



ภาคผนวก จ



เอกสารสอบเทียบเครื่องมือ



List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Tisch Environmental, Inc.	TE-5025A 3393	Jiranatee Associates Co., Ltd.	CL-004-65	26 Jul 22	25 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)	23P1396	9 May 23	8 May 24	-
3	Air Flow Meter	Particulate Matter (PM _{2.5})	Mesa Labs	DeltaCal DC1 155895	Innovative Instrument Co., Ltd.	23-AFM-188	30 Aug 23	29 Aug 24	-
4	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particulate Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23P1855	2 Jun 23	1 Jun 24	-
5	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particulate Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	22H1200	6 Jun 23	5 Jun 24	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050148	UAE Consultant Co., Ltd.	15022023	15 Feb 23	14 Feb 24	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050149	UAE Consultant Co., Ltd.	09012023	9 Jan 23	8 Jan 24	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050150	UAE Consultant Co., Ltd.	16012023	16 Jan 23	15 Jan 24	-
9	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050151	UAE Consultant Co., Ltd.	15022023	15 Feb 23	14 Feb 24	-
10	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04N199E15A01D3	21 Jun 21	21 Jun 24	-
11	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43C 43C-0611116459	UAE Consultant Co., Ltd.	07042023	7 Apr 23	6 Apr 24	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
12	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387062	UAE Consultant Co., Ltd.	07032023	7 Mar 23	6 Mar 24	-
13	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387063	UAE Consultant Co., Ltd.	07042023	7 Apr 23	6 Apr 24	-
14	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387064	UAE Consultant Co., Ltd.	14022023	14 Feb 23	13 Feb 24	-
15	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04N199E15A01D3	21 Jun 21	21 Jun 24	-
16	Wind Speed/Wind Direction	WS/WD	LSI LASTEM	E-LOG305 20070022	Thai Meteorological Department	284/23	15 Aug 23	14 Aug 24	-
17	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV36 107224	Innovative Instrument Co., Ltd.	23-ACT-117	4 Aug 23	3 Aug 24	-
18	Sound Level Meter	L _{Aeq} 24 hours, L _{Amax} , L _{A90} , L _{A10}	Larson Davis	LX72 0005286	Sithiporn Associates Co., Ltd.	ACL22081	25 Jan 22	25 Jan 24	-
19	Sound Level Meter	L _{Aeq} 24 hours, L _{Amax} , L _{A90} , L _{A10}	Larson Davis	LX72 0005289	Sithiporn Associates Co., Ltd.	ACL22082	25 May 22	24 May 24	-

List of Instruments Certification for Water Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Water									
1	pH Meter	pH	YSI	pH100A JC03354	Technology Promotion Association (Thailand-Japan)	22CH1728	21 Dec 22	20 Dec 23	-
2	DO Meter	DO	Horiba	LAQUA-DO210 HE1D0010	Technology Promotion Association (Thailand-Japan)	23TW220	27 Sep 23	26 Sep 24	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Workplace									
1	Sound Level Meter	$L_{Aeq, 2 \text{ hours}}, L_{Amax}$	Rion, Japan	NL-42 01010786	Sithiporn Associates Co., Ltd.	ACL23121	11 Apr 23	10 Apr 24	-
2	Noise Dosimeter	Noise Dosimeter	3M	NP-DLX NXQ040007	Innovative Instrument Co.,Ltd.	23-NDM-224	29 Aug 23	28 Aug 24	-

แผนการติดตามตรวจสอบคุณภาพสิ่งแวดล้อม
บริษัท เกษตรสมบูรณ์ ไบโอ-เทคโนโลยี่ จำกัด
เดือนกรกฎาคม-ธันวาคม พ.ศ. 2566

บัญชีรายการเครื่องมือหลักของห้องปฏิบัติการ สำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือสำหรับวิเคราะห์คุณภาพอากาศ									
1	Analytical Balance (Readability 0.1 mg)	ฝุ่นละอองรวมเฉลี่ย (TSP) ฝุ่นละอองขนาดเล็กไม่เกิน 10 ไมครอน	Mettler-Toledo	AB204-S / 1128312528	Technology Promotion Association (Thailand-Japan)	23MM1331	7 Apr 23	5 Apr 24	-
2	Analytical Balance (Readability 0.1 mg)	(PM-10)	Mettler-Toledo	AB204-S/FACT / B108115858	Technology Promotion Association (Thailand-Japan)	23MM1332	7 Apr 23	5 Apr 24	-
เครื่องมือหลักวิเคราะห์คุณภาพน้ำ									
3	pH Meter	ความเป็นกรด-ด่าง (pH) อุณหภูมิ (Temp)	Mettler-Toledo	Seven Easy S20 / 1230525212	National Food Institute, Ministry of Industry, Thailand	2302181-001-01	24 Mar 23	22 Mar 24	-
4	Analytical Balance (Readability 0.01 mg)	ของแข็งแขวนลอย ของแข็งละลายน้ำทั้งหมด (TDS)	Mettler-Toledo	XSR205DU / C210685394	Technology Promotion Association (Thailand-Japan)	23MM113	26 Apr 23	24 Apr 24	-
5	Hot Air Oven		Memmert	UF55 / B216.1666	Technology Promotion Association (Thailand-Japan)	22TM1490	19 Oct 22	18 Oct 23	-
6	BOD Incubator	4. บีโอดี (BOD)	Arco	UC4-1320 / (UAE.WAQ.015/2561)	Technology Promotion Association (Thailand-Japan)	23TM269	15 Feb 23	14 Feb 24	-
7	BOD Incubator		Arco	UR-1320 / (UAE.WAQ.018/2551)	Technology Promotion Association (Thailand-Japan)	23TM375	12 Apr 23	10 Apr 24	-
8	DO Meter	ดีโอ (DO)	YSI	4010-2W / 20260326	Technology Promotion Association (Thailand-Japan)	22TW240	27 Oct 22	26 Oct 23	-
9	Analytical Balance (Readability 0.1 mg)	น้ำมันและไขมัน (Oil & Grease)	Mettler-Toledo	XSR204 / C117635043	National Food Institute, Ministry of Industry, Thailand	2302827-001-01	10 May 23	8 May 24	-
10	COD Reactor (Heating Block)	ซีโอดี (COD)	Hanna	H1839800-02 / H0185001	Hanna Instruments (Thailand) Ltd.	HIT-2312-0362	10 Mar 23	9 Mar 24	-

บัญชีรายการเครื่องมือหลักของห้องปฏิบัติการ สำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
11	UV-VIS Spectrophotometer	ซีลฟอด,ไนเตรท,ซีโอที (COD) 6. แอมโมเนีย ไนโตรเจนไนไตรเจน ไนเตรท ไนโตรเจนไนไตรเจน	Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP23-007	6 Jan 23	5 Jan 24	-
12	Atomic Absorption Spectrophotometer (AAS)	สารหนู (As), ปอท (Hg) แมงกานีส (Mn) โซเดียม (Na)	Agilent Technologies	System ID:G8432A AA240FS / MY13160001	Thailand Institute of Scientific and Technological Research(TISTR)	MTA_ACI_No. 387/66	2 Feb 23	1 Feb 24	-
13	Inductively Coupled Plasma (ICP)	ตะกั่ว (Pb) แคดเมียม (Cd) ค่าอัตราส่วนการดูดซับโซเดียม (SAR)	Agilent Technologies	System ID:G8015A GB015AA / MY18030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	30 Nov 22	29 Nov 23	-
14	Digester Unit	ทีเคเอ็น (TKN)	FOSS TECATOR	2520auto / 91794469	National Food Institute, Ministry of Industry, Thailand	2302413-001-01	30 Mar 23	28 Mar 24	-

Due Date of Calibration* : Schedule the program once a year at least once a year.



JIRANATEE ASSOCIATES CO., LTD.

Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TS-17025
CALIBRATION 0357

Jirantees Associates Co., Ltd.
63/14-15, 67/35-36
Petchburi 7/7, Rd. Witthapara, Bangkoknoi,
Bangkok 10600 (Thailand)
Tel: +6608880812
Mobile: +66883399453
E-mail: jnac-calibration@jiranteec.com
Web site: www.jiranteec.com

Flow measurement laboratory
Calibration services department

CERTIFICATE OF CALIBRATION

Certificate No. : CL-004-65

Page 1 of 2 Pages

MEASUREMENT ITEM
MANUFACTURER
MODEL/TYPE
SERIAL NUMBER
ID NUMBER
CONDITION AS-RECEIVED
CUSTOMER

: Top Load Office
: Tich Environments, Inc.
: TE-5025A
: 3393
: UAE EFM 064/2560
: Used item
: United Analytical and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrakhanong,
Bangkok 10260

RECEIVED DATE
MEASUREMENT DATE
ISSUE DATE

: 15 Jul 2022
: 25 Jul 2022
: 26 Jul 2022

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

CALIBRATION CONDITION:

Preconditioning
Measurement Condition

: 24 hours at ambient conditions.

: The average values during measurement are 24.7 °C and 52.1 %RH.

Calibration procedure:

The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roots Meter) Model G65/MCN-2-0p. The WH-CL-004 was used as a calibration guideline.

Traceability:

This certificate provides a traceability of the measurement to recognized the national standards, and to realization of the international system of units (SI) through the VSL (National Metrology Institute of Netherlands) via Certificate number: 02211501

Uncertainty of Measurement:

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

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

☐ Mr. Soravit Thachalad
☒ Miss Jitraporn Lertsomphol

Approved signature



THIS CERTIFICATE REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION IS IN WRITING FROM THE LABORATORY

เอกสารไม่ควบคุม



JIRANATEE ASSOCIATES CO., LTD.

Continuation of Certificate of Calibration Number CL-004-65

Page 2 of 2 Pages

MEASUREMENT RESULTS:

The Orifice gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Roots Meter). The Humid air was used as a medium in the system. The standard conditions are 25 °C (98.15 K) and 760 mmHg for standard temperature and standard pressure respectively.

Table 1: The results of Q Standard calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [T _a] °C	Temperature [T _m] °C	Ap_meter mmHg	Ap_Office InH ₂ O	γ	Standard Flow [Q _s] m ³ /min
1	0.699	756.468	24.680	23.730	55.667	1.705	1.303	0.647
2	1.001	756.479	24.910	24.180	61.363	3.454	1.855	0.918
3	1.114	756.484	24.550	23.970	41.751	4.535	2.136	1.051
4	1.166	756.510	24.470	23.900	30.652	5.138	2.264	1.118
5	1.415	756.534	24.400	24.150	30.200	7.619	2.757	1.357

Slope (m): 2.04689

Intercept (b): -0.02301

Correlation coefficient (r): 0.99987

Uncertainty (k=2): 0.010 m³/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [T _a] °C	Temperature [T _m] °C	Ap_meter mmHg	Ap_Office InH ₂ O	γ	Standard Flow [Q _s] m ³ /min
1	0.699	756.468	24.680	23.730	55.667	1.705	0.819	0.649
2	1.001	756.479	24.910	24.180	61.363	3.454	1.167	0.922
3	1.114	756.494	24.550	23.970	41.751	4.535	1.336	1.054
4	1.166	756.510	24.470	23.900	30.652	5.138	1.422	1.121
5	1.415	756.534	24.400	24.150	30.200	7.619	1.731	1.360

Slope (m): 1.18208

Intercept (b): -0.01449

Correlation coefficient (r): 0.99987

Uncertainty (k=2): 0.011 m³/min

End of Certificate of Calibration



เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484

Certificate of Calibration

Certificate No. : 23P1396
Page : 1 of 2

Equipment : U Tube Manometer
Manufacturer : Dwyer
Model : 1221-36-W/M
Serial No. : UAE.EMA2.094/2555
ID No. :
Condition As-Received: Used item
Received Date: 26 April 2023
Calibration Date: 09 May 2023
Reference: 2304-0703WSC
Submitted by: United Analyst and Engineering Consultant Co., Ltd.
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1010 mbar
81 Soi Udomsuk 41, Sukhumvit Road, Bangkok,
Prakhianong, Bangkok 10260

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

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments
Standard according to in-house calibration procedure CP-P04, using " DKD-R 6-1 : Calibration of Pressure
Gauges, Edition 03/2014 " as a guidelines.

Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Pressure Calibrator	PC106P	1189	MP-0137-22	24 Aug 2023

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

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

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

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

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suwit Aussaree
Issue Date : 11 May 2023

Approved Signatory

Surat Suwannasri
Atapol Panurach

เอกสารไม่ควบคุม
B 0314238



Cert.No.: 23P1396
Page: 2 of 2

Result of calibration:- Without adjustment
Function:- Pressure Measurement
Increasing Pressure
Range: 0 inH₂O to 36 inH₂O
Scale Interval: 0.1 inH₂O (The Fifth Estimate)

Applied Pressure (inH ₂ O)	UUC Indication		ΔP (inH ₂ O)	Error (inH ₂ O)
	High-port side (inH ₂ O)	Low-port side (inH ₂ O)		
0.00	0.00	0.00	0.00	0.00
2.00	1.00	-1.00	2.00	0.00
4.00	2.00	-2.00	4.00	0.00
6.00	3.00	-3.02	6.02	0.02
8.00	4.00	-4.02	8.02	0.02
10.00	5.00	-5.02	10.02	0.02
12.00	6.00	-6.02	12.02	0.02
14.00	7.00	-7.02	14.02	0.02
16.00	8.00	-8.02	16.02	0.02
18.00	9.00	-9.02	18.02	0.02
20.00	9.98	-10.04	20.02	0.02
22.00	10.98	-11.04	22.02	0.02
24.00	11.98	-12.04	24.02	0.02
26.00	12.98	-13.04	26.02	0.02
28.00	13.98	-14.04	28.02	0.02
30.00	14.98	-15.06	30.04	0.04
32.00	15.98	-16.06	32.04	0.04
34.00	16.98	-17.08	34.06	0.06
35.80	17.96	-18.00	35.96	0.16

The uncertainty of measurement was ± 0.11 inH₂O

* UUC = Unit Under Calibration

* ΔP = High-port side - Low-port side

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

-60-

เอกสารไม่ควบคุม
a 1160345

Certificate of Calibration

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

Certificate No : 23-TPM-425

Request No : Req-2023-1656

Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Air Flow meter
Manufacturer : BGI
Model : Delta Cal DC1
Serial Number : 155895
Resolution : 0.1 °C
ID Number : UAE.EFM.076/2560

Range Calibration : 20 °C to 50 °C

Type of Sensor : RTD

Sensor Diameter (mm) : 3

Calibration Position (mm) : 45

Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 7 August 2023
Calibrated Date : 30 August 2023

Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/INGCO, Model: GT11 / RTD100, SN:

08000057, ID: 02-TPM Which was calibrated on 27 February 2023, Calibration Certificate No. : QR23-

0494

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

Calibration 0292

Note

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

Approved By :

Mr. [Redacted] ngart

Technical Manager

Issue Date : 30 August 2023

End of Certificate

Calibrated By :

[Redacted] dcessakul



INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SUNTINAKORN 11 TAMBON BANG KAE0,
AMPHOE BANG PHUJ SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: (66)0-2116-5860-1 FAX: (66)0-2116-7140

Certificate of Calibration

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

Certificate No : 23-TPM-459
Request No : Req-2023-1976

Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Air Flow meter
Manufacturer : BGI
Model : Delta Cal DC1
Serial Number : 155895
Resolution : 0.1 °C
ID Number : UAE.EFM.0762560

Range Calibration : 20 °C to 50 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 3
Calibration Position (mm) : 45
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 14 September 2023
Calibrated Date : 27 September 2023
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

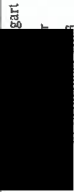
Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT11/RTD100, SN: 08000057, ID: 02-TPM Which was calibrated on 27 February 2023, Calibration Certificate No. : QR23-0494

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

Note

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

Approved By :



Issue Date :

เอกสารไม่ควบคุม

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuer.
FM-708 TPM-01 Rev.01 Issue date 13/02/20

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SUNTINAKORN 11 TAMBON BANG KAE0,
AMPHOE BANG PHUJ SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: (66)0-2116-5860-1 FAX: (66)0-2116-7140



Certificate No : 23-TPM-459

Request No : Req-2023-1976

Page : 2/2

Calibration Note

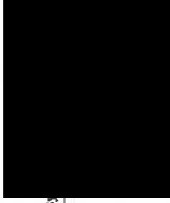
UUC Adjustment : No Adjust

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
TT	20.031	19.8	+0.2	0.13
	25.033	24.8	+0.2	0.13
	30.033	29.9	+0.1	0.13
	35.034	34.9	+0.1	0.13
	40.034	39.8	+0.2	0.13
	45.039	44.8	+0.2	0.13
	50.042	49.8	+0.2	0.13

End of Certificate

Calibrated By :



Signature

เอกสารไม่ควบคุม

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuer.
FM-708 TPM-01 Rev.01 Issue date 13/02/20



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



Certificate of Calibration

Certificate No. : 23P1855
Page : 1 of 2

Equipment : Aneroid Barometer
Manufacturer : Barigo
Model : -
Serial No. : -
ID No. : UAE.ANV.122/2550
Condition As-Received: Used Item
Received Date: 26 May 2023
Calibration Date: 02 June 2023
Reference: 2305-0919WVSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1007 mbar

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

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

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments
Standard according to in-house calibration procedure CP-P10, using " DKD-R 6-1 ; Calibration of Pressure
Gauges, Edition 03/2014 " as a guidelines.

Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DPI142	1422505046	MP-0094-23	03 May 2024

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

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

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

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suksan Khankaew
Issue Date : 08 June 2023

Approved Signature

1) Sure Suwannasri
1) Allapol Panurach

เอกสารไม่ควบคุม
B 0316955



Cert.No.: 23P1855
Page: 2 of 2

Result of calibration:- Without adjustment
Function:- Absolute Pressure Measurement
Range: 960 hPa to 1030 hPa
Scale Interval: 1 hPa (The Fifth Estimate)

Increasing Pressure		Applied Pressure (hPa)		950.59		960.35		980.35		990.39		1001.01		1011.15		1020.94		1031.45	
UUC* Indication (hPa)		960.0		970.0		980.0		990.0		1000.0		1010.0		1020.0		1030.0		1030.0	
Error (hPa)		1.50		0.41		-0.35		-0.39		-1.01		-1.15		-0.94		-1.45		-1.45	

Decreasing Pressure		Applied Pressure (hPa)		1031.45		1021.51		1012.16		1002.38		992.17		982.20		970.69		959.32	
UUC* Indication (hPa)		1030.0		1020.0		1010.0		1000.0		990.0		980.0		970.0		960.0		960.0	
Error (hPa)		-1.45		-1.61		-2.16		-2.38		-2.17		-2.20		-0.69		0.68		0.68	

The uncertainty of measurement was ± 0.30 hPa

* UUC = Unit Under Calibration

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

-000-

เอกสารไม่ควบคุม
B 1163304



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



Certificate of Calibration

Certificate No. : 23H1200
Page : 1 of 2

Equipment : Dial Thermo-Hygrometer
Manufacturer: Barigo
Model : -
Serial No.: -
ID No.: UAE.ANV.130/2550
Condition As-Received: Used Item
Received Date: 26 May 2023
Calibration Date: 30 May 2023
Reference: to 06 June 2023
2305-0919WSC
Ambient Temperature: (25 ± 3) °C
Relative Humidity: (50 ± 20) %

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

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

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

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

Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Hygro-M2 Dew Point Monitor	5112	2360195	20703	02 Aug 2023
2) Handheld Thermometer With Sensor	1523	3240076	231305	15 Mar 2024

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

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

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

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

Calibrated by : Somchal Durnwor
Issue Date : 07 June 2023

Approved Signatory :

[✓] Chakrit Waewwanjua
[] Pornthippa Tameyskul
[] Viporn Tantiyawutti

เอกสารไม่ควบคุม
B 0316274



Cert. No.: 23H1200
Page.: 2 of 2

Result of Calibration:- Function:

Humidity Measurement

Before Adjustment

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	48	7.9	1.6
25.0	60.0	63	3.0	1.7
25.0	80.0	76	-4.0	1.9

Result of Calibration:- Function:

Humidity Measurement

After Adjustment

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	44	3.9	1.6
25.0	60.0	60	0.0	1.7
25.0	80.0	75	-5.0	1.9

Result of Calibration:- Function:

Without Adjustment
Temperature Measurement

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
19.987	20.0	0.013	0.72
30.016	30.0	-0.016	0.72
39.944	39.5	-0.444	0.72

UUC* : Unit Under Calibration

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

-o0o-

เอกสารไม่ควบคุม
a 1165295

MULTI-POINT GAS TEST REPORT

Test Date : Feb 15, 2023

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : CM19050148

Standard Gas Concentration

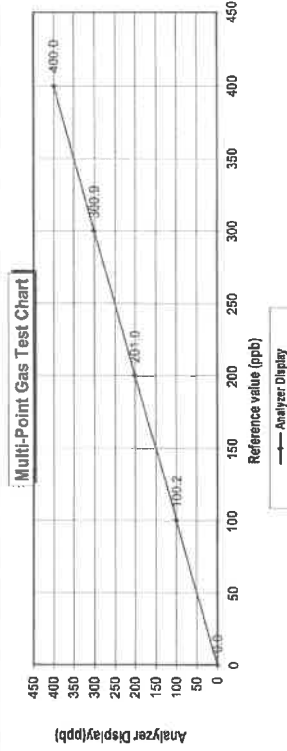
Sulphur Dioxide (SO₂) 44.68 PPM Thermo Scientific
Nitric Oxide (NO) 45.94 PPM 146i
Methane (CH₄) - PPM 1180540071
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : E80143262
Expiration Date : Jun 21, 2024

Dilutor Detail

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

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.00	0.00	0.00
Level 2 20.00%	100.0	0.20	0.20	0.20
Level 3 40.00%	201.0	1.00	0.50	0.50
Level 4 60.00%	300.9	0.90	0.30	0.30
Level 5 80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb				
Average Difference (%) 0.20				
Acceptable Limit $\pm 5\%$				



MULTI-POINT GAS TEST REPORT

Test Date : Jan 9, 2023

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : CM19050149

Standard Gas Concentration

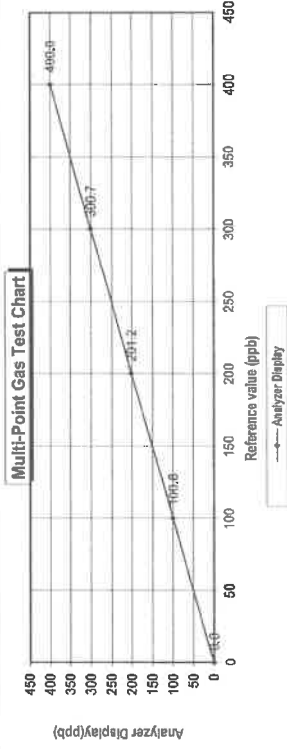
Sulphur Dioxide (SO₂) 44.68 PPM Thermo Scientific
Nitric Oxide (NO) 45.94 PPM 146i
Methane (CH₄) - PPM 1180540071
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : E80143262
Expiration Date : Jun 21, 2024

Dilutor Detail

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

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.00	0.00	0.00
Level 2 20.00%	100.8	0.80	0.79	0.79
Level 3 40.00%	201.2	1.20	0.60	0.60
Level 4 60.00%	300.7	0.70	0.23	0.23
Level 5 80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb				
Average Difference (%) 0.32				
Acceptable Limit $\pm 5\%$				



MULTI-POINT GAS TEST REPORT

Test Date : Jan 16, 2023

Equipment : Gas Analyzer (NO₂) Model : 421
Manufacturer : Thermo Scientific Serial Number : CM19050150

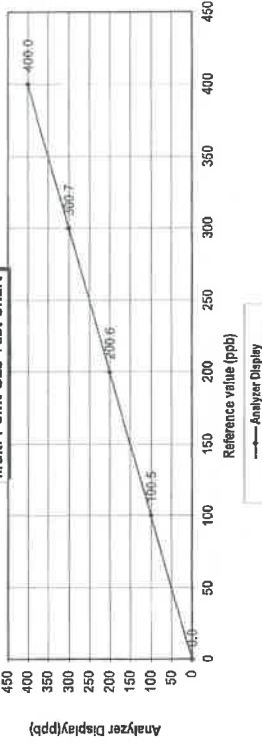
Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.68 PPM Thermo Scientific
Nitric Oxide (NO) 45.94 PPM 1461
Methane (CH₄) 984.8 PPM 1180540071
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 21, 2024

Multi-point gas test data

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

Multi-Point Gas Test Chart



MULTI-POINT GAS TEST REPORT

Test Date : Feb 15, 2023

Equipment : Gas Analyzer (NO₂) Model : 421
Manufacturer : Thermo Scientific Serial Number : CM19050151

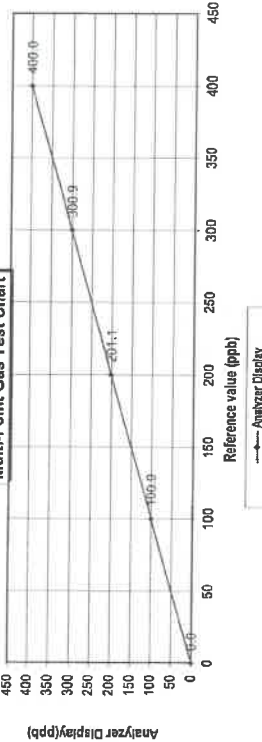
Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.68 PPM Thermo Scientific
Nitric Oxide (NO) 45.94 PPM 1461
Methane (CH₄) 984.8 PPM 1180540071
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 21, 2024

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.00	0.00	0.00
Level 2 20.00%	100.9	0.90	0.89	0.89
Level 3 40.00%	201.1	1.10	0.55	0.55
Level 4 60.00%	300.9	0.90	0.30	0.30
Level 5 80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range : 500.0 ppb				
:Acceptable Limit ± 5%				
Average Difference (%) 0.35				

Multi-Point Gas Test Chart



CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04N199E16A01D3
Cylinder Number: E0143262
Laboratory: 124 - Durham (SAP) - NC
PGVP Number: B22021
Gas Code: CO,NO,NOX,SO2,BALN
Reference Number: 122-402135167-1
Cylinder Volume: 144.4 CF
Valve Pressure: 2015 PSIG
Valve Outlet: 660
Certification Date: Jun 21, 2021
Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Testability Protocol" for Assay and Certification of Gaseous Calibration Standards (May 2012) document EPA 809-0-02-001. Using the assay procedure listed, Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. The assay and certification results are based on the use of this calibration mixture. All concentrations are on a molar basis unless otherwise indicated.

Do Not Use This Cylinder below 100 psig. L.e. 0.7 megapascals.

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Assay Dates
NOX	45.00 PPM	45.99 PPM	G1	06/14/2021, 09/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	06/14/2021, 09/21/2021
SULFUR DIOXIDE	45.00 PPM	44.98 PPM	G1	06/14/2021, 09/21/2021
CARBON MONOXIDE	1000 PPM	994.8 PPM	G1	06/14/2021
NITROGEN	Balance			

CALIBRATION STANDARDS		
Type	Lot ID	Expiration Date
NTRM	20681120	Feb 02, 2025
PRM	12386	Feb 20, 2020
GMS	401423838102	Feb 18, 2023
NTRM	16911043	Jun 17, 2022
NTRM	14860119	Nov 15, 2025
The SRM, PRM or ACUM noted above is only in reference to the GMS used in the assay and not part of the analysis.		

ANALYTICAL EQUIPMENT	
Instrument/Make/Model	Last Multipoint Calibration
Nicolet 8700 AHR0801333 CO	Jun 03, 2021
Nicolet 8700 AHR0801333 NO	Jun 03, 2021
Nicolet 8700 AHR0801333 NO2	Jun 03, 2021
Nicolet 8700 AHR0801333 SO2	Jun 03, 2021

Test Data Available Upon Request
NOTES: PO #5221002807
GROSS WT: 28.40kg
NET WT: 4.73kg



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

For Release

MULTI-POINT GAS TEST REPORT

Test Date : Apr 7, 2023

Equipment : Gas Analyzer (SO₂) Model : 43C
Manufacturer : Thermo Electron Corporation Serial Number : 43C-0611116459

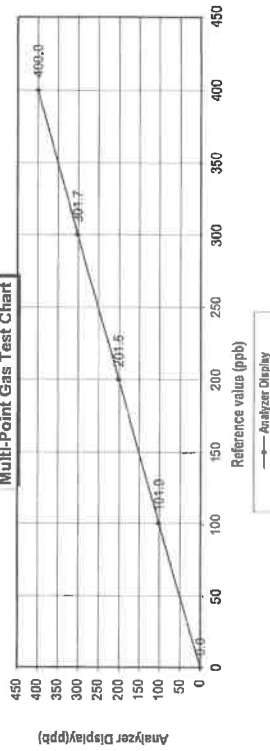
Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) 964.8 PPM
Carbon Monoxide (CO) 964.8 PPM
Cylinder No. : E0143262
Expiration Date : Jun 24, 2024

Diluter Detail
Manufacturer : Thermo SCIENTIFIC
Model : 1461
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	1.90	1.86	1.86
Level 3	40.00%	200.0	201.5	1.50	0.74
Level 4	60.00%	300.0	301.7	1.70	0.56
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range 500.0 ppb					0.63
Acceptable Limit \pm 5%					

Multi-Point Gas Test Chart



MULTI-POINT GAS TEST REPORT

Test Date : Mar 7, 2023

Equipment : Gas Analyzer (SO₂) Model : 431
Manufacturer : Thermo SCIENTIFIC Serial Number : CM22387062

Standard Gas Concentration

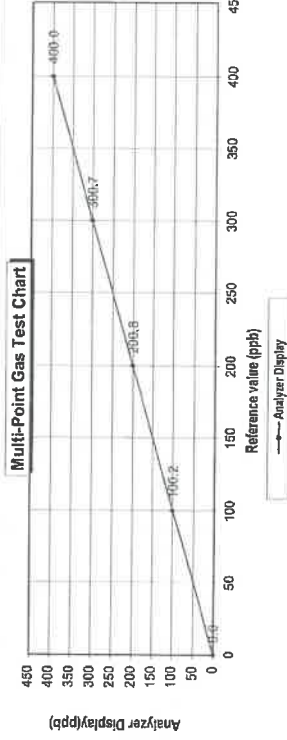
Sulphur Dioxide (SO₂) 44.68 PPM Manufacturer : Thermo SCIENTIFIC
Nitric Oxide (NO) 45.94 PPM Model : 1461
Methane (CH₄) - PPM Serial Number : 1180540071
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 24, 2024

Dilutor Detail

PPM Manufacturer : Thermo SCIENTIFIC
PPM Model : 1461
PPM Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	0.20	0.20	0.20
Level 3	40.00%	200.8	0.80	0.40	0.40
Level 4	60.00%	300.7	0.70	0.23	0.23
Level 5	80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb					
:Acceptable Limit \pm 5%					
Average Difference (%) 0.17					



MULTI-POINT GAS TEST REPORT

Test Date : Apr 7, 2023

Equipment : Gas Analyzer (SO₂) Model : 431
Manufacturer : Thermo SCIENTIFIC Serial Number : CM22387063

Standard Gas Concentration

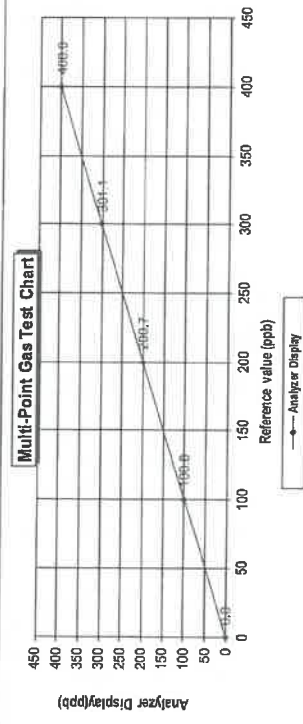
Sulphur Dioxide (SO₂) 44.68 PPM Manufacturer : Thermo SCIENTIFIC
Nitric Oxide (NO) 45.94 PPM Model : 1461
Methane (CH₄) - PPM Serial Number : 1180540071
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 24, 2024

Dilutor Detail

PPM Manufacturer : Thermo SCIENTIFIC
PPM Model : 1461
PPM Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.8	0.80	0.79	0.79
Level 3	40.00%	200.7	0.70	0.35	0.35
Level 4	60.00%	301.1	1.10	0.37	0.37
Level 5	80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb					
:Acceptable Limit \pm 5%					
Average Difference (%) 0.30					



MULTI-POINT GAS TEST REPORT

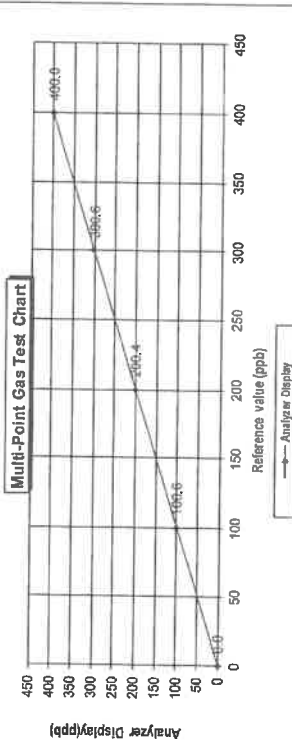
Test Date : Feb 14, 2023

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : CW22387064

Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) 984.8 PPM
Carbon Monoxide (CO) 1180540071 PPM
Cylinder No. : E80143262
Expiration Date : Jun 24, 2024

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	0.60	0.60	0.60
Level 3	40.00%	200.4	0.40	0.20	0.20
Level 4	60.00%	300.6	0.60	0.20	0.20
Level 5	80.00%	400.0	0.00	0.00	0.00
Remark	Measuring Range 500.0 ppb Acceptable Limit $\pm 5\%$				



CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: E04N189E15A01D3 Reference Number: 122-402135167-1
Cylinder Number: EB0143262 Cylinder Volume: 144.4 CF
Laboratory: 124 - Durham (SAP) - NC Cylinder Pressure: 2016 PSIG
PGVP Number: B22021 Valve Outlet: 660
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Jun 21, 2021
Expiration Date: Jun 21, 2024

Calibration performed in accordance with EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012) document EPA 600/6-12/031, and the manufacturer's instructions. The manufacturer's instructions do not require correlation for analytical reference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. These uncertainties are based on the use of this calibration measure. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
NOX	45.00 PPM	45.98 PPM	G1	$\pm 1.4\%$ NIST Traceable
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	$\pm 1.4\%$ NIST Traceable
SULFUR DIOXIDE	45.00 PPM	44.69 PPM	G1	$\pm 1.0\%$ NIST Traceable
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	$\pm 0.7\%$ NIST Traceable
NITROGEN	Balance			

CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
NTRM	20081120	CT080688	49.52 PPM NITRIC OXIDE/NITROGEN	$\pm 1.0\%$
PRM	12388	D885025	9.51 PPM NITROGEN DIOXIDE/AIR	$\pm 2.0\%$
GMS	40142338102	CS050581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	$\pm 2.1\%$
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	$\pm 0.8\%$
NTRM	14080119	CC434277	980.9 PPM CARBON MONOXIDE/NITROGEN	$\pm 0.6\%$
The SRM, PRM or RCM listed above is only in reference to the GMS used in the assay and not part of the analysis.				

ANALYTICAL EQUIPMENT	
Instrument/Make/Model	Analytical Principle
Nicolet 6700 A-HR0801333 CO	FTIR
Nicolet 6700 A-HR0801333 NO	FTIR
Nicolet 6700 A-HR0801333 NO2	FTIR
Nicolet 6700 A-HR0801333 SO2	FTIR

Triled Data Available Upon Request

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



CERT 3082.01

เอกสารไม่ควบคุม

The analytical test results reported on this certificate relate only to the material tested and are not a guarantee of quality. This concludes the test report.

please

Calibration Certificate



Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 15August, 2023

Certification No. 284/23

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : LSI

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

Serial No. : Data Logger 20070022 wind speed and wind direction 20040186
ID No. : No 16

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 1012.5 hPa

NATIONAL STANDARD WIND TUNNEL :

- Thermal Anemometer 642 S/N 91563
- HOOK GAGE NO 1425 Pitot Tube Theodor Friedrichs Type 0800 0000 serial 9023
- N.I.S.T. Test Reference Number 731/241460
- Ultrasonic Anemometer Model DA-850-3TV (sensor TR-90AH)
- Serial Number 110730029 (sensor 120629566)

JAPAN QUALITY ASSURANCE ORGANIZATION

Calibrated by
Mr. Watchapol Subwat
Mechanical Engineer



The Result of Calibration

Certification No. 284/23

15August, 2023

Page : 2 of 2

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches	Vacuum inches	Pressure hPa	Velocity m/sec	Correction m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	2.9	0.12
5.00	-	-	-	4.5	0.50
7.04	-	-	-	6.9	0.14
9.02	-	-	-	8.6	0.42
11.01	-	-	-	11.0	0.01
13.01	-	-	-	12.6	0.41
15.01	-	-	-	15.0	0.01
17.02	-	-	-	16.6	0.42
20.02	-	-	-	19.9	0.12

Wind Aloft Plotting Board

US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Mr. Watchapol Subwat
Mechanical Engineer



Certificate of Calibration

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

Certificate No : 23-ACT-117
Request No : Req-2023-1546

Unit Under Calibration Details

Measurement item : Acoustic Calibrator
Manufacturer : SVANTEK
Model : SV 36
Serial Number : 107224
ID : UAE.EFM.171/2564

Class : I
Range : 94 , 114 dB / 1000 Hz
Instrument Status : Used

Calibration Environment and Details

Temperature : (23 ±2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ±0.0 hPa)
Received Date : 21 July 2023
Calibration Date : 4 August 2023
Location of Calibration : LAB 1 Acoustic

Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EI	31 May 2024
THD Multimeter	2015	1047765	NIMT	31 January 2024

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

Note

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

Calibrated By :

Approved By :
Calibration Engineer Supervisor

Service Calibration Engineer

Issue Date : 4 August 2023

Certificate No : 23-ACT-117
Request No : Req-2023-1546

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	94.03	0.03	-	-	0.13	0.25
114 dB / 1000 Hz	114.11	0.11	-	-	0.13	0.25

Frequency of Sound pressure level

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

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

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (%)	Error (%)	Measured (%)	Error (%)		
94 dB / 1000 Hz	0.26	-	-	-	0.40	2.5
114 dB / 1000 Hz	0.38	-	-	-	0.40	2.5

Note :

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

End of Calibration

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Siphorn Rd, Bangbunmu, Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.com



MSC-TS1-715 17025
CALIBRATION 0394

Cert. No. : ACL22081
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : LARSON DAVIS
Model : LxT2/ Microphone 375B02 / Preamplifier PRLM x T2B
Serial No.: 0005286 / 011740 / 056087
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 : Nathakorn Pisutpaisan

Approved by :

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.

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Cert. No. : ACL22081
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	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 03/0264	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	NA-42KAI	34560495	AA-3003-21	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).

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

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

Result of calibration :

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	36.8

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight Acceptance Limits
125	-0.1	0.1	± 1.5
1000	-0.2	-0.2	± 1.0
8000	3.1	3.2	±5.0

Continuation of Calibration Certificate

Cert. No. : ACL22081
Job No. : VC65AC0044
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

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

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	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.8	-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
SEL	0.25	1	N/A	N/A	N/A	1.5 ; -5.0
	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, Lopeak (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

Continuation of Calibration Certificate

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

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive 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 - weight	137.0	137.0	0.0	±0.3

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

End of Calibration Certificate

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sindhorn Rd. Bangbunru, Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



NSC-TS1-75-17025
CALIBRATION 0394

Cert. No. : ACL22082
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : LARSON DAVIS
Model : LX172/ Microphone 375B02 / Pre-amplifier; PRML x T2B
Serial No.: 0005289 / 011732 / 056076
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 : Nadiakorn Pisutpaisan

Approved by :

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

เอกสารไม่ควบคุม

QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL22082
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	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY33220104	EEL.BP. 03/0264	10-Feb-22
Digital Multimeter	33461A	MY33220076	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	NA-42KAI	34560495	AA-3003-21	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).

เอกสารไม่ควบคุม

QF-TS12-04-04-020664

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

Result of calibration :**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)
29.6

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 84 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
			Acceptance Limits
			± 1.5
			± 1.0
			±5.0

Continuation of Calibration Certificate

Cert. No. : ACL22082
Job No. : VC65AC0044
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight Acceptance Limits
63	0.0	0.0	±2.0
125	0.0	0.1	±1.5
250	0.0	0.0	±1.5
500	0.0	0.0	±1.5
1000	0.0	0.0	±1.0
2000	0.0	0.1	±2.0
4000	0.0	-0.1	±3.0
8000	0.0	0.1	±5.0
16000	-0.1	0.1	±5.0-(-∞)

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

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL22082
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

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL22082
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	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.8	-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
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	135.8	-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

Continuation of Calibration Certificate

Cert. No. : ACL22082
Job No. : VC65AC0044
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate



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



HSC-TB-167025
CALIBRATION 0008

Cert.No.: 22CH1728
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : EcoSense
Model : pH100A
Serial No. : JC03354
ID No. : UAE.EFM.0632562(ENV.pH03/62)
Condition As-Received :
Received Date : 20 December 2022
Calibration Date : 21 December 2022
Reference : 2212-0568WSC-1
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

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

Approved by :
Approved Signatory

(✓) Malee Bulkrua
() Sathip Meangmai
() Warakorn Lemgagrakul
Issue Date : 23 December 2022

The Uncertainties are for a confidence probability of approximately 95 %

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

เอกสารไม่ควบคุม



Cert.No.: 22CH1728
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument : -
Instrument
1) Document Process Calibrator 54030049 130RC116 Cert. No. 22E2769 Due Date 24 Aug 2023
2) Ref. Standard Thermometer 2188080 130RC044 221285 20 Oct 2023
This certification is traceable to the International System of Unit maintained at:-
- Traceable to National Institute of Metrology (Thailand), NIMT

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	826588	09 July 2024
pH 6.987	CPA chem	823322	20 June 2023
pH 10.008	CPA chem	826590	09 July 2023

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

Calibration Results

Function : mV Measurement
Performing standard curve by Fluke at pH (4.7/7.10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
			mV	pH		
pH Meter S/N.: JC03354	pH	mV				
	4.00	177.48	177	4.01	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-178	10.01	0.58	2.00

เอกสารไม่ควบคุม



Cert.No.: 22CH1728
Page.: 3 of 3

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4.7(7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode S/N.: 220202SIAG05377	4.008	4.01	159	0.0079	2.00
	6.987	6.99	-14	0.011	2.00
	6.987	7.00	-14	0.011	2.00
	10.008	10.01	-190	0.0095	2.00

Function : Temperature Measurement

(°) Without adjustment

This equipment was connected with Temperature Probe;

- Model :

- Serial No. : 220202SIAG05377

Dimension of probe;

- Length : 112 mm.

- Diameter : 12 mm.

- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
25.0	25.001	25.1	0.099	0.13	2.00
30.0	30.002	30.1	0.098	0.13	2.00
35.0	35.003	35.1	0.097	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

-000-



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

Cert.No.: 23TW220
Page.: 1 of 2

Certificate of Testing

Equipment :

DO Meter

Manufacturer :

Horiba

Model :

LAQUA-DO210

Serial No. :

HE1D0010

ID No. :

UAE.EFM.208/2564(EFM.DO.10/64)

Received Date :

26 September 2023

Test Date :

27 September 2023

Reference :

2309-0884WSC-5

Submitted by :

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

Laboratory Condition :

Temperature (25 ± 5) °C

Test Procedure :

Humidity (50 ± 20) %

In - house method : CP-CH9

by Comparison Technique with Azide Modification Method

Tested by :

Walalak Sirithean

Approved by :

Approved Signatory

(✓) Saithip Meangmai

() Warakorn Lengagatrakul

() Ponpan Paipim

Issue Date :

28 September 2023

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

B 0325262



Cert.No.: 23TW220
Page.: 2 of 2

Condition of this result of calibration

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

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1) Burette	-	130BU10	23CG1172	22 Mar 2025
2) Balance	1124013382	140RC008	23MM18	20 Feb 2024

2. Standard Material :-

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

Result : Dissolved Oxygen Meter Adjustment With Air 100 %
Dissolved Oxygen Probe No.: 9K1B0023

Titration Method (Azide Modification Method)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.16	8.18	0.016

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency. The environmental impact control and present to organization it may concerned intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full without written approval of the laboratory

-o0o-



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



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

Cert. No.: 23LM169
Page.: 1 of 2

Certificate of Calibration

Equipment : DO Meter with Sensor
Manufacturer : Horiba
Model : LAQUA-DO210
Serial No. : HE1D0010
ID No. : UAE.EFM.208/2564(EFM.DO.10/64)
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : TPA Chemistry Calibration Laboratory

Received Order : 25 September 2023
Calibrated Date : 29 September 2023
Ambient Temperature : (28 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V

Calibrated by : Krisda Malee

Approved by :

() Ponthipha Tameya
() Ponpan Paipim
(✓) Suwit Imjai

Issue Date : 5 October 2023

The Uncertainties are for a confidence probability of approximately 95 %

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

เอกสารไม่ควบคุม
a 1182621

เอกสารไม่ควบคุม
A 0053011



Equipment: DO Meter with Sensor
Condition As-Received: Used Item
Reference: 2309-0884WSC-6
Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPT) into Temperature Bath.
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Digital Thermometer	2188080	221285	TPA	21 Oct 2023

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

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

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

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with 25.001, S/N.: 9K1B0023

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
25.0	100	25.001	25.1	0.099	0.16	2.00
30.0	100	29.997	30.1	0.103	0.16	2.00
35.0	100	35.000	35.1	0.100	0.16	2.00

UUC* : Unit Under Calibration

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

-000-

Cert. No.: 23LM169
Page: 2 of 2

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd.,Banglumru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



NSC-TS17025
CALIBRATION 0994

Cert. No. : ACL23121
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/Microphone UC-52 / Preamplifier NH-24
Serial No.: 01010786 / 194541 / 14664
ID No.: UAE.EFM.0892565

Condition As Found : GOOD

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

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

Received Date : 05 APRIL 2023
Calibration Date : 10-11 APRIL 2023
Date of Issue : 18 APRIL 2023

Calibrated by : Nathakorn Pisulpaisan

Approved by :

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.

QF-TS12-04-04-020664

เอกสารแนบ
a 1183568

Continuation of Calibration Certificate

Cert. No. : ACL23121
Job No. : VC66AC0044
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

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

Continuation of Calibration Certificate

Cert. No. : ACL23121
Job No. : VC66AC0044
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	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

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

Continuation of Calibration Certificate

Cert. No. : ACL23121
Job No. : VC66AC0044
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

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

Frequency Weighting	Measured value (dB)
A - weight	10.8
C - weight	16.9
Flat	22.6

3. Acoustical signal tests of frequency weightings

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

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

Continuation of Calibration Certificate

Cert. No. : ACL23121
Job No. : VC66AC0044
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	-0.1	-0.1	-0.1
125	-0.1	0.0	-0.1
250	0.0	0.0	-0.1
500	0.0	0.0	-0.1
1000	0.0	0.0	0.0
2000	0.0	0.0	0.0
4000	0.0	0.0	0.0
8000	0.0	0.1	0.1

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

Continuation of Calibration Certificate

Cert. No. : ACL23121
Job No. : VC66AC0044
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.1	0.1	±1.1
79.0	79.0	0.0	±1.1
74.0	74.1	0.1	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.1	0.1	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	28.9	-0.1	±1.1
28.0	28.0	0.0	±1.1
27.0	26.9	-0.1	±1.1
26.0	26.0	0.0	±1.1
25.0	24.9	-0.1	±1.1

Continuation of Calibration Certificate

Cert. No. : ACL23121
Job No. : VC66AC0044
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.4	-1.0	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

Continuation of Calibration Certificate

Cert. No. : ACL23121
Job No. : VC66AC0044
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.0	±1.5
89.6	89.6		

12. High level stability

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

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

Certificate of Calibration

Customer UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 23-NDM-224
Name 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260 Request No : Req-2023-1649
Address

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Manufacturer 3M
Model NP-DL X
Serial Number NXQ040007
ID UAE:EPM.0132559
Resolution 0.1 dB
Calibration Environment and Details
Temperature 23 °C ± 2 °C
Humidity 40 %RH ± 20 %RH
Barometric Pressure 1013 hPa ± 10 hPa
Received Date 7 August 2023
Calibrated Date 29 August 2023
Calibration Procedure In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration Lab Acoustic

Microphone Class : 2
Microphone Model : -
Microphone S/N : -
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : Used

Reference Standard

Instrument	Brand	Model	S/N.	Due calibration	Traceability
Multifrequency Calibrator	Quest	Quest-cal	188272	25 July 2024	TSI
Standard Microphone	GRAS	40AN	188273	6 October 2023	GRAS
Sine Generator	Svantek	Svm401	131	12 October 2023	WK Electric
Timer	EXTECH	-	05-AC7	20 March 2024	TPA

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

Calibrated

Approved

Calibration Officer

Calibration Engineer Supervisor
Issue Date : 29 August 2023

Certificate No : 23-NDM-224
Request No : Req-2023-1649

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement		Tolerances Limit (%)
	Ref (s)	UUC (s)	Ref (P_{μ}^2)	UUC (P_{μ}^2)	
FAST / A / 70-140	120	120	3.79	3.72	-1.85
Calibrator Setting					
1000 Hz 114 dB					3.1

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand 3M, Model AC-300, SN AC-300001087

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY (± dB)	Tolerances Limit (± dB)
	A (dB)	C (dB)		
FAST / 70-140 STD Setting				
*63 Hz	0.4	0.5	0.40	2.0
125 Hz	0.3	0.5	0.40	1.5
250 Hz	0.1	0.3	0.40	1.5
500 Hz	0.1	0.3	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	-0.4	-0.3	0.40	2.0
4000 Hz	0.0	0.0	0.40	3.0
8000 Hz	-0.7	-0.9	0.40	5.0

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

เอกสารนี้ควบคุม

Certificate No : 23-NDM-224
Request No : Req-2023-1649

3. Linearity of response to steady signals

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

UUC Setting	FAST / A / High											
	Ref (dB)	70.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0		
1000 Hz	Level A (dB)	70.2	80.1	90.0	100.0	110.0	114.0	120.0	130.0	140.1		
	Error (dB)	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	
8000 Hz	Ref (dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9		
	Level A (dB)			88.2	98.1	109.0	112.9	118.9	128.8	138.9		
	Error (dB)			0.3	0.2	0.1	0.0	0.0	-0.1	-0.1	0.0	
63 Hz	Ref (dB)						87.8	93.8	103.8	113.8		
	Level A (dB)						87.8	93.7	103.7	113.7		
	Error (dB)						0.0	-0.1	-0.1	-0.1		
Tolerances Limit (\pm dB)												
UNCERTAINTY (\pm dB)												
0.3												

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			Tolerances Limit (%)
	Ref (s)	UUC (s)	Ref (P_{μ}^2)	UUC (P_{μ}^2)	Error (%)	
FAST / A / 70-140						
Calibrator Setting						
1000 Hz 110 dB	27	27	0.30	0.30	0.00	
1000 Hz 110 dB	45	45	0.50	0.50	0.00	
1000 Hz 110 dB	90	90	1.00	0.99	-1.00	5.6
1000 Hz 110 dB	180	180	2.00	1.98	-1.00	
1000 Hz 120 dB	36	36	4.00	3.99	-0.25	
1000 Hz 120 dB	72	72	8.00	7.99	-0.13	
1000 Hz 120 dB	90	90	10.00	9.98	-0.20	
1000 Hz 120 dB	180	180	20.00	20.04	+0.20	5.6
1000 Hz 120 dB	360	360	40.00	40.05	+0.12	
1000 Hz 120 dB	720	720	80.00	80.19	+0.24	

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

เอกสารนี้ควบคุม

Certificate No 23-NDM-224

Request No Req-2023-1649

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement		Tolerances
	Ref	UUC	Ref	Error	
FAST / A / 70-140	(s)	(s)	(Pa ² h)	(Pa ² h)	(Pa ² h)
Calibrator Setting	2846	2846	1.00	-0.01	-0.29 - +0.41
4000 Hz 95 dB					

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement		Tolerances
	Ref	UUC	Ref	Error	
FAST / A / 70-140	(s)	(s)	(Pa ² h)	(%)	(%)
Calibrator Setting	2846	2846	1.00	-1.00	-21 - +26
Burst 1 ms, 95 dB	900	900	1.00	-1.00	-29 - +41
Burst 1 ms, 100 dB	143	143	1.00	0.00	-29 - +41

5. Response to unipolar pulse

UUC Setting	Time		Exposure Measurement		Tolerances
	Ref	UUC	Ref	Different	
FAST / A / 70-140	(s)	(s)	(Pa ² h)	(%)	(%)
Calibrator Setting	2846	2846	1.00	-1.66	-21 - +26
Continuous Rectangle +	29	29	10.26		
Continuous Rectangle -			10.09		

* Indicates non accredited

End of Certificate

Cert.No.: 23MM331

Page.: 1 of 3

Certificate of Calibration

Equipment : Electronic Balance

Manufacturer : Mettler Toledo

Model : AB204-S

Serial No. : 1128312528

ID No. : UAE.AIR.019/2550

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

Location : Balance Room 2

Received order : 07 April 2023

Calibration Date : 07 April 2023

Ambient Temperature : 15 °C to 40 °C

Relative Humidity : 30 % to 90 %

Calibrated by : Suwit Imjai

Approved by :

() Pomthippa Tameyakul

(/) Malee Buikrua

Issue Date :

10 April 2023

The Uncertainties are for a confidence probability of approximately 95 %

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

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

เอกสารไม่ควบคุม



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-00150C-1
Cert.No.: 23MM331
Page: 2 of 3

Procedure used :-

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

Condition of this result of calibration

1. Reference standard instruments:-

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15884	24053	70RC007	MM-001D-22	20 Jan 2024
2. This certificate is valid only to the item calibrated on date and place of calibration.					
3. This result of calibration was made on requested at the point specified by customer.					
4. This certificate is not certified for any commercial transaction.					
5. This certification is traceable to the International System of Unit.					

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

Range capacity : 0 g to 220 g Resolution 0.0001 g

Before Adjustment :

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (\pm mg)	Coverage Factor (k)
100	99.9999	+0.0001	0.19	2.03
200	200.0001	-0.0001	0.29	2.00

After Adjustment :

1. Determination of the standard deviation of weighing machine

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

(n = 10)



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-00150C-1
Cert.No.: 23MM331
Page: 3 of 3

Result of calibration

2. Effect of off center loading

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

Position 1 (g)	Position 2 (g)	Position 3 (g)	Position 4 (g)	Position 5 (g)	Maximum difference between off-center and central loading (g)
-0.0001	-0.0002	+0.0004	-0.0001	-0.0006	0.0005

3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (\pm mg)	Coverage Factor (k)
Unload	0.0000	0.0000	0.15	2.13
0.1	0.0999	+0.0001	0.15	2.13
1	0.9999	+0.0001	0.15	2.13
5	4.9999	+0.0001	0.15	2.13
10	9.9999	+0.0001	0.15	2.11
20	20.0000	0.0000	0.15	2.11
50	50.0000	0.0000	0.16	2.06
70	69.9999	+0.0001	0.18	2.04
100	99.9999	+0.0001	0.19	2.03
150	150.0003	-0.0003	0.29	2.00
200	200.0005	-0.0005	0.29	2.00

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

-o0o-

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/44 PAITANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3000-29 FAX: 0-2719-9484



Cert.No.: 23MM332
Page.: 1 of 3

Certificate of Calibration

Equipment : Electronic Balance
Manufacturer : Mettler Toledo
Model : AB204-S /FACT
Serial No. : B108115858
ID No. : UAE.AIR.018/2555

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

Location : Balance Room 2

Received order : 07 April 2023
Calibration Date : 07 April 2023
Ambient Temperature : 15 °C to 40 °C
Relative Humidity : 30 % to 90 %

Calibrated by : Suwit Imjai

Approved by :

() Ponthippa Tamey
(/) Malee Butkruea

Issue Date : 10 April 2023

The Uncertainties are for a confidence probability of approximately 95 %

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

เอกสารไม่ควบคุม



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-00150C-2

Cert.No.: 23MM332
Page: 2 of 3

Procedure used :-

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

Condition of this result of calibration

1. Reference standard instruments:-

Instruments Model Serial No. ID No. Test report No. Due date
1) Standard Weight Set (E2) 15884 24053 70RC007 MM-0010-22 20 Jan 2024
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This result of calibration was made on requested at the point specified by customer.
4. This certificate is not certified for any commercial transaction.

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

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

Range capacity : 0 g to 220 g Resolution 0.0001 g

Before Adjustment :

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
100	100.0002	-0.0002	0.21	2.06
200	200.0003	-0.0003	0.29	2.00

After Adjustment :

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

Applied Weight (g)	Standard Deviation of Reading (g)
100	0.00009
200	0.00007

เอกสารไม่ควบคุม



มูลนิธิสถาบันพัฒนาอุตสาหกรรมอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center



NSC-TIS-7025
CALIBRATION 0081

Calibration Certificate

Certificate No.:

2302181-001-01

Client name:

UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Address:

3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Prakhong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1230525212
ID No.: UAE.WAS.003/2553
Order No.: 2302181
Operation No.: 2302181-001
Date of Receipt: 14 March 2023
Date of Calibration: 24 March 2023

Calibrated by

Mr.Pheraphat Tuanjit
Scientist

Date of issue:

24 March 2023

The uncertainties are for a confidence probability of approximately

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

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



เอกสารไม่ลับ



Equipment : Electronic Balance

Condition As-Received : Used Item

Reference : 2304-00150C-2

Result of calibration

2. Effect of off center loading

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

The weighing machine reading error obtained is given in the table

Position 1 (g)	Position 2 (g)	Position 3 (g)	Position 4 (g)	Position 5 (g)
+0.0001	-0.0003	+0.0003	+0.0006	+0.0002

3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.0000	0.0000	0.18	2.17
0.1	0.0999	+0.0001	0.18	2.17
1	0.9998	+0.0002	0.18	2.17
5	5.0000	0.0000	0.18	2.17
10	10.0000	0.0000	0.18	2.17
20	20.0000	0.0000	0.18	2.15
50	50.0001	-0.0001	0.19	2.11
70	70.0001	-0.0001	0.20	2.07
100	100.0002	-0.0002	0.21	2.06
150	150.0004	-0.0004	0.29	2.00
200	200.0005	-0.0005	0.29	2.00

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

-000-

เอกสารไม่ลับ

Calibration Report

Certificate No.: 2302181-001-01

Equipment:

pH Meter
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1230528212
Type: Bench top
ID No.: UAE.WAS.00322553

Resolution: 0.01 pH ; 1 mV
Model: SevenEasy pH
Serial No.: 1230528212
Type: Bench top
ID No.: UAE.WAS.00322553

Date of Calibration: 24 March 2023

Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature: (23.4 ± 1.5) °C
Condition of Equipment: Good Condition

Relative Humidity: (52 ± 3) %

Condition of this Results of Calibration

1. Calibration Method
In house method : WI-CC-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)
2. Reference Standards / Certified Reference Material

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fluke	22E1989	17 June 2023
2.2 Digital Thermometer	2709007	Fluke	CC-850557-01	30 October 2023
2.3 Thermo-Hygro Meter	NFLBT-H003417	PONPE	TE 650555-01	21 September 2023

Certified Reference Material	Lot. No.	Manufacturer	Ref. N	Expiry Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	873608	CPAchem	PH216.L5	16 February 2025
2.5 pH buffer 6.865 (Primary pH buffer Solution)	873609	CPAchem	PH217.L5	16 February 2025
2.6 pH buffer 10.01 (Primary pH buffer Solution)	873611	CPAchem	PH220.L5	16 February 2024
2.7 pH buffer 7.00 (Standard pH buffer Solution)	873612	CPAchem	PH107.L5	16 February 2024
3. This certification is traceable to The International System of Unit (SI Unit)

3.1 Instruments No.2.1	through	NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0061
3.2 Instruments No.2.2	through	NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0061
3.3 Instruments No.2.3	through	NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0061
3.4 Certified Reference Material No. 2.4 to 2.6	traceable to	Primary measurement method- Hamed cell using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
3.5 Certified Reference Material No.2.7	traceable to	BIM Ref H-13, pH 25.05.2022; BIM Ref H-16, LpH 02.06.2022; BIM Ref H-13, pH 25.05.2022; BIM Ref H-16, LpH 02.06.2022, the Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.



Calibration Report

Certificate No.: 2302181-001-01

Equipment:

pH Meter
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1230528212
Type: Bench top
ID No.: UAE.WAS.00322553

Resolution: 0.01 pH ; 1 mV
Model: SevenEasy pH
Serial No.: 1230528212
Type: Bench top
ID No.: UAE.WAS.00322553

Date of Calibration: 24 March 2023

Calibration Results:

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

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (±mV)	Coverage Factor (k)
		mV	pH		
0	414.120	414	0.00	0.58	2.00
2	295.814	296	2.00	0.58	2.00
4	177.484	178	4.00	0.58	2.00
6	59.160	59	6.00	0.58	2.00
8	0.000	0	7.00	0.58	2.00
8	-59.158	-59	8.00	0.58	2.00
10	-177.460	-177	10.00	0.58	2.00
12	-295.811	-296	12.00	0.58	2.00
14	-414.117	-414	14.00	0.58	2.00

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

Equipment: pH Electrode
Type: Combined Electrode
Manufacturer: METTLER TOLEDO
Model: InLab Solids
Serial No.: 1156883
ID.No. N/A

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

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.01	187	-	0.0071	2.00
6.865	6.88	22	97.88	0.0075	2.00
10.010	10.01	-160	97.86	0.0086	2.00
6.985	6.99	14	-	0.0083	2.00



Calibration Report

Certificate No.:

2302181-001-01

Equipment:

Digital Thermometer with RTD (pH Meter)

Resolution: 0.1 °C Model: SevenEasy pH

Serial No.: 1230525212 ID No.: UAE.WAS.003/2553

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
HANDHELD THERMOMETER	1521	A85997			NATIONAL FOOD INSTITUTE
Platinum Resistance Thermometer (PRT)	385	509201	TE 660039-01	10-Dec-23	

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

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

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



Calibration Report

Certificate No.:

2302181-001-01

Equipment:

Digital Thermometer with RTD (pH Meter)

Resolution: 0.1 °C Model: SevenEasy pH

Serial No.: 1230525212 ID No.: UAE.WAS.003/2553

Manufacturer: METTLER TOLEDO

Date of Calibration:

24 March 2023

Page 5 of 5

Calibration point:

15.0, 25.0 and 30.0 °C

Calibration result:

- 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	29.999	- 0.2	0.12

Note

* UUC* : Unit Under Calibration

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

End

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





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert.No.: 23MM113
Page.: 1 of 3

Certificate of Calibration

Equipment : Electronic Balance
Manufacturer : Mettler Toledo
Model : XSR205
Serial No. : C210685394
ID No. : UAE.WAO.010/2565

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

Location : Balance Room

Received order : 26 April 2023
Calibration Date : 26 April 2023
Ambient Temperature : 15 °C to 40 °C
Relative Humidity : 30 % to 90 %

Calibrated by : Man Pattanasornchai-boon

Approved by :
() Ponthippa Tameyakul
() Malee Butkruea
(✓) Suwit Imjai

Issue Date : 2 May 2023

The Uncertainties are for a confidence probability of approximately 95 %

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

เอกสารนี้ควบคุม



Equipment : Electronic Balance
Condition As-Received : Used item
Reference : 2304-0459OC-2
Cert.No.: 23MM113
Page: 2 of 3

Procedure used :-

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

Condition of this result of calibration

1. Reference standard instruments:-

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15884	24053	70RC007	MM-0010-22	20 Jan 2024
2. This certificate is valid only to the item calibrated on date and place of calibration.					
3. This result of calibration was made on requested at the point specified by customer.					
4. This certificate is not certified for any commercial transaction.					
5. This certificate is traceable to the International System of Unit.					

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

Range capacity :	0 g to 81 g	Resolution	0.00001 g
	81 g to 220 g	Resolution	0.0001 g

Before Adjustment :

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
80	79.99992	+0.00008	0.15	2.00
200	199.9995	+0.00005	0.29	2.00

After Adjustment :

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

Applied Weight (g)	Standard Deviation of Reading (g)
80	0.000007
200	0.000004

เอกสาร



Equipment :
Condition As-Received :
Reference :
Result of calibration

Electronic Balance
Used Item
2304-0459OC-2

2. Effect of off center loading

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

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

3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.00000	0.00000	0.014	2.11
0.05	0.04999	+0.00001	0.015	2.09
0.1	0.09999	+0.00001	0.015	2.07
1	1.00000	0.00000	0.018	2.04
5	5.00000	0.00000	0.026	2.00
20	20.00002	-0.00002	0.045	2.00
50	50.00002	-0.00002	0.080	2.00
80	80.00002	-0.00002	0.15	2.00
100	100.00000	0.00000	0.17	2.00
150	150.00000	0.00000	0.29	2.00
200	199.99999	+0.00001	0.29	2.00

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

-000-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
33/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



NEG-TB-TEST25
CALIBRATION 0008

Cert. No.: 22TM1490
Page: 1 of 3

Certificate of Calibration

Equipment : Hot Air Oven
Manufacturer : Memmert
Model : UF 55
Serial No. : B216.1666
ID No. : UAE.WAO.027/2559
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Lab Floor 2

Received Order : 19 October 2022
Calibration Date : 19 October 2022
Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$

Calibrated by : Preecha Hahlib

Approved by :

() Pornthippa Tameyakul
() Malee Buikrua
(✓) Suwit Imjai

Issue Date : 31 October 2022

The Uncertainties are for a confidence probability of approximately 95 %

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

เอกสารไม่ควบคุม

A 0046800



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2210-05750C-1

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

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

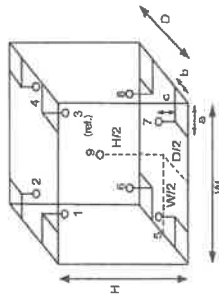
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (°) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Probe Installation Details :

a = 5.0 cm
b = 5.0 cm
c = 5.0 cm
D = 0.33 m
W = 0.40 m
H = 0.40 m
Capacity = 0.053 m³

Dimension of Chamber :

Ref. Std. ID No.: @ Calibration Point	
Position :	(104) °C (140,180) °C
1	18-04RTD-01 21-04TC-01
2	18-04RTD-02 21-04TC-02
3	18-04RTD-03 21-04TC-03
4	18-04RTD-04 21-04TC-04
5	18-04RTD-05 21-04TC-05
6	18-04RTD-06 21-04TC-06
7	18-04RTD-07 21-04TC-07
8	18-04RTD-08 21-04TC-08
9 (ref.)	18-04RTD-09 21-04TC-09

Environment during calibration		
Temp. (°C)	Beginning	Finished
REL.Humid. (%)	29	30
AC Supply (Volt)	47	40
	221	220



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2210-05750C-1
Result of Calibration :- (°) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
104.0	104.0	104.0	0.061	1.3	1.7	0.42	2
140.0	140.0	140.0	0.14	2.3	2.4	1.1	2
180.0	180.0	180.0	0.21	3.5	3.6	1.3	2

Measured Temperature (°C)								
Position			Position			Position		
1	2	3	4	5	6	7	8	9 (ref.)
104.0	103.076	103.876	103.777	104.124	104.667	104.426	103.928	104.370
140.0	138.199	139.189	138.808	139.550	140.266	139.622	139.293	140.369
180.0	177.930	179.267	178.643	179.753	181.011	180.093	179.743	181.278

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

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

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

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

UUC* : Unit Under Calibration

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

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

-o0o-

เอกสาร

a 1133252

เอกสาร



Certificate of Calibration

Equipment : BOD Incubator

Manufacturer : Arco

Model : UC4-1320

Serial No. : 13URC4S013201

ID No. : UAE.WAO.015/2561

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

Location : Lab Floor 2

Received Order : 15 February 2023

Calibration Date : 15 February 2023

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

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

Calibrated by : Preecha Hiahhib

Approved by : Malu.
Approved Signatory

() Pornthippa Tameyakul

(✓) Malee Butkruea

() Suwit Imiai

Issue Date : 24 February 2023

The Uncertainties are for a confidence probability of approximately 95%

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



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2302-02970C-1

Cert. No.: 23TM249
Page: 2 of 3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

<u>Instrument</u>	<u>Model</u>
-------------------	--------------

1) Data Acquisition

This certificate is valid only to the item calibrated on date and

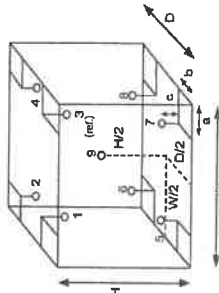
3. This certification is traceable to the International System of Units

Result of Calibration :- (*) Without Adjustment

Function of UUC* .

Function of DOC :
Fresh air setting :
Temperature :
Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	29	31
REL.Humid. (%)	63	67
AC Supply (Volt)	220	220



Probe Installation Details :

$$a = 10 \text{ cm} \quad D = 0.62 \text{ m}$$

$b =$	cm	$w =$	0.02	12	3
10	cm	$w =$	0.02	12	3

10	3M	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	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
----	----	---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----

Capacity	1.2	1.5
H=		

Position :	Ref. Std. ID No.:
1	22-18RTD-2/1
2	18RTD-2/2
3	18RTD-2/3
4	18RTD-2/4
5	18RTD-2/5
6	18RTD-2/6
7	18RTD-2/7
8	18RTD-2/8
9 (ref.)	18RTD-2/9

เอกสารไม่ควบคุม

A 0051476

เอกสารไม่ควม

04440047



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2302-0297OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Calibration Point (°C)	UUC ^a Setting (°C)	UUC ^a Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor <i>k</i>		
20.0	20.0	19.3	0.32	0.57	1.0	0.60	2		
Measured Temperature (°C)									
Calibration Point (°C)	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.086	19.916	20.386	19.976	19.973	19.838	19.837	19.821	19.949

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

Note : The reported uncertainty of measurement was included stability and excluded uniformity .
The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor *k*, providing a level of confidence of approximately 95 %.

-o0o-



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



Cert. No.: 23TM375
Page : 1 of 3

Certificate of Calibration

Equipment : BOD Incubator
Manufacturer : ARCO
Model : UR-1320
Serial No. : -
ID No. : UAE.WAQ.018/2551
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Lab Floor 2

Received Order : 11 April 2023
Calibration Date : 12 April 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Krisda Malee

Approved by : [Redacted] Laboratory

(/) Ponthippa Tameyakul
(✓) Malee Bulkruea
() Suwit Imjai

Issue Date : 24 April 2023

The Uncertainties are for a confidence probability of approximately 95 %

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

เอกสารไม่ควบคุม

a 1149512

เอกสารไม่ควบคุม

A 0053360



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2304-0156OC-2

Cert. No.: 23TM375
Page : 2 of 3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument **Model** **Serial No.** **Cert. No.** **Due Date**
1) Data Acquisition 34972A MY59003411 22LM165 26 Nov 2023

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

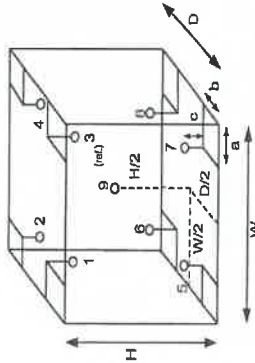
3. This certification is traceable to the International System of Unit.

Result of Calibration :-

Function of UUC* :- Without Adjustment

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	27
REL.Humid. (%)	42	45
AC Supply (Volt)	219	220



Probe Installation Details :

a = 10 cm D = 0.62 m
b = 10 cm W = 1.2 m
c = 10 cm H = 1.2 m
Capacity = 0.89 m³

Dimension of Chamber :

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



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2304-0156OC-2
Result of Calibration :-
Function of UUC* :-
Fresh air setting :
Without Adjustment
Temperature Source
Not Available

Cert. No.: 23TM375
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
20.0	20.0	20.0	0.48	0.42	1.2	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (±°C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	20.040	20.170	20.263	20.093	19.749	19.704	19.920	20.191	20.020	0.66

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

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

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

UUC* : Unit Under Calibration

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

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

-o0o-

เอกสาร

เอกสาร

a 1158258



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

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

Cert.No.: 22TW240
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : 4010-2W
Serial No. : 20260326
ID No. : UAE.WAO.063/2563
Received Date : 21 October 2022
Test Date : 26 October 2022
Reference : 2210-0734DSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
Test Procedure : In - house method : CP-CH9
by Comparison Technique with Azide Modification Method

Tested by : Walaiak Sirthean

Approved by :

() Malee Butkruea
() Sathip Meangmai
() Warakorn Lemgagrakul

Issue Date : 27 October 2022



Cert.No.: 22TW240
Page.: 2 of 2

Condition of this result of calibration

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

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1) Burette	-	130BU10	21CG1389	25 Mar 2023
2) Balance	1126143764	140RC004	22MM50	20 Sep 2023

2. Standard Material :-

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

Result : Dissolved Oxygen Meter Adjustment With Air 100 %
Dissolved Oxygen Probe No.: 20E103527

Titration Method (Azide Modification Method)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.14	8.12	0.0084

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency. The environmental impact control and present to organization it may concerned intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full, without written approval of the laboratory

-o0o-



มูลนิธิสถาบันอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center
Ministry of Industry

Calibration Certificate

Certificate No.: 2302827-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR204
Serial No.: C117635043
ID No.: UAE.WAS.012/2564
Order No.: 2302827
Operation No.: 2302827-001
Date of Receipt: 10 May 2023
Date of Calibration: 10 May 2023

Calibrated by Mr. Manas Somsak
Specialist
Approved by [Redacted]
(Mr. Phiphat, Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of Issue: 18 May 2023

The uncertainties are for a confidence probability of approximately 95%

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

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



Calibration Report

Certificate No.: 2302827-001-01

Equipment:

Electronic Balance

Manufacturer: NETTLER TOLEDO

Model: XSR204

Resolution: 0.0001 g

Serial No.: C117635943

ID No.: UAEWAS.0127254

Capacity: 220 g

Date of Calibration: 10 May 2023

Calibration Results: (Continued)

Calibration Range: 0 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
50	50.00003	50.0000	0.0000	0.00011	2.00
55	55.00005	55.0000	0.0000	0.00012	2.00
60	60.00004	60.0000	0.0000	0.00012	2.00
65	65.00005	65.0000	0.0000	0.00013	2.00
70	70.00006	70.0001	-0.0001	0.00013	2.00
75	75.00008	75.0002	-0.0001	0.00013	2.00
80	80.00007	80.0002	-0.0001	0.00014	2.00
85	85.00009	85.0002	-0.0001	0.00014	2.00
90	90.00010	90.0002	-0.0001	0.00015	2.00
100	100.00006	100.0002	-0.0001	0.00016	2.00
120	120.00009	120.0002	-0.0001	0.00018	2.00
150	150.00009	150.0002	-0.0001	0.00021	2.00
200	200.00016	200.0003	-0.0001	0.00028	2.00

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

----- End -----

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



Certificate No.: HIT-2312-0342

Page: 1 of 2

CERTIFICATE OF CALIBRATION

Equipment: COD Test Tube Heater
Meter Model: HI839800-02 Serial No.: H0185001
Tube Heater: 25 Vial Capacity Accuracy: ±2°C
Temperature Range: -10 °C to 160 °C Temperature of Reaction: 150°C
Ambient Temperature: (25 ± 2)°C Relative Humidity: (50 ± 15) % RH
Manufacturer: Hanna Instruments Made in: Romania
Condition As-Received: Used Product Reference: RE230392
Customer name: United Analyst and Engineering Consultant Co., Ltd.

3 Soi Udomsuk 41, Sukhumvit Rd., Bangchak,

Phrakhanong, Bangkok 10260

Received date: 8 March 2023

Calibrate date: 10 March 2023

Issue date: 20 March 2023

Calibrated Location: Hanna Instruments (Thailand) Ltd.

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

Calibrated by: ☒ Mr. Pichit Petthong
☐ Mr. Jakkapob Pentisan
☐ Mr. Chammarong Sornak

Approved by

HANNA
instruments
(Thailand) Limited

This certificate was certified only for the instrument we calibrated.

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

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

เอกสารไม่ควบคุม



Condition of this calibration result
Reference Standard Instruments:

Instruments	Model	Serial No.	Certificate No.	Traceable
Data Acquisition Switch Unit	34970A	MY44065265	WK2207-065-1	WK Electric Co., Ltd.

Calibration Result:

Measurement Temperature Source Accuracy for COD Reactor

Capacity (Vial)	Nominal Value (°C)	Average Value (°C)	(b) Uncertainty (°C)	(b) Tolerance of UUC (°C)	Acceptance Criteria
25 Vial	150.0	150.3	0.59	2	Pass

Figure: Shows the location of the temperature source.

(1A)	(2A)	(3A)	(4A)	(5A)
149.78°C	150.31°C	150.63°C	149.93°C	150.31°C
(1B)	(2B)	(3B)	(4B)	(5B)
150.35°C	150.18°C	149.93°C	150.18°C	150.21°C
(1C)	(2C)	(3C)	(4C)	(5C)
150.24°C	151.10°C	150.80°C	150.36°C	150.86°C
(1D)	(2D)	(3D)	(4D)	(5D)
150.16°C	149.77°C	150.22°C	150.67°C	150.43°C
(1E)	(2E)	(3E)	(4E)	(5E)
149.94°C	150.44°C	150.06°C	150.63°C	149.29°C

Remark: The Acceptance criteria is the error value plus or minus the Measurement Uncertainty, and then Not More than the Tolerance value of UUC, therefore concluded that pass.

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

** End of certificate **

เอกสารไม่ควบคุม

DQE Services Co., Ltd.

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

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



CERTIFICATE OF CALIBRATION

Certificate No. : SP23-007

Page 1 of 5

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

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

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-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 Kinnach)

Technical Manager

Approved

(Signature)

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

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

เอกสารไม่ควบคุม



REPORT OF CALIBRATION

Certificate No. : SP23-007

Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °CRelative humidity 55 ± 20 %RH

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

Certified Reference Materials :

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

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

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

Spectral Band Width of UUC : 4.0 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021



REPORT OF CALIBRATION

Certificate No. : SP23-007

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
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
440	2.1900	2.181	0.0090	0.0080	2.00
	0.0000	0.000	0.0000	0.0028	2.00
	0.5607	0.558	0.0027	0.0034	2.00
465	1.0247	1.021	0.0037	0.0035	2.00
	2.1229	2.115	0.0079	0.0081	2.00
	0.0000	0.000	0.0000	0.0028	2.00
546.1	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
590	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
635	1.9987	1.993	0.0057	0.0084	2.00
	0.0000	0.000	0.0000	0.0028	2.00
	0.5523	0.552	0.0003	0.0030	2.00
635	1.0809	1.082	-0.0011	0.0030	2.00
	2.0391	2.031	0.0081	0.0080	2.00
	0.0000	0.000	0.0000	0.0028	2.00
635	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	0.0070	2.00

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

REPORT OF CALIBRATION

Certificate No. : SP23-007

Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000 0.7478	0.000 0.743	0.0000 0.0048	0.0050 0.0057	2.00 2.00
257	0.0000 0.8686	0.000 0.861	0.0000 0.0076	0.0050 0.0059	2.00 2.00
313	0.0000 0.2912	0.000 0.291	0.0000 0.0002	0.0050 0.0051	2.00 2.00
350	0.0000 0.6448	0.000 0.639	0.0000 0.0058	0.0050 0.0055	2.00 2.00

REPORT OF CALIBRATION

Certificate No. : SP23-007

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.54 279.40 288.70 334.22 361.26 418.48 446.70 453.20 460.06 536.90 637.94	240.8 278.5 288.0 333.5 360.5 417.8 445.9 452.5 459.5 536.0 637.1	0.74 0.90 0.70 0.72 0.76 0.68 0.80 0.70 0.56 0.90 0.84	0.18 0.18 0.18 0.18 0.18 0.21 0.18 0.18 0.18 0.18 0.18	2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00
440.74 472.22 513.70 528.72 574.60 585.48 684.63 740.27 748.28 807.16 879.70	440.0 471.5 513.0 528.0 574.0 584.6 684.0 740.0 747.5 806.5 879.0	0.74 0.72 0.70 0.72 0.60 0.88 0.63 0.27 0.78 0.66 0.70	0.18 0.18 0.18 0.18 0.18 0.20 0.18 0.20 0.18 0.18 0.18	2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

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

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

- * Indicates non TISI accredited

- End of Certificate -

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021



กรมวิทยาศาสตร์
TISTR

Request No. 25-66 / 0323

MTC. ACL.No. 387 / 66

CALIBRATION CERTIFICATE

NOMENCLATURE : 1. Atomic Absorption Spectrophotometer "Agilent Technologies"

Model AA240FS, Serial No. MY13160001

2. Working standard solution "Inorganic Ventures"

Multi Analyte Custom Grade Solution, Lot No. S2-MEB708640

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

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

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

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

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

CALIBRATION DATE : 2 February 2023

REFERENCE MATERIAL : Traceable to NIST "Carlo Erba", "PanReac AppliChem"

Cadmium Lot No. 1152457, Chromium Lot No. 1793249, Copper Batch No. T117098A, Iron Batch No. T126087A,

Lead Lot No. 1227873, Manganese Batch No. T109228A, Nickel Batch No. T270178A, Zinc Batch No. T820140A

AMBIENT CONDITIONS : Temperature 22 °C Relative humidity 58 %

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

Calibrated by

Approved by

2.....Atipat

(Mr. Atipat Retana)

Acting Director, Laboratory

Ref. 2015266012600366001

Issued Date : 15 February 2023

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

FM.BI.MTC.002 Rev.4



กรมวิทยาศาสตร์
TISTR

Request No. 25-66 / 0323

1 / 5

MTC. ACL. No. 387 / 66

CALIBRATION DATA

1. Noise Level

Element	Cd	Cr	Cu	Fe	Pb	Mn	Ni	Zn
0.0020	0.0000	0.0008	0.0008	0.0000	-0.0009	0.0021	-0.0016	-0.0022
0.0015	0.0006	0.0005	0.0005	-0.0009	-0.0014	0.0018	0.0002	-0.0023
0.0014	0.0006	0.0010	0.0010	-0.0009	0.0015	0.0008	-0.0004	-0.0015
0.0021	-0.0008	0.0013	0.0013	-0.0010	0.0005	0.0005	-0.0008	-0.0004
0.0020	-0.0012	0.0004	0.0004	0.0003	-0.0004	0.0001	-0.0024	-0.001
0.0021	-0.0011	0.0011	0.0011	0.0003	0.0006	0.0009	-0.0002	-0.0013
0.0017	-0.0009	0.0001	0.0001	-0.0015	0.0010	0.0007	0.0001	-0.0016
0.0024	-0.0012	0.0004	0.0004	-0.0002	0.0008	-0.0005	-0.0012	-0.0019
0.0011	-0.0002	0.0015	0.0015	-0.0004	0.0004	0.0008	-0.0003	-0.0017
0.0017	0.0000	0.0009	0.0009	0.0004	0.0001	0.0015	-0.0009	-0.0024
0.0019	-0.0004	0.0004	0.0004	0.0000	0.0006	0.0010	-0.0005	-0.0016
0.0016	-0.0025	0.0003	0.0003	0.0005	0.0009	-0.0004	-0.0013	-0.0016
0.0018	-0.0014	0.001	0.001	-0.0009	-0.0006	0.0010	-0.0004	-0.0017
0.0019	-0.0006	0.0011	0.0011	-0.0008	0.0011	0.0004	-0.0003	-0.0005
0.0024	0.0003	0.0005	0.0005	-0.0012	-0.0002	0.0012	-0.0006	-0.0011
0.0023	-0.0012	0.0006	0.0006	-0.0007	0.0002	0.0014	-0.0012	-0.0013
0.0020	-0.0014	0.0009	0.0009	-0.0018	0.0003	0.0012	-0.0012	-0.0013
0.0010	-0.0015	0.0002	0.0002	0.0004	0.0017	0.0011	-0.0018	-0.0013
0.0016	-0.0011	0.0013	0.0013	0.0003	0.0007	0.0026	-0.0006	-0.0006
0.0001	-0.0007	0.0009	0.0009	-0.0003	0.0008	0.0008	0.0000	-0.0001
0.002	-0.001	0.001	0.001	0.000	0.000	0.001	-0.001	-0.001

Absorbance

Average Absorbance

Continue 2 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Sol 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : sumalee@tistr.or.th

FM.BI.MTC.002 Rev.4



กรมวิทยาศาสตร์
การแพทย์

Request No. 25-66 / 0323

2 / 5

MTC. ACL. No. 387 / 66

2. Precision

Element	Conc. (mg/l)	Absorbance										Ave. Abs.	SD	%RSD
Cd	0.02	0.0085	0.0084	0.0090	0.0089	0.0089	0.0090	0.0086	0.0092	0.0090	0.0089	0.009	0.0003	2.88
	0.30	0.0993	0.1001	0.1007	0.1004	0.0995	0.0997	0.0998	0.0999	0.0999	0.0996	0.100	0.0005	0.45
	0.70	0.2238	0.2229	0.2244	0.2249	0.2243	0.2233	0.2235	0.2231	0.2251	0.2240	0.224	0.0007	0.33
Cr	0.10	0.0088	0.0087	0.0094	0.0086	0.0091	0.0099	0.0095	0.0076	0.0085	0.0085	0.009	0.0006	7.25
	0.30	0.0257	0.0265	0.0255	0.0270	0.0266	0.0258	0.0261	0.0262	0.0274	0.0262	0.026	0.0006	2.25
	0.70	0.0573	0.0590	0.0580	0.0576	0.0578	0.0579	0.0593	0.0599	0.0586	0.0594	0.058	0.0009	1.51
Cu	0.05	0.0083	0.0084	0.0084	0.0075	0.0086	0.0086	0.0081	0.0080	0.0087	0.0092	0.008	0.0005	5.45
	0.30	0.0430	0.0444	0.0426	0.0429	0.0435	0.0432	0.0428	0.0441	0.0427	0.0436	0.043	0.0006	1.41
	0.70	0.0981	0.0992	0.0990	0.0997	0.0977	0.0986	0.0990	0.0982	0.0988	0.0980	0.099	0.0006	0.63
Fe	0.10	0.0109	0.0104	0.0087	0.0100	0.0087	0.0094	0.0102	0.0092	0.0094	0.0100	0.010	0.0007	7.53
	0.50	0.0456	0.0442	0.0450	0.0444	0.0450	0.0455	0.0455	0.0441	0.0446	0.0444	0.045	0.0006	1.27
	1.00	0.0904	0.0901	0.0891	0.0876	0.0873	0.0901	0.0876	0.0886	0.0879	0.0901	0.089	0.0012	1.38
Pb	0.20	0.0093	0.0099	0.0104	0.0102	0.0104	0.0109	0.0102	0.0103	0.0115	0.0117	0.010	0.0007	6.85
	0.70	0.0344	0.0336	0.0336	0.0328	0.0338	0.0346	0.0336	0.0331	0.0343	0.0350	0.034	0.0007	2.02
	1.50	0.0709	0.0718	0.0706	0.0713	0.0698	0.0718	0.0712	0.0713	0.0715	0.0719	0.071	0.0006	0.90
Mn	0.05	0.0115	0.0130	0.0131	0.0127	0.0135	0.0136	0.0124	0.0133	0.0124	0.0130	0.013	0.0006	4.88
	0.30	0.0709	0.0700	0.0714	0.0704	0.0700	0.0705	0.0714	0.0698	0.0694	0.0700	0.070	0.0007	0.96
	0.70	0.1619	0.1633	0.1646	0.1638	0.1646	0.1614	0.1632	0.1614	0.1636	0.1652	0.163	0.0014	0.83
Ni	0.10	0.0113	0.0105	0.0113	0.0114	0.0110	0.0113	0.0117	0.0112	0.0107	0.0117	0.011	0.0004	3.45
	0.50	0.0509	0.0517	0.0508	0.0502	0.0517	0.0516	0.0516	0.0523	0.0518	0.0503	0.051	0.0007	1.36
	1.00	0.0997	0.1006	0.1006	0.1006	0.0996	0.0998	0.1007	0.1000	0.1013	0.0999	0.100	0.0006	0.55
Zn	0.05	0.0315	0.0309	0.0322	0.0304	0.0329	0.0312	0.0313	0.0319	0.0308	0.0311	0.031	0.0007	2.35
	0.30	0.1705	0.1728	0.1688	0.1693	0.1711	0.1704	0.1704	0.1707	0.1708	0.1688	0.170	0.0012	0.70
	0.70	0.3559	0.3572	0.3548	0.3560	0.3559	0.3550	0.3579	0.3552	0.3574	0.3573	0.356	0.0011	0.31

Continue 3 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the

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

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpal@tistr.or.th Website: www.tistr.or.th

Office/Laboratory
Sri 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : sumalee@tistr.or.th

FM.BLMTC.002 Rev.4



กรมวิทยาศาสตร์
การแพทย์

Request No. 25-66 / 0323

3 / 5

MTC. ACL. No. 387 / 66

3. Trueness

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cd	0.02002	0.021	0.001	4.90	± 0.005
	0.30030	0.298	-0.002	0.77	± 0.005
	0.70070	0.675	-0.026	3.67	± 0.008

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cr	0.1001	0.101	0.001	0.90	± 0.009
	0.3003	0.293	-0.007	2.43	± 0.012
	0.7007	0.648	-0.053	7.52	± 0.023

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cu	0.050	0.046	-0.004	8.00	± 0.003
	0.300	0.289	-0.011	3.67	± 0.009
	0.700	0.674	-0.026	3.71	± 0.020

Continue 4 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

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

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpal@tistr.or.th Website: www.tistr.or.th

Office/Laboratory
Sri 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : sumalee@tistr.or.th

FM.BLMTC.002 Rev.4



กรมการมาตรฐาน
ประเทศไทย

Request No. 25-66 / 0323

4 / 5

MTC. ACL No. 387 / 66

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Fe	0.100	0.095	-0.005	5.00	± 0.014
	0.500	0.474	-0.026	5.20	± 0.016
	1.000	0.950	-0.050	5.00	± 0.029

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Pb	0.200	0.207	0.007	3.50	± 0.014
	0.700	0.673	-0.027	3.86	± 0.030
	1.500	1.417	-0.083	5.53	± 0.061

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Mn	0.04995	0.046	-0.004	7.91	± 0.005
	0.29970	0.294	-0.0057	1.90	± 0.007
	0.69930	0.694	-0.0053	0.76	± 0.014

Continue 5 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rump@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Sai 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

FM.BLMTC.002 Rev.4



กรมการมาตรฐาน
ประเทศไทย

Request No. 25-66 / 0323

5 / 5

MTC. ACL No. 387 / 66

3.7 Reading on wavelength- Nickel (Ni) at 232.0 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Ni	0.1001	0.103	0.003	2.90	± 0.013
	0.5005	0.501	0.001	0.10	± 0.018
	1.0010	0.987	-0.014	1.40	± 0.032

3.8 Reading on wavelength- Zinc (Zn) at 213.9 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Zn	0.050	0.046	-0.004	8.00	± 0.013
	0.300	0.311	0.011	3.67	± 0.013
	0.700	0.665	-0.035	5.00	± 0.019

Remark : The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 (k = 2) which gives a level of confidence of approximately 95%.

Calibrated

2.....Atipat.....
(Mr. Atipat Ratana)

Senior Technical Officer
Acting Director of

Analytical Chemistry Laboratory
Issued Date : 15 February 2023

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE
End of Certificate

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rump@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Sai 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

FM.BLMTC.002 Rev.4

Agilent 5110 and 5100 ICP-OES
Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended service for your analytical systems to assure reliable operation and the accuracy of your results. Delivered by highly-trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak.

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

Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- For customers using HF applications, the instrument should be returned to its standard sample introduction system.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- Any parts, not included in the Parts Lists section of this document, are not part of the recommended Preventive Maintenance service, nor are they included in the price of this service.
- If a system requires the use of additional or special procedures and/or parts for the instrument service, then these must be ordered separately and charged as a repair, which may incur additional

Service Engineer's Responsibilities

- Only complete/printout pages that relate to the system being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using a "X" or tick mark "✓" in the checkbox.
- Complete Not Applicable check boxes to indicate services not delivered, as needed.
- Complete the PM service in the order of the tasks listed.
- Complete the Service Review section together with the customer.

Agilent 5110 and 5100 ICP-OES
Preventive Maintenance Checklist

System Information

Instrument system name and ID	ICP 5110 VDV
Instrument system site and location	UAE / 3rd Floor Laboratory
List system component product numbers	
List the serial numbers of each component	
1. G8015 A	1. MY 18035001
2. G8018 A	2. 1801-01988
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.

ICP-OES Configuration table	Circle the type or write in the type if other
Nebulizer Type	SeaSpray OneNeb other
Spray Chamber	Cyclonic Single Pass Cyclonic Double Pass other
Torch	Radial Dual View other
Injector Diameter	2.4mm 1.8mm 1.4mm 0.8mm other
Injector Material	Quartz Ceramic other



Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

General Preparation

- ☒ Discuss any specific questions or issues with the customer prior to starting.
- ☒ Review the instrument logbook.
- ☒ Perform general external inspection of system for cleanliness.
- ☒ Check for proper installation of safety-related parts, assemblies, sensors etc.
- ☒ Check for required firmware/software updates and verify with customers if they would like it installed.
- ☒ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. N/A
- ☒ Run Instrument Performance test and record results in Instrument Performance Test Results Table - Pre PM.

Inspect and clean the system

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

G8481A Cooling water system

- ☐ Section NOT Applicable
- ☒ Drain cooling fluid and remove any particles from the chiller reservoir
- ☒ Remove, clean and reinstall water inlet metal mesh filter.
- ☒ Re fill with Polyclear cooling fluid.
- ☒ Clean the cooling system Air filter and the condenser by compressed air or vacuum cleaner.



Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

SPS 3 Auto Sampler

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

SPS 4 Auto Sampler

- ☒ Section NOT Applicable
- ☐ Clean the spill tray, rack location mat, end frames and chassis with a damp soft cloth and diluted mild detergent.
- ☐ Clean the auto sampler cover panels, if cover kit is installed, with domestic window cleaner
- ☐ Check the X-axis and Z-axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes.
- ☐ Check the X-axis, Theta-axis and Z-axis FFC cables for cracks, incorrect positioning, damaged edges or damaged connectors.
- ☐ Pump Tubing Replacement. Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles

AVS 4, 6, 7

- ☒ Section NOT Applicable
- ☐ Replace valve rotor seal
- ☐ Check fittings for signs of leaks
- ☐ Check tubing including autosampler tubing for kinks or excessive wear
- ☐ Check high flow pump for signs of leaks

Instrument Adjustment

- ☒ Check position of Zn peak, adjust if required.
- ☒ Check Argon Ratio, adjust to specified value if required.
- ☒ Perform Detector Calibration.
- ☒ Perform Instrument Calibration.
- ☒ Run Instrument Performance Test and record results in Instrument Performance Test Results Table - Post PM.
- ☐ For systems using ICP Expert version 7.3 and above run the following Instrument tests and record the result in the Instrument Test Results Table
 - ☒ Subsystem Communications Test
 - ☒ Air Flow

**Agilent 5110 and 5100 ICP-OES
Preventive Maintenance Checklist**

- ☒ Water Flow
☒ Gas Flows
☒ RF Generator
☒ Camera Test
☒ Optics Test
☒ Nebulizer Test

Instrument Performance Test Results Table

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

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial *	Radial	Axial *
Zn 213.857 nm SRBR	4106.6	8364.0	4375.0	8400.8
Mn 257.610 nm SRBR	11064.7	31842.1	12801.7	30846.2
Al 896.152 nm SBR	7.5	14.9	9.9	16.8
K 766.491 nm SBR	5.1	36.8	6.4	29.7

* Axial result is not applicable for G8016AAA, G8012AAA Radial View instruments.

Instrument Test Results Table

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

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

**Agilent 5110 and 5100 ICP-OES
Preventive Maintenance Checklist****ICP-OES Status Results Table**

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

Measurement	Standby Mode	Plasma On
Mains Voltage	224.540	217.973 VAC
Mains Current	0.804	0.104 A
Instrument Temperature	22.8	22.7 °C
RF Air Flow (sensor speed)	15.0	13.0 Hz
Plasma Exhaust Temperature	No measurement	26.7 °C
Water Flow Oscillator	No measurement	1.64 L/min
Water Flow Detector	1.06	1.06 L/min
Water Inlet Temperature	18.0	18.0 °C
Polychromator Temperature	35.0	35.0 °C
CCD Temperature	-33.8	-33.8 °C
Thermal Stabilizer	35.0	35.0 °C
Argon Supply Pressure	671.94	677.33 kPa
Purge Gas Supply Pressure*1	674.90	645.40 kPa
Option Gas Supply Pressure*1	N/A	N/A kPa
Nebulizer Flow	No measurement	0.70 L/min
Nebulizer Back Pressure	No measurement	164.63 kPa
Plasma Gas Flow	No measurement	11.92 L/min
Auxiliary Gas Flow	No measurement	1.00 L/min
RF Power	No measurement	1800 W
RF Supply Current	No measurement	8.663 A
RF Supply Voltage	No measurement	184.660 V

*1 If option installed



Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

ICP-OES Parts List Table

Part description	Part Number	Product / Model # where used	Quantity Consumed
Axial Pre-Optic Window	G8010-68014	G8010A, G8011A, G8014A/G8015A	1
Radial Pre-Optic Window	G8010-68015	ALI	1
Polyclear Cooling Fluid	G3292-80010	G8481A	
Purge Gas Filter	G8010-60136	ALI	1
Air inlet filter	G8000-68002	ALI	1
High Capacity Air Filter	G8010-60189	Optional	
Rotor seal for 6-7 port valve for AVS6/7	G8494-60002	G8494A/G8495	
Rotor seal for 4 port valve for AVS4	G8493-80002	G8493A	
Rinse solution to rinse station 2.5mm id x 1m	G8410-80123	SPS 4	
Barb connector 2.5mm-1.5mm ID	G8410-80124	SPS 4	
PVC waste tubing, 8mm od x 5mm id, 2m	G8410-80122	SPS 4	
Additional Parts may be required from engineers stock:			
X axis drive belt	5410047500	SPS 3	
Z axis drive belt	5410047400	SPS 3	
Peristaltic pump tubing, PVC SolvaFlex, 3 bridged,	3710049000	SPS 4	

Restore system

For HF applications, ask the customer to reinstall their sample introduction system.

Leave system in an idle state: on and purging.

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

Service Review

- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section below if there are additional comments.



Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

- ☒ Review the service and any test results with the customer.
- ☒ If the Instrument firmware was updated, record the details of the change in the Service Engineer's Comments box below or if necessary, in the customer's IQ records.

Service Engineer Comments (optional)

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

Other Important Customer Web Links

How to get information on your product:

- ☒ Literature Library - <http://www.agilent.com/en-us/products/icp-oes/icp-oes-systems/5110-icp-oes#literature>
- ☒ Need to know more? - <http://www.agilent.com/crossla/university/>
- ☒ Need technical support, FAQs? - <http://www.agilent.com/en-us/support/landing/icp-oes>
- ☒ Need supplies? - www.agilent.com/chem/supplies

Service Completion

Service request number 6005625887 Date service completed 30 NOV 2017

Agilent signature 1/07/2017 T. Customer signature

Document part number: G8014-90075

Report Summary

Instrument Model
Instrument ID
Instrument Serial Number
Software Version
Firmware Version
Tested By
Test Completed On

Agilent 5100/5110 VDV ICP-OES
G8011A/G8015A
MY18030001
7.3.1.9507
3442
Test Before PM
11/30/2022 9:35:32 AM

Result Summary

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

Skipped
Skipped
Skipped
Skipped
Skipped
Skipped
Skipped
Skipped
Pass
Pass
Pass

Pass

Resolution Test

Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	6.62
As (188.980 nm)	≤ 8.20	6.20
C (193.027 nm)	≤ 11.50	8.35
Mo (202.032 nm)	≤ 8.20	6.41
Cr (206.158 nm)	≤ 13.40	9.04
Zn (213.857 nm)	≤ 8.70	6.62
Pb (220.353 nm)	≤ 9.50	7.13
Co (228.615 nm)	≤ 17.20	11.71
Ba (230.424 nm)	≤ 9.40	7.21
Mn (257.610 nm)	≤ 13.30	9.50
Mn (260.568 nm)	≤ 20.30	14.33
Cr (267.716 nm)	≤ 11.00	8.14
Cu (324.754 nm)	≤ 25.00	18.98
Cu (327.395 nm)	≤ 14.20	11.24
Sr (338.071 nm)	≤ 33.50	24.47
Ba (455.403 nm)	≤ 44.00	33.88
Sr (460.733 nm)	≤ 36.00	17.22
Ba (493.408 nm)	≤ 36.00	25.48
Ba (614.171 nm)	≤ 42.00	25.47
Ar (675.283 nm)	≤ 74.00	59.82
K (766.491 nm)	≤ 80.00	64.94

Sensitivity Test

Radial

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	147.7	1156.5	55.5
Se (196.026 nm)	≥ 41.0	SRBR	111.1	1195.3	97.7
Zn (213.857 nm)	≥ 1421.0	SRBR	4100.6	51969.5	159.6
Pb (220.353 nm)	≥ 46.0	SRBR	192.5	2808.6	185.7
Mn (257.610 nm)	≥ 3518.0	SRBR	11064.7	264165.0	567.6
Al (396.152 nm)	≥ 3.4	SBR	7.5	48047.9	5770.5
Ba (493.408 nm)	≥ 34.0	SBR	107.4	1887710.3	17407.5
K (766.491 nm)	≥ 1.8	SBR	5.1	100805.9	16626.4

Axial

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	234.9	3056.4	152.9
Se (196.026 nm)	≥ 159.0	SRBR	218.1	3665.1	271.6
Zn (206.200 nm)	≥ 234.0	SRBR	1306.5	15850.4	144.5
Zn (213.857 nm)	≥ 1743.0	SRBR	8364.0	183037.8	476.4
Cd (214.439 nm)	≥ 4227.0	SRBR	7718.5	143240.2	342.8
Pb (220.353 nm)	≥ 320.0	SRBR	576.3	14465.2	580.4
Mn (257.610 nm)	≥ 10625.0	SRBR	31842.1	1411257.3	1958.9
Cr (267.716 nm)	≥ 1048.0	SRBR	4492.1	183110.6	1632.2
Cu (324.754 nm)	≥ 19.0	SBR	46.2	371487.5	7862.9
Al (396.152 nm)	≥ 6.0	SBR	14.9	278447.4	17552.6
Ba (493.408 nm)	≥ 60.0	SBR	190.6	10061527.3	52519.8
K (766.491 nm)	≥ 24.0	SBR	36.8	1922163.4	50858.1

เอกสารไม่ควบคุม

Precision Test

Radial

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	0.82
Se (196.026 nm)	≤ 2.60	0.71
Zn (213.857 nm)	≤ 1.50	0.43
Pb (220.353 nm)	≤ 2.60	0.76
Mn (257.610 nm)	≤ 1.50	0.60
Al (396.152 nm)	≤ 1.50	0.48
Ba (493.408 nm)	≤ 1.50	0.89
K (766.491 nm)	≤ 1.50	0.42

Axial

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.57
Se (196.026 nm)	≤ 1.50	0.76
Zn (206.200 nm)	≤ 1.50	0.61
Zn (213.857 nm)	≤ 1.50	0.51
Cd (214.439 nm)	≤ 1.50	0.55
Pb (220.353 nm)	≤ 1.50	0.52
Mn (257.610 nm)	≤ 1.50	0.54
Cr (267.716 nm)	≤ 1.50	0.54
Cu (324.754 nm)	≤ 1.50	0.89
Al (396.152 nm)	≤ 1.50	0.91
Ba (493.408 nm)	≤ 1.50	0.85
K (766.491 nm)	≤ 1.50	1.22

เอกสารไม่ควบคุม

Report Summary

Instrument Model Agilent 5100/5110 VDV ICP-OES
Instrument ID G8011A/G8015A
Instrument Serial Number MY18030001
Software Version 7.3.1.9507
Firmware Version 3442
Tested By PM Functional test
Test Completed On 11/30/2022 11:43:36 AM

Result Summary

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

Subsystem Communications Test

Pass

Air Flow Test

Pass

30% Air Flow (relative speed) 75% Air Flow (relative speed)
14.00 19.00

Water Flow Test

Pass

RF Water Flow(L/min) Camera Water Flow (L/min) Water Inlet Temperature (°C)
1.44 1.05 18.51

Gas Flows Test

Pass

Nebulizer Target Flow 0.70 Actual Flow 0.70 Back Pressure 163.37 Auxiliary Target Flow 2.00 Actual Flow 1.99 Back Pressure 108.49

Makeup Target Flow 2.00 Actual Flow 2.00 Back Pressure 112.85 Plasma Target Flow 18.00 Actual Flow 17.91 Back Pressure 23.46

RF Generator Test

Pass

RF Power Supply Test Passed
RF Power Supply (V) 147.437

RF Oscillator Test Passed
RF Oscillator Frequency (MHz) 0.000

Work Coil Current (A) 45.069
RF Power Supply Current (A) 1.997

Camera Test

Pass

Integration Time (ms) Standard Deviation Status
Electronic Offset Test 1000 5.305 Passed
Dark Current Test 6000 0.578 Passed
Array Test 5 0.024 Passed
Linearity Test 0.118 0.118 Passed

Report Summary

Instrument Model
Instrument ID
Instrument Serial Number
Software Version
Firmware Version
Tested By
Test Completed On

Agilent 5100/5110 VDV ICP-OES
G8011A/G8015A
MY18030001
7.3.1.9507
3442
PM Performance test
11/30/2022 12:10:42 PM

Result Summary

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

Skipped
Skipped
Skipped
Skipped
Skipped
Skipped
Pass
Skipped
Pass
Pass
Pass

Optics Test

Radial
Intensity
Wavelength

Axial
5823476
737.212

Pass

Resolution Test

Element Wavelength
N (174.213 nm)
As (188.980 nm)
C (193.027 nm)
Mo (202.032 nm)
Cr (206.158 nm)
Zn (213.857 nm)
Pb (220.353 nm)
Co (228.615 nm)
Ba (230.424 nm)
Mn (257.610 nm)
Mn (260.568 nm)
Cr (267.716 nm)
Cu (324.754 nm)
Cu (327.395 nm)
Sr (338.071 nm)
Ba (455.403 nm)
Sr (460.733 nm)
Ba (493.408 nm)
Ba (614.171 nm)
Ar (675.283 nm)
K (766.491 nm)

Specification
≤ 9.40
≤ 8.20
≤ 11.50
≤ 8.20
≤ 13.40
≤ 8.70
≤ 9.50
≤ 17.20
≤ 9.40
≤ 13.30
≤ 20.30
≤ 11.00
≤ 25.00
≤ 14.20
≤ 33.50
≤ 44.00
≤ 36.00
≤ 36.00
≤ 42.00
≤ 74.00
≤ 80.00

Width
6.79
6.09
8.29
6.30
9.06
6.77
7.02
11.67
7.39
9.48
14.25
7.94
18.99
11.33
24.44
33.86
17.51
25.56
24.96
59.38
65.63

Pass

Sensitivity Test						Pass					
Radial											
Element Wavelength	Specification	Method	Ratio	Standard	Blank						
As (188.980 nm)	≥ 46.0	SRBR	147.8	1149.3	54.8						
Se (196.026 nm)	≥ 41.0	SRBR	111.6	1222.8	101.0						
Zn (213.857 nm)	≥ 142.0	SRBR	4375.0	52592.3	143.7						
Pb (220.353 nm)	≥ 46.0	SRBR	199.8	2744.4	186.5						
Mn (257.610 nm)	≥ 3518.0	SRBR	12801.7	285591.3	496.0						
Al (396.152 nm)	≥ 3.4	SBR	9.9	52888.8	4873.6						
Ba (493.408 nm)	≥ 34.0	SBR	154.6	2287291.6	14698.1						
K (766.491 nm)	≥ 1.8	SBR	6.4	106701.6	14350.9						
Axial											
Element Wavelength	Specification	Method	Ratio	Standard	Blank						
As (188.980 nm)	≥ 208.0	SRBR	242.4	3170.1	154.8						
Se (196.026 nm)	≥ 159.0	SRBR	226.1	4134.5	289.3						
Zn (206.200 nm)	≥ 234.0	SRBR	1126.6	13782.0	146.5						
Zn (213.857 nm)	≥ 1743.0	SRBR	8400.8	177166.3	442.5						
Cd (214.439 nm)	≥ 4227.0	SRBR	7001.9	125884.2	321.6						
Pb (220.353 nm)	≥ 320.0	SRBR	536.3	12909.3	532.6						
Mn (257.610 nm)	≥ 10625.0	SRBR	30846.2	1287989.0	1738.8						
Cr (267.716 nm)	≥ 1048.0	SRBR	4396.0	167335.6	1424.4						
Cu (324.754 nm)	≥ 19.0	SBR	52.1	373690.7	7033.1						
Al (396.152 nm)	≥ 6.0	SBR	16.8	268357.7	15112.4						
Ba (493.408 nm)	≥ 60.0	SBR	225.2	10173441.5	44971.7						
K (766.491 nm)	≥ 24.0	SBR	39.7	1874136.2	48055.7						

Precision Test

Pass

Radial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	0.60
Se (196.026 nm)	≤ 2.60	0.84
Zn (213.857 nm)	≤ 1.50	0.29
Pb (220.353 nm)	≤ 2.60	0.59
Mn (257.610 nm)	≤ 1.50	0.28
Al (396.152 nm)	≤ 1.50	0.28
Ba (493.408 nm)	≤ 1.50	0.59
K (766.491 nm)	≤ 1.50	0.23
Axial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.71
Se (196.026 nm)	≤ 1.50	0.43
Zn (206.200 nm)	≤ 1.50	0.46
Zn (213.857 nm)	≤ 1.50	0.37
Cd (214.439 nm)	≤ 1.50	0.48
Pb (220.353 nm)	≤ 1.50	0.48
Mn (257.610 nm)	≤ 1.50	0.74
Cr (267.716 nm)	≤ 1.50	0.26
Cu (324.754 nm)	≤ 1.50	0.51
Al (396.152 nm)	≤ 1.50	0.45
Ba (493.408 nm)	≤ 1.50	0.81
K (766.491 nm)	≤ 1.50	0.84



มูลนิธิสถาบันพัฒนาอุตสาหกรรมอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center
Ministry of Industry

Verification Certificate

Certificate No.: 2302413-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 4

Equipment: HEATING BLOCK DIGESTION

Manufacturer: FOSS

Model: 2520

Serial No.: 91794469

ID No.: UAE.WAS.011/2560

Order No.: 2302413

Operation No.: 2302413-001

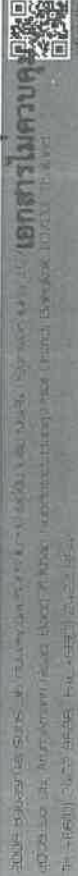
Date of Receipt: 28 March 2023

Date of Calibration: 30-31 March 2023

Calibrated by Mr.Nuttapol Niyomchat
Specialist
Approved by (Signature)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of Issue: 10 April 2023

The uncertainties are for a confidence probability of approximately 95 %.
This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

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



มูลนิธิสถาบันพัฒนาอุตสาหกรรมอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center
Ministry of Industry

Verification Report

Certificate No.: 2302413-001-01
Equipment: HEATING BLOCK DIGESTION
Model: 2520
Serial No.: 91794469
Resolution: 1 °C
ID No.: UAE.WAS.011/2560
Manufacturer: FOSS
Date of Calibration: 30-31 March 2023

Page 2 of 4

Location: Laboratory Room, NATIONAL FOOD INSTITUTE
Environment Condition: Ambient Temperature (25 ± 3) °C
Relative Humidity (55 ± 15) %
Line Voltage (220 ± 10) Volt

Condition of this results of Calibration:

1. This instrument was calibrated by Insert standard thermocouples type R into its heating block digestion and compared to temperature obtained from reference standards thermometer at calibrated point.
 - The temperature scale used was based on ITS - 90 .
 - All data show below were final values and the initial data may be obtained upon request.
2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with Thermocouple	Type R	TC2101-103 / CH2101-103	TC22/0044	5-May-2023	N.M. Technical Center Laboratory

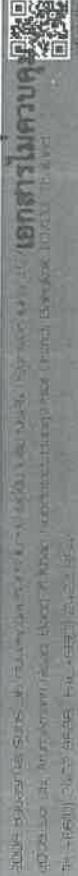
3. This certificate is traceable to international system of units (SI Units).
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.
6. Condition of Calibrated Item : Good

UUC* Description

Time of Record - Hour 30 Minute At 380 °C

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

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



Verification Report

Certificate No.: 2302413-001-01
Equipment: HEATING BLOCK DIGESTION
Model: 2520 **Serial No.:** 91794469
Resolution: 1 °C **ID No.:** UAE.WAS.011/2560
Manufacturer: FOSS

Date of Calibration: 30-31 March 2023
Calibration point: 380 °C
Calibration result:

Page 3 of 4

Reporting of Temperature

Block No.	UUC* Setting (°C)	UUC* Reading (°C)	Stability (±°C)	Standard Thermometer (°C)	Uncertainty (±°C)
1	380	380	0.96	377.74	2.1
2	380	380	0.40	377.28	2.1
3	380	380	1.18	377.82	2.1
4	380	380	0.44	377.19	1.6
5	380	380	0.11	377.30	1.6
6	380	380	0.14	377.90	1.6
7	380	380	1.17	373.85	2.1
8	380	380	0.33	376.96	2.1
9	380	380	0.14	374.18	2.1
10	380	380	0.96	378.56	2.0
11	380	380	1.04	378.34	2.0
12	380	380	0.35	378.06	2.0
13	380	380	0.48	377.05	1.6
14	380	380	0.38	379.19	1.6
15	380	380	0.50	377.48	1.6
16	380	380	0.48	378.33	1.7
17	380	380	0.71	377.60	1.7
18	380	380	0.35	376.77	1.7
19	380	380	0.84	377.05	1.8
20	380	380	0.41	378.58	1.8

Note:

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

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

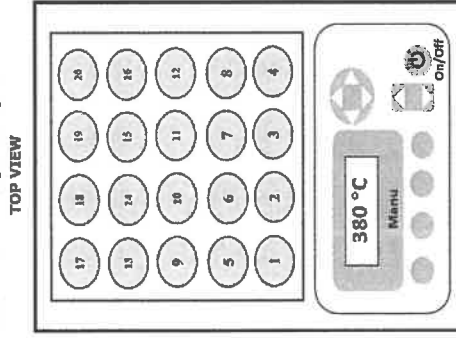
Verification Report

Certificate No.: 2302413-001-01
Equipment: HEATING BLOCK DIGESTION
Model: 2520 **Serial No.:** 91794469
Resolution: 1 °C **ID No.:** UAE.WAS.011/2560
Manufacturer: FOSS

Date of Calibration: 30-31 March 2023
Calibration point: 380 °C
Calibration result:

Page 4 of 4

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



Sensor Installation Location

Note:

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

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

----- End -----

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