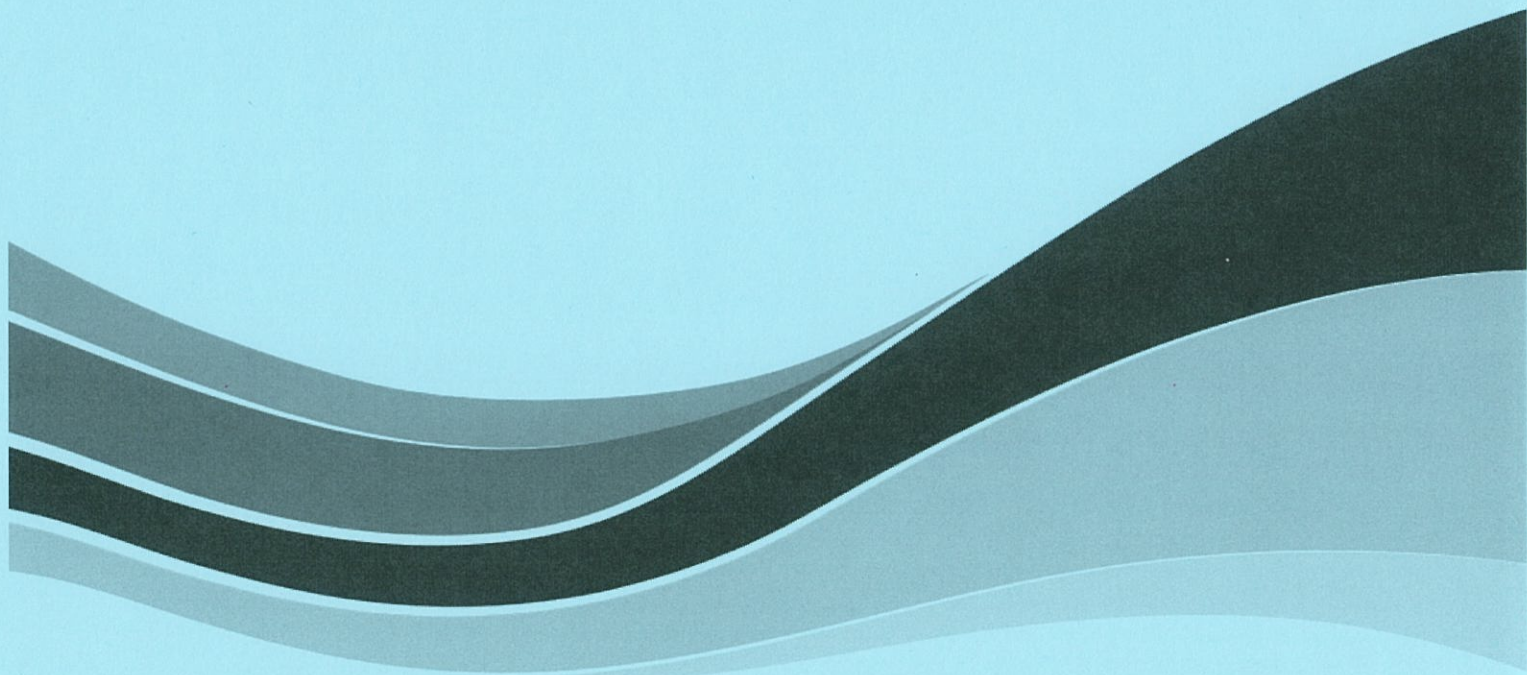


ภาคผนวก จ
เอกสารสอบเทียบเครื่องมือ



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)	Andersen Instruments, Inc.	G25A 1901	Jiranatee Associates Co., Ltd.	COF-002-66	14 Jul 23	13 Jul 25	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	24P1251	11 Apr 24	10 Apr 25	-
3	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Hydrogen Sulphide	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	24P1367	22 Apr 24	21 Apr 25	-
4	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Hydrogen Sulphide	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	24H753	10 Apr 24	9 Apr 25	-
5	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1191503036	UAE Consultant Co.,Ltd.	13112023	13 Nov 23	12 Nov 24	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1191503037	UAE Consultant Co.,Ltd.	13112023	13 Nov 23	12 Nov 24	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201497724	UAE Consultant Co.,Ltd.	21112023	21 Nov 23	20 Nov 24	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778105	UAE Consultant Co.,Ltd.	21112023	21 Nov 23	20 Nov 24	-
9	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05N191E15A0014	6 Jun 23	6 Jun 31	-
10	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387065	UAE Consultant Co.,Ltd.	03112023	3 Nov 23	2 Nov 24	-
11	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387066	UAE Consultant Co.,Ltd.	03112023	3 Nov 23	2 Nov 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 1200906875	UAE Consultant Co.,Ltd.	03112023	3 Nov 23	2 Nov 24	-
13	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1200906876	UAE Consultant Co.,Ltd.	09112023	9 Nov 23	8 Nov 24	-
14	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05NI91E15A0014	6 Jun 23	6 Jun 31	-
15	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1180540068	UAE Consultant Co.,Ltd.	08122023	8 Dec 23	7 Dec 24	-
16	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1180540074	UAE Consultant Co.,Ltd.	13122023	13 Nov 23	12 Nov 24	-
17	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i CM08140004	UAE Consultant Co.,Ltd.	13112023	13 Nov 23	12 Nov 24	-
18	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1182920020	UAE Consultant Co.,Ltd.	18122023	18 Dec 23	19 Dec 24	-
19	Standard Gases (Mixture)	Carbon Monoxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05NI91E15A0014	6 Jun 23	6 Jun 31	-
20	Wind Speed/Wind Direction	WS/AWD	Scarlet Tech Ltd.	WL-21 2111DR0041	Thai Meteorological Department	119/24	13 Mar 24	12 Mar 25	-
21	Wind Speed/Wind Direction	WS/AWD	Scarlet Tech Ltd.	WL-21 2111DR0052	Thai Meteorological Department	098/24	22 Feb 24	21 Feb 25	-
22	Wind Speed/Wind Direction	WS/AWD	Scarlet Tech Ltd.	WL-21 2111DT0058	Thai Meteorological Department	121/24	13 Mar 24	12 Mar 25	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
23	Wind Speed/Wind Directional	WS/WD	Scarlet Tech Ltd.	WL-21 2112DR0065	Thai Meteorological Department	0977/24	22 Feb 24	21 Feb 25	-
24	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV35A 73246	Innovative Instrument Co.,Ltd.	24-ACT-077	30 May 24	29 May 25	-
25	Sound Level Meter	$L_{Aeq\ 24\ hrs}$ L_{A90} L_{Adn} L_{Amax} เสียงรบกวน	Larson Davis	LXT1 0007301	Electrical And Electronics Institute Foundation For Industrial Development	CP20240286EA	2 Aug 24	1 Aug 25	-
26	Sound Level Meter	$L_{Aeq\ 24\ hrs}$ L_{A90} L_{Adn} L_{Amax} เสียงรบกวน	Larson Davis	LXT1 0007302	Electrical And Electronics Institute Foundation For Industrial Development	CP20230299EA	5 Aug 23	4 Aug 24	-
27	Sound Level Meter	$L_{Aeq\ 24\ hrs}$ L_{A90} L_{Adn} L_{Amax} เสียงรบกวน	Larson Davis	LXT1 0007306	Electrical And Electronics Institute Foundation For Industrial Development	CP20240290EA	5 Aug 24	4 Aug 25	-
28	Sound Level Meter	$L_{Aeq\ 24\ hrs}$ L_{A90} L_{Adn} L_{Amax} เสียงรบกวน	Larson Davis	LXT1 0007309	Electrical And Electronics Institute Foundation For Industrial Development	CP202340287EA	2 Aug 24	1 Aug 25	-

เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3006-24 FAX 0-2719-9484



Certificate of Calibration

Certificate No.: 24P1367
Page: 1 of 2

Equipment: Aneroid Barometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE,ANV,152/2550

Condition As-Received: Used Item

Received Date: 05 April 2024

Calibration Date: 22 April 2024

Reference: 2404-0243WSC

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

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1007 mbar

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.

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

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

Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DPH142	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 Khankaw
Issue Date: 23 April 2024

Approved Signatory:

[] Phalinee Prabpaipal

[] Sura Suwanasri

[x] Atapol Panurach

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Cert.No.: 24P1367
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)	957.13	968.77	980.13	990.56	1001.26	1011.35	1022.10	1032.61
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0
Error (hPa)	2.87	1.23	-0.13	-0.56	-1.26	-1.35	-2.10	-2.61

Decreasing Pressure

Applied Pressure (hPa)	1032.61	1021.84	1010.88	1000.82	990.20	979.52	968.48	957.17
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0
Error (hPa)	-2.61	-1.84	-0.88	-0.82	-0.20	0.48	1.52	2.83

The uncertainty of measurement was ± 0.25 hPa

* UUC = Unit Under Calibration

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

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3006-24 FAX 0-2719-9484



Certificate of Calibration

Certificate No.: 24H753
Page: 1 of 2

Equipment: Dial Thermo-Hygrometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE,ANV,127/2550

Condition As-Received: Used Item

Received Date: 05 April 2024

Calibration Date: 10 April 2024

Reference: 2404-0247WSC

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

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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except with the prior written approval of the head of
Corporate Services 3: Equipment Calibration and Testing Services.

81 Soi Udomsuk 41, Sukhumvit Road,
Bangkok, Phrahanong, 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) Chilled Mirror Hygrometer	Dew Master	44730	21656	02 Aug 2024
2) Handheld Thermometer With Sensor	1521	ASA339	2311238	16 Oct 2024

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

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

-Thunder Scientific Corporation, NVLAB Accreditation No. Calibration 200582-0

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

Calibrated by: Chakrit Waewwanja
Issue Date: 18 April 2024

Approved Signatory:

[] Chakrit Waewwanja

[x] Viporn Tantiyawuti

[] Unnoppol Harachi

เอกสารไม่ควบคุม



Cert. No.: 24H753
Page: 2 of 2

Result of Calibration:-

Without Adjustment

Function:- Humidity Measurement.

Reference Temperature	Standard Humidity	UUC* Reading	Error	Uncertainty of Measurement
(°C)	(%R.H.)	(%R.H.)	(%R.H.)	(±%R.H.)
25.0	40.1	43	2.9	1.6
25.0	60.0	60	0.0	1.7
25.0	80.0	78	-2.0	1.8

Result of Calibration:-

Without Adjustment

Function:- Temperature Measurement.

Standard Temperature	UUC* Reading	Error	Uncertainty of Measurement
(°C)	(°C)	(°C)	(±°C)
20.014	20.0	-0.014	0.72
25.033	25.0	-0.033	0.72
30.010	30.0	-0.010	0.72
35.027	34.5	-0.527	0.72
40.013	39.5	-0.513	0.72

UUC* : Unit Under Calibration

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

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เอกสารไม่ควบคุม



MULTI-POINT GAS TEST REPORT

Test Date : Nov 13, 2023

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1191503036

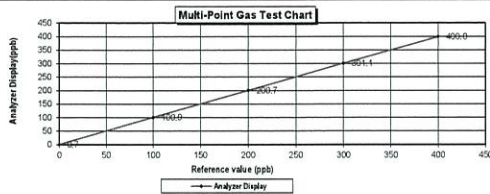
Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 21, 2024

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	0.7	0.70	0.70
Level 2	20.00%	100.0	100.9	0.90	0.89
Level 3	40.00%	200.0	200.7	0.70	0.35
Level 4	60.00%	300.0	301.1	1.10	0.37
Level 5	80.00%	400.0	400.0	0.00	0.00

Remark : Measuring Range 500.0 ppb
Acceptable Limit $\pm 5\%$
Average Difference (%) 0.46



Calculate by
13 Nov 2023

Approve by
13 Nov 2023



MULTI-POINT GAS TEST REPORT

Test Date : Nov 13, 2023

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1191503037

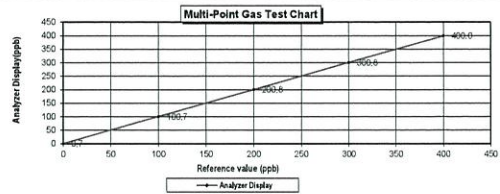
Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 21, 2024

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	0.7	0.70	0.70
Level 2	20.00%	100.0	100.7	0.70	0.70
Level 3	40.00%	200.0	200.8	0.80	0.40
Level 4	60.00%	300.0	300.8	0.80	0.27
Level 5	80.00%	400.0	400.0	0.00	0.00

Remark : Measuring Range 500.0 ppb
Acceptable Limit $\pm 5\%$
Average Difference (%) 0.41



Calculate by
13 Nov 2023

Approve by
13 Nov 2023



MULTI-POINT GAS TEST REPORT

Test Date : Nov 21, 2023

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1201497724

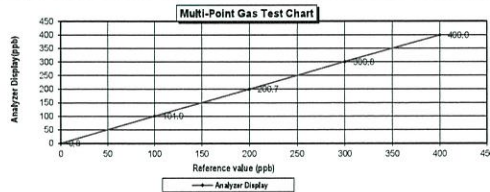
Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 21, 2024

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	0.8	0.80	0.80
Level 2	20.00%	100.0	101.0	1.00	0.99
Level 3	40.00%	200.0	200.7	0.70	0.35
Level 4	60.00%	300.0	300.8	0.80	0.27
Level 5	80.00%	400.0	400.0	0.00	0.00

Remark : Measuring Range 500.0 ppb
Acceptable Limit $\pm 5\%$
Average Difference (%) 0.48



Calculate by
21 Nov 2023

Approve by
22 Nov 2023



MULTI-POINT GAS TEST REPORT

Test Date : Nov 21, 2023

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1201778105

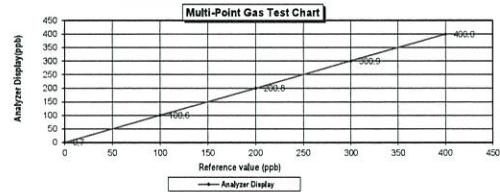
Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 21, 2024

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	0.7	0.70	0.70
Level 2	20.00%	100.0	100.6	0.60	0.60
Level 3	40.00%	200.0	200.8	0.80	0.40
Level 4	60.00%	300.0	300.9	0.90	0.30
Level 5	80.00%	400.0	400.0	0.00	0.00

Remark : Measuring Range 500.0 ppb
Acceptable Limit $\pm 5\%$
Average Difference (%) 0.40



Calculate by
21 Nov 2023

Approve by
22 Nov 2023

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND)
Part Number: LTD
Cylinder Number: E06N01E15A0014
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12023
Gas Code: CO, CO2, NO, NOX, SO2, BALN
Reference Number: 160-402772205-1
Cylinder Volume: 144.0 CF
Cylinder Pressure: 2016 PSIG
Valve Outlet: 650
Certification Date: Jul 06, 2023
Expiration Date: Jul 06, 2031

Calibration performed in accordance with EPA Testability Protocol for Assay and Certification of Gasous Calibration Standards (May 2012) document EPA 820-R-12-031. Using the assay concentration (ppb), Analytical Methodology does not require correction for analyzer interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant interferences which affect the use of the calibration mixture. All components are on a mole/mole basis unless otherwise noted. The results relate only to the items listed. The report shall not be reproduced except in full without approval of the laboratory. Do not use this cylinder below 100 psig, i.e. 0.7 megapascals.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	100.0 PPM	100.4 PPM	G1	+/- 0.9% NIST Traceable	06/27/2023 - 07/06/2023
NITRIC OXIDE	100.0 PPM	100.2 PPM	G1	+/- 0.9% NIST Traceable	06/27/2023 - 07/06/2023
SULFUR DIOXIDE	100.0 PPM	100.0 PPM	G1	+/- 1.4% NIST Traceable	06/27/2023 - 07/06/2023
CARBON MONOXIDE	200.0 PPM	199.2 PPM	G1	+/- 0.3% NIST Traceable	06/29/2023
CARBON DIOXIDE	8.000 %	7.982 %	G1	+/- 1.2% NIST Traceable	06/27/2023
NITROGEN	Balance				

Type	Lot ID	Cylinder No.	Concentration	Uncertainty	Expiration Date
GMIS	104292308	CC74364	98.36 PPM NITRIC OXIDE/NITROGEN	+/- 0.4%	Jan 04, 2021
PMIS	C2219101	APF1514248	100.19 PPM NITRIC OXIDE/NITROGEN	+/- 0.3%	Feb 28, 2025
UMIS	2625042525	CC754381	98.52 PPM NITRIC OXIDE/NITROGEN	+/- 0.4%	Apr 25, 2031
PMIS	12490	D91366	15.01 PPM NITROGEN DIOXIDE/AIR	+/- 1.5%	Feb 17, 2023
GMIS	1134022002	EB0130037	9.893 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.6%	Sep 29, 2025
NTRM	160102-22	KAL003820	97.69 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Nov 01, 2027
CO	230601	CC745902	249.47 PPM CARBON MONOXIDE/NITROGEN	+/- 0.3%	Dec 09, 2028
NTRM	130606-32	CC411730	13.359 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	May 14, 2025

Instrument/Make/Model	Analytical Principle	Last Multi-point Calibration
Nicolet 850 FTIR ALP2010245 CO2	FTIR	Jun 15, 2023
SIEMENS ULTRAMATEC N1-CA-180	NDIR	Jun 14, 2023
Nicolet 850 FTIR ALP2010245 NO	FTIR	Jun 29, 2023
Nicolet 850 FTIR ALP2010245 NO2	FTIR	Jun 15, 2023
Nicolet 850 FTIR ALP2010245 SO2	FTIR	Jun 08, 2023

Approved for Release

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MULTI-POINT GAS TEST REPORT

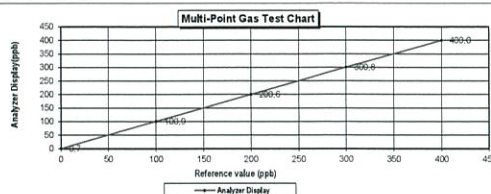
Test Date : Nov 3, 2023

Equipment : Gas Analyzer (SO₂) Model : 43
Manufacturer : Thermo SCIENTIFIC Serial Number : CM22387065

Standard Gas Concentration	Dilutor Detail
Sulphur Dioxide (SO ₂)	44.68 PPM Manufacturer : Thermo SCIENTIFIC
Nitric Oxide (NO)	45.94 PPM Model : 1461
Methane (CH ₄)	- PPM Serial Number : 1180540071
Carbon Monoxide (CO)	984.8 PPM
Cylinder No. :	EB0143262
Expiration Date :	Jun 24, 2024

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.70	0.70	0.70
Level 2 20.00%	100.0	100.9	0.90	0.89
Level 3 40.00%	200.0	200.6	0.60	0.30
Level 4 60.00%	300.0	300.8	0.80	0.27
Level 5 80.00%	400.0	400.0	0.00	0.00

Remark : Measuring Range 500.0 ppb
Acceptable Limit $\pm 5\%$



Calculate by : 03 Nov 2023
Approve by : 03 Nov 2023

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

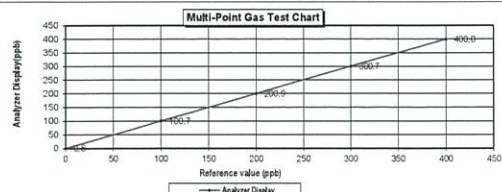
Test Date : Nov 3, 2023

Equipment : Gas Analyzer (SO₂) Model : 43
Manufacturer : Thermo SCIENTIFIC Serial Number : CM22387066

Standard Gas Concentration	Dilutor Detail
Sulphur Dioxide (SO ₂)	44.68 PPM Manufacturer : Thermo SCIENTIFIC
Nitric Oxide (NO)	45.94 PPM Model : 1461
Methane (CH ₄)	- PPM Serial Number : 1180540071
Carbon Monoxide (CO)	984.8 PPM
Cylinder No. :	EB0143262
Expiration Date :	Jun 24, 2024

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.50	0.50	0.50
Level 2 20.00%	100.0	100.7	0.70	0.70
Level 3 40.00%	200.0	200.9	0.90	0.45
Level 4 60.00%	300.0	300.7	0.70	0.23
Level 5 80.00%	400.0	400.0	0.00	0.00

Remark : Measuring Range 500.0 ppb
Acceptable Limit $\pm 5\%$



Calculate by : 03 Nov 2023
Approve by : 03 Nov 2023

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เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

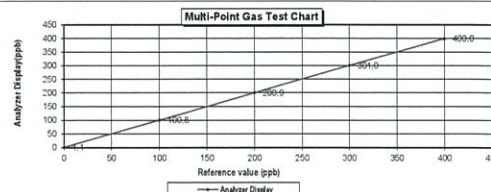
Test Date : Nov 3, 2023

Equipment : Gas Analyzer (SO₂) Model : 43
Manufacturer : Thermo SCIENTIFIC Serial Number : 1200906875

Standard Gas Concentration	Dilutor Detail
Sulphur Dioxide (SO ₂)	44.68 PPM Manufacturer : Thermo SCIENTIFIC
Nitric Oxide (NO)	45.94 PPM Model : 1461
Methane (CH ₄)	- PPM Serial Number : 1180540071
Carbon Monoxide (CO)	984.8 PPM
Cylinder No. :	EB0143262
Expiration Date :	Jun 24, 2024

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	1.10	1.10	1.10
Level 2 20.00%	100.0	100.8	0.80	0.79
Level 3 40.00%	200.0	200.9	0.90	0.45
Level 4 60.00%	300.0	301.0	1.00	0.33
Level 5 80.00%	400.0	400.0	0.00	0.00

Remark : Measuring Range 500.0 ppb
Acceptable Limit $\pm 5\%$



Calculate by : 03 Nov 2023
Approve by : 03 Nov 2023

Page 1 of 1

เอกสารไม่ควบคุม



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

MULTI-POINT GAS TEST REPORT

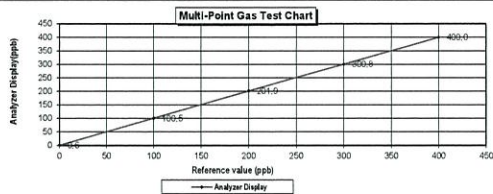
Test Date : Nov 9, 2023

Equipment : Gas Analyzer (SO₂) Model : 43
Manufacturer : Thermo SCIENTIFIC Serial Number : 1200906876

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO ₂)	44.68 PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	45.94 PPM	Model :	1461
Methane (CH ₄)	- PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	984.8 PPM		
Cylinder No. :	EB0143262		
Expiration Date :	Jun 24, 2024		

Multi-point gas test data

Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.6	0.60	0.60
Level 2	20.00%	100.0	100.5	0.50	0.50
Level 3	40.00%	200.0	201.9	1.90	0.94
Level 4	60.00%	300.0	300.8	0.80	0.27
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range		500.0 ppb	Average Difference (%)		0.46



Calculate by
G. S. S. S.
9 / 11 / 66

Approve by
R. S. S. S.
9 / Nov / 2023



Airgas Specialty Gases
Airgas USA LLC
6141 Easton Road
Pittsburgh, PA 15204
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND) LTD.
Part Number: E05N161E15A0014
Cylinder Number: EB0162121
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12023
Gas Code: CO, CO₂, NO, NO₂, SO₂, BALN
Reference Number: 160-402772205-1
Cylinder Volume: 144.0 CF
Cylinder Pressure: 2016 PSIG
Valve Outlet: 650
Certification Date: Jul 06, 2023
Expiration Date: Jul 06, 2023

Calibration performed in accordance with EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012) document EPA 800/R-12/031, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical impurity as stated below with a confidence level of 95%. There are no significant impurities which affect the use of the calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do not use this cylinder below 100 psig, 16.0 MPa maximum.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NO ₂	100.0 PPM	100.4 PPM	G1	$\pm 0.9\%$ NIST Traceable	06/27/2023, 07/06/2023
NITRIC OXIDE	100.0 PPM	100.2 PPM	G1	$\pm 0.9\%$ NIST Traceable	06/27/2023, 07/06/2023
SULFUR DIOXIDE	100.0 PPM	100.0 PPM	G1	$\pm 1.4\%$ NIST Traceable	06/27/2023, 07/06/2023
CARBON MONOXIDE	200.0 PPM	199.2 PPM	G1	$\pm 0.3\%$ NIST Traceable	06/27/2023
CARBON DIOXIDE	8.000 %	7.942 %	G1	$\pm 1.2\%$ NIST Traceable	06/27/2023
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GAS	104202303	CC754364	90.38 PPM NITRIC OXIDE/NITROGEN	$\pm 0.4\%$	Jan 04, 2031
PRM	C2219101	APE1814048	100.19 PPM NITRIC OXIDE/NITROGEN	$\pm 0.3\%$	Feb 28, 2025
GAS	2023042525	CC754381	98.52 PPM NITRIC OXIDE/NITROGEN	$\pm 0.4\%$	Apr 25, 2031
PRM	12409	D913665	15.01 PPM NITROGEN DIOXIDE/AIR	$\pm 1.5\%$	Feb 11, 2023
GAS	15340020202	EB0130037	9.693 PPM NITROGEN DIOXIDE/NITROGEN	$\pm 1.6\%$	Sep 29, 2025
NTRM	160102-22	KAL003820	97.58 PPM SULFUR DIOXIDE/NITROGEN	$\pm 0.8\%$	Nov 01, 2027
CO	230601	CC745902	249.47 PPM CARBON MONOXIDE/NITROGEN	$\pm 0.2\%$	Dec 09, 2028
NTRM	130609-02	CC4117730	13.399 % CARBON DIOXIDE/NITROGEN	$\pm 0.6\%$	May 14, 2025

Instrument/Make/Model	Analytical Principle	Last Multi-point Calibration
Nicolet 650 FTR ALP2010245 CO2	FTR	Jun 15, 2023
SIEMENS ULTRAMATRE N1-C8-180	NDIR	Jun 14, 2023
Nicolet 650 FTR ALP2010245 NO	FTR	Jun 29, 2023
Nicolet 650 FTR ALP2010245 NO2	FTR	Jun 15, 2023
Nicolet 650 FTR ALP2010245 SO2	FTR	Jun 08, 2023

Approved for Release



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

MULTI-POINT GAS TEST REPORT

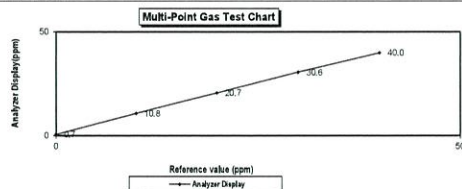
Test Date : Dec 8, 2023

Equipment : Gas Analyzer (CO) Model : 48
Manufacturer : Thermo Scientific Serial Number : 1180540068

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

Multi-point gas test data

Reference Value (ppm)		Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.7	0.7	0.7
Level 2	20.00%	10.0	10.8	0.8	7.4
Level 3	40.00%	20.0	20.7	0.7	3.4
Level 4	60.00%	30.0	30.6	0.6	2.0
Level 5	80.00%	40.0	0.0	0.0	0.0
Remark : Measuring Range 50.0 ppm			Average Difference (%)		2.69



Calculate by
G. S. S. S.
8 / 12 / 2023

Approve by
R. S. S. S.
8 / Dec / 2023



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

MULTI-POINT GAS TEST REPORT

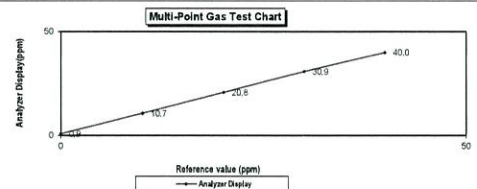
Test Date : Nov 13, 2023

Equipment : Gas Analyzer (CO) Model : 48
Manufacturer : Thermo Scientific Serial Number : 1180540074

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

Multi-point gas test data

Reference Value (ppm)		Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.9	0.9	0.9
Level 2	20.00%	10.0	10.7	0.7	6.5
Level 3	40.00%	20.0	20.8	0.8	3.8
Level 4	60.00%	30.0	30.9	0.9	2.9
Level 5	80.00%	40.0	0.0	0.0	0.0
Remark : Measuring Range		50.0 ppm	Average Difference (%)		2.84



Calculate by
G. S. S. S.
13 / 11 / 2023

Approve by
R. S. S. S.
13 / Nov / 2023



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

MULTI-POINT GAS TEST REPORT

Test Date : Nov 13, 2023

Equipment : Gas Analyzer (CO) Model : 48i
Manufacturer : Thermo Scientific Serial Number : CM08140004

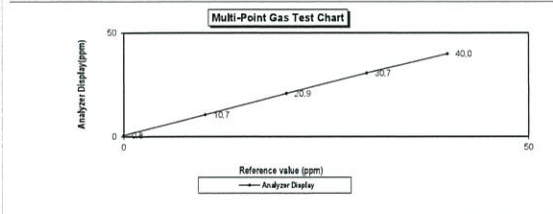
Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO ₂)	44.68 PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.94 PPM	Model :	146i
Methane (CH ₄)	- PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	984.8 PPM		
Cylinder No. :	EB0143262		
Expiration Date :	Jun 20, 2024		

Multi-point gas test data

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

Remark : Measuring Range 50.0 ppm

Acceptable Limit $\pm 5\%$



Calculate by

13 / 11 / 2023

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13 / Nov / 2023

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

MULTI-POINT GAS TEST REPORT

Test Date : Dec 18, 2023

Equipment : Gas Analyzer (CO) Model : 48i
Manufacturer : Thermo Scientific Serial Number : 1182920020

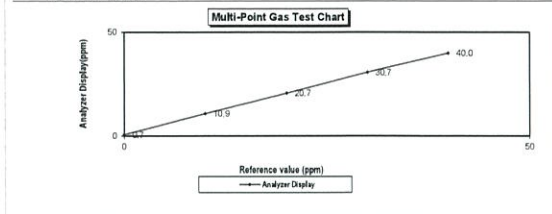
Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO ₂)	44.68 PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.94 PPM	Model :	146i
Methane (CH ₄)	- PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	984.8 PPM		
Cylinder No. :	EB0143262		
Expiration Date :	Jun 20, 2024		

Multi-point gas test data

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	% Error
Level 1	Zero	0.0	0.7	0.7	0.7
Level 2	20.00%	10.9	0.9	8.3	8.3
Level 3	40.00%	20.7	0.7	3.4	3.4
Level 4	60.00%	30.7	0.7	2.3	2.3
Level 5	80.00%	40.0	0.0	0.0	0.0

Remark : Measuring Range 50.0 ppm

Acceptable Limit $\pm 5\%$



Calculate by

18 / 12 / 2023

Approve by

18 / Dec / 2023

Page 1 of 1

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an Air Liquide company

Airgas Specialty Gases
Airgas USA LLC
641 Stanton Road
Plumsteadville, PA 18949
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND)

Part Number: EDSN01E15A0014

Cylinder Number: EBO162121

Laboratory: 124 - Plumsteadville - PA

P/GVP Number: A12023

Gas Code: CO, CO₂, NO, NO₂, SO₂, BALN

Reference Number: 160-40272205-1

Cylinder Volume: 144.0 CF

Cylinder Pressure: 2016 PSIG

Valve Outlet: 650

Certification Date: Jul 06, 2023

Expiration Date: Jul 06, 2031

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA-820R-12-021, 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%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a molar basis unless otherwise noted. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do not use this cylinder below 100 psig, i.e. 6.9 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NO _x	100.0 PPM	100.4 PPM	G1	$\pm 0.9\%$ NIST Traceable	06/27/2023, 07/06/2023
NITRIC OXIDE	100.0 PPM	100.2 PPM	G1	$\pm 0.9\%$ NIST Traceable	06/27/2023, 07/06/2023
SULFUR DIOXIDE	100.0 PPM	100.0 PPM	G1	$\pm 1.4\%$ NIST Traceable	06/27/2023, 07/06/2023
CARBON MONOXIDE	200.0 PPM	199.2 PPM	G1	$\pm 0.3\%$ NIST Traceable	06/26/2023
CARBON DIOXIDE	8.000 %	7.982 %	G1	$\pm 1.2\%$ NIST Traceable	06/27/2023
NITROGEN	Balance				

CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No.	Concentration	Uncertainty Expiration Date
GMS	104202308	CC754364	98.36 PPM NITRIC OXIDE/NITROGEN	$\pm 0.4\%$ Jan 04, 2031
PRM	C2218101	APE1514048	100.16 PPM NITRIC OXIDE/NITROGEN	$\pm 0.3\%$ Feb 28, 2025
GMS	2023042525	CC754381	98.52 PPM NITRIC OXIDE/NITROGEN	$\pm 0.4\%$ Apr 25, 2031
PRM	12409	D913660	15.01 PPM NITROGEN DIOXIDE/AIR	$\pm 1.5\%$ Feb 17, 2023
GMS	15340522002	E80130027	9.693 PPM NITROGEN DIOXIDE/NITROGEN	$\pm 1.5\%$ Sep 29, 2025
NTRM	160102-22	KAL030820	97.59 PPM SULFUR DIOXIDE/NITROGEN	$\pm 0.9\%$ Nov 01, 2027
CO	230601	CC745052	248.47 PPM CARBON MONOXIDE/NITROGEN	$\pm 0.3\%$ Dec 09, 2028
NTRM	130606-02	CC411730	13.359 PPM CARBON DIOXIDE/NITROGEN	$\pm 0.6\%$ May 14, 2025

The SEM, NTRM, PRM, or RGM 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	Last Multipoint Calibration
Nicolet (550 FTR) AUP2010245 CO2	FTR	Jun 15, 2023
SIEMENS ULTRAMATE N1-CR-180	NDIR	Jun 14, 2023
Nicolet (550 FTR) AUP2010245 NO	FTR	Jun 29, 2023
Nicolet (550 FTR) AUP2010245 NO2	FTR	Jun 15, 2023
Nicolet (550 FTR) AUP2010245 SO2	FTR	Jun 09, 2023

Approved for Release

Page 1 of 1

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THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 13 March, 2024

Certification No. 119/24

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2111DR0041

Wind Sensor 2111DT0041

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangkok, Phrakhanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1010.6 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

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

N.I.S.T. Test Reference Number 731241460 : Standard Velocity at 20 : 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-80A4)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 : 20 m/sec

STANDARD THERMOMETER : Theodor Friedrichs : Dry No.8390/94 Wet No. 8389/94

: Iteco, Iteco 645 Serial No. C2848057 : ThermoSchneider No.918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

Digital Barometer Vaisala Type PTB330 No. V1220001

Calibrated by : H. H. H.

Signed :

Mr. Watcharaporn Subwat

Mr. Pisok Promsat

Mechanical Engineer

(Authorized Signature)

for the Chief

Sub-Standard Instrument

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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 119/24

13 March, 2024

Page : 2 of 5

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Velocity	Velocity	Velocity	Correction
Ultrasonic Anemometer	inches H2O	inches H2O	inches H2O	m/sec	m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	7.0	0.04
9.02	-	-	-	9.0	0.12
11.02	-	-	-	11.0	0.02
13.01	-	-	-	13.0	0.01
15.01	-	-	-	14.9	0.11
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

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

Calibrated by: Hathrapol
Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 119/24

13 March, 2024

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mbar
1009.59	1009	0.59
1009.45	1009	0.45
1010.10	1010	0.10
1010.94	1011	-0.06
1011.46	1011	0.46
1011.54	1012	-0.16
1012.56	1012	0.06
1013.04	1013	0.04
1013.18	1013	0.16
1012.89	1013	-0.11
1013.20	1013	0.20
1013.44	1014	-0.56
1013.81	1014	-0.19
1014.19	1014	0.19
1015.98	1016	-0.04
1016.23	1016	0.23
1015.64	1016	-0.36
1015.23	1015	0.23
1012.87	1013	-0.13
1013.63	1014	-0.37

Average 0.04

Calibrated by: Hathrapol
Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 119/24

13 March, 2024

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
757.26	757	0.26
757.15	757	0.15
757.64	758	-0.36
758.27	758	0.27
758.66	758	0.66
758.94	759	-0.06
759.11	759	0.11
759.84	760	-0.16
759.95	760	-0.05
759.73	760	-0.27
759.96	760	-0.04
760.14	760	0.14
760.42	761	-0.58
760.70	761	-0.30
762.03	762	0.03
762.24	762	0.24
761.79	762	-0.21
761.48	761	0.48
759.71	760	-0.29
760.28	760	0.28

Average 0.02

Calibrated by: Hathrapol
Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 119/24

13 March, 2024

Page : 5 of 5

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

Calibrated by: Hathrapol
Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 22 February, 2024

Certification No. 098/24

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLETT/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2111DR0062

Wind Sensor 2111DT0052

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.5 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aft Plotting Board

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

N.I.S.T. Test Reference Number 731241460

: Standard Velocity at 20 - 30 m/sec

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

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

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

: test. test 645 Serial No. 02848057

: Thermoschneider No.918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB220 No. V1220015

Calibrated by : Watchapol Subwat

Signed : Mr. Pradeep Prasad

(Authorized Signatory)

Mr. Watchapol Subwat

Mr. Pradeep Prasad

Mechanical Engineer

For the Chief

Sub-Standard Instrument

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

22 February, 2024

Certification No. 098/24

Page : 2 of 5

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

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

Calibrated by : Watchapol

Mr. Watchapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

22 February, 2024

Certification No. 098/24

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mbar
1010.84	1011	-0.16
1010.60	1010	0.00
1011.71	1012	-0.29
1012.17	1012	0.17
1012.31	1012	0.31
1012.25	1012	0.25
1012.79	1013	-0.21
1012.95	1012	0.95
1013.52	1014	-0.48
1014.16	1014	0.16
1015.79	1016	-0.21
1016.02	1016	0.02
1015.85	1016	-0.14
1015.69	1015	0.69
1011.51	1012	-0.49
1011.60	1012	-0.20
1012.06	1012	0.06
1012.61	1013	-0.19
1013.22	1013	0.22
1013.49	1013	0.49

Average

0.08

Calibrated by : Watchapol

Mr. Watchapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

22 February, 2024

Certification No. 098/24

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
758.19	758	0.19
758.01	758	0.01
758.84	759	-0.16
759.19	759	0.19
759.29	759	0.29
759.25	759	0.25
759.65	760	-0.35
759.77	760	-0.23
760.20	760	0.20
760.68	760	0.68
761.90	762	-0.10
762.08	762	0.08
761.95	762	-0.04
761.83	762	-0.17
758.69	759	-0.31
758.91	759	-0.09
759.11	759	0.11
759.67	760	-0.33
759.96	760	-0.02
760.18	760	0.18

Average

0.02

Calibrated by : Watchapol

Mr. Watchapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

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

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

Calibrated by :
Mr. Watcharapol Subwat
Mechanical Engineer



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 13 March, 2024

Certification No. 121/24

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2111DR0058

Wind Sensor 2111DT0058

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prekanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1011.9 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs FCD14 Serial No. 9310119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

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

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER : Theodor Friedrichs : Dry No.8390/94 Wet No. 8389/94

: Testo, testo 645 Serial No. 02848057 : ThermoSchneider No.918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

Digital Barometer Vaisala Type PTB220 No. V1220015

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Signed :

Mr. Puad Promsat

Mechanical Engineer

(Authorized Signatory)

For the Chief

Sub-Standard Instruments

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

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

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

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

Calibrated by :
Mr. Watcharapol Subwat
Mechanical Engineer



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

13 March, 2024 Certification No. 121/24 Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mbar
1009.59	1009	0.59
1009.45	1010	-0.55
1010.10	1010	0.10
1010.94	1011	-0.06
1011.45	1011	0.45
1011.84	1012	-0.16
1012.06	1012	0.06
1013.04	1013	0.04
1013.18	1013	0.18
1012.89	1013	-0.11
1013.20	1013	0.20
1013.44	1013	0.44
1013.81	1014	-0.19
1014.19	1014	0.19
1015.96	1016	-0.04
1016.23	1016	0.23
1015.54	1015	0.54
1015.23	1015	0.23
1012.87	1013	-0.13
1013.63	1014	-0.37

Average : 0.08

Calibrated by :
Mr. Watcharapol Subwat
Mechanical Engineer



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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 121/24

13 March, 2024

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
757.25	757	0.25
757.15	757	0.15
757.04	758	-0.38
756.27	758	0.37
756.66	756	0.66
756.94	756	-0.06
759.11	759	0.11
756.84	760	-0.16
759.95	760	-0.05
759.73	760	-0.27
759.96	760	-0.04
760.14	760	0.14
760.42	761	-0.58
760.70	761	-0.30
762.03	762	0.03
762.24	762	0.24
761.79	762	-0.21
761.46	762	-0.52
759.71	760	-0.29
760.26	760	0.26

Average -0.03

Calibrated by : Watchapol
Mr. Watchapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 121/24

13 March, 2024

Page : 5 of 5

Standard Temp.	Temperature Sensor Reading	
	Reading	Correction
°C	°C	°C
45.1	45	0.1
30.2	30	0.2
15.4	15	-0.6

Calibrated by : Watchapol
Mr. Watchapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 22 February, 2024

Certification No. 097/24

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2112DR0065

Wind Sensor 2112DT0065

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.8 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aft Plotting Board

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

N.J.S.T. Test Reference Number 731/241400

: Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer

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

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

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

: Isetto, Isetto 645 Serial No. 02848057

: Thermoschneider No. 918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB220 No. V1220015

Calibrated by : Watchapol

Signed :

Mr. Watchapol Subwat

Mr. Pined Promsit

(Authorized Signatory)

for the Chief

Sub-Standard Instrument

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 097/24

22 February, 2024

Page : 2 of 5

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
m/sec	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	2.9	0.12
5.00	-	-	-	4.9	0.10
7.04	-	-	-	7.0	0.04
9.02	-	-	-	9.0	0.02
11.02	-	-	-	11.0	0.02
13.01	-	-	-	13.0	0.01
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

Wind Aft Plotting Board

US DEPARTMENT OF COMMERCE WEATHER BUREAU

WIND DIRECTION		TESTED WIND DIRECTION	
0		0	
90		90	
180		180	
270		270	

Calibrated by : Watchapol
Mr. Watchapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 097/24

22 February, 2024

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mbar
1010.84	1011	-0.16
1010.60	1011	-0.40
1011.71	1011	0.71
1012.17	1012	0.17
1012.31	1012	0.31
1012.25	1012	0.25
1012.79	1013	-0.21
1012.96	1012	0.96
1013.52	1014	-0.48
1014.16	1014	0.16
1015.79	1016	-0.21
1016.02	1015	0.02
1015.86	1016	-0.14
1015.69	1015	0.69
1011.51	1012	-0.49
1011.80	1012	-0.20
1012.08	1012	0.08
1012.81	1013	-0.19
1013.22	1013	0.22
1013.49	1014	-0.51

Average

0.03

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 097/24

22 February, 2024

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
758.19	758	0.19
758.01	758	0.01
758.84	758	0.84
758.19	759	0.19
759.29	759	0.29
759.25	759	0.25
759.65	759	0.65
759.77	760	-0.23
760.20	760	0.20
760.68	760	0.68
761.90	762	-0.10
762.08	762	0.08
761.98	762	-0.04
761.83	762	-0.17
758.96	759	-0.31
758.91	759	-0.09
758.11	759	0.11
759.87	760	-0.33
759.98	760	-0.02
760.18	760	0.18

Average

0.12

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 097/24

22 February, 2024

Page : 5 of 5

Standard	Temperature Sensor	
	Reading	Correction
Temp.	Temp.	Temp.
°C	°C	°C
45.2	45	0.2
30.3	30	0.3
15.8	16	-0.2

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT (U.S.) LTD. HEAD OFFICE
7139 MIDWAY BLVD. SUITE 100, TAMPA, FL 33634, USA
AMPHOE BANG PHU (SAMUT) PRAKAN PROVINCE 1040 THAILAND
TEL: 6600-2116-7800 FAX: 6600-2116-7140



Certificate of Calibration

Customer

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

Certificate No : 24-ACT-077
Request No : Req 2024-1138

Unit Under Calibration Details

Measurement item : Acoustic Calibrator Class : 1
Manufacturer : SVANTEK Range : 94, 114 dB / 1000 Hz
Model : SV 35A Instrument Status : Used
Serial Number : 73246
ID : UAE-EFM.104/2561

Calibration Environment and Details

Temperature : (23 ± 2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ± 10.0 hPa)
Received Date : 23 May 2024
Calibration Date : 30 May 2024
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEL	31 May 2024
THD Multimeter	2015	1047765	NIMT	16 January 2025

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

Note

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

Calibrated By :

Mr. Noppadon Luangart
Service Calibration Engineer

Approved By :

Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 30 May 2024

The results stated only to the item exhibited. The certificate shall not be reproduced except in full, without written approval of the issuer.
FIM-708-ACT-02 Rev 01 Issue date: 6/23

เอกสารไม่ควบคุม

Certificate No : 24-ACT-077
Request No : Req-2024-1138

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)
	Measured	Deviated value	Measured	Deviated value		
94 dB / 1000 Hz	93.83	-0.17	-	-	0.13	0.25
114 dB / 1000 Hz	113.80	-0.20	-	-	0.13	0.25

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (Hz)	Deviated value	Measured (Hz)	Deviated value		
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 (%)	Deviated value	Measured (%)	Deviated value		
94 dB / 1000 Hz	0.09	-	-	-	0.40	2.5
114 dB / 1000 Hz	0.28	-	-	-	0.40	2.5

Note :

Function	Maximum-permitted Uncertainty of measurement
Sound pressure level	0.15 dB
Frequency	0.20%
Total distortion+noise	0.50%

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

End of Calibration

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuer.
เอกสารไม่ควบคุม
FM-708-ACT-02 Rev.01 Issue date:8/23

Certificate of Calibration

Customer

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

Certificate No : 24-ACT-077
Request No : Req-2024-1138

Unit Under Calibration Details

Measurement item : Acoustic Calibrator Class : 1
Manufacturer : SVANTEK Range : 94 , 114 dB / 1000 Hz
Model : SV 35A Instrument Status : Used
Serial Number : 73246
ID : UAE EFM.1042561

Calibration Environment and Details


Temperature : (23 ± 2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ± 0.0 hPa)
Received Date : 23 May 2024
Calibration Date : 30 May 2024
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators


Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58679	EEL	31 May 2024
THD Multimeter	2015	1047765	NIMT	16 January 2025

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

Note

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

Calibrated By : 
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : 
Mr. Paet Mathavorn
Calibration Engineer Supervisor

Issue Date : 30 May 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuer.
เอกสารไม่ควบคุม
FM-708-ACT-02 Rev.01 Issue date:8/23

Certificate No : 24-ACT-077
Request No : Req-2024-1138

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)
	Measured	Deviated value	Measured	Deviated value		
94 dB / 1000 Hz	93.83	-0.17	-	-	0.13	0.25
114 dB / 1000 Hz	113.80	-0.20	-	-	0.13	0.25

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (Hz)	Deviated value	Measured (Hz)	Deviated value		
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 (%)	Deviated value	Measured (%)	Deviated value		
94 dB / 1000 Hz	0.09	-	-	-	0.40	2.5
114 dB / 1000 Hz	0.28	-	-	-	0.40	2.5

Note :

Function	Maximum-permitted Uncertainty of measurement
Sound pressure level	0.15 dB
Frequency	0.20%
Total distortion+noise	0.50%

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

End of Calibration

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuer.
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FM-708-ACT-02 Rev.01 Issue date:8/23



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT
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Phraeae Sa, Mueang Samut Prakan, Samut Prakan 10280
Tel : +66 2709 4860 Fax : +66 2324 0917



Certificate No.: CP20240324EA
Operation No.: CP2024080295

Certificate of Calibration

Equipment: Sound Level Meter
Manufacturer: Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)
Model/Type: LxT1 (Meter), 377B02 (Microphone), PRLxT1 (Preamplifier)
Serial No.: 0007302 (Meter), 344896 (Microphone), 0776637 (Preamplifier)
ID No.: UAE EFM.035/2566
Customer: United Analyst and Engineering Consultant Co.,Ltd.
Address: 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak
Phrakhanong, Bangkok 10260
Received Date: 9 August 2024
Calibrated Date: 22 - 27 August 2024
Issued Date: 28 August 2024
Calibrated by: Ms. Juntaporn Kunhakom

Approved by: 
(Mr. Sittichai Swaksuriyawong)
Group Manager

This report was prepared electronically using applicable electronic signature. Printing or copy of file are considered as a copy of the document.
The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor (k) providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.

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F-CL-004 Ed 1



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FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20240324EA

Calibration Report

Equipment: Sound Level Meter
Manufacturer: Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)
Model/Type: LxT1 (Meter), 377802 (Microphone), PRMLxT1 (Preamplifier)
Serial No.: 0007302 (Meter), 344896 (Microphone), 0776637 (Preamplifier)
ID No.: UAE EFM.035/2566
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Pressure: (101.3 ± 1.5) kPa

Method of Calibration :-
IEC 61672-3:2013.

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1012-23	12 November 2024
2) Arbitrary Function Generator	AFG2021	C010063	CK20240048EA	23 June 2025
3) Programmable Attenuator	PA5	2755	EF-0040-23	1 October 2024
4) 6.5 Digit precision multimeter	8846A	9610014	CB20230200EA	15 November 2024
5) Pressure humidity and Temperature Transmitter	PTU301	L3950483	CL1-P240023	24 March 2025
6) Pressure humidity and Temperature Transmitter	PTU301	L3950484	CD20240142EA	12 June 2025
7) Performance Audio Analyzer	UB903B	MY56510003	CL1-P240030	11 April 2025
			CD20240143EA	12 June 2025
			CB20240035EB	13 February 2025
			CK20230072EA	13 September 2024

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

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

- Reference standards instrument for Acoustic function
- National Institute of Metrology (Thailand)
- Reference standards instrument for Electrical function
- National Institute of Metrology (Thailand)
- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
-	-	-	-

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ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20240324EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
28.8

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	28.6
C-weighting	28.4
Z-weighting	34.3

Function : 3. Acoustical signal tests of frequency weightings (Without Windscreen)

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

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.1	0.1	0.1	±1.0
1000	0.0	0.0	0.0	±0.7
8000	-0.2	-0.2	-0.1	+1.5; -2.5

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	-0.1	0.0	0.0	±1.0
125	0.0	0.0	-0.1	±1.0
250	-0.1	0.0	-0.1	±1.0
500	0.0	0.0	-0.1	±1.0
1000	0.0	0.0	0.0	±0.7
2000	0.0	0.0	0.0	±1.0
4000	0.0	0.0	0.0	±1.0
8000	-0.1	0.0	0.0	+1.5; -2.5
16000	0.0	0.0	-0.1	+2.5; -16.0

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ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20240324EA

Calibration Report

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
C-weighting	94.0	0.0	±0.2
A-weighting	94.0	0.0	±0.2
Z-weighting	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	±0.1
Slow	94.0	0.0	±0.1
LAeq	94.0	0.0	±0.1

Function : 6. Long-Term Stability

Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	±0.1

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.8
99.0	99.0	0.0	±0.8
104.0	104.0	0.0	±0.8
109.0	109.0	0.0	±0.8
114.0	114.0	0.0	±0.8
119.0	119.0	0.0	±0.8
124.0	124.0	0.0	±0.8
129.0	129.0	0.0	±0.8
134.0	134.0	0.0	±0.8
139.0	139.0	0.0	±0.8

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ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20240324EA

Calibration Report

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.1	0.1	±0.8
39.0	39.4	0.4	±0.8

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	136.0	0.0	±0.5
	2	118.8	-0.2	+1.0; -1.5
	0.25	109.7	-0.3	+1.0; -3.0
Slow	200	129.5	-0.1	±0.5
	2	109.9	-0.1	+1.0; -3.0
	0.25	130.0	0.0	±0.5
LAE	200	110.0	0.0	+1.0; -1.5
	2	110.0	0.0	+1.0; -1.5
	0.25	100.9	-0.1	+1.0; -3.0

Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	135.4	134.8	-0.6	±2.0
Positive half cycle	134.4	134.0	-0.4	±1.0
Negative half cycle	134.4	134.1	-0.3	±1.0

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ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20240324EA

Calibration Report

Function : 10. Overload Indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
143.6	143.4	-0.2	±1.5

Function : 11. High-Level Stability

High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	139.0	139.0	0.0	±0.1

Uncertainty of measurement

Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings - Free-field sound pressure response level	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Tone burst response	0.20	0.30
9) Peak C sound level	0.20	0.35
10) Overload indication	0.20	0.25
11) High-Level Stability	0.10	0.10

- Remarks:
1. Indication at the calibration check frequency can not measured because customer does not provide a sound calibrator.
 2. The acceptance limit is for the deviated value.
 3. Acceptance limits was IEC61672-3:2013 Class 1.
 4. The coverage factor $k = 2.00$

- - End of Report - -

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Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280

Tel: +66 2709 4860 Fax: +66 2324 0917



Certificate No.: CP20240290EA

Operation No.: CP2024070253

Certificate of Calibration

Equipment: Sound Level Meter
Manufacturer: Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)
Model/Type: LxT1 (Meter), 377B02 (Microphone), PRLxT1 (Preamplifier)
Serial No.: 0007306 (Meter), 345235 (Microphone), 077641 (Preamplifier)
ID No.: UAE.EFM.039/2566
Customer: United Analyst and Engineering Consultant Co.,Ltd.
Address: 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak
Phrakhanong, Bangkok 10260
Received Date: 25 July 2024
Calibrated Date: 5 - 6 August 2024
Issued Date: 7 August 2024
Calibrated by: Ms. Juntaporn Kunhakom

Approved by:
(Mr. Sittichai Swaksuriyawong)
Group Manager

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F-CAL-004 Ed 1



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20240290EA

Calibration Report

Equipment: Sound Level Meter
Manufacturer: Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)
Model/Type: LxT1 (Meter), 377B02 (Microphone), PRLxT1 (Preamplifier)
Serial No.: 0007306 (Meter), 345235 (Microphone), 077641 (Preamplifier)
ID No.: UAE.EFM.039/2566
Ambient Temperature: $(23 \pm 2) ^\circ\text{C}$
Relative Humidity: $(50 \pm 15) \%$
Pressure: $(101.3 \pm 1.5) \text{ kPa}$
Method of Calibration :-
IEC 61672-3:2013

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1012-23	12 November 2024
2) Arbitrary Function Generator	AFG2021	C010063	CK20240048EA	23 June 2025
3) Programmable Attenuator	PA5	2755	EF-0040-23	1 October 2024
4) 6.5 Digit precision multimeter	8846A	9610014	CB20230200EA	15 November 2024
5) Pressure humidity and Temperature Transmitter	PTU301	L3950483	CL1-P240023	24 March 2025
6) Pressure humidity and Temperature Transmitter	PTU301	L3950484	CL1-P240030	11 April 2025
7) Performance Audio Analyzer	U8903B	MY56510003	CD20240143EA	12 June 2025
			CD20240143EA	12 June 2025
			CB20240035EB	13 February 2025
			CK20230072EA	13 September 2024

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

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

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- National Institute of Metrology (Thailand)

- Electrical and Electronics Institute; NSC Accredited Calibration No 0119

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
-	-	-	-

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ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20240290EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
28.8

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	28.7
C-weighting	28.4
Z-weighting	34.5

Function : 3. Acoustical signal tests of frequency weightings (Without Windscreen)

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

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.1	0.0	0.0	±1.0
1000	-0.1	-0.1	-0.1	±0.7
8000	-0.4	-0.5	-0.4	+1.5; -2.5

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz:

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	0.0	0.0	0.0	±1.0
125	0.0	0.0	0.0	±1.0
250	0.0	0.0	0.0	±1.0
500	0.0	0.0	0.0	±1.0
1000	0.0	0.0	0.0	±0.7
2000	0.0	0.0	0.0	±1.0
4000	0.0	0.0	0.0	±1.0
8000	-0.1	-0.1	0.0	+1.5; -2.5
16000	0.0	0.0	0.0	+2.5; -16.0

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ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20240290EA

Calibration Report

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
C-weighting	94.0	0.0	±0.2
A-weighting	94.0	0.0	±0.2
Z-weighting	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	±0.1
Slow	94.0	0.0	±0.1
LAeq	94.0	0.0	±0.1

Function : 6. Long-Term Stability

Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	±0.1

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.8
99.0	99.0	0.0	±0.8
104.0	104.0	0.0	±0.8
109.0	109.0	0.0	±0.8
114.0	114.0	0.0	±0.8
119.0	119.0	0.0	±0.8
124.0	124.0	0.0	±0.8
129.0	129.0	0.0	±0.8
134.0	134.0	0.0	±0.8
139.0	139.0	0.0	±0.8
140.0	140.0	0.0	±0.8

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ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20240290EA

Calibration Report

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.1	0.1	±0.8
39.0	39.4	0.4	±0.8

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	136.0	0.0	±0.5
	2	118.8	-0.2	+1.0; -1.5
	0.25	109.7	-0.3	+1.0; -3.0
Slow	200	129.5	-0.1	±0.5
	2	109.8	-0.2	+1.0; -3.0
	0.25	100.9	-0.1	+1.0; -3.0
LAeq	200	130.0	0.0	±0.5
	2	110.0	0.0	+1.0; -1.5
	0.25	100.9	-0.1	+1.0; -3.0

Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	135.4	134.8	-0.6	±2.0
Positive half cycle	134.4	134.0	-0.4	±1.0
Negative half cycle	134.4	134.0	-0.4	±1.0

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ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20240290EA

Calibration Report

Function : 10. Overload Indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
142.6	142.6	0.0	±1.5

Function : 11. High-Level Stability

High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	139.0	139.0	0.0	±0.1

Uncertainty of measurement

Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings - Free-field sound pressure response level	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Tone burst response	0.20	0.30
9) Peak C sound level	0.20	0.35
10) Overload indication	0.20	0.25
11) High-Level Stability	0.10	0.10

Remarks: 1. Indication at the calibration check frequency can not measured because customer does not provide a sound calibrator.
2. The acceptance limit is for the deviated value.
3. Acceptance limits was IEC61672-3:2013 Class 1.
4. The coverage factor $k = 2.00$

-- End of Report --

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ELECTRICAL AND ELECTRONICS INSTITUTE
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Phrae Sa, Mueang Samut Prakan, Samut Prakan 10280

Tel: +66 2709 4860 Fax: +66 2324 0917



Certificate No.: CP20240287EA

Operation No.: CP2024070250

Certificate of Calibration

Equipment: Sound Level Meter
Manufacturer: Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)
Model/Type: LxT1 (Meter), 377B02 (Microphone), PRLxT1 (Preamplifier)
Serial No.: 0007309 (Meter), 345239 (Microphone), 077644 (Preamplifier)
ID No.: UAE.EFM.041/2566
Customer: United Analyst and Engineering Consultant Co.,Ltd.
Address: 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak Phrakhanong, Bangkok 10260
Received Date: 25 July 2024
Calibrated Date: 2 - 5 August 2024
Issued Date: 7 August 2024
Calibrated by: Ms. Juntaporn Kunhakom

Approved by:
(Mr. Sittichai Swaksuriyawong)
Group Manager

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F-CAL-004 Ed.1



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20240287EA

Calibration Report

Equipment: Sound Level Meter
Manufacturer: Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)
Model/Type: LxT1 (Meter), 377B02 (Microphone), PRMLxT1 (Preamplifier)
Serial No.: 0007309 (Meter), 345239 (Microphone), 077644 (Preamplifier)
ID No.: UAE EFM.041/2566
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Pressure: (101.3 ± 1.5) kPa

Method of Calibration :-
IEC 61672-3:2013.

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1012-23	12 November 2024
2) Arbitrary Function Generator	AFG2021	C010063	CK20240048EA	23 June 2025
3) Programmable Attenuator	PA5	2755	EF-0040-23	1 October 2024
4) 6.5 Digit precision multimeter	8846A	9610014	CB20230200EA	15 November 2024
5) Pressure humidity and Temperature Transmitter	PTU301	L3950483	CL1-P240023	24 March 2025
6) Pressure humidity and Temperature Transmitter	PTU301	L3950484	CD20240142EA	12 June 2025
7) Performance Audio Analyzer	U8903B	MY56510003	CL1-P240030	11 April 2025
			CD20240143EA	12 June 2025
			CB20240035EB	13 February 2025
			CK20230072EA	13 September 2024

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

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

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- National Institute of Metrology (Thailand)

- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
-	-	-	-

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ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20240287EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
30.5

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	29.5
C-weighting	29.5
Z-weighting	35.5

Function : 3. Acoustical signal tests of frequency weightings (Without Windscreen)

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

Frequency (Hz)	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.4	0.3	0.4	±1.0
1000	0.1	0.1	0.1	±0.7
8000	-1.6	-1.6	-1.6	+1.5; -2.5

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	0.0	0.0	0.0	±1.0
125	0.0	0.0	-0.1	±1.0
250	0.0	0.0	-0.1	±1.0
500	0.0	0.0	-0.1	±1.0
1000	0.0	0.0	0.0	±0.7
2000	0.0	0.0	-0.1	±1.0
4000	0.0	0.0	-0.1	±1.0
8000	-0.1	-0.1	0.0	+1.5; -2.5
16000	0.0	0.0	-0.1	+2.5; -16.0

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Calibration Report

Function : 5. Frequency and time weighting at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
C-weighting	94.0	0.0	±0.2
A-weighting	94.0	0.0	±0.2
Z-weighting	94.0	0.0	±0.2

5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	±0.1
Slow	94.0	0.0	±0.1
LAeq	94.0	0.0	±0.1

Function : 6. Long-Term Stability

Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	±0.1

Function : 7. Level Linearity on the reference level range

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.8
99.0	99.0	0.0	±0.8
104.0	104.0	0.0	±0.8
109.0	109.0	0.0	±0.8
114.0	114.0	0.0	±0.8
119.0	119.0	0.0	±0.8
124.0	124.0	0.0	±0.8
129.0	129.0	0.0	±0.8
134.0	134.0	0.0	±0.8
139.0	139.0	0.0	±0.8
140.0	140.0	0.0	±0.8

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Calibration Report

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.1	0.1	±0.8
39.0	39.4	0.4	±0.8

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	136.0	0.0	±0.5
	2	118.9	-0.1	+1.0; -1.5
	0.25	109.8	-0.2	+1.0; -3.0
Slow	200	129.5	-0.1	±0.5
	2	109.9	-0.1	+1.0; -3.0
	200	130.0	0.0	±0.5
LAE	2	110.1	0.1	+1.0; -1.5
	0.25	101.0	0.0	+1.0; -3.0

Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	135.4	134.8	-0.6	±2.0
Positive half cycle	134.4	134.0	-0.4	±1.0
Negative half cycle	134.4	134.0	-0.4	±1.0

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Function : 10. Overload Indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
144.3	144.2	-0.1	±1.5

Function : 11. High-Level Stability

High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	139.0	139.0	0.0	±0.1

Uncertainty of measurement

Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings - Free-field sound pressure response level	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Tone burst response	0.20	0.30
9) Peak C sound level	0.20	0.35
10) Overload indication	0.20	0.25
11) High-Level Stability	0.10	0.10

Remarks:

1. Indication at the calibration check frequency can not measured because customer does not provide a sound calibrator.
2. The acceptance limit is for the deviated value.
3. Acceptance limits was IEC61672-3:2013 Class 1.
4. The coverage factor $k = 2.00$

-- End of Report --

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List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
1	Atomic Absorption Spectrometer	ARSENIC (dry weight) CADMIUM CADMIUM (dry weight) COPPER COPPER (dry weight) IRON IRON (dry weight) LEAD LEAD (dry weight) MANGANESE MANGANESE AND COMPOUNDS (dry weight) MERCURY (dry weight) NICKEL NICKEL (dry weight) SELENIUM SELENIUM (dry weight) TOTAL CHROMIUM ZINC ZINC (dry weight)	Agilent Technologies	AA240FS / MY13160001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	24 Jan 24	23 Jan 25
2	Atomic Absorption Spectrometer	ARSENIC SELENIUM	Perkin Elmer	PipAAcle 900F / PFB20031902	Perkin Elmer Co.,Ltd.	WO-02787590	14 May 24	13 May 25
3	Analytical Balance	TOTAL DISSOLVED SOLIDS TOTAL SUSPENDED SOLIDS	Mettler Toledo	XSR205DU / C210685394	National Food Institute,Ministry of Industry, Thailand	2402283-002-01	2 Apr 24	1 Apr 25
4	Analytical Balance	TOTAL SUSPENDED SOLIDS	Mettler Toledo	XSR205DU / C009071872	National Food Institute,Ministry of Industry, Thailand	2402283-001-01	2 Apr 24	1 Apr 25
5	DO Meter	BIOCHEMICAL OXYGEN DEMAND	YSI	5100 / 11B 101863	Technology Promotion Association (Thailand-Japan)	24TW39	21 Feb 24	20 Feb 25

List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
6	SCT Meter	CONDUCTIVITY (umhos/cm)	Horiba	LAQUA-EC210 / HC9L0015	Technology Promotion Association (Thailand-Japan)	24CH322	13 Mar 24	11 Mar 25
7	Gas Chromatography	C10-C14 FRACTION C15-C28 FRACTION C29-C36 FRACTION	Agilent	GC 7890A / CN11021007	Agilent Technologies (Thailand) Co.,Ltd.	Certificate of System Qualification GC-OQ	21 Feb 24	19 Feb 25
8	Gas Chromatography/Mass Spectrometer	BENZENE BENZENE(dry weight) ETHYLBENZENE ETHYLBENZENE(dry weight) TOLUENE TOLUENE(dry weight) TOTAL XYLENES TOTAL XYLENES(dry weight)	Bruker	450GC / BR1201M099	Thai Unique Co.,Ltd	SV2407/21898	16 Jul 24	15 Jul 25
9	Mercury Analyzer	MERCURY	NIC. Japan	RA-4500 / 17780278	Coax Group Corporation Ltd.	Preventive Maintenance Report	9 Jul 24	8 Jul 25
10	Hot Air Oven	TOTAL DISSOLVED SOLIDS TOTAL SUSPENDED SOLIDS	Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	24TM589	1 Apr 24	31 Mar 25
11	Cooled Incubator	TOTAL COLIFORM BACTERIA	Binder	KB400 / WTB20200000015535	Technology Promotion Association (Thailand-Japan)	24TM647	1 Apr 24	31 Mar 25
12	Incubator	TOTAL COLIFORM BACTERIA	Binder	KB400 / 20220000022479	Technology Promotion Association (THAILAND-JAPAN)	24TM698	9 Jul 24	8 Jul 25
13	Inductively Coupled Plasma- Optical Emission Spectrometer(ICP-OES)	BARIUM BARIUM (dry weight)	Agilent Technologies, USA	5110 VDV(G8015AA) / MY8030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	13 Nov 23	12 Nov 24
14	pH Meter	pH	Horiba	LAQUA-PH210 / HA1L0035	technology promotion association (thailand-japan	24CH320	12 Mar 24	11 Mar 25
15	pH Meter and pH Electrode	pH (1:1)	Mettler Toledo	pH S20 SevenEasy™ / 1231155210	National Food Institute Ministry of Industry, Thailand	2401718-001-01	11 Mar 24	10 Mar 25

List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
16	SCT Meter	CONDUCTIVITY (umhos/cm)	YSI Environmental	Pro 30 / 23A104807	Technology Promotion Association (Thailand-Japan)	24CH405	3 Apr 24	2 Apr 25
17	UV-VIS Spectrophotometer	SULPHATE	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP24-001	4 Jan 24	3 Jan 25

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

Agilent 55/240/280 Series Atomic Absorption Spectroscopy Systems

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. This checklist will be completed at the end of the service and provided to you as a record of the installation.

Note: While non-current production AA instrument and/or accessory models are not covered specifically in this document it can be used as a basic reference.

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

Introduction

Customer Information

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

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Important Customer Web Links

- For more information about Agilent Technologies services, please visit our website using the following URL: <http://www.agilent.com/en-us/products/crosslab-instrument-services/service-repair>
- To access Agilent University, visit: <http://www.agilent.com/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- A useful Agilent Resource Center web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: <https://www.agilent.com/en-us/agilentresources>
- Need technical support, FAQs, supplies? – visit our Support Home page at: <http://www.agilent.com/search/support>
- Get answers. Share insights. Build connections. Join the Agilent Community at <https://community.agilent.com/welcome>

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Confirm the ability of the instrument to deliver continued safe operation as established via the Agilent AA safe operation flow chart. (Refer directly to the AA 55/240/280 Preventive Maintenance Scope of Work to make this decision.)
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Section not applicable" checkboxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance service in the order of the tasks listed.
- Complete the Service Review section together with the customer.
- Complete the fields for page numbers at the foot of each selected page.
- Complete the total number of pages field in the Service Completion section.
- Ask the customer to sign the Service Completion section including the customer's and your signature.

This information is subject to change without notice.

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Instrument Maintenance

System Information

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

Instrument System Name and ID

Instrument System Site and Location

UNITED ANALYST AND ENGINEERING CONSULTANT / 2nd Lab

List System Component Product Numbers

1.	G 8432 A
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

List the Serial Numbers of each Component

17 016 0001

Preparation, Safe operation and Initial performance checks

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Preventive Maintenance Procedures

FLAME SYSTEM section

- ☐ Section not applicable

Electronic components

- ☒ Review and confirm instrument configuration data in SVD
- ☒ Confirm power supply voltages using the SVD Power Supply diagnostic
- ☒ For Dual Beam instruments - Confirm RBC frequency using the SVD RBC frequency diagnostic.

Mechanical components

- ☒ Check the burner adjuster controls for complete and free movement. If the burner adjuster needs lubrication, use Molykote 321 or mineral-based molybdenum disulfide grease.
- ☒ Run SVD tests to exercise all motor drives over the full range of their travel:
 - ☒ Monochromator drive
 - ☒ Slit drive
 - ☒ Lamp selector
 - ☐ ABA w/r

Optics components

- ☒ Check that external optical surfaces are clean – Clean or replace as required.
- ☒ Use SVD and perform Mono Wavelength Correction.
- ☒ Use SVD and perform Slit Calibration.
- ☒ Use SVD and perform Grating Squariness Diagnostic.
- ☒ Use SVD and perform Zero Order Offset/Mono Correction.
- ☒ Use SVD and perform Wavelength Repeatability.
- ☒ Physically inspect selected HC lamps (customer to supply per their choice) and measure the % Gain for each lamp. Advise customer if lamps are showing emission degradation due to age.
- ☒ Check that the signal energy of the D2 and HC lamps track properly. Advise customer if their D2 lamp is showing emission degradation due to age.

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Sample Introduction and Atomization

- ☒ Inspect the burner interlock plate to ensure that the interlock pin is secure and correct for the burner type.
- ☒ Clean the burner slot with a clean white card.
- ☒ Check the uniformity of the slot width.
- ☒ Clean the burner if required.
- ☒ Change the burner O-ring.
- ☒ Clean the nebulizer, spray chamber and liquid trap.
- ☒ Change all O-rings and seals in the nebulizer, nebulizer block and spray chamber.
- ☒ Check that the pressure relief bung releases readily.
- ☒ Change O-rings on the fuel and oxidant delivery ports.
- ☒ Leave the liquid trap EMPTY and verify the flame will not ignite in this state.
- ☒ Refill liquid trap and check that overflow drains freely into the drain/waste tube.
- ☒ Check the drain/waste tube for good drainage. It should not have tight bends, kinks or loops and the lower end must be above the liquid level in the waste vessel.
- ☒ Check and clean the igniter electrode.

Gas handling components and safety interlocks

- ☒ Pressure test for leaks.
- ☒ Leak test gasbox internal components and connections.
- ☒ Check safety interlock status and operation using the *SVD interlock monitoring diagnostic*.

Analytical performance for Flame systems

- ☒ Ignite a flame.
- ☒ Check that you can adjust the nebulizer uptake rate from 4 to 6.5 mL per minute.
- ☒ Optimize the instrument ready to perform Cu sensitivity test.
- ☒ Create a manual method to perform a Basic Cu ABS test - "Final Performance Testing".
- ☒ Run a PM completed sensitivity test for a 5 ppm copper sample and record the results in the AA PM Performance test results and measurements table.

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FURNACE SYSTEM section

- ☒ Section not applicable

Electronic components

- ☐ Review and confirm instrument configuration data in SVU.
- ☐ Confirm power supply voltages using the *SVD Power Supply diagnostic*.

Mechanical components

- ☐ Run SVD tests to exercise all motor drives over the full range of their travel.
 - ☐ Monochromator drive
 - ☐ Slit drive
 - ☐ Lamp selector

Optics components

- ☐ Check that external optical surfaces are clean – Clean or replace as required.
- ☐ Use SVD and perform *Mono Wavelength Correction*.
- ☐ Use SVD and perform *Slit Calibration*.
- ☐ Use SVD and perform *Grating Squareness Diagnostic*.
- ☐ Use SVD and perform *Zero Order Offset/Mono Correction*.
- ☐ Use SVD and perform *Wavelength Repeatability*.
- ☐ Physically inspect selected HC lamps (customer to supply per their choice) and measure the % Gain for each lamp. Advise customer if lamps are showing emission degradation due to age.

Gas handling, water system and workhead component checks

- ☐ Inspect the GTA workhead gas hoses and connections for leaks.
- ☐ Pressure test for gas leaks.
- ☐ If the cooler system is accessible (stand-alone) check for correct operation and coolant/water level – this includes any temperature and pressure settings plus filter cleaning (air flow and water).
- ☐ Inspect the GTA workhead water hoses and connections for leaks.
- ☐ Check all graphite components and replace if necessary.

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- ☐ Tube
- ☐ Electrodes
- ☐ Shroud

- ☐ Check and clean the end windows on the workhead.
- ☐ Check safety interlock operation.

Analytical performance for Furnace systems

- ☐ Optimize the instrument ready to perform Cu sensitivity test.
- ☐ Run the sensitivity test for a 25 ppb copper sample and record the results in the results table.

PSD autosampler accessory for Furnace systems

- ☒ Section NOT Applicable
- ☐ Check condition of the PSD capillary – replace if necessary.
- ☐ Check condition and operation of PSD syringe – ensure it does not have air locks and bubbles.
- ☐ Change PSD rinse bottle O-ring.
- ☐ Check and clean the rinse vessel.
- ☐ Check the drain tube for good drainage. It should not have tight bends, kinks or loops and the lower end must be above the liquid level in the waste vessel.
- ☐ Ensure that the waste vessel is suitable for use with the furnace system.

Sample introduction pump system (SIPS) accessory

- ☒ Section NOT Applicable
- ☐ Re-torque screws securing the hubs, presser arms and pump rotors.
- ☐ Adjust each roller so that it rotates freely.
- ☐ Wipe clean the pump rotor rollers and pump bands with a dry clean cloth.
- ☐ Ensure that the presser arms and the surfaces near the pump are free from dirt and spills.
- ☐ Remove the pump module rear cover and check for the incursion of liquids and any signs of corrosion.
- ☐ Re-torque the nuts that fasten the motor mounting plates to the chassis.
- ☐ Check clips securing the diluents holder and replace if necessary.
- ☐ Disconnect, clean T-piece, and reassemble the tubing using the following steps.

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- ☐ Remove the T-piece by disconnecting the pump tubes, the pump bands and all other tubing.
- ☐ Place the T-piece in an ultrasonic bath containing strong detergent 1-5% Decon 30 or similar, for approximately 5-10 minutes.
- ☐ Wash the T-piece under a tap with a strong flow of water.
- ☐ Rinse with distilled water through all of the inlets in the reverse direction to normal sample flow.
- ☐ Reassemble.

Sample preparation system (SPS 4) accessory

- ☒ Section NOT Applicable

The Agilent SPS 4 autosampler is designed to need minimal maintenance.

The following maintenance requirements are suggested to maintain the performance of the autosampler.

- ☐ Cleaning the spill tray, rack location mat, end frames and chassis accessories with a damp soft cloth and diluted mild detergent.
- ☐ Cleaning the autosampler cover panels with domestic window cleaner.
- ☐ Checking 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 edge or damaged connectors.

NOTE: The autosampler requires no extra lubrication throughout its lifetime.

For further details refer to the SPS 4 service manual G8410-90050.

Sample preparation system (SPS 3) accessory

- ☒ Section NOT Applicable

- ☐ Check the x-axis and z-axis timing belts – Replace if there is any cracks, splits or color deterioration and belt tension.
- ☐ Check belt tensions – adjust if required.
- ☐ Check the lubrication pad for single x-axis shaft. If pad is dry or customer has observed any vibration or erratic movements of the x-axis carriage, add 1 mL of Dow Corning 200 Fluid, 200 CS into the well.
- ☐ Check the auto-sampler ability to find tube positions – Calibrate if required.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

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Vapor generation accessory VGA (hydride generator)

☒ Section NOT Applicable

- ☐ Inspect VGA gas supply hose
- ☐ Inspect/replace VGA pump tubing
- ☐ Check low gas pressure interlock setting – adjust if required
- ☐ Check precision orifice gas flow setting – adjust if required
- ☐ Check gas regulator pressure to 4b psi (325 kPa) – adjust if required
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

UltrAA lamp accessory (external)

☒ Section NOT Applicable

- ☐ Check the condition of the power cable
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

Restore System

- ☒ If you have altered the customer's instrumentation during the course of PM, restore to the original status to allow the customer to conduct their normal activities (e.g., reload the customer's method)

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

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Signature Page

Service Review

- ☒ Attach available reports/printsouts of all tests to this documentation
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook
- ☒ Update/reset instrument maintenance counters as appropriate
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request
- ☒ Complete the Service Engineer Comments section if there are additional comments
- ☒ Review this service, parts replaced, and test results obtained with the customer
- ☒ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box or if necessary, in the customer's IQ records

Test Results

Test Description		
Flame optics PMT Gain test		
Fluor copper at 324.8 nm, 4 nA, 0.5 nm slit width	< 55 %	44 %
Flame performance test with 5 ppm copper sample		
Air/acetylene mixing paddle removed	Abs value > 0.5	0.7401 A
Air/acetylene mixing paddle installed - 10 replicates	%RSD < 1.0	0.5 % RSD
Deuterium furnace optics PMT Gain test		
Fluor copper at 324.8 nm, 3 nA, 0.5 nm slit width	< 55 %	N/A
Deuterium furnace performance test with 25 ppb copper sample (324.8 nm)		
Precision %RSD	< 4.0%	N/A
Abs value	> 0.15	N/A
Zeeman furnace analytical performance: 25 ppb copper sample (327.4 nm)		
Precision %RSD	< 4.0%	N/A
Abs value	> 0.10	N/A
MSR%	> 70 %	N/A

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AA consumable and parts list table

Part Description		Product/Model # where used	PM supplied or Consumable	Instrument Type
Test Solution – Cu 5ppm solution	6811000103	50 55 140 240 280	PM supplied	Common
Test Solution – Blank solution	5190-7001	50 55 140 240 280	PM supplied	Common
Copper, 1000 ug/ml, 100ml	5190-8779	50 55 140 240 280	*	Common
Kit, Mk 7 O-rings, aqueous, complete set	6910093400	50 55 140 240 280	PM supplied	Flame
Organic Kit	9910093500	50 55 140 240 280	PM supplied	Flame
Wire Nebulizer Cleaning	9910024700	50 55 140 240 280	consumable	Flame
Tubing Capillary Std Nebs	9910024800	50 55 140 240 280	consumable	Flame
Capillary Tube Hvac Neb (3) (organics only)	9910044000	50 55 140 240 280	consumable	Flame
Glass impact beads (5pk)	9910025700	50 55 140 240 280	consumable	Flame
Teflon impact beads (5pk) (organics only)	9910053300	50 55 140 240 280	consumable	Flame
Burner cleaning strip (100-pk)	9910053900	50 55 140 240 280	consumable	Flame
Window UV silica – round (right side)	2010092600	50 55 140 240 280	PM supplied	Common
Window UV silica – rectangular (left side)	2010082500	50 55 140 240 280	PM supplied	Common
Pad adhesive window (round)	4010012700	50 55 140 240 280	PM supplied	Common
Pad adhesive window (rectangular)	4010012000	50 55 140 240 280	PM supplied	Common
Electrode kit (1 pr) (D2)	6310003400	GTA120	PM supplied	Furnace
Shield (D2)	6310003100	GTA120	PM supplied	Furnace
Zeeman electrode kit (1 pr)	6310003500	GTA120	PM supplied	Furnace
Zeeman shield	6310005600	GTA120	PM supplied	Furnace
Oring, PSD inlet bottle	6910025900	PSD120	PM supplied	Furnace

* For engineers who only service AA instruments 5190-8279 can be used as a cheaper alternative for 6610030100.

Items classified as PM supplied in the above table are included in the standard PM

Those classified as consumable should be provided by the customer or charged to the customer if supplied by the Agilent service engineer.

Revision: 10.00, Issued: November 2021

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Service Engineer Comments (optional)

If there is a report/issue, please attach a report of the problem to the end of the report for the customer. Please write in this box.

Service Completion

Service request number: 6006371115 Date service completed: 24 January 2024

Agilent signature: Worawit T. Customer signature: [Signature]

Total number of pages in this document: 13

Revision: 10.00, Issued: November 2021

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SVD Results Report



Report ID: Diagnostic Start Time: 2/24/2024 10:11:18 AM Diagnostic End Time: 2/24/2024 10:11:18 AM
Customer: Service Engineer: Worawit T.
Address: Contact Details:

Instrument Configuration

Configuration:

Serial Number: MY13160001 Turret Type: Automatic
Instrument Model: Varian AA140/240/280 Number Of Lamps: 4
Flame Instrument: True Mono Type: Automatic
Furnace Instrument: True Gasbox Type: Y Gas Box
Zeeman Present: False Auto Burner Adjuster: False
Internal Zeeman: False Mains Frequency: 50
Internal UltraA: False Firmware Version: 2.11
Optics Type: Double Beam Photomultiplier Type: Normal(900nm)
D2 BG Correction Fitted: True PWB Version: 45
Boot Block Version: 1.09

EEPROM Data:

Instrument Run Hours: 62809.832 D2 Run Hours: 49135.000
Zero Wavelength Offset: 30.148 D2 Serial Number: not set 1
Mono Correction: 0.765 D2 Install Date: 1/1/1970
Flame Hours: 29802.416 D2 Original Intensity: 1.000
D2 Last Intensity: 475.000

Frequency:

Averaging Period: 30.0
Datapoint Count: 20

Upper Limit:
51.00

Average Frequency:
50.00

Highest Measured Frequency:
50.00

Lower Limit:
49.00

Lowest Measured Frequency:
50.00

Result: **Passed**

Report Generated At: 1/24/2024 10:11:18 AM

1

SVD Results Report

เอกสารไม่ควบคุม

Power Supply:

Averaging Period: 30.0
Datapoint Count: 20

	Lower Limit (V)	Actual (V)	Upper Limit (V)	Result:
12.00 V Rail	10.80	12.19	13.20	Passed
-12.00 V Rail	-13.20	-11.80	-10.80	Passed
5.00 V Rail	4.50	5.05	5.50	Passed
310.00 V Rail	279.00	320.00	341.00	Passed

Report Generated At: 1/24/2024 10:11:18 AM

2

SVD Results Report

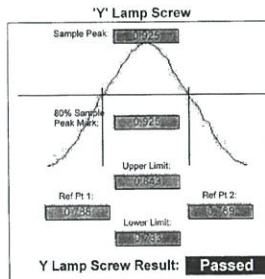
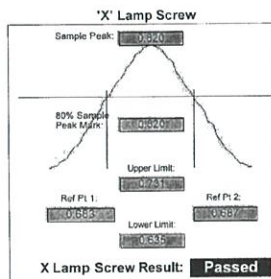
เอกสารไม่ควบคุม

Optics

Beam Balance:

Lamp Type: Copper
Lamp Socket Used: 3

Peak Selected: 324.80
Lamp Alignment: **Performed**



Grating Squareness:

Lamp Element(s): Copper
Lamp Turret Position: 3
Lamp Current(mA): 4.00
Slit Width(nm): 0.5
1st Order Wavelength(nm): 324.80
Lamp Alignment: **Performed**

	Lower Limit (nm)	Actual (nm)	Upper Limit (nm)	Result:
Zero Order	-0.10	0.00	0.10	Passed
First Order	324.45	324.75	325.15	Passed
Second Order	649.23	649.52	649.97	Passed

Report Generated At: 1/24/2024 10:11:18 AM

3

SVD Results Report

เอกสารไม่ควบคุม

Wavelength Repeatability:

Lamp Used: Copper
Peak Used(nm): 324.750
Connected to Socket: 3
Lamp Current(mA): 4
Slit Width(nm): 0.2
Slit Height: Normal

Lamp Alignment: Performed	
Lower Limit(nm) 324.765	324.888 Upper Limit(nm)
(Approach from Zero Order)	(Approach from end)
Sample 1: 324.828	Sample 2: 324.828
Sample 3: 324.828	Sample 4: 324.823
Sample 5: 324.823	Sample 6: 324.823
Sample 7: 324.823	Sample 8: 324.823
Sample 9: 324.823	Sample 10: 324.823

Mean: 324.825 Standard Deviation: 0.002

Result: **Passed**

Report Generated At: 1/24/2024 10:11:18 AM

4

SVD Results Report

เอกสารไม่ควบคุม

Mechanical

Wavelength Drive:

Passed

Slit Drive:

Passed

Turret Drive:

Passed

Auto Burner Adjuster Drive:

Untested

Miscellaneous

Signal Processing Linearity:

Calculate Mode: New Calc Mode

	Lower Limit	Actual	Upper Limit	Result:
S0	114	251	297	Passed
S1	156	165	191	Passed
S2	271	296	332	Passed
S3	474	507	579	Passed
S4	825	918	1008	Passed
S5	1435	1528	1754	Passed
S6	2498	2769	3053	Passed
S7	4347	4752	5313	Passed

Interlocks:

Burner Fitted:	Working	Flame Detect:	Working
N2O Burner Fitted:	Untested	GCU Active:	Working
Flame Shield Closed:	Working	Oxidant Pressure:	Working
Gas Control Fitted:	Untested	Oxidant Changeover:	Untested
Pressure Release Bung Fitted:	Working	Ignition:	Working
Liquid Trap Fitted:	Working		

Report Generated At: 1/24/2024 10:11:18 AM

5

SVD Results Report

เอกสารไม่ควบคุม

Auto Lamp Recognition:

Lamp 1: Uncoded Lamp/Not Connected
Lamp 2: 87 - Silver/Cadmium/Lead/Zinc/UltrAA) (Ag)
Lamp 3: 14 - Copper (Cu)
Lamp 4: Uncoded Lamp/Not Connected
Lamp 5: Not Supported
Lamp 6: Not Supported
Lamp 7: Not Supported
Lamp 8: Not Supported

Result: Passed

GTA Temperature Monitoring:

Not Performed

Notes:

PM 24 Jan 2024

Signatures:

SJand 24/1/24 Worawit T. 24/1/24
Date Date

Report Generated At: 1/24/2024 10:11:18 AM

6

SVD Results Report

เอกสารไม่ควบคุม

Sequential by time report

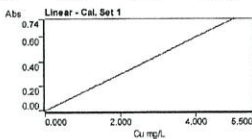
1/24/2024 11:46 AM

SpectrAA

Analyst
Date Started 1/24/2024 11:39 AM GMT: 1/24/2024 4:39 AM
Worksheet Cu 5 PPM Sense check
Comment
Methods Cu
Computer name DESKTOP-RGUFPS
Serial Number: MY13160001

Method: Cu (Flame)

Sample ID	Conc. mg/L	%RSD	Mean Abs
CAL ZERO	0.000	55.0	0.0003
Readings			
	0.0002	0.0002	0.0004
1/24/2024			
STANDARD 1	5.000	1.7	0.7410
Readings			
	0.7274	0.7515	0.7468
1/24/2024			



Curve Fit = Linear
Characteristic Conc = 0.628 mg/L
r = 1.0000
Calculated Conc = 0.000 5.000
Residuals = 0.000 0.000

Abs = 0.14833 x C + 0.00325

Sample ID	Conc. mg/L	%RSD	Mean Abs
001	4.988	0.7	0.7401
Readings			
	0.7454	0.7309	0.7349
1/24/2024			

เอกสารไม่ควบคุม

Sequential by time report

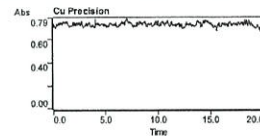
1/24/2024 11:50 AM

SpectrAA

Analyst
Date Started 1/24/2024 11:47 AM GMT: 1/24/2024 4:47 AM
Worksheet Cu 5 PPM Precision
Comment
Methods Cu
Computer name DESKTOP-RGUFPS
Serial Number: MY13160001

Method: Cu (Flame)

Sample ID	Exp Abs	%RSD	Mean Abs
Cu Precision	0.723	0.5	0.7232
Readings			
	0.7221	0.7106	0.7226
	0.7213	0.7266	0.7283
	0.7201	0.7213	0.7266
1/24/2024			



เอกสารไม่ควบคุม



PinAAcle 900F Preventive Maintenance Report

Company Name: UAE Consultant Co., LTD.

Instrument Location: 41 Sukumvit Rd.,
Phra Khanong, Bangkok 10260

Instrument Serial No.: PFBS20031902

Date: 14-May-2024

เอกสารไม่ควบคุม

PinAAcle 900F Preventive Maintenance (PM)

United Analyst and Engineering Consultant Co., LTD.			
41 Sukumvit Rd., Phra Khanong, Bangkok 10260			
Company Name:			
Address (Instrument Location):			
Serial Number:	PFBS20031902	PM Number:	2 of 2
Customer Name (if applicable):	K. Yalinda	Telephone Number:	095-5580049
Customer Support Engineer Name:	K. Chayanon	Service Order Number:	WO-02787590
Date PM Performed: (dd-MMM-YYYY)	14-May-2024	Next PM Due Date: (dd-MMM-YYYY)	14-Nov-2024
Standard Labor Hours to Complete PM:		5 hours	

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

Scope

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

The customer should save their method before the PM begins.

General Instructions:

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

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

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

Update the PM sticker and instrument logbook as required.

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PinAAcle 900F Preventive Maintenance Report (PM)

Page 1 of 7

เอกสารไม่ควบคุม

Component List

Component / Specific Model	Serial #	Configuration Notes
PinAAcle900F	PFBS20031902	Syngistix V.4.0.1.1935
Fias100(New Install)	100524040501	

Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
B0501896	Fan Filters	N/A
N3160156	O-Ring Kits for Sampling Introduction (Stainless Steels Nebulizer)	N/A
N3160157	O-Ring Kits for Sampling Introduction (Plastic Nebulizer)	N/A
N9301714	Replacement Acetylene Filter Cartridge	N/A
TH001022	Replacement Air Filter Cartridge	N/A

Additional Reagents and Standards Required for PM

Part Number (if applicable)	Description	Quality	Batch/Lot #	Expired Date (MM/YY)
N9300183	1000 mg/L Copper Standard	AR	27-39CUY1	Apr 2025

Additional Reagents and Standards Required for PM (Customer Support Solution)

Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A	DI Water	250 ml.	AR	AR
N/A	0.5% HNO ₃	250 ml.	AR	AR

PinAAcle 900F Preventive Maintenance Report (PM)

Page 2 of 7

เอกสารไม่ควบคุม

Additional Tools Required for PM

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

PinAAcle 900F Preventive Maintenance Report (PM)

Page 3 of 7

เอกสารไม่ควบคุม

Procedure Checklist

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

1. General:

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

2. PC Instrument Software:

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

3. Mechanical:

- ✓ Inspect and clean all fans and filters. Replace filters if necessary.
- ✓ Inspect all gas lines for leaks and/or wear. Replace if needed.
- ✓ Clean exterior of the instrument.
- ✓ Inspect the burner head, burner chamber, and nebulizer. Clean if needed as stated in the Hardware Guide.
- ✓ Check burner head dimensions with the feeler gauge as stated in the Hardware Guide in the Maintenance chapter section on cleaning the burner head and checking sloth width. Replace if out of specification.
- ✓ Check the condition of the end cap, burner head, and nebulizer O-rings. Replace if necessary.
- ✓ Check the drain system for signs of wear. Replace worn or damaged parts.
- ✓ Visually check for proper flame conditions when igniting the Air-C2H2 and N2O-C2H2 flames (if applicable).

4. Electrical:

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

5. Optics:

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

6. Gasses:

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

เอกสารไม่ควบคุม

7. Flame Interlock Check:

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

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

8. After PM Performance tests:

8.1 Detector Linearity with Barium

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

Parameter	Specification	Certificate Value at 553.6 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.	0.9995	1.0143	Passed
0.2 A ND Filter	± 5% from Cert.	0.1936	0.1966	Passed

8.2 Baseline Noise at 1.0 Absorbance with Barium

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.002	Passed

8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.001	0.0002	Passed

เอกสารไม่ควบคุม

8.4 D₂ Background Compensation with Copper

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0001	Passed

8.5 AA-BG Baseline Noise with Copper

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.002	Passed

8.6 AA-BG Baseline Noise with Arsenic

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0022	Passed

8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity	Specification	Results (Abs.)	Pass/Fail
5 mg/L Sensitivity SS Neb (if applicable)	> 0.250 Abs.	N/A	Not Applicable
2 mg/L Sensitivity IIS Neb (if applicable)	> 0.250 Abs.	0.8005	Passed

10. Review:

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

เอกสารไม่ควบคุม

Additional Comments

Additional Comments Regarding the PM

Review

The preventive maintenance checks and if applicable performance tests for PinAAcle 900F have been completed.

This PinAAcle 900F Passes ☒ Fails ☐ the preventive maintenance.

Review of Preventive Maintenance:

Authorized PerkinElmer Representative:	Date:
Chayaporn S.	14-May-2024 (DD-MM-YYYY)
Authorized Customer Representative:	Date:
อ.วิวัฒน์	14-May-2024 (DD-MM-YYYY)

เอกสารไม่ควบคุม



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



Calibration Certificate

Certificate No.: 2402283-002-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 SOI UDOMSUK 41, SUKHUMVIT ROAD,
Bangchack, Prakanong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR205DU

Serial No.: C210685394

ID No.: UAE.WAO.010/2565

Order No.: 2402283

Operation No.: 2402283-002

Date of Receipt: 2 April 2024

Date of Calibration: 2 April 2024

Calibrated by Mr.Jerawut Prapawuttipong
Scientist

Approved by

(Mr.Pheraphat Tuanjit)

Manager, Division of Calibration Laboratory

Responsible for the Technical Management Team

Date of Issue: 9 April 2024

The uncertainties are for a confidence probability of approximately 95%

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement related to 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

2565 เวิลด์เทรดเซ็นเตอร์ 35 แขวงปทุมวัน กรุงเทพมหานคร เขตปทุมวัน กรุงเทพมหานคร
2565 Soi 35, Asoi Ariyam Road, Bang 15 Khan Sukhumvit, Bang Prue District, Bangkok 10260, Thailand
Tel: +662-010-00000 Fax: +662-010-00000



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



Calibration Report

Certificate No.: 2402283-002-01
Equipment: Precision Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Resolution: 0.0001 g / 0.0001 g
Serial No.: C210685394
ID No.: UAE.WAO.010/2565
Capacity: 220 g

Page 2 of 4

Date of Calibration: 2 April 2024

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

Place of Calibration: Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard Model Serial No. Calibrated By Certificate No. Due Date

Standard Weight Class E2 1mg to 200g 8505567372 TCS M230-0535 8 April 2024

Instrument Model Serial No. Calibrated By Certificate No. Due Date

Thermo-Hygro Meter 608 H1 NFI BTH 016/23 Quality Reborn QR24-0341 9 February 2024

3. This certificate is traceable to SI UNIT

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

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

Calibration Results:

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.000042
60	0.000052
120	0.000048
200	0.000048

2. Off-Center Error:

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

The balance reading obtained is given in the table

1	2	3	4	5	6	(Maximum Difference)
100.0000	100.0001	99.9999	99.9999	100.0001	100.0000	0.0001

1	2	3	4	5	6	(Maximum Difference)
100.0000	100.0001	99.9999	99.9999	100.0001	100.0000	0.0001

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

2565 เวิลด์เทรดเซ็นเตอร์ 35 แขวงปทุมวัน กรุงเทพมหานคร เขตปทุมวัน กรุงเทพมหานคร
2565 Soi 35, Asoi Ariyam Road, Bang 15 Khan Sukhumvit, Bang Prue District, Bangkok 10260, Thailand
Tel: +662-010-00000 Fax: +662-010-00000



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



Calibration Report

Certificate No.: 2402283-002-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Resolution: 0.0001 g / 0.0001 g
Serial No.: C210685394
ID No.: UAE.WAO.010/2565
Capacity: 220 g

Page 3 of 4

Date of Calibration: 2 April 2024

Calibration Results: (Continued)

Calibration Range: 0 - 80 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 0 - 80 g ; Resolution: 0.00001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor
Unload	0.000000	0.000000	0.000000	0.000000	2.00
0.01	0.000001	0.000001	0.000000	0.000001	2.00
0.05	0.000005	0.000005	0.000000	0.000005	2.00
0.1	0.000010	0.000010	0.000000	0.000010	2.00
0.5	0.000050	0.000050	0.000000	0.000050	2.00
1	0.000100	0.000100	0.000000	0.000100	2.00
5	0.000500	0.000500	0.000000	0.000500	2.00
10	0.001000	0.001000	0.000000	0.001000	2.00
20	0.002000	0.002000	0.000000	0.002000	2.00
30	0.003000	0.003000	0.000000	0.003000	2.00
50	0.005000	0.005000	0.000000	0.005000	2.00
80	0.008000	0.008000	0.000000	0.008000	2.00

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

2565 เวิลด์เทรดเซ็นเตอร์ 35 แขวงปทุมวัน กรุงเทพมหานคร เขตปทุมวัน กรุงเทพมหานคร
2565 Soi 35, Asoi Ariyam Road, Bang 15 Khan Sukhumvit, Bang Prue District, Bangkok 10260, Thailand
Tel: +662-010-00000 Fax: +662-010-00000



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



Calibration Report

Certificate No.: 2402283-002-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Resolution: 0.0001 g / 0.0001 g
Serial No.: C210685394
ID No.: UAE.WAO.010/2565
Capacity: 220 g

Page 4 of 4

Date of Calibration: 2 April 2024

Calibration Results: (Continued)

Calibration Range: 81 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 81 - 200 g ; Resolution: 0.0001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor
90	90.00010	90.00010	0.00000	0.00010	2.00
100	100.00006	100.00006	0.00000	0.00006	2.00
110	110.00007	110.00007	0.00000	0.00007	2.00
120	120.00009	120.00009	0.00000	0.00009	2.00
130	130.00010	130.00010	0.00000	0.00010	2.00
140	140.00014	140.00014	0.00000	0.00014	2.00
150	150.00009	150.00009	0.00000	0.00009	2.00
160	160.00010	160.00010	0.00000	0.00010	2.00
170	170.00012	170.00012	0.00000	0.00012	2.00
200	200.00016	200.00016	0.00000	0.00016	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 %.

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

2565 เวิลด์เทรดเซ็นเตอร์ 35 แขวงปทุมวัน กรุงเทพมหานคร เขตปทุมวัน กรุงเทพมหานคร
2565 Soi 35, Asoi Ariyam Road, Bang 15 Khan Sukhumvit, Bang Prue District, Bangkok 10260, Thailand
Tel: +662-010-00000 Fax: +662-010-00000





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



Calibration Certificate

Certificate No.: 2402283-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Serial No.: C009071872
ID No.: UAE.WAO.012/2563
Order No.: 2402283
Operation No.: 2402283-001
Date of Receipt: 2 April 2024
Date of Calibration: 2 April 2024

Calibrated by Mr.Jerawut Prapawuttipong
Scientist
Approved by (Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of Issue: 9 April 2024

The uncertainties are for a confidence probability of approximately 95%

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

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

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Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center
เลขที่: 2402283-001-01
วันที่: 02-04-2567



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Food Industrial Laboratory Service Center



Calibration Report

Certificate No.: 2402283-001-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Serial No.: C009071872
Capacity: 220 g
Resolution: 0.0001 g / 0.0001 g
ID No.: UAE.WAO.012/2563

Page 2 of 4

Date of Calibration: 2 April 2024

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

Place of Calibration: Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: N1 Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard Model Serial No. Calibrated By Certificate No. Due Date

Standard Weight Class E2 1mg to 200g B505567572 TCS M23040325 8 April 2024

Instrument Model Serial No. Calibrated By Certificate No. Due Date

Thermo-Hygro Meter 608-H1 NFI-BTH 016/23 Quality Reborn Q624-0343 9 February 2023

3. This certificate is traceable to SI UNIT

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

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

Calibration Results:

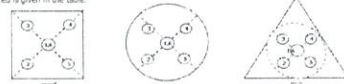
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.000052
80	0.000063
160	0.000048
200	0.000053

2. Off-Center Error:

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

The balance reading obtained is given in the table:



1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
100.0002	100.0001	100.0002	99.9999	100.0001	100.0001	0.0002

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

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Food Industrial Laboratory Service Center
เลขที่: 2402283-001-01
วันที่: 02-04-2567



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Food Industrial Laboratory Service Center



Calibration Report

Certificate No.: 2402283-001-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Serial No.: C009071872
Capacity: 220 g
Resolution: 0.0001 g / 0.0001 g
ID No.: UAE.WAO.012/2563

Date of Calibration: 2 April 2024

Calibration Results: (Continued)

Calibration Range: 0 - 80 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 0 - 80 g; Resolution: 0.00001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor
Unloaded	0.000000	0.000000	0.000000	0.000008	2.00
0.001	0.001003	0.001001	-0.000002	0.000009	2.00
0.005	0.005003	0.005000	-0.000003	0.000009	2.00
0.01	0.010003	0.010000	-0.000003	0.000009	2.00
0.05	0.050006	0.050000	-0.000006	0.000009	2.00
0.1	0.100011	0.100000	-0.000011	0.000011	2.00
0.5	0.500016	0.500000	-0.000016	0.000014	2.00
1	1.000022	1.000000	-0.000022	0.000016	2.00
2	2.000033	2.000000	-0.000033	0.000017	2.00
5	5.000017	5.000000	-0.000017	0.000020	2.00
10	10.000039	10.000000	-0.000039	0.000026	2.00
20	20.000071	20.000000	-0.000071	0.000037	2.00
30	30.000040	30.000000	-0.000040	0.000052	2.00
50	50.000026	50.000000	-0.000026	0.000068	2.00
80	80.000064	80.000000	-0.000064	0.000111	2.00

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

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เลขที่: 2402283-001-01
วันที่: 02-04-2567



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Food Industrial Laboratory Service Center



Calibration Report

Certificate No.: 2402283-001-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Serial No.: C009071872
Capacity: 220 g
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.012/2563

Page 4 of 4

Date of Calibration: 2 April 2024

Calibration Results: (Continued)

Calibration Range: 81 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 81 - 200 g; Resolution: 0.0001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor
90	90.00010	90.00000	-0.00010	0.00015	2.00
100	100.00006	100.00000	-0.00006	0.00015	2.00
110	110.00007	110.00001	-0.00006	0.00017	2.00
120	120.00009	120.00000	-0.00009	0.00018	2.00
130	130.00010	130.00000	-0.00010	0.00019	2.00
140	140.00014	140.00000	-0.00014	0.00020	2.00
150	150.00009	150.00001	-0.00008	0.00020	2.00
160	160.00010	160.00001	-0.00009	0.00022	2.00
170	170.00012	170.00001	-0.00011	0.00023	2.00
200	200.00016	200.00000	-0.00016	0.00028	2.00

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

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

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Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center
เลขที่: 2402283-001-01
วันที่: 02-04-2567





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.: 24TW39
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : 5100
Serial No. : 11B 101863
ID No. : UAE.WAO.004/2554
Received Date : 20 February 2024
Test Date : 21 February 2024
Reference : 2402-0629DSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangkok,
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 : Walalak Sirthean
Approved by :
() Pornthippa Tameyakul
() Unnopphol Harachai
(✓) Saithip Meangmai
Issue Date : 22 February 2024

เอกสารไม่ควบคุม



Cert.No.: 24TW39
Page.: 2 of 2

Condition of this result of calibration

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

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

2. Standard Material :-

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

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

Titration Method (Azide Modification Method)	DO Meter Reading	Standard Deviation
(mg/L)	(mg/L)	(mg/L)
8.20	8.19	0.0055

This report was certified only for the instrument we tested. It is allowable to use for study
Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced
other in full, without written approval of the laboratory

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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.: 24CH322
Page.: 1 of 3

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : Horiba
Model : LAQUA-EC210
Serial No. : HC9L0015
ID No. : UAE.EFM.010/2563(EFM.SCT.04/63)
Condition As-Received: Used Item
Received Date : 12 March 2024
Calibration Date : 14 March 2024
Reference : 2403-0397WSC-2
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-CH6 by direct measurement with
certified reference material (CRM)
- CP-CH8 by Comparison with temperature standard
Calibrated by : Warakorn Lemgagrakul
Approved by :
() Pornthippa Tameyakul
() Unnopphol Harachai
(✓) Saithip Meangmai
Issue Date : 15 March 2024

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

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

A 0064532



Cert.No.: 24CH322
Page.: 2 of 3

Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	1963878	130RC095	231051	05 Sep 2024
2) Ref. Std. Thermometer	4962054	110RC044	231908	26 July 2024

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

2. Certified Reference Materials :-

- Conductivity calibration solution, CPA Chem Ltd., The measurement results are traceable to SI
through CPA Chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1635

Conductivity Solution	Manufacturer	Lot No.	Exp. date
1413.0 µS/cm	CPA Chem	936624	19 Oct 2024
12.880 mS/cm	CPA Chem	931956	30 Sep 2024

- Control Conductivity calibration solution temperature by Water bath (25 ± 0.1) °C

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

Calibration results

Function : Conductivity Measurement

(*) After Adjustment at 1413.0 µS/cm

Conductivity Electrode Serial No.: 989F0277

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (±)	Coverage factor k
1413.0 µS/cm	1436 µS/cm	1413 µS/cm	9.2 µS/cm	2.00
12.880 mS/cm	13.22 mS/cm	12.95 mS/cm	0.096 mS/cm	2.00

Remark : - UUC* = Unit Under Calibration

a 1206347



Cert.No.: 24CH322
Page: 3 of 3

Calibration Results

Function : Temperature Measurement

This equipment was connected with Temperature Probe:

- Model : 9383
- Serial No. : 9B9F0277

Dimension of probe:

- Length : 110 mm
- Diameter : 10 mm
- Immersion Depth : 90 mm

Calibration Result : Without adjustment

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (± °C)	Coverage factor k
25.0	25.003	25.0	-0.003	0.13	2.00
30.0	30.002	30.0	-0.002	0.13	2.00
35.0	35.003	35.0	-0.003	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

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Sadha
a 1206348



Agilent CrossLab Start Up Services Agilent 7890 Gas Chromatograph Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended service for your analytical instruments to assure reliable operation and the accuracy of your results

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak. This checklist will be completed at the end of the service and provided to you as a record of the preventive maintenance activities.



เอกสารไม่ควบคุม

Agilent 7890 GC Preventive Maintenance Checklist



Introduction

Customer Information

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

Important Customer Web Links

- For more information about **Agilent Technologies services**, please visit our website using the following URL: <http://www.agilent.com/en-us/products/crosslab-instrument-services/service-repair>
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>
- To access **Agilent University**, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- A useful **Agilent Resource Center** web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: <https://www.agilent.com/en-us/agilentresources>
- Need technical support, FAQs, supplies? – visit our **Support Home page** <http://www.agilent.com/search/support>
- Videos** about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>
- 7890B Manuals** are also available on Agilent.com:
 - Safety** https://www.agilent.com/cs/library/usermanuals/public/7890B_Safety.pdf
 - Installation and First Start-up** https://www.agilent.com/cs/library/usermanuals/public/7890B_Installation.pdf
 - Operation Manual** https://www.agilent.com/cs/library/usermanuals/public/7890B_Operation.pdf
 - Maintaining Your GC** https://www.agilent.com/cs/library/usermanuals/public/G3430-90052%207890B_Maintaining%20GC.de.pdf

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Agilent 7890 GC Preventive Maintenance Checklist



Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check **"Section not applicable"** check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance service in the order of the tasks listed.
- Complete the Service Review section together with the customer.
- Complete the fields for page numbers at the foot of each selected page
- Complete the total number of pages field in the Service Completion section
- Ask the customer to sign the **Service Completion** section including the customer's and your signature.

Additional Instruction Notes

- Check for any active service notes for this unit. If there are any applicable "Safety" or "Modification Recommended" Service notes, plan to implement the changes on this unit before doing any qualification service.
- Do not implement firmware updates, unless you get approval from the customer and are sure that they are compatible with the instrument control software.

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System Information

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

Instrument System Name and ID	CN11021007
Instrument System Site and Location	Instrument Room
List System Component Product Numbers	List the Serial Numbers of each Component
1. G3440A	CN11021007
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components, settings as defined by current Service Notes.
- ☒ Check for required firmware updates and verify with customers if they would like them installed.
- ☒ Before starting the following procedures, record the Detector Signal Output(s) in the results table. If the GC is turned OFF or in a service mode, comparing the detector outputs before and after the service is not possible.

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Preventive Maintenance Procedure

Clean and inspect GC

- ☒ Unplug power cord from the power source.
- ☒ Open GC covers and vacuum/remove any dust/debris. Pay particular attention to cooling fans.
- ☒ Inspect internal connectors for proper contact and placement.
- ☒ Reconnect Power to the GC. Power the GC on and verify the power on self-test passed.
- ☒ Verify oven motor spins freely and turns on with the oven door closed, off when the door is opened.
- ☒ Verify operation of all other fans - the inlet and EPC cooling fans.
- ☒ Verify oven Intake/outlet flap assembly is operating smoothly while heating and cooling the oven.

Inlet and detector consumable replacement

- ☒ For the inlets installed, perform inlet maintenance as defined in the 7890 manual - "Maintaining Your GC" - for the inlet(s) installed.
- ☒ Replace the split vent trap cartridge filter on units with these inlets: Split/Splitless Capillary (SSL), Multi-Mode Inlet (MMI), Programmed Temperature Vaporizer (PTV), Volatiles Interface (VI).
- ☒ If the inlet system is used in Split Mode with viscous samples, inspect and clean the split vent tube on the inlet and flush or replace the tubing between the inlet and the split vent trap.
- ☒ If the GC includes a Flame Ionization Detector (FID), replace the jet. If the ignitor shows any buildup of sample or corrosion, replace the ignitor. Examine the FID collector and castle assemblies for contamination - clean as necessary.

Zero Sensors and Leak test

- ☒ Zero all pressure sensors per the procedure in the 7890 "Advanced User Guide".
- ☒ Perform inlet pressure decay test(s) as defined in the 7890 "Troubleshooting Manual". If the PM is done in preparation for an Operational Qualification, then the pressure decay test defined within that protocol can be used for the PM.
- ☒ Record if test passed or failed in the results table.

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ALS Maintenance

- ☐ Section NOT applicable
- ☒ Check all cabling and configuration settings between GC, tray, and injectors.
- ☒ Vacuum or remove any dust, especially around fans.
- ☒ Check operation of all fans.
- ☒ Check syringe for smooth plunger operation.
- ☒ Check for smooth operation of the needle support - clean if necessary

Restore Instrument

- ☒ Restore the normal operating conditions or customer method using the Browser interface or Data System.
- ☒ Purge the system with carrier flow for 15 minutes
- ☒ Bake out the system, then restore the normal operating conditions
- ☒ After equilibration, check and record the post PM detector signal output values
- ☒ Results should be similar or lower than the detector outputs recorded prior to PM.
- ☒ Perform a chemical checkout. If this is a routine PM, inject the customer's sample using the ALS if applicable. This will act as a final checkout of both the ALS and the GC.

Note: 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.

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เอกสารไม่ควบคุม

Signature Page

Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Update/reset instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section if there are additional comments.
- ☒ Review with the customer this service, parts replaced, and test results obtained.
- ☒ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box or if necessary, in the customer's IQ records.
- ☐ Supply the customer with a copy of the Smart Alerts flyer.
- ☐ Describe Smart Alerts to the customer.
- ☐ Install Smart Alerts if requested.

7890 GC Test Results Table

Detector Signal Outputs	Before PM Service	After PM Service
Front detector output	NA.	NA.
Back detector output	NA.	22.0
AUX detector output	NA.	NA.
Pressure decay test	Expected test result	Actual test result
Front inlet pressure decay test	Pass	Pass
Back inlet pressure decay test	Pass	NA.

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7890 Parts List Table

The following kits are recommended for capillary and purged packed inlets. If this is a general PM and the customer has a preferred set of consumables, you may use the customer's consumables.

Part description	Part number	Product or model# where used	Quantity consumed
SSL Capillary Inlet PM kit, Splitless	5188-6497	7890A/B	1
SSL Capillary Inlet PM kit, split	5188-6496	7890A/B	
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	7890A/B	
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	7890A/B	
SSL Capillary Ultra Inert Inlet Low Pressure Drop Split Liner - with Glass Wool	5190-2295	7890A/B	
PP Inlet PM kit	5188-6498	7890A/B	
Split vent trap PM kit, single cartridge (for MMI, PTV & V)	5188-6495	7890A/B	
MMI Cleaning Kit	G3510-60820	7890A/B	
PTV Septumless Head Rebuild Kit	5182-9747	7890A/B	
PTV Septumless Head Teflon Guide	5182-9748	7890A/B	
Ignitor (glow plug) assembly with O-ring	19231-60680	7890A/B	1
FID Collector Rebuild/Cleaning Kit	G1531-67000	7890A/B	
Standard .011-inch FID Jet for capillary FID base	G1531-80560	7890A/B	1
High Temperature .018-inch FID Jet for capillary FID base	G1531-80620	7890A/B	
Standard .018-inch FID Jet for packed column with packed FID base	18710-20119	7890A/B	
Standard .011-inch FID Jet for capillary column with packed/adaptable FID base	19244-80560	7890A/B	
High Temperature .018-inch FID Jet for capillary column with packed/adaptable FID base	19244-80620	7890A/B	
NPD Jet, universal fit, .011-inch ID	G1534-80580	7890A/B	
NPD Jet, universal fit, .011-inch ID Extended tip	G1534-80590	7890A/B	
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	7890A/B	
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	7890A/B	
**FID Collector Replacement Kit, if needed	G1531-67001	7890A/B	

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Service Engineer Comments

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

Service Completion

Service request number 6006748380 Date service completed 21Feb2024

Agilent signature Phuwana Yoktragul Customer signature

Total number of pages in this document 9

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THAI UNIQUE OPEN LAB SERVICE

OPERATIONAL QUALIFICATION REPORT (OQ)

Equipment Operational Qualification Report

Report No. SV2407/21898

Equipment GC-MS

System Model SQ

System ID GQS1203F021

Equipment Details Bruker

Test Protocol Scion OQ Protocol

Protocol Rev. A

Date 16-Jul-24

Report Type Report

Org. Name United Analyst and Engineering Consultant Co.,Ltd

Org. Location 3 Soi Udomsuk 41 Sukhumvit Rd.
Bangchak Phrakhanong Bagkok
Thailand 10260

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บริษัท ไทยยูนิค จำกัด THAI UNIQUE CO., LTD.

80-82 ถนนประชาปทีป โดย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200
80-82 Prachathipatjai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200
Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

CERTIFICATE OF CALIBRATION GAS CHROMATOGRAPH MASS SPECTROMETER

Certificate No.: SV2407/21898

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

Address: 3 Soi Udomsuk 41 Sukhumvit Rd. Bangkok
Phrakhanong Bangkok Thailand 10260

Instruments Model: MS Scion-SQ S/N GQS1203F021
GC 451-GC S/N BR1203M099
AUTO SAMPLER CP8400 S/N BR1203M331

Standard Reference Number: 393065201

Procedure Document Number: 394207000

System Test

PM perform and Diagnostic Test	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
Air Water Check Test	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
Tune Test EI	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
Signal to Noise Test (EI) SCAN	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
Injection EI Area Precision Test	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
Injection EI RT Precision Test	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
User Demonstration	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL

Engineer 
Somchai Pohtongkam

Date 16 July 2024



Thai Unique Co., Ltd.

Service Division

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SCION™

Operational Qualification Protocol

For SCION Instrument

Name and Model:

Serial Number:

System ID Number:

Publication no. 394207000

Revision A

November 2011

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SCION Operational Qualification Protocol

Contact

Scion Customer Service and Support uses a Customer Relationship Management (CRM) system. The interaction with this system offers the Customer immediate benefits including the contact center or help desk.

Scion worldwide service & support offices can be found from Scion website:



www.scion.com/support.html

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Publication no. 394207000, Revision A, November 2011

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SCION Operational Qualification Protocol

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1.0 Revision History

This qualification protocol is updated as necessary, which includes the event of any regulatory changes to Title 21 of the Code of Federal Regulations (21 CFR) Parts 210 and 211 (if applicable), any software or hardware changes, or updates that may impact on regulatory compliance.

Issue Number	Date	Comments

2.0 Qualification Representative and Reviewer Details


2.1 Qualification Representative Details

Each person responsible for executing any part of this Protocol must complete the table below, providing a sample of their signature and initials, and recording the date the Qualification was performed.

Qualification representatives are nominated to execute and verify the completeness of the test protocol and correctness of all entries.

All testing must be performed in accordance with procedures outlined in this manual. The representative must be trained and qualified to perform the procedures outlined in this document.

A copy of their appropriate qualifications is to be inserted into "Qualification Representative Details" on page 30.

Name (Print)	SOMCHAI POHTONGKAM
Title	ENGINEER
Signature	
Initials	SOMCHAI
Date	16 July 24

Name (Print)	
Title	
Signature	
Initials	
Date	

2.2 Reviewer Details

Each representative responsible for reviewing any part of this protocol must record their details in the following tables, providing a sample of their signature and initials, and recording the date the qualification was performed.

An employee or designee of the company operating the instrument must review these qualification procedures. All calculations and data will be checked by the reviewer. Data review must be performed in accordance with the qualification guidelines "Qualification Guidelines and GMP Documentation" on page 10 and in compliance with current Good Manufacturing Practice (cGMP) as specified by 21 CFR Parts 210 and 211.

Documentation supporting training in the area of data review and cGMP must be carefully maintained and reviewed by the instrument owner.

Reviewer representatives are responsible for reviewing the completeness of the qualification protocol and accuracy of all entries.

Name (Print)	
Title	
Signature	
Initials	
Date	

Name (Print)	
Title	
Signature	
Initials	
Date	

2.3 Quality Assurance/Control Details

As Quality Assurance/Control (QA/QC), who is empowered to approve instrument compliance documents, I approve the procedures in the SCION Operational Qualification Protocol, which I may have amended, I accept the qualification of the Qualification Representative, and I will review and initial the results.

Name (Print)	
Title	
Signature	
Initials	
Date	

Name (Print)	
Title	
Signature	
Initials	
Date	

3.0 Customer Responsibilities

The customer shall ensure that the Preventive Maintenance (PM) or Installation Qualification (IQ) up to point 9.11 is completed. A customer representative should be available at all times during the Operational Qualification Protocol.

Note The Operational Qualification Protocol test procedure should be performed after significant repairs, and at least once a year.

Qualification Rep. Initials	<i>Suh P.</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 24	Date		Date	

4.0 Qualification Guidelines and GMP Documentation

4.1 Qualification Summary

At the end of qualification execution, all tables and data entry fields must be completed and all test results, where specified, must be printed and attached to the protocol.

The Qualification Representative and the Reviewer must sign (signature or initials) and date each page that has a signature field. This represents agreement and acceptance of all data and information on the signed page.

Note Scion does not provide instructions for full Qualification of the personal computer (PC) used to operate the SCION. If further qualification of the PC is required the end-user must contact the PC manufacturer.

Note Scion does not provide full qualification instructions for non-Scion manufactured accessories. Limited instructions may be supplied. If qualification of a non-Scion accessory is required, the end user must contact the accessory manufacturer.

4.2 Qualification Guidelines

The following are general guidelines for performing the qualification tests in accordance with cGMP for the Manufacturing, Processing, Packaging, or Holding of Drugs per 21CFR Parts 210 and 211. Additional local requirements may also apply.

- Read the guidelines before starting the qualification.
- Perform all tests exactly as written.
- Use a pen with permanent blue or black ink unless otherwise specified by company policy.
- Neatly strike out any incorrect words or numbers, made while writing comments or recording results, information or data within this Protocol, with a single line. The word(s) crossed out must remain legible. Write the correction as close as possible to the original entry. Write a brief description of the error. For example, write "Transcription error" or "Re-written for clarity". Initial and date the change.
- Entering initials where a signature is requested, and vice versa is permitted. The exception to this is in 2.0: Qualification Representative and Reviewer Details on page 6, where examples of each person's signature and initials are required.
- Use the date format dd Mon yyyy (e.g. 08 Mar 2011) unless otherwise specified by company policy.

- Complete all tables and data fields to comply with this protocol. Blank fields are not permitted. For items that are not applicable, draw a line through the field, and write 'N/A' (Not Applicable). If entire tables or sections of tables are not applicable, strike a line either through the entire table or the specific area and enter 'N/A'. Complete the signature fields on the page.
- Write 'Pass', 'Fail' or 'N/A' as applicable to the test requirement or outcome.
- Ensure that results and/or specific documents are printed and attached to the specified appendix.
- The Qualification Representative and Reviewer must both sign (signature or initials) and date the signature fields on each page. This represents agreement and acceptance of all data and information on the page.

4.3 Page Numbering of Appendices

Each page that is inserted after the appendix is numbered with the letter of the appendix and a sequential number. The appendix page number must be initialed and dated by both the Qualification Representative and the Reviewer.

For example, pages inserted after Appendix C are numbered

C-1, C-2, C-3...etc. along with the initials and date.

If the reverse of each appendix page is left blank, it should be marked 'N/A' and signed and dated.

When the IQ is complete the total number of pages inserted after each appendix is written on the front page of the respective appendix sheet.

Qualification Rep. Initials	<i>Suh P.</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 24	Date		Date	

4.4 Exception Reports

An exception to the protocol occurs when the observed result differs from the acceptance criteria or expected result.

All exceptions to the protocol must be documented in the Exception Report. The Exception Report includes a detailed description of the exception and resolution by the Qualification Representative.

Each Exception Report shall be issued with a unique identification number in the form ERID-XX-X. This number is generated by the page number on which the exception occurred followed by a sequential number indicating each exception found on the page.

For example, if an exception occurs on page 34, the Exception Report shall be identified as 'ERID-34-1'. If another exception occurs on page 34, the second report shall be identified as 'ERID-34-2'. This identification number should be recorded in the 'Pass / Fail / N/A' field after each test.

Each Exception Report must be signed by the Qualification Representative and the Reviewer as evidence of approval.

The Exception Report is inserted in the appropriately named appendix and numbered as per Section 4.3 of this protocol.

Qualification Rep. Initials	<i>Suh/P</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 24	Date		Date	

4.5 Reference Documents

The following documents are relevant to this Qualification:

- Installation Qualification Protocol
- Completed service report from Preventative Maintenance (PM) schedule

Qualification Rep. Initials	<i>Suh/P</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 24	Date		Date	

4.6 Required Materials

The following stock solutions are required:

- 100 fg/μL OFN 394204200
- 1 pg/μL OFN 393085201
- 100 pg/μL OFN 393110101
- 10 pg/μL BZP 93085301
- 100 pg/μL BZP 394206200

The above solutions will be used to prepare the following working solutions which will be required to execute this OQ:

Note Refer to Appendix 1 for the preparation of the standard solutions.

Qualification Rep. Initials	<i>Suh/P</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 24	Date		Date	

4.7 General Guidelines

The following are general cGMP guidelines.

- Perform each procedure exactly as written.
- Fill in each item on the form or mark it Not Applicable (N/A).
- If an item is marked N/A, initial it and date it.
- The Reviewer reviews and initials all entries recorded by the Qualification Representative.
- Keep all raw data. The Qualification Representative and the Reviewer will initial it, and date it.
- Do not destroy raw data.
- Attach raw data from an instrument, such as the SCION, as an Addendum using the instructions in the following Addendums section.
- If several instruments are qualified simultaneously, reference shared information, such as standard preparation and chemical information, to the document containing the original information by its model and instrument identification number.
- Label all reference standards as required by local regulations.
- Record the time each reference standard was opened.
- Use reference standards within 24 hours of preparation.

Qualification Rep. Initials	<i>Suh/P</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 24	Date		Date	

4.8 Specific Instructions for Documentation

The Reviewer designates specific documentation instructions as follows.

Permanent Ink Color	Blue
Preferred Date Format	16 July 24

If more instructions are required: Use an addendum sheet, write the addendum number, and a brief description.

Qualification Rep. Initials	<i>Suh/P</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 24	Date		Date	

4.9 Documentation Corrections

Note All original entries must remain legible after corrections are made.

1. Draw a line through the incorrect information.
2. Write the correction as close as possible to the original entry, or enter a footnote.
3. Write a brief description of the error. For example, write "transcription error," "rewritten for clarity," or "correcting wrong entry".
4. Initial and date the change.

Qualification Rep. Initials	<i>S. P.</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 20	Date		Date	

4.10 Marking Procedures Not Applicable

Some sections may not be relevant for the qualification. To indicate that a procedure or part of a form is unnecessary and that it was not forgotten or inadvertently overlooked:

1. Draw a line through the portion that is not applicable. Write the letters N/A (for not applicable), your initials, and the date near the diagonal line.
2. If a procedural step is unnecessary, select N/A if it is indicated, or write a comment in an Addendum. The Qualification Representative and the Reviewer enter their initials and the date near the line.

Note The Qualification Representative and Reviewer must sign and date all forms, even when part or all of the form is marked N/A.

Qualification Rep. Initials	<i>S. P.</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 20	Date		Date	

4.11 Addendums

The following are reasons to complete an addendum sheet:

- A deviation needs documentation.
- Additional information or data needs to be recorded.
- Insufficient space to include the correction on the sheet where the error was made.

Qualification Rep. Initials	<i>S. P.</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 20	Date		Date	

4.12 Addendum Example

The following is an example of using an addendum sheet to document a deviation.

If some of the items on the sales order were not present, you could do the following:

1. Use an addendum sheet.
2. Write Instrument Delivery on the Procedure line.
3. Write the addendum page number followed by a letter. For example: page 12A, where 12 is the page and A represents the first addendum on that page.
4. Write the plan to obtain the missing items, which may be the following:
 - Scion notified that Part Number XXXXX and XXXX are missing.
 - Scion replied that the parts are in stock and will be sent overnight. While waiting for the parts to arrive, I will continue to set up the instrument.
5. Review the plan with the Reviewer and make the necessary modifications.
6. Document the arrival of the parts and write that this addendum is resolved. Attach a copy of delivery documents and create addendum pages as required.

Qualification Rep. Initials	<i>S. P.</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 20	Date		Date	

5.0 Operational Qualification

This chapter contains the tests to be completed to perform an Operational Qualification for the SCION.

5.1 OQ Preparation

The following must be done before starting the OQ:

1. Preventative Maintenance must have been completed and signed off by the Qualification Representative, Reviewer, and QA/QC person, and attach a copy of the service report and add an addendum number.

Addendum P. M. Protocol

Qualification Rep. Initials	<i>S. P.</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 20	Date		Date	

2. OQ must have been completed and signed off by the Qualification Representative, Reviewer, and QA/QC person.

Qualification Rep. Initials	<i>S. P.</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 20	Date		Date	

3. The QA/QC person must review, approve, append (if necessary), and sign the Pre-execution Approval.

Qualification Rep. Initials	<i>S. P.</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 20	Date		Date	

4. The Qualification Representative and the Reviewer must sign and date the Pre-execution Approval.

Qualification Rep. Initials	<i>S. P.</i>	Reviewer Initials		QA/QC Initials	
Date	16 July 20	Date		Date	

5.2 System Description

5.2.1 SCION Description

Installation Date: 2015	Principal Operator:	Phone Number:
Company Information		
Company: United Analyst and Engineering		
Name:	Building:	Installation Site: LAB
Address: 7 Soi Udomsak Rd.	Address/Location: Sukhumvit Rd.	
City, State: Bangkok, Nonthaburi	City, State: Bangkok	
Zip/Country: 10140	Zip/Country: 10140	
System Description		
SCION: SQ	Serial Number: GQ51203F021	
Sales Order Number:	Sales Order Addendum Number:	
GC		
Module Type: Scion 451	Serial Number: BR1203M099	
AutoSampler		
Module Type: CP8200	Serial Number: BR1203M331	
MS Workstation		
Version: MSWS 8.2.1	Serial Number: 01106-6711-BBQ-4504	
Computer Operating System		
Operating System: Windows 7	Version: R0	Serial No.: 60346-150-426-159
Computer		
Make: Dell	Model: optiplex	Serial No.: DNNV451
Addendum Number(s): 2. System description		Hard Drive 1TB Size / RAM: 4GB
Qualification Rep. Initials: Suddh P.	Reviewer Initials:	QA/QC Initials:
Date: 16 July 24	Date:	Date:

5.3 Data Sheet Specifications

Run these tests after the instrument has pumped down and is leak free. Use the factory methods. Follow the Installation Procedure; complete this section and the appropriate line of the OQ Summary. Print out the methods and results and attach as addendums. Use the factory test column Br-5ms 15m X 250im X 0.25im.

Table 5-1 TQ Specification

Mode	Concentration	Scan Range	Result †	N/A	Pass	Fail	Addendum
EI Full Scan	1 pg OFN	50-300	S/N ≥500:1				
EI MRM	100 fg OFN	272-222	S/N ≥5000:1				
PCI Full Scan‡	10 pg BZP	80-230	S/N ≥50:1				
NCI Full Scan‡	1 pg OFN	200-300	S/N ≥4000:1				

† The Signal-to-Noise ratio S/N values are based on RMS noise figure.

‡ CI tests use methane gas as reagent gas.

For any tests that did not pass, complete an Addendum for each, write the Addendum number and a brief description.

Qualification Rep. Initials: Suddh P.	Reviewer Initials:	QA/QC Initials:
Date: 16 July 24	Date:	Date:

Table 5-2 SQ Specification

Mode	Concentration	Scan Range	Result †	N/A	Pass	Fail	Addendum
EI Full Scan	1 pg OFN	50-300	S/N ≥600:1		✓		
PCI Full Scan‡	100 pg BZP	80-230	S/N ≥600:1		✓		
NCI Full Scan‡	200 fg OFN	200-300	S/N ≥1000:1		✓		

Qualification Rep. Initials: Suddh P.	Reviewer Initials:	QA/QC Initials:
Date: 16 July 24	Date:	Date:

5.4 EI Precision Test TQ

The following precision tests are for systems with autosamplers only. The test solution is 1 pg/μL OFN test mix part number 393065201.

The following is the required precision for 10 consecutive injections:

Injection	Retention Time	Peak Area
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
% RSD		

As an alternative, a % RSD summary report from MSWS can be added as an addendum.

Addendum: N/A

	N/A	Pass	Fail	Addendum
Observed Mass is between 271.6 m/z to 272.4 m/z, which is ± 0.4 of the expected m/z.	✓			
Retention Time ≤ 1% Relative Standard Deviation (RSD).	✓			
Peak Area ≤ 10% Relative Standard Deviation (RSD).	✓			

To complete this section use the factory MRM method on the system CD. Print a copy of the method and add as an addendum.

Addendum: N/A

If the hardware is not the same as the factory method, then note this in the addendum and how the hardware available has been configured to compensate. The most common variation here is the sampler, where the Combi Pal has been used instead of the 6400. This will have no impact on results and can be tracked and recorded in the addendum.

5.5 EI Precision Test SQ

The following precision tests are for systems with autosamplers only. The test solution is 1 pg/μL OFN test mix part number 393065201.

The following is the required precision for 10 consecutive injections:

Injection	Retention Time	Peak Area
1	3.645	39800
2	3.643	35595
3	3.640	38804
4	3.642	36679
5	3.641	35202
6	3.642	36225
7	3.641	37711
8	3.642	36452
9	3.642	35329
10	3.643	38639
% RSD	0.03%	4.34%

As an alternative, a % RSD summary report from MSWS can be added as an addendum.

Addendum:

	N/A	Pass	Fail	Addendum
Observed Mass is between 271.6 m/z to 272.4 m/z, which is ± 0.4 of the expected m/z.		✓		
Retention Time ≤ 1% Relative Standard Deviation (RSD).		✓		
Peak Area ≤ 10% Relative Standard Deviation (RSD).		✓		

To complete this section use the factory Scan method on the system CD. Print a copy of the method and add as an addendum.

Addendum: N/A

If the hardware is not the same as the factory method, then note this in the addendum and how the hardware available has been configured to compensate. The most common variation here is the sampler, where the Combi Pal has been used instead of the 8400. This will have no impact on results and can be tracked and recorded in the addendum.

Addendum: N/A

5.6 Final Evaluation

	N/A	Pass	Fail	Addendum
Is the equipment in normal operation condition?		✓		
Have all of the OQ requirements been completed?		✓		

Qualification Rep. Initials	Reviewer Initials	QA/QC Initials
<u>Sahai P.</u>		
Date	Date	Date
<u>16 July 2011</u>		

6.0 Protocol Approval

6.1 Protocol Acceptance / Approval by Customer

I agree that the procedures and information referenced in this document are applicable.

Instrument(s): Scion 451 SQ with CP8400

Serial Number(s): GQS 1203F021

Sales Order Number: _____

Company Name: United Analyst and Engineering Consultant Co., Ltd.

I agree that the Operational Qualification Protocol has been satisfactorily completed.	<input checked="" type="checkbox"/>
I confirm that the Operational Qualification Protocol has not been completed, because of these failed (non-passed) items	<input type="checkbox"/>

Authorized Customer Representative

Name (Print)	
Title	
Signature	
Initials	
Date	

6.2 Operational Qualification Protocol Assignment

This Operational Qualification Protocol document is used for:

Operational Qualification Protocol as final test at Scion	<input type="checkbox"/>
Operational Qualification Protocol after Installation Qualification	<input type="checkbox"/>
Operational Qualification Protocol after Preventive Maintenance and OQ completion.	<input checked="" type="checkbox"/>

6.3 Protocol Acceptance / Protocol Approval by Scion

I agree that the procedures and information referenced in this document are applicable.

Instrument(s): Scion 451 SQ with CP8400

Serial Number(s): GQS 1203F021

Sales Order Number: _____

Company Name: United Analyst and Engineering Consultant Co., Ltd.

Scion Certified Engineer

Name (Print)	SOMCHAI POHTONGKAM
Title	ENGINEER
Signature	<i>Somchai P.</i>
Initials	SOMCHAI
Date	

6.4 Remarks

Appendices

Each page that is inserted after the appendix is numbered with the letter of the appendix and a sequential number. The appendix page number must be initialed and dated by both the Qualification Representative and the Reviewer.

For example, pages inserted after Appendix C are numbered C-1, C-2, C-3...etc along with the initials and date.

If the reverse of each appendix page is left blank it should be marked NA and signed and dated.

When the OQ is complete the total number of pages inserted after each appendix is written on the front page of the respective appendix sheet.



Certificate

It is hereby certified that

Mr. Somchai Pohtongkam

Has successfully completed the Service & Application Training for

Scion Chromatography Products

Training Contents were:

Hardware Operation, Software operation, Data analysis and installation, & Troubleshooting of Model:

SCION GC, GCMS SQ, GCMS TQ

At Techcomp Singapore
By Mr. Michael Mei (Service Manager)

On 11th–15th July 2016

Hans van den Heuvel
Commercial Director
Scion Instruments

Date: 19 July 2016

Cert. No.: TSG-SCIONGC-15011602

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A.1 Qualification Representative Details

The Qualification Representative is to insert a copy of their appropriate qualification(s) after this page.

No. of Pages Inserted

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B.1 Exceptions

Each Exception Report shall be issued with a unique identification number in the form of ERID-XX-X. This number is generated by the page number on which the exception occurred followed by a sequential number indicating each exception found on the page.

For example, if an exception occurs on page 34, it shall be identified as Exception Report 'ERID-34-1'. If another exception occurs on page 34, the second exception shall be identified as 'ERID-34-2'. This identification number should be recorded in the pass/fail field after each test.

Insert Exception Reports (if any) after this page.

No. of Pages Inserted	N/A
-----------------------	-----

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Addendum Procedure: P.M. Protocol Page Number: 1

Qualification Rep. Initials	<u>Sudh' P.</u>	Reviewer Initials		QA/QC Initials	
Date	<u>16 July 24</u>	Date		Date	

Addendum Procedure: 2-System Description Page Number: 5

Qualification Rep. Initials	<u>Sudh' P.</u>	Reviewer Initials		QA/QC Initials	
Date	<u>16 July 24</u>	Date		Date	

Addendum Procedure: 3-Test Result Page Number: 30

Qualification Rep. Initials	<u>Sudh' P.</u>	Reviewer Initials		QA/QC Initials	
Date	<u>16 July 24</u>	Date		Date	

Addendum Procedure: A Certificate Page Number: _____

Qualification Rep. Initials	<u>Somchai P.</u>	Reviewer Initials		QA/QC Initials	
Date	<u>16 July 24</u>	Date		Date	

Operational Qualification Protocol Certification

for

SCION

with the serial number

GQS1203F21

has successfully completed all criteria for hardware Operational Qualification Protocol as detailed in this document.

Scion Certified Engineer

SOMCHAI RONGTONGKAM
Name (please print)Somchai P.
Signature16 July 24
Date

Authorized Customer Representative

Name / Function (please print)

Signature

Date

Customer Address

United Analyst and Engineering Consultant co., Ltd.

UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY Ltd.

Automatic Mercury Analyzer

Model RA-4500

Preventive Maintenance Report

Serial No. : 17780278

Soft version : Ver 2.0.7

ROM version : Ver 2.0.1

Date : 09 July 2024

PM by : Pradit mayong
(Pradit M.)Approved by : Kitichai S.
(Kitichai S.)

Coax Group Corporation Ltd.

1131/62,64,325-331 Nakornchaisri road,
Kwang Thanon Nakornchaisri, Dusit, Bangkok 10300 Thailand
Tel. 02-2435263, 02-6682436 Fax. 02-2437386

Inspection result

ITEM	STANDARD	RESULT	JUDGE
1. Self Check			
1.1 Heating		PASS	OK
1.2 Cooling		PASS	OK
1.3 Leak		PASS	OK
1.4 Optical system		PASS	OK
1.5 Drift		PASS	OK
2. Analytical curve inspection (AREA)			
2.1 No Pretreatment (Low Conc.)	Correlation coefficient (r) ≥ 0.9990	0.9999	OK
3. Repeatability (AREA)			
3.1 No Pretreatment 100ppb, n=3		1. 99.60 ppb 2. 101.84 ppb 3. 101.22 ppb C.V. ≤ 5% 1.15%	OK
4. Blank	Below 1.0 (AREA)	0.1002	OK

Counter

Maintenance: MASH | SC | Counter | Parameter |

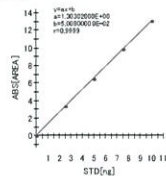
Measurement Count	205702 (08-08)	Clear	F1 Substg(3700h)	0h00m(24-07-08)	Clear
Mercury Exhaust Filter Amount(1500mg)	1022 (08-08)	Clear	F2 Substg(3200h)	0h01m(24-07-08)	Clear
Lamp Active time(3000h)	1013m(24-07-08)	Clear	F3 Substg(3200h)	0h00m(24-07-08)	Clear
Membrane Filter Usage Time(2000h)	0h08m(24-07-08)	Clear	F4 Substg(3200h)	0h00m(24-07-08)	Clear
			F5 Substg(3200h)	0h05m(24-07-08)	Clear
Main Pump Substg(750h)	0h05m(24-07-08)	Clear	F6 Substg(3200h)	0h02m(24-07-08)	Clear
Heating Lamp Time	00h03m(22-08-08)	Clear	F7 Substg(3200h)	0h02m(24-07-08)	Clear

Exit

เอกสารไม่ควบคุม

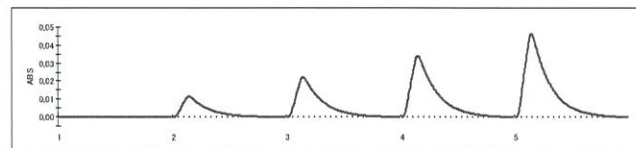
Title : Preventive Maintenance RA-4500 sn:17780278
Date : 2024-07-09
Name : Coax Group
Memo : Calibration Curve 0-10ng

Calib



STD

No.	STD [ppb]	SVOL [mL]	CVOL [mL]	DVOL [mL]	STD [ng]	AREA [ON]	MEAS [ng]	Dev [%]	Note
1	100.000	0.000	5.000	5.000	0.000	0.0846	0.0265	-	
2	100.000	0.025	5.000	5.000	2.500	3.3464	2.5298	1.2	
3	100.000	0.050	5.000	5.000	5.000	6.4170	4.8863	2.3	
4	100.000	0.075	5.000	5.000	7.500	9.8647	7.5322	0.4	
5	100.000	0.100	5.000	5.000	10.000	13.1132	10.0253	0.3	



SNP

No.	NAME	SVOL [mL]	CVOL [mL]	DVOL [mL]	AREA [ON]	MEAS [ng]	CONC [ug/L]	Note
1	100ppb	0.050	5.000	5.000	6.5389	4.9798	99.60	
2	100ppb	0.050	5.000	5.000	6.6848	5.0918	101.84	
3	100ppb	0.050	5.000	5.000	6.6446	5.0610	101.22	

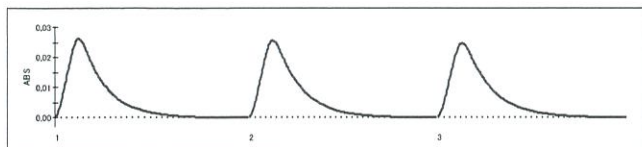
Statistics

No.	NAME	TRY	AV [ug/L]	SD [ug/L]	Cv [%]
1	100ppb	3	100.887	1.15660	1.15

-1-

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NIPPON INSTRUMENTS CORPORATION



Self Check

Heat check: PASS!! (26.3degC[05:00] -> 30.3degC[02:29])
Sensor check: PASS!! (53- 10= 43)
Leak check: PASS!! (0.1SL/min)
Sig/Ref check: PASS!! (Sig: 4.00V, Ref: 4.02V)
Drift check: PASS!! (0.0000061 - -0.0000179 = 0.0000240)

-2-

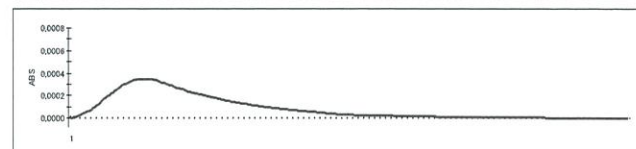
เอกสารไม่ควบคุม

NIPPON INSTRUMENTS CORPORATION

Title : Preventive Maintenance RA-4500 sn:17780278
Date : 2024-07-09
Name : Coax Group
Memo : Blank

SNP

No.	NAME	SVOL [mL]	CVOL [mL]	DVOL [mL]	AREA [ON]	MEAS [ng]	CONC [ug/L]	Note
1	Blank DI				0.1002	0.0385		



-3-

เอกสารไม่ควบคุม

NIPPON INSTRUMENTS CORPORATION



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-8484



Cert. No.: 24TM589
Page: 1 of 3

Certificate of Calibration

Equipment : Hot Air Oven
Manufacturer : Memmert
Model : UF 55
Serial No. : B212.0411
ID No. : UAE.WAO.005/2556
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok 10260
Location : Lab Floor 2
Received Order : 01 April 2024
Calibration Date : 01 - 02 April 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Krisda Malee
Approved by :
() Ponpan Palaim
(✓) Suwit Imjai
() Kunchit Promprat
Issue Date : 5 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม
A 0065065



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

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

Procedure Used :-

Calibration were conducted using calibration procedure CP-0702 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

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

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

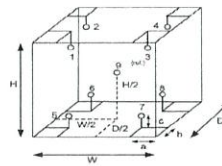
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :-

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	26
REL.Humid. (%)	47	48
AC Supply (Volt)	221	220



Probe Installation Details : Dimension of Chamber :
a = 5.0 cm D = 0.50 m
b = 5.0 cm W = 0.60 m
c = 5.0 cm H = 0.75 m
Capacity = 0.30 m³

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

เอกสารไม่ควบคุม
A 1209739



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

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

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
104.0	104.0	104.0	0.032	0.47	0.84	2
120.0	120.0	120.0	0.12	0.72	1.3	2
180.0	180.0	180.0	0.13	1.2	1.5	2

Measured Temperature (°C)										Uncertainty (± °C)
Calibration Point (°C)	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	104.464	103.847	104.226	104.232	104.106	103.691	104.275	104.127	104.013	0.42
120.0	120.486	120.089	120.635	120.596	119.531	119.644	120.364	120.144	120.158	1.1
180.0	180.574	179.769	180.285	180.870	179.594	179.790	180.267	179.661	179.802	1.1

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

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

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

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

UUC* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม
A 1209738



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3000-29 FAX.0-2719-8484



Certificate of Calibration

Cert. No.: 24TM647
Page: 1 of 3

Equipment : Incubator
Manufacturer : Binder
Model : KB 400 E6
Serial No. : 20200000015535
ID No. : UAE.MIC.018/2564
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok 10260
Location : Microbiology Laboratory (302)
Received Order : 01 April 2024
Calibration Date : 01 April 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Man Pattanaongpaiboon
Approved by :
() Ponpan Palaim
(✓) Suwit Imjai
() Kunchit Promprat
Issue Date : 7 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2404-0003OC-6

Cert. No.: 24TM647
Page : 2 of 3

Procedure Used :-

Calibration was conducted using calibration procedure CP-0702 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).

The temperature scale used was based on ITS-90

Condition of this result of calibration

1. Reference standard instrument-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY49023932	23LM122	TPA	26 Jul 2024

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

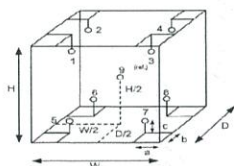
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (°) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Probe Installation Details :

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

Dimension of Chamber :

D = 0.48 m
W = 0.65 m
H = 1.2 m
Capacity = 0.37 m³

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

Position :	Ref. Std. ID No.:
1	20-16RTD-01
2	20-16RTD-02
3	20-16RTD-03
4	23-16RTD-04
5	22-16RTD-05
6	20-16RTD-06
7	20-16RTD-07
8	22-16RTD-08
9 (ref.)	22-16RTD-09

เอกสารไม่ควบคุม



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2404-0003OC-6
Result of Calibration :- (°) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 24TM647
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
35.0	35.0	35.0	0.035	0.19	0.22	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	35.000	35.022	34.841	34.851	35.027	35.011	35.023	35.028	35.007	0.30

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

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

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

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

UUC* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 16, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3000-29 FAX.0-2719-9494



Certificate of Calibration

Cert. No.: 24TM838
Page : 1 of 3

Equipment : Incubator

Manufacturer : Binder

Model : KB 400 E6

Serial No. : 2022000022479

ID No. : UAE.MIC.028/2566

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

Location : Microbiology Laboratory

Received Order : 09 July 2024

Calibration Date : 09 July 2024

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 50) %

Calibrated by : Khit Rutanaprapachai

Approved by :

() Ponpan Palpin
(✓) Suwit Injai
() Kunzhit Promprat

Issue Date : 19 July 2024

The Uncertainties are for a confidence probability of approximately 95%

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เอกสารไม่ควบคุม



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2407-0153OC-4

Cert. No.: 24TM936
Page : 2 of 3

Procedure Used :-

Calibration was conducted using calibration procedure CP-0702 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).

The temperature scale used was based on ITS-90

Condition of this result of calibration

1. Reference standard instrument-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY49001451	24LM44	TPA	17 Mar 2025

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

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

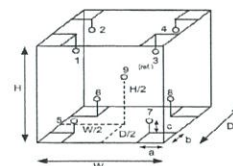
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (°) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	23	24
REL. Humid. (%)	52	54
AC Supply (Volt)	221	222



Probe Installation Details :

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

Dimension of Chamber :

D = 0.47 m
W = 0.65 m
H = 1.2 m
Capacity = 0.37 m³

Position :	Ref. Std. ID No.:
1	19RTD-2/1
2	19RTD-2/2
3	19RTD-2/3
4	19RTD-2/4
5	19RTD-2/5
6	24-19RTD-2/6
7	19RTD-2/7
8	19RTD-2/8
9 (ref.)	19RTD-2/9

เอกสารไม่ควบคุม



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2407-0153OC-4
Result of Calibration : (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert.No.: 24TM938
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
35.0	35.0	35.0	0.030	0.31	0.33	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	35.093	35.011	35.081	35.118	34.840	35.054	34.924	34.978	34.824	0.30

Average* : The average of 30 values in each position.
Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.
Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.
UUC* : Unit Under Calibration
Note : The reported uncertainty of measurement was included stability and excluded uniformity .
The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k , providing a level of confidence of approximately 95 %.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
524/4 PATTANAKARN ROAD NO.12, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000/29 FAX. 0-2719-9484



Cert.No.: 24CH320
Page: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA1L0035
ID No. : UAE.EFM.011/2565/EFM.pH.01/65)
Condition As-Received : Used Item
Received Date : 12 March 2024
Calibration Date : 14 March 2024
Reference : 2403-0396WSC-2
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Sol Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

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

Calibrated by : Warakorn Lemgagrakul

Approved by :
Approved Signatory

() Pornthippa Tameyakul
() Unnopphol Harachai
(✓) Sathip Meangmai

Issue Date : 15 March 2024

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

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A 0064530



Cert.No.: 24CH320
Page: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2902	27 Aug 2024
2) Ref. Standard Thermometer	4982054	110RC044	23I908	26 July 2024

This certification is traceable to the International System of Unit maintained through:-
- Technology Promotion Association (Thailand-Japan)

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

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

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

Calibration Results

Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (4.7)(7.10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N: HA1L0035	4.00	177.48	177.5	4.01	0.058	2.00
	7.00	0.00	0.1	7.01	0.058	2.00
	7.00	0.00	0.1	7.01	0.058	2.00
	10.00	-177.48	-177.4	10.01	0.058	2.00

a 1206343



Cert.No.: 24CH320
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: -	4.008	4.01	170.9	0.0071	2.00
	6.986	7.00	-4.0	0.0099	2.00
	6.986	7.01	-4.2	0.0099	2.00
	9.997	10.01	-178.3	0.0082	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : -
- Serial No. : -
Dimension of probe
- Length : 103 mm.
- Diameter : 16 mm.
- Immersion Depth : 90 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
25.0	25.003	25.0	-0.003	0.13	2.00
30.0	30.003	30.0	-0.003	0.13	2.00
35.0	35.004	35.0	-0.004	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 %.

-00-

a 1206344



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



Calibration Certificate

Certificate No.: 2401718-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Eoi Udomauk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 5

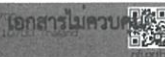
Equipment: pH Meter
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
ID No.: UAE WAT 010/2553
Order No.: 2401718
Operation No.: 2401718-001
Date of Receipt: 27 February 2024
Date of Calibration: 11 March 2024

Calibrated by: Mr. Manee Somsak Specialist
Approved by: (Mr. Phetaphat Tuanthi) Manager, Division of Calibration Laboratory
Date of Issue: 12 March 2024
Responsible for the Technical Management Team

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its compliance to recognized national standards and is the result 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-C5-009 Revision: 01 Date: 20-04-65



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



Calibration Report

Certificate No.: 2401718-001-01
Equipment: pH Meter
Resolution: 0.01 pH, 1 mV
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
Type: Bench top
ID No.: UAE WAT 010/2553

Page 2 of 4

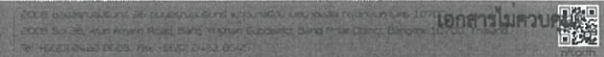
Date of Calibration: 11 March 2024
Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature: 23.4 ± 1.5 °C
Condition of Equipment: Good Condition
Condition of this Results of Calibration:

1. Calibration Method: W-TE-025 is house method based on a point measurement by using standard voltage calibration and certified reference material (CRM).
2. Reference Standards: Certified Reference Materials

Instrument	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2706C7	Fluke	737-2053	14 June 2024
2.2 Digital Thermometer	2790P1	Fluke	CC 662574-01	30 October 2024
2.3 Thermo-Hygro Meter	NF1 07H 01423	testo	CC 660353-01	3 April 2024
Certified Reference Materials				
	Lot No.	Manufacturer	Ref. No.	Expiry Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	43847	CPAchem	PH471 LE	12 April 2025
2.5 pH buffer 6.865 (Primary pH buffer Solution)	888843	CPAchem	PH0717 LS	13 April 2025
2.6 pH buffer 10.01 (Primary pH buffer Solution)	888844	CPAchem	PH0295 LS	13 April 2024
2.7 pH buffer 7.00 (Standard pH buffer Solution)	023158	HACH LANGE GmbH	SL1M004	15 October 2025

3. The certificate is traceable to the International System of Units (SI Units).
3.1 Instruments No. 2.1 through NIST 151-1025 Laboratory Accreditation of Calibration No. 9008
3.2 Instruments No. 2.2 and 2.3 through NIST 151-1025 Laboratory Accreditation of Calibration No. 9001
3.3 Certified Reference Material No. 2.4 to 2.7 traceable to Primary measurement method - national pH value calibration, Thermometer, laboratory, and non-volatile The Standard Solution preparation and certified by CPAchem Ltd. is accredited to ISO 17024 and ISO/IEC 17025
3.4 Certified Reference Material No. 2.7 traceable to PTB Certificate No. PTB-PH04-853/200422 and Certificate No. PTB-PH05-655/200202 (PTB: Physikalisch-Technische Bundesanstalt, Braunschweig, Germany)
4. This certificate was certified only for the instrument was calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.

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



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



Calibration Report

Certificate No.: 2401718-001-01
Equipment: pH Meter
Resolution: 0.01 pH, 1 mV
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
Type: Bench top
ID No.: UAE WAT 010/2553
Date of Calibration: 11 March 2024
Page 3 of 5

Calibration Results:
1. Calibration of pH Meter (Manual Temperature Compensation at 25 °C)
(offset value before adjust: -0.4 mV)

Nominal pH		DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (mV)	Coverage Factor (k)
0	414.121	414	0.00	0.00	0.00	2.00
2	295.814	296	2.00	0.00	0.00	2.00
3	172.464	176	4.00	0.00	0.00	2.00
6	58.160	59	6.00	0.00	0.00	2.00
7	0.001	0	7.00	0.00	0.00	2.00
8	-58.158	-59	8.00	0.00	0.00	2.00
10	-177.461	-177	10.00	0.00	0.00	2.00
12	-295.811	-296	12.00	0.00	0.00	2.00
14	-414.118	-414	14.00	0.00	0.00	2.00

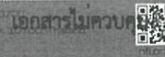
2. Calibration of pH Meter with Electrode (Manual Temperature Compensation at 25 °C)

Equipment: pH Electrode Type: Combined Electrode
Manufacturer: METTLER TOLEDO Model: InLab 9400
Serial No.: 3068701 ID No.: N/A

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

Certified Value (25 °C (pH))	Average Indicator Reading (pH)	Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
4.002	4.01	16.5	0.0071	2.00
7.001	7.00	13	0.0086	2.00
10.010	10.01	16.3	0.0084	2.00
6.802	6.87	21	0.0074	2.00

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



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



Calibration Report

Certificate No.: 2401718-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C
Model: SevenEasy pH
Serial No.: 1231155210
ID No.: UAE WAT 010/2553
Manufacturer: METTLER TOLEDO
Date of Calibration: 11 March 2024
Page 4 of 5

Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature: 23 °C ± 1 °C
Relative Humidity: 61 % ± 2 %

Condition of this results of Calibration:

1. Calibration Method: In-house method: W-TE-025 by comparison with standard thermometer.
This 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
HANDEL D THERMOMETER	1523	2118154	PEL-T 067753	05 Jun 24	TSTR
Platinum Resistance Thermometer (PRT)	507A	877332			

Support Equipment: Low Temperature Bath (SOCAL-6) Model: Europa-6 Plus Basic, S/N: 3415927

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

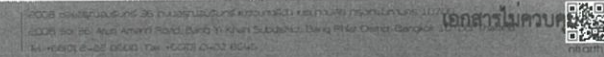
4. This certificate was certified only for the instrument was calibrated.

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

6. Condition of Calibrated item: Good

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

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





มูลนิธิส่งเสริมและพัฒนาอุตสาหกรรมอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory, Sector 7, Jomtien



Calibration Report

Certificate No.: 2491719-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C Model: SevenEasy pH
Serial No.: 1231125212 C/F No.: UAE WAT 0102953
Manufacturer: METTLER TOLEDO
Date of Calibration: 11 March 2024 Page 5 of 5

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

The probe was immersed in liquid bath or dry bath to a minimum depth of 100 mm
Description of probe: model: N/A S/N: N/A
Dimension of probe: Diameter: 4 mm, Length: 120 mm
Sheath material: Stainless Steel

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	14.998	0.1	0.080
25.1	24.998	0.1	0.080
35.1	34.997	0.1	0.080

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 -----

FCB-212 Revision: 01 Date: 20-04-05

เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3 EQUIPMENT CALIBRATION AND TESTING SERVICES
534/1 PATTANAKARN ROAD 508 (B. SIANJUAN), SUAN LANG BANGKOK 10250
TEL: 0-2717-3009-29 FAX: 0-2719-9434



Cert.No.: 24CH405
Page.: 1 of 3

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : YSI
Model : Pro 30
Serial No. : 23A104807
ID No. : UAE EFM.065/2566 (EFM.SCT 01/66)
Condition As-Received: Used Item
Received Date : 01 April 2024
Calibration Date : 03 April 2024
Reference : 2404-0036WSC-1
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangkok,
Phrakhanong, Bangkok 10260
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure: In-house method :
- CP-CH5 by direct measurement
with certified reference material (CRM)
- CP-CH5 by comparison with temperature standard

Calibrated by : Walalak Srinthan

Approved by :

() Unnopphol Harachai
() Ponpan Palpim
(✓) Sathip Meangmai

Issue Date :

6 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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

A 0062142



Cert.No.: 24CH405
Page.: 2 of 3

Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	1963878	130RC095	2311051	05 Sep 2024
2) Ref. Std. Thermometer	4982054	110RC044	231608	26 July 2024

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

2. Certified Reference Materials :-

- Conductivity calibration solution, CPA chem Ltd., The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Conductivity Solution	Manufacturer	Lot No.	Exp. date
1413.0 µS/cm	CPA Chem	940111	02 Nov 2024
12.890 mS/cm	CPA Chem	836625	19 Oct 2024

- Control Conductivity calibration solution temperature by Water bath (25 ± 0.1) °C

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

Calibration results

Function : Conductivity Measurement

(*) After Adjustment at 1413.0 µS/cm

Conductivity Electrode Serial No.: 23A100616

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (±)	Coverage factor k
1413.0 µS/cm	1398 µS/cm	1413 µS/cm	9.2 µS/cm	2.00
12.890 mS/cm	12.60 mS/cm	12.77 mS/cm	0.086 mS/cm	2.00

a 1209887



Cert.No.: 24CH405
Page.: 3 of 3

Calibration Results

Function : Temperature Measurement

This equipment was connected with Temperature Probe;

- Model : PRO 30 COND-T
- Serial No. : 23A100616

Dimension of probe;

- Length : 94 mm
- Diameter : 2.5 mm
- Immersion Depth : 90 mm

Calibration Result : Without adjustment

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (± °C)	Coverage factor k
25.0	25.002	24.9	-0.102	0.13	2.00
30.0	30.002	29.9	-0.102	0.13	2.00
35.0	35.001	34.9	-0.101	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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



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a 1209888



CERTIFICATE OF CALIBRATION

Certificate No. : SP24-001 Page 1 of 5
Customer : United Analyst and Engineering Consultant Co., Ltd. (Head Office)
Address : 3 Soi Udomsuk 41, Sukhumvit Road, Banchak, Phrakhanong, Bangkok 10260
Location of calibration : Laboratory 213
Equipment : UV-Vis Spectrophotometer
Manufacturer : Hitachi
Model : U-2900
Serial No. : Z1E22-009
ID No. : UAE.WAT.051/2564
Received Date : 4 January 2024
Calibration Date : 4 January 2024
Issue Date : 5 January 2024
Condition Instrument : Good

Calibrated by :  Approved by : 
(Mr. Tanawat Rittidach) (Ms. Chonthicha Sangnarn)
Technical Manager Quality Manager

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

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FM-708-02 R01 1/11/2021



REPORT OF CALIBRATION

Certificate No. : SP24-001 Page 2 of 5
Environment Condition : Ambient Temperature 25 ± 5 °C
Relative humidity 55 ± 20 %RH
Calibration method : In-house method CP-01 Based on ASTM E275-08

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	115663	25 October 2025
Absorbance Standard set	25757	115638	25 October 2025
Wavelength Standard set	25806	115657	25 October 2025
Wavelength Standard set	25758	115665	25 October 2025

Traceability : This certification is traceable to the International System of Unit maintained at National -
Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021



REPORT OF CALIBRATION

Certificate No. : SP24-001 Page 3 of 5
Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5780	0.575	0.0030	0.0031	2.00
	1.0484	1.045	0.0034	0.0029	2.00
	2.1876	2.192	-0.0044	0.0080	2.00
	0.0000	0.000	0.0000	0.0028	2.00
440	0.5595	0.558	0.0015	0.0034	2.00
	1.0239	1.023	0.0009	0.0035	2.00
	2.1230	2.125	-0.0020	0.0079	2.00
	0.0000	0.000	0.0000	0.0028	2.00
465	0.5230	0.520	0.0030	0.0030	2.00
	0.9633	0.961	0.0023	0.0029	2.00
	1.9753	1.975	0.0003	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.516	0.0021	0.0031	2.00
	1.0002	0.997	0.0032	0.0033	2.00
	1.9973	1.993	0.0043	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.550	0.0017	0.0030	2.00
	1.0803	1.079	0.0013	0.0030	2.00
	2.0373	2.032	0.0053	0.0080	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.558	0.0011	0.0031	2.00
	1.0518	1.050	0.0018	0.0030	2.00
	1.9274	1.923	0.0044	0.0079	2.00

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FM-708-02 R01 1/11/2021



REPORT OF CALIBRATION

Certificate No. : SP24-001 Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7469	0.743	0.0039	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8674	0.862	0.0054	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2919	0.289	0.0029	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6430	0.641	0.0020	0.0055	2.00

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FM-708-02 R01 1/11/2021

REPORT OF CALIBRATION

Certificate No. : SP24-001
Page 5 of 5

Wavelength Accuracy :

Table with 5 columns: CRMs Values (nm.), UUC Reading (nm.), Correction (nm.), Uncertainty (nm.), Coverage factor k. It contains two groups of data points for wavelength calibration.

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
JSM-708-02 B01 1/11/2021

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	Horiba	LAQUA-PH210 HA0E0041	Technology Promotion Association (Thailand-Japan)	24CH725	19 Jun 24	18 Jun 25	-
2	DO Meter	DO	YSI	Pro 20i 18K104053	Technology Promotion Association (Thailand-Japan)	24TW133	19 Jun 24	18 Jun 25	-
3	Conductivity Meter	Conductivity	YSI	Pro30 17B101801	Technology Promotion Association (Thailand-Japan)	24CH718	19 Jun 24	18 Jun 25	-



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



Certificate of Calibration

Cert.No.: 24CH725
Page.: 1 of 3

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA0E0041
ID No. : UAE EFM.069/2564(EFM pH.02/64)
Condition As-Received: Used Item
Received Date : 18 June 2024
Calibration Date : 19 June 2024
Reference : 2406-0570WSC-3
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In-house method :
- CP-CH5 by direct measurement with DC voltage
standard and direct measurement with
certified reference material (CRM)
- CP-CH6 by comparison with temperature standard

Calibrated by : Warakorn Lemgatrakul

Approved by :

() Unnopphol Harachai
() Ponpan Palpim
(✓) Salthip Meangmai

Issue Date : 20 June 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



Cert.No.: 24CH725
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2802	27 Aug 2024
2) Ref. Standard Thermometer	4982054	110RC044	23I908	26 July 2024

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

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

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

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

Calibration Results

Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (4.7)(7.10)

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

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Cert.No.: 24CH725
Page.: 3 of 3

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4.7)(7.10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (±)	Coverage factor k
pH Electrode S/N: Q9AA0001	4.008	4.01	177.6	0.0085	2.05
	6.986	7.00	2.5	0.012	2.05
	6.986	7.00	3.1	0.011	2.00
	9.997	10.01	-170.8	0.0092	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9052-100
- Serial No. : Q9AA0001

Dimension of probe

- Length : 103 mm.
- Diameter : 16 mm.
- Immersion Depth : 80 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
25.0	25.004	25.0	-0.004	0.13	2.00
30.0	30.002	30.0	-0.002	0.13	2.00
35.0	35.002	35.0	-0.002	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

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

534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

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

Cert.No.: 24TW133
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : Pro 20i
Serial No. : 18K104053
ID No. : UAE EFM.066/2562 (ENV.DO.01/62)
Received Date : 18 June 2024
Test Date : 19 June 2024
Reference : 2406-0571WSC-11
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 Azido Modification Method

Tested by : Walalak Sirthean

Approved by :
Approved Signatory

() Unnopphol Harachai
() Ponpan Palpim
(✓) Salthip Meangmai

Issue Date : 20 June 2024

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Cert.No.: 24TW133
Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

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

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

2. Standard Material :-

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

Result : Dissolved Oxygen Meter Adjustment With Air 100 %
Dissolved Oxygen Probe No.: 18K100663

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.10	8.10	0.0055

This report was certified only for the instrument we tested. It is allowable to use for study
Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced
other in full, without written approval of the laboratory.

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Cert. No.: 24LM102
Page.: 1 of 2

Certificate of Calibration

Equipment : DO Meter with Sensor
Manufacturer : YSI
Model : Pro 20i
Serial No. : 18K104053
ID No. : UAE.EFM.056/2562(ENV.DO.01/62)
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrahanong,
Bangkok 10260
Location : TPA On Site Calibration Laboratory
Received Order : 18 June 2024
Calibrated Date : 20 June 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V
Calibrated by : Warakorn Lemgagrakul
Approved by : Kunchit
Approved Signatory
() Ponpan Palpim
() Suwit Imjai
(✓) Kunchit Promprat
Issue Date : 24 June 2024

The Uncertainties are for a confidence probability of approximately 95%

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

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Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2406-0571WSC-12

Cert. No.: 24LM102
Page.: 2 of 2

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with
Industrial Platinum Resistance Thermometer (IPRT) 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	231216	TPA	11 Oct 2024

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

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

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

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 18K100663

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor K
25.0	100	25.001	24.7	-0.301	0.16	2.00
30.0	100	30.004	29.7	-0.304	0.16	2.00
35.0	100	35.004	34.7	-0.304	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 %.

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Cert.No.: 24CH716
Page.: 1 of 3

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : YSI
Model : Pro 30
Serial No. : 17B101801
ID No. : UAE.EFM.121/2580(ENV.SCT.01/60)
Condition As-Received: Used Item
Received Date : 18 June 2024
Calibration Date : 19 June 2024
Reference : 2406-0572WSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrahanong, Bangkok 10260
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure: In-house method :
- CP-CH6 by direct measurement
with certified reference material (CRM)
- CP-CH6 by comparison with temperature standard
Calibrated by : Warakorn Lemgagrakul
Approved by : Sathip
Approved Signatory
() Unnopphol Harachai
() Ponpan Palpim
(✓) Sathip Meangmai
Issue Date : 20 June 2024

The Uncertainties are for a confidence probability of approximately 95%

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

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Cert.No.: 24CH718
Page.: 2 of 3

Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument **Serial No.** **ID No.** **Certificate No.** **Due date**

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

2. Certified Reference Materials :-

- Conductivity calibration solution, CPA chem Ltd., The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Conductivity Solution	Manufacturer	Lot No.	Exp. date
1413.0 $\mu\text{S/cm}$	CPA Chem	940111	02 Nov 2024
12.880 mS/cm	CPA Chem	938625	19 Oct 2024

- Control Conductivity calibration solution temperature by Water bath (25 ± 0.1) $^{\circ}\text{C}$

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

Calibration results

Function : Conductivity Measurement

(*) After Adjustment at 1413.0 $\mu\text{S/cm}$

Conductivity Electrode Serial No.: 17B100319

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (\pm)	Coverage factor k
1413.0 $\mu\text{S/cm}$	1044 $\mu\text{S/cm}$	1412 $\mu\text{S/cm}$	9.2 $\mu\text{S/cm}$	2.00
12.880 mS/cm	9.33 mS/cm	12.64 mS/cm	0.086 mS/cm	2.00

Remark : - UUC* = Unit Under Calibration

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Cert.No.: 24CH718
Page.: 3 of 3

Calibration Results

Function : Temperature Measurement

This equipment was connected with Temperature Probe:

- Model : PRO 30 COND-T

- Serial No. : 17B100319

Dimension of probe:

- Length : 7 mm

- Diameter : 2.5 mm

- Immersion Depth : 90 mm

Calibration Result : Without adjustment

Calibration Point ($^{\circ}\text{C}$)	Standard Temperature ($^{\circ}\text{C}$)	UUC* Reading ($^{\circ}\text{C}$)	Error ($^{\circ}\text{C}$)	Uncertainty of Measurement (\pm $^{\circ}\text{C}$)	Coverage factor k
25.0	25.002	24.7	-0.303	0.13	2.00
30.0	30.001	29.7	-0.301	0.13	2.00
35.0	35.002	34.7	-0.302	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

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