bath		Memmert	WNE 14 / L416.0612	Technology Promotion Association (Thailand-Japan)	24TM30	10 Feb 24	8 Feb 25	-
18	Auto Clave		ALP	CL-40L / 808763	National Food Institute, Ministry of Industry, Thailand	2402281-001-01	2 Apr 24	1 Apr 25	-
19	Auto Clave		ALP	CL-40L / 810010	DKSH (Thailand) Ltd.	C11230106	9 Jun 23	8 Jun 24	-
20	Analytical Balance		OHAUS	PX623 / C236754745	DKSH (Thailand) Ltd.	C01234158	7 Dec 23	6 Dec 24	-

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

## Calibration Report

**Certificate No.:** 2402420-003-01

**Equipment:** Electronic Balance

**Model:** MS204TS/00

**Serial No.:** C252436235

**Capacity:** 220 g

**Manufacturer:** METTLER TOLEDO

**Resolution:** 0.0001 g

**ID No.:** UAE.AIR.023/2566

**Date of Calibration:** 19 April 2024

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

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

**Condition of Equipment:** Good Condition

### Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	15880	TCS	M2311181S	28 November 2024
Standard Weight Class E2	1-500g	15882	TCS	M2311182S	28 November 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH.019/23	Quality Reborn	QR24-0492	4 March 2025

3. This certification is traceable to SI UNIT

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

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

### Calibration Results:

#### 1. Repeatability of Reading:

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

#### 2. Off-Center Error:

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

The balance reading obtained is given in the table.

<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
1 (g)	2 (g)	3 (g)
100.0005	100.0006	100.0003
100.0003	100.0006	100.0003
100.0003	100.0006	100.0005
100.0005	100.0006	100.0005
(Maximum Difference) (g)		
0.0002		

FCS-012 Revision: 01 Date: 20-04-65

## Calibration Certificate

**Certificate No.:** 2402420-003-01

**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,

Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

**Equipment:** Electronic Balance

**Manufacturer:** METTLER TOLEDO

**Model:** MS204TS/00

**Serial No.:** C252436235

**ID No.:** UAE.AIR.023/2566

**Order No.:** 2402420

**Operation No.:** 2402420-003

**Date of Receipt:** 19 April 2024

**Date of Calibration:** 19 April 2024

**Calibrated by** Mr.Pheraphat Tuanjit

Scientist

**Approved by** *P. Jaenghantit*

( Miss Preeyaporn Jaenghantit )

Vice President, Department of Laboratory Services

Responsible for the Technical Management Team

**Date of Issue:** 23 April 2024

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

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


FCS-009 Revision: 01 Date: 20-04-65

## Calibration Certificate

**Certificate No.:** 2402420-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

**Equipment:** Electronic Balance  
**Manufacturer:** METTLER TOLEDO  
**Model:** AB204-S/FACT  
**Serial No.:** B108115858  
**ID No.:** UAE.AIR.016/2555  
**Order No.:** 2402420  
**Operation No.:** 2402420-001  
**Date of Receipt:** 19 April 2024  
**Date of Calibration:** 19 April 2024

**Calibrated by** Mr.Pheraphat Tuanjit  
Scientist  
**Approved by**   
( Miss Preeyaporn Jaengkarnkit )  
Vice President, Department of Laboratory Services  
Responsible for the Technical Management Team  
**Date of Issue:** 23 April 2024

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

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

FCS-009 Revision: 01 Date: 20-04-65

## Calibration Report

**Certificate No.:** 2402420-003-01  
**Equipment:** Electronic Balance  
**Manufacturer:** METTLER TOLEDO  
**Model:** MS204TS/00  
**Resolution:** 0.0001 g  
**Serial No.:** C252436235  
**ID No.:** UAE.AIR.023/2566  
**Capacity:** 220 g

Page 3 of 3

**Date of Calibration:** 19 April 2024

**Calibration Results:** (Continued)

**Calibration Range:** 0-200 g

**Calibration Adjustment:** Internal Calibration

**3. Departure from Nominal Value:**

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

  
23 April 2024

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

\*\*\*\*\* End \*\*\*\*\*

FCS-012 Revision: 01 Date: 20-04-65



## Calibration Report

**Certificate No.:** 2402420-001-01

**Equipment:**

**Manufacturer:** METTLER TOLEDO

**Model:** AB204-S/FACT

**Resolution:** 0.0001 g

**Serial No.:** B108115858

**ID No.:** UAE.AIR.016/2555

**Capacity:** 220 g

**Date of Calibration:** 19 April 2024

Page 3 of 3

**Calibration Results:** (Continued)

**Calibration Range:** 0-200 g

**Calibration Adjustment:** Internal Calibration

**3. Departure from Nominal Value:**

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (±g)	Coverage Factor k
Unload	0.00000	0.0000	0.0000	0.000009	2.00
0.1	0.10000	0.1000	0.0000	0.000009	2.00
1	0.99998	1.0000	0.0000	0.000092	2.00
5	4.99997	5.0000	0.0000	0.000091	2.00
10	10.00002	10.0001	-0.0001	0.00012	2.00
20	20.00003	20.0001	-0.0001	0.00014	2.00
50	49.99998	50.0000	0.0000	0.00012	2.00
70	70.00000	69.9999	0.0001	0.00016	2.00
100	99.99997	100.0000	0.0000	0.00017	2.00
150	149.99994	149.9997	0.0002	0.00022	2.00
200	200.00001	199.9995	0.0005	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 \*\*\*\*\*

FCS-012 Revision: 01 Date: 20-04-65

## Calibration Report

**Certificate No.:** 2402420-001-01

**Equipment:**

**Manufacturer:** METTLER TOLEDO

**Model:** AB204-S/FACT

**Resolution:** 0.0001 g

**Serial No.:** B108115858

**ID No.:** UAE.AIR.016/2555

**Capacity:** 220 g

**Date of Calibration:** 19 April 2024

Page 2 of 3

**Environment Condition:** Ambient Temperature: 22.1 ± 0.6 °C Relative Humidity: 49 ± 1.9 %

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

**Condition of Equipment:** Good Condition

**Condition of This Results of Calibration:**

1. Calibration Method: NFI Method W-M4-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	15880	TCS	M2311815	28 November 2024
Standard Weight Class E2	1-500g	15882	TCS	M2311825	28 November 2024
<b>Instrument</b>	<b>Model</b>	<b>Serial No.</b>	<b>Calibrated By</b>	<b>Certificate No.</b>	<b>Due Date</b>
Thermo-Hygro Meter	608-H1	NFI.BTH 019/23	Quality Reborn	QI24-0492	4 March 2025

3. This certification is traceable to SI UNIT

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

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

**Calibration Results:**

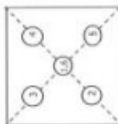
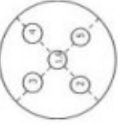
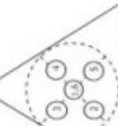
**1. Repeatability of Reading:**

Nominal Value (g)	Standard Deviation of Reading (g)
100	0.000057
200	0.000079

**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)
99.9999	99.9997	99.9996
4 (g)	5 (g)	6 (g)
99.9998	99.9998	100.0000
99.9998	99.9998	99.9998
(Maximum Difference) (g)		
0.0003		

FCS-012 Revision: 01 Date: 20-04-65

Calibration Results:

pH Scale

Input (mV)	pH Meter Reading			Uncertainty of Measurement (mV)	Coverage Factor (k)
	(mV)	Error (mV)	(pH)		
414.12	414	-0.12	0.00	0.58	2.00
354.96	355	0.04	1.00	0.58	2.00
295.8	296	0.20	2.00	0.58	2.00
236.64	237	0.36	3.00	0.58	2.00
177.48	178	0.52	4.00	0.58	2.00
118.32	118	-0.32	5.00	0.58	2.00
59.16	59	-0.16	6.00	0.58	2.00
0	0	0.00	7.00	0.58	2.00
-59.16	-59	0.16	8.00	0.58	2.00
-118.32	-118	0.32	9.00	0.58	2.00
-177.48	-177	0.48	10.00	0.58	2.00
-236.64	-236	0.64	11.00	0.58	2.00
-295.8	-296	-0.20	12.00	0.58	2.00
-354.96	-355	-0.04	13.00	0.58	2.00
-414.12	-414	0.12	14.00	0.58	2.00

Certificate of Calibration



Equipment:

Model: pH METER  
Serial No. (or ID.): SevenEasy  
Manufacturer: METTLER TOLEDO  
Electrode Serial No.: 1230525212 (UAE.WAS.003/2553)  
Condition: In Condition

Customer:

United Analyst and Engineering Consultant Company Limited  
3 Soi Udomsuk 41 Sukhumvit Road,  
Bangkok, Prakanong, Bangkok 10260 Thailand

Environment Condition:

Temperature 23 °C ± 2 °C  
Humidity 50 %RH ± 15 %RH

Calibration Place:

Environment Laboratory, DKSH Technology Limited,  
2533 Sukhumvit Road, Bangkok,  
Prakanong, Bangkok 10260 Thailand

Calibration By:

Miss.Orawan Khlaiphloi

Calibration Date:

9 April 2024

The Method used:

In house method, CAL-WI-58, base on ASTM E 70-07

Traceability:

This certificate is traceable to SI Units, Sample Test is assured through primary measurement method Harned cell, through CPAchem Ltd. (ISO/IEC 17034) Certificate No. 938377, 931985, 931984 And pH Scale traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through Industrial Foundation Electrical and Electronics Institute Certificate No. CA20230350EA

Orawan

(Miss Orawan Khlaiphloi)

Person in charge

Nilinun

(Mr. Nilinun Srihawan)

Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to International or national standard or other recognized national standard laboratories.  
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).  
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or stamped. The report shall not be reproduced except in full without approval of DKSH Technology Limited.



## Certificate of Calibration



**Equipment:** Digital Thermometer with Probe  
**Model:** SevenEasy pH  
**Serial No.:** 1230525212  
**Manufacturer:** METTLER TOLEDO  
**ID No.:** UAE.WAS.003/2553

**Certificate No.:** C15240373  
**Issued Date:** 09 April 2024  
**Job No.:** WO-00024208  
**Page:** 1 of 2  
**Condition:** In Condition

**Customer:** United Analyst and Engineering Consultant Company Limited  
3 Soi Udomsuk 41 Sukhumvit Road,  
Bangkok, Prakanong, Bangkok 10260 Thailand

**Environment Condition:** Temperature: 22 °C ± 3 °C  
Humidity: 50 %RH ± 20 %RH  
Voltage: 220 VAC ± 10 %

**Calibration Place:** Thermo-Hygro Laboratory, DKSH Technology Limited,  
2533 Sukhumvit Road, Bangkok,  
Phrakhanong, Bangkok 10260 Thailand

**Calibration By:** Mr. Nateekarn Mitijt  
**Calibration Date:** 09 April 2024  
**The Method used:** In house method, CAL-WI-19, by comparison with standard thermometer  
**Traceability:** This certificate is traceable to the International System of Unit maintained by Quality Rebom Co.,Ltd. (QR) Certificate No. QR23-1073

(Mr. Nateekarn Mitijt)  
Person in charge

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.  
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).  
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled.  
The report shall not be reproduced except in full without approval of DKSH Technology Limited.

(Mr. Pramote Ramrong)  
Authorized signatory



### Practical slope and zero point\*

The three-point calibration using three standard buffer solutions; pH 4.008 , pH 6.985 and pH 9.997  
-During calibration, display of pH meter reading: pH 4.00 , pH 7.00 and pH 10.01  
The practical slope of the pH electrode; 57.01 (mV/pH), 96.37%  
The zero point of the pH electrode; 6.88 (pH)

### Sample Test Results

Standard Buffer Solution (pH)	Unit Under Calibration (pH)	Difference (pH)	Uncertainty of Measurement (pH)	Coverage Factor (k)
4.008	3.99	-0.018	0.0070	2.00
6.985	7.00	0.015	0.0091	2.00
9.997	10.02	0.023	0.0074	2.00

\* Calibration Marked "Not TISI Accredited" in this Certificate have been included for completeness.

The End of Certificate



## Calibration Certificate

**Certificate No.:** 2303560-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhnong, Bangkok 10260

Page 1 of 5

<b>Equipment:</b>	pH Meter
<b>Manufacturer:</b>	Mettler Toledo
<b>Model:</b>	Seven Compact S220
<b>Serial No.:</b>	C113432421
<b>ID No.:</b>	UAE.WAT.009/2564
<b>Order No.:</b>	2303560
<b>Operation No.:</b>	2303560-001
<b>Date of Receipt:</b>	23 June 2023
<b>Date of Calibration:</b>	26 June 2023

**Calibrated by** Mr. Worapob Sooktong  
Scientist

**Approved by** *S. Pongthamkit*  
( Mr. Phraphat Tuanjit ) (for)  
Manager, Division of Calibration Laboratory

**Date of issue:** 27 June 2023  
**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 recognised national standards and to the units of measurement realised 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

### Reference standard equipment:

Equipment	Certificate no	Cal. date	Next Cal. date
Digital Thermometer with Probe	QR23-1073	2 May 23	2 May 24

### Calibration Results: Without Adjustment

Sensor Type: RTD

Diameter (mm) 4 Length (mm): 135 Channel: -

Immersion (mm): 110

Calibrate Point (°C)	STD. Reading (°C)	UUC. Reading (°C)	Correction of UUC (°C)	Uncertainty (± °C)
15.0	15.010	15.1	-0.090	0.076
25.0	25.006	25.1	-0.094	0.076
35.0	35.004	35.0	0.004	0.076

The End of Certificate

## Calibration Report

Certificate No.: 2303560-001-01

Equipment: pH Meter

Resolution: 0.01 pH : 1 mV

Manufacturer: Mettler Toledo

Model: Seven Compact S220

Type: Bench top

Serial No.: C113432421

ID No.: UAE.WAT.009/2564

Date of Calibration: 26 June 2023

Page 3 of 5

### Calibration Results:

1. Calibration of pH Meter (Manual Temperature Compensation at 25 °C)


Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (±mV)	Coverage Factor (k)
		mV	pH		
0	414.121	414	0.00	0.58	2.00
2	295.814	295	2.00	0.58	2.00
4	177.484	177	4.00	0.58	2.00
6	59.160	59	6.00	0.58	2.00
7	0.001	0	7.00	0.58	2.00
8	-59.159	-59	8.00	0.58	2.00
10	-177.461	-177	10.00	0.58	2.00
12	-295.811	-295	12.00	0.58	2.00
14	-414.118	-414	14.00	0.58	2.00

2. Calibration of pH Meter with Electrode (Manual Temperature Compensation at 25 °C)

Equipment: pH Electrode  
Type: Combined Electrode  
Manufacturer: Mettler Toledo  
Model: InLab Expert Pro-ISM  
Serial No.: 3114136  
ID No.: N/A

Performance of Electrode system (Three-Point Calibration at pH 4, pH 7 and pH 10)

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.01	177	-	0.0071	2.00
6.865	6.90	9	98.28	0.0074	2.00
10.01	10.01	-168	96.20	0.0085	2.00
6.986	7.02	3	-	0.0093	2.00

  
27 June 2023

## Calibration Report

Certificate No.: 2303560-001-01

Equipment: pH Meter

Resolution: 0.01 pH : 1 mV

Manufacturer: Mettler Toledo

Model: Seven Compact S220

Type: Bench top

Serial No.: C113432421

ID No.: UAE.WAT.009/2564

Date of Calibration: 26 June 2023

Page 2 of 5

Location: Chemical Calibration Laboratory, National Food Institute

Environment Condition: Ambient Temperature: ( 24.3 ± 1.5 ) °C Relative Humidity: ( 49 ± 3 ) %

Condition of Equipment: Good Condition

Condition of this Results of Calibration

1. Calibration Method In house method - W-CC-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

2. Reference Standards / Certified Reference Material

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fluke	23E2003	14 June 2024
2.2 Digital Thermometer	2709007	Fluke	CC-650567-01	30 October 2023
2.3 Thermo-Hygro Meter	NFIBTH00317	PONPE	TE 650566-01	21 September 2023
Certified Reference Material				
2.4 pH buffer 4.008 (Primary pH buffer Solution)	873608	CPAchem	PH216.L5	16 February 2025
2.5 pH buffer 7.00 (Standard pH buffer Solution)	873612	CPAchem	PH107.L5	16 February 2024
2.6 pH buffer 10.01 (Primary pH buffer Solution)	873611	CPAchem	PH220.L5	16 February 2024
2.7 pH buffer 6.865 (Primary pH buffer Solution)	873609	CPAchem	PH217.L5	16 February 2025

3. This certification is traceable to The International System of Unit (SI Unit)

3.1 Instruments No.2.1	through
3.2 Instruments No.2.2	through
3.3 Instruments No.2.3	through
3.4 Certified Reference Material No. 2.4 to 2.6	traceable to

3.5 Certified Reference Material No.2.7

traceable to

NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0008

NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0061

NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0061

Primary measurement method: Harned cell using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025

BIM RefN HI-13 LoN 25.05.2022; BIM RefN HI-16 LoN 02.06.2022; BIM RefN HI-13 LoN 25.05.2022; BIM RefN HI-16 LoN 02.06.2022; the Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025

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 Report

**Certificate No.:** 2303560-001-01  
**Equipment:** Digital Thermometer with RTD (pH Meter)  
 Resolution: 0.1 °C Model: Seven Compact S220  
 Serial No.: C113432421 ID No.: UAE.WAT.009/2564  
 Manufacturer: Mettler Toledo  
**Date of Calibration:** 26 June 2023

Page 5 of 5

**Calibration point:** 15.0, 25.0 and 35.0 °C  
**Calibration result:**

- The probe was immersed in liquid bath or dry bath to a minimum depth of 100 mm.

- Description of probe, model : HI1310 SN : 078743

Dimension of probe : Diameter 12 mm., Length 175 mm.,

Sheath material : Plastic

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.0	15.003	0.0	0.099
24.9	25.005	0.1	0.099
34.9	35.005	0.1	0.099

Note - UUC\* : Unit Under Calibration

  
 27 June 2023

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

----- End -----

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



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## Calibration Report

**Certificate No.:** 2303560-001-01  
**Equipment:** Digital Thermometer with RTD (pH Meter)  
 Resolution: 0.1 °C Model: Seven Compact S220  
 Serial No.: C113432421 ID No.: UAE.WAT.009/2564  
 Manufacturer: Mettler Toledo  
**Date of Calibration:** 26 June 2023

Page 4 of 5

**Location:** Chemical Calibration Laboratory, National Food Institute

**Environment Condition:** Ambient Temperature ( 24.4 ± 1.0 ) °C

Relative Humidity ( 54 ± 2 ) %

### Condition of this results of Calibration:

- Calibration Method :
  - In house method: W-TE-025 by comparison with standard thermometer.
  - The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.
  - The temperature scale in use at this laboratory is the International Temperature scale of 1990 ( ITS-90 ).
- Reference Standard Instrument :
  - Low Temperature Bath (ISOCAL-6), Model: Europa-6 Plus Basic, S/N: 341592/2

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	2933097	PSL-T 1282/85	03-Nov-23	TISTR
Platinum Resistance Thermometer (PRT)	5627A	923972			

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- Condition of Calibrated Item : Good
- Result of Calibration :
  - ☒ Without adjustment
  - ☐ After adjustment

  
 27 June 2023

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



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# Calibration Report

**Certificate No.:** 2402283-002-01

**Equipment:** Electronic Balance

**Manufacturer:** METTLER TOLEDO

Resolution: 0.00001 g / 0.00001 g

ID No.: UAE\_WAO.010/2565

Capacity: 220 g

2 April 2024

Page 2 of 4

Page 1 of 4

Date of Calibration: 2 April 2024

<b>Environment Condition:</b>	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:

<u>Reference Standard</u>	<u>Model</u>	<u>Serial No.</u>
Standard Weight Class F7	1mm to 200n	B505567572

Instrument	Model	Serial No
Standard Weight Class 14	Model 14	0000000000

Model	Serial No.
000 100	000 100

Thermo-Hygro Meter  
608-HI

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:**

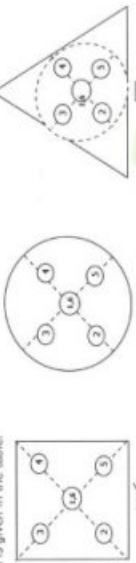
### 1. Repeatability of Reading:

Nominal Value ( g )	Standard Deviation of Reading ( g )
40	0.000042
80	0.000052
100	0.000048
200	0.000048

## 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 )
100.0000	100.0000	100.0001	99.9999	99.9999	100.0001	100.0000	0.0001

100

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

E-CC-012 Revision: 01 Date: 20 04-65

1. **THE PROBLEM**

สามารถนำมาใช้ประโยชน์ได้ทั้งทางเคมี สามารถสกัดจาก GC สามารถใช้ประโยชน์

08 Sa 36, Nun Amarin Road, Bang Yi Khan Sa

$$+65(0) 2422 8688 \quad \text{Fax: } +65(0) 2422 8545$$

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## Calibration Report

**Certificate No.:** 2400141-001-01  
**Equipment:** CHAMBER (Hot Air Oven)  
**Model:** UF 55 **Serial No.:** B216.1666  
**Resolution:** 0.1 °C **ID No.:** UAE.WAO.027/2559  
**Manufacturer:** MEMMERT  
**Date of Calibration:** 11 October 2023

Page 2 of 3

**Location:** Laboratory, Floor 2, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

**Environment Condition:**  
Ambient Temperature ( 28 ± 1 ) °C  
Relative Humidity ( 63 ± 2 ) %  
Line Voltage ( 228 ± 1 ) Volt

### Condition of this results of Calibration:

- This instrument was calibrated by Insert 9 standard thermometer into its chamber and calibration according to W-TE-014 Based on TLAS G-20-1/02-08 (E); Guidelines for Calibration and Checks of Temperature Controlled Enclosures.  
- The temperature scale used was based on ITS - 90.  
- All data show below were final values and the initial data may be obtained upon request.
- Reference Standard Instrument :

Instrument	Model	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	34972A RTD	MY49016894 CH#201-209/ RTD#201-209	TE 660380-01	22 April 2024	NATIONAL FOOD INSTITUTE

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.

Condition of Calibrated Item : Good

UUC Description :

Time of Record 1 Hour 9 Minute At 104.0, 140.0 and 180.0 °C  
Fresh air Damper  
Open ☐ Position ☐  
Close ☒  
Not Available ☐

7. Result of Calibration : ☒ Without adjustment ☐ After adjustment

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



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## Calibration Certificate

**Certificate No.:** 2400141-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakanong, Bangkok 10260

Page 1 of 3

**Equipment:** CHAMBER (Hot Air Oven)

**Manufacturer:** MEMMERT

**Model:** UF 55

**Serial No.:** B216.1666

**ID No.:** UAE.WAO.027/2559

**Order No.:** 2400141

**Operation No.:** 2400141-001

**Date of Receipt:** 11 October 2023

**Date of Calibration:** 11 October 2023

**Calibrated by** Mr. Worapob Sooktong **Approved by** (Mr. Pheraphat Tuanjit)  
Scientist Manager, Division of Calibration Laboratory

**Date of Issue:** 16 October 2023 **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



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



## Certificate of Calibration

Cert.No.: 24MM293  
Page.: 1 of 3

Equipment : Electronic Balance  
Manufacturer : Mettler Toledo  
Model : XSR204  
Serial No. : C117635043  
ID No. : UAE.WAS.012/2564

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

Location : Balance Room (108)

Received order : 11 May 2024

Calibration Date : 11 May 2024

Ambient Temperature : 15 °C to 40 °C

Relative Humidity : 30 % to 90 %

Calibrated by : Khit Ruttanaprapachai

Approved by :   
Approved Signatory

( ) Porpan Palipim  
( ) Suwit Imjai  
(✓) Kunchit Promprat

Issue Date : 15 May 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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ศูนย์ทดสอบและพัฒนาอุตสาหกรรมอาหาร  
Foundation for Industrial Development National Food Institute  
Food Industrial Laboratory Service Center  
Ministry of Industry



## Calibration Report

Certificate No.: 2400141-001-01  
Equipment: CHAMBER (Hot Air Oven)  
Model: UF 55 Serial No.: B216.1666  
Resolution: 0.1 °C ID No.: UAE.WAO.027/2559  
Manufacturer: MEMMERT

Page 3 of 3

Date of Calibration: 11 October 2023

Calibration point: 104.0, 140.0 and 180.0 °C

Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
MIN	28.2	61.4	227.4
MAX	28.3	65.1	229.3

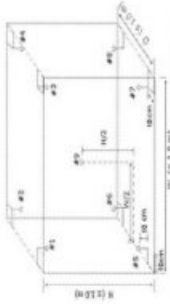


Table 1 : Reporting of Temperature

Calibration point (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty ± (°C)
	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	
104.0	104.05	103.98	104.02	104.08	104.00	104.05	103.99	104.17	104.00	0.53
140.0	140.09	139.99	139.91	140.05	139.99	139.91	139.97	140.26	139.97	0.73
180.0	180.46	180.33	180.25	180.28	180.33	179.96	180.31	180.64	180.16	0.90

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	MIN	MAX	Average			
104.0	104.0	104.0	104.0	0.090	0.18	0.38
140.0	140.0	140.1	140.0	0.075	0.28	0.47
180.0	180.0	180.1	180.0	0.13	0.48	0.88

Note The quoted uncertainty include " Stability " and " Loading effect (20% of Temp Uniformity) "

UUC\* = Unit Under Calibration

Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors,  
for at least half an hour after reaching steady state.

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.

Overall Variation = The difference of the maximum and minimum measured temperatures throughout observation time.

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

\*\*\*\*\* End \*\*\*\*\*



FCS-012 Revision: 01 Date: 20-04-65

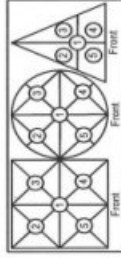


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Equipment : Electronic Balance  
Condition As-Received : Used Item  
Reference : 2405-0166OC-2

Cert.No.: 24MM293  
Page: 3 of 3



### 2. Effect of off center loading

A mass of 100 g was placed to various position on the pan.  
The weighing machine reading error obtained is given in the table

Position 1 (g)	Position 2 (g)	Position 3 (g)	Position 4 (g)	Position 5 (g)
+0.0002	-0.0001	0.0000	+0.0002	0.0000

Maximum difference between  
off-center and central loading  
(g)

0.0003

### 3. Departure from nominal value

Applied Weight (g)		Balance Reading (g)	Correction (g)	Measurement Uncertainty ( $\pm$ mg)	Coverage Factor (k)
Unload		0.0000	0.0000	0.15	2.13
1		1.0000	0.0000	0.15	2.13
5		5.0000	0.0000	0.15	2.13
10		10.0000	0.0000	0.15	2.11
20		20.0000	-0.0000	0.19	2.03
50		50.0001	-0.0001	0.19	2.06
60		60.0001	-0.0001	0.19	2.04
80		80.0001	-0.0001	0.27	2
100		100.0002	-0.0002	0.27	2.03
120		120.0001	-0.0001	0.29	2
200		200.0001	-0.0001	0.31	2

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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Equipment : Electronic Balance  
Condition As-Received : Used Item  
Reference : 2405-0166OC-2

Cert.No.: 24MM293  
Page: 2 of 3

### Procedure used :-

Calibration were conducted using in-house calibration procedure CP-OB01 based on UKAS LAB 14 according to direct measurement method against standard weight.

### Condition of this result of calibration

1. Reference standard instruments:-

- Standard Weight Set (E2) Model 15884 Serial No. 24053 ID No. 70RC007 Test report No. MM-0013-24 Due date 25 Jan 2026
- This certificate is valid only to the item calibrated on date and place of calibration.
- This result of calibration was made on requested at the point specified by customer.
- This certificate is not certified for any commercial transaction.
- This certification is traceable to the International System of Unit.

Result of calibration ( ) Without Adjustment ( \* ) After Adjustment by Internal Calibration

Range capacity : 0 g to 220 g Resolution 0.0001 g

Before Adjustment :

Applied Weight (g)		Balance Reading (g)		Correction (g)		Measurement Uncertainty ( $\pm$ mg)		Coverage Factor (k)	
100		100.0000		0.0000		0.27		2.03	
200		200.0001		-0.0001		0.31		2	

After Adjustment :

1. Determination of the standard deviation of weighing machine (n = 10)

Applied Weight (g)		Standard Deviation of Reading (g)	
100		0.00007	
200		0.00007	

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**Equipment :** BOD Incubator  
**Condition As-Received :** Used Item  
**Reference :** 2402-0234OC-1  
**Result of Calibration :-** ( \* ) Without Adjustment  
**Function of UUC\* :** Temperature Source  
**Fresh air setting :** Not Available

**Cert. No.:** 24TM303  
**Page :** 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
20.0	20.1	19.9	0.37	0.72	1.4	2

Calibration Point (°C)	Measured Temperature (°C)								Uncertainty (± °C)
	1	2	3	4	5	6	7	8	
20.0	19.873	19.803	20.322	19.690	19.615	19.585	19.612	19.558	0.58

**Average\* :** The average of 30 values in each position.  
**Temperature stability :** One-half of the greatest maximum difference of measured temperature at any one sensor.  
**Temperature uniformity :** The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.  
**Overall Variation :** The Difference of the maximum and minimum measured temperatures throughout observation.  
**UUC\* :** Unit Under Calibration

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

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

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



**Cert. No.:** 24TM303  
**Page :** 1 of 3

## Certificate of Calibration

**Equipment :** BOD Incubator  
**Manufacturer :** Arco  
**Model :** UC4-1320  
**Serial No. :** 13JRC4S013201  
**ID No. :** UAE.WAO.015/2561  
**Submitted by :** United Analyst and Engineering Consultant Co.,Ltd.  
3 Sol Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
**Location :** Lab Floor 2  
**Received Order :** 10 February 2024  
**Calibration Date :** 10 February 2024  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %  
**Calibrated by :** Tawatchai Pama

**Approved by :**   
Approved Signatory

( ) Ponthippa Tameyakul  
( ☒ ) Unnopphol Harachai  
( ) Suwit Imjai

**Issue Date :** 19 February 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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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

Equipment : DO Meter  
Manufacturer : YSI  
Model : 5100  
Serial No. : 11B 101863  
ID No. : UAE.WAO.004/2554  
Received Date : 20 February 2024  
Test Date : 21 February 2024  
Reference : 2402-0629DSC-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 : Walailak Sirithean

Approved by :   
Approved Signatory

( ) Pormthippa Tameyakul  
( ) Umnopphol Harachai  
(✓) Saithip Meangmai

Issue Date : 22 February 2024

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Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2402-0234OC-1  
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

- Reference standard Instrument:-  
Instrument Serial No. Cert. No. Traceable Due Date  
1 ) Data Acquisition MY59003411 23LM208 TPA 27 Dec 2024
- This certificate is valid only to the item calibrated on date and place of calibration.
- This certification is traceable to the International System of Unit.

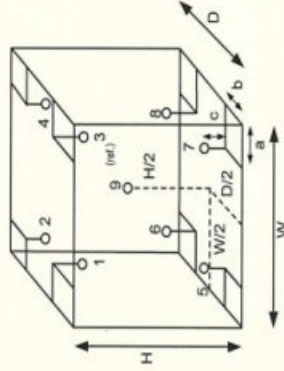
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Not Available

Environment during calibration	
	Environment during calibration
Temp. ( °C )	Beginning 28 Finished 31
REL.Humid. ( % )	70 65
AC Supply ( Volt )	233 234



Position :	Ref. Std. ID No.:
1	20RTD-2/1
2	20RTD-2/2
3	20RTD-2/3
4	20RTD-2/4
5	20RTD-2/5
6	20RTD-2/6
7	20RTD-2/7
8	20RTD-2/8
9 (ref.)	20RTD-2/9

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>

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**LS 45/50B/55 - Preventive Maintenance report**

<b>Company Name:</b>	United analyst and Engineering Consultant Co.,Ltd.		
<b>Address:</b>	3 Soi Udomsuk 41, Sukumvit Road, Phrakhanong, Bangkok 10260		
<b>User Name :</b>	K. Primpun	<b>WO Number:</b>	WO-01624974
<b>Telephone Number :</b>	02-763-2828	<b>Certificate Number :</b>	FLR1001-2023
<b>Customer Support Engineer :</b>	Tanongsak	<b>P.M. Number</b>	1 of 1
<b>PM Performed: (DD-MMM-YYYY)</b>	2-Feb-2023	<b>Next PM Due Date: (DD-MMM-YYYY)</b>	2-Feb-2024

**Scope**

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

**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 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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**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).

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1. Burette	-	130BU10	23CG1172	22 Mar 2025
2. Balance	14233821	110RC001	23MM405	16 July 2024

**2. Standard Material :-**

Material	Manufacturer	Lot.No.	Assay
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

**Result :** Dissolved Oxygen Meter Adjustment With Air 100 %  
Dissolved Oxygen Probe No.: 22B100125

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (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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## 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.
- ☐ Perform general inspection of system for cleanliness.

### 2. Optical checks and Clean:

- ☐ Lamp Alignment/Intensity
- ☐ Sample Compartment and Windows
- ☐ Mirror and Grating Alignment
- ☐ Filter Wheel
- ☐ Cell Holder Alignment

### 3. Mechanical:

- ☐ Physical inspection – Please write any comments in the additional comments section.
- ☐ Grating Drive Mechanism.
- ☐ Slit Drive Mechanism.
- ☐ Sample Holder

### 4. Test:

- ☐ Emission Wavelength Accuracy.

Emission Wavelength Accuracy		Actual Value	Validation Criteria
Target Peak (nm)		(nm)	Accuracy Limit +/- (nm)
Target Peak # 1	253.7	254.0	± 1.0 nm
Target Peak # 2	507.3	507.4	± 1.0 nm
Target Peak # 3	626.0	625.8	± 1.0 nm

## Component List

Component Model	Serial #	Software Version	Configuration Notes
LS55	81440	4.00.03	
-	-	-	-
-	-	-	-

## Parts Lists

Test standard Used				
Part Number (if applicable)	Description			
C 520-7440	Stanadard Fluorence Intensity Filter			
B050 7805	Sealed Water Cell			
Additional Tools Required for PM				
Part Number (if applicable)	Description	Quantity	Serial #	Calibration Due Date (MM/YY)



- ☒ Water Raman Sensitivity

	Actual Value
Signal to Noise	288 : 1
Drift	0.03

- ☒ Stray Light

	Actual Value
Stray Light at 290nm	2.64
Stray Light at 300nm	0.77

#### 5. Accessory (where applicable):

- ☐ Micro Plate Reader  
☐ Integrating Sphere  
☐ Multi Cell Holder  
☐ Water Jacketed Cell Holder  
☐ etc. ....

#### 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.

- ☒ Excitation Wavelength Accuracy.

Excitation Wavelength Accuracy		Actual Value	Validation Criteria
Target Peak (nm)		(nm)	Accuracy Limit +/- (nm)
Target Peak # 1	253.7	253.2	± 1.0 nm
Target Peak # 2	365.0	365.4	± 1.0 nm
Target Peak # 3	507.3	508.0	± 1.0 nm

- ☒ Emission Slit calibration.

Emission Slit		Actual Value	Validation Criteria
Target Value (nm)		(nm)	Accuracy Limit +/- (nm)
Target Peak # 1	2.5	2.63	± 0.5 nm
Target Peak # 2	5.0	4.75	± 0.5 nm
Target Peak # 3	10.0	9.99	+ 1.0 / - 0.5 nm

- ☒ Excitation Wavelength Repeatability.

Emission Slit		Actual Value	Validation Criteria
Target Value (nm)		(nm)	Accuracy Limit +/- (nm)
Target Peak # 1	2.5	2.57	± 0.5 nm
Target Peak # 2	5.0	5.08	± 0.5 nm
Target Peak # 3	10.0	9.80	+ 1.0 / - 0.5 nm

DQE Services Co.,Ltd.

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230

Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

MSC-TRUST 17025

CALIBRATION 1404

CERTIFICATE OF CALIBRATION

Page 1 of 5

Certificate No. :  
SP24-018

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 :  
Agilent Technologies

Model :  
Cary 60

Serial No. :  
MY15410009

ID No. :  
UAE.WAT.020/2558

Received Date :  
7 May 2024

Calibration Date :  
7 May 2024

Issue Date :  
9 May 2024

Condition Instrument :  
Good

Calibrated by :  
ปณิพัทธ์  
( Mr.Tanawat Rittidach )  
Technical Manager

Approved by :  
ชลวิศา  
( 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.

PerkinElmer

For the Better

Additional Comments

Additional Comments Regarding the PM
Reference intensity low

Review

The PM checks and if applicable performance tests for LS 45/50B/55 have been completed.

This LS 45/50B/55 ☒ Passes ☐ Fails ☐ the PM.

Review of Preventive Maintenance:

Authorized PerkinElmer Representative:  
Tanawat R.

Date:  
2-Feb-23  
(DD-MMM-YYYY)

Authorized Customer Representative:  
วิมล

Date:  
2-Feb-23  
(DD-MMM-YYYY)

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021

เอกสารไม่ควบคุม

Page 6





## REPORT OF CALIBRATION

Certificate No. : SP24-018

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 0.7469	0.0000 0.7435	0.0000 0.0034	0.0050 0.0057	2.00 2.00
257	0.0000 0.8674	0.0000 0.8639	0.0000 0.0035	0.0050 0.0060	2.00 2.00
313	0.0000 0.2919	0.0000 0.2907	0.0000 0.0012	0.0050 0.0051	2.00 2.00
350	0.0000 0.6430	0.0000 0.6402	0.0000 0.0028	0.0050 0.0055	2.00 2.00

## REPORT OF CALIBRATION

Certificate No. : SP24-018

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor <i>k</i>
241.72	242.0	-0.28	0.18	2.00
279.45	279.5	-0.05	0.18	2.00
287.81	287.9	-0.09	0.18	2.00
334.06	333.9	0.16	0.18	2.00
360.93	360.5	0.43	0.18	2.00
418.59	418.1	0.49	0.18	2.00
445.94	445.6	0.34	0.18	2.00
453.66	453.3	0.36	0.18	2.00
460.02	459.8	0.22	0.18	2.00
536.59	536.0	0.59	0.18	2.00
637.98	638.7	-0.72	0.18	2.00
431.38	430.8	0.58	0.18	2.00
472.50	472.4	0.10	0.18	2.00
513.47	513.7	-0.23	0.18	2.00
528.88	529.1	-0.22	0.18	2.00
573.17	573.5	-0.33	0.18	2.00
585.35	585.2	0.15	0.20	2.00
684.40	685.1	-0.70	0.18	2.00
740.72	741.4	-0.68	0.20	2.00
748.55	749.1	-0.55	0.18	2.00
807.03	807.3	-0.27	0.18	2.00
879.28	879.3	-0.02	0.18	2.00

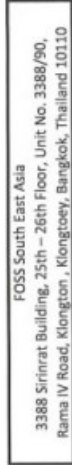
Remark : - UUC = Unit Under Calibration

- 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%
- \* Indicates non TISI accredited

- End of Certificate -

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FOR TISI 1021

เอกสารไม่ควบคุม



Report No:	8411
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Date:	29/05/23
Customer:	UAE
Instrument:	KT860
Address:	Bangkok, Thailand
Serial:	91829052

Hours	Travel To Customer		Labour		Travel From Customer	
Start	07:00		09:00		15:30	
Finish	08:30	1.5 hr	15:00	6 hr	18:30	2 hr

Application		Job Type			
		Special		Standard	
Normal		Courtesy Visit		Installation	Training
Distributor		PMA Onboarding		Quote	In House
Digital Service		Warranty		Repair	PM
		Sales Support		Remote	Other

PO/Quote Number:	if applicable
------------------	---------------

PMA Type	if applicable	Contract No.	if applicable
	Performs		

Details of Work / Test	Condition / Status
- Water Function Test Machine OK	OK
- Minimum Port On 50 PM - kit blow down 12 Ma	OK
- Water Anti-foaming Heating Coil = 32.3 °C	OK
- Water Anti-foaming Splash head Steam generator	OK
- Water Anti-foaming Steam Valve = 54.8 °C	OK
- Water Anti-foaming Condenser Water Cooling Valve A to = 54.8 °C	OK
- Water Anti-foaming Water 100 ml → 100 ml After 10 min → 51 ml	OK
- Water Anti-foaming Water 170 ml → 170 ml	OK
- Water Blank = 0.12 Recovery = 100%	OK

If not OK - Continue

Part No.	Batch	Description	Qty
----------	-------	-------------	-----

Part No:	Batch	Description	Qty
B00218A7	18-09-2022	Fours PM kit KT <sup>®</sup> w/B16 L/Mo	L

I confirm this report is accurate and complete

	Signed FOSS		Signed Customer	
	Name		Name	
				William

Would you be willing to participate in a brief survey in order to tell us how we performed?

## เอกสารไม่ควบคุม



## 9809

Date:	8 Feb 2024
Customer:	UAE
Instrument:	DT2520

Hours	Travel To Customer	
Start	08:00	
Finish	09:30	

Application		Job Type			
		Special		Standard	
Normal	×	Courtesy Visit	×	Installation	×
Distributor	×	PMA Onboarding	×	Quote	Training In House
Internal	×	Warranty	×	Repair	PM
Digital Service	×	Sales Support	×	Remote	Other
					X

PO/Quote Number:	If applicable
------------------	---------------



PMA Type	FOSS/CMV if applicable	Contract No.	if applicable

Instrument Ready for Use	OK	Not OK	Condition / Status
<p>Details of Work / Test</p> <p># RM DT2520</p> <ul style="list-style-type: none"> <li>- Transmission factors</li> <li>- RS232C connection</li> <li>- Wavelength calibration kit, temp set out</li> <li>- Wavelength 0.420</li> <li>- <math>300 - 100^\circ \text{C} = 10 \text{ min}</math></li> <li>- <math>20^\circ - 420^\circ \text{C} = 37 \text{ min}</math></li> <li>- Instrument 419.0 meter = 419.0</li> </ul>	OK	Not OK	OK done

Dart No.	Batch	Description	Qty.
----------	-------	-------------	------

Part No:	Batch	Description	Qty
60079652	23.04.2023	Cable left digester	1
10015654	08.01.2023	Temperature control	1

I confirm this cannot be accurate and complete

Signed FOSS		Signed Customer	
Name		Name	John

Would you be willing to participate in a brief survey in order to tell us how we performed?	Email
---	-------





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
S34/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL.0-2717-3000-29 FAX.0-2719-9484

Cert. No.: 24TM648  
Page : 2 of 3

Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2404-0003OC-1

#### 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.				

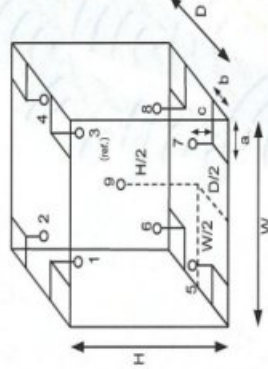
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	24	24
REL.Humid. ( % )	54	57
AC Supply ( Volt )	221	223



#### Probe Installation Details :

Dimension of Chamber :	
a =	5.0 cm
b =	5.0 cm
c =	5.0 cm
D =	0.50 m
W =	0.64 m
H =	0.80 m
Capacity =	0.26 m <sup>3</sup>

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

## Certificate of Calibration

Cert. No.: 24TM648  
Page : 1 of 3

Equipment : Incubator

Manufacturer : Memmert

Model : IPP 260

Serial No. : V615.0187

ID No. : UAE.MIC.003/2559

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

Location : Microbiology Laboratory

Received Order : 01 April 2024

Calibration Date : 01 April 2024

Ambient Temperature : ( 26 ± 10 ) °C

Relative Humidity : ( 50 ± 30 ) %

Calibrated by : Man Pattanapongpalboon

Approved by :

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

*Suwit*

Approved Signatory

Issue Date : 7 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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



## Certificate of Calibration

Cert. No.: 24TM651  
Page : 1 of 3

Equipment : Incubator  
Manufacturer : Memmert  
Model : IPP 260  
Serial No. : V618.0033  
ID No. : UAE.MIC.021/2561  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Microbiology Laboratory (302)  
Received Order : 01 April 2024  
Calibration Date : 02 April 2024  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
Calibrated by : Man Pattanapongpalboon  
Approved by :   
( ) Ponpan Paipim  
(✓) Suwit Imjai  
( ) Kunchit Promprat

Issue Date : 7 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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Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2404-0003OC-1  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 24TM648  
Page : 3 of 3

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Coverage Factor k	2			
35.0	35.0	35.0	0.028	0.13	0.24					
Calibration Point ( °C )	Measured Temperature ( °C )							Uncertainty ( ± °C )		
	Position									
	1	2	3	4	5	6	7		8	9 (ref.)
35.0	34.908	35.004	34.989	35.099	35.089	35.095	34.921	34.936	35.002	0.30

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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เอกสารไม่ควบคุม





Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2404-0003OC-3  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 24TM651  
Page : 3 of 3

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Coverage Factor k
22.0	22.0	22.0	0.039	0.22	0.42	2
44.0	44.0	44.0	0.048	0.50	0.90	2

Calibration Point ( °C )	Measured Temperature ( °C )								Uncertainty ( ± °C )	
	Position									
	1	2	3	4	5	6	7	8		9 (ref.)
22.0	22.008	22.034	22.039	22.021	21.746	21.698	21.668	21.668	21.846	0.30
44.0	44.267	44.602	44.293	44.402	44.004	43.961	43.756	44.000	44.205	0.30

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 %.

-o0o-



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2404-0003OC-3  
Procedure Used :-

Cert. No.: 24TM651  
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	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.

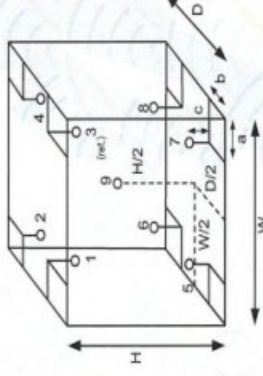
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	25	25
REL.Humid. ( % )	54	57
AC Supply ( Volt )	221	224



#### Probe Installation Details :

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

#### Dimension of Chamber :

D =	0.50	m
W =	0.64	m
H =	0.80	m
Capacity =	0.26	m <sup>3</sup>

Position :	Ref. Std. ID No.:
1	20-16RTD-01
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

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เอกสารไม่ควบคุม



**Equipment :** Water Bath  
**Condition As-Received :** Used Item  
**Reference :** 2402-0232OC-2  
**Procedure Used :-**

Calibration were conducted using in-house calibration procedure CP-OT04 Based on ASTM E715 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer ( IPRT ).

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1 ) Data Acquisition	MY49001451	23LM27	TPA	25 Feb 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

**Heat transfer medium used :** Water

	Environmental		AC Voltage Supply ( Volt )
	( °C )	( %R.H. )	
Beginning of Calibration	26	51	220
Finished of Calibration	25	50	221



Front

Position :	Ref. Std. ID No.:
1	N37P301419
2	N37P300732
3	N37P301420
4	N37P301421
5(ref.)	N37P301425

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



MSC-TS1-TS17025  
CALIBRATION 0008

Cert. No.: 24TM29  
Page : 1 of 3

## Certificate of Calibration

<b>Equipment :</b>	Water Bath
<b>Manufacturer :</b>	Memmert
<b>Model :</b>	WNE 14
<b>Serial No. :</b>	L416.0606
<b>ID No. :</b>	UAE.MIC.002/2560
<b>Submitted by :</b>	United Analyst and Engineering Consultant Co.,Ltd. 3 Sol Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
<b>Location :</b>	Microbiology Laboratory
<b>Received Order :</b>	10 February 2024
<b>Calibration Date :</b>	10 February 2024
<b>Ambient Temperature :</b>	( 26 ± 10 ) °C
<b>Relative Humidity :</b>	( 50 ± 30 ) %
<b>Calibrated by :</b>	Krisda Malee
<b>Approved by :</b>	 Approved Signatory
	( ) Ponthippa Tameyakul ( <input checked="" type="checkbox"/> ) Unnopphol Harachai ( ) Suwit Injai

**Issue Date :** 19 February 2024

The Uncertainties are for a confidence probability 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.: 24TM30  
Page : 1 of 3

## Certificate of Calibration

Equipment : Water Bath  
Manufacturer : Memmert  
Model : WNE 14  
Serial No. : L416.0612  
ID No. : UAE.MIC.003/2560  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Microbiology Laboratory  
Received Order : 10 February 2024  
Calibration Date : 10 February 2024  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$   
Calibrated by : Krisda Malee

Approved by :  
  
Approved Signatory

( ) Ponthippa Taneyakul  
(x) Unnopphol Harachai  
( ) Suwit Imjai

Issue Date : 19 February 2024

The Uncertainties are for a confidence probability of approximately 95 %

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Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2402-0232OC-2  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source

Cert. No.: 24TM29  
Page : 3 of 3

Calibration point ( $^{\circ}\text{C}$ )	UUC* Setting ( $^{\circ}\text{C}$ )	UUC* Reading ( $^{\circ}\text{C}$ )	Average* Standard Reading ( $^{\circ}\text{C}$ )					Uncertainty ( $\pm ^{\circ}\text{C}$ )
			1	2	3	4	5 (ref.)	
44.5	44.4	44.4	44.508	44.469	44.502	44.521	44.527	0.15

Calibration point ( $^{\circ}\text{C}$ )	Uniformity ( $^{\circ}\text{C}$ )	Stability ( $\pm ^{\circ}\text{C}$ )	Coverage Factor $k$
44.5	0.15	0.074	2

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

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

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

UUC\* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2402-0232OC-3  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source

Cert. No.: 24TM30  
Page : 3 of 3

Calibration point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Average* Standard Reading ( °C )					Uncertainty ( ± °C )
			Position					
			1	2	3	4	5 (ref.)	
44.5	44.6	44.6	44.491	44.483	44.496	44.518	44.528	0.15

Calibration point ( °C )	Uniformity ( °C )	Stability ( ± °C )	Coverage Factor <i>k</i>
44.5	0.12	0.059	2

**Average\*** : The average of 30 values in each position.  
**Uniformity** : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.  
**Stability** : One-half of the greatest maximum difference of measured temperature at any one probe.  
**UUC\*** : Unit Under Calibration  
**Note** : The reported uncertainty of measurement was included stability and excluded uniformity.

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

-o0o-



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2402-0232OC-3  
Procedure Used :-

Cert. No.: 24TM30  
Page : 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT04 Based on ASTM E715 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer ( IPRT ).

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

**Instrument**                      **Serial No.**                      **Cert. No.**                      **Traceable**                      **Due Date**  
1 ) Data Acquisition                      MY49001451                      23LM27                      TPA                      25 Feb 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.

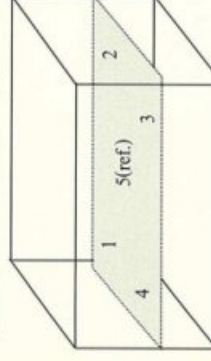
**Remark** : TPA : Technology Promotion Association ( Thailand - Japan )

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

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

**Heat transfer medium used** : Water

	Environmental		AC Voltage Supply ( Volt )
	( °C )	( %R.H. )	
Beginning of Calibration	24	54	221
Finished of Calibration	26	55	220



Front

Position :	Ref. Std. ID No.:
1	N37P301419
2	N37P300732
3	N37P301420
4	N37P301421
5(ref.)	N37P301425



## Calibration Report

Certificate No.: 2402281-001-01

Equipment: Autoclave

Model: CL-40L Serial No.: 808763

Resolution: 0.1 °C ID No.: UAE.MIC.026/2563

Manufacturer: ALP

Date of Calibration: 2 April 2024

Page 2 of 3

Location: LABORATORY, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Environment Condition: Ambient Temperature ( 25 ± 1 ) °C

Relative Humidity ( 55 ± 7 ) %

Line Voltage ( 225 ± 5 ) Volt

### Condition of this results of Calibration:

1. This instrument was calibrated by insert 3 standard temperature recorder with RTD into its autoclave and calibration according to W-TE-018 based on BS 2646-1(2021) : Autoclaves for sterilization in laboratories Design, construction, safety and performance Specification.

- The temperature scale used was based on ITS - 90 .

- All data show below were final values and the initial data may be obtained upon request.

2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with RTD (Data Logger)	HITemp140-2	RS4918	TE 660383-01	8 April 2024	NATIONAL FOOD INSTITUTE
	HITemp140-2	S25601	TE 670033-01	9 November 2024	MADGETECH INC.
	HITemp140-2	S25602	TE 670034-01	9 November 2024	MADGETECH INC.

3. This certificate is traceable to International System of Units (SI Units).

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.

6. This standard does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical.

7. Condition of Calibrated item : Good

UUC Description : Setting program function sterilization : STERILIZE/NORMAL

Time of sterilization 15 Minute At 115.0 and 121.0 °C

8. Result of Calibration : ☒ Without adjustment

☐ After adjustment

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

## Calibration Certificate

Certificate No.: 2402281-001-01

Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Address: 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

Equipment: Autoclave

Manufacturer: ALP

Model: CL-40L

Serial No.: 808763

ID No.: UAE.MIC.026/2563

Order No.: 2402281

Operation No.: 2402281-001

Date of Receipt: 2 April 2024

Date of Calibration: 2 April 2024

Calibrated by Mr.Jerawut Prapawuttipong Approved by  
Scientist ( Mr.Pheraphat Tuenjit )

Date of Issue: 9 April 2024  
Manager, Division of Calibration Laboratory  
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





# Certificate of Calibration



**Equipment:** Autoclave  
**Model:** CL-40L  
**Serial No. (or ID.):** 810010  
**Manufacturer:** ALP  
**Condition:** In Condition  
**Certificate No.:** C11230106  
**Issued Date:** 11 June 2023  
**Job No.:** KSPR2308770  
**Page:** 1 of 4  
**Customer:** United Analyst and Engineering Consultant Company Limited.  
3 Soi Udomsuk 41 Sukhumvit Road,  
Bangkok, Prakanong, Bangkok 10260 Thailand.

**Environment Condition:** Temperature: 22 °C ± 0.8 °C  
Humidity: 58 %RH ± 4.0 %RH  
Voltage: 229 VAC ± 1.3 VAC  
**Calibration Place:** United Analyst and Engineering Consultant Company Limited. (301 Room)  
3 Soi Udomsuk 41 Sukhumvit Road,  
Bangkok, Prakanong, Bangkok 10260 Thailand.  
**Calibration By:** Mr. Anomthep Phumpro  
**Calibration Date:** 09 June 2023  
**The Method used:** In house method, CAL-WI-18, base on BS 2646 : Part 5  
**Traceability:** This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through Quality reborn Co., Ltd.  
Certificate No.QR23-0086

**Person in charge**  
(Mr. Anomthep Phumpro)  
**Authorized signatory**  
(Mr. Udon Srichana)  
This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.  
The measurement uncertainty stated is the expanded uncertainty which is obtained with the Guide to Expression of Uncertainty in Measurement (GUM).  
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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DKSH Technology Limited  
2333 Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260  
Phone: +66 2639 71000 Email: info.calibration@dksh.com Website: www.dksh.com/identify-thailand

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CAL-FM-C11-15: 12 Sep 2022

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ศูนย์บริการสอบเทียบ  
National Food Institute  
Food Industrial Laboratory Service Center

# Calibration Report

**Certificate No.:** 2402281-001-01  
**Equipment:** Autoclave  
**Model:** CL-40L  
**Serial No.:** 808763  
**Resolution:** 0.1 °C  
**ID No.:** UAE.MIC.026/2563  
**Manufacturer:** ALP  
**Date of Calibration:** 2 April 2024

Calibration point: 115.0 and 121.0 °C

Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
Min	24.4	48.6	220
Max	25.5	62.1	230

Table 1 : Reporting of Temperature

Calibration Point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.2 is REF)			Uncertainty ± (°C)
	Std.# 1	Std.# 2 (Ref)	Std.# 3	
115.0	115.28	115.35	115.38	0.64
121.0	121.28	121.36	121.37	0.64

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	Min (°C)	Max (°C)	Average (°C)			
115.0	115.0	115.1	115.0	0.08	0.13	0.48
121.0	121.0	121.1	121.0	0.12	0.10	0.38

## Note

The quoted uncertainty include " Stability " and " Loading effect ( 20% of Uniformity ) "

UUC\* = Unit Under Calibration

Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, for at least half an hour after reaching steady state.

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.

Overall Variation = The difference of the maximum and minimum measured temperatures throughout observation time.  
The report uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k= 2, providing a level of confidence of approximately 95 %.

----- End -----

F-C5-012 Revision: 01 Date: 20-04-65

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เอกสารไม่ควบคุม

Calibration Results:  
Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 115.0 °C

Locations	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
#1	115.34	0.34	0.35
#2	115.43	0.43	0.35
#3	115.43	0.43	0.35

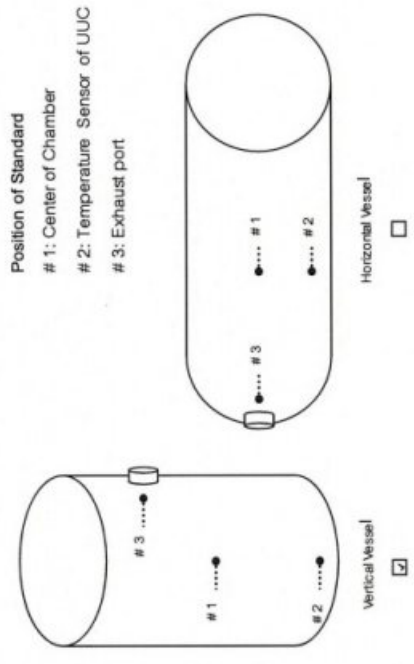
Temperature Distribution

Temperature			Pressure	Measured Temperature at Spread Locations			Uncertainty
Desired (°C)	Setting (°C)	Indicating (°C)	Indicating Mpa	#1 (°C)	#2 (°C)	#3 (°C)	(± °C)*
115	115	115.0	0.08	115.34	115.43	115.43	0.35

Chamber Characterization

Indicating Temperature (°C)	Indicating Pressure Mpa	Measured Stability (± °C)
115.0	0.08	0.15

Note: \* Maximum uncertainty of the each position  
Record every 10 seconds after reaching steady state or after one achieved complete cycle.



Standard Installation Locations

- Standard Locations (#1): Geometric center of the chamber
- Standard Locations (#2): Distance from temperature sensor of UUC 2 (cm.)
- Standard Locations (#3): Distance from the wall 5 (cm.)

Position of Std	#1	#2	#3
Channel of Logger	4	5	6

Definitions

- Indicating Temperature:** The average reading of indicating device which forms the integral part of the enclosure.
- Measured Temperature:** The average reading of standards at any positions or location.
- Measured Stability:** The one-half of greatest maximum difference of measured temperatures at any one probe.





## Certificate of Calibration



**Equipment:** Balance  
**Model:** PX623  
**Serial No. (or ID.):** C236754745 (UAE.MIC.055/2565)  
**Manufacturer:** Ohaus  
**Condition:** In condition

**Certificate No.:** C01234158  
**Issued Date:** 08 December 2023  
**Job No.:** WO-00011251  
**Page:** 1 of 3

**Customer:** United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak Sub-District,  
Phra Khanong District, Bangkok, THAILAND 10260

**Environment Condition:** Temperature 25 °C ± 0.5 °C  
Humidity 54 %RH ± 1.7 %RH

**Calibration Place:** United Analyst and Engineering Consultant Co., Ltd. (301 Microbiology Room)  
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak Sub-District,  
Phra Khanong District, Bangkok, THAILAND 10260

**Calibration By:** Mr. Adisai Maknoi  
**Calibration Date:** 07 December 2023  
**The Method used:** In-house method, CAL-WI-47, based on UKAS Lab 14  
**Traceability:** This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Co., Ltd. Certificate No. C02222534

*Ad.*

(Mr. Adisai Maknoi)

Person in charge

*Rungrod*

(Mr. Rungrod Jenkitrakulchai)

Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.  
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ( $k=2$ ) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).  
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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2533 สุขุมวิท ถนน, กรุงเทพฯ, กรุงเทพมหานคร 10260  
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C01-14: 12 Sep 2022



Certificate No.: C11230106

Page: 4 of 4

### Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 121.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	121.34	0.34	0.35
#2	121.40	0.40	0.35
#3	121.26	0.26	0.35

### Temperature Distribution

Temperature			Pressure	Measured Temperature at Spread Locations			Uncertainty (± °C)*
Desired (°C)	Setting (°C)	Indicating (°C)	Indicating Mpa	#1 (°C)	#2 (°C)	#3 (°C)	
121	121	121.0	0.12	121.34	121.40	121.26	0.35

### Chamber Characterization

Indicating Temperature (°C)	Indicating Pressure Mpa	Measured Stability (± °C)
121.0	0.12	0.07

Note: \* Maximum uncertainty of the each position

Record every 10 seconds after reaching steady state or after one achieved complete cycle.

The End of Certificate

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Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C11-15: 12 Sep 2022



### After Adjustment

Eccentric Error: Weight to be 1/3 or 1/2 of Maximum capacity, taken from the center of the pan as a zero reference.

	Nominal Test Value					(g)
	A	B	C	D	E	
	-	0.001	-0.002	-0.002	0.001	0.001

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.001 (g)

Nominal test value (g)	Standard Deviation
50	0.0006
500	0.0008

Error of Indication from nominal or conventional mass value., Readability 0.001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of Indication (g)	Uncertainty (g)	k
1	1.0000	1.000	0.000	0.0013	2.10
5	5.0001	5.000	0.000	0.0013	2.10
10	10.0001	10.000	0.000	0.0013	2.10
20	20.0000	20.000	0.000	0.0013	2.10
50	50.0001	50.000	0.000	0.0013	2.10
100	100.0001	100.000	0.000	0.0014	2.09
200	200.0004	200.000	0.000	0.0014	2.07
300	300.0005	300.001	0.001	0.0015	2.05
400	400.0006	400.002	0.001	0.0017	2.04
500	500.0006	500.001	0.000	0.0019	2.02
600	600.0007	600.002	0.001	0.0021	2.01

The End of Certificate

### Calibration Results:

#### Before Adjustment

Eccentric Error: Weight to be 1/3 or 1/2 of Maximum capacity, taken from the center of the pan as a zero reference.

	Nominal Test Value					(g)
	A	B	C	D	E	
	-	0.000	-0.003	0.000	0.001	0.001

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.001 (g)

Nominal test value (g)	Standard Deviation
50	0.0006
500	0.0008

Error of Indication from nominal or conventional mass value., Readability 0.001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of Indication (g)	Uncertainty (g)	k
1	1.0000	1.000	0.000	0.0013	2.10
5	5.0001	5.000	0.000	0.0013	2.10
10	10.0001	10.001	0.001	0.0013	2.10
20	20.0000	20.000	0.000	0.0013	2.09
50	50.0001	50.000	0.000	0.0013	2.09
100	100.0001	100.001	0.001	0.0013	2.09
200	200.0004	200.002	0.002	0.0014	2.07
300	300.0005	300.002	0.002	0.0015	2.05
400	400.0006	400.004	0.003	0.0016	2.03
500	500.0006	500.008	0.007	0.0019	2.02
600	600.0007	600.009	0.008	0.0021	2.01

**Statements of conformity:****Before Adjustment**

Readability: 0.001 g

Nominal Value g	Error of indication g	Guard band (w) g	Tolerance (±) g	Conformity
1	0.000	0.0013	0.002	Pass
5	0.000	0.0013	0.010	Pass
10	0.001	0.0013	0.020	Pass
20	0.000	0.0013	0.040	Pass
50	0.000	0.0013	0.100	Pass
100	0.001	0.0013	0.200	Pass
200	0.002	0.0014	0.400	Pass
300	0.002	0.0015	0.600	Pass
400	0.003	0.0016	0.800	Pass
500	0.007	0.0019	1.000	Pass
600	0.008	0.0021	1.200	Pass

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

**Statements of conformity:**

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

The error of indication determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, UKAS Lab14. Therefore, those parameters have not been assessed separately.

**Tolerance and Decision rules:**

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

**Decision rule :** ☐ Choice A Binary Statement for Simple Acceptance Rule ( $w = 0$ ), Specific Risk < 50% PFA.

☒ Choice B Non-binary statement with guard band ( $w = 1$  U), Pass or Fail Specific Risk < 2.5% PFA and Condition Pass or Condition Fail Specific Risk < 50% PFA.

☐ Choice C Customer defined, Customers may define arbitrary multiple of  $r$  to have applied as guard band ( $w = r$  U) .

; PFA – Probability of False Accept



(Mr. Rungrod Jenkitrakulchai)

Authorized signatory

Statements of conformity:

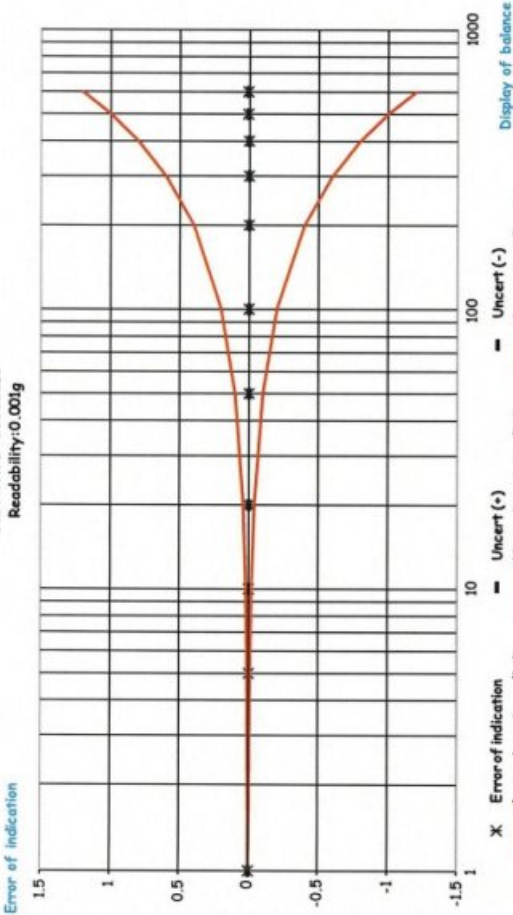
After Adjustment  
Readability: 0.001 g

Nominal Value g	Error of Indication g	Guard band (w) g	Tolerance (±) g	Conformity
1	0.000	0.0013	0.002	Pass
5	0.000	0.0013	0.010	Pass
10	0.000	0.0013	0.020	Pass
20	0.000	0.0013	0.040	Pass
50	0.000	0.0013	0.100	Pass
100	0.000	0.0014	0.200	Pass
200	0.000	0.0014	0.400	Pass
300	0.001	0.0015	0.600	Pass
400	0.001	0.0017	0.800	Pass
500	0.000	0.0019	1.000	Pass
600	0.001	0.0021	1.200	Pass

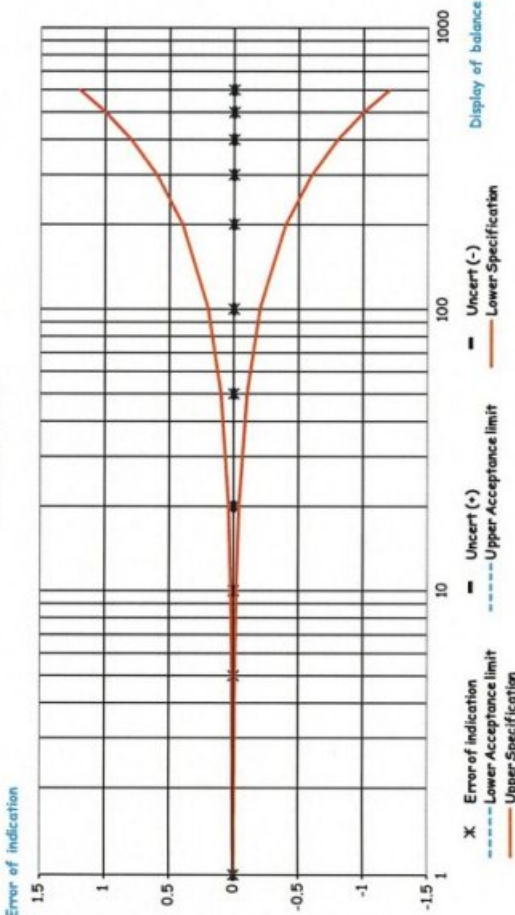
The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

The End of Statements of conformity

Before Adjustment  
Job No. WO-00011251  
Readability: 0.001g



After Adjust  
Job No. WO-00011251  
Readability: 0.001g





ใบตรวจสอบสภาพเครื่องชั่ง

ชนิดเครื่องมือ: Balance      รุ่น: PX623      เลขที่ใบงาน: WO-00011251  
หมายเลขเครื่อง: C236754745

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
ปกติ	ไม่ปกติ		07 Dec 2023	ไม่ปกติ	
			ปกติ		
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ/Adapter, power supply 220/110V	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสมบูรณ์ชุดกระชกกันลม (Cover)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. ความสมบูรณ์ชุดของระดับน้ำ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การปรับระดับของขาตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. การตอบสนองของปุ่มกด	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. ความสมบูรณ์ของ Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. การแสดงผลของ Display หลังวางน้ำหนัก	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ชุดรองจานชั่ง (Stopper) / pan support	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. การทำงานของ Function Internal / External	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. ความสะอาดของตัวเครื่องภายนอกและแกน load cell	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	11. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

หมายเหตุเพิ่มเติม/ข้อแนะนำ :

Mr. Adisai Maknoi  
Service Engineer