

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 ₁₀)	Andersen Instruments, Inc.	G25A 1901	Tisch Environmental, Inc.	05072022	5 Jul 22	4 Jul 24	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	22P968	12 Aug 22	11 Aug 23	-
3	Flow Meter	Particulate Matter Less Than	Mesa Labs	DeltaCal DC1 159822	Innovative Instrument Co., Ltd.	22-AFM-140	7 Sep 22	6 Sep 23	-
4	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particulate Matter Less Than 2.5 Microns (PM _{2.5}) VOCs	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 ₁₀) Particulate Matter Less Than 2.5 Microns (PM _{2.5}) VOCs	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	22H1586	27 Jul 22	26 Jul 23	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo	42i 1201778105	UAE Consultant Co., Ltd.	13022023	13 Feb 23	12 Feb 24	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Environmental Instrument	42i CM19050150	UAE Consultant Co., Ltd.	16012023	16 Jan 23	15 Jan 24	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo	42i CM19050149	UAE Consultant Co., Ltd.	09012023	9 Jan 23	8 Jan 24	-
9	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
10	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i CM08140003	UAE Consultant Co., Ltd.	18012023	18 Jan 23	17 Jan 24	-

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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 1180540068	UAE Consultant Co.,Ltd.	21022023	21 Feb 23	20 Feb 24	-
12	Carbon Monoxide Analyzer	Carbon Monoxide	Horiba	APMA-370 YRLHTB7G	UAE Consultant Co.,Ltd.	08022023	8 Feb 23	7 Feb 24	-
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 KWWV1R96	UAE Consultant Co.,Ltd.	15022023	15 Feb 23	14 Feb 24	-
15	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 RATFJBXS	UAE Consultant Co.,Ltd.	08022023	8 Feb 23	7 Feb 24	-
16	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 GY21PTED	UAE Consultant Co.,Ltd.	20022023	20 Feb 23	19 Feb 24	-
17	Standard Gas	Total Hydrocarbons	Linde	D824432	Linde	09042013	4 Aug 20	4 Aug 28	-
18	Wind Speed/Wind Direction	WSWD	LSI LASTEM	E-LOG305 20040002	Thai Meteorological Department	275/22	2 Aug 22	1 Aug 23	-
19	Wind Speed/Wind Direction	WSWD	LSI LASTEM	E-LOG305 20040005	Thai Meteorological Department	259/22	12 Jul 22	11 Jul 23	-
20	Wind Speed/Wind Direction	WSWD	LSI LASTEM	E-LOG305 20080022	Thai Meteorological Department	262/22	12 Jul 22	11 Jul 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 0005286	Sithiporn Associates Co., Ltd.	ACL22081	25 Jan 22	25 Jan 24	-
23	Sound Level Meter	$L_{Aeq\ 24\ hours}$, $L_{Aeq\ 1\ hour}$, L_{Amax} , L_{Adn}	Larson Davis	LxT2 0005289	Sithiporn Associates Co., Ltd.	ACL22082	25 May 22	24 May 24	-
24	Sound Level Meter	$L_{Aeq\ 24\ hours}$, $L_{Aeq\ 1\ hour}$, L_{Amax} , L_{Adn}	Larson Davis	LxT2 0005400	Innovative Instrument Co.,Ltd.	22-ACT-036	21 Jan 22	20 Jan 24	-

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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	HL2020-02 / C0051107	National Food Institute, Ministry of Industry, Thailand	2203135-001-01	8 Jun 22	7 Jun 23	-
26	pH Meter		Mettler-Toledo	Seven Easy S20 / 1230525212	National Food Institute, Ministry of Industry, Thailand	2302181-001-01	24 Mar 23	22 Mar 24	-
27	Conductivity Meter	การนำไฟฟ้า (Conductivity)	SI Analytics	Lab955 / 16300356	SPC Calibration Center Co.,Ltd.	C24220084	22 Mar 22	21 Mar 23	-
28	Conductivity Meter		SI Analytics	Lab955 / 16300356	DKSH Technology Limited	C24230059	16 Mar 23	14 Mar 24	-
29	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	-
30	UV-VIS Spectrophotometer	ความขุ่น (Turbidity) ไนโตรเจน-ไนโตรเจน (Nitrate-Nitrogen : NO3-N)	Agilent Technologies	Cary60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP22-016	23 May 22	22 May 23	-
31	UV-VIS Spectrophotometer	ฟอสเฟต-ฟอสฟอรัส (Phosphate-Phosphorus : P) ซัลเฟต(Sulfate :SO ₄ ²⁻), ไนเตรด(Nitrate: NO ₃ ⁻)	Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP23-007	6 Jan 23	5 Jan 24	-
32	UV-VIS Spectrophotometer	ซีโอดี (Chemical Oxygen Demand : COD)	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP23-008	6 Jan 23	5 Jan 24	-
33	Atomic Absorption Spectrometer (AAS)	เหล็ก (Iron: Fe) แมงกานีส (Manganese : Mn)	Perkin Elmer	PinAAcle 900F / PFBS20031902	Perkin Elmer Co.,Ltd.	PM Service No. WO-01710010	20 Jul 22	19 Jul 23	-
34	Atomic Absorption Spectrometer (AAS)		Agilent Technologies	System ID:G8432A AA240FS / MY13160001	Thailand Institute of Scientific and Technological Research(TISTR)	MTC.ACL.No. 387/66	2 Feb 23	1 Feb 24	-

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No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
35	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	-
36	Analytical Balance (Repeatability 0.01 mg)	ของแข็งแขวนลอย (Suspended Solids : SS)	Mettler-Toledo	XSR205DU / C210685394	Technology Promotion Association (Thailand-Japan)	23MM113	26 Apr 23	24 Apr 24	-
37	Hot Air Oven		Memmert	UF55 / B216.1666	Technology Promotion Association (Thailand-Japan)	22TM1490	19 Oct 22	18 Oct 23	-
38	BOD Incubator	ความต้องการออกซิเจนทางชีวภาพ (Biochemical Oxygen Demand : BOD)	Arco	UC4-1320 / (UAE.WAO.002/2550)	Technology Promotion Association (Thailand-Japan)	22TM1232	15 Aug 22	14 Aug 23	-
39	BOD Incubator		Arco	UC4-1320 / (UAE.WAO.015/2561)	Technology Promotion Association (Thailand-Japan)	23TM249	15 Feb 23	14 Feb 24	-
40	COD Reactor (Heating Block)	ซีไอดี (Chemical Oxygen Demand : COD)	Hanna	H839800-02 / H018500I	Hanna Instruments (Thailand) Ltd.	HIT-2209-0184	1 Mar 22	1 Mar 23	-
41	COD Reactor (Heating Block)		Hanna	H839800-02 / H018500I	Hanna Instruments (Thailand) Ltd.	HIT-2312-0342	10 Mar 23	9 Mar 24	
42	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	-
43	Incubator (Cooled Incubator)	แบคทีเรียกลุ่มโคลิฟอร์มทั้งหมด (Total Coliform Bacteria)	Memmert	IPP 260 / V616.0066	Technology Promotion Association (Thailand-Japan)	22TM672	5 May 22	4 May 23	-
44	Incubator (Cooled Incubator)	แบคทีเรียกลุ่มฟิโคไลโคลิฟอร์ม (Fecal Coliform Bacteria)	Memmert	IPP 260 / V615.0187	Technology Promotion Association (Thailand-Japan)	23TM378	12 Apr 23	10 Apr 24	-
45	Water Bath	<i>E.Coli</i>	Memmert	WB 14 / I401.0569	Technology Promotion Association (Thailand-Japan)	๒	11 Jul 22	10 Jul 23	-
46	Analytical Balance		OHAUS	PX623 / C236754745	DKSH (Thailand) Ltd.	C01223732	9 Dec 22	8 Dec 23	-
47	Auto Clave		ALP	CL-40L / 807298	Technology Promotion Association (Thailand-Japan)	22TM1121	11 Jul 22	10 Jul 23	-



RECALIBRATION
DUE DATE:
July 5, 2023

Certificate of Calibration

Calibration Certification Information			
Cal. Date:	July 3, 2022	Tic: 297	%
Operator:	Jim Tisch	Roameter S/N:	438120
Calibration Model #:	G25A	Pa: 750.1	mm Hg
		Calibrator S/N:	1901

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3540	3.3	2.00
2	3	4	1	0.9650	6.4	4.00
3	5	6	1	0.8640	8.0	5.00
4	7	8	1	0.8200	8.9	5.50
5	9	10	1	0.6780	12.9	8.00

Data Tabulation			
Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta P \cdot \left(\frac{Pa}{Pstd} \times \frac{Tstd}{Ta} \right)}$ (y-axis)	$\sqrt{\Delta H \cdot \left(\frac{Tstd}{Ta} \right)}$ (y-axis)
0.9859	0.7281	1.4073	0.8899
0.9818	1.0174	1.9902	1.2574
0.9797	1.1339	2.2251	1.451
0.9785	1.1933	2.3337	1.4757
0.9732	1.4354	2.8146	1.7798
QSTD	m= 1.98897 b= -0.03691 r= 0.99996	QA	m= 1.24546 b= -0.02334 r= 0.99996

Calculations			
Vstd= ΔVol(Pa-AP)/Pstd(Tstd/Ta)	Va= ΔVol(Pa-AP)/Pa	Vstd= ΔVol(Pa-AP)/Pstd(Tstd/Ta)	Va= ΔVol(Pa-AP)/Pa
Qstd= Vstd/ΔTime	Qa= Va/ΔTime	Qstd= Vstd/ΔTime	Qa= Va/ΔTime
Qstd= $\frac{1}{m} \cdot \left(\sqrt{\Delta P \cdot \left(\frac{Pa}{Pstd} \times \frac{Tstd}{Ta} \right)} - b \right)$	Qa= $\frac{1}{m} \cdot \left(\sqrt{\Delta H \cdot \left(\frac{Tstd}{Ta} \right)} - b \right)$	Qstd= $\frac{1}{m} \cdot \left(\sqrt{\Delta P \cdot \left(\frac{Pa}{Pstd} \times \frac{Tstd}{Ta} \right)} - b \right)$	Qa= $\frac{1}{m} \cdot \left(\sqrt{\Delta H \cdot \left(\frac{Tstd}{Ta} \right)} - b \right)$

Standard Conditions	
Tstd:	298.15 °K
Pstd:	760 mm Hg
Key	
ΔH:	calibrator manometer reading (in H2O)
ΔP:	rootsmeter 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	

Tisch Environmental, Inc.
145 South Miami Avenue
Village of Cleves, OH 45002
www.tisch-env.com
TOLL FREE: (877)263-7610
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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
3144 PATTANAKARN ROAD SOI 18, SUKHUMVIT, BANGKOK 10110
TEL: 0-2717-9000-28 FAX: 0-2717-9484

Certificate of Calibration

Certificate No.: 22P908
Page: 1 of 2

Equipment: U Tube Manometer
Manufacturer: Dwyer
Model: 1221-010-WM
Serial No.:
ID No.: UAC.EFM.170.2581

Condition As-Received: Used Item

Received Date: 02 August 2022

Calibration Date: 12 August 2022

Reference: 2201-0131WB/C

Ambient Temperature: 1.23 ± 2.1 °C

Relative Humidity: 1.50 ± 18.1 %

Atmospheric Pressure: 1013.25 mbar

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-POL using "DKD-R 6-1" Calibration of Pressure Gauge, Edition 03/2014 " as a guideline.

Condition of this result of calibration

1. Reference standards instruments

1) Pressure Calibrator

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

3) Scale and conversion factor is 1 MPa = 4.0146229 mbar

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

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

6) This instrument was installed in vertical calibration and top of the pressure part was used as the reference level.

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

8) This Calibration is traceable to the International System of Unit maintained at National Institute of Metrology (NIMT)

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

(81 Soi Ladprao 41, Sukhumvit Road, Bangkok, Thailand, Bangkok 10260)

Model: PC-1000P

Serial No.: 1188

Certificate No.: MP-0113-22

Due Date: 14 Jul 2023

Calibrated by: Sudd Asatirano
Issue Date: 14 August 2022

Approved Signatory:
1. Phatthana Pradipat
1. Suni Suvannarat
1. Atsapol Manojak

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0282416

Certificate No. : 22-APM-140
Request No. : Req-2022-007

Result of Calibration :

Flow Setting (LPM)	WTD Flow Reading (LPM)	UUC Flow Reading (LPM)	Correction Flow (LPM)	Uncertainty (LPM)
14.2	14.36	14.17	-0.07	0.31
15.0	15.06	14.90	-0.06	0.32
16.8	16.86	16.68	-0.08	0.33
18.6	18.66	18.47	-0.07	0.39
19.3	19.36	19.10	-0.10	0.36

Note
STD : Standard
UUC : Unit Under Calibration
Correction media : Air
* Indication not corrected

End of Certificate

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Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT
Name : UAC, LTD.
Address : 81 Soi Udonrak 41, Sukhumvit Road, Bangkok, Praking
Bangkok 10260

Certificate No. : 22-TPM-379
Request No. : Req-2022-007
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument type : Air Flow meter
Manufacturer : PG1
Model : Delta Cal DC1
Serial Number : 150423
Resolution : 0.1 °C
ID Number : UAE-2756.036(2361)
Range Calibration : 20 °C to 45 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 3
Calibration Position (mm) : 45
Instrument Status : Used

Calibration Environment and Details

Temperature : 25 °C ± 0.5 °C
Humidity : 55-58RH ± 1% RH
Received Date : 22 August 2022
Calibration Date : 27 September 2022

Calibration Procedure : In-house method (C-TPM-6) by Comparison with Standard Thermometer

Reference Standard

Digital Thermometer with Sensor, Manufacturer : OMEGA ENGINEERING, Model : OT11 RTD103, SN : 09000007, ID : 02-TPM Which was calibrated on 10 March 2022, Calibration Certificate No. : QRC22-0579

Traceability : This Certificate is traceable to SI Unit through Quality Reflow Co., Ltd., NIST-CNSC Accreditation No. : Calibration 0292

Note

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

Approved By :

Mr. Patch Mahasarak
Calibration Engineer Supervisor
Issue Date : 7 September 2022

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INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
51/26 MIYOJI, 501 MATSUYAMA-11, TAMURA HAYASHI KAYAKI
AMPHOE BANG HILLI BANG, THAKAN PHU PHU 9401 1040 THAILAND
TEL: 0662-2116-2066-1 FAX: 0662-2116-7148

Certificate No. : 20-1004-176
Request No. : Req-2022-1687
Page : 22

Result of Calibration :

UVC Sensor	Standard Temperature (°C)	UVC Reading (%)	Excursion (%)	Excursion (°C)
Ts	25.004	20.0	0.0	0.14
	25.003	20.0	+0.1	0.14
	25.001	20.0	0.0	0.14
	11.002	24.0	+0.1	0.14
	44.002	30.0	+0.2	0.14
Vt	41.000	47.0	0.0	0.14
	36.004	30.1	-0.1	0.14
	25.003	24.0	+0.1	0.14
	10.003	20.0	+0.1	0.14
	11.002	16.0	+0.1	0.14
Vt	44.002	30.0	+0.1	0.14
	41.003	47.2	-0.2	0.14

Result of Certificate

Calibrated by :

Ms. Nopphadol Tangsri



Certificate No. : 20-1004-176
Request No. : Req-2022-1687
Page : 22

Result of Calibration :

UVC Sensor	Standard Temperature (°C)	UVC Reading (%)	Excursion (%)	Excursion (°C)
Ts	25.004	20.0	0.0	0.14
	25.003	20.0	+0.1	0.14
	25.001	20.0	0.0	0.14
	11.002	24.0	+0.1	0.14
	44.002	30.0	+0.2	0.14
Vt	41.000	47.0	0.0	0.14
	36.004	30.1	-0.1	0.14
	25.003	24.0	+0.1	0.14
	10.003	20.0	+0.1	0.14
	11.002	16.0	+0.1	0.14
Vt	44.002	30.0	+0.1	0.14
	41.003	47.2	-0.2	0.14

Result of Certificate

Calibrated by :

Ms. Nopphadol Tangsri

The results obtained only on the basis of the data. The certificate shall not be reproduced except in full, without written approval of the Instrument Calibration Co., Ltd.
Tel: 066-2116-2066-1 Fax: 066-2116-7148 Issue date: 13/03/22

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
51/26 MIYOJI, 501 MATSUYAMA-11, TAMURA HAYASHI KAYAKI
AMPHOE BANG HILLI BANG, THAKAN PHU PHU 9401 1040 THAILAND
TEL: 0-2712-3990-24 FAX: 0-2718-9441



Certificate of Calibration

Certificate No. : 22P2722
Page : 1 of 2

Equipment : Ambient Barometer
Manufacturer : Burigo
Model :
Serial No. :
ID No. : UAC-ANV-0132547
Condition As-Received : Used Item
Received Date : 20 July 2022
Calibration Date : 22 July 2022

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

81 Soi Udomsak 41, Sukhumvit Road, Bangkok,
Prachinburi, Bangkok 10250

Reference : 2207-0244V9C
Ambient Temperature : $(23 \pm 2) ^\circ\text{C}$
Relative Humidity : $(60 \pm 10) \%$
Atmospheric Pressure : 1013.0 mbar

Procedure used : The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CR-EP10, using "DICKER 6-1 : Calibration of Pressure Gauges, Series 03/2014." as a reference.

Condition of this result of calibration

1. Reference standards instruments :

Instrument

1) Standard Barometer

Model

DP142

Serial No.

1422025048

Certificate No.

MP-0070-22

Due Date

22 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 request of the client 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 in the item calibrated on date and place of calibration.

8. This Calibration is according to the International System of Unit maintained at:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Sualit Aunamue
Issue Date : 25 July 2022

Approved Signatory :

☐ Prachin Pichanont

☐ Sualit Aunamue

☒ Abasat Panuath

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0283205



Statement of Calibration - Ambient Air Pressure Measurement

Scale Interval: 1 mmHg (100 Pa)

Scale: 1 mmHg to 760 mmHg

Increasing Pressure	
Applied Pressure (mmHg)	715.48
UUT ¹ Indication (mmHg)	720.0
Error (mmHg)	4.52

Decreasing Pressure	
Applied Pressure (mmHg)	725.90
UUT ¹ Indication (mmHg)	730.0
Error (mmHg)	4.10

The uncertainty of measurement with a 0.24 mmHg

UUT¹ is 0.24 mmHg

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 %.

400-

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TECHNOLOGY PROMOTIONS ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES, EQUIPMENT CALIBRATION AND TESTING SERVICES
5341 PATTANABANG ROAD SU 11, SIAM OCEAN, BANGKOK 10140
TEL. 02-717-3065-24 FAX 02-717-0488



Certificate of Calibration

Certificate No. : 22P1501
Page : 1 of 2

Equipment : Dual Thermo-Hygrometer

Manufacturer :

Barigo

Model :

-

Serial No. :

-

ID No. :

UAT-ANV-0042548

Condition As-Received :

Used Item

Received Date :

30 July 2022

Calibration Date :

22 July 2022

Reference :

2207-0049950

Ambient Temperature :

(29 ± 3) °C

Relative Humidity :

(50 ± 20) %

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

81 Soi Udonrak 41, Sukhumvit Road, Bangkok,
Phrahanong, Bangkok 10260

Procedure used :

Calibration was conducted using in-house calibration procedure CH-M22 according to comparison with standard certified mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber

Conditions of this result of calibration

1. Reference standards (Instruments)

Instrument

1) Standard Certified Mirror Hygrometer Sensor

Model : Dew Point 8

Serial No. : 31803

Certificate No. : 19714

Due Date : 17 Sep 2022

2) Standard Humidity/Temperature Meter

Model : 410

Serial No. : 10240737

Certificate No. : TH-0125-21

Due Date : 13 Dec 2022

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

3. This Calibration 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 (NIMT)

Calibrated by : Somchai Dornmuang

Issue Date : 03 August 2022

Approved Signatory :

1/ J Chaiwan Watanvijit

2/ J Pongthepa Tamsakul

3/ J Wiparn Tantiyewat

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0293722



Cert. No.: 22415686

Page: 2 of 2

Result of Calibration:-

Function: Humidity measurement

Reference Temperature (°C)	Standard Humidity (%RH)	UUC* Reading (%RH)	Error (%RH)	Uncertainty of Measurement (%RH)
25.0	40.1	38	-2.1	1.6
25.0	60.0	67	-3.0	1.8
25.0	80.0	74	-6.0	2.0

Result of Calibration:-

Function: Humidity measurement

Reference Temperature (°C)	Standard Humidity (%RH)	UUC* Reading (%RH)	Error (%RH)	Uncertainty of Measurement (%RH)
25.0	40.1	40	-0.1	1.6
25.0	60.0	60	0.0	1.6
25.0	80.0	77	-3.0	2.0

Result of Calibration:-

Function: Temperature measurement

Reference Temperature (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (°C)
20.00	20.00	20.5	0.50	0.72
26.04	26.04	26.0	-0.04	0.72
30.01	30.01	30.0	-0.01	0.72
35.04	35.04	34.5	-0.54	0.72
38.96	38.96	39.0	-0.96	0.72

UUC* : Unit Under Calibration

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

06/06/2023

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1119774



United Analyst and Engineering Consultant Co., Ltd.

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Tel: 0 2783 3333 Fax: 0 2783 3500 www.uac.co.th E-mail: uac@uac.co.th

MULTI-POINT GAS TEST REPORT

Test Date : Feb 13, 2023

Equipment : Gas Analyzer (NOx)
Manufacturer : Thermo Scientific
Model : 43i
Serial Number : 1201278105

Standard Gas Concentration

Gas	Concentration	Unit	Manufacturer
Sulfur Dioxide (SO ₂)	44.60	ppm	Thermo Scientific
Nitric Oxide (NO)	45.94	ppm	446i
Methane (CH ₄)	-	ppm	3182540371
Carbon Monoxide (CO)	984.8	ppm	
Cylinder No.	E80143362		
Expiration Date	Jun 21, 2024		

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error
Level 1	Zero	0.0	0.02	0.00	0.00
Level 2	20.00%	100.0	0.35	0.35	0.35
Level 3	40.00%	200.0	0.62	0.31	0.31
Level 4	60.00%	300.0	0.92	0.31	0.31
Level 5	80.00%	400.0	0.92	0.23	0.23

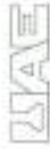
Range : Measuring Range 500.0 ppb

Accuracy Limit $\pm 5\%$

Multi-Point Gas Test Chart



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United Analyst and Engineering Consultant Co., Ltd.

3 Soi Udomsak 41, Samsorn Road, Bangkok, Phrahanong, Bangkok 10250

Tel. 0 2763 2828 Fax 0 2763 2820 www.uaeconsultant.com E-mail: uae@uaeconsultant.com

MULTI-POINT GAS TEST REPORT

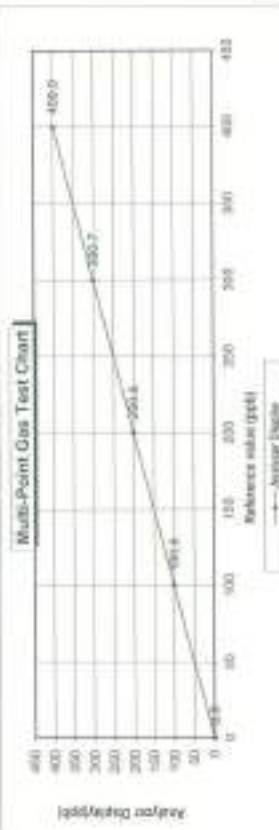
Test Date : Jan 10, 2023

Equipment : Gas Analyzer (NOx) Model : 421
Manufacturer : Thermo Scientific Serial Number : CM18050150

Standard Gas Concentration		Diluter Detail	
Sulfur Dioxide (SO ₂)	44.58	PPM	Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	149
Methane (CH ₄)	-	PPM	1180540071
Carbon Monoxide (CO)	984.8		
Cylinder No. :	ES0143362		
Expiration Date :	Jan 24, 2024		

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error
Level 1 : 0.0	0.0	0.00	0.00	0.00
Level 2 : 20.02%	100.0	0.30	0.30	0.30
Level 3 : 40.05%	200.0	0.30	0.30	0.30
Level 4 : 60.05%	300.7	0.70	0.23	0.23
Level 5 : 80.05%	400.0	0.00	0.00	0.00
Remark : Measuring Range		100.0 ppb		
Acceptable Limit ± 5%			Average Difference (%)	0.21



Signature
Date: Jan 10, 2023

เอกสารไม่ควบคุม



United Analyst and Engineering Consultant Co., Ltd.

3 Soi Udomsak 41, Samsorn Road, Bangkok, Phrahanong, Bangkok 10250

Tel. 0 2763 2828 Fax 0 2763 2820 www.uaeconsultant.com E-mail: uae@uaeconsultant.com

MULTI-POINT GAS TEST REPORT

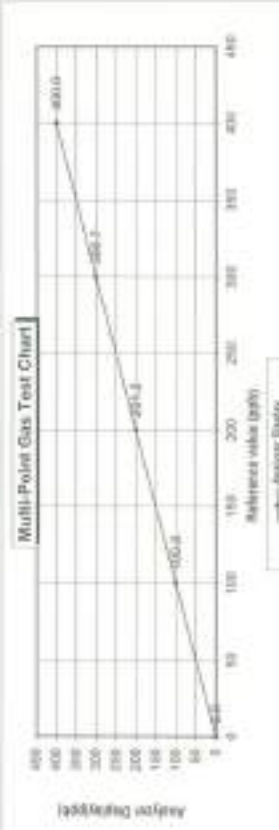
Test Date : Jan 9, 2023

Equipment : Gas Analyzer (NOx) Model : 421
Manufacturer : Thermo Scientific Serial Number : CM18050149

Standard Gas Concentration		Diluter Detail	
Sulfur Dioxide (SO ₂)	44.58	PPM	Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	149
Methane (CH ₄)	-	PPM	1180540071
Carbon Monoxide (CO)	984.8		
Cylinder No. :	ES0143362		
Expiration Date :	Jan 24, 2024		

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error
Level 1 : 0.0	0.0	0.00	0.00	0.00
Level 2 : 20.02%	100.0	0.30	0.30	0.30
Level 3 : 40.05%	201.2	1.20	0.60	0.60
Level 4 : 60.05%	300.7	0.70	0.23	0.23
Level 5 : 80.05%	400.0	0.00	0.00	0.00
Remark : Measuring Range		500.0 ppb		
Acceptable Limit ± 5%			Average Difference (%)	0.32



Signature
Date: Jan 9, 2023

เอกสารไม่ควบคุม



Airgas Specialty Gases
Airgas USA, LLC
Apex, United States
Durham, NC 27709
Airgas.com

CERTIFICATE OF ANALYSIS Grade of Product: EPA Protocol

Part Number: E04039E15A6103
Cylinder Number: EB0143252
Laboratory: 124 - Durham (BAP) - NC
PUMP Number: 822021
Gas Code: CO/NO/NOX/CO2/BALN
Reference Number: 122-402135167-1
Cylinder Volume: 144.4 CF
Cylinder Pressure: 2016 PSIG
Valve Outlet: 850
Expiration Date: Jun 21, 2021

Certification performed in accordance with ASTM D2584, Traceable to National Institute of Standards and Technology (NIST) 2012/2013 documented gas standards (95%¹), using the latest procedures. Analytical Methodology does not require correction for analytical interference. This cylinder has a total gross weight of 144.4 lbs. (65.5 kg). There are no significant impurities which affect the use of this calibration cylinder. All measurements are on a minimum basis unless otherwise noted.
Do Not Use For Safety Critical Applications (See 124-402135167-1 for details)

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Assay Date
NOX	48.00 PPM	48.00 PPM	01	99/14/2021, 99/21/2021
NITROGEN DIOXIDE	48.00 PPM	48.00 PPM	01	99/14/2021, 99/21/2021
SULFUR DIOXIDE	48.00 PPM	48.00 PPM	01	99/14/2021, 99/21/2021
CARBON MONOXIDE	1300 PPM	554.8 PPM	01	99/14/2021, 99/21/2021
NITROGEN				

CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
NITROGEN	20081120	CO2E0308	48.00 PPM NITROGEN DIOXIDE/NITROGEN	±1.00%
PMMA	12008	CO2E0308	50.00 PPM NITROGEN DIOXIDE/NITROGEN	±1.00%
PMMA	40143206106	CO2E0308	4.548 PPM NITROGEN DIOXIDE/NITROGEN	±1.00%
NITROGEN	16011540	CO2E0308	48.00 PPM SULFUR DIOXIDE/NITROGEN	±1.00%
NITROGEN	14081119	CO2E0308	880.0 PPM CARBON MONOXIDE/NITROGEN	±1.00%

The 95% PPM or more value listed in this table is the value to be used for the assay and for the calibration.

ANALYTICAL EQUIPMENT	
Instrument/Model	Last Multi-point Calibration
Model: 0705 AF-91501333 CO	Jan 03, 2021
Model: 0705 AF-91501333 NO	Jan 03, 2021
Model: 0705 AF-91501333 NO2	Jan 03, 2021
Model: 0705 AF-91501333 NO2	Jan 03, 2021

Total Data Available Upon Request
NOTES: (NO) #5221002007
GROSS WT: 20.45kg
NET WT: 4.73kg



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

Approved for Release

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United Analyst and Engineering Consultant Co., Ltd.
8 Soi Udomrak 41, Sukhumvit Road, Bangkok, Prapachong, Bangkok 10600
Tel: 0 2703 2000 Fax: 0 2703 2000 www.uacconsultant.com E-mail: uac@uacconsultant.com

MULTI-POINT GAS TEST REPORT

Test Date: 1 Jan 18, 2023

Equipment: Gas Analyser (CO)
Manufacturer: Thermo Scientific
Model: 48
Serial Number: CH08140053

Standard Gas Concentration

Standard Gas Concentration	PPM	Manufacturer
Sulfur Dioxide (SO ₂)	44.68	Thermo Scientific
Nitric Oxide (NO)	45.94	PPM
Methane (CH ₄)	984.8	PPM
Carbon Monoxide (CO)	850.04262	PPM
Cylinder No.:	Jun 20, 2024	

Multi-point gas test data

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	% Error
Level 1	0.0	0.0	0.0	0.0	0.0
Level 2	20.02%	18.7	0.7	3.5	6.5
Level 3	40.00%	20.9	0.9	2.3	4.3
Level 4	60.00%	35.9	0.5	0.8	1.6
Level 5	80.00%	49.9	0.0	0.0	0.0

Bottom: Measuring Range
Acceptable Limit: ± 3%

Multi-Point Gas Test Chart



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MULTI-POINT GAS TEST REPORT

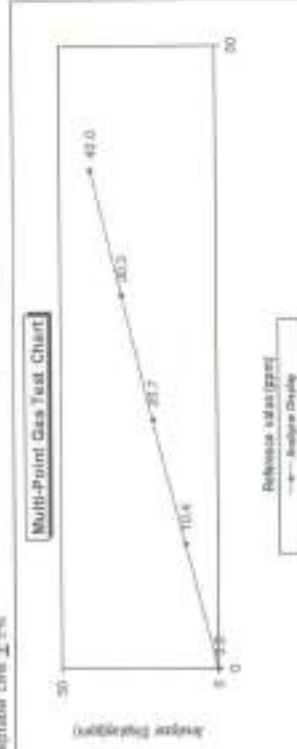
Test date: 1 Feb 21, 2023

Equipment:	Gas Analyzer (CO)	Model:	401
Manufacturer:	Thermo Scientific	Serial Number:	11801540068

Standard Gas Concentration		Diluent Detail	
Sulfur Dioxide (SO ₂)	44.85	Manufacturer :	1991
Nitric Oxide (NO)	51.94	Model :	1994
Methane (CH ₄)	-	Serial Number :	1994
Carbon Monoxide (CO)	104.8		199

Multi-point test data

Reference Value (ppm)		Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zone				
Level 1	Zone	0.0	0.0	0.0	0.0
Level 2	20-50%	10.4	0.4	3.8	3.8
Level 3	60-10%	30.0	0.7	2.4	3.4
Level 4	60-10%	30.0	0.5	1.6	1.0
Level 5	80-200%	40.0	0.0	0.0	0.0
MAX. G. Error			Average Difference (%)		1.8



22, Feb, 2023

MULTI-POINT GAS TEST REPORT

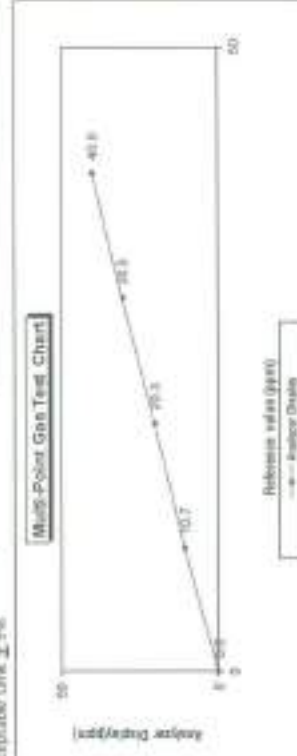
Test Date : Feb 8, 2023

Equipment :	Gas Analyzer (CO)	Model :
Manufacturer :	HORIBA	Serial Number :

Standard Gas Concentration		Solution Detail	
Sulphur Dioxide (SO ₂)	44.08	ppm	Manufacture :
Nitric Oxide (NO)	45.94	ppm	Model :
Methane (CH ₄)	—	ppm	Serial Number :
Carbon Monoxide (CO)	984.8	ppm	
Cylinder No. :	BB143562		
Expiry Date :	Jun 20, 2024		

Multi-point on test data

Reference Value (ppm)		Analyzer Display (ppm)	Offset Error	Percent Error	% Error
Level 1	Low	5.0	0.0	0.0	0.0
Level 2	20.0 (0%)	15.0	0.7	5.5	6.5
Level 3	40.0 (0%)	35.0	0.3	1.5	1.5
Level 4	60.0 (0%)	30.0	0.5	1.6	1.6
Level 5	80.0 (0%)	40.0	0.0	0.0	0.0
SAC % Error			Average Off-Percent (%)		1.52



8, 02, 66



Airgas Specialty Gases
Airgas USA, LLC
Apco United Drive
Dunbar, W.V. 26039
Airgas.com

CERTIFICATE OF ANALYSIS Grade of Product: EPA Protocol

Part Number: E04839E15A61C0
Cylinder Number: EB0143252
Laboratory: 124 - Durham (BAP) - NC
PMP Number: 822021
Gas Code: CO/NO/NOX/CO2/BALN
Reference Number: 122-402135167-1
Cylinder Volume: 144.4 CF
Cylinder Pressure: 2015 PSIG
Valve Outlet: 850
Certification Date: Jun 21, 2021
Expiration Date: Jun 21, 2024

Certification performed in accordance with ASTM D2539, Standard for Assay and Certification of Standard Calibration Gases (July 2012), approved plus addendum 1955N, using the latest procedures. Analytical Methodology does not require correction for analytical interference. This grade has a total purity/assay uncertainty of stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration grade. All measurements are on a minimum basis unless otherwise noted.
For lot use only. See COA for details. Lot 122-402135167-1.

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
NOX	48.00 PPM	48.00 PPM	01	$\pm 1.4\%$ NIST Traceable
HTNRC OXIDE	48.00 PPM	48.00 PPM	01	$\pm 1.4\%$ NIST Traceable
SULFUR DIOXIDE	48.00 PPM	48.00 PPM	01	$\pm 1.4\%$ NIST Traceable
CARBON MONOXIDE	1300 PPM	1300 PPM	01	$\pm 0.7\%$ NIST Traceable
NITROGEN				

CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
HTNRC	20081120	COT8308	48.00 PPM HTNRC OXIDE/NITROGEN	$\pm 1.0\%$
HTNRC	12088	D065533	5.00 PPM NITROGEN OXIDE/SULFUR	$\pm 2.0\%$
HTNRC	40143326105	CC835991	4.548 PPM NITROGEN DIOXIDE/NITROGEN	$\pm 1.2\%$
HTNRC	16011540	CC473237	48.00 PPM SULFUR DIOXIDE/NITROGEN	$\pm 1.2\%$
HTNRC	14081119	CC434617	880.0 PPM CARBON MONOXIDE/NITROGEN	$\pm 0.8\%$

ANALYTICAL EQUIPMENT				
Instrument/Model	Analytical Principle	Last Multi-point Calibration	Uncertainty	Expiration Date
Model: 0705 AI-41301133 CO	FTIR	Jun 03, 2021	$\pm 1.0\%$	Feb 02, 2026
Model: 0705 AI-41301133 NO	FTIR	Jun 03, 2021	$\pm 2.0\%$	Feb 02, 2026
Model: 0705 AI-41301133 NO2	FTIR	Jun 03, 2021	$\pm 1.2\%$	Feb 02, 2026
Model: 0705 AI-41301133 CO2	FTIR	Jun 03, 2021	$\pm 0.8\%$	Feb 02, 2026

Total Data Available Upon Request
NOTES: (NO) #5221002007
GROSS WT: 20.45kg
NET WT: 4.73kg



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

Approved for Release

เอกสารไมควบคุม

United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsri 41, Sukhumvit Road, Bangkok, Phrasabong, Bangkok 10000
Tel: 0 2763 2828 Fax: 0 2763 2830 www.uac.co.th E-mail: uac@uac.co.th

MULTI-POINT GAS TEST REPORT

Test Date : Feb 15, 2023

Equipment : Hydrocarbon Analyzer
Manufacturer : HANNA
Model : APM-370
Serial Number : K88V01856

Standard Gas Concentration
Sulfur Dioxide (SO2) : PPM
Nitric Oxide (NO) : PPM
Methane (CH4) : PPM
Carbon Monoxide (CO) : PPM
Cylinder No. : D024432
Expiration Date : Aug 4, 2026

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	% Error 1
Level 1 : Zero : 0.00	0.43	0.43	0.43	0.43
Level 2 : 30.00%	45.00	-0.57	-1.45	1.45
Remark : Measuring Range : 50.00 ppm				Average Difference (%) : 0.93
Acceptable Limit : 5%				

Multi-Point Gas Test Chart



15, Feb, 2023

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3 Set Udomrak 41, Sukhumvit Road, Bangkok, Prachinong, Bangkok 10260

Tel. 0 2763 2528 Fax 0 2763 2530 www.uaecol.com E-mail: uaecol@uaecol.com

MULTI-POINT GAS TEST REPORT

Test Date : Feb 6, 2023

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : RA717DS

Standard Gas Concentration

Sulphur Dioxide (SO₂) :
Nitric Oxide (NO)
Methane (CH₄) : 39.8
Carbon Monoxide (CO)
Cylinder No. : D02-6432
Expiration Date : Aug 4, 2028

Dilutor Detail

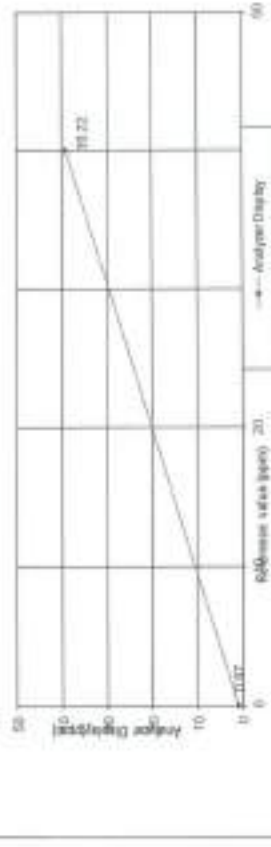
PPH
PPH
PPH
PPH

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	0.07	0.37	0.37
Level 2	39.05%	40.06	0.76	1.95	1.99
Result: Measuring Range: 50.00 ppm			Average Difference (%)		1.48

Multi-Point Gas Test Chart



Y. Feb 6, 2023



United Analyst and Engineering Consultant Co., Ltd.

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Tel. 0 2763 2528 Fax 0 2763 2530 www.uaecol.com E-mail: uaecol@uaecol.com

MULTI-POINT GAS TEST REPORT

Test Date : Feb 20, 2023

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : 6721PTED

Standard Gas Concentration

Sulphur Dioxide (SO₂) :
Nitric Oxide (NO)
Methane (CH₄) : 39.8
Carbon Monoxide (CO)
Cylinder No. : D02-6432
Expiration Date : Aug 4, 2028

Dilutor Detail

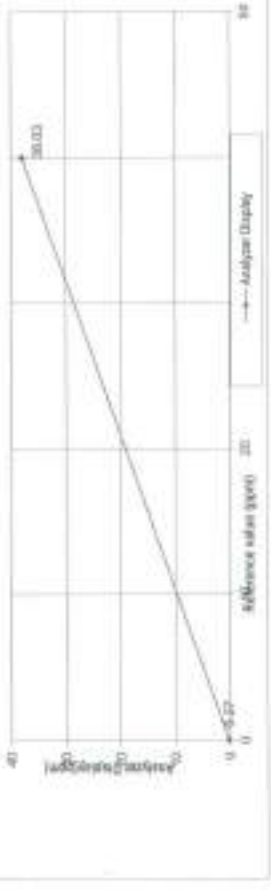
PPH
PPH
PPH
PPH

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	0.27	0.27	0.27	0.27
Level 2 : 39.80%	40.05	39.63	-2.97	-5.18	-5.18
Result : Measuring Range		Average Difference (%)		-2.73	
		50.00 ppm			

Multi-Point Gas Test Chart



20 Feb 2023

20 Feb 2023

[illegible]



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangkok, 10240 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 375722

2 August, 2022

Page : 2 of 2

Standard Ultrasonic Anemometer model	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure mmHg (10)	Velocity mmHg (10)	Velocity m/sec	Velocity m/sec	Correction mmHg
3.00	-	-	-	1.0	-0.09
3.02	-	-	-	3.0	0.02
3.00	-	-	-	4.0	0.10
7.04	-	-	-	6.8	0.24
9.02	-	-	-	8.8	-0.22
11.01	-	-	-	10.7	0.31
13.01	-	-	-	12.7	0.31
15.01	-	-	-	14.6	0.41
17.02	-	-	-	16.6	-0.42
20.02	-	-	-	19.5	-0.52

Wind Audit Putting Result		
U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU		
WIND DIRECTION	TESTED WIND DIRECTION	
0	0	
90	90	
180	180	
270	270	

Calibrated by :

Mr. Wanchai Subwat
Mechanical Engineer



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangkok, 10240 Tel. 081-454-2804, 0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section | Meteorological Instruments Bureau

Date of Issue : 12 July, 2022

Certification No. : 359-22

Page : 1 of 2

Object	Wind speed and wind direction
Manufacturer	LSI
Type	Data Logger E-LOG 205 wind speed and wind direction DMA 521
Serial No.	Data Logger : 20040000 wind speed and wind direction 20040164 ID No. : No. 4/20
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 : 1006.4 hPa

NATIONAL STANDARD WIND TUNNEL :

- Thermal Anemometer (42 S/N 91563)
- HOOK GAGE NO. 1425 Pitot Tube Theodolite Type 0000.0000 serial 0003
- N.I.S.T. Test Reference Number 73124-460 : Standard Velocity at 20 - 30 m/sec
- Ultrasonic Anemometer Model DA-650-3TV (Sensor TR-00AH) : (Sensor TR-00AH)
- Serial Number 110730026 : (Sensor 1206282660)

JAPAN QUALITY ASSURANCE ORGANIZATION

Calibrated by
Mr. Wanchai Subwat
Mechanical Engineer



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4553 Sukhumvit, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

12 July, 2022

Certification No. 259/22

Page : 2 of 2

Standard Ultrasonic Anemometer model	HOOP GAGE NO. 1425		TESTED ANEMOMETER	
	Pressure mmHg	Vacuum mmHg	Velocity m/sec	Correction mm/sec
1.00	-	-	0.6	0.40
3.02	-	-	2.4	0.62
5.00	-	-	4.1	0.90
7.04	-	-	6.4	0.64
9.02	-	-	8.1	0.92
11.01	-	-	10.4	0.61
13.01	-	-	12.5	0.51
15.01	-	-	14.7	0.31
17.02	-	-	16.5	0.32
20.02	-	-	19.7	0.32

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. Wintharapol Suwan
Mechanical Engineer



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THAI METEOROLOGICAL DEPARTMENT

4553 Sukhumvit, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 12 July, 2022

Certification No. 253/22

Page : 1 of 2

Object :	Wind speed and wind direction
Manufacturer :	LSI
Type :	Dan Lopper 8-LOG 205 wind speed and wind direction DHA 021
Serial No. :	Dan Lopper 20000022 wind speed and wind direction 20000130
ID No. :	No. 20221
Customer :	United Analyst and Engineering Consultant Co., Ltd. 81 Sir Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 35.1 °C Barometric Pressure 1003.6 hPa

NATIONAL STANDARD WIND TUNNEL :

- Thermal Anemometer 842 SN 015603
- HOOP GAGE NO 1425 Hot Wire Thermal Probe Type OGD-0000 series 9003
- N.I.S.T. Test Reference Number 7312041480 : Standard Velocity at 20 - 20 m/sec
- Ultrasonic Anemometer Model DA-850-3TV (sensor TR-80A11) (sensor TR-80A11)
- Serial Number 1101700029 (sensor 1206250180)

JAPAN QUALITY ASSURANCE ORGANIZATION

Calibrated by :
Mr. Wintharapol Suwan
Mechanical Engineer



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Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Uncertainty (\pm dB)	Acceptance limit Class 2 (\pm dB)
	Measured	Error		
94 dB / 1000 Hz	93.86	-0.14	0.11	0.60
114 dB / 1000 Hz	113.92	-0.08	0.11	0.60

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Uncertainty (\pm %)	Acceptance limit Class 2 (\pm %)
	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	1000.00	0.00	0.10	1.7
114 dB / 1000 Hz	1000.00	0.00	0.10	1.7

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

Calibration Range (Hz)	Without Adjustment		Uncertainty (\pm %)	Acceptance limit Class 2 (\pm %)
	Measured (%)	Measured (%)		
94 dB / 1000 Hz	0.14	-	0.00	3.0
114 dB / 1000 Hz	0.28	-	0.00	3.0

NOTE 2
Acceptance limit was 0.04047 (0.77 Class 1)
The calibration results include the calibration process uncertainty
The calibration results exclude the measurement system uncertainty

End of Calibration

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : LARSON DAVIS
Model : Lx12 / Microphone 375B02 / Pre-amplifier PDM-L x 12B
Serial No.: 0005286 / 011740 / 006087
ID No.: -

Condition As Found : GOOD

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

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

Received Date : 18 JANUARY 2022
Calibration Date : 26 JANUARY 2022
Date of Issue : 28 JANUARY 2022

Calibrated by : Nattakorn Pitsurathan

Approved by :

(Thanakul Petchura)

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

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Continuation of Calibration Certificate

Cert. No. : ACL22081
Job No. : VC65AC0644
Pages : 2 of 8

Calibration Procedure : CP-AC-02

Calibration Method :

This equipment was calibrated by based on IEC-61073-3 (2013) Standard for sound level meter (SLM).
The SLM had tests in Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52502742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-BP-05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL-BP-03/0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NIA-42KA	34560495	AA-3003-21	14-Feb-22

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

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

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

Continuation of Calibration Certificate

Cert. No. : ACL22081
Job No. : VC65AC0644
Pages : 3 of 8

Summary of Measurement Result.

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

Continuation of Calibration Certificate

Cert. No. : ACL22081
Job No. : VC65AC10044
Pages : 4 of 8

Result of calibration 2.

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	94.0	0.0	± 0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
31.0

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

Frequency Weighting	Measured value (dB)
A - weight	30.8
C - weight	30.6
Flat	30.8

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 94 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
125	-0.1	0.1	0.0
1000	-0.2	-0.2	-0.2
8000	3.1	3.2	3.2
			± 5.0

Continuation of Calibration Certificate

Cert. No. : ACL22081
Job No. : VC65AC10044
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
63	0.0	0.0	0.0
125	0.0	0.0	0.0
250	0.0	0.0	0.0
500	0.0	0.0	0.0
1000	0.0	0.0	0.0
2000	0.0	0.1	0.0
4000	0.0	0.0	0.0
8000	0.0	0.0	0.0
16000	-0.1	0.0	0.1
			$\pm 5.0 (-0.0)$

5. Frequency and time weightings at 1 kHz.

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

Continuation of Calibration Certificate

Cert. No. : ACL22081
Job No. : VC65AC0044
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.1	0.1	± 1.1
132.0	132.1	0.1	± 1.1
131.0	131.1	0.1	± 1.1
129.0	129.1	0.1	± 1.1
124.0	124.1	0.1	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.1	0.1	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.1	0.1	± 1.1
44.0	44.2	0.2	± 1.1
39.0	39.6	0.6	± 1.1

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Continuation of Calibration Certificate

Cert. No. : ACL22081
Job No. : VC65AC0044
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
140	94.0	94.0	0.0	±0.5

9. Tone burst response

Time Weighting	Time burst duration, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.8	-0.2	1.5 ; -5.0
	2	8	117.0	116.7	-0.3	1.0 ; -2.5
	200	800	134.0	133.9	-0.1	±1.0
Slow	2	8	108.0	107.8	-0.2	1.5 ; -5.0
	200	800	127.6	127.5	-0.1	±1.0
	0.25	1	N/A	N/A	N/A	1.5 ; -5.0
SEL	2	8	N/A	N/A	N/A	1.0 ; -2.5
	200	800	N/A	N/A	N/A	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.7	-0.7	±3.0

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

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Continuation of Calibration Certificate

Cert. No. : ACL22081
Job No. : VC65AC9044
Pages : 8 of 8

11. Overload indication

Measured value (dB)	Deviated Value		Acceptance Limits (dB)
	Positive one-half cycle	Negative one-half cycle	
89.2	89.4	0.2	±1.5

12. High level stability

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

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

End of Calibration Certificate

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631-45171 Sidhachon Rd, Bangpoo, Bangkok 10700 THAILAND
Tel: 0-2635-8800 Fax: 0-2435-1629 e-mail: cal-center@thiporn.com http://www.thiporn.com

Cert. No. : ACL22082
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : LARSON DAVIS
Model : LA72 / Microphone 375B02 / Preamp/Filter P80ML x 12B
Serial No.: 0005280 / 011732 / 0516076
ID No.:

Condition As Found : GOOD

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

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

Received Date : 18 JANUARY 2022
Calibration Date : 26 JANUARY 2022
Date of Issue : 28 JANUARY 2022

Calibrated by : Natchakorn Pisuapitak

Approved by :

(Tharakul Perichuan)

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Continuation of Calibration Certificate

Cert. No. : AC1.22082
Job No. : VC65AC0044
Pages : 2 of 8

Calibration Procedure : CP-AC-02

Calibration Method :

This equipment was calibrated by based on IEC 61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY53303742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EE1_BP-050264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EE1_BP-030264	08-Feb-22
Digital Multimeter	34461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAF-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	N/A-42KAI	34560495	AA-2003-21	16-Feb-22

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

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

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

Continuation of Calibration Certificate

Cert. No. : AC1.22082
Job No. : VC65AC0044
Pages : 3 of 8

Summary of Measurement Result :

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

Continuation of Calibration Certificate

Cert. No. : ACL22082
Job No. : VC65AC10044
Pages : 4 of 8

Result of calibration 1.

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.90)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
29.8

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

Frequency Weighting	Measured value (dB)
A - weight	29.4
C - weight	29.1
Flat	34.8

3. Acoustical signal tests of frequency weightings

Meter free field acoustic response at a level of 94 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
125	-0.1	0.2	0.2
1000	-0.2	-0.2	-0.2
8000	2.6	2.6	2.6

Continuation of Calibration Certificate

Cert. No. : ACL22082
Job No. : VC65AC00044
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
63	0.0	0.0	0.0
125	0.0	0.1	0.0
250	0.0	0.0	0.0
500	0.0	0.0	0.0
1000	0.0	0.0	0.0
2000	0.0	0.1	0.0
4000	0.0	-0.1	0.0
8000	0.0	0.1	0.0
16000	-0.1	0.1	0.1

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

Frequency Weighting	SUM Display at initial (dB)	SUM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

Continuation of Calibration Certificate

Cert. No. : ACCL22082
Job No. : VC65AC0044
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1

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Continuation of Calibration Certificate

Cert. No. : ACCL22082
Job No. : VC65AC0044
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
140	94.0	94.0	0.0	± 0.5

9. Tone burst response

Time Weighting	Time burst duration, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.8	-0.2	1.5 ± 5.0
	2	8	117.0	116.7	-0.3	1.0 ± 2.5
	200	800	134.0	133.9	-0.1	± 1.0
Slow	2	8	108.0	107.8	-0.2	1.5 ± 5.0
	200	800	127.6	127.6	0.0	± 1.0
	0.25	1	N/A	N/A	N/A	1.5 ± 5.0
SPL	2	8	N/A	N/A	N/A	1.0 ± 2.5
	200	800	N/A	N/A	N/A	± 1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{epk} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.8	-0.6	± 3.0

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

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2. Indication of the calibration check frequency

Model	UIC Setting	Normal		Heavier Adjust		Adjust	UNCERTAINTY	Asymptotic
		Level	UIC	ERR	UIC			
EWST / A: 37-120		1000	1000	1000	1000	0.00	1.2400	0.3
Calibration Setting		1000	1000	1000	1000	0.00	1.2400	0.3
0.000 for 114.00-225		1000	1000	1000	1000	0.00	1.2400	0.3

7. Self-generated noise. Microphone installed

a. 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 2679, 2680, 2681, 2682, 2683, 2684, 2685, 2686, 2687, 2688, 2689, 2690, 2691, 2692, 2693, 2694, 2695, 2696, 2697, 2698, 2699, 2700, 2701, 2702, 2703, 2704, 2705, 2706, 2707, 2708, 2709, 2710, 2711, 2712, 2713, 2714, 2715, 2716, 2717, 2718, 2719, 2720, 2721, 2722, 2723, 2724, 2725, 2726, 2727, 2728, 2729, 2730, 2731, 2732, 2733, 2734, 2735, 2736, 2737, 2738, 2739, 2740, 2741, 2742, 2743, 2744, 2745, 2746, 2747, 2748, 2749, 2750, 2751, 2752, 2753, 2754, 2755, 2756, 2757, 2758, 2759, 2760, 2761, 2762, 2763, 2764, 2765, 2766, 2767, 2768, 2769, 2770, 2771, 2772, 2773, 2774, 2775, 2776, 2777, 2778, 2779, 2780, 2781, 2782, 2783, 2784, 2785, 2786, 2787, 2788, 2789, 2790, 2791, 2792, 2793, 2794, 2795, 2796, 2797, 2798, 2799, 2800, 2801, 2802, 2803, 2804, 2805, 2806, 2807, 2808, 2809, 2810, 2811, 2812, 2813, 2814, 2815, 2816, 2817, 2818, 2819, 2820, 2821, 2822, 2823, 2824, 2825, 2826, 2827, 2828, 2829, 2830, 2831, 2832, 2833, 2834, 2835, 2836, 2837, 2838, 2839, 2840, 2841, 2842, 2843, 2844, 2845, 2846, 2847, 2848, 2849, 2850, 2851, 2852, 2853, 2854, 2855, 2856, 2857, 2858, 2859, 2860, 2861, 2862, 2863, 2864, 2865, 2866, 2867, 2868, 2869, 2870, 2871, 2872, 2873, 2874, 2875, 2876, 2877, 2878, 2879, 2880, 2881, 2882, 2883, 2884, 2885, 2886, 2887, 2888, 2889, 2890, 2891, 2892, 2893, 2894, 2895, 2896, 2897, 2898, 2899, 2900, 2901, 2902, 2903, 2904, 2905, 2906, 2907, 2908, 2909, 2910, 2911, 2912, 2913, 2914, 2915, 2916, 2917, 2918, 2919, 2920, 2921, 2922, 2923, 2924, 2925, 2926, 2927, 2928, 2929, 2930, 2931, 2932, 2933, 2934, 2935, 2936, 2937, 2938, 2939, 2940, 2941, 2942, 2943, 2944, 2945, 2946, 2947, 2948, 2949, 2950, 2951, 2952, 2953, 2954, 2955, 2956, 2957, 2958, 2959, 2960, 2961, 2962, 2963, 2964, 2965, 2966, 2967, 2968, 2969, 2970, 2971, 2972, 2973, 2974, 2975, 2976, 2977, 2978, 2979, 2980, 2981, 2982, 2983, 2984, 2985, 2986, 2987, 2988, 2989, 2990, 2991, 2992, 2993, 2994, 2995, 2996, 2997, 2998, 2999, 3000, 3001, 3002, 3003, 3004, 3005, 3006, 3007, 3008, 3009, 3010, 3011, 3012, 3013, 3014, 3015, 3016, 3017, 3018, 3019, 3020, 3021, 3022, 3023, 3024, 3025, 3026, 3027, 3028, 3029, 3030, 3031, 3032, 3033, 3034, 3035, 3036, 3037, 3038, 3039, 3040, 3041, 3042, 3043, 3044, 3045, 3046, 3047, 3048, 3049, 3050, 3051, 3052, 3053, 3054, 3055, 3056, 3057, 3058, 3059, 3060, 3061, 3062, 3063, 3064, 3065, 3066, 3067, 3068, 3069, 3070, 3071, 3072, 3073, 3074, 3075, 3076, 3077, 3078, 3079, 3080, 3081, 3082, 3083, 3084, 3085, 3086, 3087, 3088, 3089, 3090, 3091, 3092, 3093, 3094, 3095, 3096, 3097, 3098, 3099, 3100, 3101, 3102, 3103, 3104, 3105, 3106, 3107, 3108, 3109, 3110, 3111, 3112, 3113, 3114, 3115, 3116, 3117, 3118, 3119, 3120, 3121, 3122, 3123, 3124, 3125, 3126, 3127, 3128, 3129, 3130, 3131, 3132, 3133, 3134, 3135, 3136, 3137, 3138, 3139, 3140, 3141, 3142, 3143, 3144, 3145, 3146, 3147, 3148, 3149, 3150, 3151, 3152, 3153, 3154, 3155, 3156, 3157, 3158, 3159, 3160, 3161, 3162, 3163, 3164, 3165, 3166, 3167, 3168, 3169, 3170, 3171, 3172, 3173, 3174, 3175, 3176, 3177, 3178, 3179, 3180, 3181, 3182, 3183, 3184, 3185, 3186, 3187, 3188, 3189, 3190, 3191, 3192, 3193, 3194, 3195, 3196, 3197, 3198, 3199, 3200, 3201, 3202, 3203, 3204, 3205, 3206, 3207, 3208, 3209, 3210, 3211, 3212, 3213, 3214, 3215, 3216, 3217, 3218, 3219, 3220, 3221, 3222, 3223, 3224, 3225, 3226, 3227, 3228, 3229, 3230, 3231, 3232, 3233, 3234, 3235, 3236, 3237, 3238, 3239, 3240, 3241, 3242, 3243, 3244, 3245, 3246, 3247, 3248, 3249, 3250, 3251, 3252, 3253, 3254, 3255, 3256, 3257, 3258, 3259, 3260, 3261, 3262, 3263, 3264, 3265, 3266, 3267, 3268, 3269, 3270, 3271, 3272, 3273, 3274, 3275, 3276, 3277, 3278, 3279, 3280, 3281, 3282, 3283, 3284, 3285, 3286, 3287, 3288, 3289, 3290, 3291, 3292, 3293, 3294, 3295, 3296, 3297, 3298, 3299, 3300, 3301, 3302, 3303, 3304, 3305, 3306, 3307, 3308, 3309, 3310, 3311, 3312, 3313, 3314, 3315, 3316, 3317, 3318, 3319, 3320, 3321, 3322, 3323, 3324, 3325, 3326, 3327, 3328, 3329, 3330, 3331, 3332, 3333, 3334, 3335, 3336, 3337, 3338, 3339, 3340, 3341, 3342, 3343, 3344, 3345, 3346, 3347, 3348, 3349, 3350, 3351, 3352, 3353, 3354, 3355, 3356, 3357, 3358, 3359, 3360, 3361, 3362, 3363, 3364, 3365, 3366, 3367, 3368, 3369, 3370, 3371, 3372, 3373, 3374, 3375, 3376, 3377, 3378, 3379, 3380, 3381, 3382, 3383, 3384, 3385, 3386, 3387, 3388, 3389, 3390, 3391, 3392, 3393, 3394, 3395, 3396, 3397, 3398, 3399, 3400, 3401, 3402, 3403, 3404, 3405, 3406, 3407, 3408, 3409, 3410, 3411, 3412, 3413, 3414, 3415, 3416, 3417, 3418, 3419, 3420, 3421, 3422, 3423, 3424, 3425, 3426, 3427, 3428, 3429, 3430, 3431, 3432, 3433, 3434, 3435, 3436, 3437, 3438, 3439, 3440, 3441, 3442, 3443, 3444, 3445, 3446, 3447, 3448, 3449, 3450, 3451, 3452, 3453, 3454, 3455, 3456, 3457, 3458, 3459, 3460, 3461, 3462, 3463, 3464, 3465, 3466, 3467, 3468, 3469, 3470, 3471, 3472, 3473, 3474, 3475, 3476, 3477, 3478, 3479, 3480, 3481, 3482, 3483, 3484, 3485, 3486, 3487, 3488, 3489, 3490, 3491, 3492, 3493, 3494, 3495, 3496, 3497, 3498, 3499, 3500, 3501, 3502, 3503, 3504, 3505, 3506, 3507, 3508, 3509, 3510, 3511, 3512, 3513, 3514, 3515, 3516, 3517, 3518, 3519, 3520, 3521, 3522, 3523, 3524, 3525, 3526, 3527, 3528, 3529, 3530, 3531, 3532, 3533, 3534, 3535, 3536, 3537, 3538, 3539, 3540, 3541, 3542, 3543, 3544, 3545, 3546, 3547, 3548, 3549, 3550, 3551, 3552, 3553, 3554, 3555, 3556, 3557, 3558, 3559, 3560, 3561, 3562, 3563, 3564, 3565, 3566, 3567, 3568, 3569, 3570, 3571, 3572, 3573, 3574, 3575, 3576, 3577, 3578, 3579, 3580, 3581, 3582, 3583, 3584, 3585, 3586, 3587, 3588, 3589, 3590, 3591, 3592, 3593, 3594, 3595, 3596, 3597, 3598, 3599, 3600, 3601, 3602, 3603, 3604, 3605, 3606, 3607, 3608, 3609, 3610, 3611, 3612, 3613, 3614, 3615, 3616, 3617, 3618, 3619, 3620, 3621, 3622, 3623, 3624, 3625, 3626, 3627, 3628, 3629, 3630, 3631, 3632, 3633, 3634, 3635, 3636, 3637, 3638, 3639, 3640, 3641, 3642, 3643, 3644, 3645, 3646, 3647, 3648, 3649, 3650, 3651, 3652, 3653, 3654, 3655, 3656, 3657, 3658, 3659, 3660, 3661, 3662, 3663, 3664, 3665, 3666, 3667, 3668, 3669, 3670, 3671, 3672, 3673, 3674, 3675, 3676, 3677, 3678, 3679, 3680, 3681, 3682, 3683, 3684, 3685, 3686, 3687, 3688, 3689, 3690, 3691, 3692, 3693, 3694, 3695, 3696, 3697, 3698, 3699, 3700, 3701, 3702, 3703, 3704, 3705, 3706, 3707, 3708, 3709, 3710, 3711, 3712, 3713, 3714, 3715, 3716, 3717, 3718, 3719, 3720, 3721, 3722, 3723, 3724, 3725, 3726, 3727, 3728, 3729, 3730, 3731, 3732, 3733, 3734, 3735, 3736, 3737, 3738, 3739, 3740, 3741, 3742, 3743, 3744, 3745, 3746, 3747, 3748, 3749, 3750, 3751, 3752, 3753, 3754, 3755, 3756, 3757, 3758, 3759, 3760, 3761, 3762, 3763, 3764, 3765, 3766, 3767, 3768, 3769, 3770, 3771, 3772, 3773, 3774, 3775, 3776, 3777, 3778, 3779, 3780, 3781, 3782, 3783, 3784, 3785, 3786, 3787, 3788, 3789, 3790, 3791, 3792, 3793, 3794, 3795, 3796, 3797, 3798, 3799, 3800, 3801, 3802, 3803, 3804, 3805, 3806, 3807, 3808, 3809, 3810, 3811, 3812, 3813, 3814, 3815, 3816, 3817, 3818, 3819, 3820, 3821, 3822, 3823, 3824, 3825, 3826, 3827, 3828, 3829, 3830, 3831, 3832, 3833, 3834, 3835, 3836, 3837, 3838, 3839, 3840, 3841, 3842, 3843, 3844, 3845, 3846, 3847, 3848, 3849, 3850, 3851, 3852, 3853, 3854, 3855, 3856, 3857, 3858, 3859, 3860, 3861, 3862, 3863, 3864, 3865, 3866, 3867, 3868, 3869, 3870, 3871, 3872, 3873, 3874, 3875, 3876, 3877, 3878, 3879, 3880, 3881, 3882, 3883, 3884, 3885, 3886, 3887, 3888, 3889, 3890, 3891, 3892, 3893, 3894, 3895, 3896, 3897, 3898, 3899, 3900, 3901, 3902, 3903, 3904, 3905, 3906, 3907, 3908, 3909, 3910, 3911, 3912, 3913, 3914, 3915, 3916, 3917, 3918, 3919, 3920, 3921, 3922, 3923, 3924, 3925, 3926, 3927, 3928, 3929, 3930, 3931, 3932, 3933, 3934, 3935, 3936, 3937, 3938, 3939, 3940, 3941, 3942, 3943, 3944, 3945, 3946, 3947, 3948, 3949, 3950, 3951, 3952, 3953, 3954, 3955, 3956, 3957, 3958, 3959, 3960, 3961, 3962, 3963, 3964, 3965, 3966, 3967, 3968, 3969, 3970, 3971, 3972, 3973, 3974, 3975, 3976, 3977, 3978, 3979, 3980, 3981, 3982, 3983, 3984, 3985, 3986, 3987, 3988, 3989, 3990, 3991, 3992, 3993, 3994, 3995, 3996, 3997, 3998, 3999, 4000, 4001, 4002, 4003, 4004, 4005, 4006, 4007, 4008, 4009, 4010, 4011, 4012, 4013, 4014, 4015, 4016, 4017, 4018, 4019, 4020, 4021, 4022, 4023, 4024, 4025, 4026, 4027, 4028, 4029, 4030, 4031, 4032, 4033, 4034, 4035, 4036, 4037, 4038, 4039, 4040, 4041, 4042, 4043, 4044, 4045, 4046, 4047, 4048, 4049, 4050, 4051, 4052, 4053, 4054, 4055, 4056, 4057, 4058, 4059, 4060, 4061, 4062, 4063, 4064, 4065, 4066, 4067, 4068, 4069, 4070, 4071, 4072, 4073, 4074,
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1. Self-generated noise. Microphone replaced by the electrical input signal device

UUC Starting	Measured	UNCERTAINTY
FACT - 37130		
UUC Weighting	(10)	± 400
A	28.6	0.10
C	28.2	0.10
E	32.6	0.03

4. Acoustic signal test of frequency variations (Without Windtunnel)

1142 Sorting	Headslice from various Properties				USCERABILITY (\pm mm)	Acceptance Limit (\pm mm)
	Sampling Stepwise curve					
	A	C	(dB)	Z		
FAST / 25-120			(dB)	(dB)		
STB Sorting						
250 Hz	-8.1	0.1	0.0	0.0	0.0	0.0
1000 Hz	0.0	0.0	0.0	0.0	0.0	1.0
4000 Hz	0.5	0.5	0.5	0.5	0.0	0.0
8000 Hz	0.4	0.4	0.3	0.3	0.0	0.0

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

AUC Sorting	Surflection from various frequency		UNCERTAINTY (± 400)	Asymptote Lieht (± 400)
	Weighting Resonance curve			
	A (0.00)	C (0.00)		
FAST / 32-120				
STD Sorting				
43.1 Hz	-0.2	-0.1	0.0	2.8
133 Hz	-0.1	0.0	0.0	1.8
259 Hz	-0.1	0.0	0.0	1.8
500 Hz	-0.1	0.0	0.0	1.8
1000 Hz	-0.0	0.0	0.0	1.8
2000 Hz	-0.0	0.0	0.0	2.8
4000 Hz	-0.0	0.0	0.0	3.8
8000 Hz	-0.1	0.0	0.0	8
16000 Hz	-0.1	0.1	0.0	-0.002

6. Frequency and time constraints in 1940

ULC Sorting		STD	Measure		UNCERTAINTY (± 400)	Accuracy (± 400)
		REF	ULC std	REF std		
PAST (7/13)		14.0	14.0	0.0	0.2	0.2
ULC Weighing		14.10	14.0	0.0		
	A	14.10	14.0	0.0	0.2	0.2
	C	14.10	14.0	0.0		
	D	14.00	14.0	0.0		

UIC Setting		STD	Measured		Uncertainty (± 0.01)	Acceptance Limit (± 0.01)
ST-120 / A	UIC Time Display		UIC	R408		
		114.20 (40)	114.0	0.0		
	Pass	114.40	114.0	0.0		
	Slow	114.40	114.0	0.0	0.2	0.1
	Comp	114.40	114.0	0.0		0.1

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7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
	UUC (dB)	1 ± 40%	1 ± 40%
FAST / A / 27-120	114.0		
STD dB	114.0		
Final	0.0	0.1	0.1

8. Level Linearity on the reference level range

UUC Setting	Assigned	Deviation		UNCERTAINTY	Acceptance Limit
	REF (dB)	UUC (dB)	KRR (dB)		
FAST / A / 27-120				0.7	0.2 dB
STD dB					
110.00	100	130.0	0.0		1.1
118.00	104	130.0	0.0		1.1
126.00	108	126.0	0.0		1.1
134.00	112	126.0	0.0		1.1
142.00	116	110.0	0.0		1.1
150.00	114	110.0	0.0		1.1
158.00	100	106.0	0.0		1.1
166.00	104	104.0	0.0		1.1
174.00	99	96.0	0.0		1.1
182.00	94	91.0	-1.1		1.1
190.00	89	88.0	-1.1		1.1
198.00	83	82.0	-1.1		1.1
206.00	74	72.0	-1.1		1.1
214.00	69	69.0	0.0		1.1
222.00	60	60.0	-1.1		1.1
230.00	50	50.0	0.0		1.1
238.00	40	40.0	0.0		1.1
246.00	34	34.0	0.0		1.1
254.00	24	24.0	0.0		1.1
262.00	14	14.0	0.0		1.1
270.00	4	4.0	0.0		1.1

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9. Level Linearity including the level range control

UUC Setting	STD REF (dB)	Measured		UNCERTAINTY	Acceptance Limit
		UUC (dB)	KRR (dB)		
FAST / A	100			1 ± 40%	1 ± 40%
UUC Range	42.8	43.2	0.3	1.1	1.1
270.30	11.8	114.0	0.0	0.1	1.1

10. Tone Burst response

UUC Setting	STD Tonalburst (dB)	Assigned Ref (dB)	Measured		UNCERTAINTY	Acceptance Limit
			UUC (dB)	KRR (dB)		
A / 27-120					1 ± 40%	1 ± 40%
UUC Tone Response	200	114.0	113.8	0.0		
Tone	2	118.0	113.8	-0.2		
	8.25	108.0	108.8	-0.2		
	200	128.8	128.3	-0.1	0.1	
Tone	2	108.0	108.8	-0.2		
	200	128.8	128.8	0.0		
0dB	2	108.0	109.0	0.0		
	8.25	108.8	90.8	-9.1		

11. Peak C-Sound level

UUC Setting	Assigned REF (dB)	Measured		UNCERTAINTY	Acceptance Limit
		UUC (dB)	KRR (dB)		
FAST / 1 / 80-140				1 ± 40%	1 ± 40%
STD Setting	137.4	136.8	-0.30		
Complex tone	136.4	136.2	-0.20	0.2	2.0
Positive half cycle	136.4	136.2	-0.20		
Negative half cycle	136.4	136.2	-0.20		

The results obtained only to the best calibration. This certificate shall not be reproduced except by ANAB without written approval by ANAB.

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2023108-001-01
Equipment: Digital Thermometer with RTD (J&H Model)
Resolution: 0.1 °C
Model: H82003-02
Serial No.: 00251107
ID No.: UAC H82003-0202
Manufacturer: HANNA INSTRUMENTS
Date of Calibration: 8 June 2023

Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature (23.5 ± 1.5) °C
 Relative Humidity (55 ± 3) %

Condition of this results of Calibration:

- 1. Calibration Method :
 - In house method, WTC-028 by comparison with standard thermometer
 - This Calibration is determined by comparing with a frozen thermometer
 - Not a standard certificate thermometer
 - This temperature scale is used at this laboratory is the International Temperature scale of 1990 (ITS-90)
- 2. Reference Standard Instrument:
 - Low Temperature Bath (SCCH-40), Model Europe 4 Plus Model, Serial 3013000

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANNA-H82003-02 DIGITAL THERMOMETER	H820	2119104	PHL-F 000134	24-Apr-23	YES
Reference Resistance Thermometer (PRT)	8027A	877032			

Support Equipment: Low Temperature Bath (SCCH-40), Model Europe 4 Plus Model, Serial 3013000

3. This certificate is traceable to International System of Units (SI Units)
 4. This certificate was carried out by the instrument set calibrated
 5. The result of calibration was found accurate as shown on date and place of calibration only
 6. Condition of Calibration tag : ☒ Good ☐ Without adjustment ☐ After adjustment
 7. Result of Calibration

Calibration Report

Certificate No.: 2023108-001-01
Equipment: Digital Thermometer with RTD (J&H Model)
Resolution: 0.1 °C
Model: H82003-02
Serial No.: 00251107
ID No.: UAC H82003-0202
Manufacturer: HANNA INSTRUMENTS
Date of Calibration: 8 June 2023

Calibration point: 10.0, 20.0 and 25.0 °C
Calibration result:

- The probe was immersed in liquid bath in dry bath to a minimum depth of 120 mm.
 (Calculation of probe model) 1411320 50A 10143

Dimension of probe (Diameter) 12 mm, Length 120 mm.
 Probe material : Glass

LUCE Reading (°C)	Standard temperature (°C)	Correction Value (°C)	Uncertainty u (°C)
16.1	18.001	-0.1	0.009
20.1	20.002	-0.1	0.009
25.2	25.003	-0.2	0.009

Note : LUCE7, Unit Under Calibration

This report uncertainty of measurement was listed in standard uncertainty multiplied by coverage factor k = 2, providing a level of confidence of approximately 95 %.

Calibration Certificate

Certificate No.: 2352781-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Ladonsak 41, Sukhumvit Road,
Bangchak, Phrompong, Bangkok 10260

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Equipment:	pH Meter
Manufacturer:	METTLER TOLEDO
Model:	SevenEasy pH
Serial No.:	123456789
ID No.:	UAE-WAS-0032553
Order No.:	202181
Operation No.:	202181-401
Date of Receipt:	14 March 2023
Date of Calibration:	24 March 2023

Calibrated by:	Mr Phemphet Tarritt Scientist	Approved by:	(Dr. Nataraj Nataraj) Specialist, Division of Calibration Laboratory Responsible for the Technical Measurement Team
Date of Issue:	24 March 2023		

The accumulation rate for a continuous population of organisms is given by

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 conformity to recognized national standards and to the needs of customers as indicated at the accompanying national standards laboratory. This certificate may not be renewed other than in full except with the prior written approval of the National Food Institute.

LONG-TERM BENEFITS OF THE FRUIT - 50 mg/day



เอกสารไม่ควบคุม

Calibration Report

Certificate No.: Equipment:	208218.LA91-01
pH Input:	Resolution: 0.01 pH : 1 mV
Manufacturer:	Model: NUTTALL TOLSON General Glass pH
Serial No.):	Type: 13065075 Bench Top
(S) Date:	LAB VALUE 03/23/2005

Figure 3. (continued)

Location		Chemical Calibration Laboratory, National Food Institute	
Environmental Conditions		Ambient Temperature	23.5 ± 1.8 °C
Condition of Equipment		Solid Content	
Goodness of Fit Results of Calibration			
1. Calibration Method		In-house method - WCL-800 (based on direct measurement by using standard weight calibration and certified reference material CRM6)	
2. Reference Standards / Certified Reference Material			
Instruments		Serial ID No.	Manufacturer
2.1. 11C sulfate Calibrator		200801T	Fuke
2.2. Digital Thermometer		200802T	Fuke
2.3. Thermocouple Meter		NL-1700C-V7	POANG
Certified Reference Material		Lot No.	Manufacturer
2.4. pH buffer 4.005 (Primary pH buffer Solution)		875008	CPAchem
2.5. pH buffer 6.880 (Primary pH buffer Solution)		875009	CPAchem
2.6. pH buffer 10.01 (Primary pH buffer Solution)		875010	CPAchem
2.7. NaCl buffer 7.68 (Secondary salt buffer Solution)		875011	CPAchem

3. The contribution is identical to The International Bureau of Intellectual Property.

3.1. Instrumentation No. 1	through	143C-T68-T18-T1025 Laboratory Accreditation of Calibration No.0009
3.2. Instrumentation No.2	through	143D-T68-T18-T1025 Laboratory Accreditation of Calibration No.0001
3.3. Instrumentation No.3	through	143C-T68-T18-T1025 Laboratory Accreditation of Calibration No.0001
3.4. Certified Reference Material No. 2.4 to 2.8	Incomparable	Primary measurement method- Harned cell using distilled water/sodium chloride, all the reagents are the standard substance preparation and certified by CPNICHM Lab is accredited to ISO 17030 and ISO/IEC 17025
3.5. Certified Reference Material No.2.7	Incomparable to	804 Polymers 15, 1494 28.05.2022, 804 Polymers 40, 46, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804,

4. This certificate was modified only for this book review as reflected

^a This series of coefficients results if records are shown as dots on plots and values of coefficients are

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Calibration Report

Certificate No.: 350219148141
 Equipment: pH Meter
 Resolution: 0.01 pH : 1 mV
 Manufacturer: METTLER TOLEDO
 Model: Smart Easy pH
 Serial No.: 120030712
 Type: Bench top
 ID No.: UAE WAS 05372553
 Date of Calibration: 24 March 2023
 Calibration Results:
 1. Calibration of pH Meter
 (Manual Temperature Compensation at 25 °C)

Page 3 of 5

Measured pH	OC Voltage Reading (mV)	Average Indicator Reading		Uncertainty (± 2σ)	Coverage Factor (k = 2)
		mV	pH		
5	414.120	414	5.83	0.08	2.00
6	268.813	268	5.82	0.08	2.00
8	177.685	178	6.82	0.08	2.00
9	88.505	89	6.83	0.08	2.00
7	0.020	0	7.82	0.08	2.00
9	38.154	-89	8.83	0.08	2.00
10	-177.460	-177	10.08	0.08	2.00
12	-206.811	-206	12.08	0.08	2.00
14	-414.117	-414	14.08	0.08	2.00

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

Equipment	pH Electrode	Type	Chemical Electrode
Manufacturer	METTLER TOLEDO	Model	Indust 8000
Serial No.	1708880	ID No.	82A
Performance of Electrode system (Three-Point Calibration at pH 4, pH 7 and pH 10)			

Certified Value (25 °C (pH))	Average Indicator Reading		Relative Slope (%)	Uncertainty (± 2 σ)	Coverage Factor (k = 2)
	pH	mV			
-0.08	4.01	107	-	0.0071	2.00
6.88	6.86	-22	87.88	0.0015	2.00
12.078	12.01	-128	87.88	0.0008	2.00
6.888	6.88	14	-	0.0003	2.00

PC-012 Revision: 01 Date: 20-04-05

Calibration Report

Certificate No.: 2302181-001-01
 Equipment: Digital Thermometer with RTD (pH Meter)
 Resolution: 0.1 °C
 Model: Secondary pH
 Serial No.: 1231625212
 ID No.: UAE WAS 05372553
 Manufacturer: METTLER TOLEDO
 Date of Calibration: 24 March 2023

Page 4 of 5

Location: Chemical Calibration Laboratory, National Food Institute
 Environment Condition:
 Ambient Temperature: 25 °C ± 1 °C
 Relative Humidity: 55 % ± 5 %

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 :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDELD THERMOMETER	1521	A85997	TE 660035-01	10-Dec-23	NATIONAL FOOD INSTITUTE
Platinum Resistance Thermometer (PRT)	385	509201			

Support Equipment : - Low Temperature Bath (ISOCAL-6), Model: Europe-5 Plus Basic, S/N: 341593/2

3. This certificate is traceable to International System of Units (SI Units).
4. This certificate was certified only for the instrument was 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

PC-012 Revision: 01 Date: 20-04-05

Calibration Report

Certificate No.: 2302131-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
 Reagents: 0.1 °C Model: SevenEasy pH
 Serial No.: 123654321 ID No.: IAC.WAS.002/2553
 Manufacturer: METTLER TOLEDO
Date of Calibration: 24 March 2023

Page 3 of 3

Calibration point:
Calibration result:

15.0, 25.0 and 30.0 °C
 - The probe was immersed in liquid bath or dry bath to a minimum depth of 120 mm.
 - Description of probe, model: N/A S/N: N/A
 Dimension of probe: Diameter 3 mm, Length 120 mm.
 Sheath material: N/A

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.2	14.999	-0.2	0.12
25.2	24.999	-0.2	0.12
30.2	30.000	-0.2	0.12

Notes

- 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 -----

4-23-013 Revision: 01 Date: 26-04-66

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Certificate of Calibration

Equipment: CONDUCTIVITY METER
 Model: L4455
 Serial No. (or ID.): 16300366
 Manufacturer: SI Analytics
 Electrode Serial No.: 16070067
 Condition: In Condition
Certificate No.: C24220084
Issued Date: 22 March 2022
Job No.: KSPH2203267
Page: 1 of 2
Model: LF413T
Brand: SI Analytics

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 Wachirathamsewini 57, Sukhumvit 101/1 Rd.,
 Bangkok, Prakanong, Bangkok 10260 Thailand

Calibration By: Mr. Wasen Nuchnabee
Calibration Date: 22 March 2022

The Method used: In house method, SPCC-WI-48, 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



(Mr. Wasen Nuchnabee)
 Person in charge

(Mr. Dumrong Boonsaporn)
 Authorized signatory

This certificate is issued in accordance with the rules 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 in 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 additional non specified conditions. The results relate only to the items tested, calibrated as specified. The report shall not be reproduced except in full without approval of SPC RT Co., Ltd.

เอกสารไม่ควบคุม
 SPCC-FRM-C24-66: 23 Nov 2022



Certificate of Calibration

Equipment: CONDUCTIVITY METER
Model: Lab 855
Serial No. (or ID): 16300368
Manufacturer: SI Analytics
Electrode Serial No. Condition: 16070087 In Condition
Certificate No.: C24230059
Issued Date: 16 March 2023
Job No.: KSPRC2304472
Page: 1 of 2
Brand : SI Analytics

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

Environment Condition: Temperature 23 °C ± 2 °C
Humidity 50 %RH ± 15 %RH

Calibration Place: Environment Laboratory, DKSH Technology Limited,
2533 Sukhumvit Road, Bangkok,
Phraekhanong, Bangkok 10260 Thailand

Calibration By: Mr. Atachai Ngamcharat
Calibration Date: 16 March 2023

The Method used: In house method, CAL-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. (ISOMET 17034) Certificate No. 838312, 838313, 838316

(Mr. Atachai Ngamcharat)

Person in charge

(Mr. Nitnun Srihawan)

Authorized signatory

This certificate is issued for the purpose 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 in this certificate 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 serviced. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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CAL-FM-C24-06-12 Sep 2022

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Certificate No.: C24230059

Page: 2 of 2

Calibration Results:

Before Adjustment

Standard Conductivity Solution	Unit Under Calibration Reading	Correction	Coverage Factor (k)	Uncertainty (±)
25.000 µS/cm	24.5 µS/cm	0.500 µS/cm	2.00	0.21 µS/cm
1413.0 µS/cm	1403 µS/cm	10.0 µS/cm	2.00	9.0 µS/cm
111.3 mS/cm	108.5 mS/cm	2.80 mS/cm	2.00	0.67 mS/cm

After Adjustment : at 1413 µS/cm

Standard Conductivity Solution	Unit Under Calibration Reading	Correction	Coverage Factor (k)	Uncertainty (±)
25.000 µS/cm	24.8 µS/cm	0.200 µS/cm	2.00	0.21 µS/cm
1413.0 µS/cm	1413 µS/cm	0.0 µS/cm	2.00	9.0 µS/cm
111.3 mS/cm	109.8 mS/cm	2.50 mS/cm	2.00	0.67 mS/cm

The End of Certificate

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CAL-FM-C24-06-12 Sep 2022



ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: KSP92304472

วันที่: Lab 805

ชนิดเครื่องวัด: CONDUCTIVITY METER

หมายเลขเครื่อง: 16300366

ตารางสอบ (ปี)		รายการตรวจสอบ	ตรวจสอบ (ปี)		หมายเหตุ
16 Mar 2023			16 Mar 2023		
ปี	ใบ		ปี	ใบ	
		General			
<input type="checkbox"/>	<input type="checkbox"/>	1. ความถูกต้องเครื่อง	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	3. สวิตช์ On – off เครื่อง (On-Off Switch)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input type="checkbox"/>	<input type="checkbox"/>	
		Spectrophotometer			
<input type="checkbox"/>	<input type="checkbox"/>	6. แบตเตอรี่ไฟฟ้า (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ความถูกต้องความยาวคลื่น (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. แสงที่ผ่าน (UV < 3,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	10. แสงที่ผ่าน (Visible < 5,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	11. เซลล์ควบคุมตัวอย่าง (Carousel Module)	<input type="checkbox"/>	<input type="checkbox"/>	
		pH Meter and Conductivity Meter			
<input type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	13. เซลล์มาตรฐาน Electrode (Level KCl)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดป้องกัน Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	15. ขั้วไฟฟ้าไทเทเนียม (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
		Turbidimeter			
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่น (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. เซลล์มาตรฐานความขุ่น (>= 2.5 ไมครอน 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
		Automatic Rinsing			
<input type="checkbox"/>	<input type="checkbox"/>	18. ส่วน Rinse 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. ระบบล้างและเติมสารละลาย	<input type="checkbox"/>	<input type="checkbox"/>	

หมายเหตุ: Electrode ใช้งานอยู่ที่ 25.1°C ใน Control Waterbath ที่ 25.0 ± 0.1°C

Mr. Atachai Ngamchanat

Service Engineer

เอกสารไม่ควบคุม

CAL-FRM-R31-03 29 Jul 2022

DKSH Technology Limited
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Delivering Growth - In Asia and Beyond



ศูนย์ทดสอบและมาตรฐานอาหาร
กรมส่งเสริมการค้าระหว่างประเทศ
Ministry of Commerce
Promoter for National Calibration National Food Institute
Food Calibration Laboratory Service Center



Calibration Certificate

Certificate No.: 2203120-001-01

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

Address: 3 Soi Udomsak 41, Sukhumvit Road,
Bangchak, Prakhonong, Bangkok 10260

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Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: AB204-S/FACF
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 Saebo
Scientist

Approved by

(Mr. Phengphet Tuntit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue:

7 June 2022

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 responsibility to recognize national standards and to the units of measurement related 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-03-006 Revision: 01 Date: 12-04-01

เอกสารไม่ควบคุม
เอกสารไม่ควบคุม
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CERTIFICATE OF CALIBRATION

Page 1 of 5

Certificate No. : SP22-016
Customer : United Analyst and Engineering Consultant Co.,Ltd. (Head Office)
Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phraekhanong, Bangkok 10260

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Agilent Technologies

Model : Cary 60

Serial No. : MY15410009

ID No. : N/A

Received Date : 23 May 2022

Calibration Date : 23 May 2022

Issue Date : 26 May 2022

Condition Instrument : Good

Calibrated by :  (Mr. Tanawat Rattichai) **Approved by :**  (Ms. Chonticha Sengsena)
 Technical Manager Quality Manager

The calibration result is applied only to the above specified item and may be used outside its scope or date and place of calibration only.
 The measurement capability of the laboratory and its responsibility to recognized national standards and to the acts of measurement realized in 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

PM-708-02-001 1.1 (2021)

REPORT OF CALIBRATION

Page 2 of 5

Certificate No. : SP22-016
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 Sigma 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.

เอกสารไม่ควบคุม

PM-708-02-001 1.1 (2021)

REPORT OF CALIBRATION

Certificate No. : SP22-016

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Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UVC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.0000	0.0000	0.0028	2.00
	0.5787	0.5755	0.0032	0.0031	2.00
	1.0490	1.0436	0.0054	0.0029	2.00
	2.1000	2.1847	0.0053	0.0075	2.00
440	0.0000	0.0000	0.0000	0.0028	2.00
	0.5607	0.5588	0.0019	0.0034	2.00
	1.0247	1.0232	0.0015	0.0035	2.00
	2.1229	2.1211	0.0018	0.0082	2.00
465	0.0000	0.0000	0.0000	0.0028	2.00
	0.5236	0.5197	0.0039	0.0029	2.00
	0.9634	0.9625	0.0009	0.0028	2.00
	1.9763	1.9752	0.0011	0.0070	2.00
546.1	0.0000	-0.0001	0.0001	0.0028	2.00
	0.5191	0.5171	0.0020	0.0031	2.00
	1.0003	0.9984	0.0019	0.0033	2.00
	1.9987	1.9946	0.0041	0.0084	2.00
590	0.0000	0.0000	0.0000	0.0028	2.00
	0.5523	0.5509	0.0014	0.0030	2.00
	1.0809	1.0799	0.0010	0.0029	2.00
	2.0391	2.0329	0.0062	0.0080	2.00
635	0.0000	0.0000	0.0000	0.0028	2.00
	0.5601	0.5584	0.0017	0.0031	2.00
	1.0512	1.0498	0.0014	0.0029	2.00
	1.9294	1.9265	0.0029	0.0082	2.00

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REPORT OF CALIBRATION

Certificate No. : SP22-016

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Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UVC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.0001	-0.0001	0.0050	2.00
	0.7478	0.7421	0.0057	0.0056	2.00
257	0.0000	0.0000	0.0000	0.0050	2.00
	0.8686	0.8619	0.0067	0.0059	2.00
313	0.0000	0.0000	0.0000	0.0050	2.00
	0.2912	0.2896	0.0016	0.0051	2.00
350	0.0000	0.0000	0.0000	0.0050	2.00
	0.6448	0.6403	0.0045	0.0055	2.00

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REPORT OF CALIBRATION

Certificate No. : SP22-016

Wavelength Accuracy :

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CRM's Values	UUC Reading	Correction	Uncertainty	Coverage factor
(nm.)	(nm.)	(nm.)	(nm.)	k
243.72	242.0	-0.28	0.18	2.00
279.45	279.5	-0.05	0.18	2.00
287.81	287.5	0.31	0.18	2.00
354.06	353.5	0.50	0.18	2.00
360.93	360.9	0.43	0.18	2.00
418.59	418.0	0.59	0.18	2.00
445.94	445.4	0.54	0.18	2.00
453.66	453.2	0.46	0.18	2.00
460.02	459.7	0.32	0.18	2.00
536.59	536.2	0.39	0.18	2.00
637.96	638.3	-0.32	0.18	2.00
431.38	431.0	0.58	0.18	2.00
472.50	472.5	0.00	0.18	2.00
513.47	513.5	-0.03	0.18	2.00
528.86	528.5	0.38	0.18	2.00
575.17	575.0	0.17	0.18	2.00
585.35	585.0	0.35	0.20	2.00
684.40	684.7	-0.50	0.18	2.00
740.72	740.8	-0.08	0.20	2.00
748.55	748.5	0.05	0.18	2.00
807.03	807.3	-0.27	0.18	2.00
879.28	879.0	0.28	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 TIS1 accredited

- End of Certificate -

เอกสารไม่ควบคุม

PM-708-02 001 (11/2021)

CERTIFICATE OF CALIBRATION

Certificate No. : SP23-007

Page 1 of 5

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

Address : 3 Soi Udomsak 41, Sukhumvit Road, Bangchak, Phrakhanung, 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 : 6 January 2023

Calibration Date : 6 January 2023

Issue Date : 10 January 2023

Condition Instrument : Used

Calibrated by :

(Mr.Tanawat Rittidach)
Technical Manager

Approved by :

(Ms. Charnichha Sangsriam)
Quality Manager

This calibration result is applied only to the status submitted (new and was found accurate in above on date and place of calibration only)

The measurement capability of the laboratory and its traceability to recognized national standards and in the case of measurement indicated in 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

PM-708-02 001 (11/2023)

REPORT OF CALIBRATION

Certificate No. : SP23-007

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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 Sarna 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.

เอกสารไม่ควบคุม

PM-708-02 Rev. 1/1/2021

REPORT OF CALIBRATION

Certificate No. : SP23-007

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Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor A
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5787	0.575	0.0037	0.0031	2.00
	1.0490	1.044	0.0050	0.0029	2.00
	2.1900	2.181	0.0090	0.0080	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5607	0.558	0.0027	0.0034	2.00
	1.0247	1.021	0.0037	0.0035	2.00
	2.1229	2.115	0.0079	0.0081	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5236	0.520	0.0036	0.0030	2.00
	0.9634	0.961	0.0024	0.0029	2.00
	1.9763	1.968	0.0083	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	1.993	0.0057	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	2.031	0.0081	0.0080	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5601	0.562	-0.0019	0.0032	2.00
	1.0512	1.052	-0.0008	0.0030	2.00
	1.9294	1.923	0.0064	0.0075	2.00

เอกสารไม่ควบคุม

PM-708-02 Rev. 1/1/2021

REPORT OF CALIBRATION

Certificate No. : SP23-007

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Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
215	0.0000	0.000	0.0000	0.0050	2.00
	0.7478	0.743	0.0048	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	0.639	0.0058	0.0055	2.00

เอกสารไม่ควบคุม

PM-30-02 Rev. 1.11.2023

REPORT OF CALIBRATION

Certificate No. : SP23-007

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Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.54	240.8	0.74	0.18	2.00
279.40	278.5	0.90	0.18	2.00
388.70	388.0	0.70	0.18	2.00
354.22	353.5	0.72	0.18	2.00
361.26	360.5	0.76	0.18	2.00
418.48	417.8	0.68	0.21	2.00
446.70	445.9	0.80	0.18	2.00
453.20	452.5	0.70	0.18	2.00
460.00	459.5	0.50	0.18	2.00
536.90	536.0	0.90	0.18	2.00
637.94	637.1	0.84	0.18	2.00
440.74	440.0	0.74	0.18	2.00
472.22	471.5	0.72	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	574.0	0.60	0.18	2.00
584.48	584.6	0.88	0.20	2.00
684.63	684.0	0.63	0.18	2.00
740.27	740.0	0.27	0.20	2.00
748.28	747.5	0.78	0.18	2.00
867.16	866.5	0.66	0.18	2.00
879.70	879.0	0.70	0.18	2.00

Remark : - UUC = Unit Under Calibration

- NA = Not Available

- The result reported accuracy of measurement is based on the specified uncertainty of measurement multiplied by the coverage factor k.

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

- * Indicates not TDS accredited

- End of Certificate -

เอกสารไม่ควบคุม

PM-30-02 Rev. 1.11.2023

CERTIFICATE OF CALIBRATION

Certificate No. : SP23-008

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

Address : 3 Soi Udomsak 41, Sukhumvit Road, Bangchak, Phra Khanong, 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 : 6 January 2023

Calibration Date : 6 January 2023

Issue Date : 10 January 2023

Condition Instrument : Used

Calibrated by : (Mr. Tanawat Rittirath) Technical Manager

Approved by : (Ms. Chonticha Sangsorn) Quality Manager

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

The measurement capability of the laboratory and its traceability to recognized national standards and in 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

PM-708-02 Rev. 1.0 (2021)

REPORT OF CALIBRATION

Certificate No. : SP23-008

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	95915	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 Saeua Scientific Limited

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

PM-708-02 Rev. 1.0 (2021)

REPORT OF CALIBRATION

Certificate No. : SP23-008

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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	0.000	0.0000	0.0028	2.00
	0.5787	0.574	0.0047	0.0031	2.00
	1.0490	1.044	0.0050	0.0029	2.00
	2.1900	2.182	0.0080	0.0080	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5607	0.558	0.0027	0.0034	2.00
	1.0247	1.021	0.0037	0.0035	2.00
	2.1229	2.114	0.0089	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5236	0.520	0.0036	0.0030	2.00
	0.9634	0.960	0.0034	0.0029	2.00
	1.9763	1.969	0.0073	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5191	0.516	0.0031	0.0031	2.00
	1.0003	0.997	0.0033	0.0033	2.00
	1.9987	1.991	0.0077	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5523	0.550	0.0023	0.0030	2.00
	1.0809	1.078	0.0029	0.0030	2.00
	2.0391	2.032	0.0071	0.0080	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5603	0.558	0.0021	0.0031	2.00
	1.0512	1.049	0.0022	0.0030	2.00
	1.9294	1.922	0.0074	0.0079	2.00

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REPORT OF CALIBRATION

Certificate No. : SP23-008

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Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7478	0.744	0.0038	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8686	0.863	0.0056	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2912	0.290	0.0012	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6448	0.639	0.0058	0.0055	2.00

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