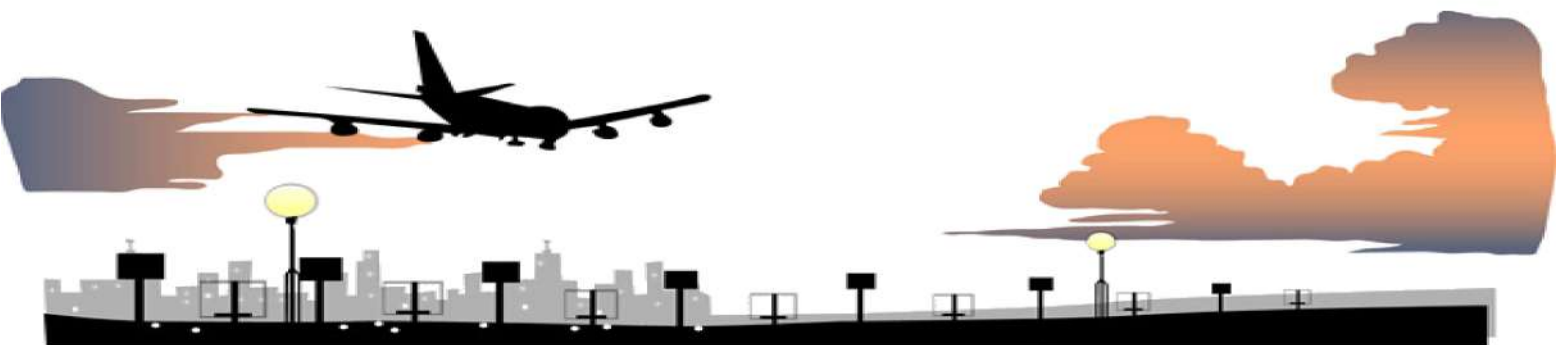


## ภาคผนวก ค

### สำเนาใบรับรองการสอบเทียบเครื่องมือการตรวจวัด



รายการใบรับรองสอบเทียบเครื่องมือวัดหลักประจำห้องปฏิบัติการสำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Andersen Instruments, Inc.	G25A 11MX	Tisch Environmental, Inc.	28062022	28 Jun 21	27 Jun 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)	22P800	12 Mar 22	11 Mar 23	-
3	Flow Meter	Particulate Matter Less Than	Mesa Labs	- 159822	NIST Traceable Calibration Facility	21-AFM-095	31 Aug 21	30 Aug 22	-
4	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> ) Particulate Matter Less Than	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	22P2722	22 Jul 22	21 Jul 23	-
5	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> ) Particulate Matter Less Than	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	22H1586	27 Jul 22	26 Jul 23	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo	42C 42C-0508011076	UAE Consultant Co., Ltd.	2110/2021	21 Oct 21	20 Oct 22	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Environmental Instrument	42C 42C-76412-383	UAE Consultant Co., Ltd.	21102021	21 Oct 21	20 Oct 22	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo	42C 42C-0508011076	UAE Consultant Co., Ltd.	19042022	19 Apr 22	18 Apr 23	-
9	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04N99E15A01D3	21 Jun 21	21 Jun 24	-
10	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1200636464	UAE Consultant Co., Ltd.	24112021	24 Nov 21	23 Nov 22	-

รายการใบรับรองสอบเทียบเครื่องมือวัดมลพิษทางอากาศสำหรับการปฏิบัติงานสำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
11	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1200636465	UAE Consultant Co.,Ltd.	24112021	24 Nov 21	23 Nov 22	-
12	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1200636466	UAE Consultant Co.,Ltd.	24112021	24 Nov 21	23 Nov 22	-
13	Standard Gases (Mixture)	Carbon Monoxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04N99E15A01D3	21 Jun 21	21 Jun 24	-
14	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 VUPVTC21	UAE Consultant Co.,Ltd.	09032022	9 Mar 22	8 Mar 23	-
15	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 PDXEGXF7	UAE Consultant Co.,Ltd.	09032022	9 Mar 22	8 Mar 23	-
16	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 SSGEYBJ	UAE Consultant Co.,Ltd.	09032022	9 Mar 22	8 Mar 23	-
17	Standard Gas	Total Hydrocarbons	Linde	D824432	Linde	09042013	4 Aug 20	4 Aug 28	-
18	Wind Speed/Wind Direction	WSWD	Scarlet Tech Ltd.	WL-21 2111DT0004	Scarlet Tech Ltd.	22022022	22 Feb 22	21 Feb 23	-
19	Wind Speed/Wind Direction	WSWD	Scarlet Tech Ltd.	WL-21 2111DT0041	Scarlet Tech Ltd.	25032022	25 Mar 22	24 Mar 23	-
20	Wind Speed/Wind Direction	WSWD	Scarlet Tech Ltd.	WL-21 2111DT0052	Scarlet Tech Ltd.	25032022	25 Mar 22	24 Mar 23	-
21	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Larson Davis	CAL150 6457	Innovative Instrument Co.,Ltd.	22-ACT-370	8 Jun 22	7 Jun 23	-
22	Sound Level Meter	$L_{Aeq\ 24\ hours}$ , $L_{Aeq\ 1\ hour}$ , $L_{Amax}$ , $L_{Adn}$	Larson Davis	LxT2 0005394	Innovative Instrument Co.,Ltd.	22-ACT-034	21 Jan 22	20 Jan 23	-
23	Sound Level Meter	$L_{Aeq\ 24\ hours}$ , $L_{Aeq\ 1\ hour}$ , $L_{Amax}$ , $L_{Adn}$	Larson Davis	LxT2 0005396	Innovative Instrument Co.,Ltd.	22-ACT-105	11 Feb 22	10 Feb 23	-
24	Sound Level Meter	$L_{Aeq\ 24\ hours}$ , $L_{Aeq\ 1\ hour}$ , $L_{Amax}$ , $L_{Adn}$	Larson Davis	LxT2 0005398	Innovative Instrument Co.,Ltd.	22-ACT-035	21 Jan 22	20 Jan 23	-

รายการใบรับรองสอบเทียบเครื่องมือวัดหลักประจำห้องปฏิบัติการสำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Water									
25	pH Meter	ค่าความเป็นกรด-ด่าง (pH)	Hanna Instrument	HI2211 / 8165345	National Food Institute, Ministry of Industry, Thailand	2202097-001-01	16 Mar 22	15 Mar 23	-
26	pH Meter		Mettler-Toledo	Seven Easy S20 / 1231155210	National Food Institute, Ministry of Industry, Thailand	2201793-001-01	1 Mar 22	28 Feb 23	-
27	Conductivity Meter	การนำไฟฟ้า (Conductivity)	SI Analytics	Lab955 / 16300356	SPC Calibration Center Co.,Ltd.	C24220084	22 Mar 22	21 Mar 23	-
28	Analytical Balance (Repeatability 0.1 mg)	Oil & Grease (น้ำมันและไขมัน)	Mettler-Toledo	AB-204S/FACT / 1129361010	National Food Institute, Ministry of Industry, Thailand	2203120-001-01	1 Jun 22	31 May 23	-
29	UV-VIS Spectrophotometer	ความขุ่น (Turbidity) ไนเตรท-ไนโตรเจน (Nitrate-Nitrogen : NO3-N)	Agilent Technologies	Cary60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP21-015	29 May 21	28 May 22	-
30	UV-VIS Spectrophotometer	ฟอสเฟต-ฟอสฟอรัส (Phosphate-Phosphorus : P) ซัลเฟต(Sulfate :SO <sub>4</sub> <sup>2-</sup> ), ไนเตรด(Nitrate: NO <sub>3</sub> <sup>-</sup> )	Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP22-007	20 Jan 22	19 Jan 23	-
31	UV-VIS Spectrophotometer	ซีโอดี (Chemical Oxygen Demand : COD)	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP22-008	20 Jan 22	19 Jan 23	-
32	Atomic Absorption Spectrometer (AAS)	เหล็ก (Iron: Fe) แมงกานีส (Manganese : Mn)	Perkin Elmer	PinAAcle 900F / PFB520031902	Perkin Elmer Co.,Ltd.	PM Service No. WO-01710010	20 Jul 22	19 Jul 23	-
33	Atomic Absorption Spectrometer (AAS)		Agilent Technologies	System ID:G8432A AA240FS / MY13160001	Thailand Institute Of Science And Technological Research (TISTR)	MTC.ACL. No. 486/65	7 Mar 22	6 Mar 23	-
34	Analytical Balance (Repeatability 0.01 mg)	ของแข็งที่ละลายน้ำได้ทั้งหมด (Total Dissolved Solids : TDS)	Mettler-Toledo	XSR205DU / C210685394	Mettler-Toledo (Thailand) Ltd.	2058-043-050622-ACC-	9 May 22	8 May 23	-
35	Hot Air Oven	ของแข็งแขวนลอย (Suspended Solids : SS)	Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	22TM304	7 Apr 22	6 Apr 23	-



รายการใบรับรองสอบเทียบเครื่องมือหลักประจำห้องปฏิบัติการสำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
36	BOD Incubator	ความต้องการออกซิเจนทางชีวภาพ (Biochemical Oxygen Demand : BOD)	Arco	UC4-1320 / (UAE.WAO.015/2561)	Technology Promotion Association (Thailand-Japan)	22TM90	17 Feb 22	16 Feb 23	-
37	BOD Incubator		Arco	UR-1320 / (UAE.WAO.006/2553)	Technology Promotion Association (Thailand-Japan)	22TM306	7 Apr 22	6 Apr 23	-
38	COD Reactor (Heating Block)	ซีโอดี (Chemical Oxygen Demand : COD)	Hanna	H1839800-02 / H0185001	Hanna Instruments (Thailand) Ltd.	HIT-2209-0184	1 Mar 22	1 Mar 23	-
39	Digester Unit	ทีเคเอ็น (Total Kjeldahl Nitrogen : TKN)	Velp	DKL20 / 213517	National Food Institute, Ministry of Industry, Thailand	2203368-001-01	23 Jun 22	22 Jun 23	-
40	Incubator (Cooled Incubator)	แบคทีเรียกลุ่มโคลิฟอร์มทั้งหมด (Total Coliform Bacteria)  แบคทีเรียกลุ่มฟิโคไลต์ฟอร์ม (Fecal Coliform Bacteria)  <i>E.Coli</i>	Memmert	IPP 260 / V616.0066	Technology Promotion Association (Thailand-Japan)	22TM672	5 May 22	4 May 23	-
41	Incubator (Cooled Incubator)		Memmert	IPP 260 / V615.0187	Technology Promotion Association (Thailand-Japan)	22TM563	7 Apr 22	6 Apr 23	-
42	Water Bath		Memmert	WNE 14 / L416.0606	Technology Promotion Association (Thailand-Japan)	22TM333	17 Feb 22	16 Feb 23	-
43	Analytical Balance	Auto Clave	Mettler-Toledo	MS603S / B0070110311	Mettler-Toledo (Thailand) Ltd.	2058-096-040722-ACC-	7 Apr 22	6 Apr 23	-
44	Auto Clave		ALP	CL-40L / 807298	Technology Promotion Association (Thailand-Japan)	22TM1121	11 Jul 22	10 Jul 23	-

# Certificate of Calibration

Calibration Certification Information			
Cal. Date:	June 28, 2021	Rootsometer S/N:	438320
Operator:	Jim Tisch	Ta:	297 °K
Calibration Model #:	G25A	Pa:	753.6 mm Hg
		Calibrator S/N:	11MX

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3910	3.3	2.00
2	3	4	1	0.9890	6.4	4.00
3	5	6	1	0.8850	8.0	5.00
4	7	8	1	0.8430	9.0	5.50
5	9	10	1	0.6970	12.9	8.00

Data Tabulation			
Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left( \frac{Pa}{Pstd} \right) \left( \frac{Tstd}{Ta} \right)}$ (y-axis)	Va (x-axis)
0.9906	0.7421	1.4106	0.9956
0.9865	0.9975	1.9949	0.9915
0.9844	1.1123	2.2304	0.9894
0.9831	1.1661	2.3393	0.9881
0.9779	1.4030	2.8213	0.9829
m = 2.04215			
b = -0.04258			
r = 1.00000			
QA			
m = -0.27876			
b = -0.02680			
r = 1.00000			

Calculations	
Vstd = $\Delta Vol / ((Pa - \Delta P) / Pstd) (Tstd / Ta)$	Va = $\Delta Vol / ((Pa - \Delta P) / Pa)$
Qstd = Vstd / ΔTime	Qa = Va / ΔTime
For subsequent flow rate calculations:	
$Qstd = 1/m \left( \sqrt{\Delta H \left( \frac{Pa}{Pstd} \right) \left( \frac{Tstd}{Ta} \right)} - b \right)$	
$Qa = 1/m \left( \sqrt{\Delta H \left( \frac{Ta}{Pa} \right)} - b \right)$	

Standard Conditions	
Tstd:	298.15 °K
Pstd:	760 mm Hg
Key	
ΔH:	calibrator manometer reading (in H2O)
ΔP:	rootsometer manometer reading (mm Hg)
Ta:	actual absolute temperature (°K)
Pa:	actual barometric pressure (mm Hg)
b:	intercept
m:	slope

RECALIBRATION  
US EPA recommends annual recalibration per 1998 40 Code of Federal Regulations Part 50 to 51, Appendix B to Part 50, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere, 9.2.17, page 30



## Certificate of Calibration

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

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

Condition As-Received: Used Item  
Received Date: 03 March 2022  
Calibration Date: 12 March 2022

Reference: 2203-0131WSC Submitted by: United Analyst and Engineering Consultant Co., Ltd.

Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 15 ) %  
Atmospheric Pressure: 1010 mbar  
81 Soi Udonsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10280

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P04, 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

1) Pressure Calibrator

Model

PC106P

Serial No.

1189

Due Date

09 Aug 2022

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

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

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

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

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by: Suwit Aussarree  
Issue Date: 14 March 2022

Approved Signatory :



Cert.No.: 22P800  
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	-5.02	10.02	0.02
12.00	6.00	-6.02	12.02	0.02
14.00	7.00	-7.04	14.04	0.04
16.00	8.00	-8.04	16.04	0.04
18.00	9.00	-9.04	18.04	0.04
20.00	10.00	-10.04	20.04	0.04
22.00	11.00	-11.02	22.02	0.02
24.00	12.00	-12.02	24.02	0.02
26.00	13.00	-13.02	26.02	0.02
28.00	14.00	-14.04	28.04	0.04
30.00	15.00	-15.04	30.04	0.04
32.00	16.00	-16.04	32.04	0.04
34.00	16.98	-17.06	34.04	0.04
35.80	17.98	-18.00	35.98	0.18

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 %.

-oOo-

INNOVATIVE INSTRUMENT CALIBRATION LAB  
INNOVATIVE INSTRUMENT CO., LTD HEAD OFFICE  
9189 MOO 13, SOI SINTINAKORN 11 TAMBON BANG KAKO,  
AMPHOE BANG PHU, SAMUT PRAKAN PROVINCE 10540 THAILAND  
TEL: 6600-2116-5860-1 FAX: 6600-2116-7140



Page 1/2

## Certificate of Calibration

### Customer

Certificate No : 21-AFM-095

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Request No : Req-2021-0988

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

### Unit Under Calibration Details

Measurement Item : Air Flow Meter

Manufacturer : BGI

Model : deluCal DC1

Serial Number : 159822

ID : UAE.EFM.039/2561

Location of Calibration : LAB 4 AIR VELOCITY METER

### Calibration Environment and Details

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

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

Barometric Pressure :  $1013 \text{ hPa} \pm 10 \text{ hPa}$

Received Date : 22 July 2021

Calibration Date : 31 August 2021

Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 High flow	18501012012	Sensidyne	21 May 2022

### Traceability :

This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of

Units (SI)

### Note :

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

Calibration By :

Approved By :

Service Calibration Engineer

Calibration Engineer Supervisor

Issue Date :

1 September 2021

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

FM-708-AFM-01 Rev.00 Issue date 01/07/19

เอกสารแนบ  
a 1099526

เอกสารแนบ





Certificate No : 21-DPM-101  
Request No : Req-2021-0988

Measurement results : Barometric Pressure

Calibration Range (mmHg)	Barometric Pressure		
	STD Reading (mmHg)	UUC Reading (mmHg)	Correction (mmHg)
745	745.02	744.2	-0.82
750	750.04	749.2	-0.84
755	755.01	754.2	-0.81
760	760.03	759.2	-0.83
765	765.05	764.2	-0.85

Calibration Procedure : In-house method CP-DPM-03 by Comparison With Standard Barometric Pressure

End of Certificate

## Certificate of Calibration

### Customer

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

Certificate No : 21-RHM-064

Request No : Req-2021-0988

### Unit Under Calibration Details

Measurement Item : Air Flow Meter  
Manufacturer : BGI  
Model : deltaCal DC1  
Serial Number : 159822  
ID : UAE.EFM.039/2561  
Resolution : 0.1 (°C)  
Sensor Model : 2182 (1T)  
Sensor SN : MRG/024084-001  
Sensor ID : UAE.EFM.039/2561  
Instrument Status : Used

### Calibration Environment and Details

Temperature :  $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$   
Humidity :  $55\% \text{RH} \pm 20\% \text{RH}$   
Received Date : 22 July 2021  
Calibration Date : 31 August 2021  
Calibration By : Mr. Sirichok Jirapukdeesakun

Location of Calibration : LAB 2 Temperature

Calibration Method : In-house method CP-THM-01 by Comparison With Standard Relative Humidity Meter and Standard  
Thermometer with RTD Probe in Humidity / Temperature Chamber

### Reference Standard

Standard Thermometer Model: GT11, S/N: 12000077, Which was calibration on 30 March 2021, Calibration of Certificate No. : QR21-0719  
and Relative Humidity Meter, Model: HP23-A, S/N: 6129979, Which was calibration on 28 September 2020, Calibration of Certificate No. :

QR20-1651

### Traceability

This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No. Calibration 0293

### Note

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

Calibrated By : \_\_\_\_\_

Service Calibration Engineer

Approved By : \_\_\_\_\_

Calibration Engineer Supervisor

Issue Date : 1 September 2021

Calibration Results : Without Adjustment

Temperature Calibration : Filter Temperature (Tf)

Temperature Range (°C)	STD Reading (°C)	Without Adjustment UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
20	19.999	20.1	-0.101	0.10
25	24.997	25.1	-0.103	0.10
30	30.000	30.2	-0.200	0.10
35	35.003	35.2	-0.197	0.10
40	40.004	40.2	-0.196	0.10

Temperature Calibration : Ambient Temperature (Ta)

Temperature Range (°C)	STD Reading (°C)	Without Adjustment UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
20	19.999	20.1	-0.101	0.10
25	24.997	25.1	-0.103	0.10
30	30.000	30.2	-0.200	0.10
35	35.003	35.2	-0.197	0.10
40	40.004	40.3	-0.296	0.10

End of Certificate

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

FM-708-TM4-01 Rev.00 Issue date 01/07/19

เอกสารไม่ควบคุม



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



## Certificate of Calibration

Certificate No : 22P2722  
Page : 1 of 2

Equipment : Aneroid Barometer

Manufacturer : Barigo

Model : -

Serial No. : -

ID No. : UAE.ANV.013/2547

Condition As-Received: Used Item

Received Date: 20 July 2022

Calibration Date: 22 July 2022

Reference: 2207-0584WSC

Ambient Temperature: ( 23 ± 2 ) °C

Relative Humidity: ( 50 ± 15 ) %

Atmospheric Pressure: 1010 mbar

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

81 Soi Udomsuk 41, Sukhumvit Road, Bangkok,

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**

1) Standard Barometer

**Model**  
DPI142

**Serial No.**  
1422505046

**Certificate No.**  
MP-0076-22

**Due Date**  
02 May 2023

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

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

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

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

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

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

8.This Certificate is traceable to the International System of Unit maintained at:-

-National Institute of Metrology Thailand (NIMT)

**Calibrated by :** Suwit Aussarree  
**Issue Date :** 25 July 2022

**Approved Signatory :**

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B 0293205



Cert No.: 22P2722  
Page: 2 of 2

Result of calibration:- Without adjustment  
Function:- Absolute Pressure Measurement  
Range: 720 mmHg to 760 mmHg  
Scale Interval: 1 mmHg ( The Fifth Estimate )

Increasing Pressure									
Applied Pressure (mmHg)	718.46	729.33	739.85	750.22	760.90	772.01	785.89		
UUC* Indication (mmHg)	720.0	730.0	740.0	750.0	760.0	770.0	780.0		
Error (mmHg)	1.54	0.67	0.15	-0.22	-0.90	-2.01	-5.89		
Decreasing Pressure									
Applied Pressure (mmHg)	785.90	771.99	760.85	750.17	739.90	729.57	718.62		
UUC* Indication (mmHg)	780.0	770.0	760.0	750.0	740.0	730.0	720.0		
Error (mmHg)	-5.90	-1.99	-0.85	-0.17	0.10	0.43	1.38		

The uncertainty of measurement was  $\pm 0.24$  mmHg

\* UUC = Unit Under Calibration

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

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



MSC-T80-T817025  
CALIBRATION 0088

## Certificate of Calibration

Certificate No. : 22H1586  
Page : 1 of 2

Equipment :

Dial Thermo-Hygrometer

Manufacturer:

Barigo

Model :

-

Serial No.:

-

ID No.:

UAE.ANV.004/2548

Condition As-Received:

Used Item

Received Date:

20 July 2022

Calibration Date:

22 July 2022  
to 27 July 2022

Reference:

2207-0566WSC

Ambient Temperature:

(  $25 \pm 3$  ) °C

Relative Humidity:

(  $50 \pm 20$  ) %

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

81 Soi Udomsuk 41, Sukhumvit Road, Bangkok,

Phra Khanong, Bangkok 10260

Procedure used:

Calibration were conducted using in-house calibration procedure GP-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) Standard Chilled Mirror Hygrometer Sensor

Dew Prime II

31863

19714

17 Sep 2022

2) Standard Humidity/Temperature Meter

400

10240757

TH-0125-21

13 Dec 2022

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 at:-

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

-National Institute of Metrology Thailand (NIMTT)

Calibrated by : Somchai Dumnwor  
Issue Date : 03 August 2022

Approved Signatory :

เอกสารแนบ  
B 0293722





Cert. No.: 22H1586  
Page.: 2 of 2

**Result of Calibration:-**

Function: Humidity measurement.

Reference Temperature (°C)	Standard Humidity (%R.H.)	Before Adjustment	
		UUC* Reading (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	38	1.6
25.0	60.0	57	1.8
25.0	80.0	74	2.0

**Result of Calibration:-**

Function: Humidity measurement.

Reference Temperature (°C)	Standard Humidity (%R.H.)	After Adjustment	
		UUC* Reading (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	40	1.6
25.0	60.0	60	1.8
25.0	80.0	77	2.0

**Result of Calibration:-**

Function: Temperature measurement.

Reference Temperature (°C)	Standard Temperature (°C)	Without Adjustment	
		UUC* Reading (°C)	Uncertainty of Measurement (±°C)
20.00	20.00	20.5	0.72
25.04	25.04	25.0	-0.04
30.01	30.01	30.0	0.72
35.04	35.04	34.5	-0.54
39.98	39.98	39.0	-0.98

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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a 1119774



United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangkok 10260  
Tel. 0 2763 2828 Fax 0 2763 2800 www.uaec consultant.com E-mail: uaec@uaec consultant.com

**MULTI-POINT GAS TEST REPORT**

Test Date : Oct 21, 2021

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42C  
Manufacturer : Thermo Electron Corporation Serial Number : 42C-0508011076

**Standard Gas Concentration**

Sulphur Dioxide (SO<sub>2</sub>) 45.75 PPM  
Nitric Oxide (NO) 45.35 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 1007 PPM  
Cylinder No. : CC159599  
Expiration Date : Jul 30, 2022

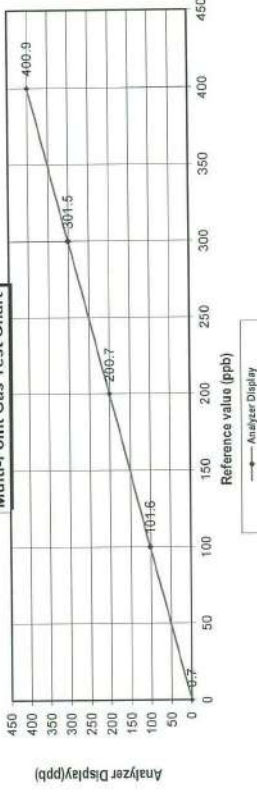
**Dilutor Detail**

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

**Multi-point gas test data**

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error
Level 1	Zero	0.0	0.70	0.70	0.70
Level 2	20.00%	100.0	101.6	1.60	1.57
Level 3	40.00%	200.0	200.7	0.70	0.35
Level 4	60.00%	300.0	301.5	1.50	0.50
Level 5	80.00%	400.0	400.9	0.90	0.22
Remark : Measuring Range 500.0 ppb					0.67
Acceptable Limit ± 5%					

**Multi-Point Gas Test Chart**



เอกสารไม่ควบคุม



### MULTI-POINT GAS TEST REPORT

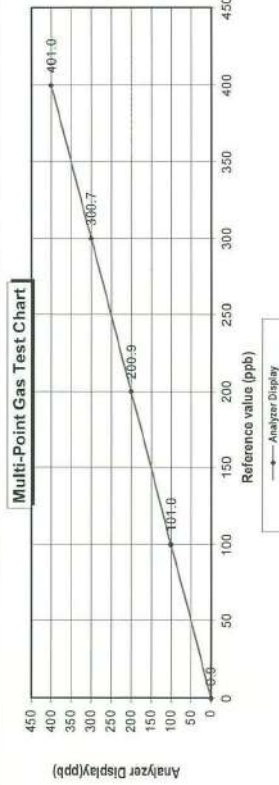
Test Date : Oct 21, 2021

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42C  
Manufacturer : Thermo Environmental Instruments Serial Number : 42C-76412-383

**Standard Gas Concentration**  
Sulphur Dioxide (SO<sub>2</sub>) 44.75 PPM Manufacturer : Thermo Scientific  
Nitric Oxide (NO) 45.35 PPM Model : 1461  
Methane (CH<sub>4</sub>) - PPM Serial Number : 1180540071  
Carbon Monoxide (CO) 1007  
Cylinder No. : CC159599  
Expiration Date : Jul 30, 2022

#### Multi-point gas test data

Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error ]
Level 1	Zero	0.0			
Level 2	20.00%	100.0	0.90	0.90	0.90
Level 3	40.00%	200.0	1.00	0.99	0.99
Level 4	60.00%	300.0	0.90	0.45	0.45
Level 5	80.00%	400.0	0.70	0.23	0.23
Remark : Measuring Range		500.0 ppb	1.00	0.25	0.25
			Average	Difference (%)	0.56



### MULTI-POINT GAS TEST REPORT

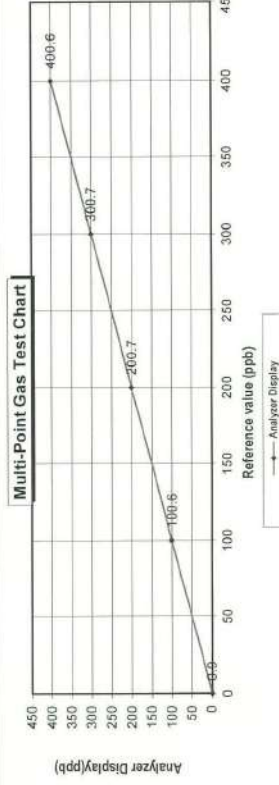
Test Date : Apr 19, 2022

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42C  
Manufacturer : Thermo Electron Corporation Serial Number : 42C-0508011076

**Standard Gas Concentration**  
Sulphur Dioxide (SO<sub>2</sub>) 45.75 PPM Manufacturer : Thermo Scientific  
Nitric Oxide (NO) 45.35 PPM Model : 1461  
Methane (CH<sub>4</sub>) - PPM Serial Number : 1180540071  
Carbon Monoxide (CO) 1007  
Cylinder No. : CC159599  
Expiration Date : Jul 30, 2022

#### Multi-point gas test data

Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error ]
Level 1	Zero	0.0	0.90	0.90	0.90
Level 2	20.00%	100.6	0.60	0.60	0.60
Level 3	40.00%	200.7	0.70	0.35	0.35
Level 4	60.00%	300.7	0.70	0.23	0.23
Level 5	80.00%	400.6	0.60	0.15	0.15
Remark : Measuring Range		500.0 ppb	Average Difference (%)		0.45



## CERTIFICATE OF ANALYSIS Grade of Product: EPA Protocol

Part Number: E04N89E15A01D3  
Cylinder Number: EB0143252  
Laboratory: 124 - Durham (SAP) - NC  
PGVP Number: B22021  
Gas Code: CO, NO, NOX, SO2, BALN  
Reference Number: 122-402135167-1  
Cylinder Volume: 144.4 CF  
Cylinder Pressure: 2015 PSIG  
Valve Outlet: 680  
Certification Date: Jun 21, 2021  
Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards" (May 2012), document EPA 600/R-12/031, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.  
Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Assay Dates
NOX	45.00 PPM	45.98 PPM	G1	06/14/2021, 06/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	06/14/2021, 06/21/2021
SULFUR DIOXIDE	45.00 PPM	44.88 PPM	G1	06/14/2021, 06/21/2021
CARBON MONOXIDE	1000 PPM	994.8 PPM	G1	06/14/2021, 06/21/2021
NITROGEN	Balance			

CALIBRATION STANDARDS			
Type	Lot ID	Cylinder No	Expiration Date
NTRM	20061120	CC708068	Feb 02, 2025
PRM	12386	D855026	Feb 20, 2020
GMIS	40142383102	CC505581	Feb 18, 2023
NTRM	16011043	CC473277	Jun 17, 2022
NTRM	14060119	CC434277	Nov 16, 2025

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

ANALYTICAL EQUIPMENT	
Instrument/Make/Model	Analytical Principle
Nicolet 6700 AHR0801333 CO	FTIR
Nicolet 6700 AHR0801333 NO	FTIR
Nicolet 6700 AHR0801333 NO2	FTIR
Nicolet 6700 AHR0801333 SO2	FTIR

### Triad Data Available Upon Request

NOTES: PO #5221002807  
GROSS WT: 28.40kg  
NET WT: 4.73kg

The analytical test results reported on this certificate relate only to the cylinder



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### MULTI-POINT GAS TEST REPORT

Test Date : Nov 24, 2021

Equipment : Gas Analyzer (CO) Model : 481  
Manufacturer : Thermo Scientific Serial Number : 1200636464

### Standard Gas Concentration

Sulphur Dioxide (SO<sub>2</sub>) 44.75 PPM Manufacturer : Thermo Scientific  
Nitric Oxide (NO) 45.35 PPM Model : 1461  
Methane (CH<sub>4</sub>) - PPM Serial Number : 1180540071  
Carbon Monoxide (CO) 1007 PPM  
Cylinder No. : CC159599  
Expiration Date : Jul 30, 2022

### Dilutor Detail

Manufacturer : Thermo Scientific  
Model : 1461  
Serial Number : 1180540071

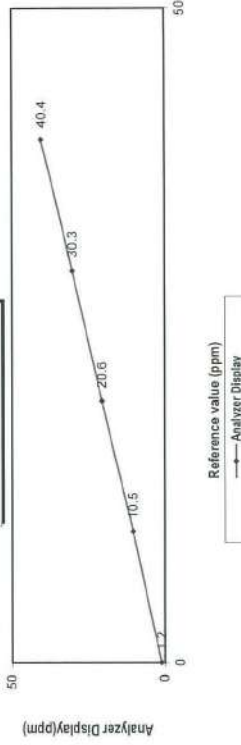
### Multi-point gas test data

Reference Value (ppm)		Analyzer Display (ppm)	Difference Error	Percent Error	% Error ]
Level 1	Zero	0.0	1.2	1.2	1.2
Level 2	20.00%	10.0	0.5	4.8	4.8
Level 3	40.00%	20.0	0.6	2.9	2.9
Level 4	60.00%	30.0	0.3	1.0	1.0
Level 5	80.00%	40.4	0.4	1.0	1.0
Remarks : Measuring Range		50.0 ppm	Average Difference (%)		2.17

Remark : Measuring Range

Acceptable Limit ± 5%

### Multi-Point Gas Test Chart





### MULTI-POINT GAS TEST REPORT

Test Date : Nov 24, 2021

Equipment : Gas Analyzer (CO) Model : 48i  
Manufacturer : Thermo Scientific Serial Number : 1200636465

#### Standard Gas Concentration

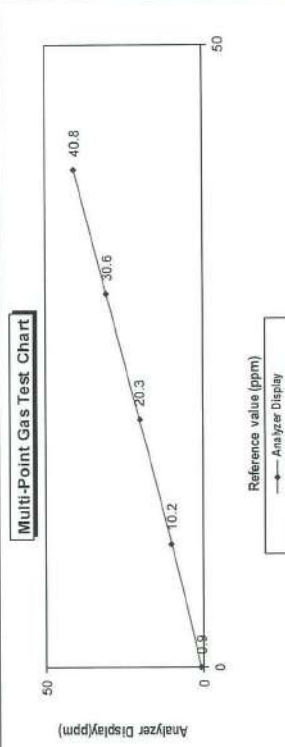
Sulphur Dioxide (SO <sub>2</sub> )	44.75	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.35	PPM	Model :	146i
Methane (CH <sub>4</sub> )	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007	PPM		
Cylinder No. :	CC159599			
Expiration Date :	Jul 30, 2022			

#### Dilutor Detail

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

#### Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error ]
Level 1 Zero	0.0	0.9	0.9	0.9
Level 2 20.00%	10.0	10.2	0.2	2.0
Level 3 40.00%	20.0	20.3	0.3	1.5
Level 4 60.00%	30.0	30.6	0.6	2.0
Level 5 80.00%	40.0	40.8	0.8	2.0
Remark : Measuring Range 50.0 ppm		Average Difference (%)		1.65
:Acceptable Limit ± 5%				



### MULTI-POINT GAS TEST REPORT

Test Date : Nov 24, 2021

Equipment : Gas Analyzer (CO) Model : 48i  
Manufacturer : Thermo Scientific Serial Number : 1200636466

#### Standard Gas Concentration

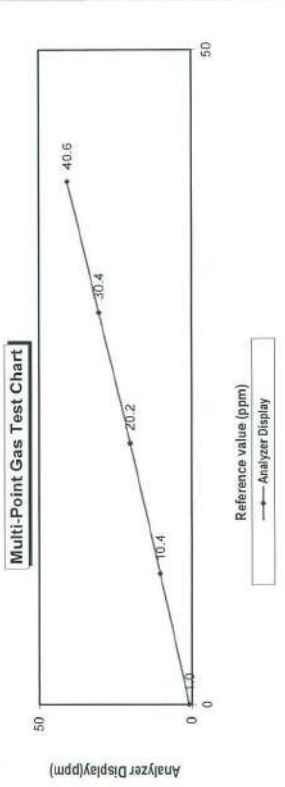
Sulphur Dioxide (SO <sub>2</sub> )	44.75	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.35	PPM	Model :	146i
Methane (CH <sub>4</sub> )	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	1007	PPM		
Cylinder No. :	CC159599			
Expiration Date :	Jul 30, 2022			

#### Dilutor Detail

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

#### Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error ]
Level 1 Zero	0.0	1.0	1.0	1.0
Level 2 20.00%	10.0	10.4	0.4	3.8
Level 3 40.00%	20.0	20.2	0.2	1.0
Level 4 60.00%	30.0	30.4	0.4	1.3
Level 5 80.00%	40.0	40.6	0.6	1.5
Remark : Measuring Range 50.0 ppm		Average Difference (%)		1.73
:Acceptable Limit ± 5%				





### MULTI-POINT GAS TEST REPORT

Test Date : Mar 9, 2022

Equipment : Hydrocarbon Analyzer Model : APHA-370  
Manufacturer : HORIBA Serial Number : PDXEGXF7

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

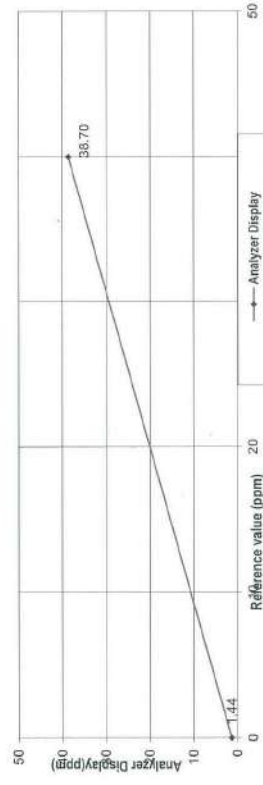
**Dilutor Detail**  
Manufacturer :  
Model :  
Serial Number :

#### Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error ]
Level 1 Zero 0.00	1.44	1.44	1.44	1.44
Level 2 80.00%	38.70	-1.30	-3.36	3.36
Average Difference (%)				
2.40				

Remark : Measuring Range 50.00 ppm  
:Acceptable Limit  $\pm 5\%$

#### Multi-Point Gas Test Chart



### MULTI-POINT GAS TEST REPORT

Test Date : Mar 9, 2022

Equipment : Hydrocarbon Analyzer Model : APHA-370  
Manufacturer : HORIBA Serial Number : SSCEJYB3

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

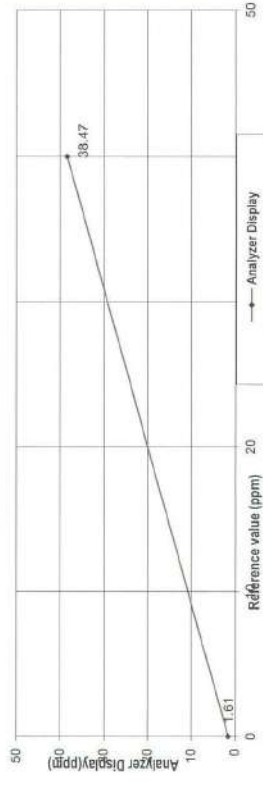
**Dilutor Detail**  
Manufacturer :  
Model :  
Serial Number :

#### Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error ]
Level 1 Zero 0.00	1.61	1.61	1.61	1.61
Level 2 80.00%	40.00	-1.53	-3.98	3.98
Average Difference (%)				
2.79				

Remark : Measuring Range 50.00 ppm  
:Acceptable Limit  $\pm 5\%$

#### Multi-Point Gas Test Chart







# Certificate of Calibration

## WL-21 Wireless Anemometer

Scarlet Tech Ltd. hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (st-wl-21) and is within manufacturer's specification at the time when the calibration is done.

**Client:** Envir Service Co., Ltd.

**Serial No.:** 2111DT0004

Calibration Date: 2022/2/22

**Calibration Expiry Date:** 2023/2/21

## The Result of Calibration

Velocity		Tolerance	Result
Measured Value (m/s)	Actual Value (m/s)		
1.0	0.9	0.1	Pass
2.0	2	1.8 - 2.2	Pass
5.0	4.8	4.7 - 5.3	Pass
7.0	7.1	6.0 - 8.0	Pass
10.0	9.7	9.5 - 10.5	Pass
20.0	20	19.0 - 21.0	Pass

Wind Direction		Deviation	Tolerance	Result
Measured Value	Actual Value			
45°	48	3	42 – 48	Pass
135°	134	1	132 – 138	Pass
225°	227	2	222 – 228	Pass
315°	315	0	312 – 318	Pass
0°	1	1	357 – 3	Pass

Inspection Room Temp	Actual Value	Deviation	Tolerance	Result
22.5°C	22.1	0.4	21.5-23.5	Pass

Atmospheric Pressure Inspection	Actual Value	Deviation	Tolerance	Result
998	1000	2	994-1002	Pass

**Environment conditions:**

Air temperature: 24 °CRelative humidity: 58 %Static pressure: 118.3 kPa

**Performed by:**

Certified by  
Head of Engineering department

This certificate may not be published or reproduced, except in full, unless obtaining permission in writing form from Scarlet Tech Ltd.

เอกสารไม่ควบคุม

THE LINDE GROUP

# Certificate of Analysis Special Gases Mixture

## Customer Details

Name:  
United Analyst & Engineering Co., Ltd.

Address:

3 Soi Udomsuk 41, Sukhumvit Rd., Bang  
Chak, Khut Phra Khanong, Bangkok 10260

Customer Tag No.:

## Certificate Details

Number: 3384/20 Date of Issue: 4-Aug-2020 Expiry date: 4-Aug-2028  
Material Details: Material Code: 400400-AL-34 Cylinder No.: D824432  
Production Order: 90161442 Filling pressure: 137.0 bar Valves: CGA 590 BRASS  
Gas content: 6.60 M<sup>3</sup> Cylinder Material: Aluminum Cylinder Size: 50 L  
Cylinder Owner: LINDE

## Laboratory Report

Component: Normal Concentration: 40.0 ppm  
Methane: In Air  
Analysis Result<sup>1</sup>: 39.8 ppm  
Uncertainty<sup>2</sup>:  $\pm 1\%$  relative  
Method of Analysis<sup>3</sup>: (6) HPB-352  
Assay Date: 4-Aug-2020

## Reference Standard

Methane  
In Nitrogen

## Reference Standard used in Assay

Cylinder number: 49-29  $\pm 0.39$  ppm  
Concentration: 25599956

Expiry date:  
4-OCT-2020

Instrument/Make/Model  
FTIR Spectrometers Nicolet 1550

## Analytical Instruments used in Assay

Analytical Principle  
FTIR-CH

Last Multipoint Calibration  
4-Aug-2020

## Recommend usage condition

Minimum utilization: 5% of actual content or before expiry date whichever comes first.  
Storage condition: Keep in well ventilation and secure area.

## Comments

When reordering, please quote the material number

## Note:

- All results expressed in this report are on mole/mole basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the EPA Traceability Protocol EPA-600/P-12/531 for the Assay and Certification of Gascon Calibration Standards using gravimetric 63.
- The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k=2$ , providing a level of confidence of approximately 95%. The measurement of this material is traceable to the SI through the reference gas standard which is traceable to Swiss National Standard of Mass or to the International Union of Pure and Applied Chemistry (IUPAC) standard.
- (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyser, (3) Infrared-based Oxygen Analyser, (4) Electrochemical Methane Analyser
- (5) Total Hydrocarbon Analyzer, (6) Other - Specified

Page 1 of 1

This report shall not be reproduced except in full

United Analyst & Engineering Co., Ltd. (unanal)

unanal@unanal.com

15 unanal@unanal.com 6.6 M<sup>3</sup> methane

unanal@unanal.com 105.40 Total (60) 2338-6333

unanal@unanal.com 105 M<sup>3</sup> methane 24100

unanal@unanal.com 38.570-323

PH-007/7006

Signature for and on behalf of Linde (Thailand) Public Company Limited

15<sup>th</sup> Floor, Bangkok Tower A, 273 Moo 14, Bangna-Trad Rd., A.S. Road, Bangnae

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Bangnae, Samutprakan 10540, Tel: (66) 2338-6333 Fax: (66) 2338-6333

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# THAI METEOROLOGICAL DEPARTMENT

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

## Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 20 May, 2021 Certification No. 274/21

Page : 1 of 2

Object : Weather Station

Manufacturer : Met One Instruments

Model No. : Data Logger 580 Wind Sensor 034B

Mfg Code : Data Logger X23725 Wind Sensor X21189

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 1009.2 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563  
: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

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

JAPAN QUALITY ASSURANCE ORGANIZATION

Calibrated by :  
Mr. Wachara  
Mechanical



เอกสารแนบควบคุม



# THAI METEOROLOGICAL DEPARTMENT

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

## The Result of Calibration

Certification No. 274/21

Page : 2 of 2

20 May, 2021

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches	Vacuum inches	Pressure hPa	Velocity m/sec	Correction m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.00	-	-	-	7.0	0.00
9.02	-	-	-	9.0	0.02
11.01	-	-	-	11.0	0.01
13.01	-	-	-	13.0	0.01
15.01	-	-	-	16.0	-0.99
17.02	-	-	-	18.0	-0.98
20.02	-	-	-	21.0	-0.98

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. Wachara  
Mechanical Engineer



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SCARLET | TECH

# Certificate of Calibration

## WL-21 Wireless Anemometer

Scarlet Tech Ltd. hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (st-wl-21) and is within manufacturer's specification at the time when the calibration is done.

Client: Envir Service Co., Ltd.

Serial No.: 2111DT0041

Calibration Date: 2022/3/25

Calibration Expiry Date: 2023/3/24

### The Result of Calibration

Velocity		Measured Value (m/s)	Actual Value (m/s)	Deviation	Tolerance	Result
1.0		1	1.8	0	0.9 - 1.1	Pass
2.0			1.8	0.2	1.8 - 2.2	Pass
5.0		5		0	4.7 - 5.3	Pass
7.0		7.2		0.2	6.0 - 8.0	Pass
10.0			9.9	0.1	9.5 - 10.5	Pass
20.0		20		0	19.0 - 21.0	Pass

Wind Direction		Measured Value	Actual Value	Deviation	Tolerance	Result
45°			43	2	42 - 48	Pass
135°			135	0	132 - 138	Pass
225°			227	2	222 - 228	Pass
315°			318	3	312 - 318	Pass
0°			0	0	357 - 3	Pass

Inspection Room Temp	Actual Value	Deviation	Tolerance	Result
24.2°C	24.8	0.6	23.2-25.2	Pass

Atmospheric Pressure Inspection	Actual Value	Deviation	Tolerance	Result
998	1001	3	994-1002	Pass

Environment conditions :

Air temperature: 22 °C

Relative humidity: 62 %

Static pressure: 102.2 kPa

Performed by: \_\_\_\_\_

Certified by  
Head of Engineering department

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4F-3, No. 347, 2nd Sec., Heping E. Rd., Daan Dist, Taipei City 106, Taiwan

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SCARLET | TECH

# Certificate of Calibration

## WL-21 Wireless Anemometer

Scarlet Tech Ltd. hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (st-wl-21) and is within manufacturer's specification at the time when the calibration is done.

Client: Envir Service Co., Ltd.

Serial No.: 2111DT0052

Calibration Date: 2022/3/25

Calibration Expiry Date: 2023/3/24

### The Result of Calibration

Velocity		Measured Value (m/s)	Actual Value (m/s)	Deviation	Tolerance	Result
1.0			0.9	0.1	0.9 - 1.1	Pass
2.0			1.9	0.1	1.8 - 2.2	Pass
5.0			4.8	0.2	4.7 - 5.3	Pass
7.0			7.0	0	6.0 - 8.0	Pass
10.0			9.9	0.1	9.5 - 10.5	Pass
20.0			20.0	0	19.0 - 21.0	Pass

Wind Direction		Measured Value	Actual Value	Deviation	Tolerance	Result
45°			45	0	42 - 48	Pass
135°			137	2	132 - 138	Pass
225°			223	2	222 - 228	Pass
315°			316	2	312 - 318	Pass
0°			1	1	357 - 3	Pass

Inspection Room Temp	Actual Value	Deviation	Tolerance	Result
24.2°C	24.0	0.2	23.2-25.2	Pass

Atmospheric Pressure Inspection	Actual Value	Deviation	Tolerance	Result
998	1000	2	994-1002	Pass

Environment conditions :

Air temperature: 22 °C

Relative humidity: 62 %

Static pressure: 102.2 kPa

Performed by: \_\_\_\_\_

Certified by  
Head of Engineering department

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## Certificate of Calibration

## Customer

Name	: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.	Certificate No : 22-ACT-004
Address	: 81 Soi Udomsak 41, Sakhumvit Road, Bangchak, Prakanong, Bangkok 10260	Request No : Req-2022-0092

### Unit Under Calibration Details

Measurement Item :	: Sound Level Meter	Microphone Class : 2
Manufacturer	: LARSON DAVIS	Microphone Model : 375A04
Model	: LxT2	Microphone S/N : 329361
Serial Number	: 0005384	Preamplifier Model : PRMLxT2C
ID	: UAEFFM.0312564	Preamplifier S/N : 073810
Resolution	: 0.1 dB	Instrume Status : Used

### Calibration Environment and Details

Temperature	: 23 °C ± 2 °C
Humidity	: 50%RH ± 20 %RH
Barometric Pressure	: 1013 hPa ± 10 hPa
Received Date	: 14 January 2022
Calibrated Date	: 21 January 2022
Calibration Procedure	: In-house method CP-S(M-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration	: Lab Acoustic

### Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000724	14 June 2022	TSI
Audio Generator	Svaniek	Svan401	131	18 October 2022	Wk Electric

**Note**

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

Calibrated By:

Calibration Officer

Approved By :

Calibration Engineer Supervisor

Issue Date : 21 January 2022

21 January 2022

The results related only to the item in librated. The certificate shall not be reproduced except in full, without written approval of the National Science Museum.

เอกสารนี้เกี่ยวข้องกับวัตถุในพิพิธภัณฑ์วิทยาศาสตร์แห่งชาติเท่านั้น ไม่สามารถนำเอกสารนี้ไปเผยแพร่โดยไม่ได้รับอนุญาตจากกรมวิทยาศาสตร์วัฒนธรรม

01/07/19

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Certificate No	:	22-ACT-034
Request No	:	Req-2022-00

## 1. Indication at the calibration check frequency

UUC Setting	Nominal Level (dB)	Before Adjust		Adjust		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)		
FAST / A / 37-139							
Calibrator Setting							
1000 Hz 114.00 dB	113.85	113.9	+0.05	113.9	0.05	0.0	0.3

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

## 2. Self-generated noise, Microphone installed

	UNCERTAINTY	
	Measured (dB)	( $\pm$ dB)
UUC Setting		
FAST / 37-139		
UUC Weighting		
A	27.8	0.10

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

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	( $\pm$ dB)
A	27.5	0.10
C	27.0	0.10
Z	31.8	0.10

#### 4. Acoustic signal test of frequency weightings

UUC/Setting	Deviation from various Frequency				UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
	Weighting Response curve					
	A	C	Z			
FAST / 37-139						
STD Setting	(dB)	(dB)	(dB)	(dB)		
125 Hz	0.0	0.1	0.0	0.0	0.50	2.0
1000 Hz	0.0	0.0	0.0	0.0	0.60	1.0
4000 Hz	0.2	0.3	0.2	0.2	0.60	3.0
8000 Hz	-0.3	-0.3	-0.3	-0.3	0.70	5.0

Certificate No : 22-ACT-034  
Request No : Req-2022-0092

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

UUC Setting FAST / 37-139	Deviation from various Frequency				UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)
	Weighting Response curve					
	A (dB)	C (dB)	Z (dB)			
STD Setting						
63 Hz	-0.2	-0.1	0.0			2.0
125 Hz	-0.1	0.0	0.0			1.5
250 Hz	-0.1	0.0	0.0			1.5
500 Hz	-0.1	0.0	0.0			1.5
1000 Hz	0.0	0.0	0.0		0.2	1.0
2000 Hz	0.0	0.0	0.0			2.0
4000 Hz	0.0	0.0	0.0			3.0
8000 Hz	-0.1	-0.1	0.0			5
16000 Hz	-0.1	-0.1	-0.1			+5, -1NE,

6. Frequency and time weightings at 1kHz

UUC Setting FAST / 37-139	STD REF (dB)	Measured		UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)
		UUC (dB)	ERR (dB)		
UUC Weighting					
A	114.00	114.0	0.0		0.2
C	114.00	114.0	0.0	0.2	0.2
Z	114.00	114.0	0.0		0.2
UUC Setting 37-139 / A					
UUC Time Response					
Fast	114.00	114.0	0.0		0.1
Slow	114.00	114.0	0.0	0.2	0.1
Leq	114.00	114.0	0.0		0.1

Certificate No : 22-ACT-034  
Request No : Req-2022-0092

7. Long Term Stability

UUC Setting FAST / A / 37-139	Measured		UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)
	UUC (dB)			
STD Setting				
Initial	114.0			
Final	114.0			
Deviated	0.0		0.1	0.3

8. Level linearity on the reference level range

UUC Setting FAST / A / 37-139	Anticipated		Deviation		UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)
	STD dB	REF (dB)	UUC (dB)	ERR (dB)		
	139.00	139	139.0	0.0		1.1
	134.00	134	134.0	0.0		1.1
	129.00	129	129.0	0.0		1.1
	124.00	124	124.0	0.0		1.1
	119.00	119	119.0	0.0		1.1
	114.00	114	114.0	0.0		1.1
	109.00	109	109.0	0.0		1.1
	104.00	104	104.0	0.0		1.1
	99.00	99	99.0	0.0		1.1
	94.00	94	93.9	-0.1		1.1
	89.00	89	88.9	-0.1		1.1
	84.00	84	83.9	-0.1	0.3	1.1
	79.00	79	78.9	-0.1		1.1
	74.00	74	73.9	-0.1		1.1
	69.00	69	69.0	0.0		1.1
	64.00	64	63.9	-0.1		1.1
	59.00	59	59.0	0.0		1.1
	54.00	54	54.0	0.0		1.1
	49.00	49	49.0	0.0		0.8
	44.00	44	44.1	0.1		1.1
	39.00	39	39.3	0.3		1.1
	38.00	38	38.3	0.3		1.1
	37.00	37	37.5	0.5		1.1





9. Level linearity including the level range control

	LUC Setting	STD	Measured			UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
			REF (dB)	UUC (dB)	ERR (dB)		
FAST / A							
	UUC Range						
	37-139	42.8	43.0	0.2	0.3	1.1	
		114	114.0	0.0		1.1	

## 10. Tone burst response

20. Tone burst response	UUC Setting		STD Toneburst (ms)	Anticipated Ref (dB)	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
	A / 37-139	UUC Time Response			UUC (dB)	ERR (dB)		
Fast			200	135.0	135.0	0.0		1
			2	118.0	117.7	-0.3		+1.0, -2.5
			0.25	109.0	108.8	-0.2		+1.3, -5.0
Slow			200	128.6	128.5	-0.1	0.3	1
			2	109.0	108.9	-0.1		+1.0, -5.0
			200	129.0	129.0	0.0		1
SEL			2	109.0	109.1	+0.1		+1.0, -2.5
			0.25	100.0	100.0	0.0		+1.5, -5.0

## 11. Peak C Sound level

UUC Setting	Anticipated REF (dB)	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
		UUC (dB)	ERR (dB)		
FAST / C / 95-142					
STD Setting					
Complete cycle	137.4	136.8	-0.60		3.0
Positive half cycle	136.4	136.1	-0.30	0.2	2.0
Negative half cycle	136.4	136.2	-0.20		2.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory.

เอกสารไม่ควบคุม

01.07.19

# เอกสารไม่ควบคุม

date 01/07/19



## 12. Overload Indication

UUC Setting	Measured UUC (dB)	UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
FAST / A, 37°-139	141.7	0.2	1.5
STD Setting	141.8		
Positive one-half cycle Negative one-half cycle	-0.1		

### 13. High Level Stability

UUC Setting		Measured UUC (dB)	UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
FAST / A / 37°/139				
STD Setting				
Initial		138.0		
Final		138.0		
Deviated		0.0	0.1	0.3

End of Certificate

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

เอกสารนี้ควบคุม

Date: 01/07/19

# เอกสารไม่ควบคุม

Date 01/07/19

## Certificate of Calibration

**Customer**  
Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260  
Certificate No : 22-ACT-105  
Request No : Req-2022-0229

**Unit Under Calibration Details**  
Measurement item : Sound Level Meter  
Manufacturer : LARSON DAVIS  
Model : LxT2  
Serial Number : 0005396  
ID : UAE.EFM.033/2564  
Resolution : 0.1 dB  
Microphone Class : 2  
Microphone Model : 375A04  
Microphone S/N : 329350  
Preamplifier Model : PRMLxT2C  
Preamplifier S/N : 073812  
Instrument Status : Used

### Calibration Environment and Details

Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 31 January 2022  
Calibrated Date : 11 February 2022  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic

### Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	14 June 2022	TSI
Audio Generator	Svaniek	Svan401	131	18 October 2022	WK Electric

### Note

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

Calibrated By : \_\_\_\_\_

Calibration Officer

Approved By : \_\_\_\_\_

Calibration Engineer Supervisor

Issue Date : 11 February 2022

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd  
PM-708-SLM-01 Rev.0 Issue date 01/07/15

เอกสารไม่ควบคุม

Certificate No : 22-ACT-105  
Request No : Req-2022-0229

### 1. Indication at the calibration check frequency

UUC Setting	Nominal Level (dB)	Before Adjust		Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)		
FAST / A / 37-139							
Calibrator Setting							
1000 Hz 114.00 dB	113.85	113.9	+0.05	113.9	0.05	0.20	0.3

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

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

UUC Setting	Measured (dB)	UNCERTAINTY (± dB)
FAST / 37-139		
UUC Weighting		
A	27.8	0.10

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

UUC Setting	Measured (dB)	UNCERTAINTY (± dB)
FAST / 37-139		
UUC Weighting		
A	27.8	0.10
C	27.3	0.10
Z	33.1	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A (dB)	C (dB)	Z (dB)		
FAST / 37-139					
STD Setting					
125 Hz	0.1	0.1	0.2	0.50	2.0
1000 Hz	0.0	0.0	0.0	0.60	1.0
4000 Hz	0.6	0.5	0.6	0.60	3.0
8000 Hz	0.1	0.0	0.2	0.70	5.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd  
PM-708-SLM-01 Rev.0 Issue date 01/07/15

เอกสารไม่ควบคุม

Certificate No : 22-ACT-105

Request No : Req-2022-0229

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

UUC Setting		Deviation from various Frequency			UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)
		Weighting Response curve				
FAST / 37-139		A (dB)	C (dB)	Z (dB)		
STD Setting						
63 Hz		-0.2	0.0	0.0	0.2	2.0
125 Hz		-0.1	0.0	0.0		1.5
250 Hz		-0.1	0.0	0.0		1.5
500 Hz		-0.1	0.0	0.0		1.5
1000 Hz		0.0	0.0	0.0		1.0
2000 Hz		0.0	0.1	0.0		2.0
4000 Hz		0.0	0.0	0.0		3.0
8000 Hz		0.0	0.0	0.0		5.0
16000 Hz		-0.1	-0.1	-0.1		+5, -INF.

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
		UUC	ERR		
		(dB)	(dB)		
FAST / 37-139					
UUC Weighting					
A	114.00	114.0	0.0		0.2
C	114.00	114.0	0.0	0.2	0.2
Z	114.00	114.0	0.0		0.2

UUC Setting	STD	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
		UUC	ERR		
		(dB)	(dB)		
37-139 / A					
UUC Time Response					
Fast	114.00	114.0	0.0		0.1
Slow	114.00	114.0	0.0	0.2	0.1
Leq	114.00	114.0	0.0		0.1

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FM-708-SLM-01 Rev.0 Issue date 01/07/16

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Certificate No : 22-ACT-105

Request No : Req-2022-0229

7. Long Term Stability

UUC Setting	Measured		UNCERTAINTY ( ± dB)	Acceptance Limit ( ± dB)
FAST / A / 37-139	UUC (dB)			
STD Setting				
Initial		114.0		
Final		114.0		
Deviated		0.0	0.1	0.3

8. Level linearity on the reference level range

UUC Setting	FAST / A / 37-139	Anticipated		Deviation		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
		REF	(dB)	UUC	ERR		
		(dB)		(dB)	(dB)		
FAST / A / 37-139							
STD dB							
139.00		139		139.0	0.0		1.1
134.00		134		134.0	0.0		1.1
129.00		129		129.0	0.0		1.1
124.00		124		124.0	0.0		1.1
119.00		119		119.0	0.0		1.1
114.00		114		114.0	0.0		1.1
109.00		109		109.0	0.0		1.1
104.00		104		104.0	0.0		1.1
99.00		99		99.0	0.0		1.1
94.00		94		93.9	-0.1		1.1
89.00		89		88.9	-0.1		1.1
84.00		84		83.9	-0.1	0.3	1.1
79.00		79		78.9	-0.1		1.1
74.00		74		73.9	-0.1		1.1
69.00		69		68.9	-0.1		1.1
64.00		64		63.9	-0.1		1.1
59.00		59		58.9	-0.1		1.1
54.00		54		53.9	-0.1		1.1
49.00		49		48.9	-0.1		1.1
44.00		44		44.0	0.0		1.1
39.00		39		39.2	0.2		1.1
38.00		38		38.3	0.3		1.1

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

FM-708-SLM-01 Rev.0 Issue date 01/07/16

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Certificate No : 22-ACT-105  
Request No : Req-2022-0229

9. Level linearity including the level range control

UUC Setting	STD REF (dB)	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
		UUC (dB)	ERR (dB)		
37-139	43.2	42.8	-0.4	0.3	1.1
	114	114.0	0.0		1.1

10. Tone burst response

UUC Setting	STD Toneburst (ms)	Anticipated Ref (dB)	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
			UUC (dB)	ERR (dB)		
Fast	200	135.0	134.9	-0.1	0.3	1.0
	2	118.0	117.6	-0.4		+1.0, -2.5
	0.25	109.0	108.7	-0.3		+1.5, -5.0
Slow	200	128.6	128.5	-0.1	0.3	1.0
	2	109.0	108.9	-0.1		+1.0, -5.0
	200	129.0	129.0	0.0		1.0
SEL	2	109.0	108.9	-0.1	0.3	+1.0, -2.5
	0.25	100.0	100.0	0.0		+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated REF (dB)	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
		UUC (dB)	ERR (dB)		
FAST / C / 95-142	137.4	136.7	-0.70	0.2	3.0
	136.4	136.2	-0.20		2.0
	136.4	136.2	-0.20		2.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd  
FM-708-SLM-01 Rev.0 Issue date 01/07/11

เอกสารไม่ควบคุม

Certificate No : 22-ACT-105  
Request No : Req-2022-0229

12. Overload indication

UUC Setting	Measured UUC (dB)	UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
FAST / A / 37-139	141.7	0.2	1.5
STD Setting			
Positive one-half cycle			
Negative one-half cycle	141.8	0.2	1.5
Deviated	-0.1		

13. High Level Stability

UUC Setting	Measured UUC (dB)	UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
FAST / A / 37-139	138.0	0.1	0.3
STD Setting			
Initial			
Final	138.0	0.1	0.3
Deviated	0.0		

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd  
FM-708-SLM-01 Rev.0 Issue date 01/07/11

เอกสารไม่ควบคุม

## Certificate of Calibration

### Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260  
Certificate No : 22-ACT-035  
Request No : Req-2022-0094

### Unit Under Calibration Details

Measurement item : Sound Level Meter  
Manufacturer : LARSON DAVIS  
Model : LX12  
Serial Number : 0005398  
ID : UAE.EFM.0352564  
Resolution : 0.1 dB  
Microphone Class : 2  
Microphone Model : 375A04  
Model : LX12  
Serial Number : 328675  
Pre-amplifier Model : PRMLX72C  
Pre-amplifier SN : 071793  
Instrument Status : Used

### Calibration Environment and Details

Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 14 January 2022  
Calibrated Date : 21 January 2022  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic

### Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Standard Microphone	GRAS	40AAN	188273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	14 June 2022	TSI
Audio Generator	Svanek	Svan401	131	18 October 2022	WK Electric

### Note

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

Calibrated By :

Y

Approved By :

Y

Calibration Officer

Calibration Engineer Supervisor

Issue Date :

21 January 2022

Certificate No : 22-ACT-035

Request No : Req-2022-0094

### 1. Indication at the calibration check frequency

UUC Setting	Nominal Level (dB)	Before Adjust		Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)		
FAST / A / 37-139							
Calibrator Setting							
1000 Hz 114.00 dB	113.85	114.0	+0.15	113.9	0.05	0.20	0.3

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

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

UUC Setting	Measured (dB)	UNCERTAINTY (± dB)
FAST / 37-139	28.1	0.10
UUC Weighting		
A		0.10

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

UUC Setting	Measured (dB)	UNCERTAINTY (± dB)
FAST / 37-139		
UUC Weighting		
A	27.9	0.10
C	27.3	0.10
Z	31.9	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A (dB)	C (dB)	Z (dB)		
FAST / 37-139					
STD Setting					
125 Hz	0.0	0.0	0.0	0.50	2.0
1000 Hz	0.0	0.0	0.0	0.60	1.0
4000 Hz	0.4	0.3	0.3	0.60	3.0
8000 Hz	-0.1	-0.2	-0.1	0.70	5.0



Certificate No : 22-ACT-035  
Request No : Req-2022-0094

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

UUC Setting FAST / 37-139	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A (dB)	C (dB)	Z (dB)		
STD Setting					
63 Hz	-0.2	-0.1	-0.1		2.0
125 Hz	-0.1	0.0	-0.1		1.5
250 Hz	-0.1	0.0	-0.1		1.5
500 Hz	-0.1	0.0	-0.1		1.5
1000 Hz	0.0	0.0	0.0	0.2	1.0
2000 Hz	0.0	0.0	0.0		2.0
4000 Hz	0.0	0.0	0.0		3.0
8000 Hz	-0.1	-0.1	0.0		5
16000 Hz	-0.1	-0.1	-0.1		+5, -INF.

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
		UUC	ERR		
		(dB)	(dB)		
FAST / 37-139					
UUC Weighting					
A	114.00	114.0	0.0		0.2
C	114.00	114.0	0.0	0.2	0.2
Z	114.00	114.0	0.0		0.2

UUC Setting	STD	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
		UUC	ERR		
		(dB)	(dB)		
37-139 / A					
UUC Time Response					
Fast	114.00	114.0	0.0		0.1
Slow	114.00	114.0	0.0	0.2	0.1
Leq	114.00	114.0	0.0		0.1

Certificate No : 22-ACT-035  
Request No : Req-2022-0094

7. Long Term Stability

UUC Setting	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
	UUC	(dB)		
FAST / A / 37-139				
STD Setting				
Initial		114.0		
Final		114.0		
Deviated		0.0	0.1	0.3

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
		REF	UUC		
FAST / A / 37-139		(dB)	(dB)		
		(dB)	(dB)		
STD dB					
139.00		139	139.0	0.0	1.1
134.00		134	134.0	0.0	1.1
129.00		129	129.0	0.0	1.1
124.00		124	124.0	0.0	1.1
119.00		119	119.0	0.0	1.1
114.00		114	114.0	0.0	1.1
109.00		109	109.0	0.0	1.1
104.00		104	104.0	0.0	1.1
99.00		99	99.0	0.0	1.1
94.00		94	93.9	-0.1	1.1
89.00		89	88.9	-0.1	1.1
84.00		84	83.9	-0.1	1.1
79.00		79	78.9	-0.1	1.1
74.00		74	73.9	-0.1	1.1
69.00		69	69.0	0.0	1.1
64.00		64	63.9	-0.1	1.1
59.00		59	59.0	0.0	1.1
54.00		54	54.0	0.0	1.1
49.00		49	49.0	0.0	0.8
44.00		44	44.1	0.1	1.1
39.00		39	39.3	0.3	1.1
38.00		38	38.3	0.3	1.1
37.00		37	37.5	0.5	1.1

Certificate No : 22-ACT-035  
Request No : Req-2022-0094

9. Level linearity including the level range control

UUC Setting	STD REF (dB)	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
		UUC (dB)	ERR (dB)		
37-139	43.2	43.4	0.2	0.3	1.1
	114	114.0	0.0		1.1

10. Tone burst response

UUC Setting	STD Toneburst (ms)	Anticipated Ref (dB)	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
			UUC (dB)	ERR (dB)		
A / 37-139	200	135.0	135.0	0.0	0.3	1
	2	118.0	117.9	-0.1		+1.0, -2.5
	0.25	109.0	108.7	-0.3		+1.5, -5.0
Slow	200	128.6	128.5	-0.1	0.3	1
	2	109.0	108.9	-0.1		+1.0, -5.0
	200	129.0	129.0	0.0		1
SEL	2	109.0	109.1	+0.1	0.3	+1.0, -2.5
	0.25	100.0	99.9	-0.1		+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated REF (dB)	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
		UUC (dB)	ERR (dB)		
FAST / C / 95-142	137.4	136.8	-0.60	0.2	3.0
Complete cycle	136.4	136.1	-0.30		2.0
Positive half cycle	136.4	136.1	-0.30		2.0

Certificate No : 22-ACT-035  
Request No : Req-2022-0094

12. Overload indication

UUC Setting	Measured UUC (dB)	UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
FAST / A / 37-139	142.3	0.2	1.5
STD Setting	142.0		
Positive one-half cycle	0.3		

13. High Level Stability

UUC Setting	Measured UUC (dB)	UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)
FAST / A / 37-139	138.0	0.1	0.3
STD Setting	138.0		
Initial	0.0		

End of Certificate

# Calibration Certificate

Certificate No.: 2202097-001-01  
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
Address: 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhnong, Bangkok 10260

Page 1 of 5

Equipment:	pH Meter
Manufacturer:	HANNA INSTRUMENTS
Model:	HI 2211
Serial No.:	08165345
ID No.:	UAE.WAT.004/2556
Order No.:	2202097
Operation No.:	2202097-001
Date of Receipt:	11 March 2022
Date of Calibration:	16 March 2022
Calibrated by	Mr.Manas Somsak Specialist
Date of Issue:	21 March 2022
Approved by	( M ) 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 technical competence of the calibration laboratory and the equipment used in the calibration. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

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# Calibration Report

Certificate No.: 2202097-001-01  
Equipment: pH Meter  
Resolution: 0.01 pH ; 0.1/1 mV  
Manufacturer: HANNA INSTRUMENTS  
Model: HI 2211  
Serial No.: 08165345  
Type: Bench top  
ID No.: UAE.WAT.004/2556  
Date of Calibration: 16 March 2022

Page 2 of 5

Location:	Chemical Calibration Laboratory, National Food Institute.				
Environment Condition:	Ambient Temperature: ( 23.0 ± 1.5 ) °C      Relative Humidity: ( 49.5 ± 5 ) %				
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					
Instrument	Serial / ID No.	Manufacturer	Certificate No.	Due Date	
2.1 DC Voltage Calibrator	2709007	Fluke	SCL-21F-0687	24 June 2022	
2.2 Digital Thermometer	2709007	Fluke	CC-640599-01	30 October 2022	
2.3 Thermo-Hygro Meter	ana.kh.BTH 005558	PONPE	QR21-2787	15 November 2022	
Certified Reference Material	Lot. No.	Manufacturer	Ref. N	Expiry Date	
2.4 pH buffer 4.008 (Primary pH buffer Solution)	780012	CPAchem	PH216.L5	21 November 2023	
2.5 pH buffer 6.865 (Primary pH buffer Solution)	780013	CPAchem	PH217.L5	21 November 2023	
2.6 pH buffer 10.01 (Primary pH buffer Solution)	780015	CPAchem	PH220.L5	21 November 2022	
2.7 pH buffer 7.00 (Standard pH buffer Solution)	776840	CPAchem	PH107.L5	8 November 2022	
3. This certification is traceable to The International System of Unit (SI Unit)					
3.1 Instruments No.2.1	through	NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0076			
3.2 Instruments No.2.2	through	NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0061			
3.3 Instruments No.2.3	through	NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0262			
3.4 Certified Reference Material No. 2.4 to 2.6	traceable to	Primary measurement method- Hanna 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			
3.5 Certified Reference Material No. 2.7	traceable to	BIM Ref N HI-7 LoN 30.04.2020; BIM Ref N HI-9 LoN 28.05.2020; BIM Ref N HI-10 LoN 28.05.2020. 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.					

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.

เอกสารไม่ควบคุม



## Calibration Report

**Certificate No.:** 2202097-001-01  
**Equipment:** pH Meter  
**Resolution:** 0.01 pH : 0.1/1 mV  
**Manufacturer:** HANNA INSTRUMENTS  
**Model:** HI 2211  
**Serial No.:** 08165345  
**Type:** Bench top  
**ID No.:** UAE.WAT.004/2556  
**Date of Calibration:** 16 March 2022

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	414.117	414	0.00	0.58	2.00
2	235.811	293.7	2.00	0.063	2.00
4	177.462	177.4	4.00	0.063	2.00
6	59.159	59.2	6.00	0.063	2.00
7	-0.001	0.1	7.00	0.063	2.00
8	-59.159	-59.1	8.00	0.063	2.00
10	-177.463	-177.3	10.00	0.063	2.00
12	-295.812	-295.6	12.00	0.063	2.00
14	-414.119	-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:** LE420  
**Serial No.:** 1142602  
**ID No.:** N/A

Performance of Electrode system (Three-Point Calibration at pH4, pH7 and pH10)

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.01	180.5	99.3	0.0071	2.00
6.866	6.87	12.5	-	0.0074	2.00
10.015	10.01	-171.5	99.1	0.0090	2.00
6.983	6.98	5.2	-	0.0092	2.00

## Calibration Report

**Certificate No.:** 2202097-001-01  
**Equipment:** Digital Thermometer with RTD (pH Meter)  
**Resolution:** 0.1 °C  
**Model:** HI 2211  
**Serial No.:** 08165345  
**ID No.:** UAE.WAT.004/2556  
**Manufacturer:** HANNA INSTRUMENTS  
**Date of Calibration:** 16 March 2022

Page 4 of 5

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

### Environment Condition:

Ambient Temperature ( 23.0 ± 1.0 ) °C  
Relative Humidity ( 50 ± 4 ) %

### Condition of this results of Calibration:

1. 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 ).
2. 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	2118154	PSLT 0851/04	24-Jun-22	TISTR
Platinum Resistance Thermometer (PRT)	5627A	877332			

Support Equipment : - Low Temperature Bath (ISOCAL-6), Model: Europa-6 Plus Basic, S/N: 341592/2

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. Condition of Calibrated Item : Good

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

## Calibration Report

**Certificate No.:** 2202097-001-01  
**Equipment:** Digital Thermometer with RTD (pH Meter)  
**Resolution:** 0.1 °C  
**Model:** HI-2211  
**Serial No.:** 08165345  
**ID No.:** UAE.WAT.004/2656  
**Manufacturer:** HANNA INSTRUMENTS  
**Date of Calibration:** 16 March 2022

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: N/A S/N: N/A  
Dimension of probe: Diameter 3.5 mm., Length 100 mm.,  
Sheath material: Stainless Steel

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.0	15.001	0.0	0.099
25.0	25.002	0.0	0.099
35.0	35.002	0.0	0.099

Note - UUC\* : Unit Under Calibration

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

----- End -----

F-CS-012 Revision: 00 Date: 14-12-61

เอกสารแนบฉบับ

## Calibration Certificate

**Certificate No.:** 2201793-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhonong, Bangkok 10280

Page 1 of 5

**Equipment:** pH Meter  
**Manufacturer:** METTLER TOLEDO  
**Model:** SevenEasy pH  
**Serial No.:** 1231155210  
**ID No.:** UAE.WAT.010/2553  
**Order No.:** 2201793  
**Operation No.:** 2201793-001  
**Date of Receipt:** 21 February 2022  
**Date of Calibration:** 1 March 2022

Calibrated by

Scientist

1 March 2022

Approved by

Specialist, 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: 00 Date: 14-12-61

เอกสารแนบฉบับ



## Calibration Report

**Certificate No.:** 2201793-001-01  
**Equipment:** pH Meter  
**Resolution:** 0.01 pH ; 1 mV  
**Manufacturer:** METTLER TOLEDO  
**Model:** SevenEasy pH  
**Serial No.:** 1231155210  
**Type:** Bench top  
**ID No.:** UAE.WAT.010/2553  
**Date of Calibration:** 1 March 2022

Page 2 of 5

**Location:** Chemical Calibration Laboratory, NATIONAL FOOD INSTITUTE  
**Environment Condition:** Ambient Temperature: ( 23.5 ± 1.5 ) °C Relative Humidity: ( 53 ± 5 ) %  
**Condition of Equipment:** Good Condition

### Condition of this Results of Calibration

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

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fluke	SCL-21F-0687	24 June 2022
2.2 Digital Thermometer	2709007	Fluke	CC-8-05599-01	30 October 2022
2.3 Thermo-Hygro Meter	NFLBTH-004H8	PONPE	QR22-0195	27 January 2023

### Certified Reference Material

Lot No.	Manufacturer	Ref N	Expire Date
741339	CPAchem	PH216.L5	19 April 2023
741340	CPAchem	PH217.L5	19 April 2023
741342	CPAchem	PH220.L5	19 April 2022
735636	CPAchem	PH107.L5	16 March 2022

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  
NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0075  
NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0061  
NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0292  
Primary measurement method- Harred oil using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution prepared and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025  
BIM Re/N HI-7 Lo/N 30.04.2020; BIM Re/N HI-8 Lo/N 28.05.2020; BIM Re/N HI-8 Lo/N 30.04.2020; BIM Re/N HI-10 Lo/N 28.05.2020. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
- 3.5 Certified Reference Material No. 2.7 traceable to

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.:** 2201793-001-01  
**Equipment:** pH Meter  
**Resolution:** 0.01 pH ; 1 mV  
**Manufacturer:** METTLER TOLEDO  
**Model:** SevenEasy pH  
**Serial No.:** 1231155210  
**Type:** Bench top  
**ID No.:** UAE.WAT.010/2553  
**Date of Calibration:** 1 March 2022

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 ( × )
		mV	pH		
0.00	414.117	414	0.00	0.58	2.00
2.00	298.811	296	2.00	0.58	2.00
4.00	177.462	178	4.00	0.58	2.00
6.00	59.159	59	6.00	0.58	2.00
7.00	-0.001	0	7.00	0.58	2.00
8.00	-59.159	-59	8.00	0.58	2.00
10.00	-177.463	-177	10.00	0.58	2.00
12.00	-298.812	-296	12.00	0.58	2.00
14.00	-414.119	-414	14.00	0.58	2.00

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

**Equipment:** pH Electrode  
**Manufacturer:** METTLER TOLEDO  
**Serial No.:** 1156852  
**Type:** Combined Electrode  
**Model:** In1 anSolaS  
**ID No.:** N/A

**Performance of Electrode system**  
(Three-Point Calibration at pH4, pH7 and pH10)

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty ( ± pH )	Coverage Factor ( × )
	pH	mV			
4.008	4.00	180	96.25	0.0075	2.00
6.866	6.88	16	-	0.0079	2.00
10.012	10.01	-162	96.13	0.0094	2.00
6.865	7.00	9	-	0.0097	2.00

## Calibration Report

**Certificate No.:** 2201793-001-01  
**Equipment:** Digital Thermometer with RTD (pH Meter)  
 Resolution: 0.1 °C Model: SevenEasy pH  
 Serial No.: 1231155210 ID No.: UAE.WAT.010/2553  
 Manufacturer: METTLER TOLEDO  
**Date of Calibration:** 1 March 2022

Page 4 of 5

**Location:** Chemical Calibration Laboratory, NATIONAL FOOD INSTITUTE  
**Environment Condition:**  
 Ambient Temperature 24 °C ± 1 °C  
 Relative Humidity 53 % ± 2 %

### Condition of this results of Calibration:

- Calibration Method :
  - In house method: WTE-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 :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	2119154	PSL-T 0851/64	03-Jun-22	TISTR
Platinum Resistance Thermometer (PRT)	5627A	877332			

Support Equipment : - Low Temperature Bath (ISOCAL-6), Model: Europa-6 Plus Basic, S/N: 341192/2

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. Condition of Calibrated Item : Good

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

## Calibration Report

**Certificate No.:** 2201793-001-01  
**Equipment:** Digital Thermometer with RTD (pH Meter)  
 Resolution: 0.1 °C Model: SevenEasy pH  
 Serial No.: 1231155210 ID No.: UAE.WAT.010/2553  
 Manufacturer: METTLER TOLEDO  
**Date of Calibration:** 1 March 2022

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 : N/A SIN : N/A

Dimension of probe : Diameter 4 mm., Length 100 mm.,

Sheath material : Stainless Steel

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	15.006	-0.1	0.099
25.1	25.004	-0.1	0.099
35.1	35.003	-0.1	0.099

### Note

- UUC\* : Unit Under Calibration

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 \*\*\*\*\*





## Certificate of Calibration

**Equipment:** CONDUCTIVITY METER  
**Model:** Lab555  
**Serial No. (or ID.):** 16300356  
**Manufacturer:** SI Analytics  
**Electrode Serial No.** 16070087  
**Condition:** In Condition  
**Certificate No.:** C24220084  
**Issued Date:** 22 March 2022  
**Job No.:** KSPR2203267  
**Page:** 1 of 2  
**Brand :** SI Analytics  
**Model :** LF413T

**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, SPC RT Co., Ltd.  
1194 Soi Wachirathamsehit 57, Sukhumvit 101/1 Rd.,  
Bangchak, Prakanong, Bangkok 10260 Thailand

**Calibration By:** Mr. Wasan Nuchnabee  
**Calibration Date:** 22 March 2022  
**The Method used:** In house method, SPCC-WI-49, base on ASTM D 1125-14 and D 5391-14  
**Traceability:** This certificate is traceable to the SI Units maintained by CRM of NIST(SRM) through CPA chem Co., Ltd. (ISO/IEC 17034) Certificate No. 794135, 794136, 772624

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. This report shall not be reproduced except in full without approval of SPC RT Co., Ltd.

SERT  
บริษัท เอสพีอาร์ที จำกัด  
SPC RT Co., Ltd.

Authorized signatory

Certificate No.: C24220084

Page: 2 of 2

## Calibration Results:

## Before Adjustment

Standard	Unit Under Calibration	Correction	Coverage Factor	Uncertainty ( ± )
Conductivity Solution	Reading			
25.000 µS/cm	25.9 µS/cm	-0.900 µS/cm	2.00	0.22 µS/cm
1413.0 µS/cm	1444 µS/cm	-31.0 µS/cm	2.00	8.9 µS/cm
111.3 mS/cm	107.9 mS/cm	3.40 mS/cm	2.00	0.66 mS/cm

## After Adjustment : at 1413 µS/cm

Standard	Unit Under Calibration	Correction	Coverage Factor	Uncertainty ( ± )
Conductivity Solution	Reading			
25.000 µS/cm	25.0 µS/cm	0.000 µS/cm	2.00	0.22 µS/cm
1413.0 µS/cm	1413 µS/cm	0.0 µS/cm	2.00	8.9 µS/cm
111.3 mS/cm	107.2 mS/cm	4.10 mS/cm	2.00	0.66 mS/cm

The End of Certificate



ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

ชนิดเครื่องมือ: CONDUCTIVITY METER  
รุ่น: Lab955  
หมายเลขเครื่อง: 16300356  
เลขที่ใบงาน: KSPR2203267

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)	
22 Mar 2022			22 Mar 2022	หมายเหตุ
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ
		<i>General</i>		
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด ( ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ ปิด – เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		<i>Spectrophotometer</i>		
<input type="checkbox"/>	<input type="checkbox"/>	6. แรงดันไฟฟ้า (Battery Backup) $\geq 2.5$ VDC	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV $< 3,000$ hour)	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible $< 5,000$ hour)	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	<input type="checkbox"/>	<input type="checkbox"/>
		<i>pH Meter and Conductivity Meter</i>		
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด ( Electrode and Connection Cable )	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl )	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาจับอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>
		<i>Turbidimeter</i>		
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความทึบที่ต่ำสุด (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง ( $\geq 2.5$ ไมเกิน 3.0)	<input type="checkbox"/>	<input type="checkbox"/>
		<i>Automatic titrator</i>		
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาพ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>

ข้อแนะนำ : Electrode วัดอุณหภูมิได้ 24.9 °C โดย Control Waterbath ที่ 25.0 ± 0.1 °C

Mr. Wasan Nuchnabee  
Service Engineer

บริษัท เอสพีซี อาร์ที จำกัด  
SPC RT CO., LTD.  
สาขาที่ 00003 1194 รอยบ  
Branch 00003 1194 Sol  
Tel: 0 2165 4333 Ext 3300

# เอกสารไม่ควบคุม

SPCC-FM-R31-02: 23 Nov 2020<sup>9</sup>



อุตสาหกรรมพลังงานอสังหาริมทรัพย์  
ศูนย์บริการข้อมูลปฏิบัติการอุตสาหกรรมอาหาร  
Foundation for Industrial Development National Food Institute  
Food Industrial Laboratory Service Center

NSC-TISI-TIS 17025  
CALIBRATION 0061

# Calibration Certificate

**Certificate No.:** 2203120-001-01  
**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:	Electronic Balance
Manufacturer:	METTLER TOLEDO
Model:	AB204-S/FACT
Serial No.:	1129361010
ID No.:	UAE.WAS.002/2552
Order No.:	2203120
Operation No.:	2203120-001
Date of Receipt:	1 June 2022
Date of Calibration:	1 June 2022

Calibrated by  
Mr. Taveesak Sallee  
Scientist

Approved by

Date of Issue: 7 June 2022  
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.

FCS-009 Revision: 01 Date: 20-04-55

# เอกสารไม่ควมด

**เอกสารเผยแพร่**

nfl.garth



**CERTIFICATE OF CALIBRATION**

Certificate No. : SP22-007 Page 1 of 5

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

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

Bangkok 10260

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-1900

Serial No. : 2021-064

ID No. : UAE.WAS.006/2552

Received Date : 20 January 2022

Calibration Date : 20 January 2022

Issue Date : 24 January 2022

Condition Instrument : Good

Calibrated by : \_\_\_\_\_ Approved by : \_\_\_\_\_

Technical Manager

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.

**REPORT OF CALIBRATION**

Certificate No. : SP22-007 Page 2 of 5

Environment Condition : Ambient Temperature  $25 \pm 5$  °C

Relative humidity  $55 \pm 20$  %RH

Calibration method : In-house method CP-01 Based on ASTM E275-08

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	95935	22 October 2023
Absorbance Standard set	25757	95929	22 October 2023
Wavelength Standard set	25806	95916	22 October 2023
Wavelength Standard set	25758	95915	22 October 2023

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

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

Spectral Band Width of UUC : 4.0 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.



## REPORT OF CALIBRATION

Certificate No. : SP22-007

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5787	0.577	0.0017	0.0031	2.00
	1.0490	1.050	-0.0010	0.0029	2.00
	2.1900	2.183	0.0070	0.0080	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5607	0.560	0.0007	0.0034	2.00
	1.0247	1.023	0.0017	0.0035	2.00
	2.1229	2.118	0.0049	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5236	0.521	0.0026	0.0030	2.00
	0.9634	0.963	0.0004	0.0029	2.00
	1.9763	1.974	0.0023	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5191	0.518	0.0011	0.0031	2.00
	1.0003	1.000	0.0003	0.0033	2.00
	1.9987	1.996	0.0027	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5523	0.552	0.0003	0.0030	2.00
	1.0809	1.082	-0.0011	0.0030	2.00
	2.0391	2.033	0.0061	0.0079	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5601	0.562	-0.0019	0.0031	2.00
	1.0512	1.052	-0.0008	0.0030	2.00
	1.9294	1.925	0.0044	0.0079	2.00

## REPORT OF CALIBRATION

Certificate No. : SP22-007

Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7478	0.746	0.0018	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8686	0.861	0.0076	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2912	0.291	0.0002	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6448	0.638	0.0068	0.0055	2.00

## REPORT OF CALIBRATION

Certificate No. : SP22-007

Wavelength Accuracy :

Page 5 of 5

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor <i>k</i>
241.54	240.8	0.74	0.18	2.00
279.40	278.5	0.90	0.18	2.00
288.70	288.0	0.70	0.18	2.00
334.22	333.5	0.72	0.18	2.00
361.26	360.5	0.76	0.18	2.00
418.48	418.0	0.48	0.18	2.00
446.70	446.0	0.70	0.18	2.00
453.20	453.0	0.20	0.18	2.00
460.06	459.5	0.56	0.18	2.00
536.90	536.0	0.90	0.18	2.00
637.94	637.2	0.74	0.18	2.00
440.74	440.0	0.74	0.18	2.00
472.22	471.6	0.62	0.18	2.00
513.70	513.0	0.70	0.18	2.00
528.72	528.0	0.72	0.18	2.00
574.60	573.8	0.80	0.18	2.00
585.48	584.6	0.88	0.20	2.00
684.63	684.0	0.63	0.18	2.00
740.27	739.8	0.47	0.20	2.00
748.28	747.8	0.48	0.18	2.00
807.16	806.4	0.76	0.18	2.00
879.70	878.8	0.90	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 -

เอกสารไม่ควบคุม

## CERTIFICATE OF CALIBRATION

Certificate No. : SP22-008

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

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

Bangkok 10260

Location of calibration : Laboratory 213

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-2900

Serial No. : 21E22-009

ID No. : UAE.WAT.051/2564

Received Date : 20 January 2022

Calibration Date : 20 January 2022

Issue Date : 24 January 2022

Condition Instrument : Good

Calibrated by :

Approved by :

Technical Manager

Quality Manager

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

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

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SP22-008

Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 ° C

Relative humidity 55 ± 20 %RH

Calibration method : In-house method CP-01 Based on ASTM E275-08

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	95935	22 October 2023
Absorbance Standard set	25757	95929	22 October 2023
Wavelength Standard set	25806	95916	22 October 2023
Wavelength Standard set	25758	95915	22 October 2023

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

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

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

REPORT OF CALIBRATION

Certificate No. : SP22-008

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5787	0.576	0.0027	0.0031	2.00
	1.0490	1.046	0.0030	0.0029	2.00
	2.1900	2.182	0.0080	0.0075	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5607	0.559	0.0017	0.0034	2.00
	1.0247	1.023	0.0017	0.0035	2.00
	2.1229	2.116	0.0069	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5236	0.521	0.0026	0.0030	2.00
	0.9634	0.962	0.0014	0.0029	2.00
	1.9763	1.970	0.0063	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5191	0.519	0.0001	0.0031	2.00
	1.0003	0.999	0.0013	0.0033	2.00
	1.9987	1.992	0.0067	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5523	0.552	0.0003	0.0030	2.00
	1.0809	1.080	0.0009	0.0030	2.00
	2.0391	2.031	0.0081	0.0079	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5601	0.560	0.0001	0.0031	2.00
	1.0512	1.052	-0.0008	0.0030	2.00
	1.9294	1.922	0.0074	0.0079	2.00



## REPORT OF CALIBRATION

Certificate No. : SP22-008

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 0.7478	0.000 0.747	0.0000 0.0008	0.0050 0.0057	2.00 2.00
257	0.0000 0.8686	0.000 0.865	0.0000 0.0036	0.0050 0.0059	2.00 2.00
313	0.0000 0.2912	0.000 0.290	0.0000 0.0012	0.0050 0.0051	2.00 2.00
350	0.0000 0.6448	0.000 0.640	0.0000 0.0048	0.0050 0.0055	2.00 2.00

## REPORT OF CALIBRATION

Certificate No. : SP22-008

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor <i>k</i>
241.72 279.45 287.81 334.06 360.93 418.59 445.94 453.66 460.02 536.59 637.98	241.0 279.0 287.0 333.5 360.0 418.0 445.5 453.0 459.5 536.0 637.5	0.72 0.45 0.81 0.56 0.93 0.59 0.44 0.66 0.52 0.59 0.48	0.18 0.18 0.18 0.18 0.18 0.18 0.18 0.18 0.18 0.18 0.18	2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00
431.38 472.50 513.47 528.88 573.17 585.35 684.40 740.72 748.55 807.03 879.28	431.0 472.0 513.0 528.5 573.0 585.0 684.0 740.5 748.5 807.0 879.5	0.38 0.50 0.47 0.38 0.17 0.35 0.40 0.22 0.05 0.03 -0.22	0.18 0.18 0.18 0.18 0.18 0.20 0.18 0.20 0.18 0.18 0.18	2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 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 -

## CERTIFICATE OF CALIBRATION

Certificate No. : SP21-015 Page 1 of 5

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

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

Location of calibration Laboratory 315

Equipment : Spectrophotometer

Manufacturer : Agilent Technologies

Model : Cary 60

Serial No. : MY15410009

ID No. : N/A

Received Date : 29 May 2021

Calibration Date : 29 May 2021

Issue Date : 30 May 2021

Condition of Instrument : Used

Calibrated by :

Approved by :

Technical Manager

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 recognised 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.

## REPORT OF CALIBRATION

Certificate No. : SP21-015 Page 2 of 5

Environment Condition : Ambient Temperature  $25 \pm 5$  °C

Relative humidity  $50 \pm 15$  %RH

Calibration method : In-house method CP-01 Calibration of UV-Vis Spectrophotometer Based on ASTM E275-08

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	80102	11/7/2021
Absorbance Standard set	25757	80105	11/7/2021
Wavelength Standard set	25806	80103	11/7/2021
Wavelength Standard set	25758	80104	11/7/2021

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

of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 90 nm/min

Scan Interval of UUC : 0.15 nm.

Resolution of UUC : Photometric 0.0001 Abs.

Wavelength 0.1 nm.

REPORT OF CALIBRATION

Certificate No. : SP21-015

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Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	242.0	-0.28	0.19	2.00
279.45	279.5	-0.05	0.19	2.00
287.81	287.9	-0.09	0.19	2.00
334.06	333.8	0.26	0.19	2.00
360.93	360.5	0.43	0.19	2.00
418.59	418.2	0.39	0.19	2.00
445.94	445.6	0.34	0.19	2.00
453.66	453.3	0.36	0.19	2.00
460.02	459.8	0.22	0.19	2.00
536.59	536.7	-0.11	0.19	2.00
637.98	638.4	-0.42	0.19	2.00
431.38	430.9	0.48	0.19	2.00
472.50	472.5	0.00	0.19	2.00
513.47	513.4	0.07	0.19	2.00
528.88	529.2	-0.32	0.19	2.00
573.17	573.5	-0.33	0.19	2.00
585.35	584.8	0.55	0.20	2.00
684.40	684.9	-0.50	0.19	2.00
740.72	740.4	0.32	0.19	2.00
748.55	749.0	-0.45	0.19	2.00
807.03	807.1	-0.07	0.19	2.00
879.28	879.4	-0.12	0.19	2.00

REPORT OF CALIBRATION

Certificate No. : SP21-015

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Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000 0.5791 1.0488 2.1914	0.0000 0.5767 1.0444 2.1841	0.0000 0.0024 0.0044 0.0073	0.0042 0.0042 0.0042 0.0092	2.00 2.00 2.00 2.00
440	0.0000 0.5618 1.0260 2.1259	0.0001 0.5609 1.0244 2.1192	-0.0001 0.0009 0.0016 0.0067	0.0042 0.0042 0.0042 0.0091	2.00 2.00 2.00 2.00
465	0.0000 0.5240 0.9639 1.9788	0.0000 0.5212 0.9632 1.9717	0.0000 0.0028 0.0007 0.0071	0.0042 0.0042 0.0042 0.0091	2.00 2.00 2.00 2.00
546.1	0.0000 0.5194 0.9991 1.9970	-0.0001 0.5184 0.9991 1.9911	0.0001 0.0010 0.0000 0.0059	0.0042 0.0042 0.0042 0.0093	2.00 2.00 2.00 2.00
590	0.0000 0.5523 1.0810 2.0369	0.0000 0.5517 1.0802 2.0293	0.0000 0.0006 0.0008 0.0076	0.0042 0.0042 0.0042 0.0092	2.00 2.00 2.00 2.00
635	0.0000 0.5596 1.0513 1.9268	-0.0001 0.5593 1.0505 1.9217	0.0001 0.0003 0.0008 0.0051	0.0042 0.0042 0.0042 0.0092	2.00 2.00 2.00 2.00



## REPORT OF CALIBRATION

Certificate No. : SP21-015

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## Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
235	0.0000 0.7498	0.0001 0.7438	-0.0001 0.0060	0.0075 0.0075	2.00 2.00
257	0.0000 0.8712	0.0000 0.8647	0.0000 0.0065	0.0075 0.0075	2.00 2.00
313	0.0000 0.2920	0.0000 0.2900	0.0000 0.0020	0.0075 0.0075	2.00 2.00
350	0.0000 0.6459	0.0000 0.6428	0.0000 0.0031	0.0075 0.0075	2.00 2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

- The result expanded uncertainty of measurement  $U$  is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k$ , which for a normal distribution corresponds to a coverage probability of approximately 95%

- End of Certificate -

PerkinElmer  
For the BetterPinAAcle 900F  
Preventive Maintenance Report

Company Name: UNITED ANALYST AND ENGINEERING

Instrument Location: BANGCHAK, PRAKHANONG  
BANGKOK, 10260

Instrument Serial No.: PFBS20031902


Date: 20-Jul-2022

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PinAAcle 900F Preventive Maintenance (PM)

Company Name: UNITED ANALYST AND ENGINEERING			
Address: BANGCHAK, PRAKHANONG, BANGKOK, 10260			
Serial Number:	PFBS20031902	PM Number:	2/2
Customer Name (if applicable):	K. SATHIDA	Telephone Number:	095-5580-049
Customer Support Engineer Name:	K. DUANG	Service Order Number:	WO-01710010
Date PM Performed: (DD-MMM-YYYY)	Jul 20, 2022	Next PM Due Date: (DD-MMM-YYYY)	Jan 20, 2023
Standard Labor Hours to Complete PM :			5 hours

Part Number	Release	Publication Date
09370145 Rev.9	A	January 2018

**PerkinElmer**

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

**General Instructions:**  
The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM.  
Always check with the customer before making any changes that may affect the customer's analysis or calibration, including a current back-up of system software and/or data files.  
The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer.  
Update the PM sticker and instrument logbook as required.

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Component List

Component / Specific Model	Serial #	Configuration Notes

Parts Lists

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

Additional Reagents and Standards Required for PM			
Part Number (if applicable)	Description	Quality	Batch/Lot #
N9300183	1000 mg/L Copper Standard	AR	25-76CUY1
			30-Oct-2022

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

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Additional Tools Required for PM			
Part Number (if applicable)	Description	Quantity	Serial #
N1013000	0.2A Neutral density filter	1	MG0-252
N1013002	1.0A Neutral density filter	1	MG0-358
03030997	System 2 EDL Driver	1	03030997
N3050605	As System 2 EDL	1	16148
N3050121	Cu Lumina HCL	1	092216-010130
N3050109	Ba Lumina HCL	1	102416-040160
N3050139	K Lumina HCL	1	110716-010060
N3050152	Ni Lumina HCL	1	100516-030190

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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.

✓

Inspect the customer log book and make any appropriate PM entries.

✓

Perform general inspection of system for cleanliness.
2. PC Instrument Software:

✓

Instrument Software user files/databases archived, packed, and/or deleted as needed.
3. Mechanical:

✓

Inspect and clean all fans and filters. Replace filters if necessary

✓

Inspect all gas lines for leaks and/or wear. Replace if needed.

✓

Clean exterior of the instrument.

✓

Inspect the burner head, burner chamber, and nebulizer. Clean if needed as stated in the Hardware Guide.

✓

Check burner head dimensions with the feeler gauge as stated in the Hardware Guide in the Maintenance chapter section on cleaning the burner head and checking sloth width. Replace if out of specification

✓

Check the condition of the end cap, burner head, and nebulizer O-rings. Replace if necessary.

✓

Check the drain system for signs of wear. Replace worn or damaged parts.

✓

Visually check for proper flame conditions when igniting the Air-C2H2 and N2O-C2H2 flames (if applicable).
4. Electrical:

✓

Inspect PC boards. Clean if necessary.

✓

Carefully check all internal and external cable connections.

✓

Check instrument firmware revisions upgrade to current levels (if necessary)

✓

Run Diagnostics Test within the Advanced function of the Spectrometer page. Check the results in the service log folder in the Spectrometer BM Log Viewer.
5. Optics:

✓

Inspect and clean the sample compartment windows, if needed.

✓

Inspect optics. Clean or replace if necessary,
6. Gasses:

✓

Verify that the Gasses supplied to the instrument are within the pressure and purity specifications found in the PinAAcle 900 Series Pre-Installation Checklist SDB.

✓

Verify that the acetylene filter and air filter element is dry. Replace if necessary.

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7. Flame Interlock Check:

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

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

8. After PM Performance tests:

8.1 Detector Linearity with Barium

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

Parameter	Specification	Certificate Value at 553.6 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.	0.9798	0.9848	Passed
0.2 A ND Filter	± 5% from Cert.	0.2042	0.1963	Passed

8.2 Baseline Noise at 1.0 Absorbance with Barium

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0008	Passed

8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

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

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

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0049	Passed

8.5 AA-BG Baseline Noise with Copper

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0003	Passed

8.6 AA-BG Baseline Noise with Arsenic

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0005	Passed

8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity	Specification	Results (Abs.)	Pass/Fail
5 mg/L Sensitivity SS Neb (if applicable)	> 0.250 Abs.	NA	Not Applicable
2 mg/L Sensitivity HS Neb (if applicable)	> 0.250 Abs.	0.3353	Passed

10. Review:

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

## Additional Comments

Additional Comments Regarding the PM

## Review

The preventive maintenance checks and if applicable performance tests for PinAAcle 900F have been completed.	
This PinAAcle 900F Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.	
Review of Preventive Maintenance:	
Authorized PerkinElmer Representative:	Date: 20-Jul-2022 (DD-MMM-YYYY)
Authorized Customer Representative:	Date: 20-Jul-2022 (DD-MMM-YYYY)

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Request No. 25-65 / 0398

MTC. ACLNo. 486 / 65

### CALIBRATION CERTIFICATE

NOMENCLATURE : 1. Atomic Absorption Spectrophotometer "Agilent Technologies"

Model AA240FS, Serial No. MY13160001

2. Working standard solution "Inorganic Ventures"

Multi Analyte Custom Grade Solution, Lot No. P2-MEB675610

SUBMITTED BY : United Analyst and Engineering Consultant Co., Ltd.

3. Soi Udomsuk41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

CALIBRATION PROCEDURE : 1. Performance Verification of Atomic Absorption Spectrophotometer (WI-500-02-30)

2. Estimation Uncertainty of Measurement in Analytical Chemistry (QP-513)

REFERENCE MATERIAL : Traceable to NIST "Agilent Technologies", "Carlo Erba"

Cadmium Lot No. 0108047046, Chromium Lot No. 0106315418, Copper Lot No. 0107480530, Iron Lot No. 0104697566,

Lead Lot No. 0104659473, Manganese Lot No. T109228A, Nickel Lot No. 010978044, Zinc Lot No. 0100792297

CALIBRATION RANGE: 0.02,0.10,0.30,0.50,0.70 mg/l at 228.8 nm.Cd, 0.10,0.20,0.30,0.50,0.70 mg/l at 357.9 nm.Cr, 0.05,0.10,0.30,0.50,0.70 mg/l at 324.7 nm.Cu, 0.10,0.30,0.50,0.70,1.00 mg/l at 248.3 nm.Fe, 0.20,0.50,0.70,1.00,1.50 mg/l at 217.0 nm.Pb, 0.05,0.10,0.30,0.50,0.70 mg/l at 279.5 nm.Mn, 0.10,0.30,0.50,0.70,1.00 mg/l at 232.0 nm.Ni, 0.05,0.10,0.30,0.50,0.70 mg/l at 213.9 nm.Zn

AMBIENT CONDITIONS : Temperature 22 °C Relative humidity 60 %

The Atomic Absorption Spectrophotometer set has been calibrated against Reference Material traceable to National Institute of Standards and Technology ( NIST ) by The Analytical Chemistry Laboratory. The results are attached herewith.

Calibrated by

Approved by

Director of Analytical Chemistry Laboratory

Ref. 2025265020400522001

Calibration Date : 3 February 2022

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

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FIMDL/MTC.002 Rev.4

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Request No. 25-65 / 0398

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MTC. ACL. No. 486 / 65

CALIBRATION DATA

1. Noise Level in term of standard deviation

Element	Cd	Cr	Cu	Fe	Pb	Mn	Ni	Zn
Absorbance	-0.0004	0.0002	0.0007	0.0002	-0.0016	-0.0001	-0.0004	-0.0001
	0.0002	-0.0005	0.0010	0.0007	0.0000	-0.0003	0.0007	-0.0014
	-0.0002	0.0001	0.0008	0.0000	-0.0001	-0.0003	-0.0012	-0.0006
	0.0000	-0.0007	0.0007	0.0000	-0.0005	-0.0004	-0.0004	-0.0012
	0.0001	0.0004	0.0013	0.0014	-0.0001	-0.0001	0.0003	-0.0008
	0.0000	-0.0004	0.0003	-0.0012	-0.0005	-0.0007	-0.0004	-0.0008
	0.0000	-0.0009	0.0009	-0.0002	-0.0010	-0.0008	0.0007	-0.0003
	-0.0004	-0.0003	0.0015	0.0010	-0.0005	-0.0003	-0.0002	-0.0004
	0.0004	0.0008	0.0014	-0.0004	-0.0014	-0.0005	-0.0006	-0.0003
	-0.0006	-0.0013	0.0012	-0.0006	-0.0006	-0.0006	-0.0007	-0.0007
	0.0005	-0.0003	0.0014	-0.0004	-0.0008	-0.0003	-0.0006	-0.0011
	-0.0007	-0.0014	0.0004	-0.0001	-0.0001	0.0000	0.0000	-0.0003
	0.0008	0.0004	0.0005	-0.0006	-0.0008	0.0000	-0.0005	-0.0009
	0.0011	0.0002	0.0005	0.0017	-0.0016	-0.0008	0.0004	-0.0005
	0.0002	0.0010	0.0014	-0.0002	-0.0010	-0.0010	0.0002	-0.0001
Average Absorbance	0.0001	-0.0011	0.0011	-0.0003	-0.0011	-0.0003	-0.0008	-0.0012
	0.0000	-0.0015	0.0009	-0.0010	-0.0011	-0.0013	0.0000	-0.0004
	0.0015	-0.0012	0.0005	0.0002	-0.0017	-0.0001	0.0005	-0.0002
	0.0006	0.0014	0.0010	0.0002	-0.0003	0.0001	-0.0006	-0.0010
Standard Deviation	0.0001	0.0003	0.0003	-0.0001	-0.0004	-0.0002	-0.0001	-0.0001
	0.000	0.000	0.001	0.000	-0.001	0.000	0.000	-0.001
Standard Deviation	0.0005	0.0008	0.0004	0.0007	0.0005	0.0004	0.0005	0.0004

Continue 2 / 5

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MTC. ACL. No. 486 / 65

2. Precision

Element	Conc. (mg/l)	Absorbance										Ave. Abs.	SD	%RSD
		0.02	0.0074	0.0062	0.0065	0.0062	0.0070	0.0068	0.0070	0.0065	0.0069	0.0069	0.007	0.0004
Cd	0.30	0.0952	0.0959	0.0951	0.0957	0.0952	0.0950	0.0950	0.0952	0.0948	0.0956	0.0943	0.095	0.0005
	0.70	0.2213	0.2180	0.2203	0.2208	0.2234	0.2211	0.2196	0.2219	0.2201	0.2194	0.221	0.0015	0.67
	0.10	0.0096	0.0098	0.0097	0.0102	0.0106	0.0097	0.0098	0.0099	0.0103	0.0093	0.010	0.0004	3.83
Cr	0.30	0.0309	0.0302	0.0300	0.0316	0.0306	0.0299	0.0309	0.0297	0.0311	0.0296	0.030	0.0007	2.20
	0.70	0.0659	0.0667	0.0664	0.0648	0.0656	0.0662	0.0658	0.0638	0.0663	0.0669	0.066	0.0011	1.70
	0.05	0.0080	0.0075	0.0078	0.0075	0.0077	0.0081	0.0080	0.0075	0.0074	0.0076	0.008	0.0003	3.26
Cu	0.30	0.0417	0.0419	0.0412	0.0421	0.0424	0.0420	0.0423	0.0403	0.0418	0.0415	0.042	0.0006	1.47
	0.70	0.0969	0.0965	0.0972	0.0957	0.0961	0.0958	0.0961	0.0963	0.0959	0.0972	0.096	0.0006	0.58
	0.10	0.0090	0.0105	0.0078	0.0099	0.0091	0.0093	0.0096	0.0094	0.0093	0.0084	0.009	0.0007	8.11
Fe	0.50	0.0462	0.0470	0.0464	0.0464	0.0467	0.0462	0.0467	0.0460	0.0468	0.0466	0.047	0.0003	0.67
	1.00	0.0867	0.0886	0.0910	0.0892	0.0897	0.0873	0.0892	0.0885	0.0888	0.0874	0.089	0.0013	1.43
	0.20	0.0091	0.0095	0.0088	0.0087	0.0082	0.0082	0.0094	0.0090	0.0087	0.0082	0.0090	0.0004	4.94
Pb	0.70	0.0322	0.0321	0.0324	0.0318	0.0335	0.0326	0.0327	0.0315	0.0336	0.0321	0.032	0.0007	2.09
	1.50	0.0653	0.0645	0.0663	0.0664	0.0652	0.0671	0.0662	0.0666	0.0657	0.0648	0.066	0.0008	1.28
	0.05	0.0092	0.0092	0.0097	0.0087	0.0085	0.0079	0.0096	0.0085	0.0084	0.0099	0.009	0.0007	7.33
Mn	0.30	0.0616	0.0630	0.0632	0.0633	0.0634	0.0628	0.0640	0.0633	0.0640	0.0629	0.063	0.0007	1.08
	0.70	0.1396	0.1366	0.1386	0.1377	0.1386	0.1386	0.1396	0.1380	0.1374	0.1383	0.138	0.0009	0.67
	0.10	0.0102	0.0092	0.0097	0.0104	0.0091	0.0105	0.0105	0.0096	0.0098	0.0102	0.010	0.0005	5.22
Ni	0.50	0.0488	0.0489	0.0489	0.0495	0.0484	0.0490	0.0481	0.0492	0.0495	0.0492	0.049	0.0004	0.91
	1.00	0.0976	0.0979	0.0975	0.0992	0.0977	0.0973	0.0986	0.0962	0.0985	0.0982	0.098	0.0008	0.85
	0.05	0.0340	0.0349	0.0340	0.0352	0.0337	0.0351	0.0344	0.0346	0.0349	0.0343	0.035	0.0005	1.49
Zn	0.30	0.1669	0.1653	0.1628	0.1642	0.1657	0.1637	0.1659	0.1652	0.1654	0.1657	0.165	0.0012	0.72
	0.70	0.3456	0.3467	0.3445	0.3430	0.3422	0.3444	0.3437	0.3438	0.3435	0.3438	0.344	0.0013	0.37

Continue 3 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

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FMJBL-MTC.002 Rev.4

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TISTR

Request No. 25-65 / 0398

3 / 5

MTC. ACL. No. 486 / 65

### 3. Trueness

#### 3.1 Reading on wavelength- Cadmium(Cd) at 228.8 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cd	0.02004	0.019	-0.001	5.19	± 0.004
	0.30060	0.291	-0.010	3.19	± 0.006
	0.70140	0.678	-0.023	3.34	± 0.012

#### 3.2 Reading on wavelength- Chromium (Cr) at 357.9 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cr	0.1002	0.101	0.001	0.80	± 0.007
	0.3006	0.298	-0.003	0.86	± 0.012
	0.7014	0.635	-0.066	9.47	± 0.023

#### 3.3 Reading on wavelength- Copper (Cu) at 324.7 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cu	0.0502	0.046	-0.004	8.37	± 0.004
	0.3012	0.295	-0.006	2.06	± 0.010
	0.7028	0.694	-0.009	1.25	± 0.021

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TISTR

Request No. 25-65 / 0398

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MTC. ACL. No. 486 / 65

### 3.4 Reading on wavelength- Iron (Fe) at 248.3 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Fe	0.1003	0.106	0.006	5.68	± 0.008
	0.5015	0.522	0.021	4.09	± 0.017
	1.0030	0.993	-0.010	1.00	± 0.032

### 3.5 Reading on wavelength- Lead (Pb) at 217.0 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Pb	0.1988	0.197	-0.002	0.91	± 0.014
	0.6958	0.722	0.026	3.77	± 0.022
	1.4910	1.463	-0.028	1.88	± 0.041

### 3.6 Reading on wavelength- Manganese (Mn) at 279.5 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Mn	0.04955	0.054	0.004	8.98	± 0.004
	0.29730	0.317	0.0197	6.63	± 0.006
	0.69370	0.682	-0.0117	1.69	± 0.012

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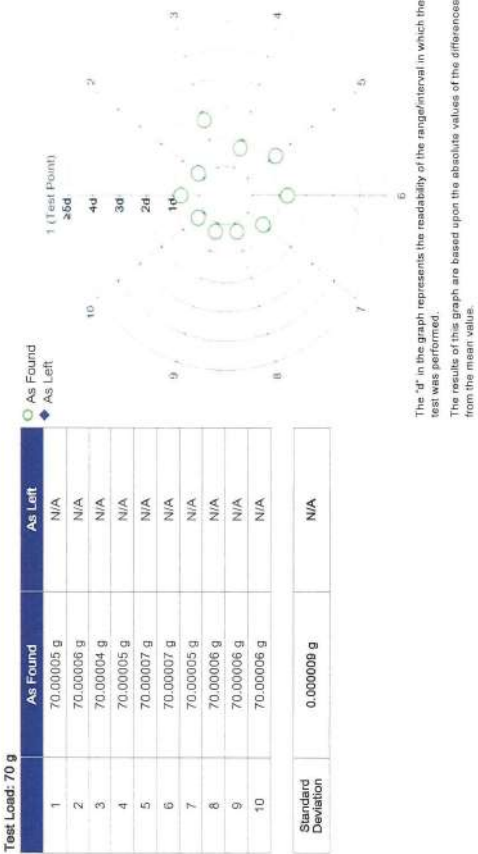
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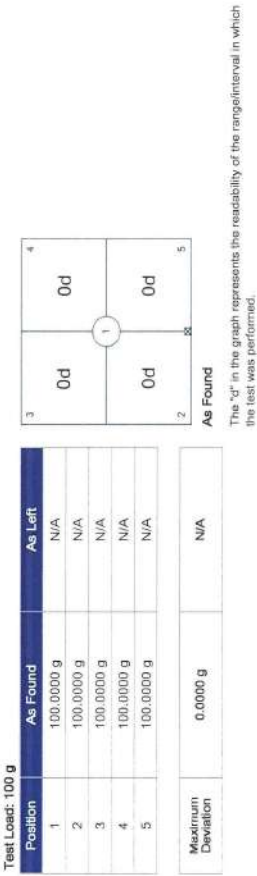


Measurement Results

Repeatability



Eccentricity

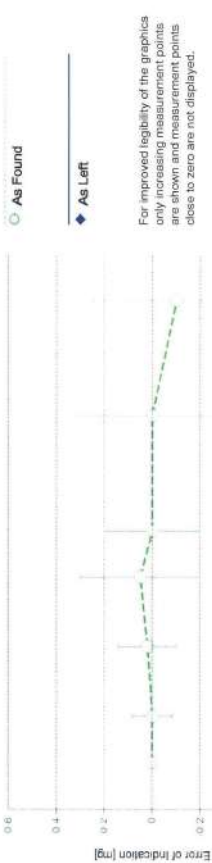


Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.00000 g	0.00500 g	0.00500 g	0.020 mg	2
2	0.05000 g	0.05001 g	0.00001 g	0.023 mg	2
3	0.10001 g	0.10001 g	0.00000 g	0.025 mg	2
4	1.00000 g	1.00001 g	0.00001 g	0.034 mg	2
5	5.00001 g	5.00001 g	0.00000 g	0.049 mg	2
6	20.00002 g	20.00002 g	0.00000 g	0.062 mg	2
7*	50.00000 g	50.00002 g	0.00002 g	0.12 mg	2
8	80.00004 g	80.00009 g	0.00005 g	0.25 mg	2
9	100.00000 g	100.00000 g	0.00000 g	0.20 mg	2
10*	150.00000 g	150.00000 g	0.00000 g	0.31 mg	2
11	200.00000 g	199.99999 g	-0.00001 g	0.35 mg	2

\*The calculated uncertainty was replaced by the CMC (Calibration and Measurement Capabilities) value because the calculated uncertainty was smaller than the CMC value.



The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2

Weight Set No.:	W554	Date of Issue:	17-Nov-2020
Certificate Number:	170240	Calibration Due Date:	15-May-2022

Thermo Hygrometer

Equipment No.:	IN161	Date of Issue:	14-Jun-2021
Certificate Number:	21H1220	Calibration Due Date:	01-Jun-2022



Remarks

- FACT adjustment functionality activated
- Equipment condition: Good
- Calibration after installation
- Next calibration according to customer's procedure
- Calibration data not decide by calibration laboratory

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with  $k=2$  in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value  $R$  represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use:  $1.5 \cdot 10^{-6} / K$

Temperature range on site for the evaluation of the measurement uncertainty in use:  $3 K$

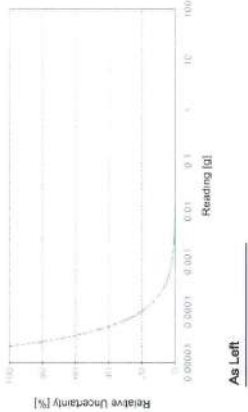
Linearization of Uncertainty Equation

Range		As Found		As Left	
	d	Max			
1	0.00001 g	81 g	$U_1 = 0.021 \text{ mg} + 0.00450 \text{ mg/g} \cdot R$		N/A
2	0.0001 g	220 g	$U_2 = 0.06 \text{ mg} + 0.00448 \text{ mg/g} \cdot R$		N/A

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication		As Found		As Left	
0.00220 g		0.021 mg	0.95%	N/A	N/A
0.02200 g		0.021 mg	0.096%	N/A	N/A
0.22000 g		0.022 mg	0.0100%	N/A	N/A
2.20000 g		0.031 mg	0.0014%	N/A	N/A
220.0000 g		1.0 mg	0.00048%	N/A	N/A



The weighing range shown in the absolute uncertainty graph refers to the first interval/range of the device.



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-27 FAX. 0-2719-9484



NIST  
NIST-TB17017026  
CALIBRATION 0008

Cert. No.: 22TM304  
Page.: 1 of 3

## Certificate of Calibration

Equipment : Hot Air Oven

Manufacturer : Memmert

Model : UF 55

Serial No. : B212.0411

ID No. : UAE.WAO.005/2556

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

Location : Lab Floor 2

Received Order : 7 April 2022

Calibration Date : 7 April 2022

Ambient Temperature : ( 26 ± 10 ) °C

Relative Humidity : ( 50 ± 30 ) %

Calibrated by : Man Pattansongpalboon

Approved by :

( ) Pornthippa Tameyakul  
( ) Malee Butkruea  
( ) Suwit Imjai

Issue Date :

18 April 2022

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.

เอกสารไม่ควบคุม

A 0040245



Equipment : Hot Air Oven

Condition As-Received : Used Item

Reference : 2204-0015OC-1

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument Model Serial No. Cert. No. Due Date  
1 ) Data Acquisition 34970A MY41021843 22LM4 10 Jan 2023

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

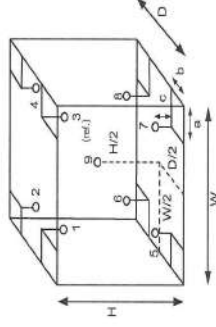
3. This certification is traceable to the International System of Unit.

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	28	28
REL Humid. ( % )	56	55
AC Supply ( Volt )	221	224



Probe Installation Details :

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

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

Cert. No.: 22TM304  
Page.: 2 of 3

เอกสารไม่ควบคุม

a 1104316



**Equipment :** Hot Air Oven  
**Condition As-Received :** Used Item  
**Reference :** 2204-00150C-1  
**Result of Calibration :-** ( \* ) Without Adjustment  
**Function of UUC\* :** Temperature Source  
**Fresh air setting :** Close

**Cert. No.:** 22TM304  
**Page.:** 3 of 3

Calibration Point ( °C )	Measured Temperature ( °C )									Overall Variation ( °C )	Uncertainty ( ± °C )	Coverage Factor <i>k</i>
	1	2	3	4	5	6	7	8	9 (ref.)			
104.0	104.403	104.220	104.517	104.474	103.778	103.859	104.292	104.357	104.319			
120.0	120.183	119.878	120.238	120.355	119.476	119.455	120.046	120.173	120.199			
180.0	180.502	179.929	180.655	180.797	179.012	179.044	180.043	180.305	180.340			

**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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MSC-TS-101/1026  
CALIBRATION 0008

**Cert. No.:** 22TM90  
**Page.:** 1 of 3

## Certificate of Calibration

**Equipment :** BOD Incubator  
**Manufacturer :** Arco  
**Model :** UC4-1320  
**Serial No. :** 13URC4S013201  
**ID No. :** UAE.WAO.015/2561

**Submitted by :** United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
**Location :** Lab Floor 2

**Received Order :** 17 February 2022  
**Calibration Date :** 17 February 2022  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %

**Calibrated by :** Kunchit Promprat

**Approved by :**

( / ) Pornthippa Tameyakul  
( / ) Malee Butkruea  
( ) Suwit Imjai

**Issue Date :** 22 February 2022

The Uncertainties are for a confidence probability of approximately 95 %

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**a 1104315**

**เอกสารไม่ควบคุม**  
**A 0038099**





Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2202-0446OC-1  
Procedure Used :-

Cert. No.: 22TM90  
Page.: 2 of 3

Calibration were conducted using calibration procedure CP-OT02 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	Model	Serial No.	Cert. No.	Due Date
1 ) Data Acquisition	34970A	MY44035217	21LM30	23 Dec 2022

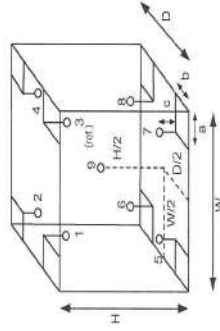
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

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

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

**Fresh air setting :** Not Available



**Probe Installation Details :**

a =	10	cm	D =	0.62	m
b =	10	cm	W =	1.2	m
c =	10	cm	H =	1.2	m
Capacity =				0.89	m <sup>3</sup>

**Dimension of Chamber :**

Position :	Ref. Std. ID No.:
1	18-10RTD-01
2	18-10RTD-02
3	18-10RTD-03
4	18-10RTD-04
5	18-10RTD-05
6	22-10RTD-10
7	18-10RTD-07
8	18-10RTD-08
9 (ref.)	18-10RTD-09

Environment during calibration		
Temp. ( °C )	Beginning	Finished
REL.Humid. ( % )	28	28
AC Supply ( Volt )	68	75
	226	226



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2202-0446OC-1  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Not Available

Cert. No.: 22TM90  
Page.: 3 of 3

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Uncertainty ( ± °C )	Coverage Factor <i>k</i>
20.0	19.5	19.4	0.30	0.58	1.0	0.55	2

Measured Temperature ( °C )									
Position									
Calibration Point ( °C )	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.154	20.013	20.356	19.939	19.834	19.761	19.817	19.824	19.922

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

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

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

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

**UUC\* :** Unit Under Calibration

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

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

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a 1096042

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a 1096041



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MSC 068-1517923  
CALIBRATION UNIT

Cert. No.: 22TM306  
Page.: 1 of 3

## Certificate of Calibration

Equipment : BOD Incubator

Manufacturer : ARCO

Model : UR-1320

Serial No. : -

ID No. : UAE.WAO.006/2553

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

Location : Lab Floor 2

Received Order : 7 April 2022

Calibration Date : 7 April 2022

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

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

Calibrated by : Man Pattanapongpalboon

Approved by :

( ) Pornthippa Tameyakul  
( ) Malee Burkruea  
( ) Suwit Imjai

Issue Date : 18 April 2022

The Uncertainties are for a confidence probability of approximately 95 %

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

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

เอกสารไม่ควบคุม

A 0040247



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2204-0015OC-3  
Procedure Used :-

Cert. No.: 22TM306  
Page.: 2 of 3

Calibration were conducted using calibration procedure CP-OT02 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 Model Serial No. Cert. No. Due Date  
1 ) Data Acquisition 34970A MY41021843 22LM4 10 Jan 2023

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

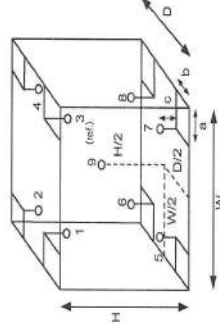
3. This certification is traceable to the International System of Unit.

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	27	27
REL.Humid. ( % )	59	57
AC Supply ( Volt )	221	220



### Probe Installation Details :

a = 10 cm      D = 0.62 m  
b = 10 cm      W = 1.2 m  
c = 10 cm      H = 1.2 m  
Capacity = 0.89 m<sup>3</sup>

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

เอกสารไม่ควบคุม

A 1104312



**Equipment :** BOD Incubator  
**Condition As-Received :** Used Item  
**Reference :** 2204-0015OC-3  
**Result of Calibration :-** ( \* ) Without Adjustment  
**Function of UUC\* :** Temperature Source  
**Fresh air setting :** Not Available

**Cert. No.:** 22TM306  
**Page.:** 3 of 3

Calibration Point ( °C )	Measured Temperature ( °C )								Coverage Factor <i>k</i>
	1	2	3	4	5	6	7	8	
20.0	20.176	20.413	19.711	19.637	20.218	20.286	19.639	19.642	19.922

**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

๑ 1104311



**Hanna Instruments (Thailand) Ltd.**  
410/67-68 Soi Ratchadapisek 24, Ratchadapisek Rd., Samsen-nok,  
Huaykwang, Bangkok 10310 Tel: 0-2541-4199 Fax: 0-2541-4198

Certificate No. : HIT-2209-0184

Page : 1 of 3

## CERTIFICATE OF CALIBRATION

**Equipment :** COD Test Tube Heater  
**Meter Model :** HI839800-02  
**Manufacturer :** Hanna Instruments  
**Made in :** Romania  
**Condition As-Received :** Used Product  
**Reference :** RE220234  
**Customer name :** United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Rd., Bangchak,  
Phrakhanong, Bangkok 10260  
**Received date :** 21 February 2022  
**Calibrate date :** 1 March 2022  
**Issue date :** 2 March 2022  
**Ambient Temperature :** ( 25 ± 2 ) °C  
**Relative Humidity :** ( 50 ± 15 ) % RH  
**Calibrated Location :** Hanna Instruments (Thailand) Ltd.

Calibrated by :

Approved by :

Calibration Engineer

Authorized Signatory



This certificate was certified only for the instrument we calibrated.

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

\*\* This certificate may not be reproduced other than in full, except with the prior written \*\*  
approval of the head of Hanna Instrument (Thailand)

เอกสารไม่ควบคุม



#### Condition of this result of calibration

##### Reference Standard Instruments :

Instruments	Model	Serial No.	Certificate No.	Traceable
Thermometer With Sensor	HI935005	03250060101	21T167	Technology Promotion Association ( Thailand-Japan )

##### Reference / Procedure :

This equipment was calibration by comparison to the reference standard (Standard platinum resistance thermometer) whose accuracy is traceable to the national standard. The calibration was performed by generating the specified working point of temperature then recorded the temperature reading values against the reference standard according to Hanna Calibration Laboratory work Instruction No. 141.

This temperature scale used was based on ITS-90

All data shown below were as-received values without adjustment.

##### SITE CALIBRATION

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25

เอกสารไม่ควบคุม

#### Result of Calibration :

Calibration Point	Unit Under Calibration Setting	Unit Under Calibration Reading	Temperature Stability	Uncertainty of Measurement
150.0 (°C)	- (°C)	150.6 (°C)	1.3 (°C)	± 0.39 (°C)

Calibration Point (°C)	Average Standard Reading (°C)				
	Position				
150.0	1	2	3	4	5
	150.2	150.4	150.4	150.3	150.2
	6	7	8	9	10
	150.4	150.9	151.1	151.1	150.6
	11	12	13	14	15
	150.4	151.0	151.5	151.3	150.5
	16	17	18	19	20
	150.3	150.8	151.2	151.2	150.5
	21	22	23	24	25
	150.2	150.3	150.5	150.4	150.3

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

\*\* End of certificate \*\*

เอกสารไม่ควบคุม

## Verification Certificate

**Certificate No.:** 2203368-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 4

**Equipment:** Digestor Unit  
**Manufacturer:** VELP SCIENTIFICA  
**Model:** DKL20  
**Serial No.:** 213517  
**ID No.:** UAE.WAS.005/2555  
**Order No.:** 2203368  
**Operation No.:** 2203368-001  
**Date of Receipt:** 22 June 2022  
**Date of Calibration:** 23-24 June 2022

**Calibrated by** Mr.Nuttapol Niyomchat **Approved by**   
**Specialist** **Manager, Division of Calibration Laboratory**  
**Date of Issue:** 30 June 2022 **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

## Verification Report

**Certificate No.:** 2203368-001-01  
**Equipment:** Digestor Unit  
**Model:** DKL20 **Serial No.:** 213517  
**Resolution:** 1 °C **ID No.:** UAE.WAS.005/2555  
**Manufacturer:** VELP SCIENTIFICA  
**Date of Calibration:** 23-24 June 2022

Page 2 of 4

**Location:** Laboratory Room, NATIONAL FOOD INSTITUTE  
**Environment Condition:** Ambient Temperature ( 25 ± 1 ) °C  
Relative Humidity ( 58 ± 8 ) %  
Line Voltage ( 224 ± 2 ) Volt

### Condition of this results of Calibration:

- This instrument was calibrated by insert standard thermocouples type S/R into its chamber and Calibration according to NFI Method W-TE-026 based on BS 4309 : 1968 : LABORATORY ELECTRIC RESISTANCE FURNACE.
  - 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.	Certificate No.	Due Date	Through
Digital Thermometer with Thermocouple	34970A Type R	MY4045576/MY41194453 R/CH1 to R/CH3	TC22/0044	5-May-2023	N.F.I. Technical Center Laboratory

- This certificate is traceable to International System of Units (SI Units).
- This certificate is 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 6 Minute At 380 °C

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

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

## Verification Report

**Certificate No.:** 2203368-001-01  
**Equipment:** Digestor Unit  
 Model: DKL20      Serial No.: 213517  
 Resolution: 1 °C      ID No.: UAE.WAS.005/2555  
 Manufacturer: VELP SCIENTIFICA

Page 3 of 4

Table1 : Reporting of Temperature

Block No.	UUC* Setting (°C)	UUC* Reading (°C)	Stability (±°C)	Standard Thermometer (°C)	Uncertainty (±°C)
1	380	378 - 380	0.23	381.88	2.4
2	380	378 - 380	0.64	382.15	2.4
3	380	378 - 380	0.21	382.38	2.4
4	380	378 - 380	0.40	380.44	2.4
5	380	378 - 380	0.34	378.52	2.4
6	380	378 - 380	0.25	379.64	2.4
7	380	378 - 380	0.31	382.46	2.4
8	380	378 - 380	0.29	381.13	2.4
9	380	378 - 380	0.36	382.25	2.4
10	380	378 - 380	0.17	382.23	2.4
11	380	378 - 380	0.24	382.47	2.4
12	380	378 - 380	0.39	381.63	2.4
13	380	378 - 380	0.63	382.02	2.5
14	380	378 - 380	0.46	382.39	2.5
15	380	378 - 380	0.38	381.69	2.5
16	380	378 - 380	0.38	377.97	2.4
17	380	378 - 380	0.50	379.87	2.4
18	380	378 - 380	0.33	380.73	2.4
19	380	378 - 380	0.56	378.47	2.4
20	380	378 - 380	0.41	378.77	2.4

**Note:**

- UUC\* = Unit Under Calibration
- Immersion depth of standard thermometer in tube level high of sand is equal heater plate of UUC.
- Stability = One-half of the greatest maximum difference of measured temperatures at one sensors, for at least half an hour after reaching steady state.

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

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

**เอกสารไมเคิล**

2008 ๒๕๔9 กรุงเทพฯ 36 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10700, Thailand  
2008 Soi 36, Aun Amarin Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand  
Tel +66(0) 2422 8660 Fax +66(0) 2422 8545

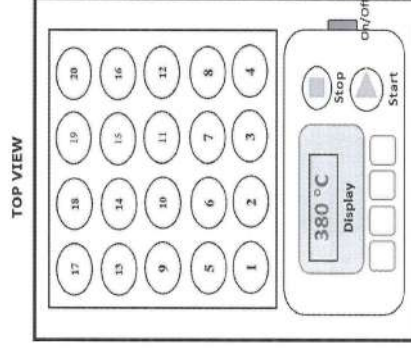
nfi.orth

## Verification Report

**Certificate No.:** 2203368-001-01  
**Equipment:** Digestor Unit  
 Model: DKL20  
 Resolution: 1 °C  
 Serial No.: 213517  
 ID No.: UAE.WAS.005/2555  
 Manufacturer: VELP SCIENTIFICA  
 Date of Calibration: 23-24 June 2022

Page 4 of 4

Figure 1. Location of Reference Standard and Block Diagram of Digestion Unit



Sensor Installation Location

**Note:**

- UUC\* = Unit Under Calibration
- Immersion depth of standard thermometer in tube level high of sand is equal heater plate of UUC.
- Stability = One-half of the greatest maximum difference of measured temperatures at one sensors, for at least half an hour after reaching steady state.

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

**เอกสารไม่ควบคุม**

2008 ๒๕๔๘๖๓๐๑ 36 ถนนสุขุมวิท เขตคลองเตย กรุงเทพมหานคร 10700, Thailand  
2008 Soi 36, Asoke Road, Bang Yi Khan Subdistrict, Bang Phut District, Bangkok 10700, Thailand  
Tel +66(0) 2422 9688 Fax +66(0) 2422 8545

031.orth





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18 SUANLIANG, SUANLIANG BANGKOK 10250  
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 22TM672  
Page.: 1 of 3

## Certificate of Calibration

**Equipment :** Incubator  
**Manufacturer :** Memmert  
**Model :** IPP 260  
**Serial No. :** V616.0066  
**ID No. :** UAE.MIC.032/2559  
**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 :** 3 May 2022  
**Calibration Date :** 5 May 2022  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %

**Calibrated by :** Preecha Hlahib

**Approved by :**

( ) Ponthippa Tameyakul  
(✓) Malee Butkruea  
( ) Suwit Imjai

**Issue Date :** 11 May 2022

The Uncertainties are for a confidence probability of approximately 95 %

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

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

เอกสารไม่ควบคุม



**Equipment :** Incubator  
**Condition As-Received :** Used Item  
**Reference :** 2205-0003OC-3  
**Procedure Used :-**

Calibration were conducted using calibration procedure CP-QT02 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

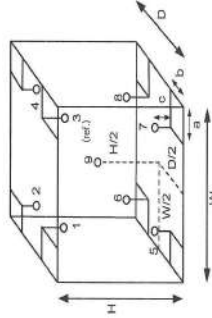
1. Reference standard instrument:-

**Instrument** **Model** **Serial No.** **Cert. No.** **Due Date**  
1 ) Data Acquisition 34970A MY44067817 21LM10 20 Jul 2022  
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

**Function of UUC\* :** Temperature Source  
**Fresh air setting :** Not Available

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	25	23
REL.Humid. ( % )	62	57
AC Supply ( Volt )	221	221



**Probe Installation Details :**  
a = 5.0 cm  
b = 5.0 cm  
c = 5.0 cm  
**Dimension of Chamber :**  
D = 0.50 m  
W = 0.60 m  
H = 0.80 m  
Capacity = 0.24 m<sup>3</sup>

Position :	Ref. Std. ID No.:
1	19-15RTD-01
2	19-15RTD-02
3	19-15RTD-03
4	19-15RTD-04
5	19-15RTD-05
6	21-15RTD-06
7	19-15RTD-07
8	19-15RTD-08
9 (ref.)	19-15RTD-09

เอกสารไม่ควบคุม



**Equipment :** Incubator  
**Condition As-Received :** Used Item  
**Reference :** 2205-0003OC-3  
**Result of Calibration :-** ( \* ) Without Adjustment  
**Function of UUC\* :** Temperature Source  
**Fresh air setting :** Not Available

**Cert. No.:** 22TM672  
**Page.:** 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
25.0	25.0	25.0	0.021	0.18	0.33	0.30	2
36.0	36.0	36.0	0.077	0.96	1.8	0.33	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
25.0	25.221	25.146	25.127	25.113	24.968	24.986	24.933	25.017	25.047
36.0	35.637	35.238	36.130	36.515	36.928	36.845	36.630	36.761	36.113

**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



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-27 FAX. 0-2719-9484



ASCT-18-7519228  
CALIBRATION 0000

**Cert. No.:** 21TM1355/1  
**Page.:** 1 of 3

## Certificate of Calibration

This Certificate was issued to replace to the Certificate No. 21TM1355

**Equipment :** Water Bath

**Manufacturer :** Memmert

**Model :** WB 14

**Serial No. :** 1401.0569

**ID No. :** UAE.MIC.004/2544

**Submitted by :**

United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Microbiology Laboratory

**Location :**

**Received Order :** 14 July 2021  
**Calibration Date :** 14 July 2021  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %

**Calibrated by :** Preecha Hiahib

**Approved by :**

( ) Ponthippa Tameyakul  
( ✓ ) Malee Butkruea  
( ) Suwit Injai

**Issue Date :** 30 July 2021

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;

เอกสารไม่ควบคุม

A 0030834



**Equipment :** Water Bath  
**Condition As-Received :** Used Item  
**Reference :** 2107-0318OC-5  
**Cert. No.:** 21TM1355/1  
**Page.:** 2 of 3

**Procedure Used :-**

Calibration were conducted using in-house calibration procedure CP-OT04 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** 1 ) Data Acquisition  
**Model** 34972A  
**Serial No.** MY57013823  
**Cert. No.** 21LM3  
**Due Date** 26 Feb 2022

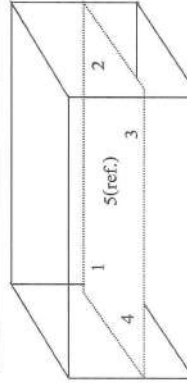
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

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

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

	Environmental		AC Voltage Supply
	( °C )	( %R.H. )	( Volt )
Beginning of Calibration	25	54	220
Finished of Calibration	25	57	222



Front

Position :	Ref. Std. S/N.:
1	4804539-006
2	4804539-007
3	4804539-008
4	4804539-009
5(ref.)	4804539-010

เอกสารไม่ควบคุม

๑ 1065656



**Equipment :** Water Bath  
**Condition As-Received :** Used Item  
**Reference :** 2107-0318OC-5  
**Result of Calibration :-** ( \* ) Without Adjustment  
**Function of UUC\* :** Temperature Source

Calibration point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Average* Standard Reading ( °C )				
			1	2	3	4	5 (ref.)
41.5	41.2	41.2	41.418	41.379	41.374	41.447	41.420

Calibration point ( °C )	Uniformity ( °C )	Stability ( ± °C )	Uncertainty ( ± °C )	Coverage Factor <i>k</i>
41.5	0.084	0.043	0.15	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

๑ 1065655





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 16, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 22TM333  
Page.: 1 of 3

## Certificate of Calibration

Equipment : Water Bath

Manufacturer : Memmert

Model : WNE 14

Serial No. : L416.0606

ID No. : UAE.MIC.002/2560

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

Location : Microbiology Laboratory

Received Order : 17 February 2022

Calibration Date : 17 February 2022

Ambient Temperature : ( 26 ± 10 ) °C

Relative Humidity : ( 50 ± 30 ) %

Calibrated by : Suwit Imjai

Approved by :

( / ) Pornthippa Tameyakul  
( / ) Malee Butkruea

Issue Date :

22 February 2022

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.

เอกสารไม่ควบคุม



Equipment : Water Bath

Condition As-Received : Used Item

Reference : 2202-04440C-3

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT04 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 : 1 ) Data Acquisition  
Model : 34970A  
Serial No. : MY44067817  
Cert. No. : 21LM10  
Due Date : 20 Jul 2022

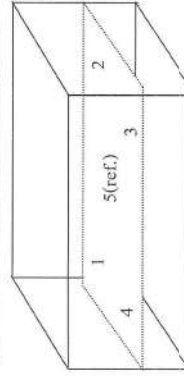
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

	Environmental		AC Voltage Supply
	( °C )	( %R.H. )	( Volt )
Beginning of Calibration	21	65	229
Finished of Calibration	22	58	230



Front

Position :	Ref. Std. ID No.:
1	70RC143
2	70RC144
3	70RC145
4	70RC146
5(ref.)	70RC147

Cert. No.: 22TM333  
Page.: 2 of 3

เอกสารควบคุม



**Equipment :** Water Bath  
**Condition As-Received :** Used Item  
**Reference :** 2202-0444OC-3  
**Result of Calibration :-** ( \* ) Without Adjustment  
**Function of UUC\* :** Temperature Source

**Cert. No.:** 22TM333  
**Page.:** 3 of 3

Calibration point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Average* Standard Reading ( °C )				
			1	2	3	4	5 (ref.)
44.5	44.5	44.5	44.498	44.481	44.482	44.518	44.534

Calibration point ( °C )	Uniformity ( °C )	Stability ( ± °C )	Uncertainty ( ± °C )	Coverage Factor <i>k</i>
44.5	0.13	0.057	0.15	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

Calibration Certificate ID  
TH2058-096-040722-ACC-TH

METTLER TOLEDO

Mettler-Toledo (Thailand) Ltd.  
846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District  
Bangna District, Bangkok 10260  
+66 2723 0382  
MT-TH.ServiceSupport@mtl.com



## Accuracy Calibration Certificate

### Customer

**Company:** United Analyst and Engineering Consultant Co., Ltd.  
**Address:** 3 Soi Udom Suk 41, Sukhumvit Rd., Bang Chak  
**City:** Phra Khanong  
**Zip / Postal:** 10260  
**State / Province:** Bangkok  
**Order Number:**  
**Contact:** Suwit Chotnok



### Weighing Device

**Manufacturer:** Mettler Toledo  
**Model:** MS03S/01  
**Serial No.:** B007010311  
**Building:** N/A  
**Floor:** 2  
**Room:** Balance Room (206)  
**Instrument Type:** Weighing Instrument  
**Asset Number:** UAE.MC.008/2553  
**Terminal Model:** N/A  
**Terminal Serial No.:** N/A  
**Terminal Asset No.:** N/A

Range	Max. Capacity	Readability (g)
1	620 g	0.001 g

### Procedure

#### Calibration Guideline:

#### METTLER TOLEDO Work Instruction:

EURAMET cg-18 v. 4.0 (11/2015)  
CPW002/20  
This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.  
The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.

In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

As Found	Temperature		Humidity	
	Start: 22.8 °C	End: 23.0 °C	Start: 49.9 %	End: 56.3 %

**As Found Calibration Date:** 07-Apr-2022

**As Left Calibration Date:** N/A

**Issue Date:** 08-Apr-2022

**Calibrator:**

**Approved Signatory:**

☒ Kasakorn Tassanachaisakul  
☐ Santi Jitniyom  
☐ Surachet Sukkate

Software Version: 1.23.0.208  
Report Version: 2.16.13  
Form Number: F-103C

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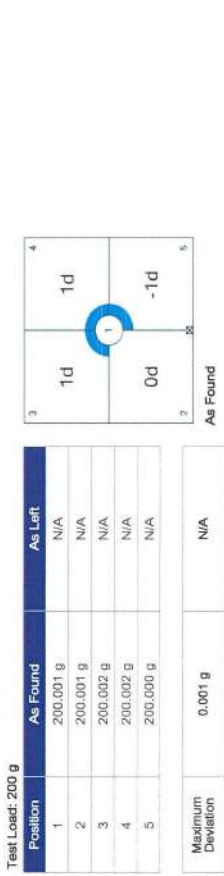
Measurement Results

Repeatability



The "d" in the graph represents the readability of the range/interval in which the test was performed.  
The results of this graph are based upon the absolute values of the differences from the mean value.

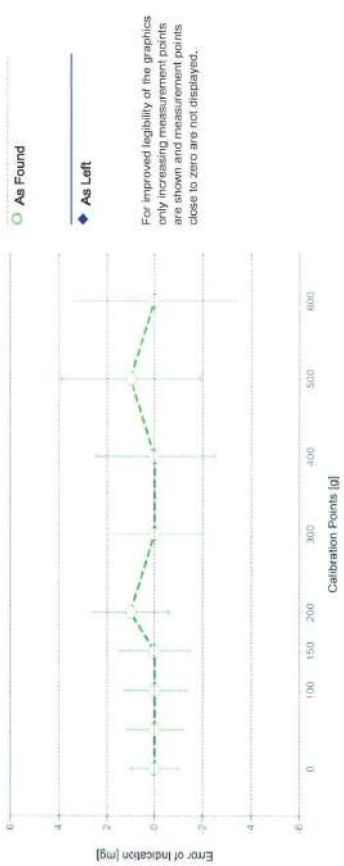
Eccentricity



The "d" in the graph represents the readability of the range/interval in which the test was performed.

Error of Indication

As Found	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.000 g	0.000 g	0.000 g	1.0 mg	2
2	0.500 g	0.500 g	0.000 g	1.2 mg	2
3	1.000 g	1.000 g	0.000 g	1.2 mg	2
4	50.000 g	50.000 g	0.000 g	1.2 mg	2
5	100.000 g	100.000 g	0.000 g	1.3 mg	2
6	150.000 g	150.000 g	0.000 g	1.5 mg	2
7	200.000 g	200.001 g	0.001 g	1.6 mg	2
8	300.001 g	300.001 g	0.000 g	2.0 mg	2
9	400.001 g	400.001 g	0.000 g	2.5 mg	2
10	500.001 g	500.002 g	0.001 g	2.9 mg	2
11	600.001 g	600.001 g	0.000 g	3.4 mg	2



For improved legibility of the graphics only increasing measurement points are shown and measurement points close to zero are not displayed.

The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.



Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML F1

Weight Set No.: WS55  
Certificate Number: CCM-0137-21-C  
Date of Issue: 09-Jul-2021  
Calibration Due Date: 07-Jul-2022

Weight Set 2: OIML E2

Weight Set No.: WS80  
Certificate Number: C208581631  
Date of Issue: 23-Feb-2022  
Calibration Due Date: 14-Aug-2023

Thermo Hygrometer

Equipment No.: IN161  
Certificate Number: 21H1220  
Date of Issue: 14-Jun-2021  
Calibration Due Date: 01-Jun-2022

Remarks

FACT adjustment functionality activated  
Equipment condition: Good  
Next calibration according to customer's procedure  
Calibration data not decide by calibration laboratory

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with  $k=2$  in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value  $R$  represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use:  $3.0 \cdot 10^{-6} / K$

Temperature range on site for the evaluation of the measurement uncertainty in use:  $3 K$

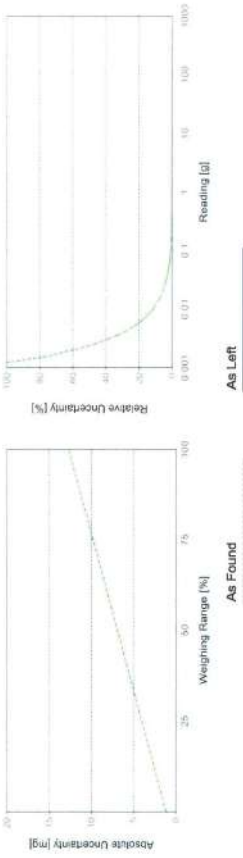
Linearization of Uncertainty Equation

Range		As Found	As Left
d	Max		
1	0.001 g	820 g	N/A

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication		As Found	As Left
0.062 g		1.2 mg	1.9%
0.620 g		1.2 mg	0.20%
6.200 g		1.3 mg	0.021%
62.000 g		2.4 mg	0.0038%
620.000 g		13 mg	0.0021%
			N/A
			N/A
			N/A
			N/A





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, 27 FAX. 0-2719-9484



Cert. No.: 22TM89  
Page.: 1 of 3

## Certificate of Calibration

**Equipment :** Autoclave  
**Manufacturer :** ALP  
**Model :** CL-40L  
**Serial No. :** 802664  
**ID No. :** UAE.MIC.014/2550

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

**Received Order :** 17 February 2022  
**Calibration Date :** 17 February 2022  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %

**Calibrated by :** Kunchit Promprat

**Approved by :**

( ) Pornthippa Tameyakul  
( ) Malee Butkruea  
( ) Suwit Imjai

**Issue Date :** 22 February 2022

The Uncertainties are for a confidence probability of approximately 95 %

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

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

เอกสารไม่ควบคุม



**Equipment :** Autoclave  
**Condition As-Received :** Used Item  
**Reference :** 2202-0444OC-1  
**Procedure Used :**

Calibration were conducted using in-house calibration procedure CP-OT03 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T  
The temperature scale used was based on ITS-90.

### Condition of this result of calibration

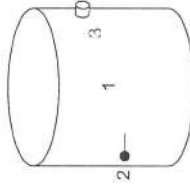
1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1 ) Data Acquisition	34970A	MY44035217	21LM30	23 Dec 2022

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.  
4. This result of calibration covers laboratory autoclaves for the sterilization of goods and material which could be infected with organisms categorized as Hazard Group 1, 2 and 3\*\*

(\*\* = Categorization of pathogens according to hazard and categories of containment, second edition, 1990 )  
It does not cover autoclaves for use with material infect with organisms in Hazard Group 4, for which complete containment and sterilization of infected condensate is considered to be essential.  
This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical or veterinary purposes which are directly concerned with patient care, or those used for fabrics subjected to sterilization which are required to be dry at the end of cycle.

**Result of Calibration :-** ( \* ) Without Adjustment  
**Function of UUC\* :** Temperature Source



Environmental	
( °C )	( %R.H. ) ( Volt )
Beginning of Calibration	27 68 226
Finished of Calibration	27 65 226

Position	Description	Ref. Std. ID No.:
1 =	Center of chamber	22-10TC-01
2 =	Temperature sensor	22-10TC-02
3 =	Exhaust port	22-10TC-03

เอกสารไม่



**Equipment :** Autoclave  
**Condition As-Received :** Used Item  
**Reference :** 2202-0444OC-1

**Cert. No.:** 22TM89  
**Page.:** 3 of 3

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

**Operating parameter Set : Temperature =** 122 °C

**Sterilization period =** 30 minute

UUC* Setting ( °C )	UUC* Reading ( °C )	Position	Average* Standard Reading ( °C )	Stability ( ± °C )	Pressure Reading ( MPa )	Uncertainty ( ± °C )	Coverage Factor <i>k</i>
122	122	1	122.373	0.32	0.12	1.2	2
		2	122.421				
		3	122.292				

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

**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

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